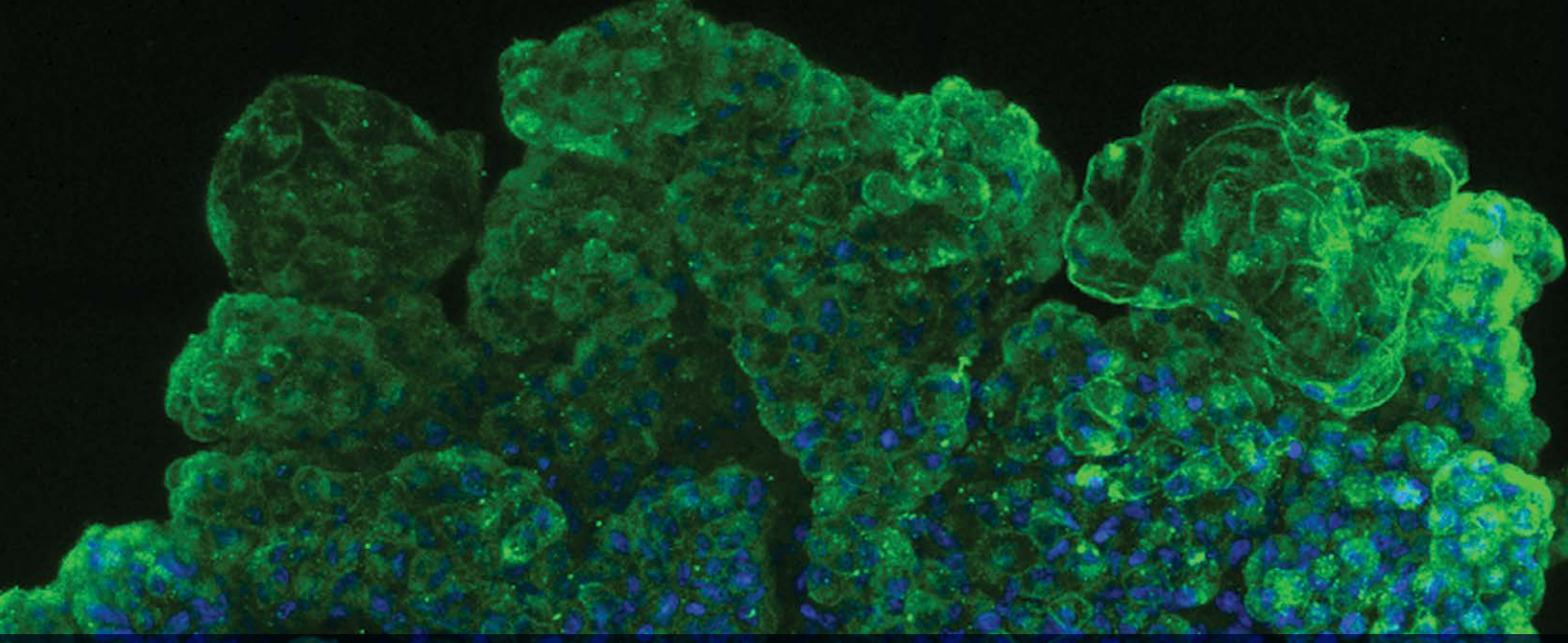

How reprogramming cells turns back time

For the past decade scientists have been able to reprogram skin cells, nasal cells and other mature cells to become pluripotent stem cells that can turn into any cell type in the human body. How it works is only starting to become clear.

Teams led by Professors Ryan Lister at The University of Western Australia, Jose Polo at Monash University and Ernst Wolvetang at The University of Queensland are working together to understand how this process occurs, whether all cell types follow the same path to becoming pluripotent cells, and if this impacts their ability to mimic disease in the laboratory.

Through a series of collaborations over the last ten years the scientists have uncovered a number of stem cell secrets, opening the door for more targeted research and, ultimately, treatments for diseases.

"Human pluripotent stem cells offer a powerful model system for understanding the molecular processes that cause disease."

Ryan and Jose have deciphered how specialised cells such as skin cells are reprogrammed and found that the 'roadmap' for change is different in different cells. This means that scientists are one step closer to formulating consistent reprogramming processes in different cell types.

"Undertaking these complex research projects has only been possible by collaborating," says Jose.

"Working together we have answered questions that otherwise would have been impossible or taken far longer to answer."

Ryan agrees. "By combining the distinct scientific techniques that our different laboratories specialise in—which range from manipulating and interrogating cell identity and function, to mapping features of the genome and sophisticated computational analyses—the whole can be bigger than the parts."

The laboratories are spread across the country but they share information, ideas and reagents and connect online and face-to-face thanks to support from Stem Cells Australia.

Progressing stem cell science as quickly as possible is of particular interest to Ernst who works on human diseases and is involved with patient advocacy groups.

"I want to understand how mutations in genes or alterations in gene copy number lead to diseases, especially those that affect the brain, and how a decline in stem cell function contributes to ageing," said Ernst.

So far, the teams have made several discoveries related to neurodegenerative diseases including leukodystrophies, Rubinstein-Taybi syndrome and Down syndrome, identifying new potential treatments and providing insights into the cell types and processes that underlie Alzheimer's disease.

While they have taken big steps, particularly over the last ten years, towards understanding the paths that cells take towards pluripotency and disease, all three researchers agree there is still a lot of work for them to do together.