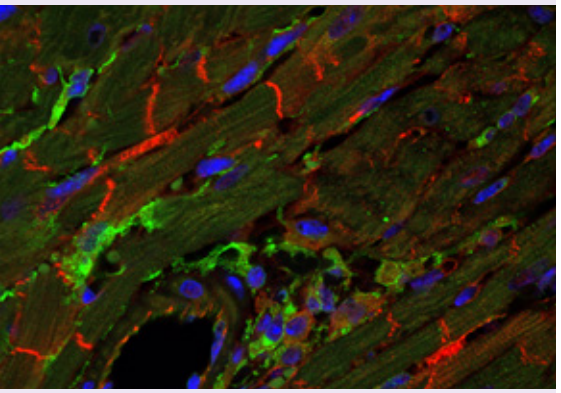
At a glance

New insights delivered by two Australian research teams puts heart research on the fast track to the clinic.

Professor Robert Graham

Professor Richard Harvey and team



Pathways to heart repair

The need

Heart trauma and disease are a leading cause of disability and death in children and adults, affecting one in every six Australians. Next to cancer, it has the highest burden in terms of treatment cost and lost income to patients and their families and caregivers. Most current treatments focus on reducing the risk or impact of heart conditions. This is largely due to the fact that heart muscle cells, also called cardiomyocytes, do not readily divide to replace damaged tissue. New regenerative medicine approaches are required to stimulate the heart's cells to form healthy new heart tissue, and will offer hope of a better quality of life for those affected by heart disease.

The projects

Finding ways to motivate the heart to regenerate requires a deep understanding of the intrinsic cues that control normal heart growth and repair. Professors Robert Graham and Richard Harvey, based at the Victor Chang Cardiac Research Institute and the University of New South Wales, have made substantial contributions to this quest.

In 2014, Graham's research team overturned a long-standing belief that heart cells do not divide after birth. They meticulously followed the development and division of heart cells in mice and found that the number of heart cells increased rapidly, by 40%, during pre-adolescence and that this spike in growth was linked to the presence of thyroid hormone.

Nearby, Harvey's team was making its own discoveries. In a 2015, they showed that a single protein that binds the hormone neuregulin could supercharge the repair pathways of the adult heart, causing a ~5-fold increase in cardiomyocyte division. This pathway may work hand-in-hand with how heart stem cells are regulated, a theme they are now investigating. In the same year, Harvey also identified a new network of proteins that interact with the gene NKX2-5, one of the master-regulators of heart development. Through genome-wide and computational approaches, Harvey's team revealed how this network goes awry to cause congenital heart disease.

The impact

The research from these labs could fast-track new and desperately needed heart therapies. Based on the work of the Graham lab, research is underway to see if thyroid hormone could be harnessed to help repair damage in adult hearts. Similarly, research from the Harvey lab opens new avenues to determine whether existing or new drugs could stimulate adult heart muscle to divide. Through understanding how heart development is regulated, the Harvey team is also one step closer to identifying the point during development in which congenital abnormalities occur. Both of these labs have built a strong, international network of colleagues, ensuring that their findings directly contribute to global efforts to improve cardiovascular health.