Our Research

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- **Designer Cells**
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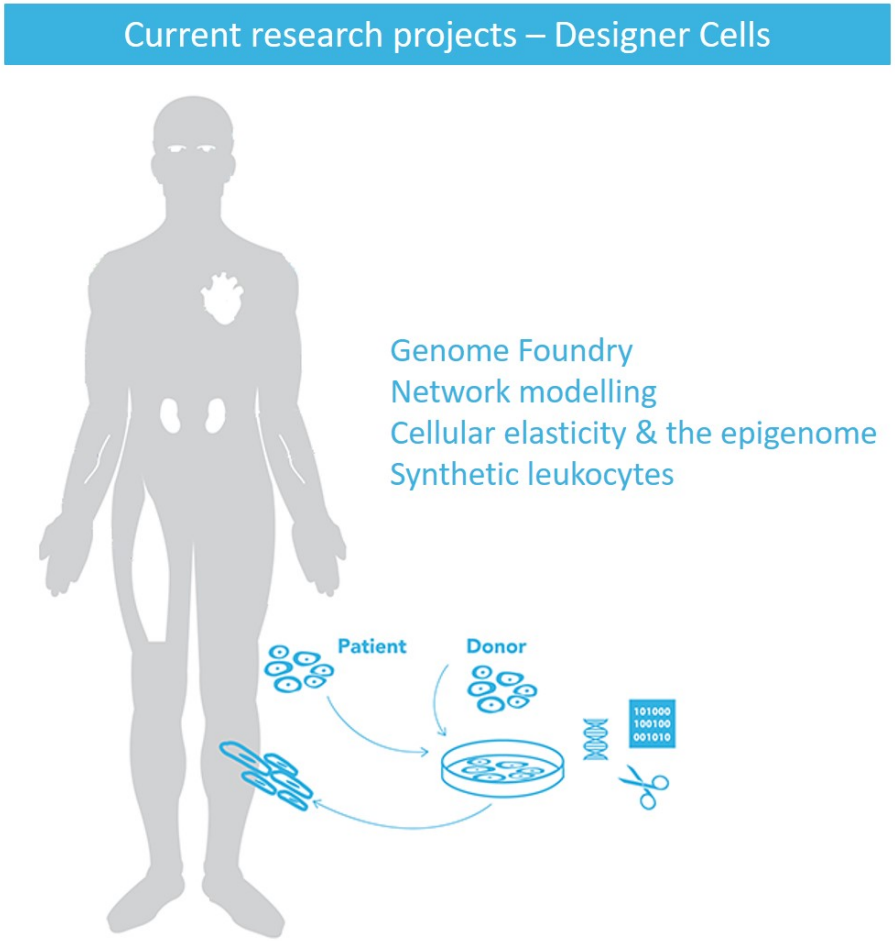
DESIGNER CELLS

Designer Cells is one of three pillars of research in Stem Cells Australia.

The Designer Cells program is using a combination of molecular tools to design and construct completely novel types of cells, built to deliver a specific function. Examples might include a universal cell that is engineered to be compatible for all transplant patients, or that produces therapeutic compounds only when given a specific command to do so.



3.1 Genome Foundry

Nathan Palpant (University of Queensland), Lars Nielsen (University of Queensland), Ernst Wolvetang (University of Queensland), Shalin Naik (Walter and Eliza Hall Institute), Ryan Lister (University of Western Australia), Ed Stanley (Murdoch Children's Research Institute)

Future applications of stem cells will require the capacity to introduce multiple genetic changes to the cells, to introduce useful properties. Such properties could include the ability to trace cells as they multiply or migrate, to count the number of cell divisions or to enable cells to make decisions based on their environment. Such multiple genetic changes in human cells are likely to present technical challenges and have complicated and unpredictable outcomes. To assess the best way to do large-scale gene editing requires the ability to test large numbers of changes. This project will develop and validate a set of tools to form the basis for a mammalian cell genome foundry to provide this technology.

3.2 Modelling molecular networks in cells that describe cellular functions

Kim-Anh Le Cao (University of Melbourne), Jess Mar (University of Queensland)

This project will develop methods for modelling large sets of data in public databases about the molecular properties of cells. The data sets include Stemformatics and FANTOM and the Human Cell Atlas. The methods will focus on molecular circuits and networks in cardiac cell development, neural differentiation and macrophage identity and function.

3.3 Exploring and manipulating cell identity

Jose Polo (Monash University), Ryan Lister (University of Western Australia)

One of the greatest promises of regenerative medicine lies in our ability to, in principle, reprogram any cell type in the body into any other cell type, since every cell has the same genome. This project will explore critical gene expression patterns that determine cellular identity, assess the “elasticity” of these patterns during cellular reprogramming and develop editing tools to manipulate epigenetic modifications of chromatin that affect gene expression.

3.4 Towards synthetic leukocytes

Christine Wells (University of Melbourne), Ed Stanley (Murdoch Children’s Research Institute), Trevor Kilpatrick (University of Melbourne), Samir Taoudi (Walter and Eliza Hall Institute)

The goal of this project is to engineer leukocytes in a dish that have desirable artificial properties. These include the properties of tissue-resident or age-appropriate cells, specific functions such as the machinery to package certain proteins in specific secretory vesicles or adopting immunomodulatory functions. This will be achieved using gene-editing technology on blood cells derived from human induced pluripotent stem cells.

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