Breakthrough in human cell transformation could revolutionise regenerative medicine

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Mogrify is a predictive computational system for direct reprogramming between human cell types. The image shows a rendering of the celluar reprogramming landscape from real data. Credit: Cherrie Kong

A breakthrough in the transformation of human cells by an international team led by researchers at the University of Bristol could open the door to a new range of treatments for a variety of medical conditions. Their paper, published today in *Nature Genetics*, demonstrates the creation of a system that predicts how to create any human cell type from another cell

type directly, without the need for experimental trial and error.

Julian Gough, professor of bioinformatics at the University of Bristol, said: 'The barrier to progress in this field is the very limited types of cells scientists are able to produce. Our system, Mogrify, is a bioinformatics resource that will allow experimental biologists to bypass the need to create stem cells.'

Pluripotent stem cells – or cells that have not yet 'decided' what to become – can be used to treat many different medical conditions and diseases. The first human artificial pluripotent stem cells were created by Japanese researcher Shinya Yamanaka in 2007, through a process of educated trial and error that took a long time. In the nine years since, scientists have only been able to discover further conversions for human cells a handful of times.

Professor Gough said: 'Mogrify predicts how to create any human cell type from any other cell type directly. With Professor Jose Polo at Monash University in Australia, we tested it on two new human cell conversions, and succeeded first time for both. The speed with which this was achieved suggests Mogrify will enable the creation of a great number of human cell types in the lab.'

'The ability to produce numerous types of human cells will lead directly to tissue therapies of all kinds, to treat conditions from arthritis to macular degeneration, to heart disease. The fuller understanding, at the molecular level of cell production leading on from this, may allow us to grow whole organs from somebody's own cells.

'This represents a significant breakthrough in regenerative medicine, and paves the way for life-changing medical advances within a few years from now, and the possibility in the longer term of improving the quality of longer lives, as well as making them longer.'

To achieve this game-changing result, Professor Gough worked with then-PhD student Dr Owen Rackham (who now works at Duke-NUS Medical School in Singapore) for five years to develop a computational algorithm to predict the cellular factors for cell conversions. The algorithm was conceived from data collected as a part of the FANTOM international consortium (based at RIKEN, Japan) of which Professor Gough is a long time member. The algorithm, called Mogrify, has been made available online for other researchers and scientists, so that the field may advance rapidly.

More information: A predictive computational framework for direct reprogramming between human cell types, DOI: 10.1038/ng.3487

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