Stem cells know where they want to go

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Human stem cells have the ability to become any cell type in the human body, but when it comes to their destination they know where they want to go.

This finding by McMaster University researchers sheds new light on how these regenerative cells turn into more specialized cell types, such as neural or blood cells. Until now, the thought has been that stem cells keep all their options open and have no preference when it comes to becoming more specialized.

In a paper published in the scientific journal *Cell Stem Cell*, Mick Bhatia, director of the McMaster Stem Cell and Cancer Research Institute, led a team of investigators to discover the molecular underpinnings of how human pluripotent stem cells make decisions. Pluripotency is the ability of stem cells to turn into any one of the 226 cell types that make up the human body.

The researchers discovered the fate – or destination – of human pluripotent stem cells is encoded by how their DNA is arranged, and this can be detected by specific proteins on the surface of the stem cells.

"It's like going on secret trip," said Bhatia, a professor in the Department of Biochemistry and Biomedical Sciences at the Michael G. DeGroote School of Medicine. "When you decide to go to Jamaica, you pack your toothbrush, underwear, and of course shorts, t-shirts and swimsuits. But if, at the last minute, you get rerouted to Alaska, you unpack a few things but the basic elements, like your toothbrush, are going to be the

same. You may just trade the shorts and swimsuits for long pants and a sweater."

Until now, common scientific belief has been that all pluripotent stem cells are equivalent and keep all options open at the same time. But that's really not the case, Bhatia says.

"This study showed that pluripotent cells are not all equal," he said. "They are all pluripotent. You can force a cell that normally would love to become a neural cell to turn into blood, just like you can force the vacationer to go Alaska instead of Jamaica. They'll do it, but not very well and not happily."

For the study, Bhatia and his research team found stem cells with roadmaps and specifically packed suitcases for the blood and neural destinations. The researchers discovered when they isolated these stem cells by new protein markers on the surface of cells, they were able produce a greater number of specialized cells – nearly five times as many blood cells and twelve times as many neural cells compared to when the stem cells had to be forced into those cell types.

The results open the door to tailoring stem cells and improving their ability for tissue and organ regeneration. The researchers now plan to investigate how the process works in induced pluripotent stem cells – the kind created from adult skin.

Provided by McMaster University

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