McMaster researchers say not all stem cells the same

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Until now it's been thought that human stem cell lines are all identical and possess the same ability to differentiate, or change into more specific cell types. But new research from McMaster University has shown there are subsets of stem cells that respond differently depending on what stem cell properties are measured and what test is used.

"We discovered pluripotent stem cells [cells capable of giving rise to several different cell types] in humans are not made equally and they're certainly not measured equally," said Mick Bhatia, scientific director of the McMaster Stem Cell and Cancer Research Institute and a lead author of the study. "This study affirms that we should no longer make the assumption that every stem cell is the same or has the same potential."

The research, funded by the Canadian Institutes of Health Research, was published online Oct. 17 in the prestigious journal Nature Methods.

Stem cells give rise to at least 226 different cell types in the human body, but scientists don't use the same litmus test to measure each kind. Instead, they follow a specific set of instructions - or recipe - to produce a blood cell or a neural cell, for example. They also examine how stem cells become specialized by measuring them either in a culture dish or in a mouse. That may change.

Bhatia and his team discovered at least four subsets of stem cells that vary in their capacity to differentiate or make copies of themselves, a stem cell property called self-renewal. The researchers found that some

stem cells differentiate only in a culture dish, while others differentiate only in mice. They found a third subset that didn't respond at all, and a fourth subset - a small fraction of the cells - that differentiated in both environments.

"People have always understood that there are probably differences in cells in the dish, but they couldn't measure the differences and they didn't know the contribution of stem cells to one measure versus another, or the impact of those differences," said Bhatia, a professor in the Department of Biochemistry and Biomedical Sciences.

The massive research study was conducted over four and a half years by investigators in the McMaster Stem Cell and Cancer Research Institute. The study involved "permanent" tagging of hundreds of stem cells by inserting a piece of DNA into them. The researchers then measured the differentiation capacity of each stem cell by using cell-based tests, known as functional assays, and following the tag.

Bhatia said the research could signal a new approach to the way stem cells are measured. It could also lead to a different interpretation of previous data or a refined approach to cell-replacement therapy.

"This study has implications on stem-cell-based regenerative medicine. We actually didn't know which stem cells were responding to our recipes until we did this experiment," he said. "As we move forward, the methods in which we evaluate stem cells are critical. If the methods are wrong, or misinterpreted, it changes everything."

Provided by McMaster University

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