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Researchers discover human embryonic stem cells are the ultimate perpetual fuel cell

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A startling discovery on the development of human embryonic stem cells by scientists at McMaster University will change how future research in the area is done.

An article published in the prestigious scientific journal *Nature* this week reports on a new understanding of the growth of human stem cells. It had been thought previously that stem cells are directly influenced by cells in the local environment or 'niche', but the situation may be more complex. Human embryonic stem cells are perpetual machines that generate fuel for life.

In this week's *Nature*, researchers of the McMaster Cancer and Stem Cell Research Institute show that human embryonic stem (ES) cells can actually produce distinctive niche cells, which then release stem-cell nourishing proteins to help keep their 'parents' ticking over.

Scientific Director Mick Bhatia and colleagues provide the first evidence that human ES cells have the unique ability to generate human-ES-cell-derived fibroblast-like niche cells (hdFs) in vitro despite removal from their in vivo microenvironment. These hdFs then provide a continuous source of supportive proteins, including insulin-like growth factor 2 (IGF-II), which they now show could be "the" protein to sustain hESCs..

Researchers are interested in the relationship between stem cells and their niche, because the niche represents a route for modifying stem cell

behaviour — if human ES cells can be reliably guided down a particular pathway, then they can be more readily used for future clinical therapy to regenerate damaged tissue such as neurons for Parkinson's disease, or insulin producing cells for diabetes .

The research has been funded by the Canadian Institutes for Health Research and the National Cancer Institute of Canada.

The *Nature* article is the latest in a series of important papers published by scientists at the 18-month-old institute, which was established with funding by philanthropist Michael G. DeGroote. The institute has a research focus on the molecular determinants of cancer and tissue repair and is building scientific momentum.

"This discovery of a new fundamental understanding about how human stem cells develop is the kind of scientific work which has already put this Institute on the map as the leader in this field," said John Kelton, dean and vice-president of McMaster's Faculty of Health Sciences.

Mick Bhatia said that he and his scientific team have been working for the past year to prove themselves wrong, but as every test confirmed their discovery, it was time to submit the work for international peer review from other experts.

"This will be critical for future developments involving drug and gene screening of human ES cells, that will be required before clinical use of human stem cells of this kind," he said.

Stem cells, which have the ability to turn into many different types of cells, have been the subject of intense study for the past two decades, as scientists have been gradually deciphering the processes by which unspecialized stem cells become the many specialized cells types in the body.

The new discovery about how human ES cells grow and multiply will create a paradigm shift in how scientists conduct future research, which could someday lead to new therapies for various illnesses.

"The fact that there is a niche for human ES cells, I think, changes how any regenerative medicine that starts with human ES cells would ever occur," said Bhatia. "If at their most fundamental level, human embryonic stem cells themselves are producing a cell that regulates their decisions on future differentiation, one way of controlling differentiation would be to control the niche."

Source: McMaster University