

Stem cell scientists discover potential way to expand cells for use with patients

Canadian and Italian stem cell researchers have discovered a new "master control gene" for human blood stem cells and found that manipulating its levels could potentially create a way to expand these cells for clinical use.

The findings, published today online ahead of print in *Cell Stem Cell*, usher in a new paradigm for the regulation of human blood [stem cells](#), says co-principal investigator Dr. John Dick, who holds a Canada Research Chair in [Stem Cell Biology](#) and is a Senior Scientist at University Health Network's McEwen Centre for [Regenerative Medicine](#) and Ontario Cancer Institute (OCI), the research arm of the Princess Margaret Cancer Centre. He is also a Professor in the Department of [Molecular Genetics](#), University of Toronto.

"For the first time in human blood stem cells, we have established that a new class of non-coding RNA called miRNA represents a new tactic for manipulating these cells, which opens the door to expanding them for therapeutic uses," says Dr. Dick.

In 2011, Dr. Dick isolated a human blood stem cell in its purest form "as a single stem cell capable of regenerating the entire [blood system](#)" paving the way for clinical uses. He also pioneered the cancer stem cell field by identifying leukemia stem cells in 1994 and [colon cancer](#) stem cells in 2007.

OCI lead author Dr. Eric Lechman says the research team removed a master control gene "microRNA 126 (miR-126)" that normally governs the expression of hundreds of other genes by keeping them silenced, which in turn keeps the stem cells in a non-dividing dormant state. The method was to introduce excess numbers of miR-126 binding sites into the stem cells by using a specially designed [viral vector](#).

"The virus acted like a sponge and mopped up the specific miRNA in the cells. This enabled the expression of normally repressed genes to become prominent, after which we observed a long-term expansion of the blood stem cells without exhaustion or [malignant transformation](#)," says Dr. Lechman.

Adds Dr. Dick: "We've shown that if you remove the miRNA you can expand the stem cells while keeping their identity intact. That's the key to long-term stem cell expansion for use with patients." The co-principal investigator was Dr. Luigi Naldini, Director, of the San Raffaele Telethon Institute for Gene Therapy, Milan.

Dr. Dick's research was funded by the Canadian Institutes of Health Research, the Canadian Cancer Society, the Terry Fox Foundation, Genome Canada through the Ontario Genomics Institute, the Ontario Institute for Cancer Research, the Canada Research Chair Program, the Ontario Ministry of Health and Long-Term Care, the Canada Foundation of Innovation, as well as The Princess Margaret Cancer Foundation.

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