Researchers learn how blood cells 'talk'

August 5th, 2009 By Paul Cantin

(PhysOrg.com) -- Researchers at the University of Toronto have developed a new model that explains how cells communicate and specifically reveals how blood cells "talk" to each other. The result could help transform treatments for diseases such as leukemia.

The paper, published online by the journal *Molecular* Systems Biology, details how a team led by Canada Research Chair in Stem Cell Bioengineering Professor Peter Zandstra (Institute of Biomaterials and Biomedical Engineering, Department of Chemical Engineering and Applied Chemistry) revealed a new mathematical model that links functional cellular assays to specific model outputs, defines cell-level kinetic parameters such as cell cycle rates and self-renewal probabilities as functions of culture variables, and simulates feedback regulation using cell-cell interaction networks.

Blood stem cell transplantation is used to treat and cure genetic blood diseases, such as anemia, and blood cancers like leukemia and lymphoma. Usually, the more blood stem cells you have to transplant, the better the outcome. But while there is great demand, there is not a large supply, primarily because it is so hard to grow blood stem cells in vitro. Scientists have been working for years to expand these cells, but nobody has yet been able to find a robust and reliable method.

"The goal of our study was to understand what regulated human blood stem cell growth outside of the body," said Daniel Kirouac, lead author and a PhD student in the Institute for Biomaterials and Biomedical Engineering.

"In the human body, cells talk to each other using secreted factors. Sometimes they send messages that encourage cell growth and sometimes they send messages that disrupt cell growth," said Zandstra, who is also affiliated with the Terrence Donnelly Centre for Cellular and Biomolecular Research and the R. Samuel McLaughlin Centre for Molecular Medicine at the University of Toronto and McEwen Centre for Regenerative Medicine at the University Health Network. "Our model provides a formal framework to try to understand the codes that cells use in this communication system."

The team tested their model predictions by culturing umbilical cord blood stem cells and measured the effects of specific manipulations on blood stem and progenitors cell output. They found that they could influence communication between cells, disrupting cellular cross-talk that hindered growth and encouraging cross-talk that stimulated growth. The new model is a useful tool to simulate blood culture outputs and to test, in computer simulations, new ideas about how to improve blood stem cell growth.

"We've applied this model to cell cultures in various configurations, and also expanded it to provide insight into how blood stem cells may be regulated in humans under normal and abnormal conditions, such as in patients with leukemia. We can use a computer to predict conditions for enhanced blood stem cell growth outside of the body," says Prof. Zandstra. This should contribute towards efforts to generate a greater supply of blood stem cells for transplantation, which would greatly impact the hundreds of thousands of people suffering from blood diseases and cancers around the world.

A synopsis of the research can be found online at **http://www.nature.com/msb/journal/v5/n1/synopsis/msb200949.html**

Provided by University of Toronto (**news** : **web**)

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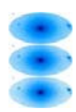

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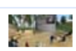

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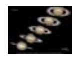

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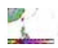

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