Singapore scientists discover how to control fate of stem cells

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Scientists from the Genome Institute of Singapore (GIS), an institute of the Agency for Science, Technology and Research (A*STAR), in collaboration with the Cancer Science Institute of Singapore (CSI), have discovered how the body uses a single communication system to decide the fate of stem cells. The study, published in the scientific journal *PLoS Genetics* on 23rd June 2011, paves the way for the development of new methods of stem cell therapy with fewer side effects.

Dr Kian Leong Lee and his team of scientists studied how a single signaling system known as the Nodal/Activin pathway tells stem cells what cell type they should eventually become. The pathway is able to specify a wide range of eventual cell types, challenging the current belief that chemical signaling systems are highly specific and only control a limited number of outcomes. This discovery is a major step forward for stem cell therapies and personalised medicine; by exploiting this signaling system, scientists will be able to control the eventual fate of a stem cell by simply adjusting the chemical environment of a cell. This method of controlling stem cell differentiation also avoids modifying the genetic material of the cell, a procedure that might lead to the cells becoming cancerous.

Dr Lee, first author and post-doctoral research fellow at GIS and CSI said, "Many scientists believe that protein and chemical signaling systems have highly specific functions in biology. However, our study demonstrates that the same type of signal can be changed very dramatically to give different instructions. This finding is extremely

significant because it paves the way for advanced studies in cell regeneration and tissue repair, which could ultimately lead to its use in personalized medicine, where stem cells from the same patient could be manipulated to make other types of cells that are genetically matched to the donor."

Urban Lendahl, professor of genetics and vice-chairman at the Department of Cell and Molecular Biology at the Karolinska Institutet, Sweden mentioned, "The report by Lee et al represents a truly significant advance in our understanding of how one of the key signaling mechanisms controls stem cell maintenance and differentiation. The authors show that either an increase or decrease in Nodal/Activin signaling leads to exit from the stem cell state in embryonic stem cells. They also take this a step further, by providing a very exciting molecular explanation for this observation. The finding that pSmad2 regulates distinct gene sets at different levels of Nodal/Activin signaling provides new and important insights into the molecular regulation of the stem cell state."

More information: "Graded Nodal/Activin Signaling Titrates Conversion of Quantitative Phospho-Smad2 Levels into Qualitative Embryonic Stem Cell Fate Decisions", *PLoS Genetics.*

Provided by Agency for Science, Technology and Research (A*STAR)

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