# Stem Cell Club

## *Embryonic Stem Cells; growth, genomics and differentiation*

***(Organised by the Stem Cells Research, Singapore, Website Committee, http://www.stemcell.edu.sg)***

Date: June 15th 2005, Wednesday
Time: 5.00 - 8.00
Venue: Theaterette 4 (Level 4), The Matrix, Biopolis

| Time | Title | Speaker |
|---|---|---|
| 5.00 - 5.15 | Introduction | Sohail Ahmed |
| Chair | Gerald Udolph | |
| 5.15 - 5.30 | Establishment of Defined Culture Conditions for the Expansion of Undifferentiated Human Embryonic Stem Cells | Andre Choo |
| 5.30 - 6.00 | The Genetic Regulatory Architecture of the Embryonic Stem Cells | Paul Robson |
| 6.00 - 6.30 | Directed Osteogenic and Chondrogenic Differentiation Of Human Embryonic Stem Cells | Cao Tong |
| 6.30 - 8.00 | Cheese and Wine | |

**Establishment of Defined Culture Conditions For The Expansion of Undifferentiated Human Embryonic Stem Cells**

Andre Choo, Angela Chin, Jayanthi Padmanabhan, Fong Wey Jia, Goh Lin-Tang, Robin Philp & Steve Oh

Stem Cell, Analytics and Proteomics Groups, Bioprocessing Technology Institute, 20 Biopolis Way, #06-01, Centros, SINGAPORE 138668

Human embryonic stem cells (hESC) are pluripotent cells derived from the inner cell mass of blastocysts. They have the potential to proliferate indefinitely in culture, but still retain their capacity for differentiation into a wide variety of cells. hESC are currently maintained either on feeder layers or on matrigel with conditioned-medium (CM) from primary mouse embryonic fibroblasts (MEFs).

We describe here our efforts to establish defined conditions that will allow the continuous expansion of undifferentiated hESC in a feeder-free and serum-free culture system. This includes the development of a robust hESC passaging method based on enzymatic dissociation, immortalization of mouse and human feeders for the generation of consistent batches of conditioned-media, and the evaluation of different extracellular matrices and culture media that are free of animal-derived products. In addition, proteomic tools are used to elucidate the factors secreted by feeders in CM that are essential for hESC self-renewal.

Apart from defining culture conditions, our group is also addressing strategies to scale-up hESC to quantities required for differentiation studies and *in vivo* animal models. Concurrently, tools and methodologies are being developed to characterize stem cell pluripotency. These include the raising of monoclonal antibodies to novel cell surface markers on hESC.

For profile of Andre Choo see: http://www.stemcell.edu.sg/andre.html

## The Genetic Regulatory Architecture of the Embryonic Stem Cell

Paul Robson
Stem Cell & Developmental Biology, Genome Institute of Singapore

A comprehensive understanding of the genetic regulatory network underlying the pluripotent embryonic stem cell (ESC) will improve our ability to manipulate these cells to our desire, whether this be for stem cell maintenance or directed differentiation. We focus on characterizing the cis-regulatory modules and corresponding transcription factors involved in maintaining the pluripotent phenotype. Nanog, Sox2, and Oct4 are transcription factors known to be essential for this maintenance of ESC pluripotency. Through a cooperative interaction Sox2 and Oct4 have previously been described to drive pluripotent-specific expression of a number of genes, including Sox2. I will discuss our recent results that have now extended the list of Sox2-Oct4 target genes to also include Nanog and Pou5f1 (ie. the gene encoding Oct4) itself. This clearly positions the Sox2-Oct4 complex as a central player in the pluripotent cell genetic regulatory network by virtue of its involvement in regulating the transcription of Nanog, Sox2, and Pou5f1.

For profile of Paul Robson see: http://www.stemcell.edu.sg/paul.htm

## Directed Osteogenic and Chondrogenic Differentiation Of Human Embryonic Stem Cells

Cao Tong
Faculty of Dentistry, National University of Singapore

Human embryonic stem cells (hESC) possess several advantages for clinical application in regenerative medicine; in particular it's human origin, pluripotency, genetic stability, and capacity for permanent symmetrical self-renewal. Additionally, hESC will also be an ideal source of cells for (1) human-related toxicology screening i.e. drugs, food, human clinical implants, (2) environmental analysis of water, soil, air, and natural/artificial products, (3) study of human development and disease, and (4) research/evaluation of gene-medicine and cell-based therapy prior to actual clinical trials. To fulfil these promises, there is a strong requirement for well-defined and efficient protocols for directing the differentiation of hESC into targeted somatic lineages, followed by their selective purification and proliferation in vitro. The development of such protocols would reduce the likelihood of spontaneous differentiation of hESC into divergent lineages, as well as reduce the risk of teratoma formation. Additionally, such protocols could provide useful in vitro models for basic research in developmental biology. The development of toxicity screening tests could also utilize protocols developed for the somatic differentiation of hESC. Our work on directing osteogenic and chondrogenic differentiation of hESC will be discussed in this talk.

For profile of Cao Tong see: http://www.stemcell.edu.sg/caotong.html