

**NUS Graduate School for Integrative Sciences and Engineering
Research Project Write-up**

Title of Project : Derivation of progenitor and somatic lineages from human embryonic stem cells

Name of Supervisor : CAO Tong

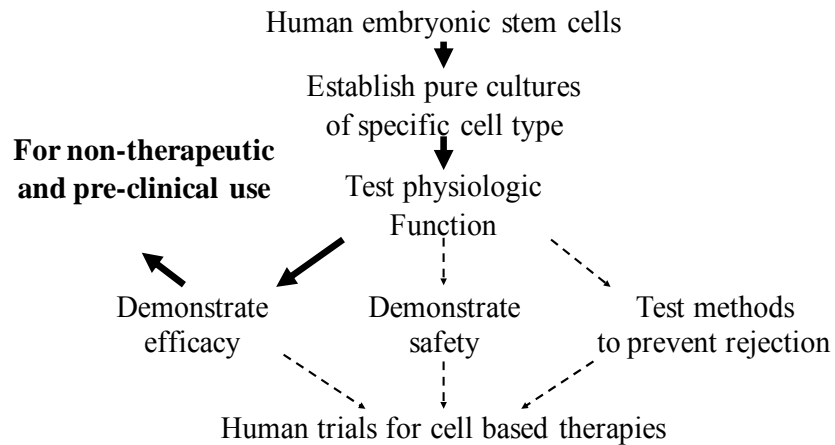
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Short Description

Human embryonic stem cells and progenies are ideal cell source for wide biomedical and biotech applications [1]:

- Human relevant bio-toxicity assessment for materials, drugs, food, chemicals and materials;
- Human relevant environment analysis of water, soil, air, and natural/artificial products;
- Gene/protein delivery to cure diseases;
- Cell based reconstruction therapy including regenerative medicine;
- Development and gene control of human tissue/body;
- Disease study.

Current work on human embryonic stem cells is at the first target: for non-therapeutic and pre-clinical applications:



Lineages of differentiation:

- Mesenchymal lineage
- Fibrogenic lineage
- Osteogenic lineage
- Chondrogenic lineage
- Endothelial lineage
- Keratinocyte lineage
- Hepatocyte lineage

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Research Project Write-up**

Title of Project : Utilizing of human embryonic stem cells and progenies in studies of cytotoxicity, genotoxicity, carcinogenicity and mutogenicity for wide biomedical and biotech needs

Name of Supervisor : CAO Tong

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Short Description

As one of global pioneers in this innovation, our work demonstrated the great potential of human embryonic stem cell for this purpose. The human embryonic stem cell lines are of single clonal origin, have been demonstrated to be genetically healthy and stable, possess unlimited proliferative capacity, and can potentially serve as an unlimited and permanent source of human cells for various clinical and non-clinical applications.

Industries are currently hindered by a lack of functional human cell systems, and predominantly use cells of low clinical relevance in addition to costly live animal models. Existing models of live animals or on immortalized cell lines of either animal or human origin, often poorly reflect human physiology. Primary human cell cultures are difficult to procure in sufficient quantity and can be prone to much inter-batch variability, depending on the cell source. By contrast, self-renewable human embryonic stem cells exhibit enhanced biological relevance and predictivity over its more expansive counterparts [2]. Based on our work on human embryonic stem cell differentiation, we have developed various differentiated progenitor and somatic lineages from human embryonic stem cells for industrial and health applications.

Hence, we endeavour to develop a technically-simple, cost-effective and replicable system of generating differentiated human embryonic stem cell progenies. These will then be applied to the studies of cytotoxicity, genotoxicity, carcinogenicity and mutogenicity specified by the International Organization for Standardization (ISO) and the Organization for Economic Co-operation and Development (OECD) guidelines. The human embryonic stem cells and progenies will also be compared with established cell lines and primary cultures, to determine whether these provide a better cellular model for the studies.

References

1. *Stem Cells: Scientific Progress and Future Research Directions*. Department of Health and Human Services (USA). June 2001. /info/scireport.
2. Gunjan Sinha. *Human Embryonic Stem Cells May Be Toxicology's New Best Friends*. *Science* 308(5728):1538