

## HKU Scientists Bring New Hopes to Translate Human Stem Cell Technologies to the Clinic

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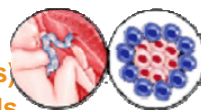
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## What are stem cells?

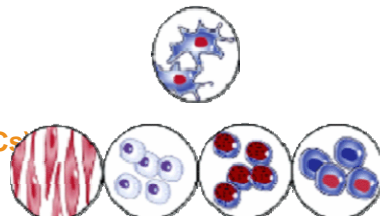
- **Pluripotent Stem Cells**

- ✓ Human Embryonic Stem Cells (hESCs)
- ✓ Human Induced Pluripotent Stem Cells (hiPSCs)



- **Adult stem cells**

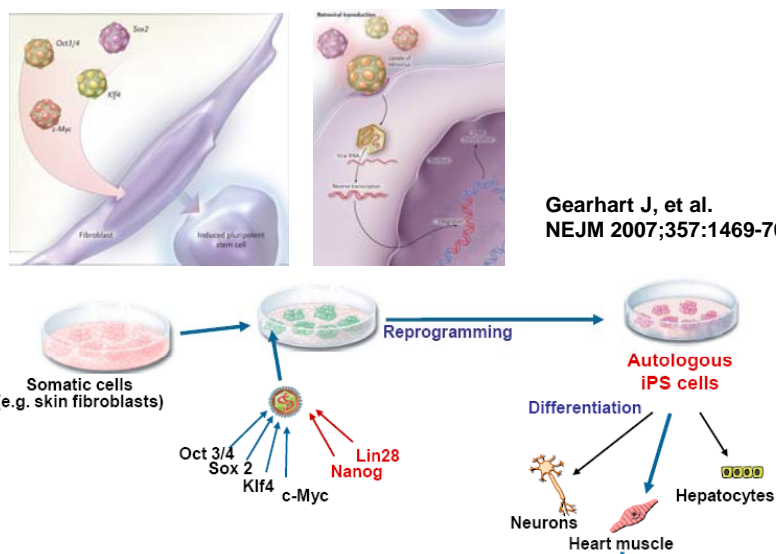
- ✓ Bone marrow stem cells
- ✓ Mesenchymal stem cells (MSCs)
- ✓ Cord blood stem cells
- ✓ Fat stem cells....



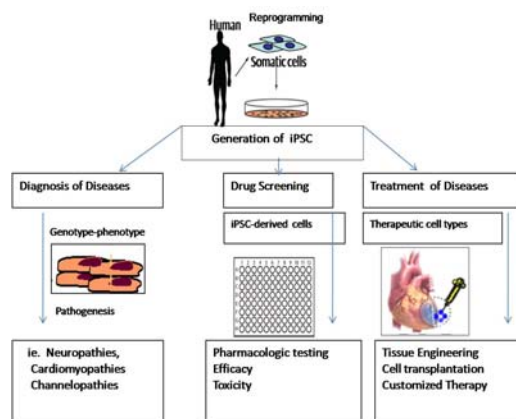
## Promises of Stem Cell Research

- ✓ ↑ ageing population with chronic health problems
- ✓ ↑ diseases, conditions, and disabilities including heart failure, Parkinson's and Alzheimer's diseases, spinal cord injuries, stroke, burns, diabetes, osteoarthritis and rheumatoid arthritis which existing drugs or therapies do not provide a cure.

## Human Induced Pluripotent Stem Cells (hiPSCs)



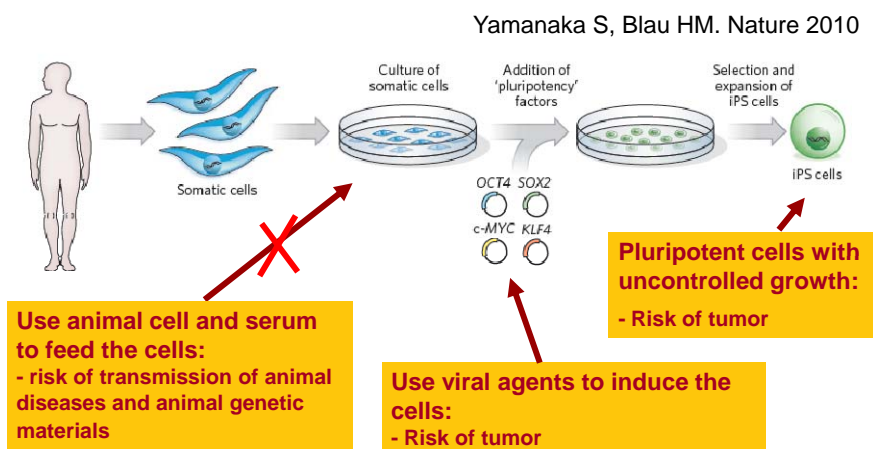
## Promises of Human induced Pluripotent Stem Cell Research

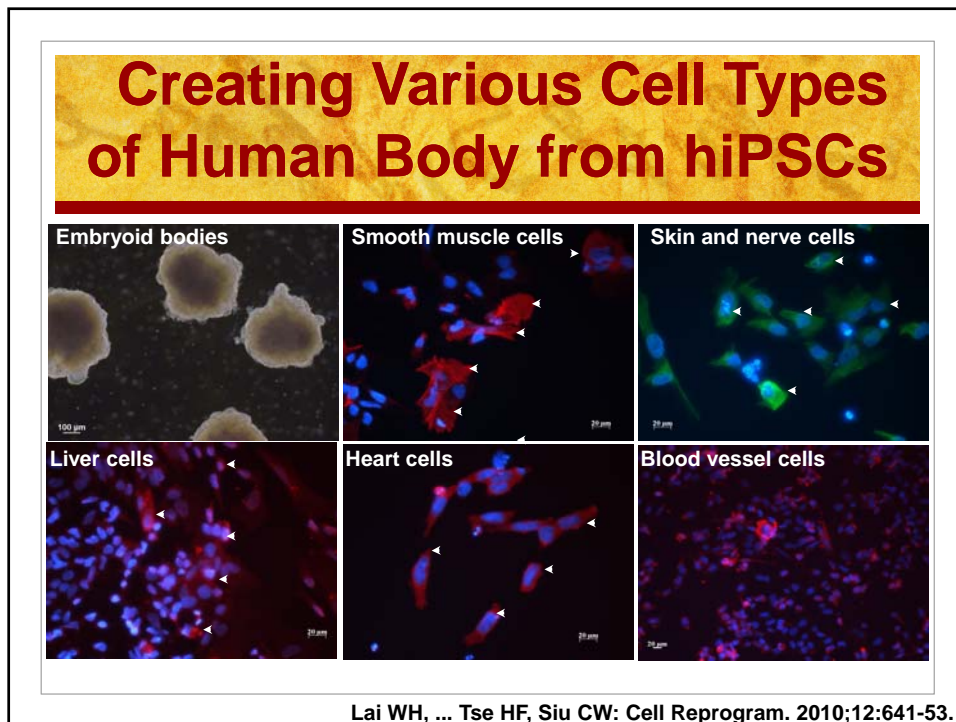
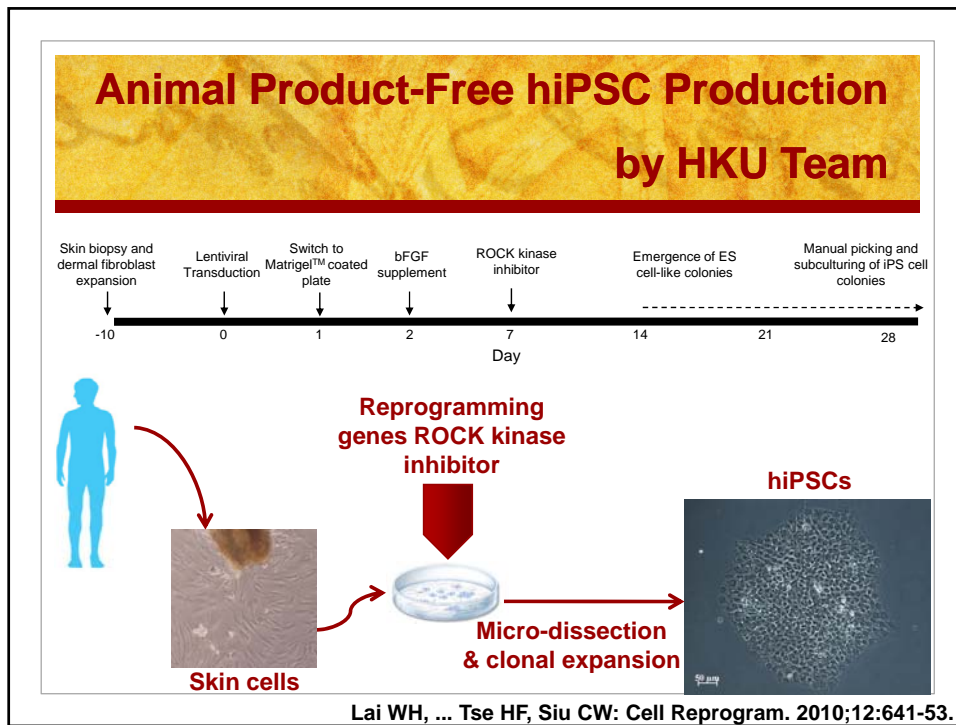


- Possible patient-specific: no risk of immune rejection because of the same genetic makeup of stem cells as patients
- No ethic concerns of human embryo uses as in hESCs
- Unlimited cell sources for clinical applications

Lian Q....Tse HF, Thromb Haemost 2010

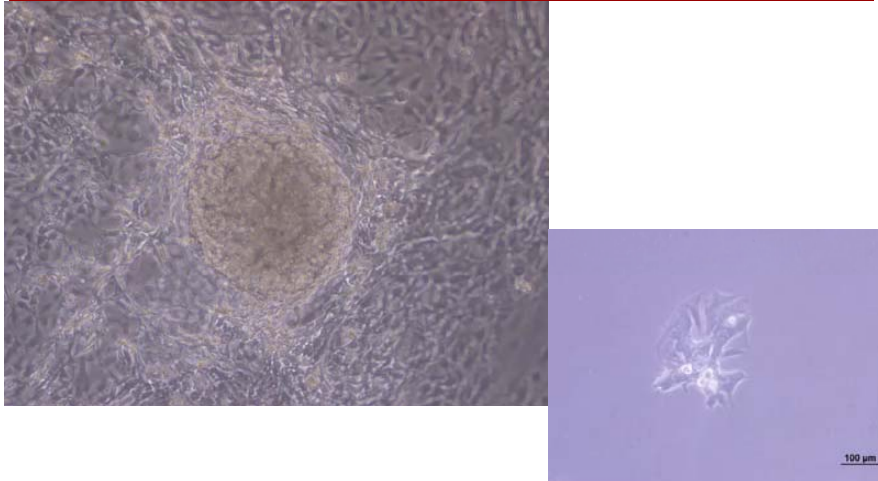
## Major Hurdles for Clinical Applications of hiPSCs



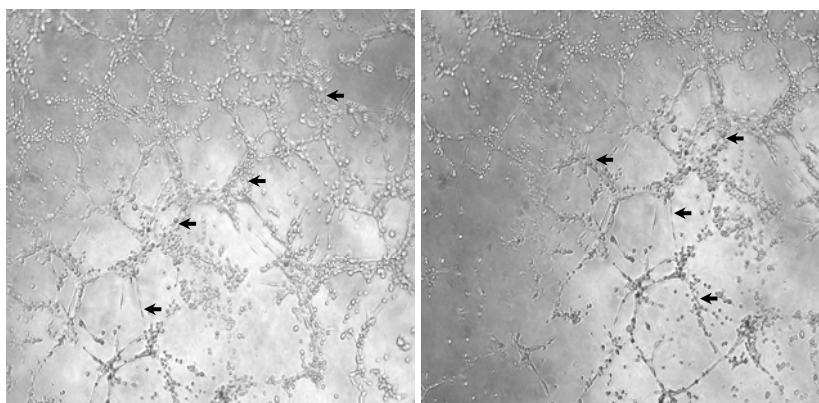




## Beating Heart Muscle Cells Generated from hiPSCs



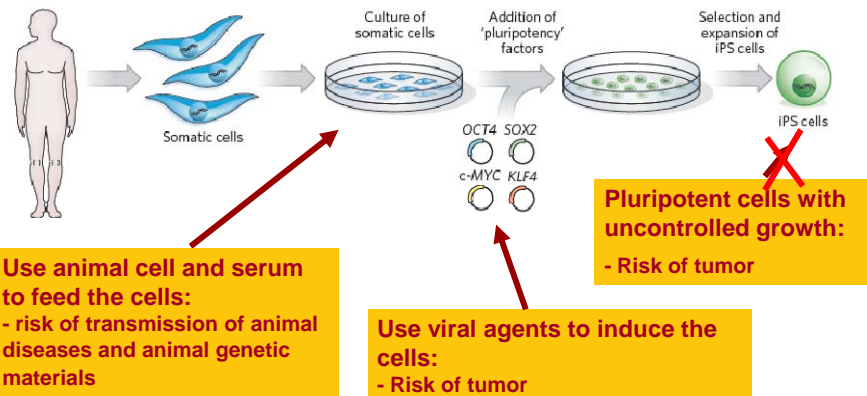
## Forming New Blood Vessels in Culture Dish



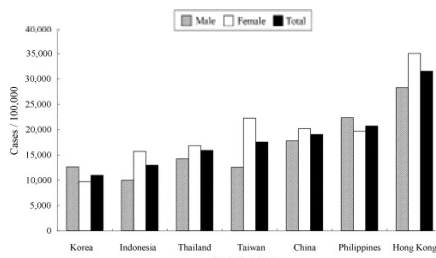
Lai WH, ... Tse HF, Siu CW: Cell Reprogram. 2010;12:641-53.

# Major Hurdles for Clinical Applications of hiPSCs

Yamanaka S, Blau HM. Nature 2010



# Leg Ulcer Due to Arterial Blockage



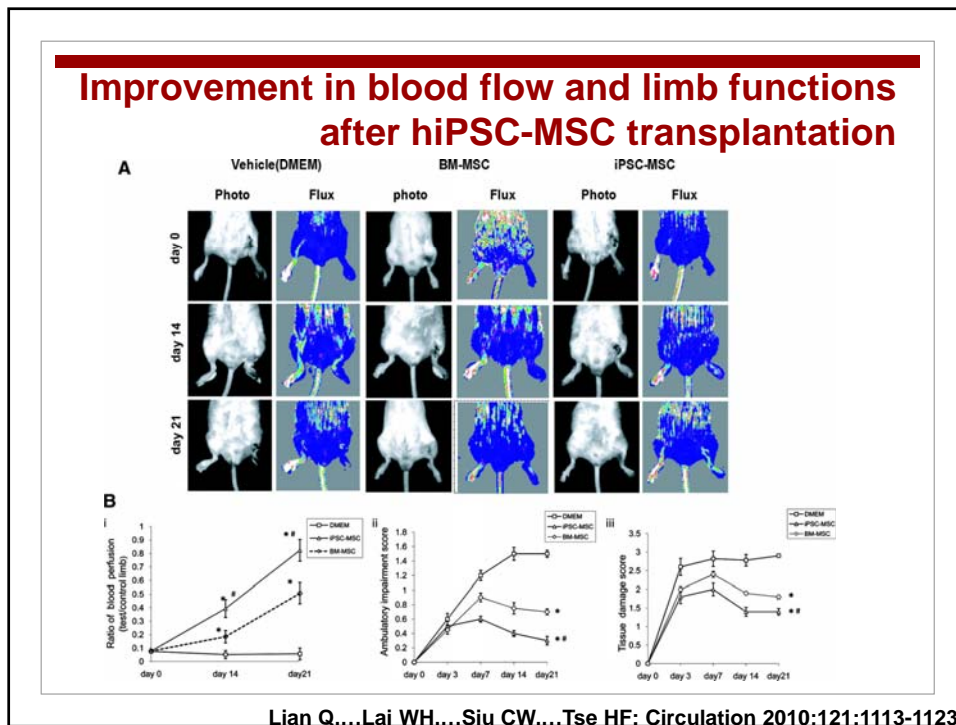
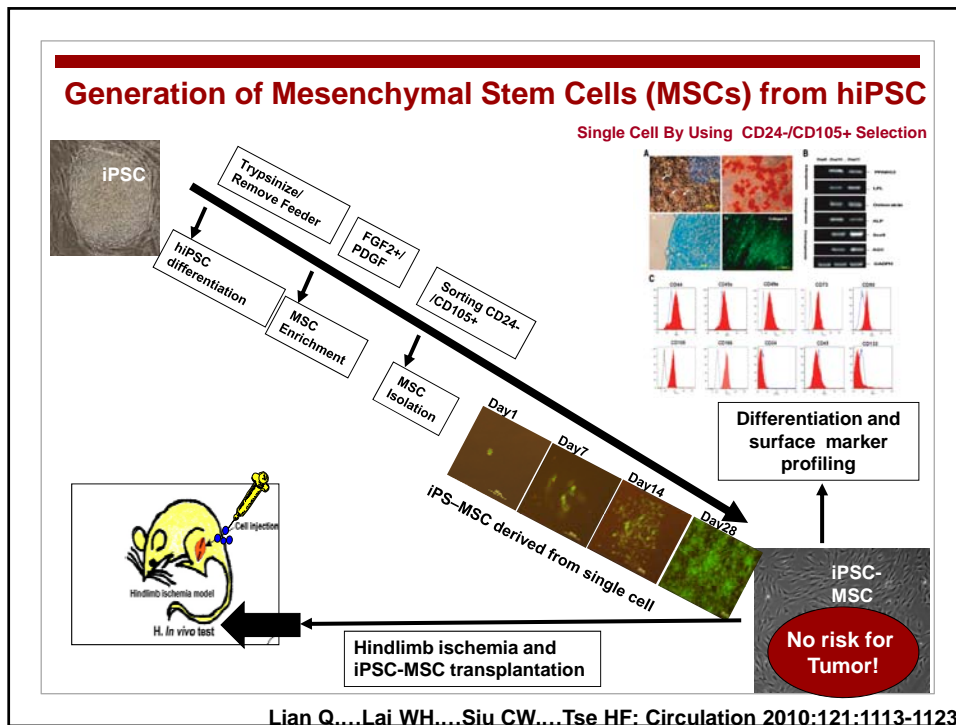
Shen Z NEJM 2010;363:2651.

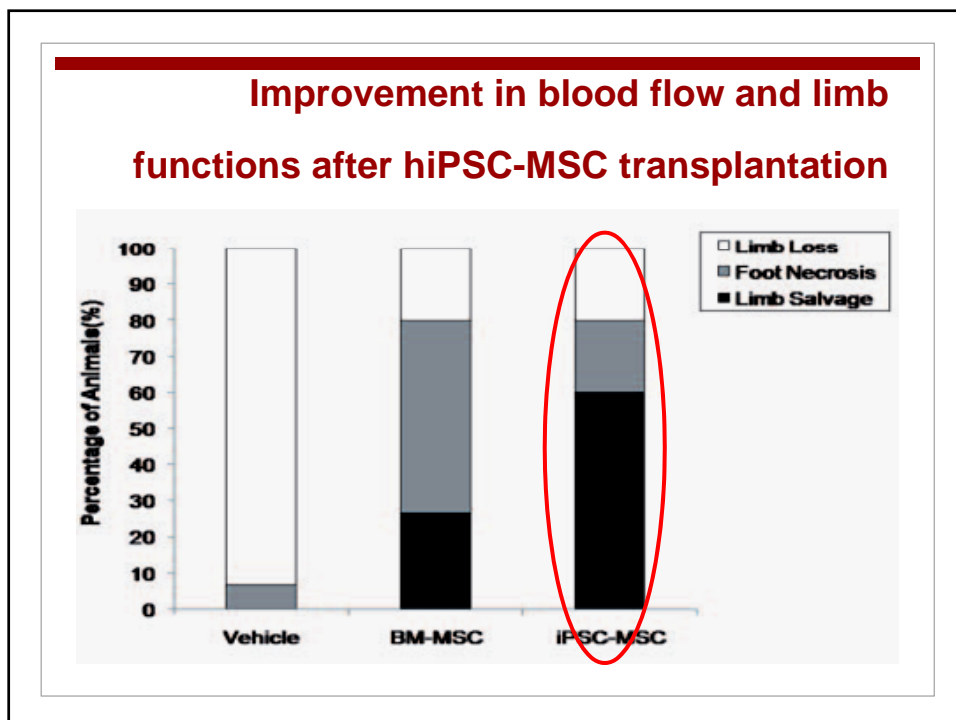
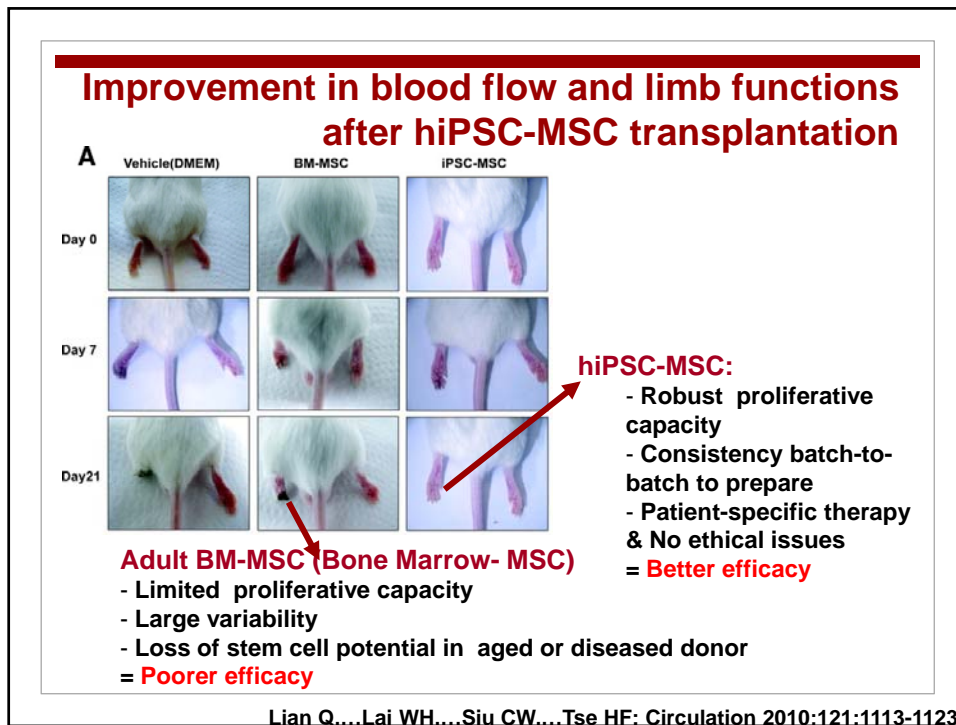
Peripheral arterial disease (PAD) due to obstruction of large arteries resulting in lack of blood supply

Patients with PAD may suffer from claudication and even limb loss (amputation) in ~5% of those with the most severe status.

PAD commonly secondary to atherosclerosis (DM, HT, Lipid and smoking)

In US, ~1200-5000/100,000 subjects need leg amputation for PAD per year.







# Modeling of Human Diseases with hiPSC



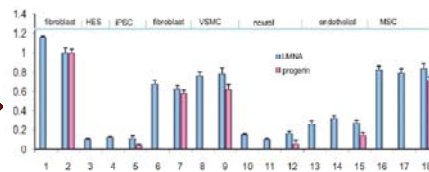
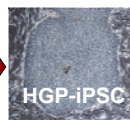
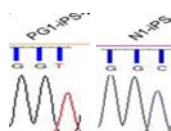
Source: <http://www.sbdevi.org/ProgeriaHGPS.html>.

- Premature ageing syndrome (Progeria) in children due to gene mutation
- Patients die at early teens due to ageing disease such as heart attack and stroke
- No cure or treatment yet available
- Understanding the progeria provides important clues to human ageing!

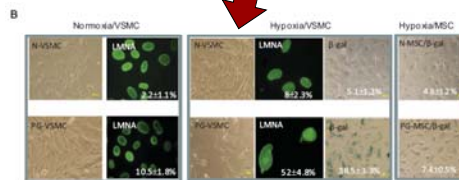
## A human iPSC model of Hutchinson Gilford Progeria (HGP) reveals vascular smooth muscle and mesenchymal stem cell defects



Young Children looks like elderly

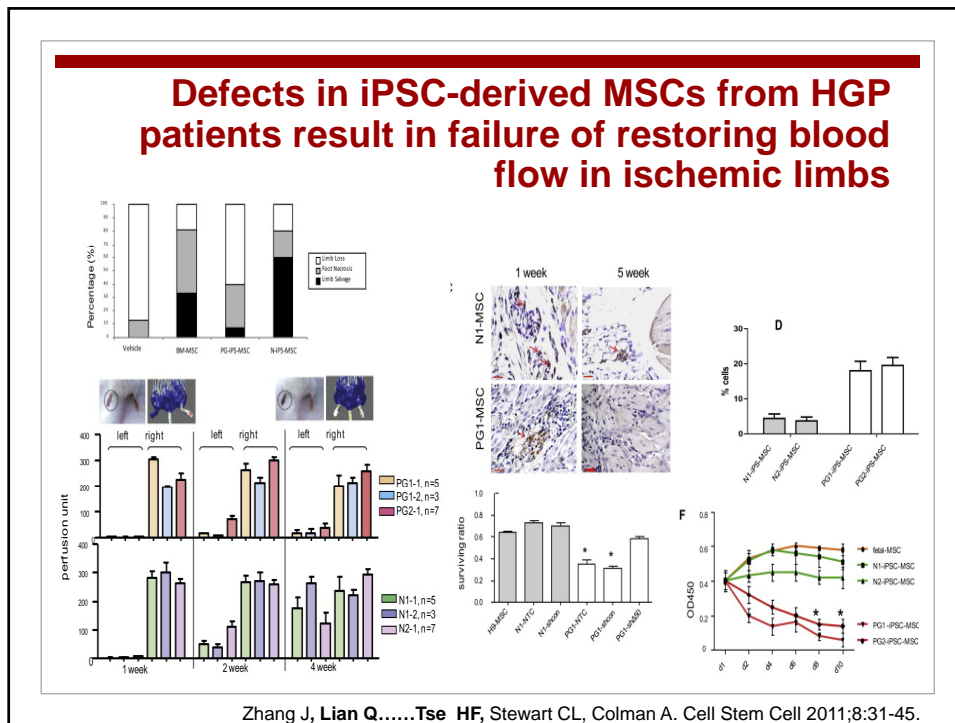


Modeling disease process in different organs



Studying disease pathophysiology

Zhang J, Lian Q.....Tse HF, Stewart CL, Colman A. Cell Stem Cell 2011;8:31-45.



## Our Future Targets on hiPSC Research in HKU.....

- ✓ **Establish a library of disease-specific hiPSC for disease modeling:**
  - > 10 disease-specific hiPSC lines have been established in several form human diseases: familial cardiomyopathy or channelopathy, progeria and neurodegenerative diseases
- ✓ **Simplify the methods of creating hiPSC, including the elimination of viral vector and create from different tissues specimen**
- ✓ **To improve the safety and efficacy of hiPSC based stem cell therapy**

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