BHARATHIDASAN UNIVERSITY

Tiruchirappalli- 620024, Tamil Nadu,
India

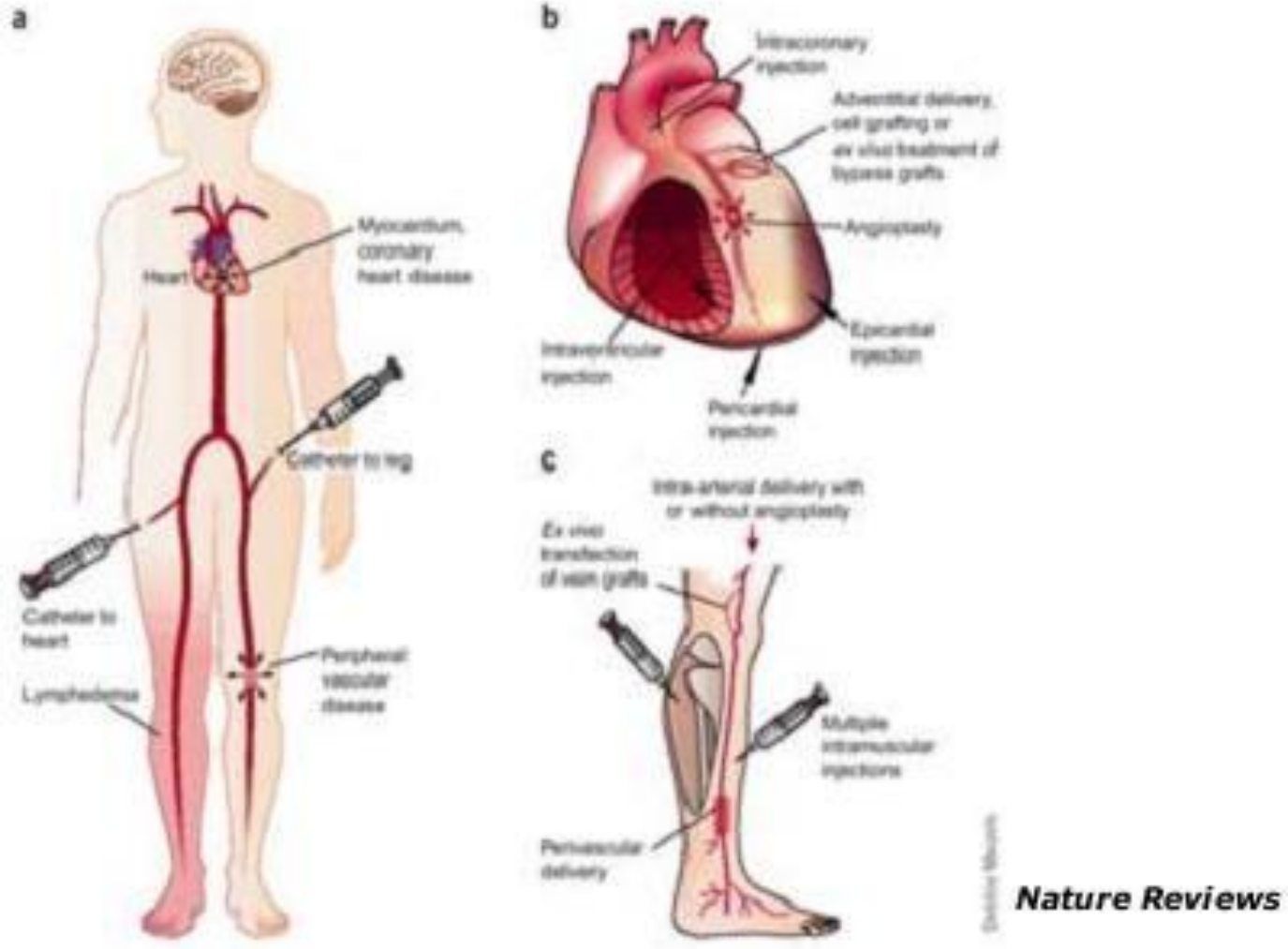
Programme: M.Sc., Biomedical Science
(5 Year Integrated Program)

Course Title : Stem Cell Biology and Tissue engineering
Course Code : 18BMS48C14

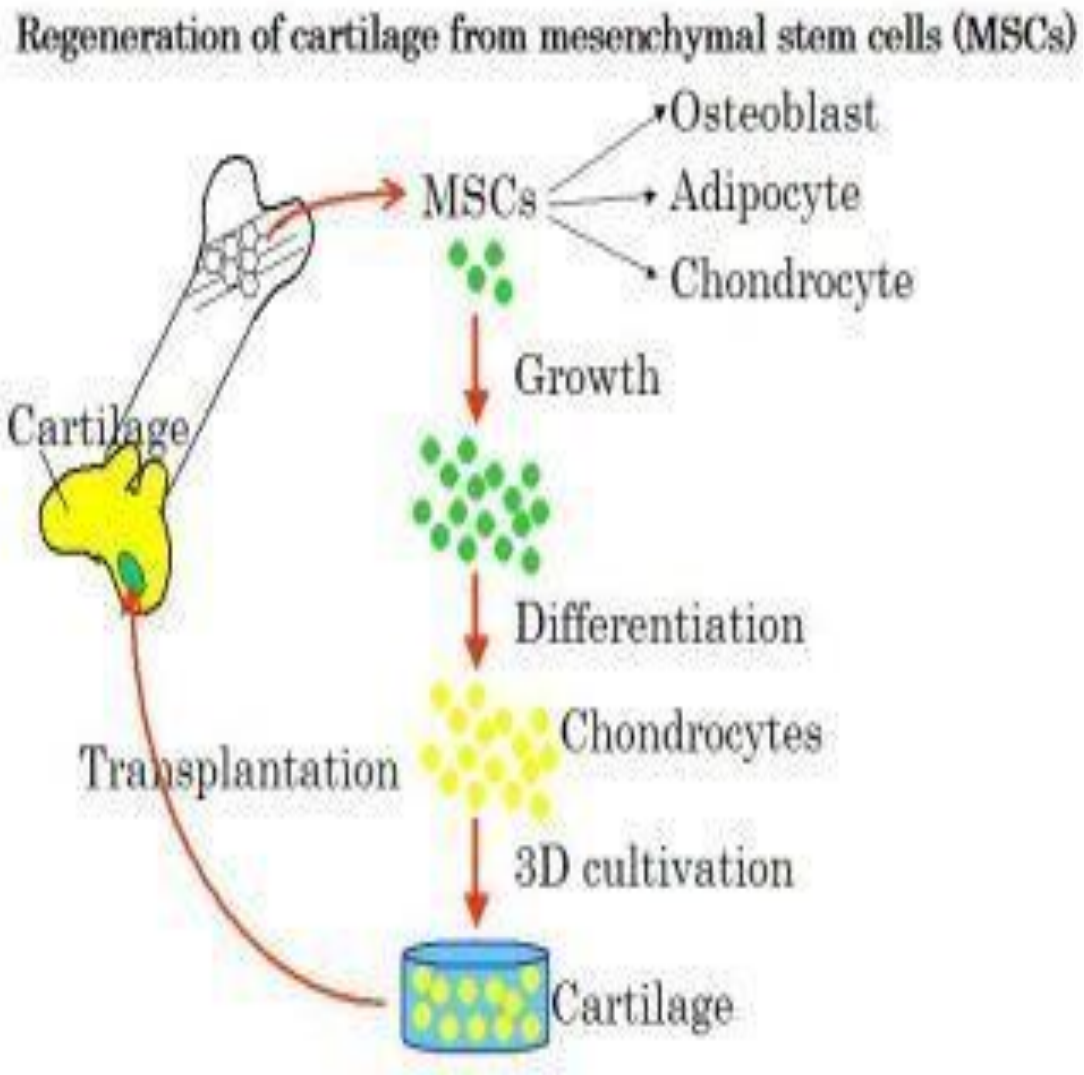
Unit-V
Tissue Engineering and Regenerative Medicine

Dr. K. PREMKUMAR
Professor
Department of Biomedical Science

Stem Cells in Tissue Engineering and Regenerative Medicine



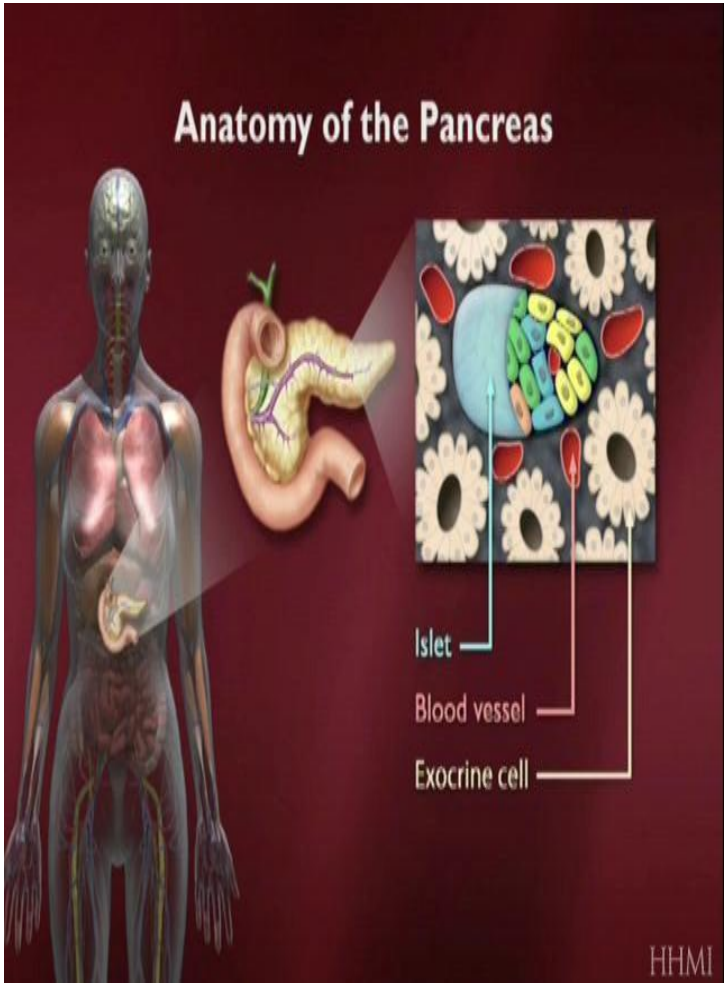
Bone Regeneration



Insulin Independence

- There is insulin independence for Type 1 diabetes patients

- A study showed patients receiving injections with adult stem cells were able to go as long as four years without having to rely on insulin shots.



Process of stem cells for spinal cord injury

- Bone Marrow taken from the hip 6 weeks of cultivating the adult stem cells to increase total to 100 million.
- Adult Stem Cells injected at injury site (C3-C4) in a surgical procedure

The Promise of Stem Cell Research

Drug Development and Toxicity Tests

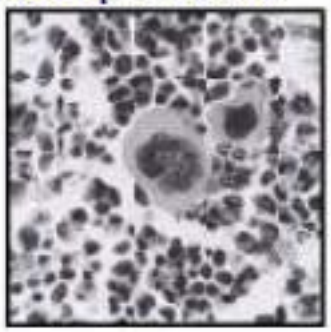
Experiments to Study Development and Gene Control

Cultured Pluripotent Stem Cells

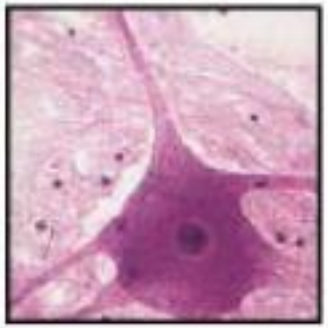
Tissues/Cells for Therapy

- Test new drugs on tissues generated from stem cells in vitro.
- Faster drug development.

- What is the genetic program that controls cell differentiation?
- Faster gain in knowledge.

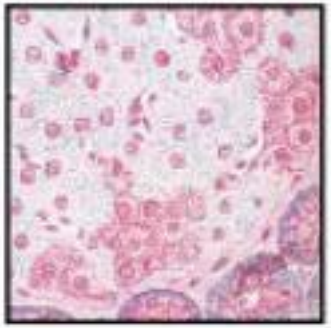


Bone Marrow



Nerve Cells

Heart Muscle Cells



Pancreatic Islet Cells

www.stemcells.nih.gov

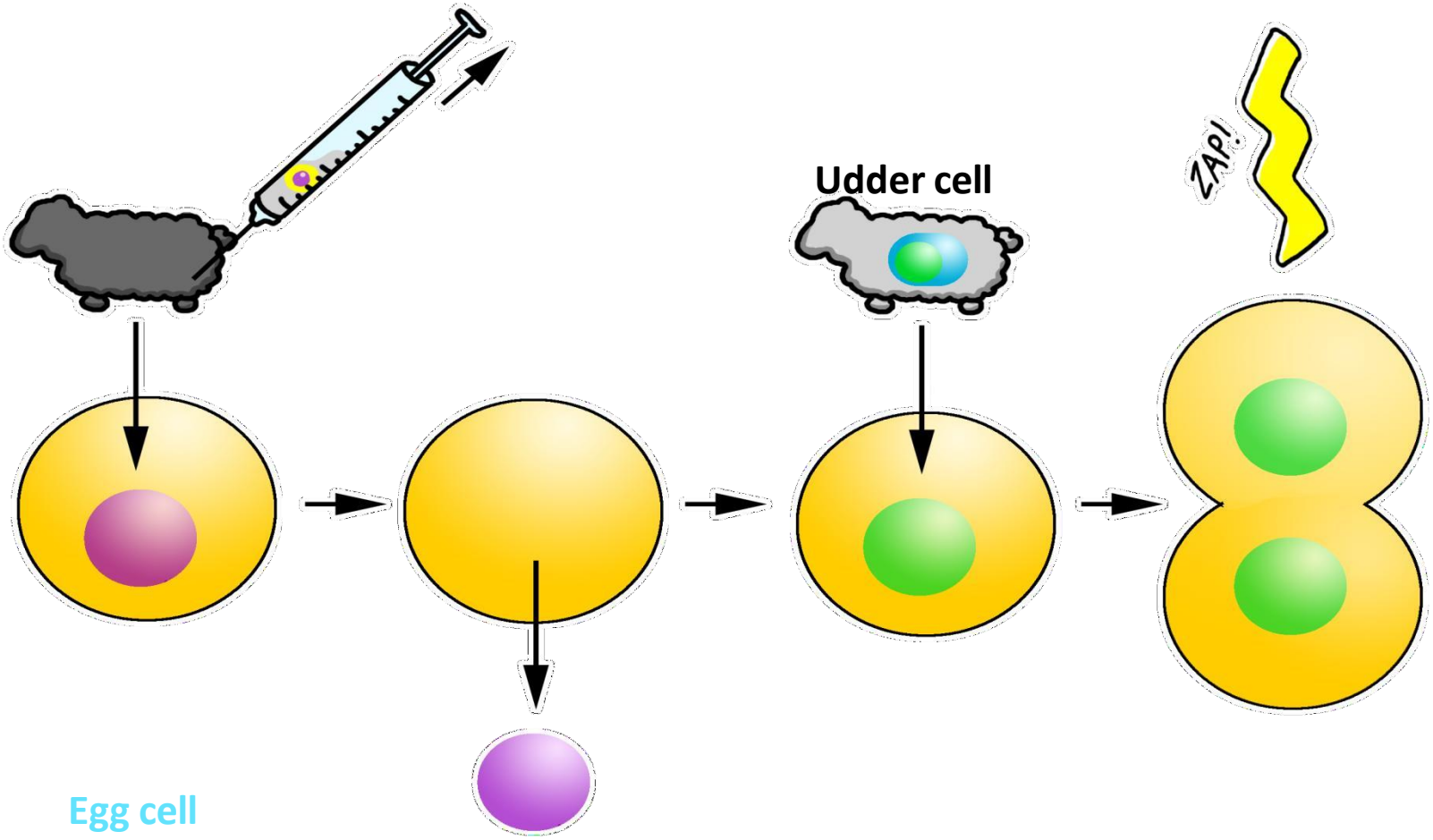
What are stem cell technologies?

- Cloning technologies
  - Is human cloning a technology?
  - What is different about cloning embryonic stem cells?

- Induced Pluripotent Stem cells
  - New ways to potentially avoid the use of embryos
  - Disease-specific stem cell lines created
  - The promise and potential pitfalls of this approach

Somatic Cell Nuclear Transfer (SCNT)

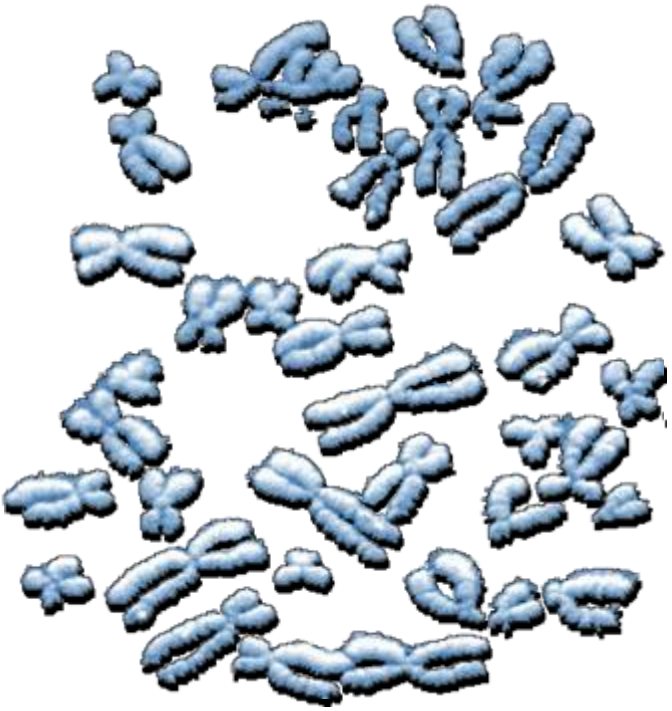
Cloning of embryonic stem cells



Unknowns in Stem Cell/Cloning Research

- It is uncertain that human embryonic stem cells *in vitro* can give rise to all the different cell types of the adult body.
- It is unknown if stem cells cultured *in vitro* (apart from the embryo) will function as the cells do when they are part of the developing embryo

Challenges to Stem Cell/Cloning Research



- Stem cells need to be differentiated to the appropriate cell type(s) *before* they can be used clinically.
- Recently, abnormalities in chromosome number and structure were found in three human ESC lines.

Challenges to Stem Cell/Cloning Research

- Stem cell development or proliferation must be controlled once placed into patients.
- Possibility of rejection of stem cell transplants as foreign tissues is very high.

Challenges to Stem Cell/Cloning Research

- Contamination by viruses, bacteria, fungi, and Mycoplasma possible.
- The use of mouse “feeder” cells to grow ESC could result in problems due to xenotransplantation (complicating FDA requirements for clinical use).

ETHICS & POLITICS

Ethics

How far can we go with this?
Is it morally right?

Are humans playing god?

Will embryo farms be around in the future?

Igor visits the Mad Scientist Shopping Club

Health care costs

- Who will pay for all this?

Will cloning factories produce human organs?

THANK YOU