Therapeutic applications of Stem Cells

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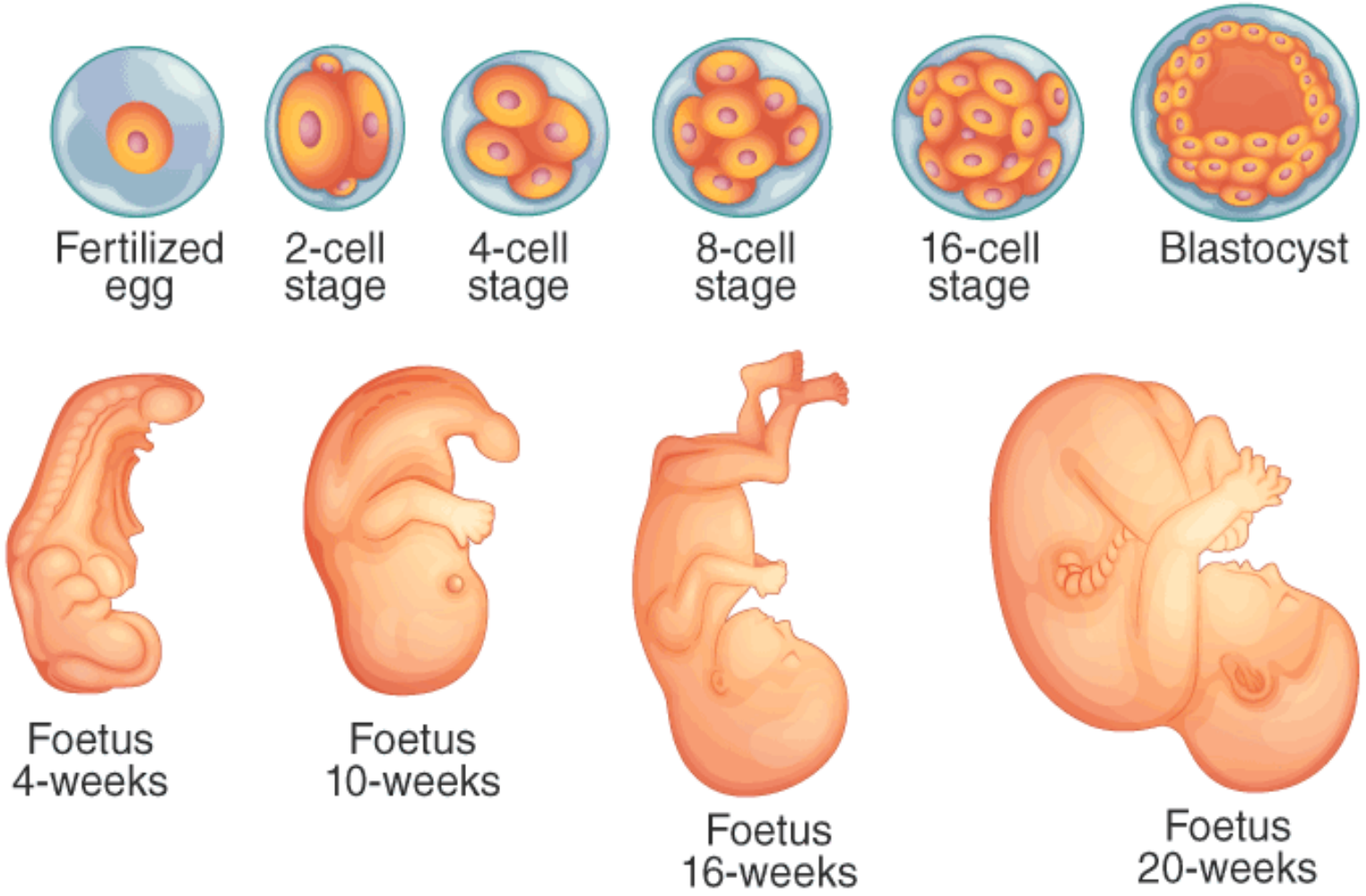
What should we first know?



Cell

↓

Division and Differentiation

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Tissues and Organs

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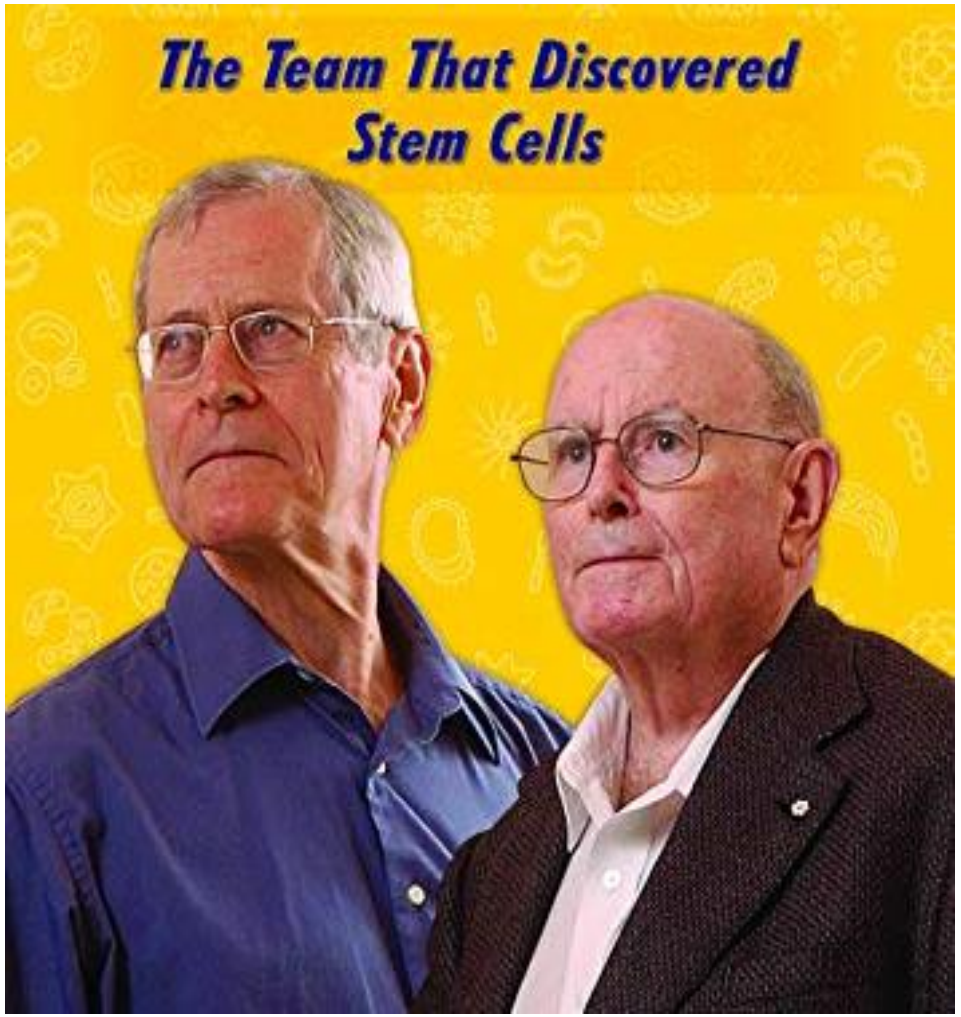
Organism

Growth, Development and Aging…

Discovery of stem cells

- In 1962
- Ernest McCulloch
- James Till



What are stem cells?

- Body's master cells
- Architect of all the structural and functional units of our body
- Undifferentiated or partially differentiated cells that can differentiate into various types of cells

Why is there such an interest in stem cells?

- Increase understanding of how diseases occur
- Generate healthy cells to replace diseased or damaged cells (regenerative medicine)
- Test new drugs for safety and effectiveness

Sources of stem cells

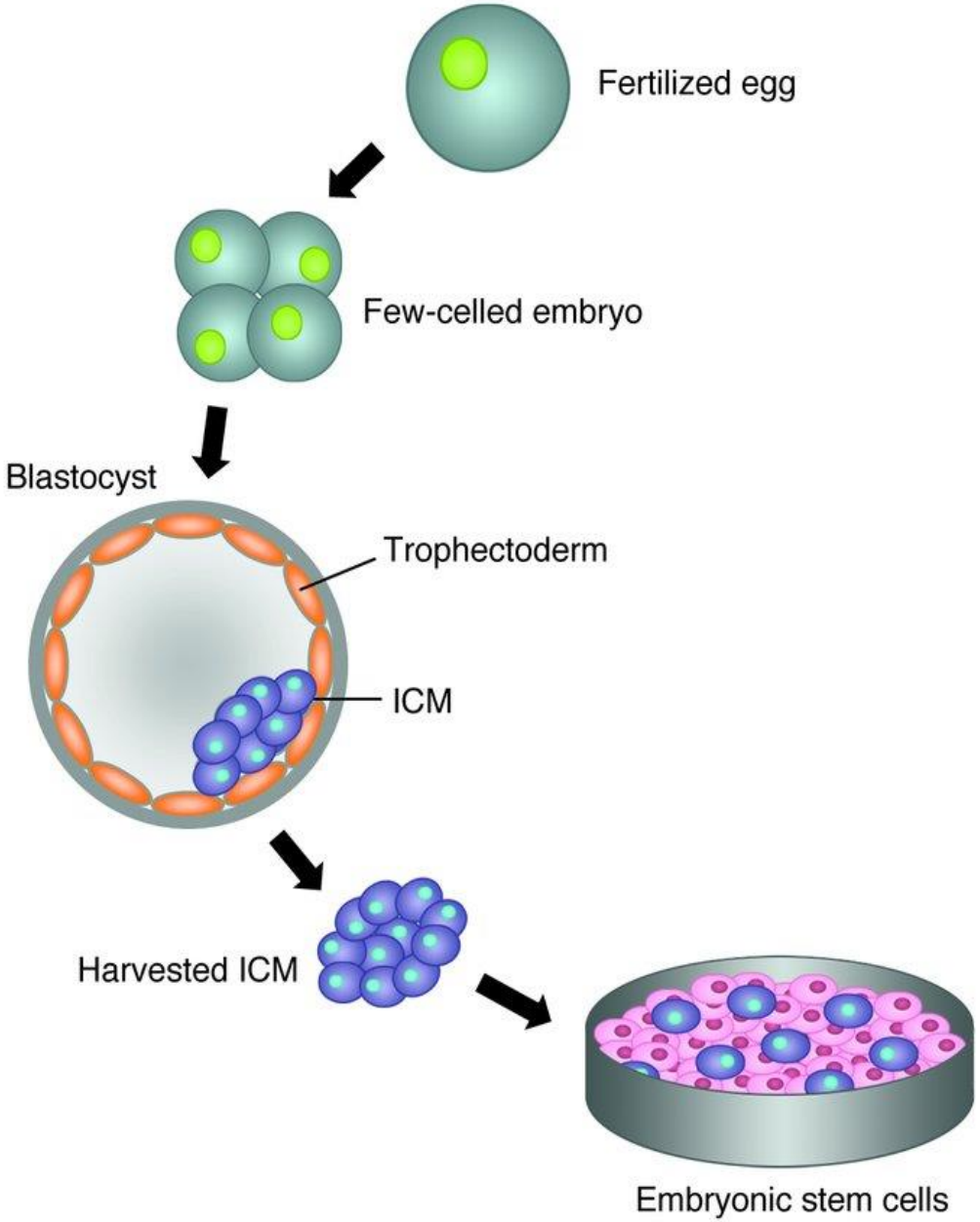
- Embryonic stem cells
- Umbilical cord
- Adult stem cells
- Adult cells altered to have properties of embryonic stem cells

Unipotent

Multipotent

Pluripotent

Embryonic stem cells

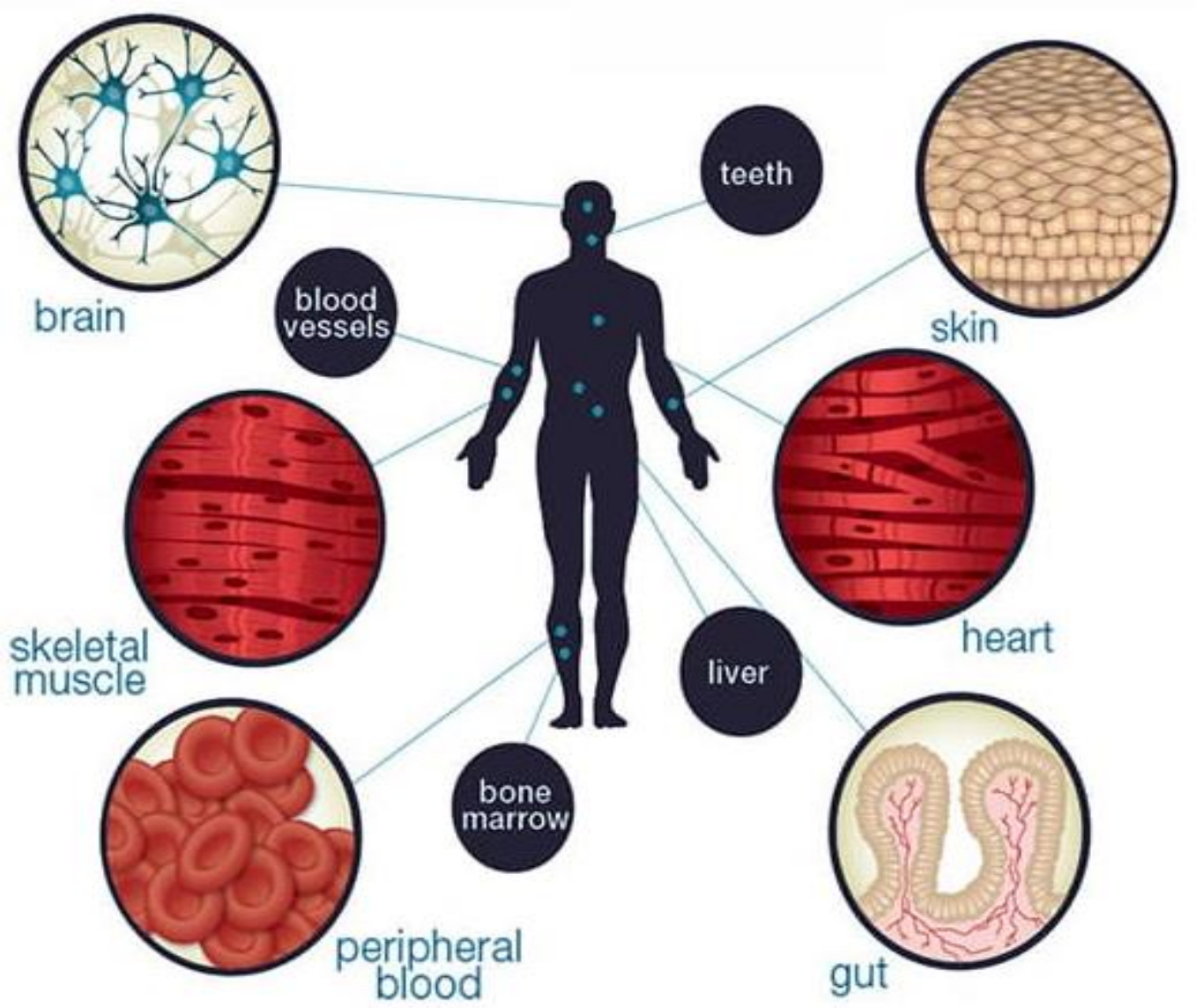


- In 1998 Thomson and his team isolated and cultured the first hESCs
- From embryos that are three to five days old
- Methods to isolate ICM: Mechanical pressure, laser dissection, and by using immunosurgery procedures
- hESCs are pluripotent
- hESCs research is limited to tumor formation and immunorejection, social, ethical, and political aspects

Adult stem cells

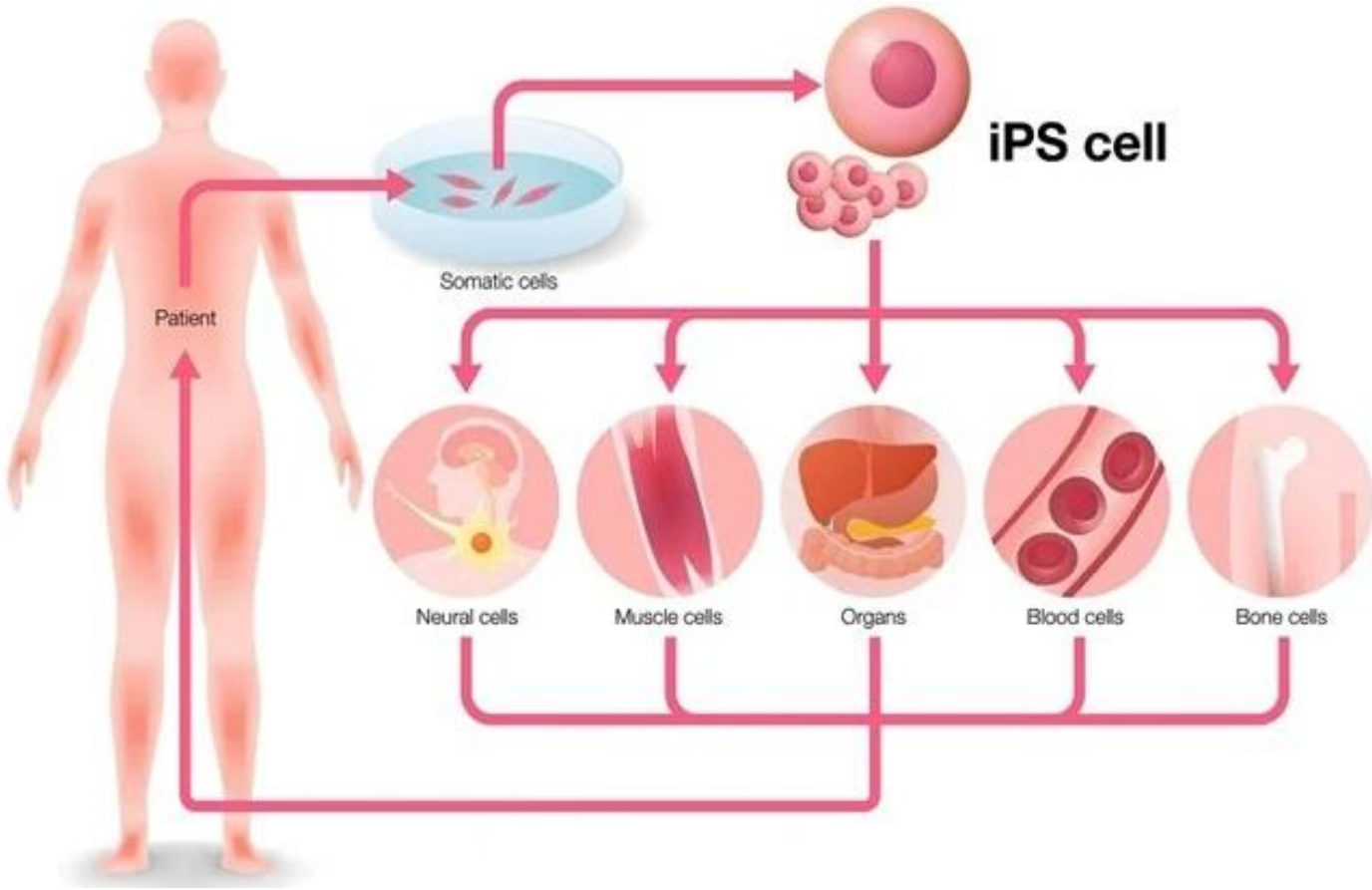
- Found in small numbers in most adult tissues
- Limited ability to give rise to various cells of the body
- Difficult to isolate a unique group of stem cells in pure form
- They are harvested in one of three ways:

a. Blood draw
b. Tissue fat extraction (liposuction)
c. Bone marrow extraction

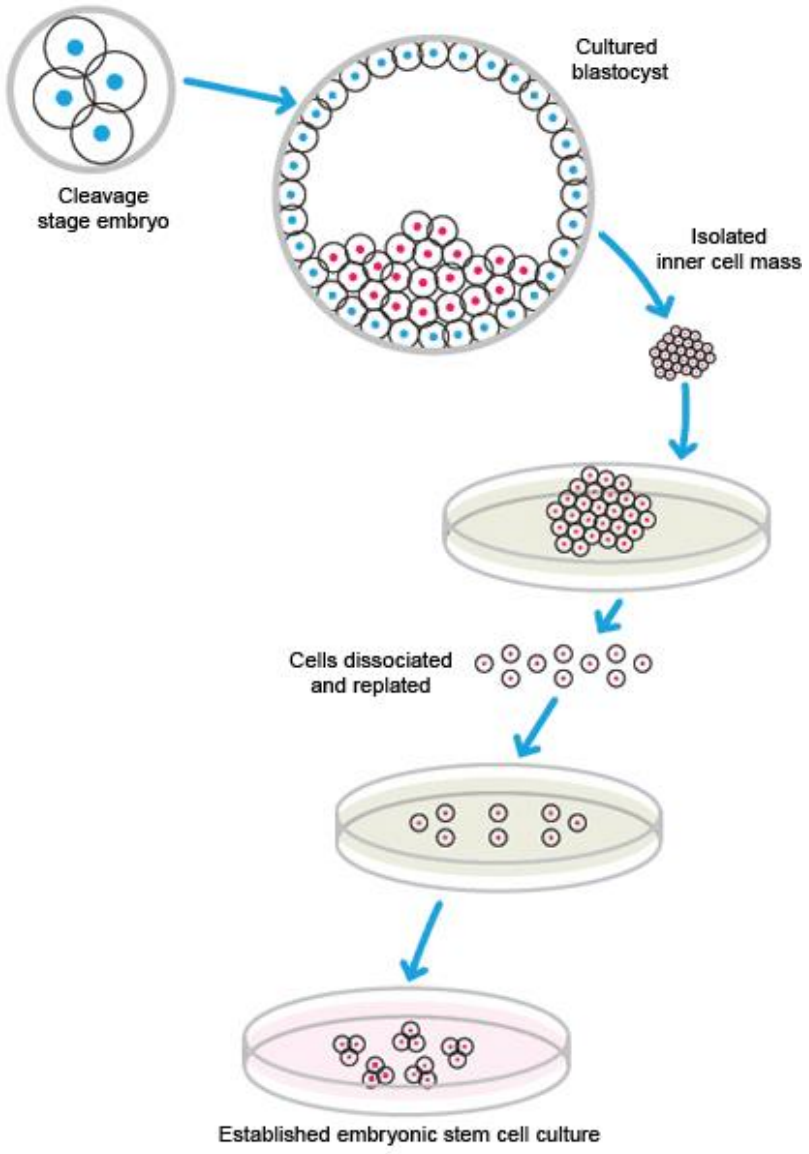


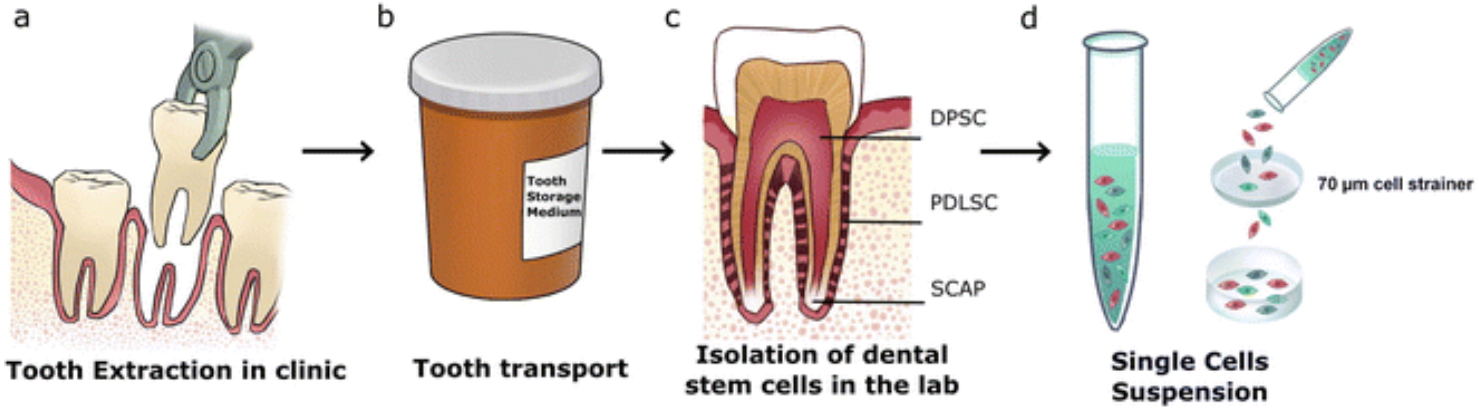
Induced pluripotent stem cells

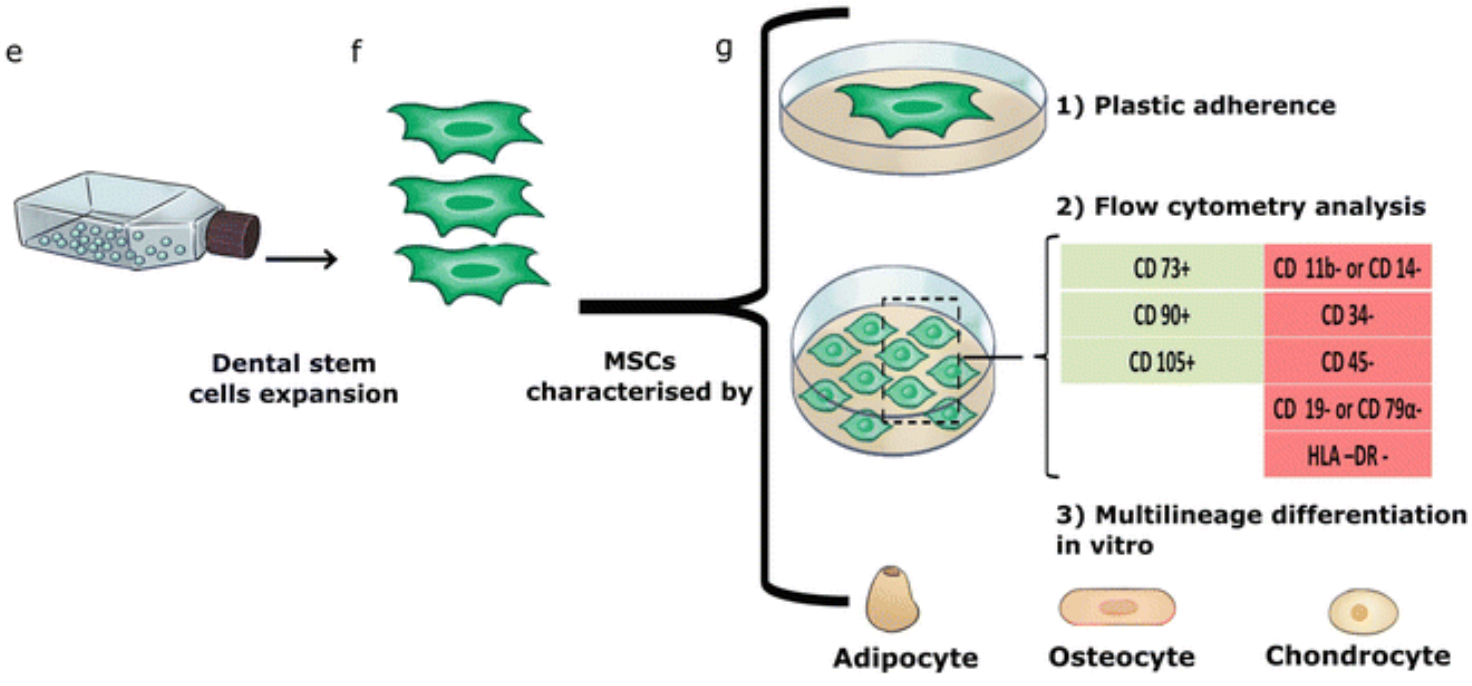
- They are derived from skin or blood cells
- Reprogrammed back into an embryonic-like pluripotent state
- Enable the development of an unlimited source of any type of human cell needed for therapeutic purposes



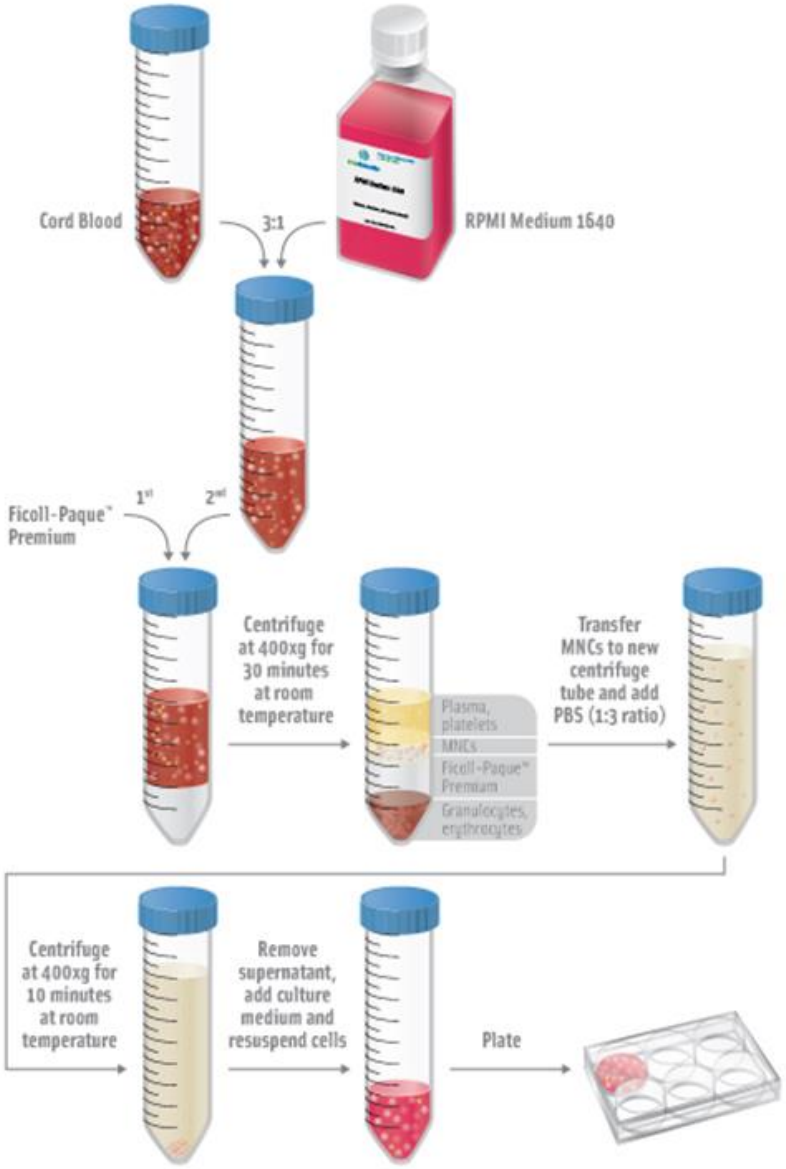
Isolation of stem cells

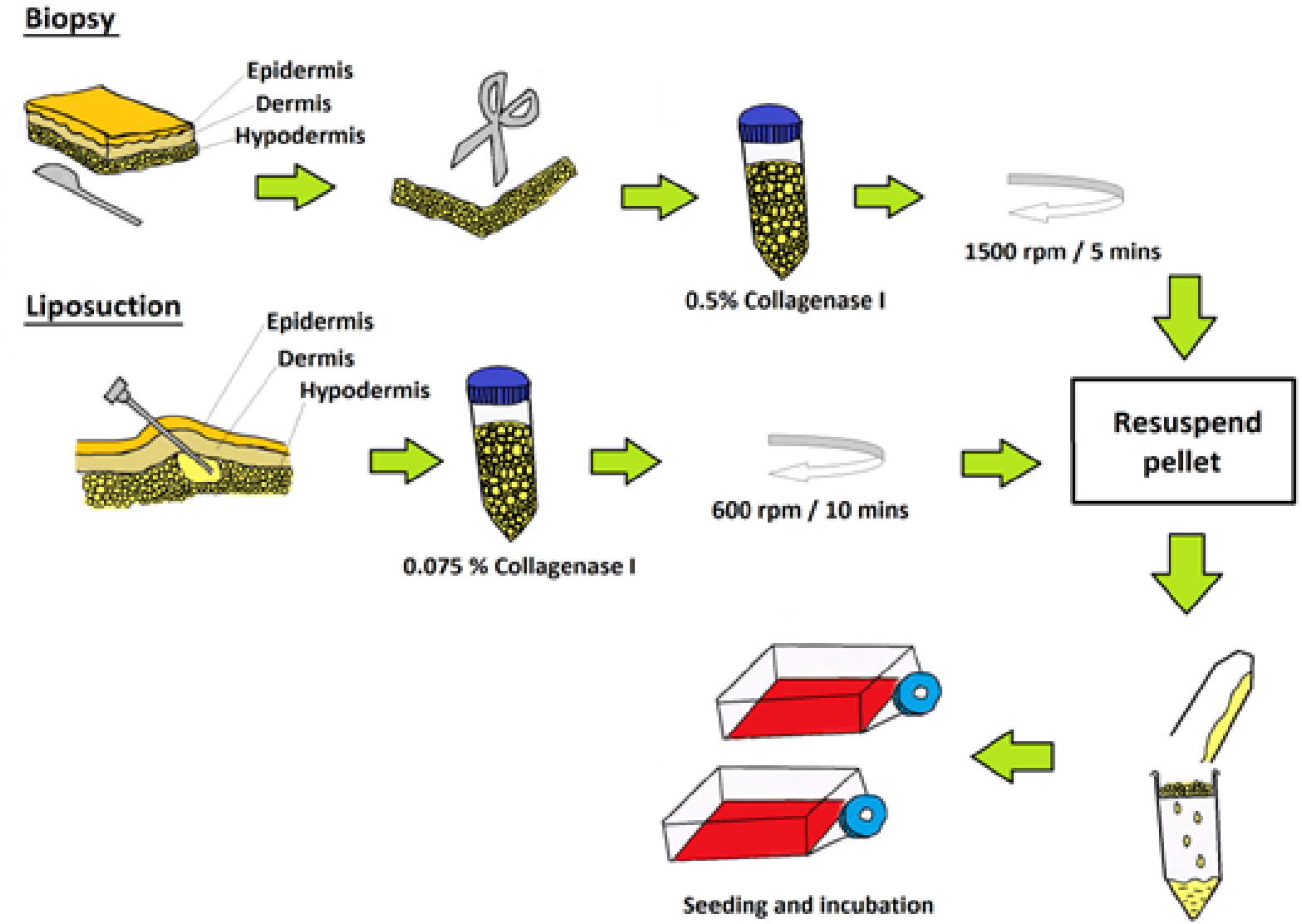




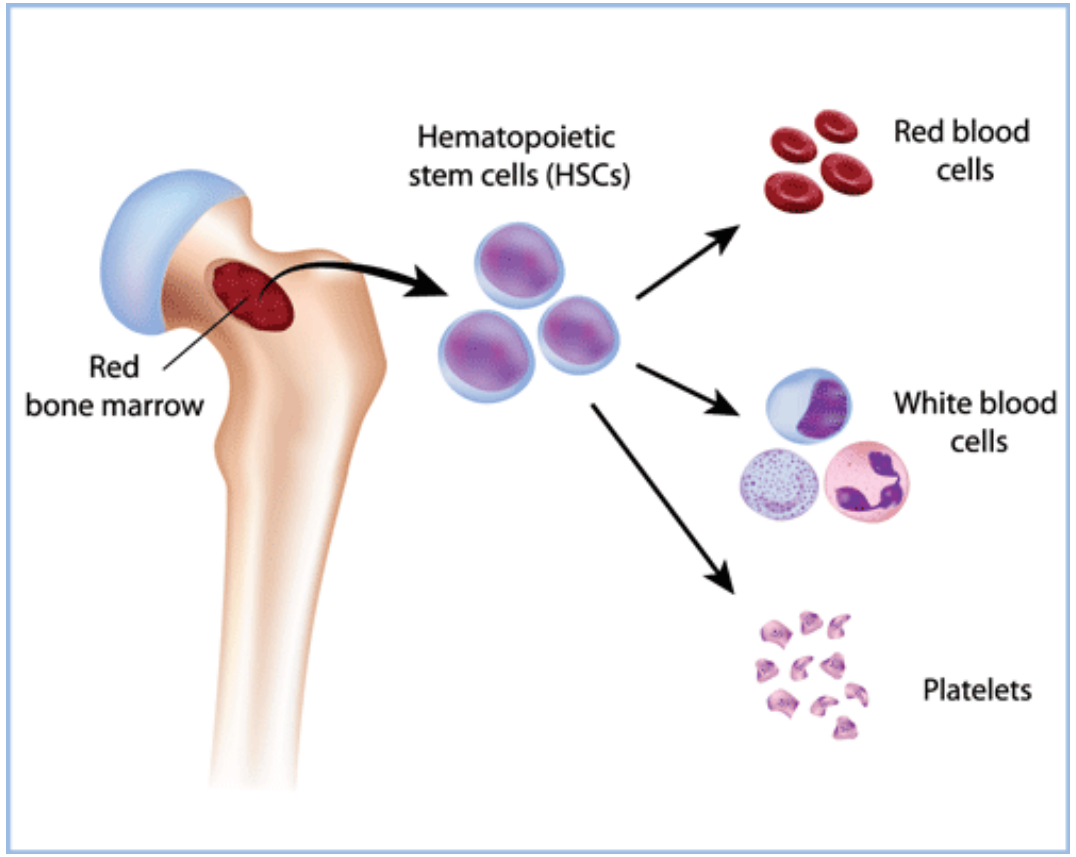


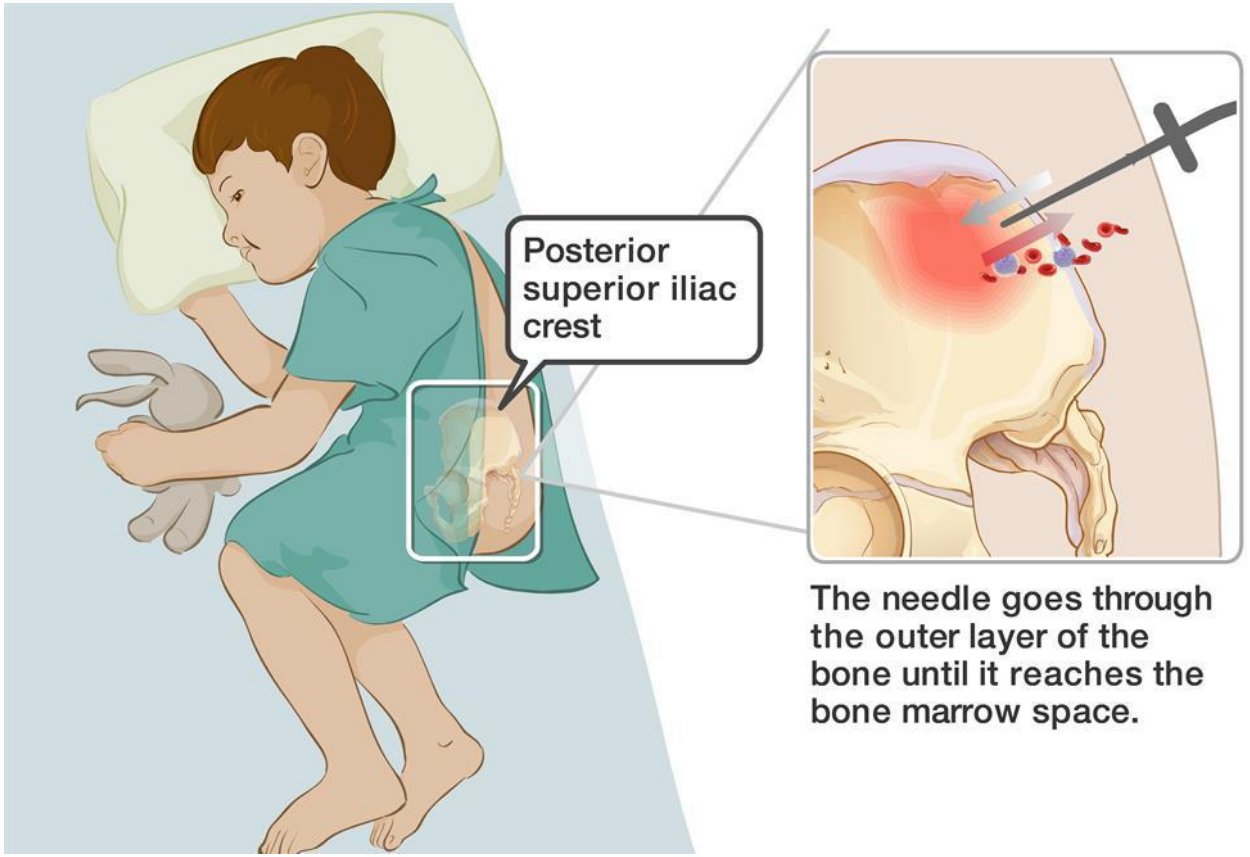
Isolation of stem cells





Isolation of stem cells

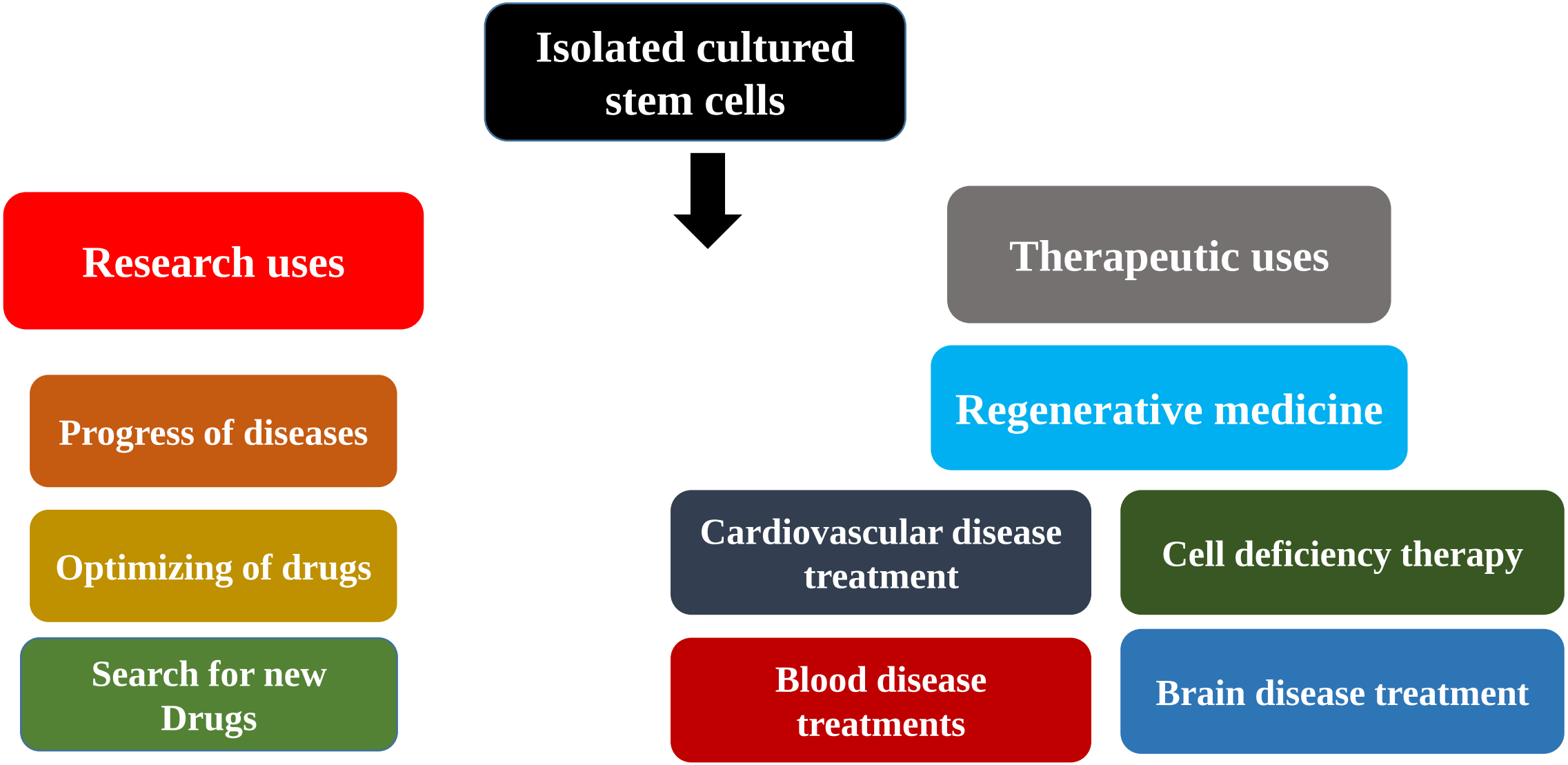




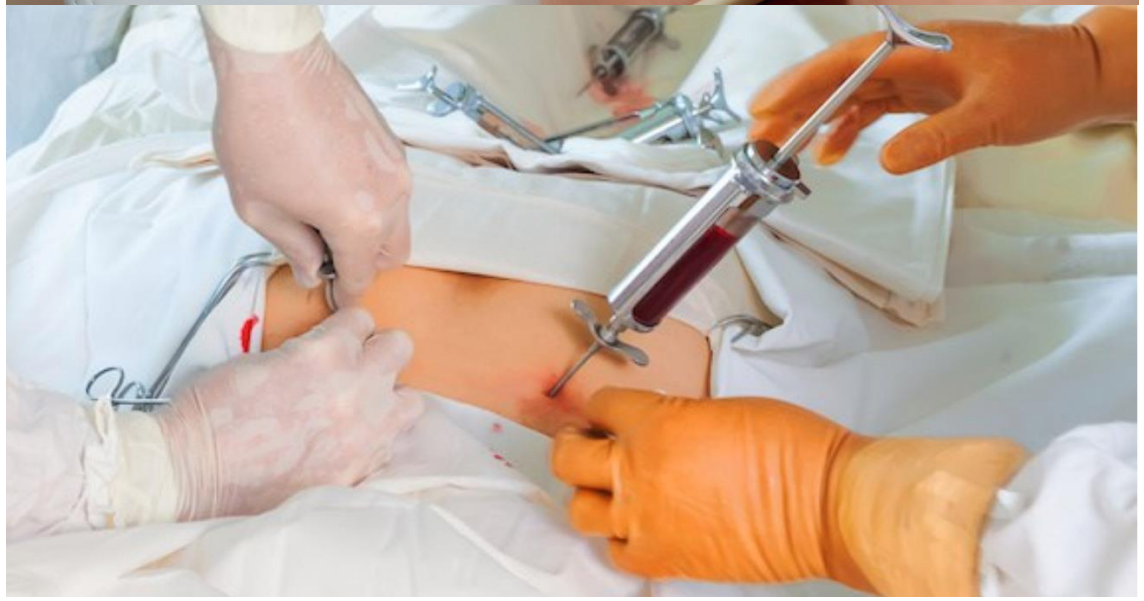
Culturing stem cells

Cell culture laboratory

Current Good Manufacturing Practice (CGMP)Regulations



Stem cells transplantation



Current state of stem cells-based therapies

- **Bone marrow transplants of hematopoietic stem cells**
- **Skin grafts**
- **Stem cell-based therapies for ocular diseases**
  Macular degeneration

Current state of stem cells-based therapies

- **Stem cell-based therapy for neurodegenerative diseases**

  a. Parkinson’s

  b. Alzheimer’s

  c. Multiple sclerosis (MS)

Spinal cord injury

Current state of stem cells-based therapies

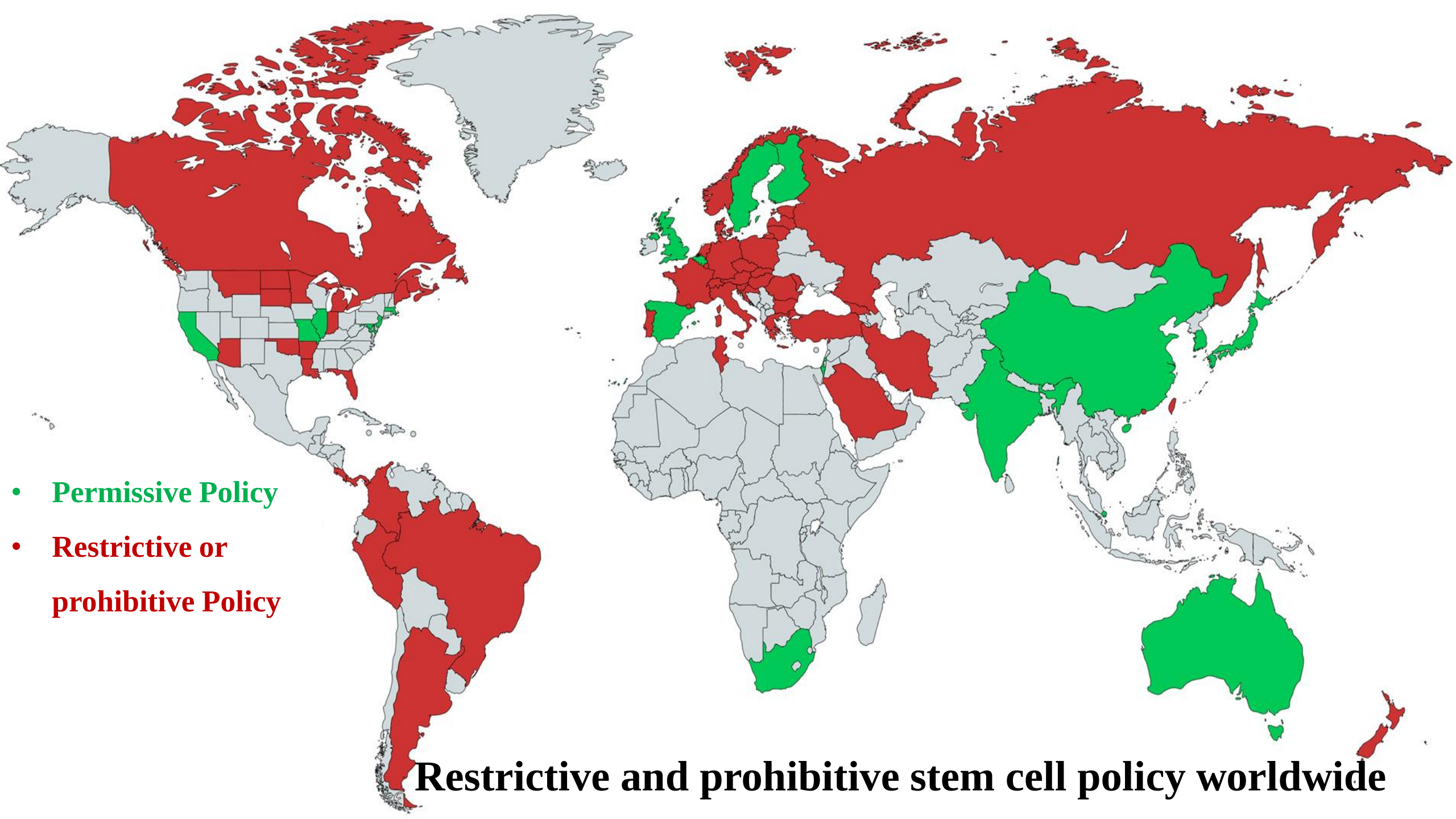
- **Stem cells in dentistry**

  a. Dental pulp regeneration

  b. Periodontal tissue regeneration

  c. Regeneration of mandibular bony defects

- **Stem cell-based therapies for treatment of diabetes**



Restrictive and prohibitive stem cell policy worldwide

Cost of stem cells therapy in India

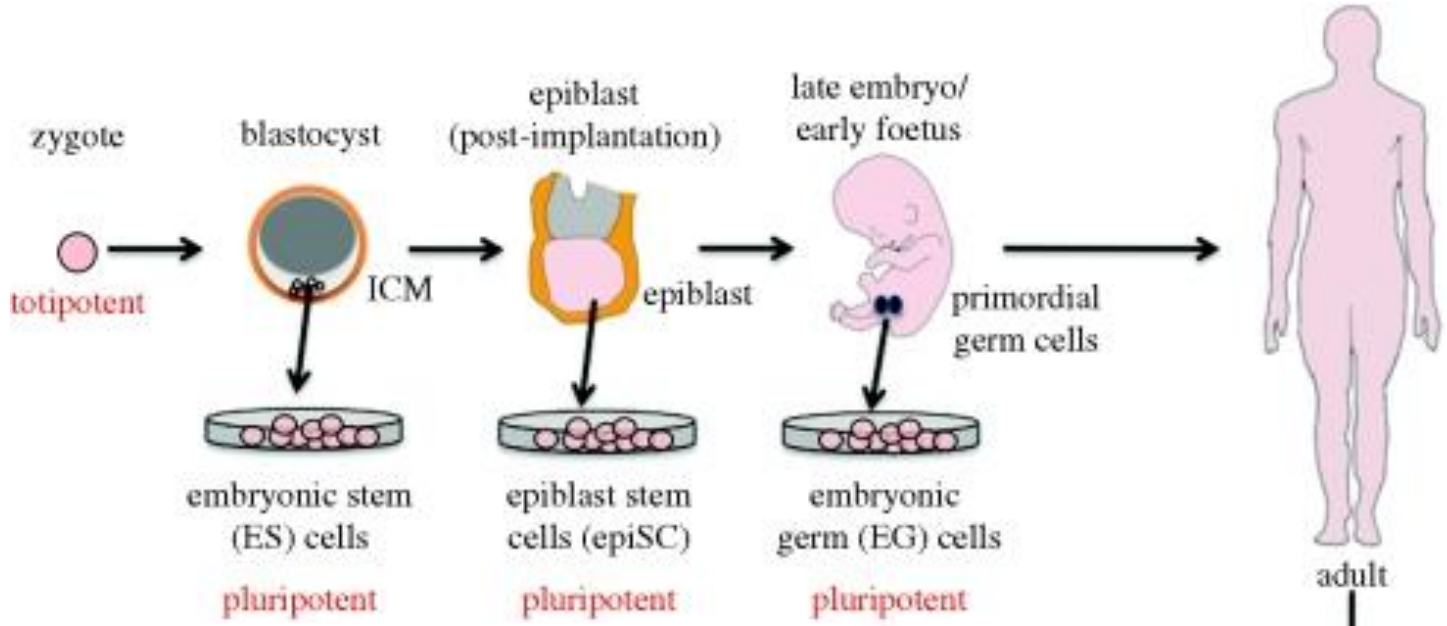
- Blood Cancer ($12,000) - ($28,000)
- Spinal Cord ($6500) - ($8000)
- Kidney failure ($5500) - ($6800)
- Knee problem ($6616) - ($8233)
- Hair loss ($3000) - ($10000)
- Autism ($4500) - ($6500)
- Parkinson's Disease ($6800) - ($13000)
- Cerebral Palsy ($7500) - ($10000)

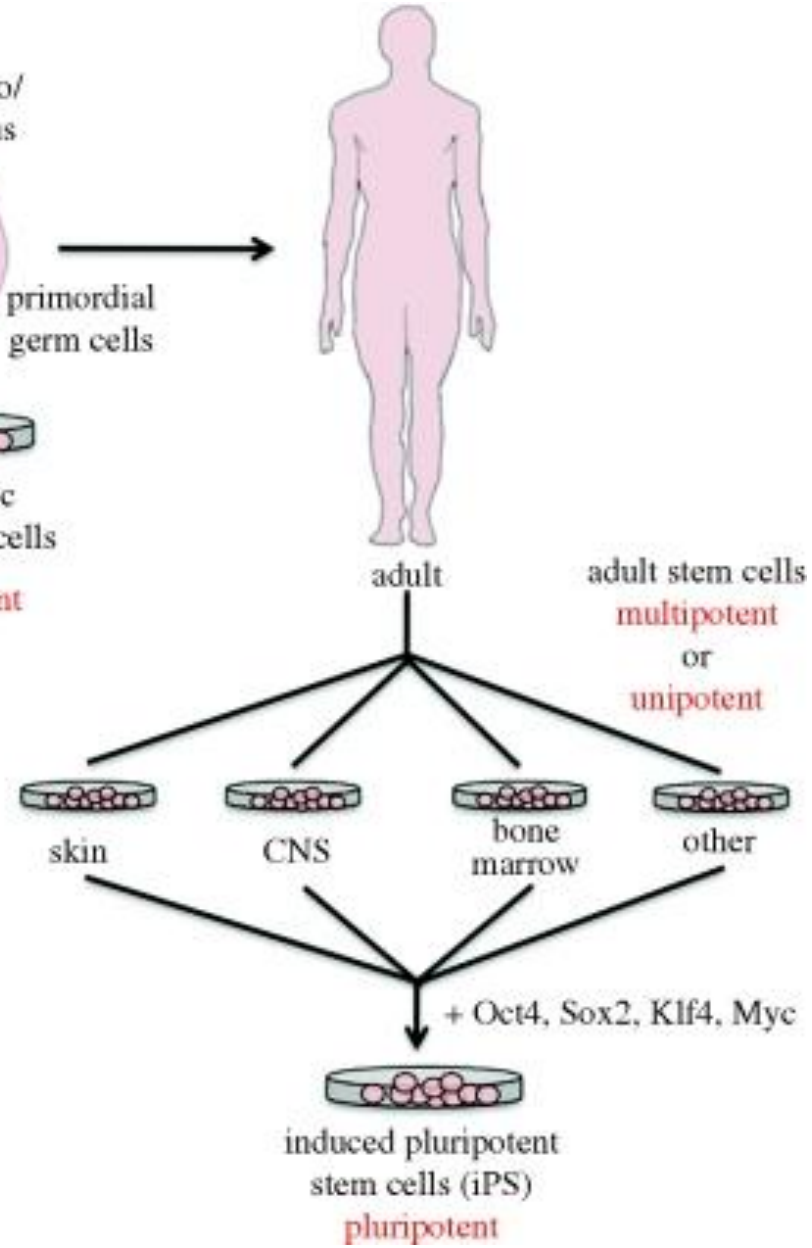
Cost of stem cells therapy

Condition	India	UK	USA	Singapore
PRP (per serssion)	$140	$460	$1,000	$2,000
BMT	$21,013	$233,310	$350,000	$80,000
Knee	$2,152	$24,082	$35,120	$19,065
SPINE CHORD	$6,200	$8,400	$28,300	$45,700

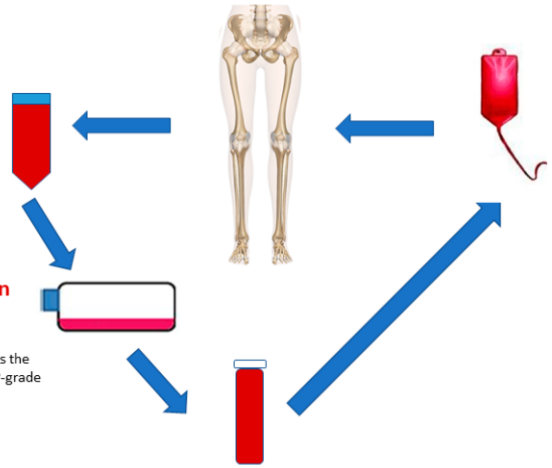
Prof. Dr. Susanne Dobler

Thank you for your Listening





The autologous transplant process



1. Harvest

Stem cells are harvested from patient's bone marrow

- Method, device

2. Isolation & expansion culture

Stem cells are isolated and cultured in laboratory. The processing follows the standard protocols to produce GMP-grade products.

- Method, device, medium
- Protocol
- Evaluation: quality & quantity

3. Cryopreservation

Stem cells are stored in frozen. The stocks can delivery when they are needed

- Short-term storage: temperature, solution
- Long-term storage, stem cell banking
- Safety & effects after storage

4. Infusion into patient

Stem cells are reinfused into the patient.

- Cell dose, route, interval of administration
- Combine with other treatment method