What to Know Before Getting Stem Cells

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Outline of Lecture

Embryonic vs. Adult

Multipotent vs. Pluripotent

Mesenchymal vs. Peripheral Blood-Based

Making a Stem Cell Decision

What are Stem Cells?

- Undifferentiated biological cells that differentiate into specialized cells or divide to produce more stem cells
- Have the ability to divide and generate all cell types of the organ from which they originate
- Stem cell therapy can stimulate tissue re-growth and greater blood flow to the affected areas
- Can be obtained from bone marrow, adipose tissue, blood, or embryonic tissue

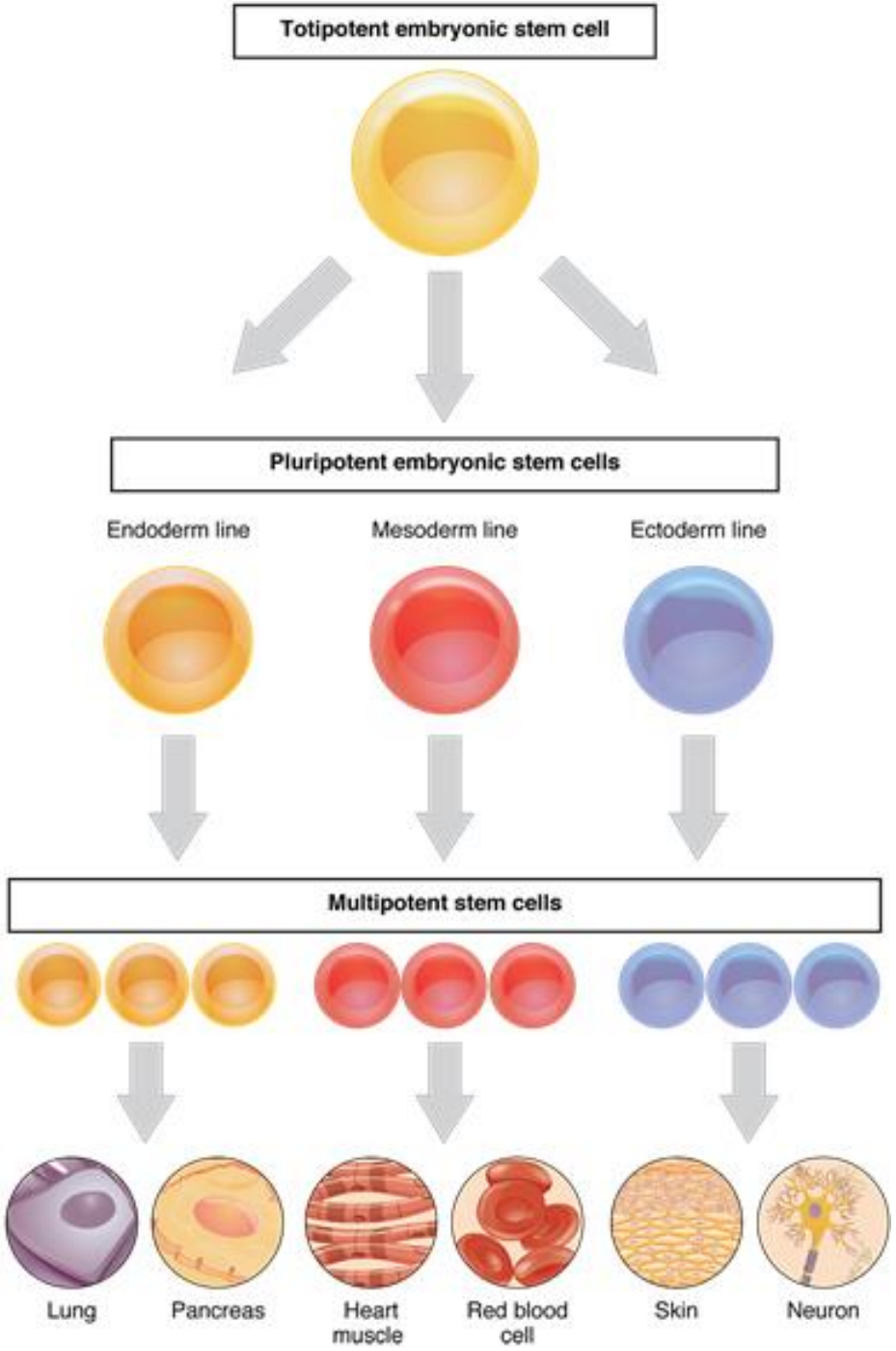
Embryonic Stem Cells

- Derived from the fetus
- Require special regulatory approval
- Mostly used for research purposes
- Not readily available
- Expensive
- Not autologous
- Ethically controversial

Adult Stem Cells

- Derived from bone, adipose, or blood
- Require physician expertise and quality control
- Mostly used for regenerative and cosmetic purposes
- Readily available
- Less expensive
- Autologous use is permitted in US (with restrictions)

Multipotent vs. Pluripotent Stem Cells

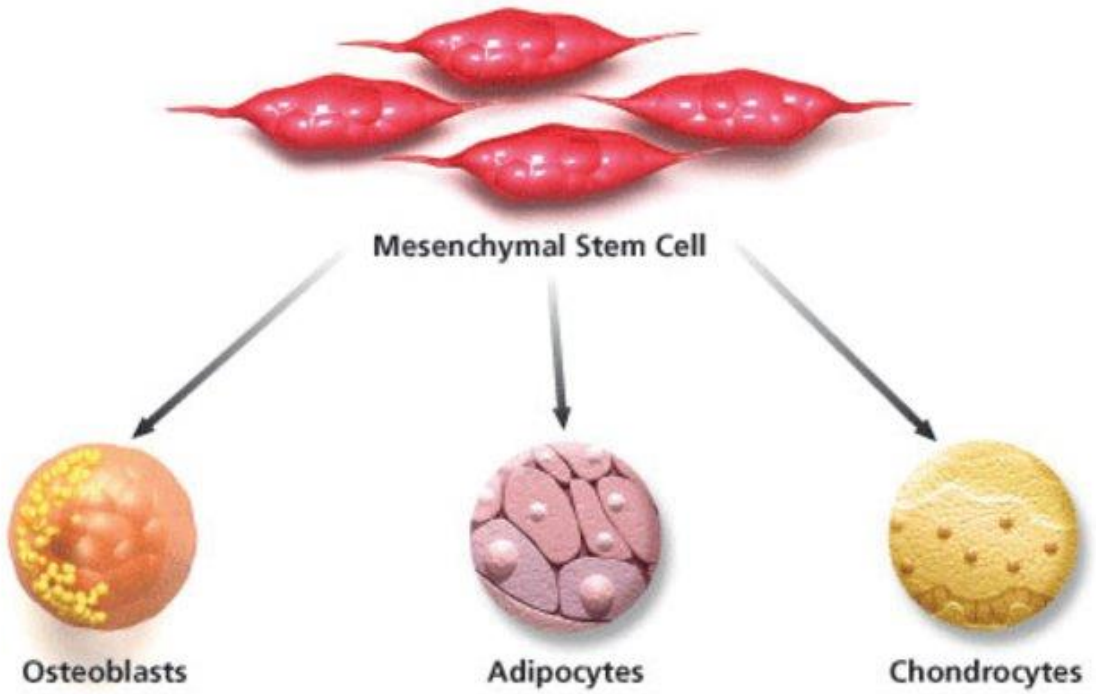


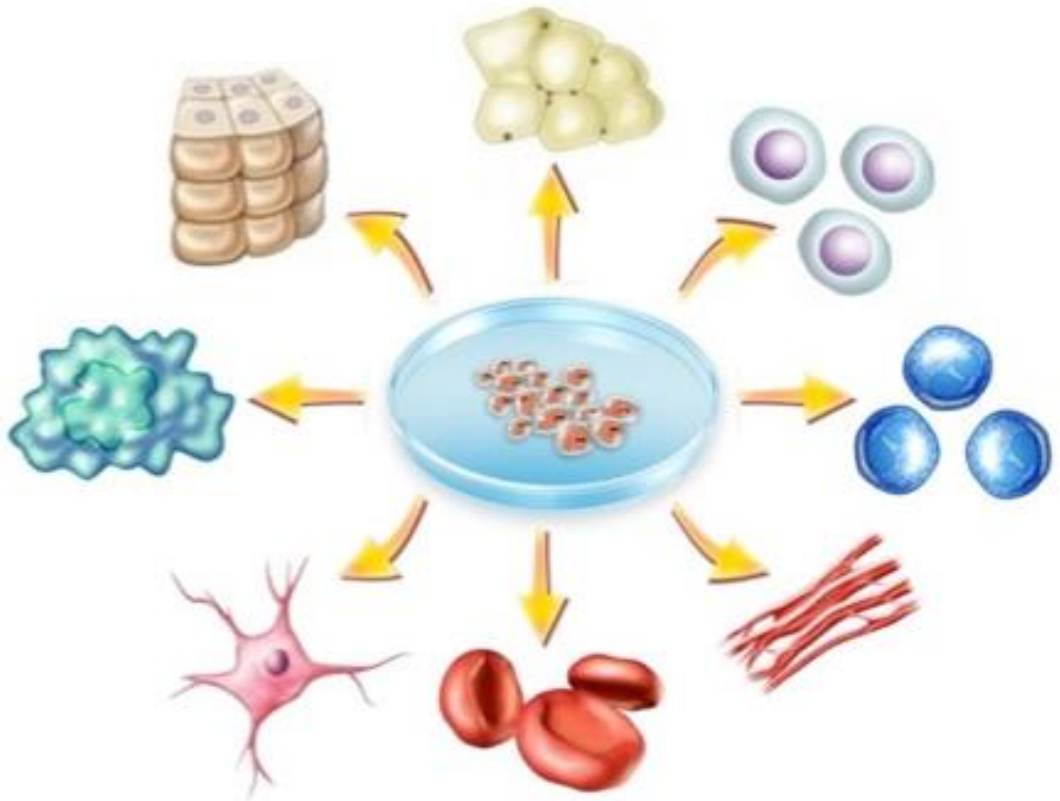
Multipotent Stem Cells

- Derived from cord blood, blood, bone marrow, fat and muscle
- Forms only cell types from the mesoderm
- Has a development trajectory towards a specific type of cell
- “Teenage cell” already differentiated into it’s target adult cell type

Pluripotent Stem Cells

- Derived from the embryo or blood
- Forms all cell types in the body except the embryo or the placenta
- Does not have a specialized trajectory of development
- “Young, baby cell” with great ability to differentiate into other cell types





Mesenchymal vs. Peripheral Blood-Based Stem Cells

(Multipotent)

(Pluripotent)

Mesenchymal Stem Cells

(Multipotent)

Characteristics:

- Primarily isolated from adult fat or bone marrow, or umbilical cord blood
- Modulate endogenous tissue and immune cells
- Have already partially differentiated
- On a development trajectory towards specific target tissues
- Considered *multipotent:* specialization potential limited to one or more cell lines
- Provides over 480 growth factors, reduction in inflammation, and immune modulation that may support joint health

Mesenchymal Stem Cells

(Multipotent)

Clinical Indications / Side Effects:

- Most effective clinical use: same tissues transplantation (bone marrow to bone marrow, fat to fat)
- Alternative clinical use: joint (if related to autoimmune or systemic inflammation) and autoimmune disorders
- These cells **do not** develop into new cartilage cells
- Therapeutic effects are short-lived
  - "Recent studies have suggested that less than 1% of systemically administered MSCs persist for longer than a week following injection" (Parekkadan & Milwid, 2010, pg 2).

Mesenchymal Stem Cells

(Multipotent)

Dangers:

- Harvesting of bone marrow and fat can be unpleasant
  - Repeat harvesting is limited
- Immunomodulatory effects can predispose the patients to more infections or even cancer (Sundin et al., 2006)
- Reduce inflammation for 6 months – 2 years but have limited regenerative benefits
- Increased FDA restriction for non-homologous tissue use

Peripheral Blood-Based Stem Cells

(Pluripotent / Embryonic-Like)

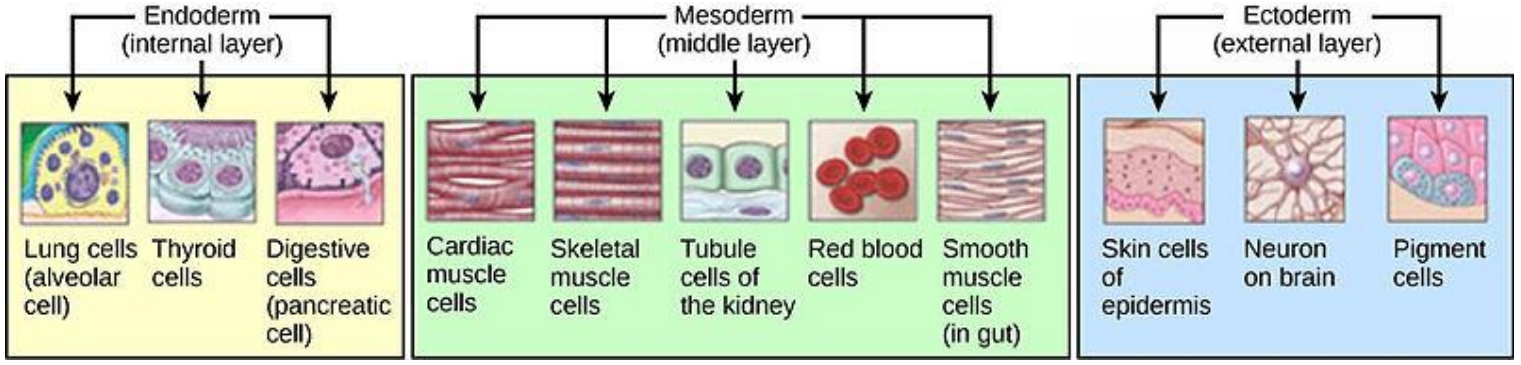
Characteristics:

- Originate in bone marrow and present in peripheral blood
- Were thought only to exist in embryonic stem cells until Dr. Young's discovery of them in the peripheral blood in the late 20th century (Young & Black, 2004)
- Forms cells from the three primary germ-layer lineages
  - Lineage-uncommitted cells
- Also known as very small embryonic-like stem cells (VSELs) or blastomere-like stem cells
- Have a long lifespan (can double more than 70 times)
- *Not derived from umbilical cord blood (mesenchymal)

Peripheral Blood-Based Stem Cells

(Pluripotent / Embryonic-Like)

- Understanding lineage uncommitted pluripotent stem cells requires an understanding of the germ layers



- Lineage uncommitted pluripotent stem cells can produce all types of cells in the germ later (Young & Black, 2004)

Peripheral Blood-Based Stem Cells

(Pluripotent / Embryonic-Like)

Clinical indications:

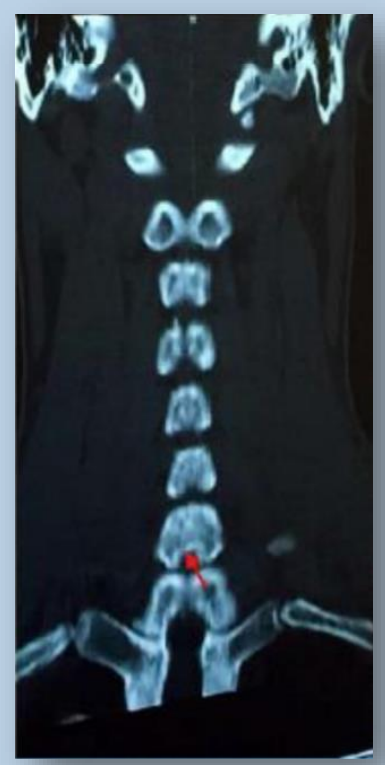
- Regenerative in their applications unlike mesenchymal
- Actually develop into new target tissue such as organs, cartilage, neurons, muscle, skin, etc.
- Conditions treated: traumatic brain injury, chronic pain, ligament / tendon injuries, diabetes, osteoarthritis, osteoporosis, Alzheimer's disease, fertility, aging, etc.

Peripheral Blood-Based Stem Cells

Pre-Treatment

Displaced (5mm) C-7 proximal spinal fracture failed to heal 9 months post trauma

Post-Treatment



4 months post-treatment of peripheral blood-based stem cells - the fracture is fully healed

Clinical Indications

Mesenchymal / Multipotent

- **Tissue Replacement (Homologous Only):**
  - Bone marrow transplant
  - Breast, lips, cheeks, eyes, buttocks
- **Systemic inflammatory conditions:**
  - Autoimmune disorders
  - Acute renal failure
  - Myocardial infarction
  - Type I diabetes
  - Graft-vs-host disease
  - Systemic lupus
  - Pulmonary fibrosis

Blood-Based / Pluripotent

- **Degenerative diseases:**
  - Diabetes
  - Osteoarthritis / osteoporosis
  - Alzheimer's disease
- **Regenerative applications:**
  - Traumatic brain injury
  - Joint / ligament repair
  - Anti-aging
  - Post cancer treatment
  - Fertility

Bone Marrow
Cost: $10,000 - $300,000
Recovery time: One Month

Adipose (Fat)
Cost: $7,000 - $15,000
Recovery time: One Month

Peripheral Blood-Based
Cost: $7,500
Recovery time: Less than a week

Making a Stem Cell Decision

Q & A

Aspen Integrative Medicine
970-927-0308
aspenintegrativemedicine.com

TBI Therapy
303-447-1257
tbitherapy.com

aspenintegrativemedicine.com/what-to-know-stem-cells

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