

BME449 Tissue Engineering



Lecture #7 Stem Cells

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Adult Stem Cells

Strengths

- Ethics, not controversial
- Immune-privileged
 - Allogenic, xenogenic transplantation
- Many sources
 - Most somatic tissues

Limitations

- Differentiation Capacity?
- Self-renewal?
- Rarity among somatic cells

Potential Solutions

- Differentiation Capacity
 - Mimic stem cell niche
- Limited Self-renewal
 - Gene therapy
- Limited availability
 - Fluorescence-activated cell sorting
 - Adherence
 - Heterogenous population works better clinically

Mesenchymal Stem Cells

- Easy isolation, high expansion, reproducible

Hematopoietic Stem Cells

- Best-studied, used clinically for 30+ years

Induced Pluripotent Stem Cells

Strengths

- Patient DNA match
- Similar to embryonic stem cells?

Limitations

- Same genetic pre-dispositions
- Viral gene delivery mechanism

Potential Solutions

- Same genetic pre-dispositions
 - Gene therapy in culture
- Viral gene delivery mechanism
 - Polymer, liposome, controlled-release
- Use of known onco-genes
 - Try other combinations

Soluble Chemical Factors

- Transduce signals
 - Cell type-dependent
 - Differentiation stage-dependent
 - Timing is critical
 - Dose-dependence
- Growth
- Survival
- Motility
- Differentiation