BME449 Tissue Engineering

Lecture #8
Cell Sources

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Clinical Questions

- What cell source do you use?
- How should cells be delivered?
- What cells within that pool are beneficial?
- How many cells do you need?
- When should you deliver the cells?
- What type of scaffold should be used?

These answers all depend on various factors

Very sensitive to methodology!

- 2 nearly identical clinical trials, opposite results
  - Autologous Stem cell Transplantation in Acute Myocardial Infarction (ASTAMI)
  - Reinfusion of Enriched Progenitor cells And Infarct Remodeling in Acute Myocardial Infarction (REPAIR-AMI)
- Same inclusion criteria
- Same cell source (Bone marrow aspirates)
- Same delivery mechanism (intracoronary infusion)
- Same timing of delivery
- SIMILAR cell preparation methods

Cell preparation comparison

- Bone marrow aspirates diluted with 0.9% NaCl (1:5)
- Mononuclear cells isolated on Lymphoprep™ gradient 800rcf 20 min
- Washed 3 x 45 mL saline + 1% autologous plasma (250rcf)
- Stored overnight 4°C saline + 20 autologous plasma

- Bone marrow aspirates diluted with 0.9% NaCl (1:5)
- Mononuclear cells isolated on Ficoll™ gradient 800rcf 20 min
- Washed 3 x 45mL PBS (800rcf)
- Stored overnight room temperature in 10 + 20% autologous serum

Courtesy of Dr. Tor Jensen

Future Directions

- Standardization
  - Central cell processing facilities
  - Protocols
- Improved antimicrobial methods
  - Allergies
- Synthetic biology
  - Natural materials made synthetically, economically

Long-term: “clinical-grade” cell lines

- Animal-substance free conditions
  - Human feeder cells, chemically-defined media
  - Feeder-free culture
- No immune rejection, no immunosuppressive drugs
  - Somatic cell nuclear transfer
  - Genetic engineering, reprogramming
- Goals: understand normal/disease development, then repair/replace diseased organs and vice versa
  - Tissue engineering approach
    - ex vivo, in situ for now
    - In vitro for the future?