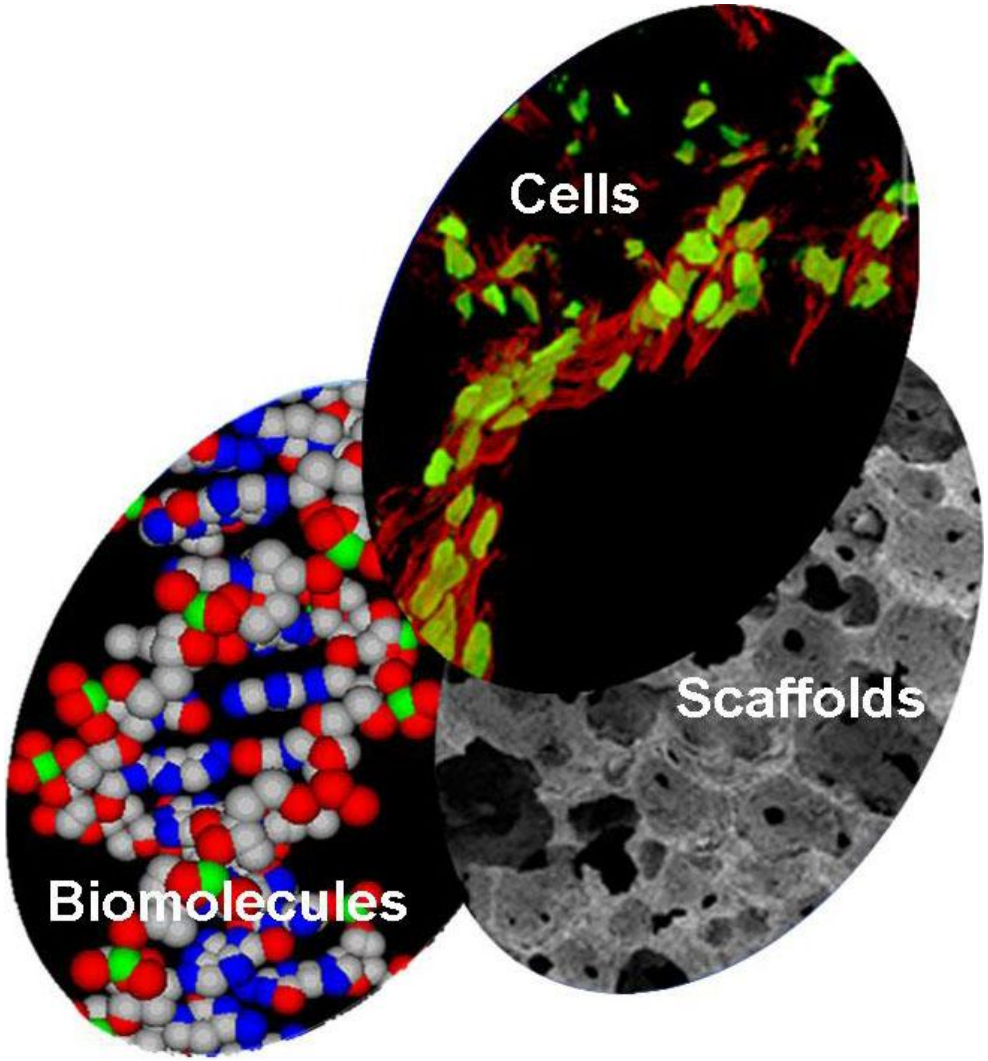

Tissue Engineering

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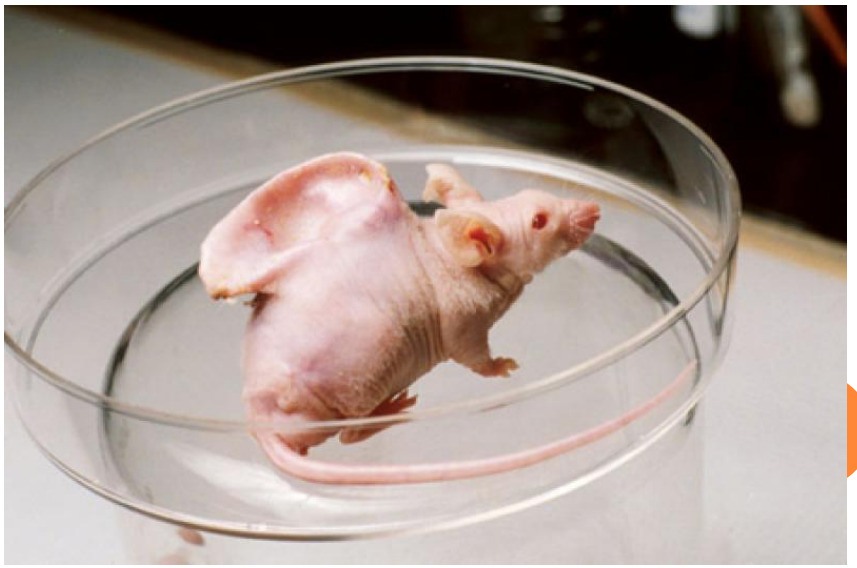
BME 181 Spring 2013

The History

- Idea dates back to early human civilization
  - Adam & Eve
- Ambroise Pare` (1510–1590)
  - *Dix livres de la chirurgie*
- Johann Friedrich Dieffenbach (1792–1847)
- Dr. Charles Vacanti at the University of Massachusetts Medical Center
  - Brought tissue engineering to the forefront of public awareness



What is Tissue Engineering?

- "An interdisciplinary field that applies the principles of engineering and life sciences toward the development of biological substitutes that restore, maintain, or improve tissue function or a whole organ"
  - The use of cells to regenerate the damaged tissue, leaving only natural substances to restore organ function

Common Issues

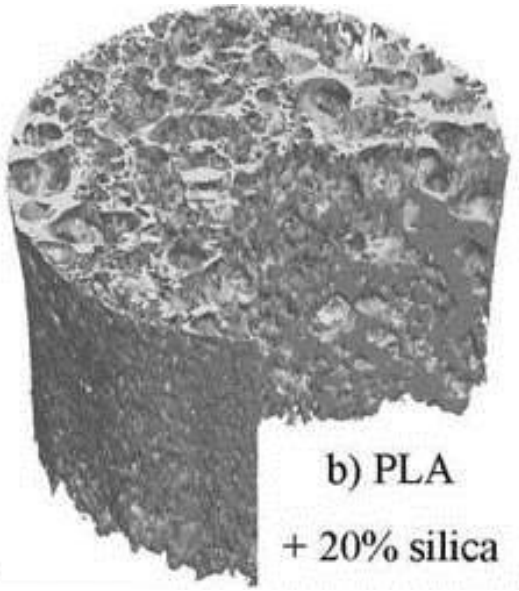
- A substrate material must be inserted to aid in organization of the cells in three dimensions
- The substrate material must demonstrate good biocompatibility
- The mechanical properties of the scaffold must be sufficient so that it does not collapse during the patient's normal activities.

Scaffolds

- Must have a large surface area to allow cell attachment and promote tissue growth
- Fiber Bonding
  - PLLA or PLGA is dissolved in chloroform and sprayed onto the PGA fibers. The solvent is then evaporated, leaving the fibers glued with PLLA or PLGA.
  - Problems:
    - Involves use of toxic solvents that would be harmful to cells if not completely removed

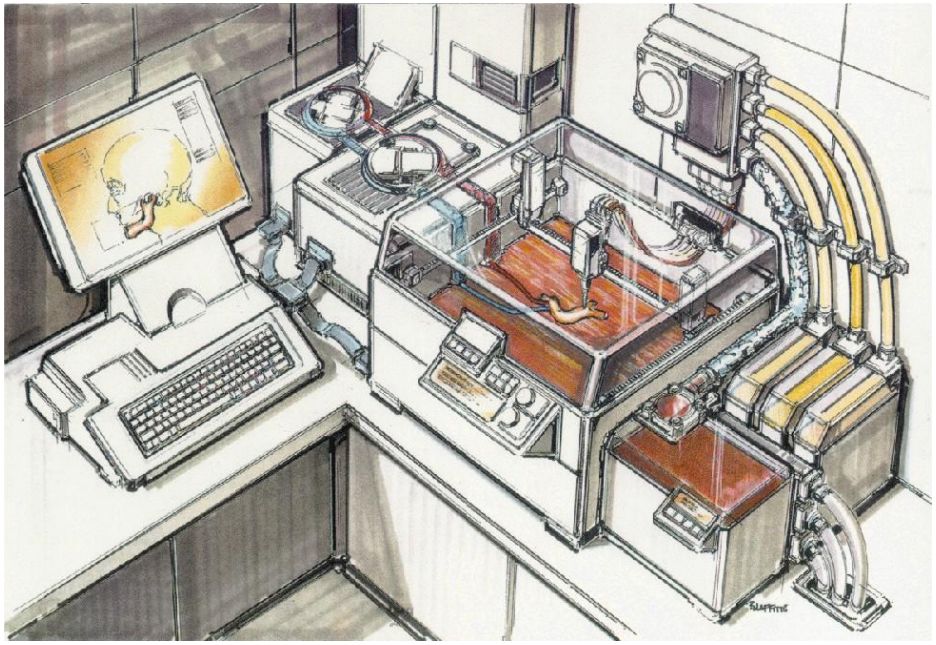
Scaffold's Cont…

- Solvent Casting/ Particulate Leaching
- Gas Foaming
  - Preferred due to no use of harsh chemicals
  - But limited
- Phase Separation/ Emulsification
  - Emulsification → freeze drying
  - Liquid-liquid phase separation



Bioreactors

- A device that promotes cell or tissue growth in vivo
  - Many parameters for the physiological environment
- Typically used to replicate the specific physiological environment of the tissue being grown



Why It Is Important

- Recent lack of donor organs
- The tissues are tailored to each specific case
- Last for a lifetime

It's Future

- Cardiac, neural, bone, skin, etc…
- Advances in technologies
  - High throughput screening
  - Micro fluidics

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