

BME449 Tissue Engineering



# Lecture #1 Tissue Engineering: Introduction

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# Milestones in Tissue Engineering

- Animal and clinical work on Skin transplantation: Freidrich Dieffenbach (1792-1847)
- First succesful autologous skin transplantation: Heinrich Christian Bünger
- relation between tissue regeneration and cellular proliferation: Rudolf Virchow (1821-1902)
- Active growth cells in culture: R. G. Harrison
- generate new cartilage using chondrocytes seeded onto spicules of bone (in early 1970s)
- generate a tissue-engineered skin substitute using a collagen matrix to support the growth of dermal fibroblasts : Burke and Yannas (1982)
- The term “tissue engineering” was introduced in medicine (1987)
- Definition of Tissue engineering by Vacanti and Langer (Science, 1993)

# Definition of 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.”

Langer, R & Vacanti JP  
*Science* 260, 920-6; 1993

# Why Do We Need Tissue Engineering?

- Failing tissues and organs
- Shortfalls of current options
  - Autologous grafts
  - Allogenic grafts
  - Xenogenic grafts

# Autografts

- Tissue from the same patient

## Advantages:

- Biocompatible
- No immune response
- Natural

## Disadvantages:

- Secondary surgical operation
- Increased general anesthesia
- Donor site morbidity
- Donor limitation

# Allografts

- Tissue from another person

Advantages:

- More practical than autologous harvest

Disadvantages:

- Severe shortage of donors
- Increased immune response to foreign material
- Immunosuppressives

# Xenografts

- Tissue harvested from animals

## Advantages:

- Potentially readily available

## Disadvantages:

- Immune response from host to foreign material
- Risk of disease transmission from animal to human
- Significant ethical considerations