

BME341 Biomaterials



# Lecture #1 Materials for Biomedical Applications

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# Objectives of this course

- To understand the **breadth of the field** and **important definitions**
- To be able to compare/contrast **natural** and **synthetic materials**
- To be able to compare/contrast **surface** and **bulk properties** and understand that design criteria depend on the final application
- To understand that the material induces a **biological response** which affects the material performance
- To understand that the **form of the material** can influence its properties and the biological response to its implantation
- To understand how **electron structure** contributes to various types of **bonding**

# Definitions

- *Biomaterial*: A material intended to interface with the biological systems to evaluate, treat, augment or replace any tissue, organ or function of the body.

# Definitions

- *Biocompatibility*: The ability of a material to perform with an appropriate host response in a specific application

# History of Biomaterials

- Gold, ivory and wood in dentistry and prosthesis
- 1860: Aseptic surgery
- 1900: Bone plate
- 1930: Artificial joints
- 1961: PE and stainless steel hip prosthesis
- >2000: Functional tissue regeneration

# Ex. Cardiovascular applications

- In the cardiovascular area, app. 100,000 replacement heart valves and 300,000 vascular grafts are implanted per year in US.

## Ex. Orthopedic applications

- Over 500,000 artificial joint replacements (knee, hip, shoulder..) are implanted yearly in US

## Ex. Renal Dialysis

- Over 300,000 patients in US with compromised kidney function must receive renal dialysis 3 times per week to remove waste from the blood in order to maintain life.