



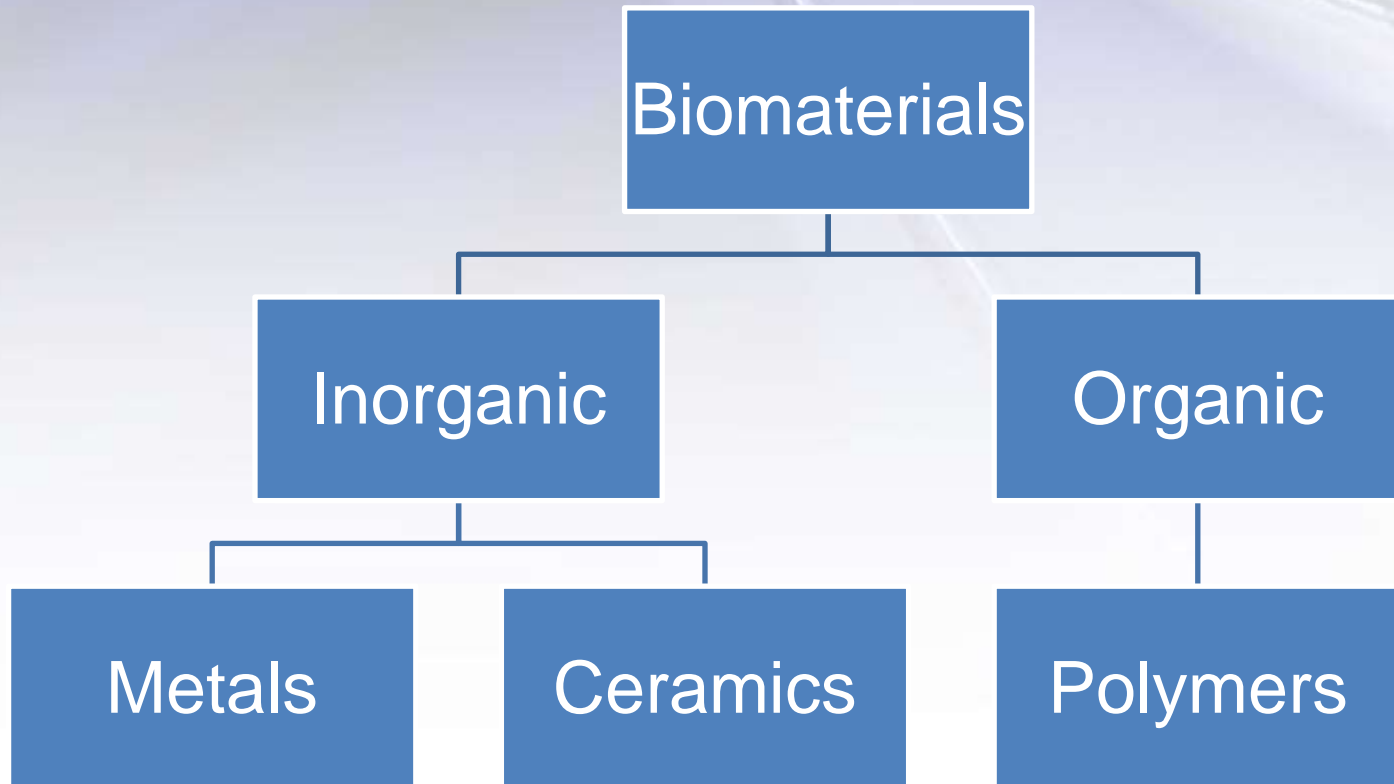
BOMATERIAL *classification*

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Type of Biomaterials

- Biomaterials are classified as:
 - **Organic if contain carbon**
 - Inorganic if they do not.
- More specifically biomaterials fall into one of three of materials:
 - Metals (inorganic material)
 - Ceramics(inorganic material)
 - Polymers (organic material)

Type of Biomaterials



Type of Biomaterials

Materials	Advantages	Disadvantages	Examples
Polymers Nylon, Polyethylene, Silicone, Teflon, Dacron, Acrylates, PGA, PLA	Resilient, Easy to fabricate	Not Strong, Deforms with time, may degrade	Sutures, vascular graft, hip socket, intraocular lenses
Metals (Titanium and its alloys, Co-Cr alloys, stainless steel, Gold)	Strong, Tough, Ductile	May corrode, Dense, Difficult to make	Joint replacement, Bone plates and screws, Dental root implant

Type of Biomaterials

Materials	Advantages	Disadvantages	Examples
Ceramics Aluminum oxide, Calcium phosphates, Carbon	Very biocompatible, Inert, Strong in compression	Brittle, Not resilient, Difficult to make	Dental implant, Femoral head of hip replacement, Coating of dental and orthopedic implants
Composites Carbon-carbon Ceramic-polymer	Strong, less stiff than metals, Strong in compression	Difficult to make, Weak in tension	Joint implants Dental fillings



Metal

- Metals appear as shiny surfaces with high density and high melting and boiling points as well.
- They are ductile and malleable, best representatives of mechanical strength and thermal and electrical conductivity
- more than 70% of the implant devices is made from metals
- Most metals are used in the form of alloys.
- An alloy is a substance that has metallic properties and is made up of two or more elements.

Metal

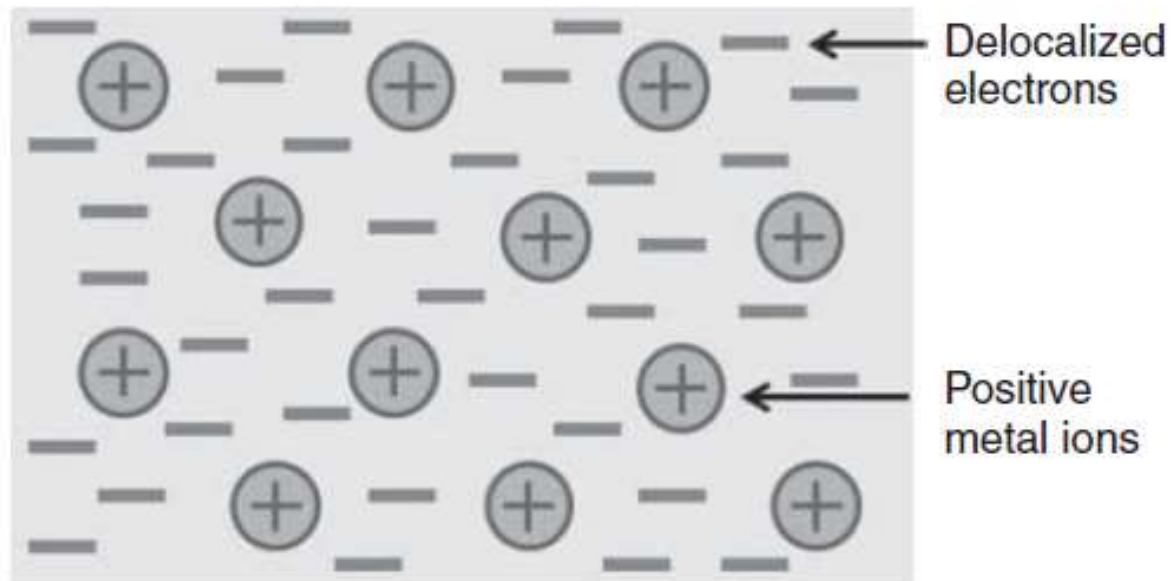


Figure 1.36. Diagram showing delocalized electrons and positive ions in a

Performance of biomaterials

- The success of biomaterials in the body depends on factors such as:
 - Material properties
 - Design of the implants
 - Biocompatibility of the materials
 - Technique used by the surgeon
 - Health and condition of the patient
 - Patient activities

Material Selection Parameters

- ☐ Mechanical
- ☐ Thermal/Electrical Conductivity
- ☐ Diffusion
- ☐ Water Absorption
- ☐ Biostability
- ☐ Biocompatibility

An Interdisciplinary Field

Bioengineers
Material Scientists
Immunologists
Chemists
Biologists
Surgeons

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Some Commonly Used Biomaterials

Material

Silicone rubber

Dacron

Cellulose

Poly(methyl methacrylate)

Polyurethanes

Hydrogels

Stainless steel

Titanium

Alumina

Hydroxyapatite

Collagen (reprocessed)

Applications

Catheters, tubing

Vascular grafts

Dialysis membranes

Intraocular lenses, bone cement

Catheters, pacemaker leads

Ophthalmological devices, Drug Delivery

Orthopedic devices, stents

Orthopedic and dental devices

Orthopedic and dental devices

Orthopedic and dental devices

Ophthalmologic applications, wound dressings

