

**Massachusetts Institute of Technology
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**DESIGN OF MEDICAL DEVICES/IMPLANTS:
Overview**

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AGES OF ORTHOPEDIC SURGERY

1920-1970

Age of Devices

1970-

Age of Biomaterials

2000-

Age of Tissue Engineering

2010 -

Age of Gene Therapy (?)

AGES OF ORTHOPEDIC SURGERY

1920-1970

Age of Devices

- Fracture fixation
- Joint replacement
- Spine instrumentation

1970-

Age of Biomaterials

- Hydroxyapatite coatings for TJA
- Bone graft substitute materials

AGES OF ORTHOPEDIC SURGERY

2000-

Age of Tissue Engineering

-Porous absorbable materials to be seeded with cells or implanted alone to be infiltrated with cells *in vivo*

2010 -

Age of Gene Therapy (?)

-Materials as delivery systems for genes

NEW MATERIALS IN ORTHOPEDIC SURGERY

Present: Joint Replacement Prostheses

- **Method of sterilizing polyethylene**
 - gamma-radiation in air results in breakdown
- **Molecular modification (cross-linking) of polyethylene**
- **Abrasion resistant metal alloy (oxidized zirconium)**
- **Improved calcium phosphate (hydroxyapatite) coatings for bone bonding**

NEW MATERIALS IN ORTHOPEDIC SURGERY

Future: Tissue Engineering

- Porous absorbable materials to be seeded with cells *in vitro* or infiltrated with cells *in vivo*
 - synthetic polymers (polyglycolic acid) and natural polymers (collagen), alone or in combination with other molecules (e.g., glycosaminoglycans, adhesion proteins)
 - sponge-like or nonwoven fiber materials

WAITING LIST FOR ORGANS

Sci. Registry of Transplant Recipients

	No. on waiting list as of 6/30/01	No. who died on list 7/1/00-6/30/01
Kidney	49,860	2,837
Liver	18,089	1,799
Pancreas	976	23
Kidney-Pancreas	2,587	220
Heart	4,200	608
Lung	3,798	497
Heart-Lung	222	35
Intestine	170	24
All	79,902	6,043

2.782 PROJECTS 1999

Retinal Tissue Engineering

Glaucoma Implant

Thermo-Conforming Anastomer

UriValve Incontinence Device

Dr. Frankenstein's Brain

GERD Prosthesis

2.782 PROJECTS 2001

**Polyurethane Implant for Brain
Stabilization**

Continuous Glucose Monitor

Biodegradable Ligament Connector

Intellistent