

2014 INDO-AMERICAN FRONTIERS OF ENGINEERING SYMPOSIUM

# BIOMATERIALS

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# BIOMATERIALS

- ▶ Are any substances (other than drugs), natural or synthetic, that mimic, treat, augment, or replace any tissue, organ, or body function in a safe, reliable, economic, and physiologically acceptable manner.<sup>1</sup>

<sup>1</sup> Williams, D.F. (1987) Biomaterials. Proceedings of a Consensus Conference of the European Society For Biomaterials, England, 1986, Elsevier, New York.

### Multidisciplinary

Engineering  
Material science  
Biology  
Medicine  
Regulations

### Multi-material

Polymers  
Metals  
Ceramics  
Composites

### Need-driven

Products are used  
in the treatment of  
affected population  
  
Impacted  
population growth  
by over 10% a year

### Huge market

Market size  
represents 7 to 8%  
of the world wide  
health care  
spending

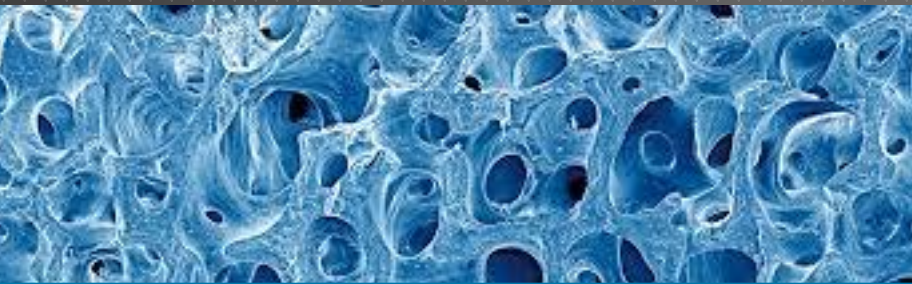
### Risk benefit

In spite of the risk  
of infection from  
an implant, quality  
of life has improved

## Characteristics of Biomaterial Science

# INSPIRATION

- ▶ The need for biomaterials stems from an inability to treat many diseases, injuries, and conditions with other therapies or procedures:



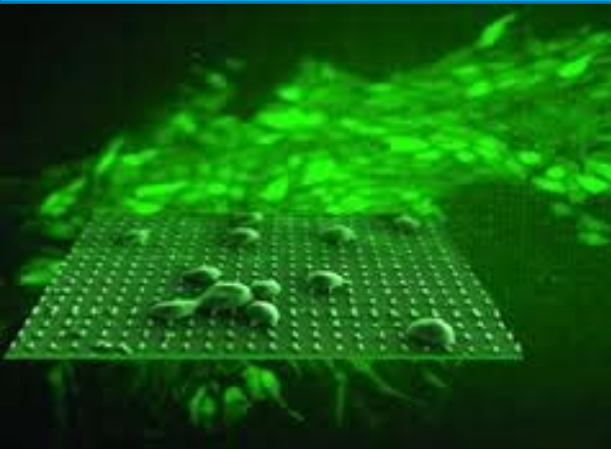
TISSUE ENGINEERING



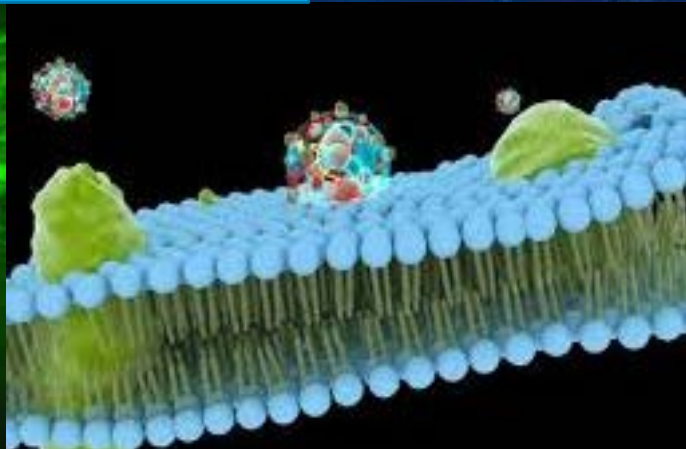
ORTHO. TOOLS



STENTS



MEDICAL DEVICES



NANOTECHNOLOGY



PROSTHETICS

# HISTORY



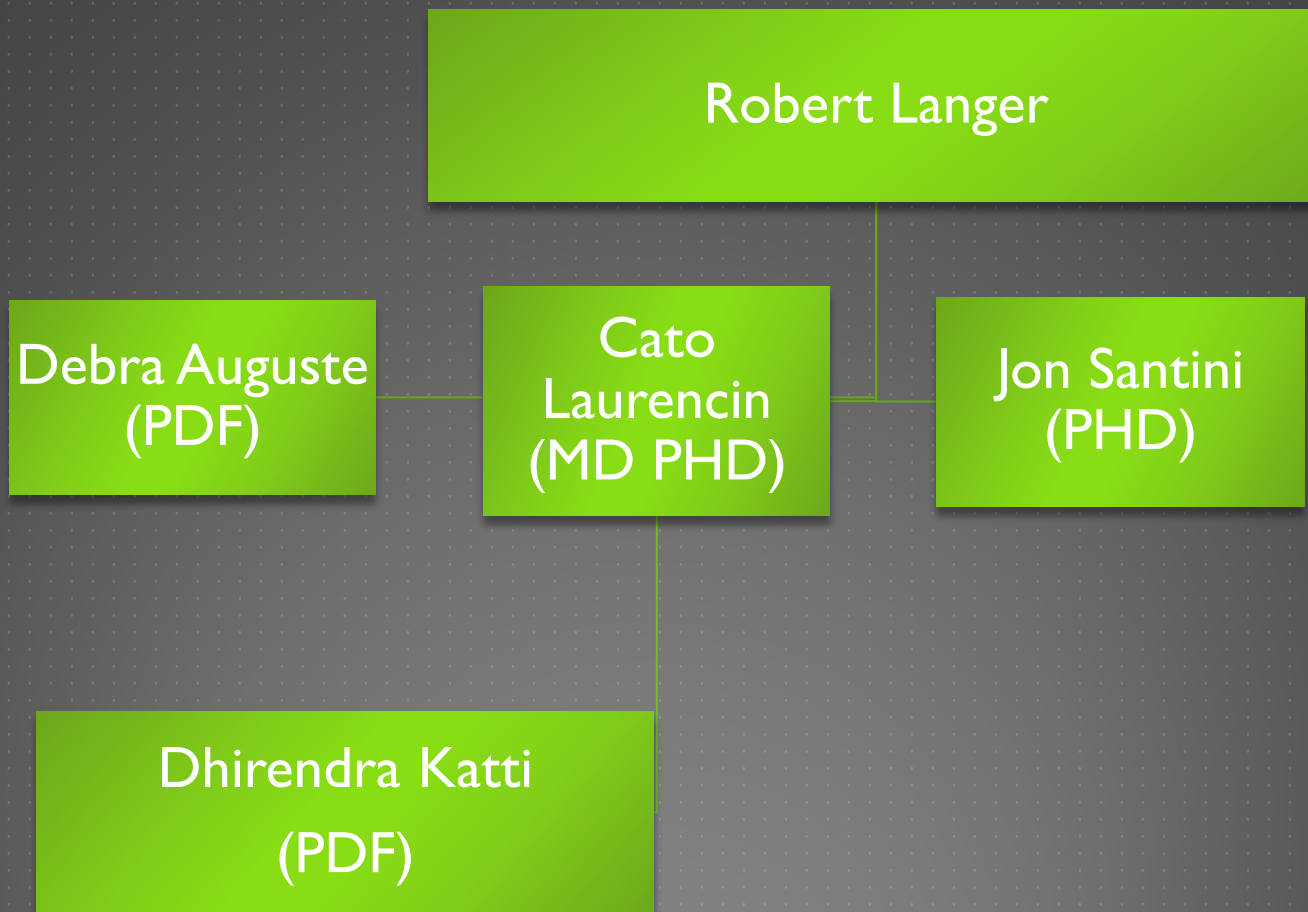
- ▶ 1400 BC Egyptian artificial toe
- ▶ 600 BC Autologous tissue grafts by Hindu surgeons
- ▶ 400 BC Artificial limbs and eye inlays for assisting dead in next world
- ▶ 300 BC Roman wood/bronze legs
- ▶ 1350 Eyeglasses
- ▶ 1500's Functional prosthesis, iron hand
- ▶ 1965 Liposomes
- ▶ 1970s Stents, Degradable polymers
- ▶ 1980s Tissue Engineering
- ▶ 1995 Doxil
- ▶ 1996 Integra – silicon coated ECM
- ▶ 2010s Decellularized matrices, multi-functional, manipulating cells

**Integra.**

Dermal Regeneration Template

Warning: unsanctioned slides....

# ACADEMIC TREE



# SPEAKERS

- ▶ Dhirendra Katti, IIT Kanpur
  - ▶ Rinti Banerjee, IIT Mumbai
  - ▶ Suzie Pun, University of Washington
  - ▶ John Santini, ApoGen Biotechnologies
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