Great Expectations

Life expectancy is now 77.7 years ... and people are expecting to stay *actively moving* through those years.

Aging baby boomers expect to stay active, placing unprecedented demands on surgical options previously reserved for the elderly.
Total Hip Replacement
Knee Replacement
Joint Replacement Advances

- Materials (Failure)
- Bearings (Wear)
- Surgery
  - Infection
  - DVT
- Today:
  - Biomaterials
  - Bearings
  - Safe Surgery
- Future?
  - Biological solutions
Meeting Demand for Ortho R&D

• Biomaterials
  – Mimic skeletal bone (elasticity, porosity)
  – Bearing wear and compatibility
  – Biological options

• Surgical techniques and procedures
  – Less invasive surgery and faster recovery

• Patient education and rehabilitation
  – Consumers are better informed
Collaborative Research

- Orthopaedic scientists and surgeons
- Engineering and materials scientists
- Veterinary medicine scientists and clinicians

Working together.
Collaboration

Comparative Orthopaedics Laboratory-MU
Missouri University of Science & Technology-Rolla
Department of Orthopaedic Surgery-MU
Biomaterials

- OC plugs in Rabbits
  - Regenerate Cartilage
  - Bioactive Glasses
Tissue-engineered patella

- Columbia University
  New York City

- COL at MU
  Columbia, MO
Stem Cell Engineered Cartilage
Comparative Orthopaedics

- **Identify** “real world” problems
- Develop **hypothesis** and aims
- **Break it down** into the components
- **Assess the variables** to test the hypothesis
- **Optimize** the solutions
- **Apply** it to the problem
- **Test** the solution in the real world
- Stakeholders: Veterinary and Human
Ceramic-Metal Femoral Head

Compressive stress

(a) Al\textsubscript{2}O\textsubscript{3} - Metal taper

(b) Al\textsubscript{2}O\textsubscript{3} - Nb core - Metal taper

Maximum hoop stress
Material Composites

- Optimizing Bioactive Glasses
- Testing tissue-engineered cartilage
- Combining biomaterials
  - Bioactive glass
  - Porous titanium
  - Biologically active materials
The Value of Investigation?

#1 Disability: Arthritis

Leading Cause of Death: Heart Disease
The Case for Moving Forward

57% of adults with heart disease also have arthritis

Arthritis = difficulty being physically active
Less active = difficulty managing heart disease
Investments in Motion

- Government grants
- Foundation grants
- Corporate giving
- Individual giving
Research to Products

• Once we have the biomaterials:
• MU Biodesign Team
  – New applications
  – New solutions
• Business Incubator
  – Business School
  – Commercial Venture
Investments in Motion

Missouri Orthopaedic Institute

University of Missouri Health System