

Biomaterials for Tissue Repair and Regeneration at

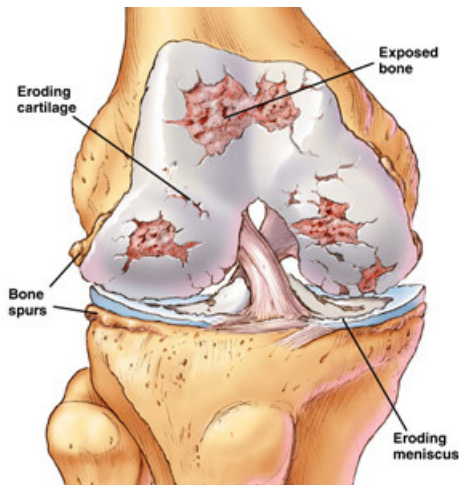


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Regeneration

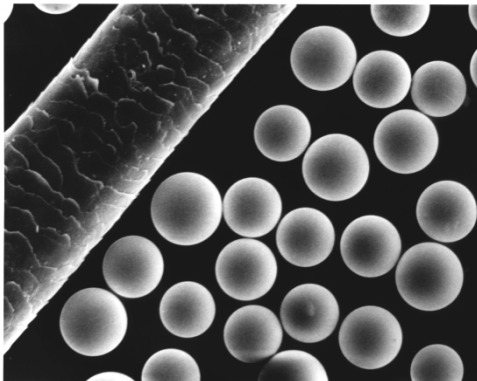
Biomaterials

- Backbone for biomedical research and reconstructive surgery
- Demand: \$40 billion/year worldwide; 10-20%/year growth



Biomaterials Research at Missouri S&T

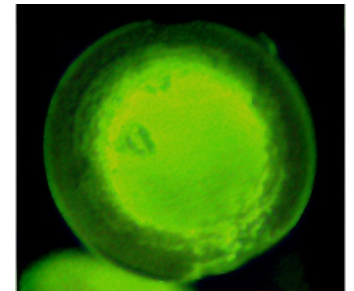
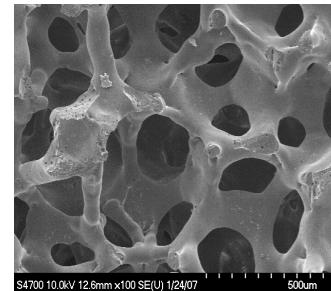
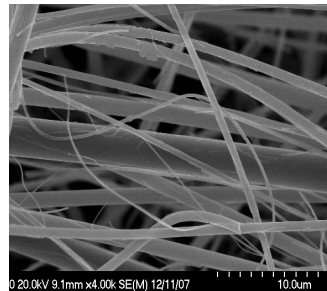
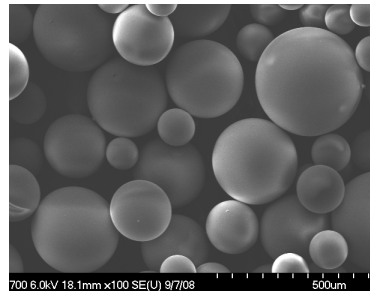
- History on engineering and science
- Interdisciplinary environment for basic and applied research in biomaterials
- Center for Bone and Tissue Repair and Regeneration
- Collaboration with
UMKC: Life sciences; dental school
UMC: Medical school: orthopaedic surgery



Therasphere® - Radioactive glass microspheres for treating liver cancer. Jointly developed by Missouri S&T and UM-Columbia. Technology licensed to MDS Nordion, Inc. Approved by FDA 2000.

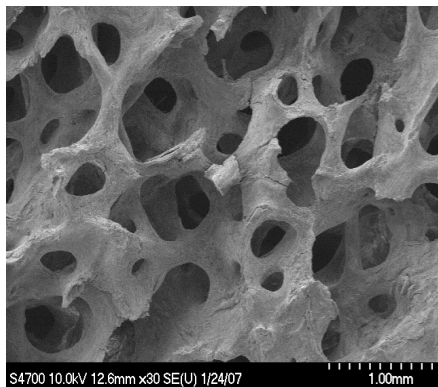
Biomaterials Research at Missouri S&T

- Development of mechanically and biologically optimized bioactive glass implants for bone repair
- Synthetic biomaterials for joint repair
- Tissue engineered composites for joint repair
- Inorganic (calcium phosphate-based) particles for protein and drug delivery
- Rapid prototyping of scaffolds for bone repair

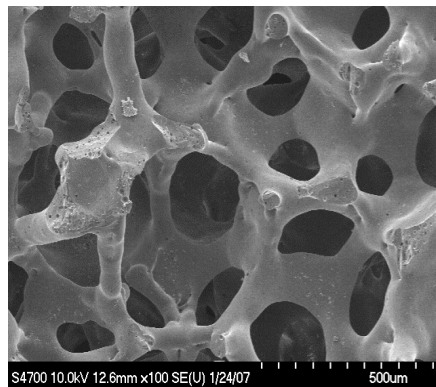


Optimized Bioactive Glass for Bone Repair

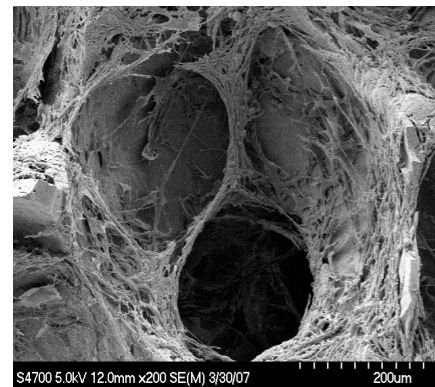
- **Missouri S&T:** Preparation and *in vitro* evaluation
- **UMKC; UMC:** *In vivo* evaluation



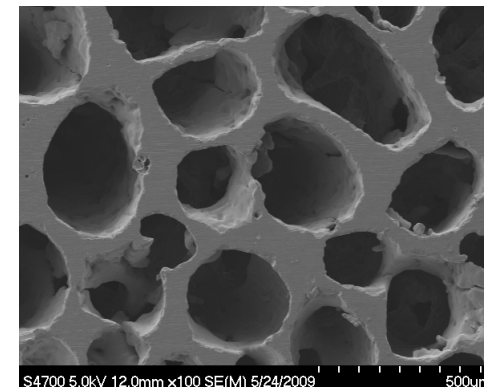
Human trabecular bone



Glass sponge scaffold



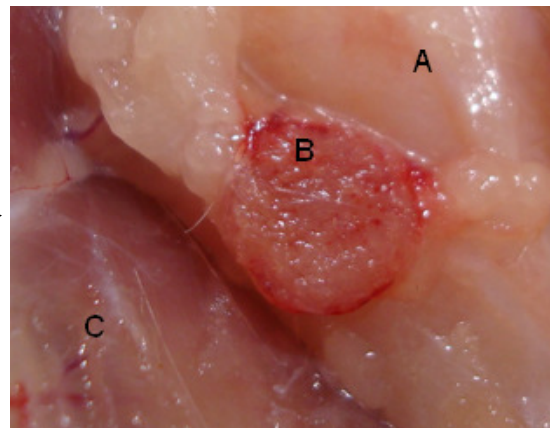
Osteoblasts on glass scaffold



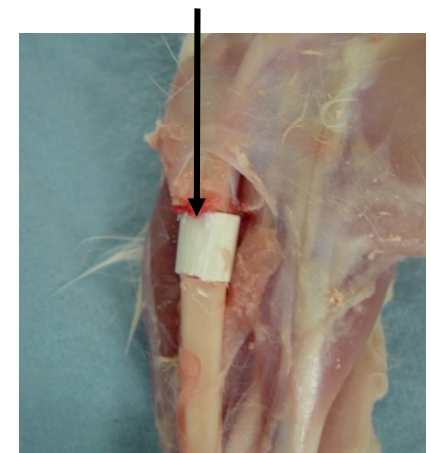
Glass oriented scaffold



Glass fibrous scaffold

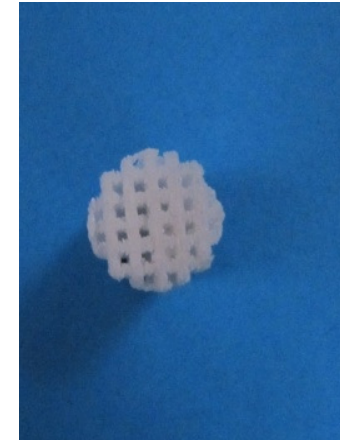
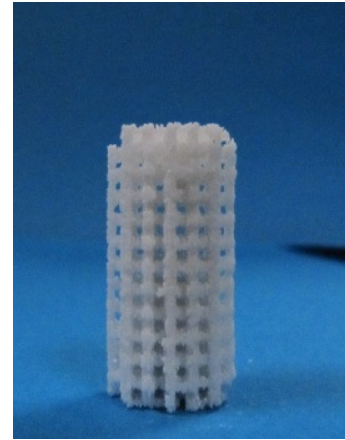
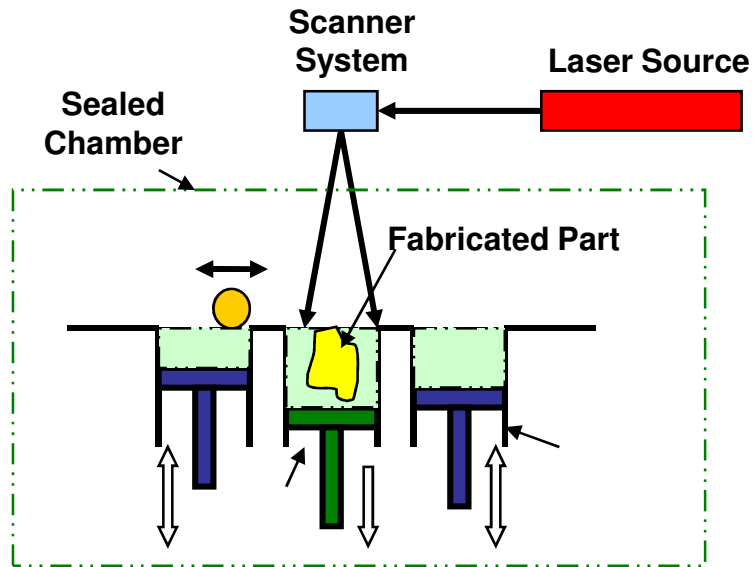


Subcutaneous implantation: 6 weeks

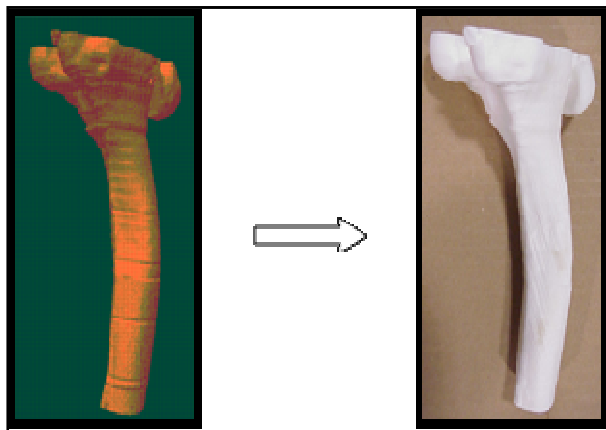


Substitution of segmental defect

Rapid Prototyping of Implants

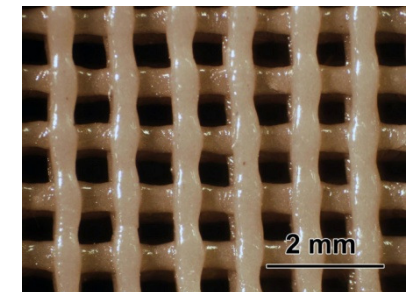
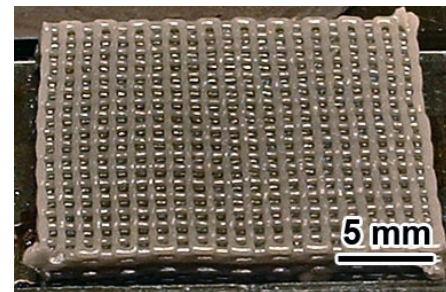


Selective laser sintering of bioactive glass



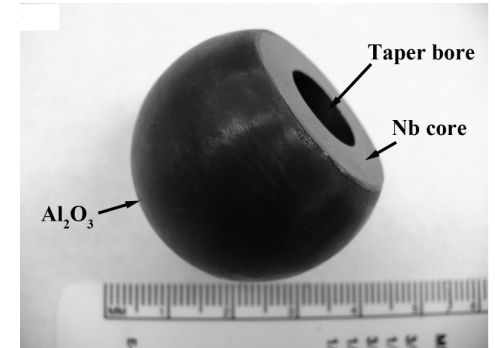
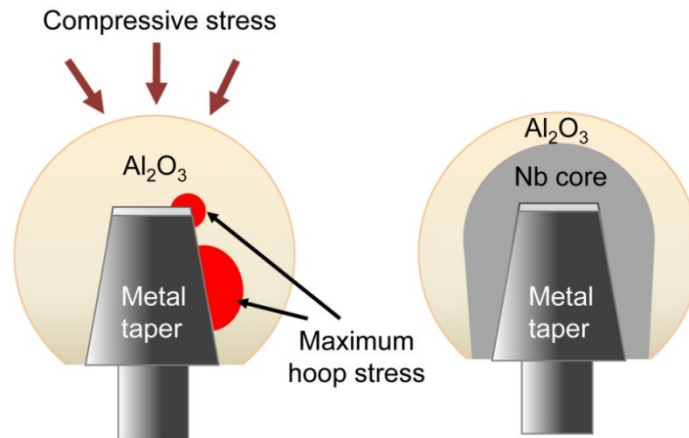
CAD Model

SLS green part

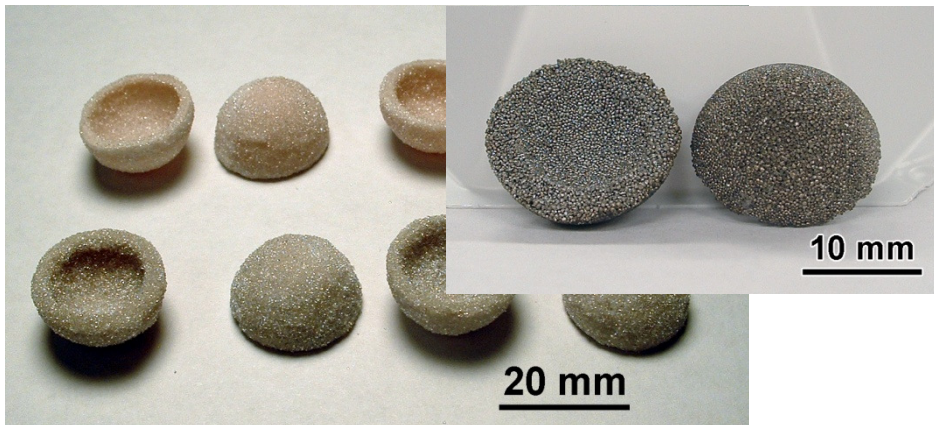


Freeze extrusion fabrication of bioactive glass

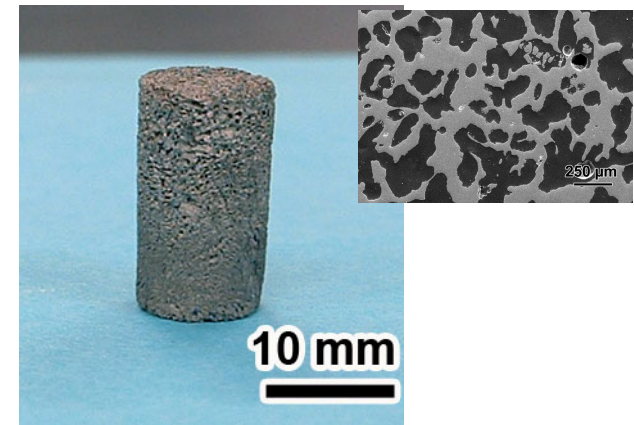
Biomaterials for Bone and Joint Repair (Missouri S&T; UMC)



Ceramic-Metal Femoral Head for Improved Reliability and Lifetime

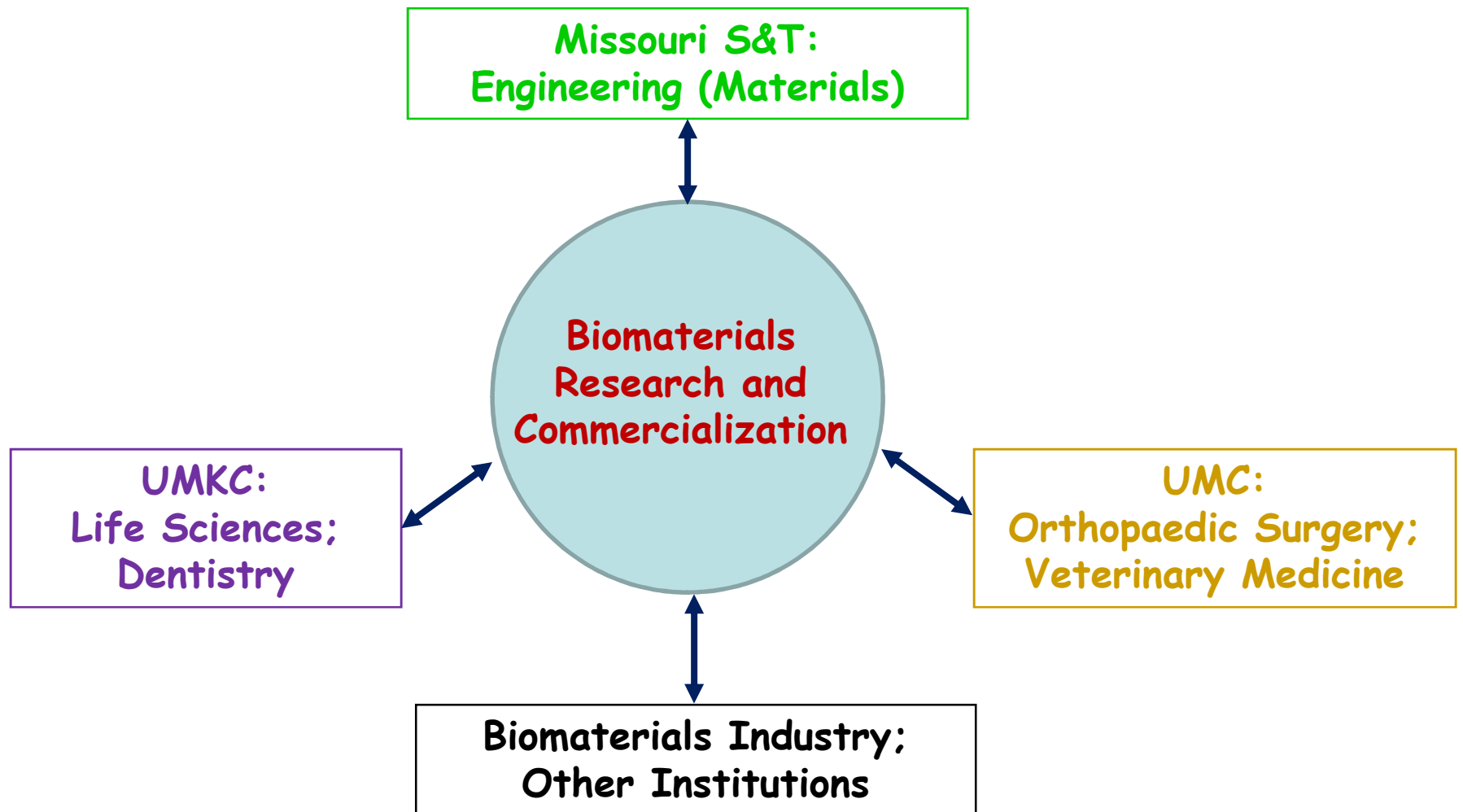


Bioactive glass and Ti shells for femoral head resurfacing



Porous Ti implants

Going Forward - Enhancing Collaboration in Biomaterials



Benefits

- Speed the development of new biomaterials
- Enhance technology transfer and entrepreneurship
- Enhance Missouri's role in the growing biomaterials industry
- Attract biotechnology and related companies (jobs)
- Produce researchers with the ability to attract funding
- Train the next generation of biomedical/biomaterials students

Needs

- Support
 - General: institutional; philosophical
 - Financial
- Resources
 - People
 - Facilities; infrastructure
 - Educational

Acknowledgements

Missouri S&T: Drs. Brown; Day; Leu; Rahaman;
Graduate students

UMC: Dr. Bal

UMKC: Drs. Bonewald; Eick

Biomaterials

Spare Parts for the Body