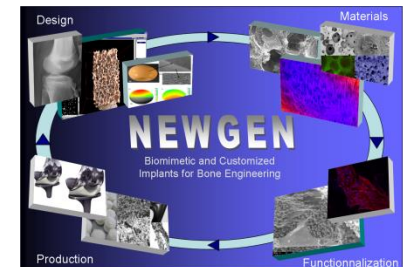


- **Location:** Rolla, MO, USA
- **Director:** Prof. Mohammed Rahaman
- **Contact Person in NEWGEN:** Prof. Richard K. Brow- brow@mst.edu
- **Working Group involvment:** WG1 (R.K. Bow)
- **Staff:** Nine professors, five asst. prof., two research prof., 12 PhD students
- **Research topics:**
  - Bioactive glasses and ceramics for bone repair, wound healing, and drug-delivery
  - Biomarkers for the detection of cancer; biosensors for monitoring blood glucose levels; antibacterial coatings and implants
- **Researchers expertise:**
  - Material scientists: glasses, ceramics, metals, polymers and composites
  - Bio-chemists / analytical chemists: biological testing
  - Electrical engineers / mechanical engineers: sensor design

## **CBSE**

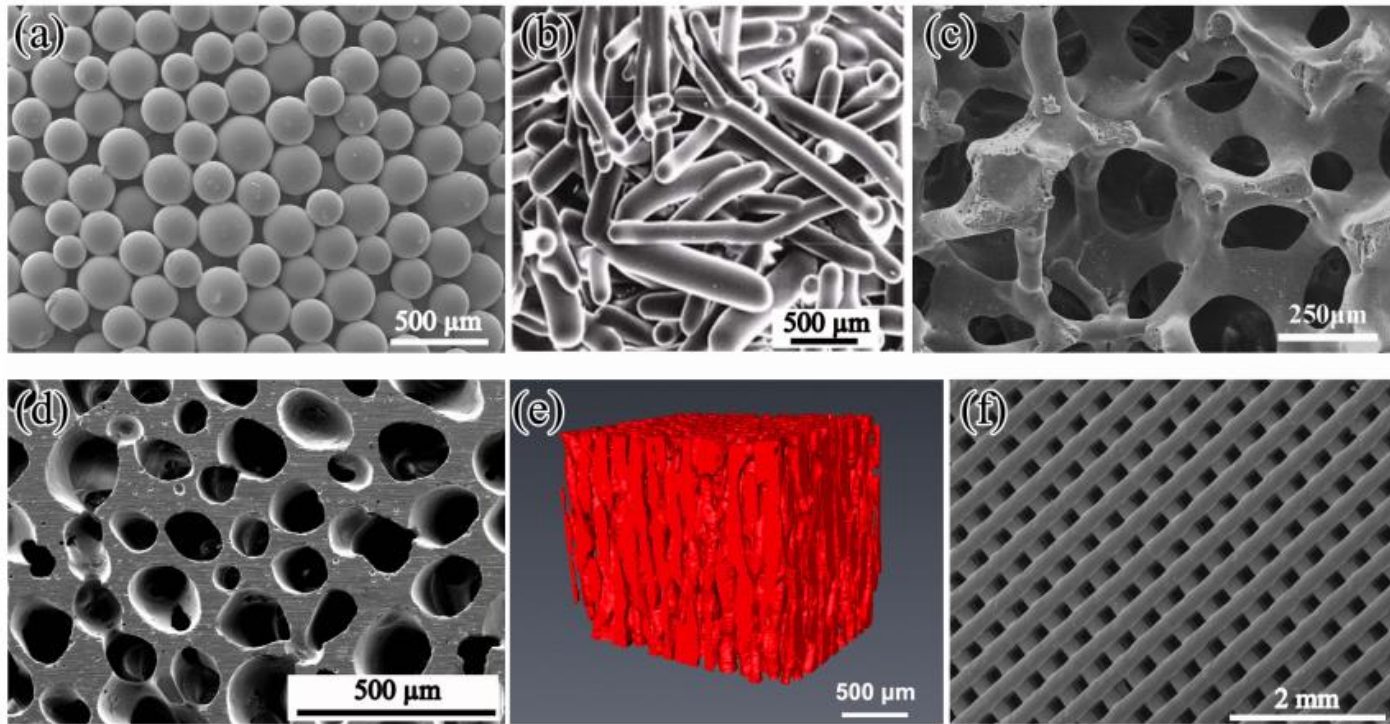
Missouri S&T  
224 McNutt Hall  
Rolla, MO 65409 - USA



**COST Action MP1301**

### Processing Glass Scaffolds for Segmental Bone Defects

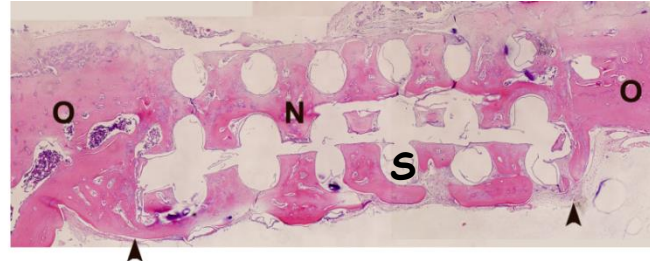
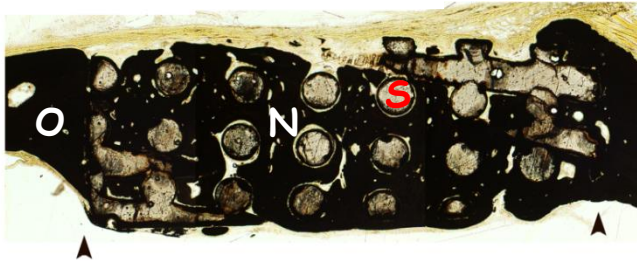
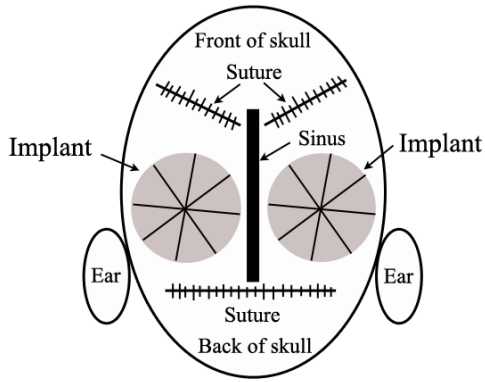
- a. Microspheres
- b. Short fibers
- c. Polymer foam replication
- d. Unidirectional freezing of suspensions
- e. X-ray tomography of (d)
- f. Robocasting of particles



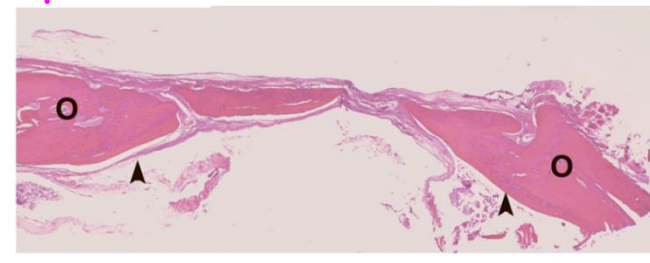
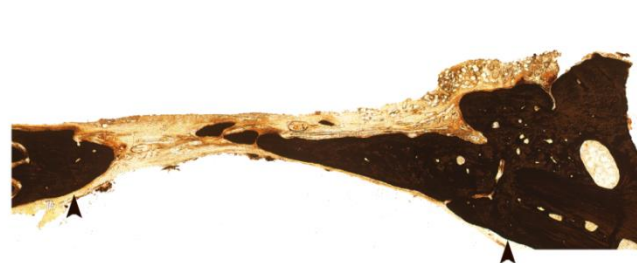
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## In-vivo Studies of Bioglass Scaffolds

- BG scaffolds produced by robocasting to regenerate bone evaluated in rat calvarial defects (4.6 mm)
- BG scaffolds almost completely infiltrated with new bone within 6 weeks (von Kossa; H&E stains)

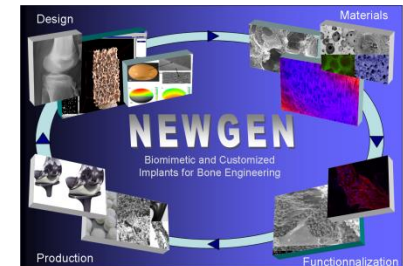
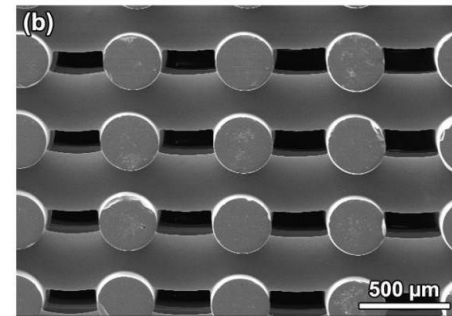


Grid-like scaffolds implanted for 6 weeks



Unfilled defect at 24 weeks

1mm

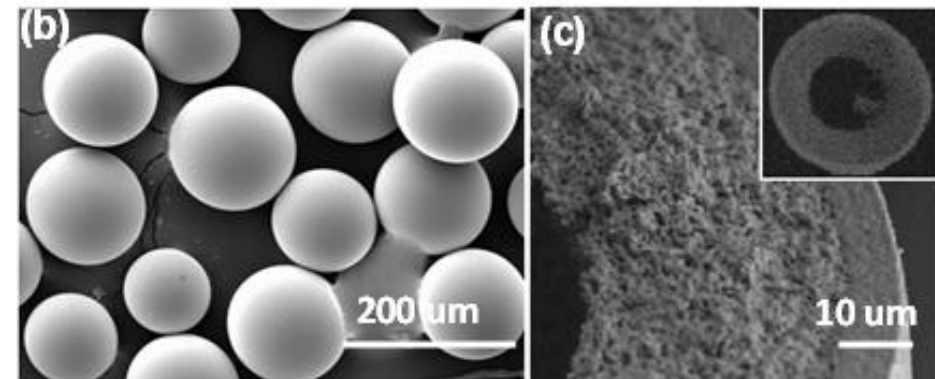
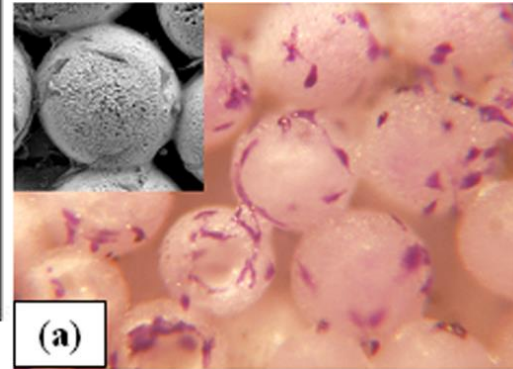
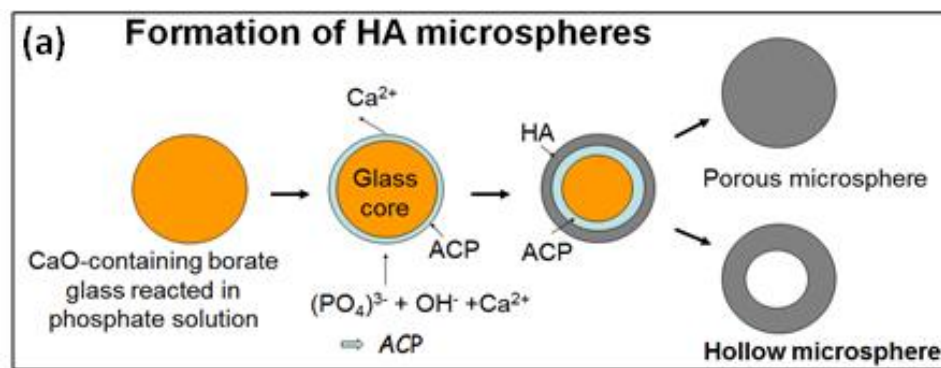


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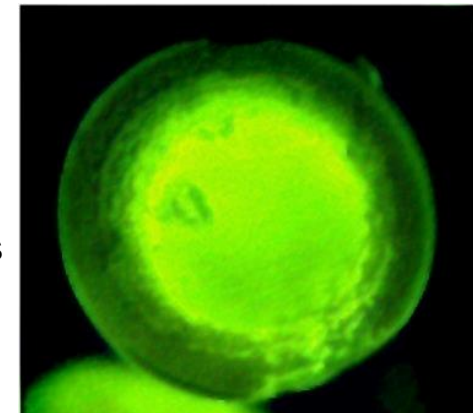
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## Hollow Hydroxyapatite Microspheres

Hollow HA microspheres support cell proliferation *in vitro* (biocompatibility)



Hollow HA micro-spheres loaded with a fluorescent protein (BSA):

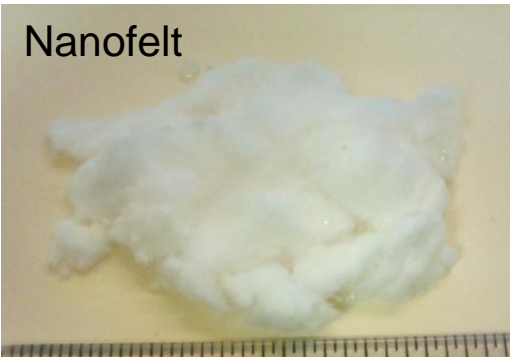


Hollow hydroxyapatite (HA) microspheres have a high-surface-area mesoporous shell (Surface area >100 m<sup>2</sup>/g; pore size 10-20 nm)

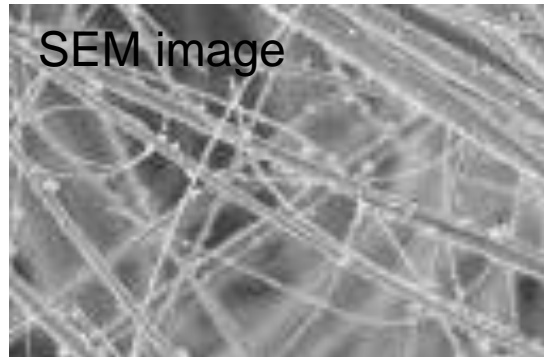
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## Bioactive Glass Nanofibers for Wound Healing

Nanofelt

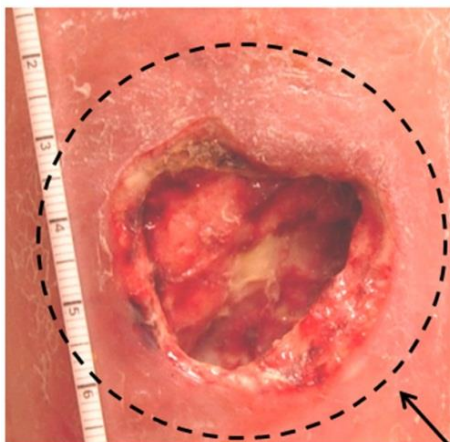


SEM image



Nano-size fibers made from a bioactive borate glass that react with the body fluids are placed on the wound and stimulate the body to grow new blood vessels.

Pre Treatment



undermining

37 Days



111 Days



216 Days



No scarring; no sign of infection

70-year old female; diabetic; non-healing (>4 months) wound treated with bioactive glass nanofibers

**Materials Synthesis:** Full capabilities for producing ceramic and glass materials

### Processing Methods:

- Ceramic/glass powders: Pressing, slip casting, tape casting, directional freeze-casting, robo-casting, screen printing, etc.
- Densification under controlled atmospheres,  $>2000^{\circ}\text{C}$
- Glass fibers, microspheres, monoliths, thin films (sputter deposition), etc.

### Materials Characterization:

- **Physical and mechanical:** powder characterization (porosimetry, particle size analysis, etc.), rheometry, nano-indentation, fatigue testing, dilatometry, etc.
- **Chemical and structural:** Raman and FT-IR, UV/VIS and spectrofluorometry, NMR, XRD, analytical SEM/TEM, etc.
- **Biological characterization:** cell culture and histology, tissue processing, etc.
- **Small animal laboratory**

