



## TECHNOLOGY

# Injectable Matrix for Load-Bearing Bone Repair

## OVERVIEW

Dr. Huakun Xu and his team at UMB have created an injectable and mechanically strong construct to be used with or without stem cells for bone tissue engineering. The UMB inventors have designed a strong, moldable, and injectable stem cell-containing scaffold for bone tissue engineering that can be used in minimally-invasive surgical procedures for dental and craniofacial reconstruction and orthopedic applications. The three main elements of this scaffolding material are: (1) a CPC paste, (2) stem cell-containing beads, and (3) polymer fibers. The CPC paste hardens to a microcrystalline hydroxyapatite and has been improved with biofunctionalizing agents to facilitate stem cell attachment, proliferation, osteogenic differentiation, and bone mineral synthesis. Encapsulating stem cells into degradable beads allows a homogenous distribution of cells when mixed with the CPC paste. When the beads degrade, the result is a stem-cell containing macroporous structure. The polymer fibers contribute early load-bearing capacity, to be replaced gradually by natural bone over the course of healing. The inventors demonstrated that the mechanical properties of the biofunctionalized CPC scaffold match the reported strength and elastic modulus of cancellous bone. Work is underway in animal models to measure bone healing over time following treatment of cranial defects.

## APPLICATIONS

Autograft bone has historically been the standard of care for repairing bone, but its use is limited by availability and medical problems that patients experience at the bone harvest site. Allografts also have their limitations which include infections and tissue rejection. Alternative bone substitute materials have been developed, using natural and synthetic polymers, ceramics, and composites, some incorporating cell-based strategies. Despite the many advances in bone graft substitutes, there remains a real need for an alternative with optimal bone regeneration properties.

A May 2008 report by Epsicom Business Intelligence declared that the "orthobiologics" market is the fastest growing segment of the global orthopedics market. There are more than three million musculoskeletal procedures performed annually in the U.S. of which about half involve an autograft or allograft. Worldwide, autografts and allografts are used in approximately 2.2 million orthopedics procedures annually.

## ADVANTAGES

Can be used for:

- (a) tissue engineering scaffolds that are injectable but lack mechanical strength
- (b) polymer blocks or donor tissue shaped to fit into a defect but which require more extensive surgery to fit.

## STAGE OF DEVELOPMENT

The composition of the injectable scaffold material has been optimized and studies are currently underway in animal models demonstrating the utility and versatility of this product for bone repair.

## R&D REQUIRED

Complete preclinical data in preparation for clinical development.

(AS OF 6/8/2017) - MEW

## LICENSING POTENTIAL

UMB seeks partners for full development of this technology as a healthcare product.

## CONTACT INFO

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## Additional Information

### INSTITUTION

University of Maryland, Baltimore

### PATENT STATUS

HX-2010-041: US patent application 13/695,122, HX-2012-027: US 9,427,491, EU 12 841 976.9, CON 15/241,950  
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### LICENSE STATUS

Available for licensing; Available for sponsored research

### CATEGORIES

- Bioengineering
- Dental

### INVESTIGATOR(S)

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### ATTACHMENTS

-  [Download HX-2010-041 HX-2012-027 Technology Summary - final.pdf](#)

### EXTERNAL RESOURCES

- [Human embryonic stem cells and macroporous calcium phosphate construct for bone regeneration in cranial defects in rats](#)
- [Calcium phosphate cement with biofunctional agents and stem cell seeding for dental and craniofacial bone repair](#)
- [An injectable calcium phosphate-alginate hydrogel-umbilical cord mesenchymal stem cell paste for bone tissue engineering](#)

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