

Spatially organized biomaterials to direct functional tissue regeneration

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EDUCATION AND TRAINING

- B.S., Materials Science and Engineering, University of Florida
- Ph.D., Materials Science and Engineering, Northwestern University
- Postdoc, Materials & Bioengineering, Imperial College London

KEY PUBLICATIONS

- KB Seims, NK Hunt, LW Chow, “Strategies to control or mimic growth factor activity of for bone, cartilage, and osteochondral tissue engineering,” *Bioconjugate Chemistry* 32(5): 861-878, 2021.
- JW Tolbert, DE Hammerstone, N Yuchimiuk, JE Seppala, LW Chow, “Solvent-cast 3D printing of biodegradable polymer scaffolds,” *Macromolecular Materials and Engineering* 306(12): 2100442, 2021.
- P Camacho, A Behre, M Fainor, KB Seims, LW Chow, “Spatial organization of biochemical cues in 3D-printed scaffolds to guide osteochondral tissue engineering,” *Biomaterials Science* 9: 6813-6829, 2021.
- DE Hammerstone, TF Babuska, S Lazarte, BA Krick, LW Chow, “Characterizing properties of scaffolds 3D-printed with peptide-polymer conjugates,” *Biomaterials Advances* 152: 213498, 2023.

KEYWORDS FOR RESEARCH INTERESTS

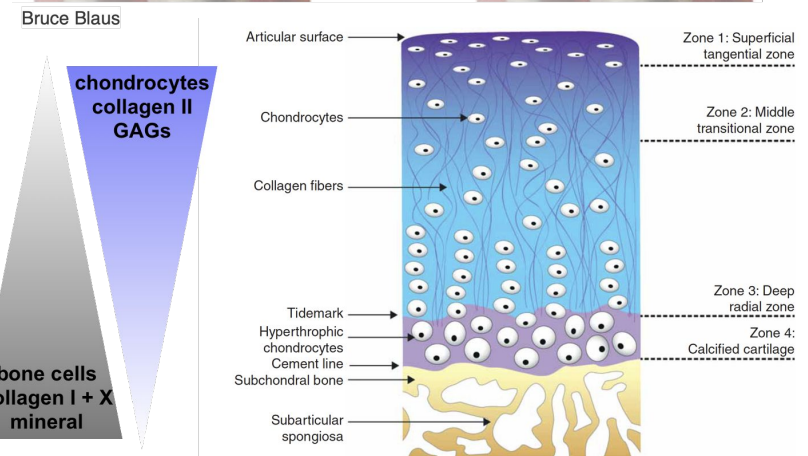
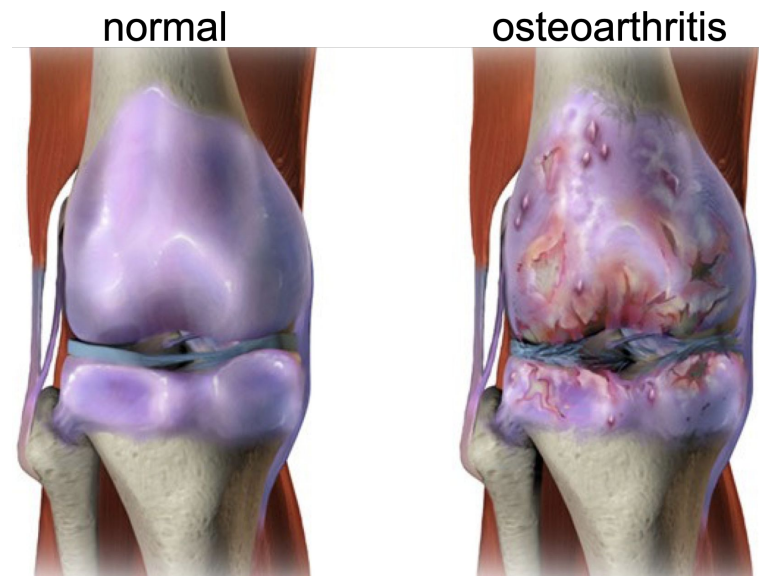
biomaterials, musculoskeletal tissue engineering, additive manufacturing, regenerative medicine, peptides, biodegradable polymers

What is the physiology / pathology being studied?

- Osteochondral (bone-cartilage) interface
- Cartilage injury and repair
- Post-traumatic osteoarthritis (PTOA)

Why is this topic significant?

- Osteoarthritis (OA) is the most common joint disease worldwide with 12% of all OA resulting from injury or trauma (PTOA)
- OA treatments like artificial joint replacement are less acceptable for younger patients who will likely outlive their implants and require revision surgery
- Younger patients need early-stage interventions after injury to prevent or delay the progression of PTOA and OA
- Current surgical techniques to repair cartilage defects typically result in poorly organized tissues that fail to restore tissue function



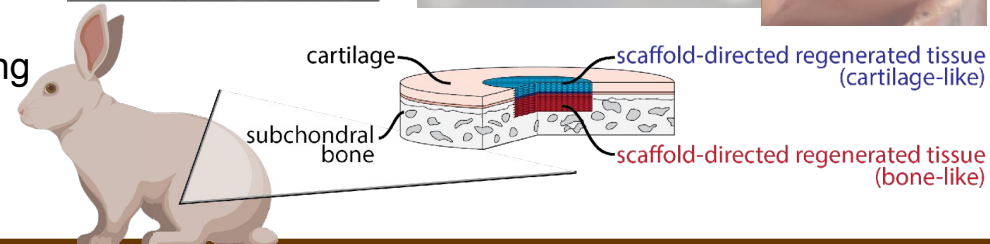
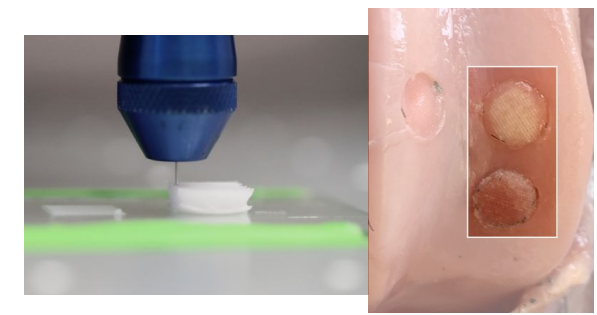
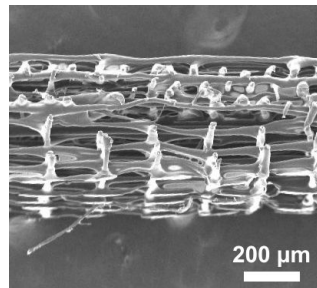
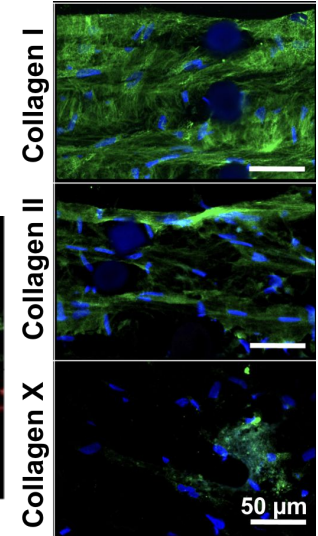
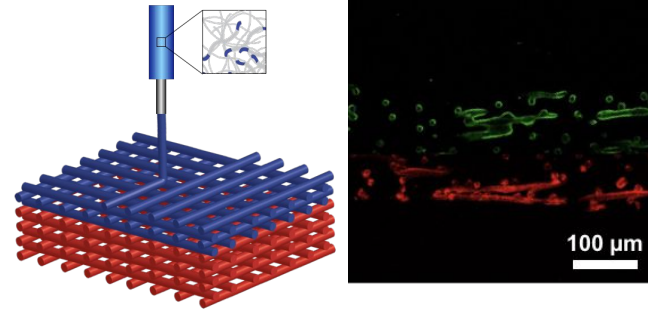
Adapted from: Gadjanski & Vunjak-Novakovic. *Expert Opin Biol Ther* 15(11): 1583-1599, 2015.

How is this topic studied/addressed?

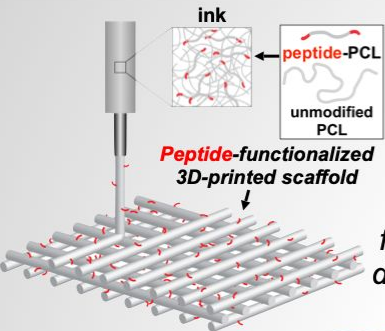
- peptide-polymer conjugates with cartilage-promoting and bone-promoting sequences
- 3D-printed scaffolds with multi-peptide organization to direct spatial cell response and matrix formation to mimic native tissue
- *in vitro* cell culture experiments with human mesenchymal stem cells (hMSCs)

What are the future directions of this research?

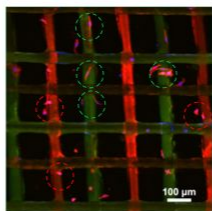
- 3D-printed scaffolds with biochemical and physical properties tailored to synergistically enhance complex tissue regeneration
- *in vivo* studies in a critical-sized osteochondral defect model (rabbits, goats) to investigate *in situ* tissue formation with endogenous cells
- spatiotemporal delivery of growth factor-mimicking peptides to promote stable tissue formation



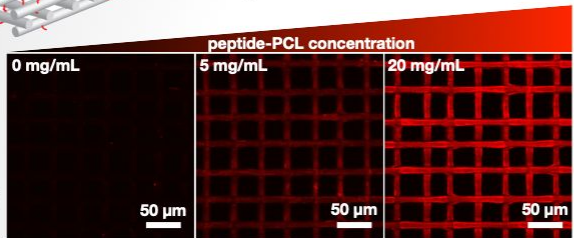
Modular Biomaterials Laboratory



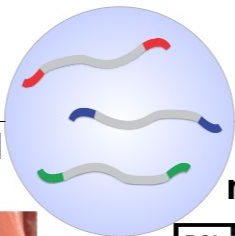
selective
bioorthogonal
chemistries



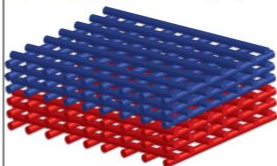
controllable
surface
concentration



spatially organized
bioactive cues



HAbind (cartilage)

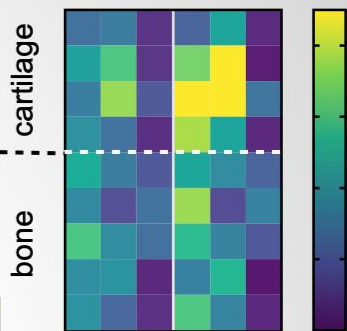
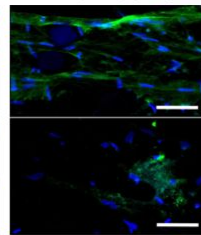
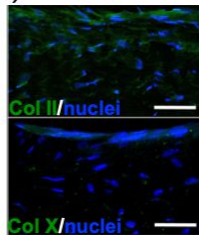


continuous scaffold
with distinct
peptide regions

E3 (bone)

PCL

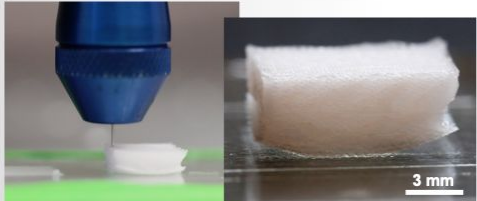
HAbind/*E3*



synergistic effect
on stem cell response

Camacho, Fainor, Seims, Tolbert, Chow. *J Biol Methods*, 2021, 8(1), e146.
Camacho, Behre, Fainor, Seims, Chow. *Biomater Sci* 2021, 9, 6812-6829.

tunable physical
properties

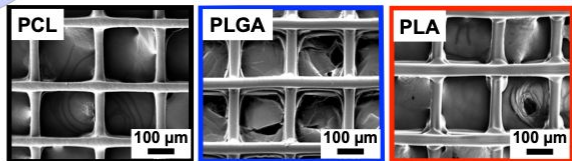


scalable platform
for *in vivo*
translation



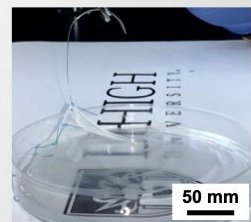
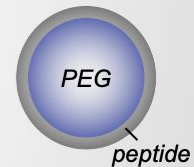
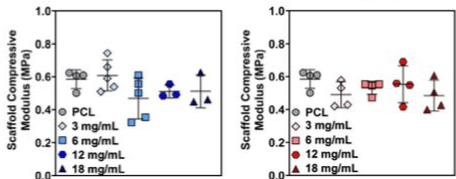
adaptable
materials library

tailorable
polymer chemistries



Tolbert, Hammerstone, Yuchimiuk, Seppala, Chow. *Macromol Mater Eng*, 2021 306(12), 2100442.

independent
control of
biochemical &
physical
properties



The Modular Biomaterials Laboratory

thechowlab.com

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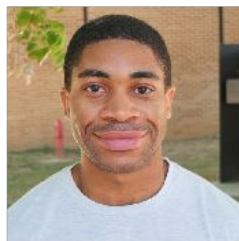
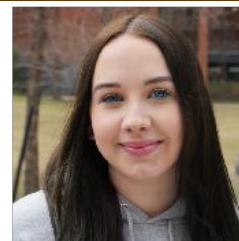
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