Collaborators and Funding

CLEMSON BIOENGINEERING

Spartanburg Regional Healthcare System

GREENVILLE HEALTH SYSTEM

South Carolina SPACE GRANT

NSF GRFP

PRECLINICAL SURGICAL RESEARCH LABORATORY
Colorado State University

STEADMAN HAWKINS CLINIC of the CAROLINAS

NIH National Institutes of Health
Turning Discovery Into Health

CLEMSON CREATIVE INQUIRY

OrthO-X Team Members

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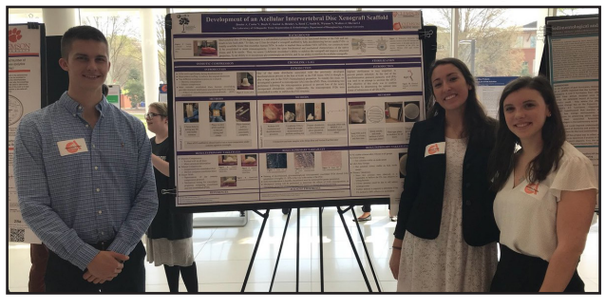
Graduate Researchers

(Left to Right) Eric Schatzer, Ryan Borem, Mackenzie Bowman, Alan Marionneaux, Joshua Walters

Undergraduate Creative Inquiry



Alex Boulez, Victor Casler, Courtney Doyle, Alex Garon, Austin Hensley, Christopher Rood, Karenna Smith, Nikki Wyman

OrthO-X

Laboratory of Orthopaedic Tissue Regeneration & Orthobiologics

Mission Statement:

"To improve clinical outcomes for patients suffering from musculoskeletal conditions through the development and application of biomaterials and stem cell technologies in collaboration with clinicians and industry leaders."

Research Interests:

- Orthobiologics
- Tissue Engineering
- Regenerative Medicine
- Intervertebral Disc Therapeutics
- Osteochondral Implants
- Mesenchymal Stem Cell Research
- *In Vitro* and *In Vivo* Musculoskeletal Models

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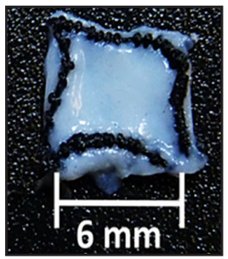
Research Areas

Translational Technologies

Annulus Fibrosus Repair Patch (AFRP)

A Multi-laminate Barrier for Prevention of Re-herniation and Retention of NP Replacements

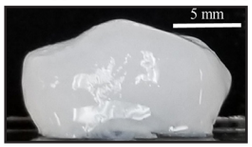


- Angle-ply, mimetic structure
- Acellular, xenogenic material
- Simple assembly and processing
- Comparable mechanical properties
- Supports cell seeding
- U.S. Patent Serial No: 15/758,528

Acellular Bovine Nucleus Pulposus (ABNP)

A Decellularized Nucleus Pulposus Replacement

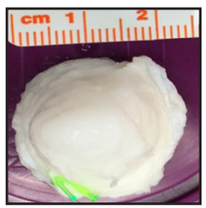
- Acellular, xenogenic material rich in aggrecan and collagen type 2
- Cytocompatible
- Mechanically Competent
- Native Architecture
- Batch decellularization
- Patent Application No: PCT/US2016/050689



Acellular IVD (aIVD) Xenograft

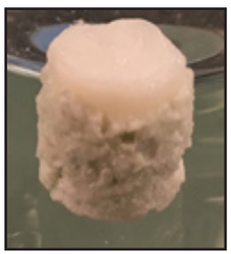
A Decellularized Whole Disc Replacement

- Acellular, xenogenic material comprising intact NP and AF
- Similar to human IVD
  - Size and geometry
  - Native micro-architecture
  - Biochemical composition
  - Mechanical properties
- Osmotically Active



Osteochondral Plug (OCP)

An Off-the-Shelf Implant for Focal Osteochondral Defects



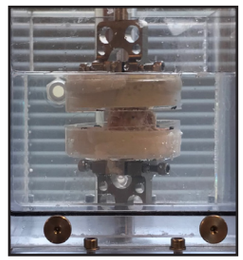
- Biomimetic, tri-layered structure
  - Polymer-mineral composite
  - Biological cartilage analog
- Low cost, scalable manufacturing
- Established single-step implantation
- U.S. Patent Serial No:
  - 62/638,422
  - 62/638,530

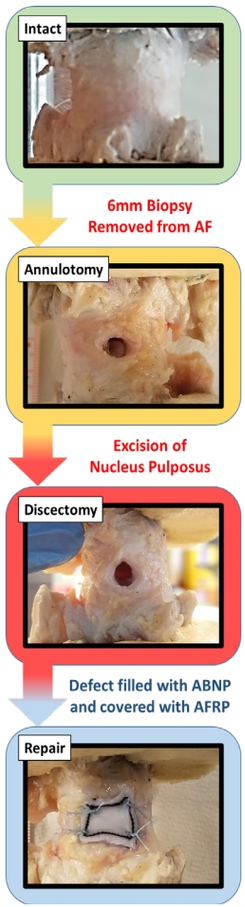
Pathophysiology

Intervertebral Disc Degeneration (IDD)

We incorporate several models into our methods when evaluating the pre-clinical efficacy of our implants, including an *ex vivo* bovine kinematic model and an *in vivo* ovine chemonucleolytic model.

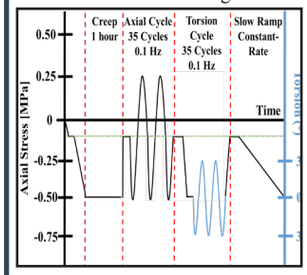
Ex Vivo Kinematic Model



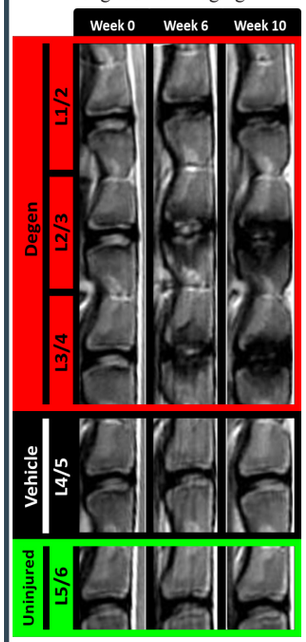


In Vivo Degeneration Model

Kinematic Testing



Longitudinal Imaging

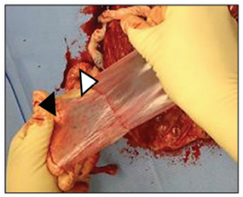


Biochemical/Histological Analysis

Stem Cell Therapies

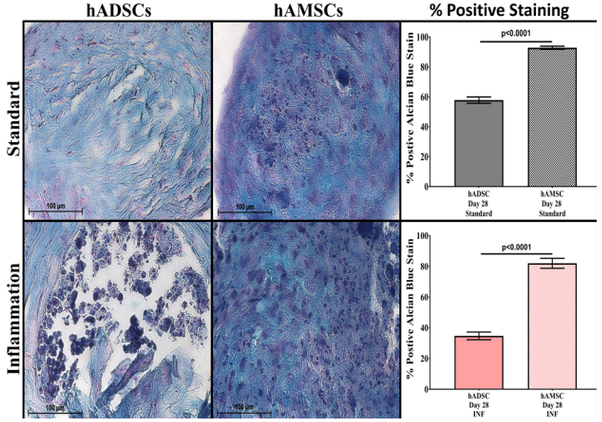
Amnion Mesenchymal Stem Cells (hAMSCs)

- By-product cell source
- Minimal ethical concerns
- No donor site morbidity
- High yield per tissue volume
- Allogenic transplantation
- "Youthful" phenotype with Immunomodulatory Capacity



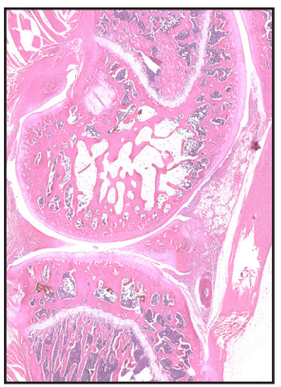
Chondroprotective Effect of hAMSCs *In Vitro*

hAMSCs have shown superior chondrogenic potential compared to adipose-derived stem cells when exposed to inflammation *in vitro*.



Mitigation of Osteoarthritis (OA)

hAMSC Chondroprotection has been investigated using *in vivo* models:



- Dunkin Hartly Guinea Pig
  - Model: Naturally Onset OA
- Rat Meniscectomy
  - Model: Post-traumatic OA