Effects of UV-Long Wave Exposure on Mechanical Properties of GAG Hollow Fibers
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OPPORTUNITY AND SIGNIFICANCE
Volumetric Muscle Loss (VML) occurs in patients who have undergone tumor extirpations or chronic denervation by way of blunt or sharp trauma. The basal membrane of their skeletal muscle is damaged, removing chemical and mechanical cues which muscle fibers use for regeneration.

TECHNICAL OBJECTIVES AND RELATED WORK
The Howard Matthew Tissue Engineering Lab proposes the 3D printing of glycosaminoglycan (GAG)-based hollow fibers developed by a previous undergraduate student (Mr. Alex Gagliardi), culturing muscle stem cells and chemically binding the GAG fibers, mimicking the myofibers of the skeletal muscle. This can be developed by starting with:

1. Modification of chitosan (CTS) polymer.
2. Evaluation of GMA-CTS photocrosslinking effects on mechanical strength of microcapsules and hollow fibers.
3. Analysis on growth rate and differentiation of muscle stem cell cultures in GAG-CTS hollow fibers.

TECHNICAL APPROACH
Batches of microcapsules with varied levels of GMA substitution were made. The effects of GMA level and UV photocrosslinking on the strength of GAG-CTS microcapsules was tested by 1) manually crushing the microcapsules while in saline bath, and 2) rapidly crushing the microcapsules using a low force mechanical testing system.

1 mL of GAG mixture (1.0% CMC/4.0% CSA) was injected into rapidly spinning modified GMA:CTS baths.

GMA:CTS Molar Ratios
- 4:1
- 3:1
- 1:1

Microcapsules were also studied using a load cell.

ACCOMPLISHMENTS & RESULTS

NEXT STEPS FOR DEVELOPMENT
1. Establish permanent design for load cell device
2. Continue exploring various GMA degrees of substitution in GAG-CTS
3. Rat muscle stem cells (Lonza) will be expanded in culture; encapsulate in GAG-CTS
4. Cell-containing microcapsules will be photocrosslinked with different durations of UV exposure, and growth of stem cells will be evaluated over several days using AlamarBlue assay
5. GMA-CTS and UV duration with best performance will be used to encapsulate stem cells in GAG-CTS hollow fibers using Gagliardi protocol; stem cell differentiation will be evaluated in long-term cultures

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REFERENCES