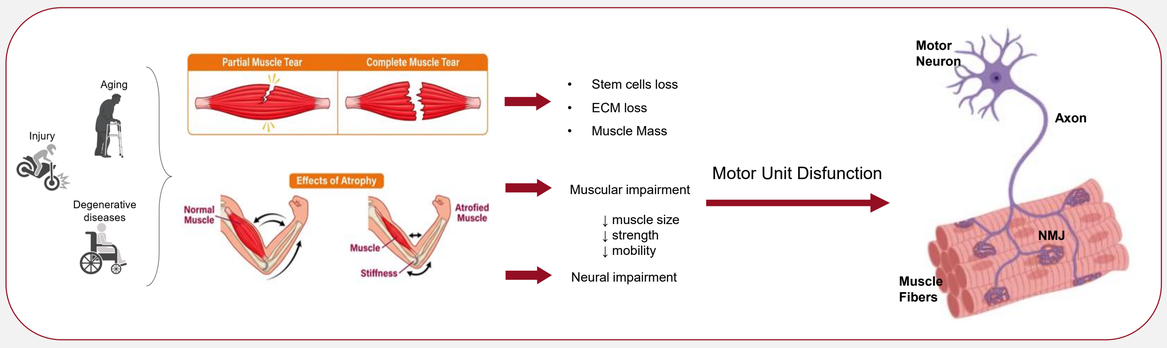
Microscale Neuromuscular Scaffolds via 2PP for Muscle Tissue Engineering

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Introduction and background

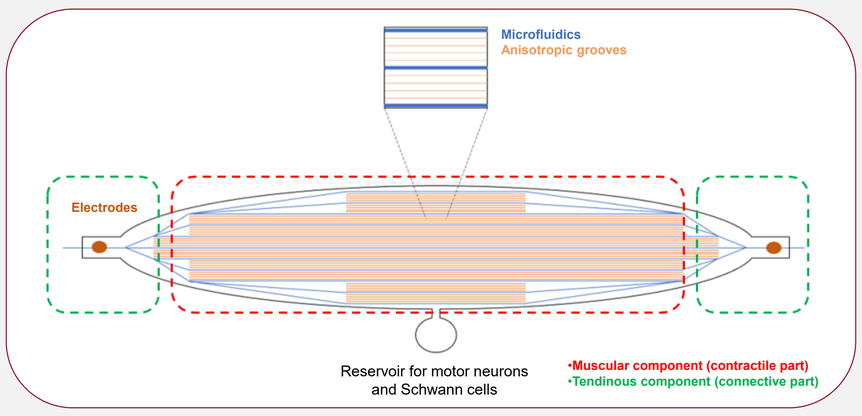
- Muscle atrophy and damage caused by trauma, disease, and aging lead to a drastic loss of strength and mobility, severely compromising quality of life.



- Current therapies are unable to completely regenerate the complex architecture and function of skeletal muscle and the muscle-tendon unit.

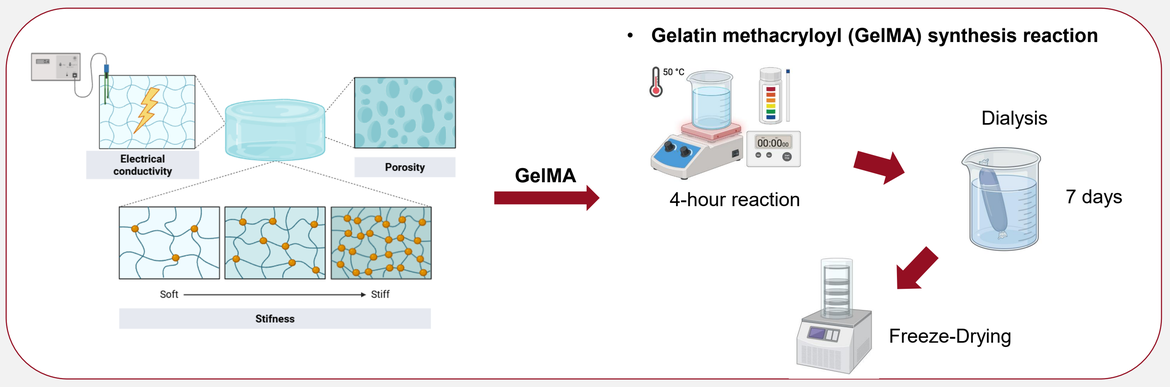
Objective

- Recent bioengineered skeletal muscle models allow stable co-culture in compartmentalized structures.
- However, they are incompletely differentiated and lack neuronal and glial components, as well as effective electrical stimulation systems and the microfluidic systems essential for nutrient delivery and long-term cell survival.

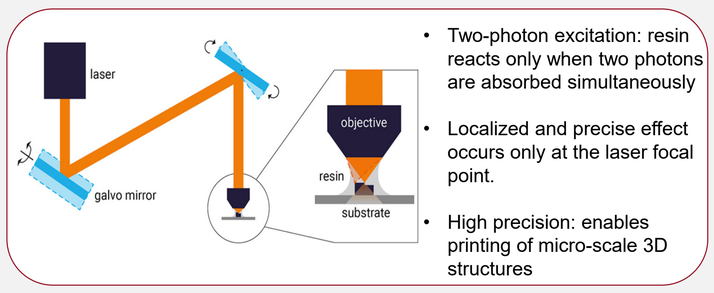


Materials and Methods

- Photosensitive, adaptable natural and biocompatible hydrogels

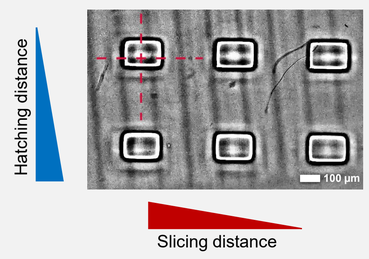


- Printing with Two-Photon Polymerization

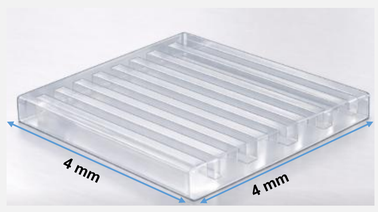


Parameter sweep printing

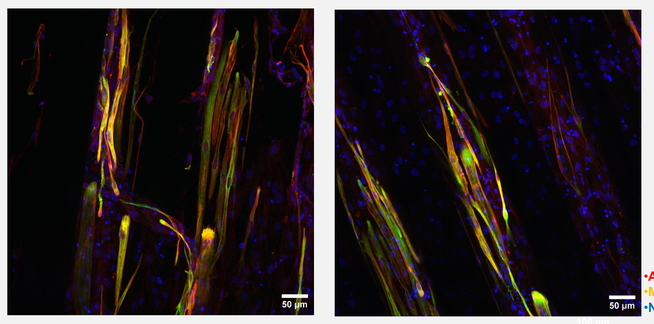
- Printed with 10X objective



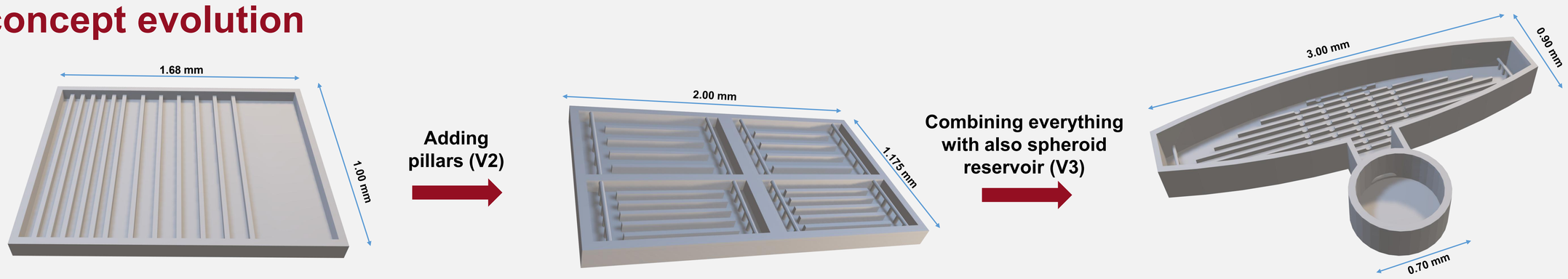
- PDMS molded **Groove substrate** ○ Three spacing in between grooves: **50 & 100 & 150 µm**



○ **150 µm spacing**



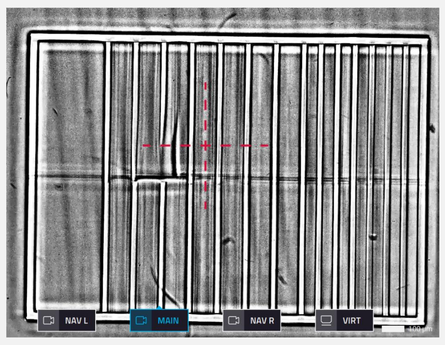
Scaffold concept evolution



Cell seeding experiment

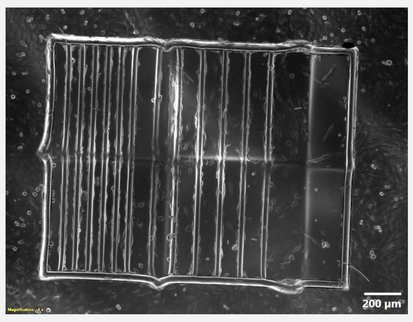
GelMA Groove substrate V1

- Printed at Nanoscribe Quantum X
- Dimensions: **1.68 x 1.0 x 0.1 mm**
- On the left: larger spacing as control
- Two spacing in between grooves:
  - **50 & 100 µm and control of 300 µm**

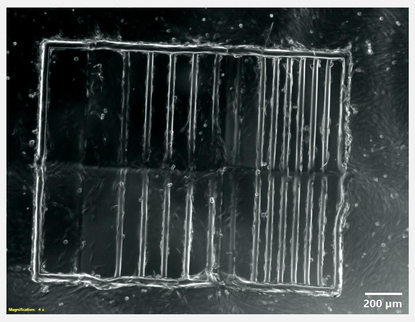


- **Day 1 after seeding in the three conditions**

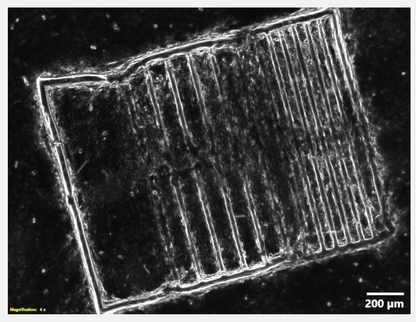
Dry structure



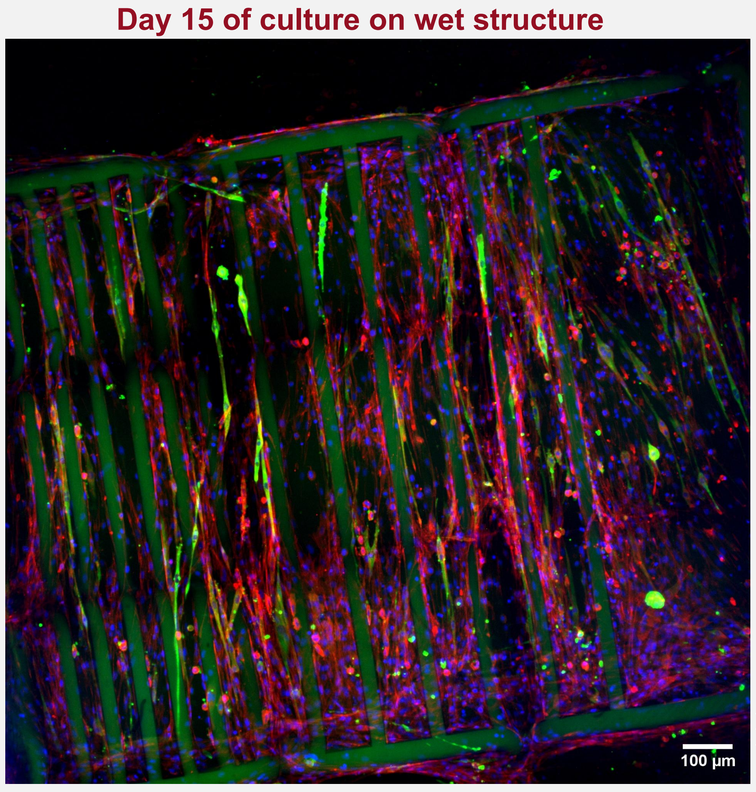
Wet structure



Ring around structure



Day 15 of culture on wet structure



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Cartoon images made by AI and BioRender

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