



CENTER FOR ADVANCED BIOMANUFACTURING



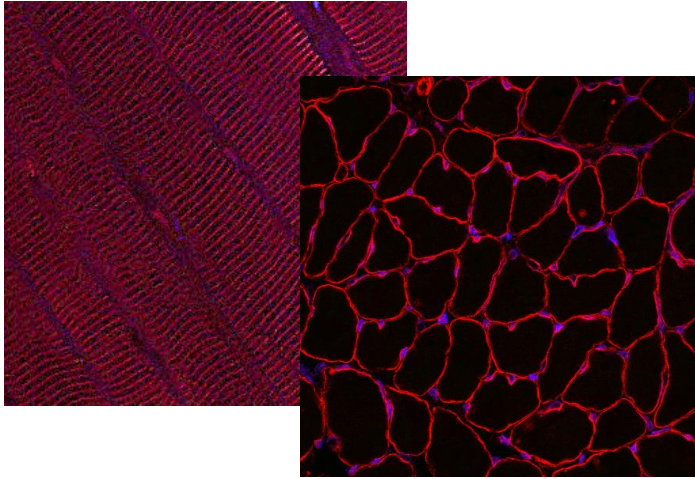
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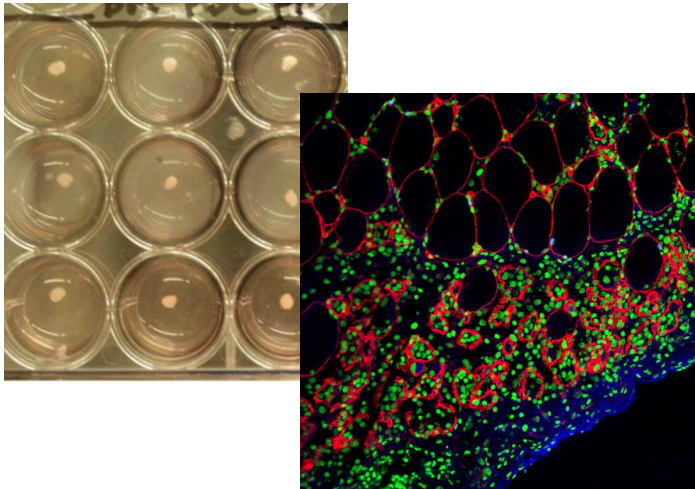
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Why 3D-biomanufacturing?

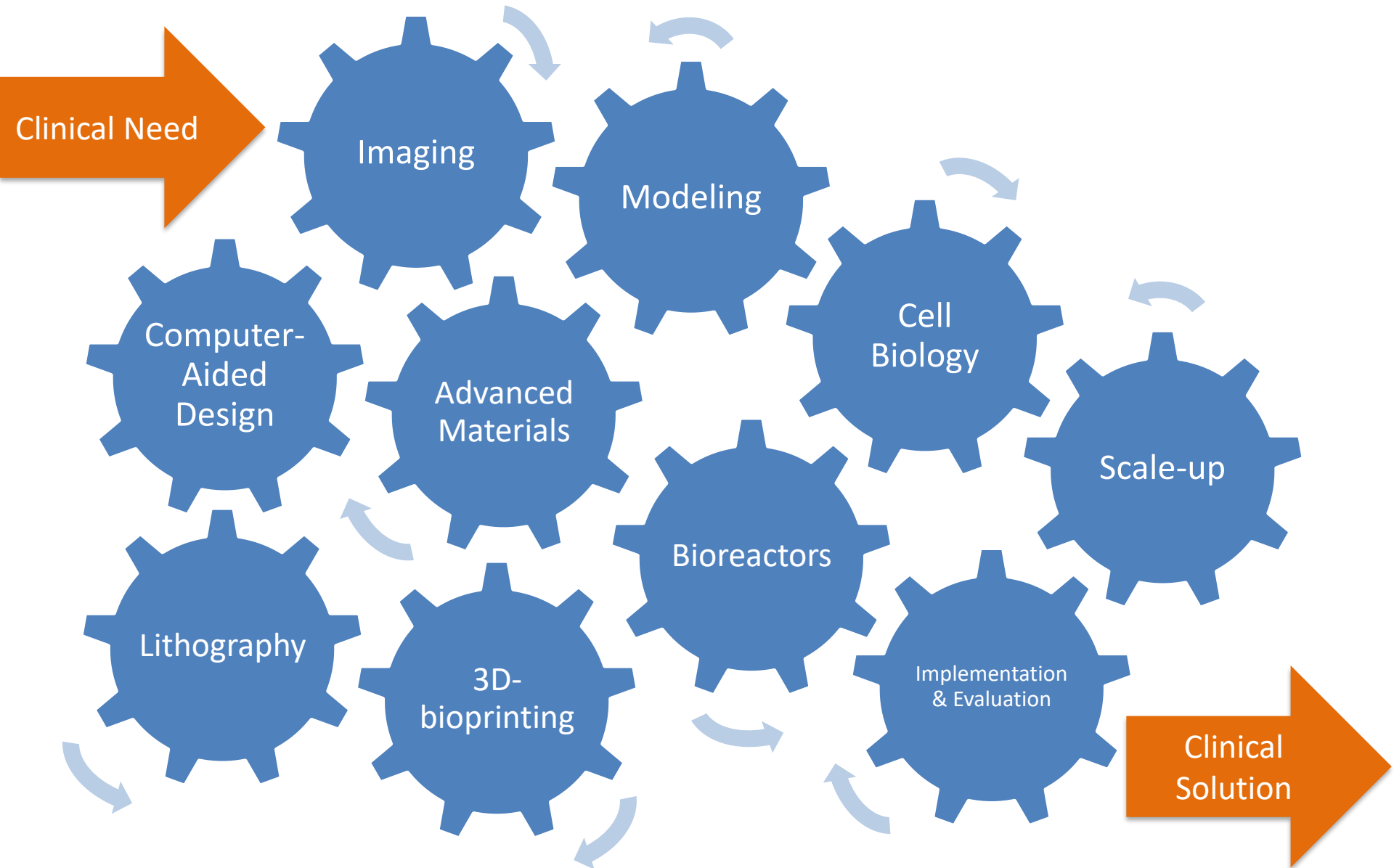


Transplantable tissues to regenerate and restore function (e.g. skeletal muscle)

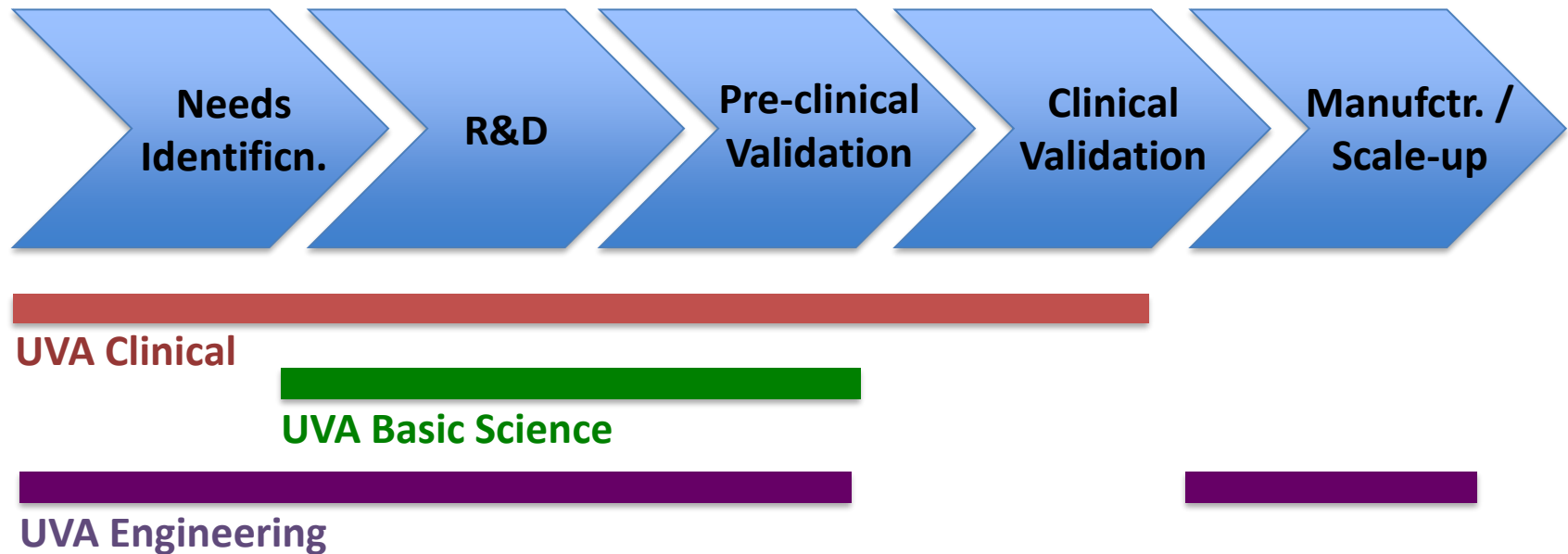


In vitro tissue mimics for drug testing and screening (e.g. dystrophic muscle)

What is 3D-biomanufacturing?



The pipeline for translation is robust at UVA!



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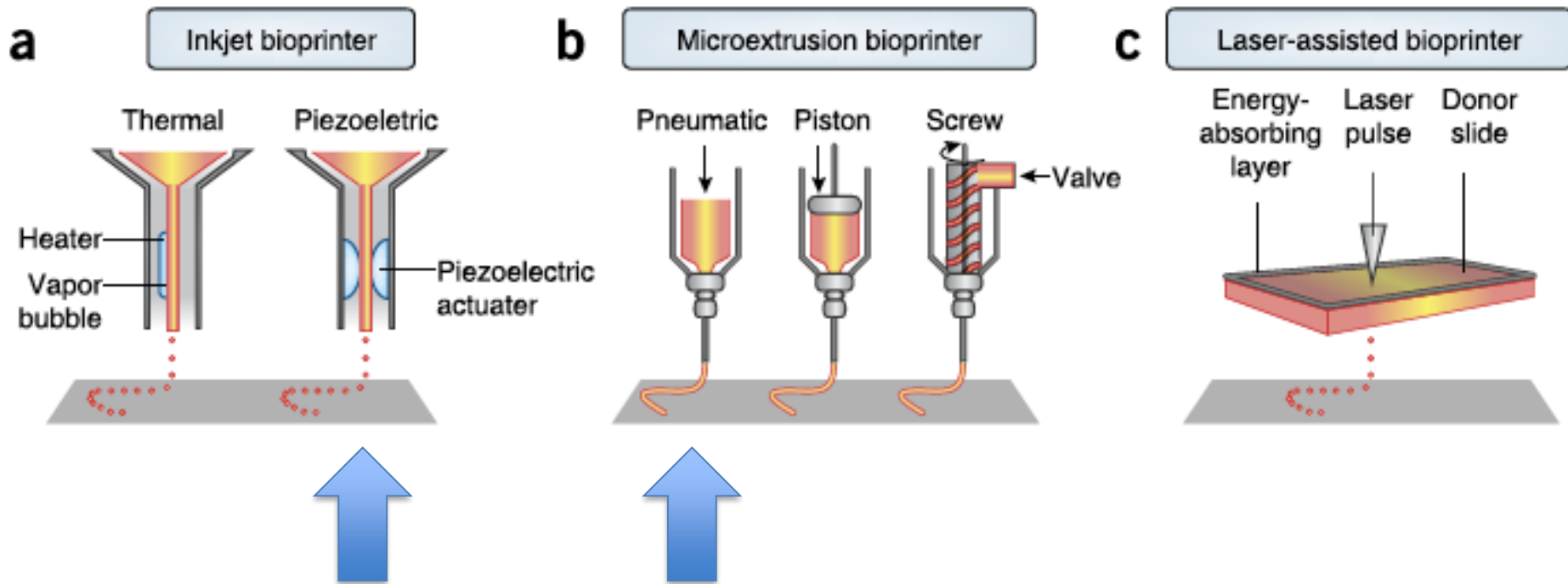
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<https://shayn94.wixsite.com/uvabiomanufacturing>

- **New state-of-the art equipment**
- **Seed funding for collaborative projects**
- **Post doctoral trainees & technicians**

Monday, May 22nd 9:00 am - 1:00 pm: Retreat

What is 3D-bioprinting?



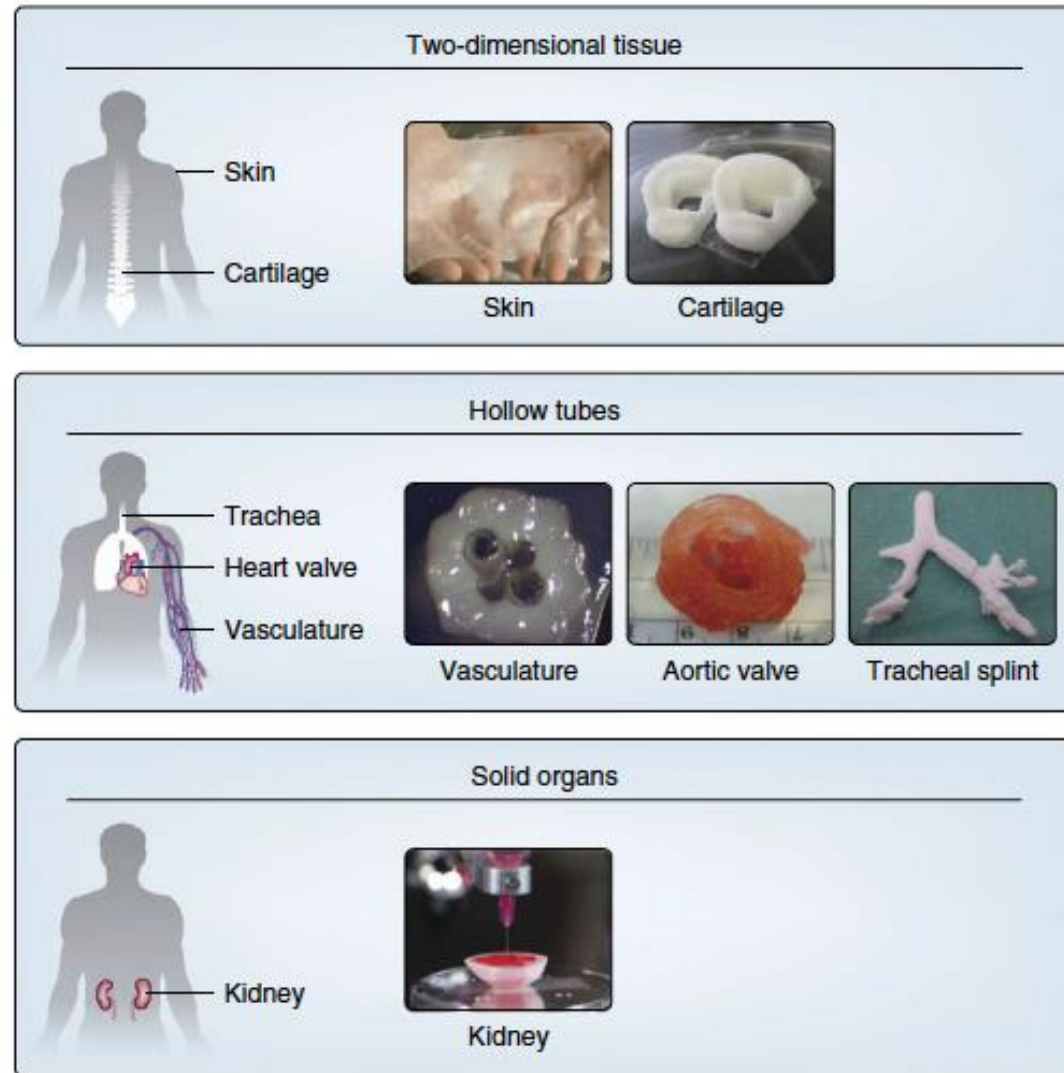
Currently present at UVA

UVA's 3D-bioprinters

Challenges facing 3D-bioprinting

Anatomy:

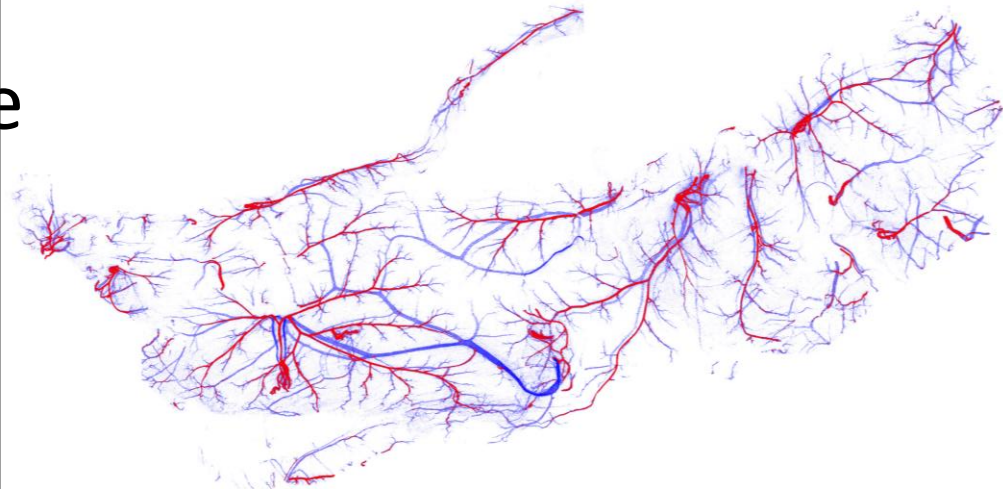
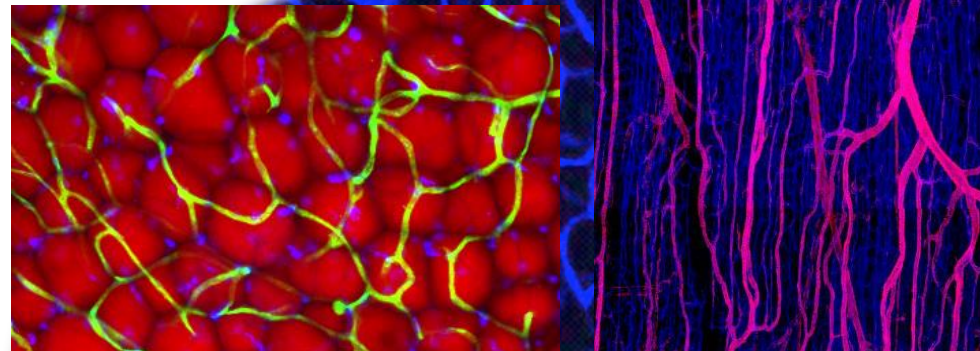
- 1) Size
- 2) Complexity
- 3) Interfaces



Challenges facing 3D-bioprinting

Vascularity:

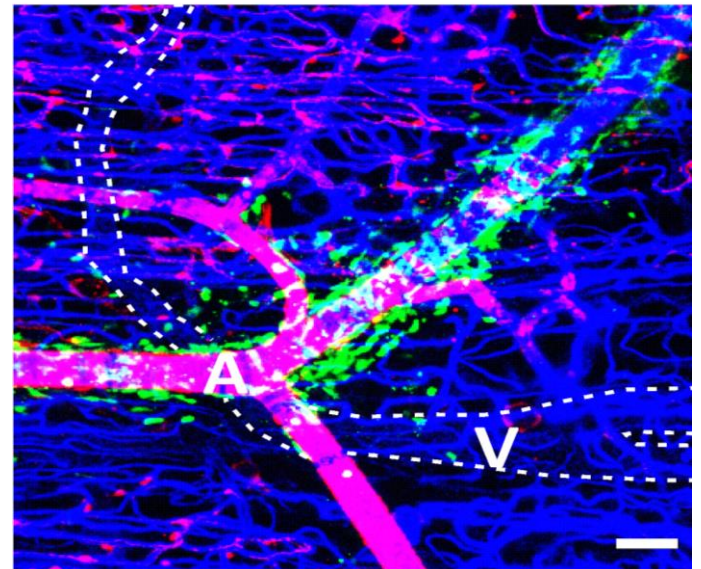
- 1) Abundance
- 2) Integrated with tissue
- 3) Branched network



Challenges facing 3D-bioprinting

Immune acceptance:

- 1) Rejection risk
- 2) Immunosuppressants



Current 3D-bioprinting projects

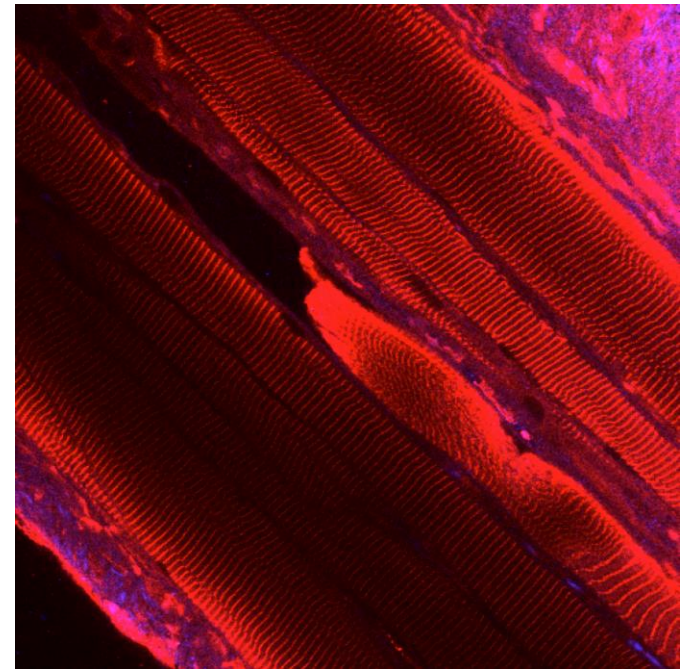
- Skeletal muscle (G. Christ)
- Lymph node (J. Munson & R. Pampano)
- Skin (C. Campbell)
- Pancreas (K. Brayman)

Biomanufacturing of skeletal muscle

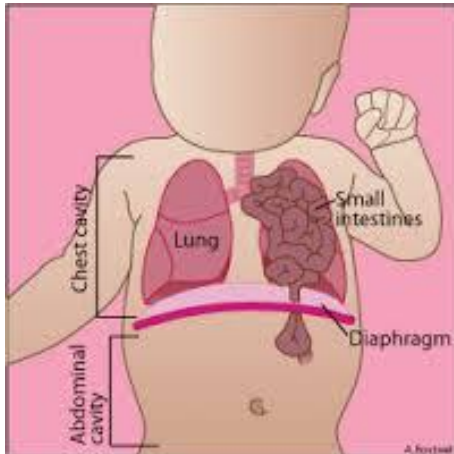
Cleft Palate Repair



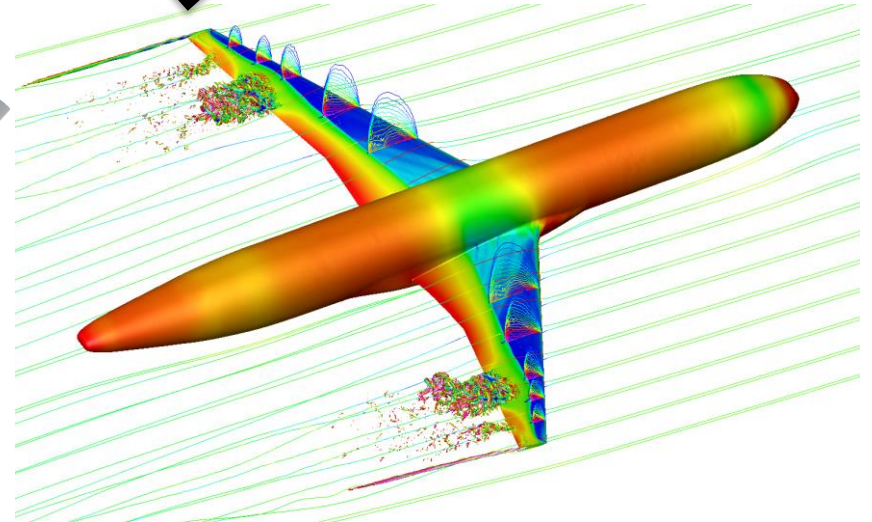
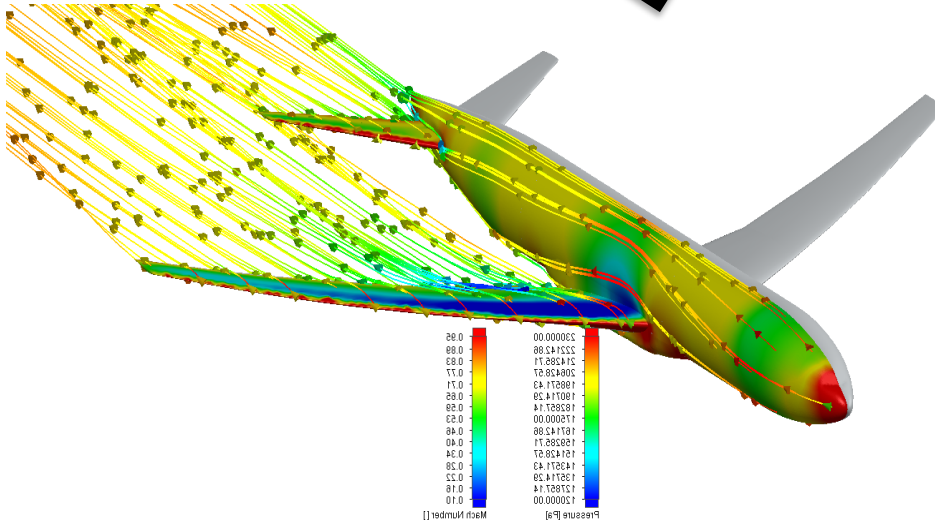
In vitro models for DMD drug screening



Congenital Diaphragmatic Hernia



Model-driven design



Model-driven design



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BRIEF REPORT

Vision Loss after Intravitreal Injection of Autologous “Stem Cells” for AMD

Ajay E. Kuriyan, M.D., Thomas A. ... Justin H. Townsend, M.D., ... Rodriguez, M.D., Ph.D., Hemang K. Pandya, M.D., Robert E. Leonard, II, M.D., ... Brandon Parrott, M.D., Ph.D., ... Rosenfeld, M.D., Ph.D., Harry W. Flynn, Jr., M.D., and Jeffrey L. Goldberg, M.D., Ph.D.

N Engl J Med 2017; 376:1047-1053 | [March 16, 2017](#) | DOI: 10.1056/NEJMoa1609583

Model-driven design of skeletal muscle

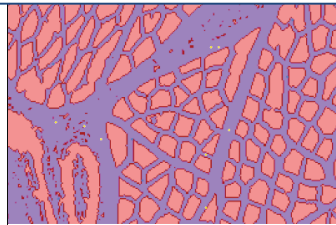
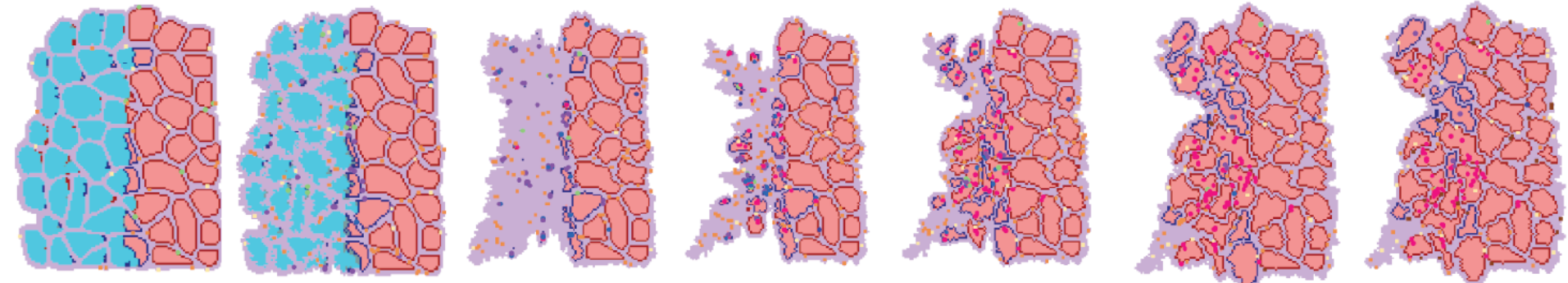
import histology



prescribe injury



simulate cell dynamics during recovery



model output:

fiber CSA:

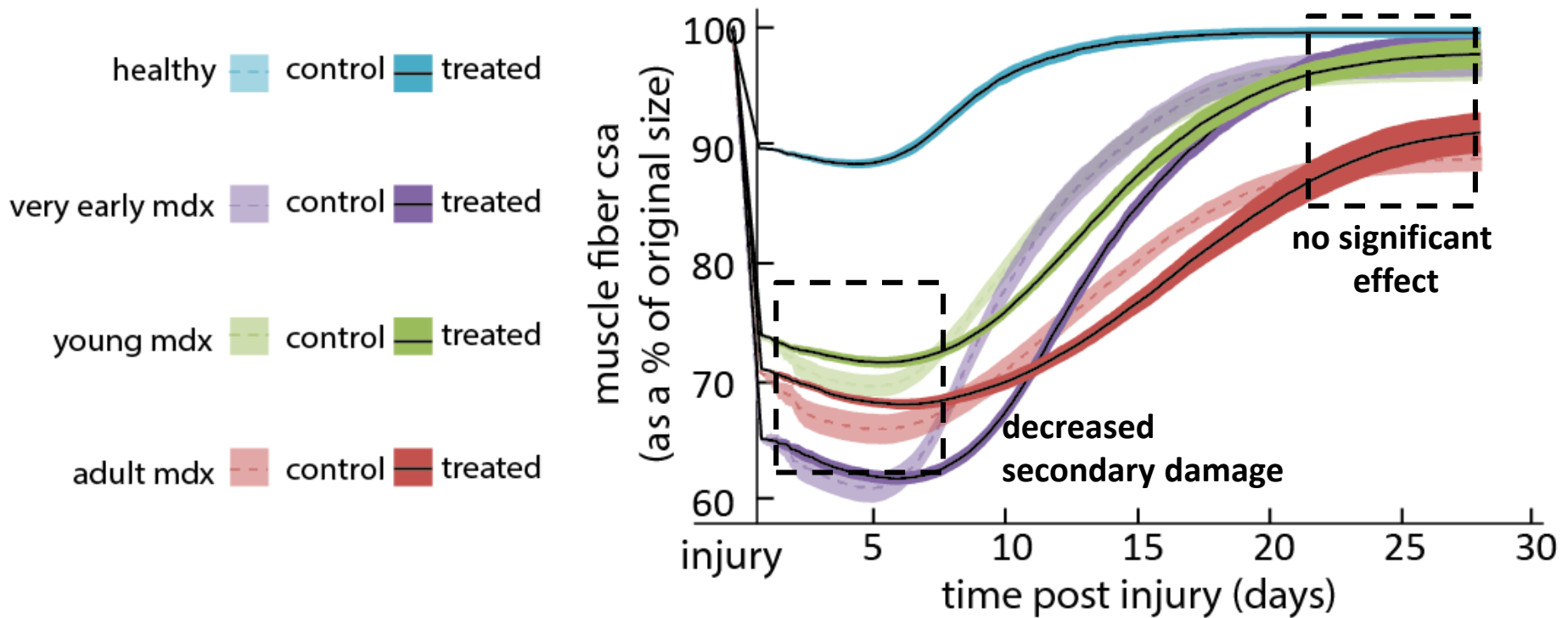
- muscle fibers
- ECM
- necrosis/damage

cell counts:

- quiescent SSC's
- active SSC
- myoblasts
- fused myocytes
- fibroblasts
- myofibroblasts

with Silvia Blemker, UVA BME

Model-driven design of skeletal muscle: Predict outcomes of design decisions

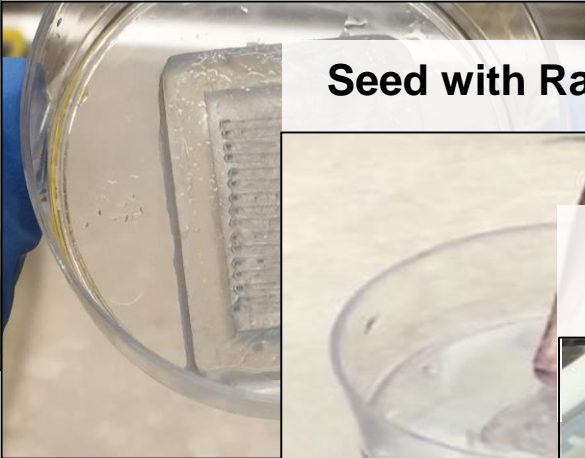


with Silvia Blemker, UVA BME

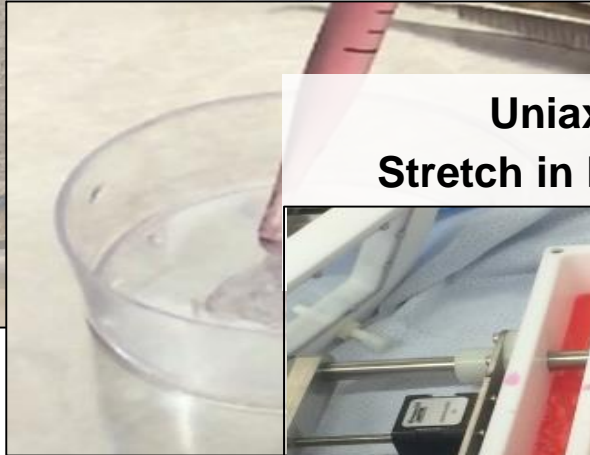
Bioprinting Small Muscles

Acellular Bladder Matrix

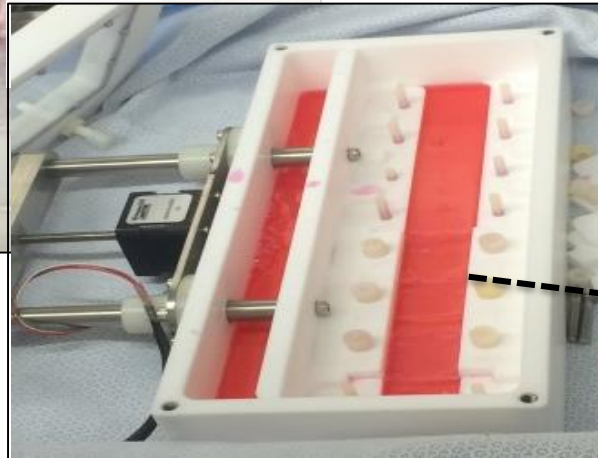
Bioprinted Sodium
Alginate Channels



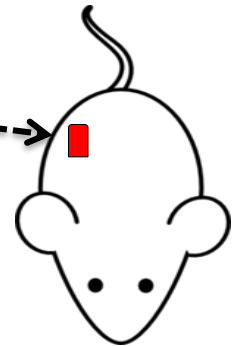
Seed with Rat Myoblasts



Uniaxially
Stretch in Bioreactor

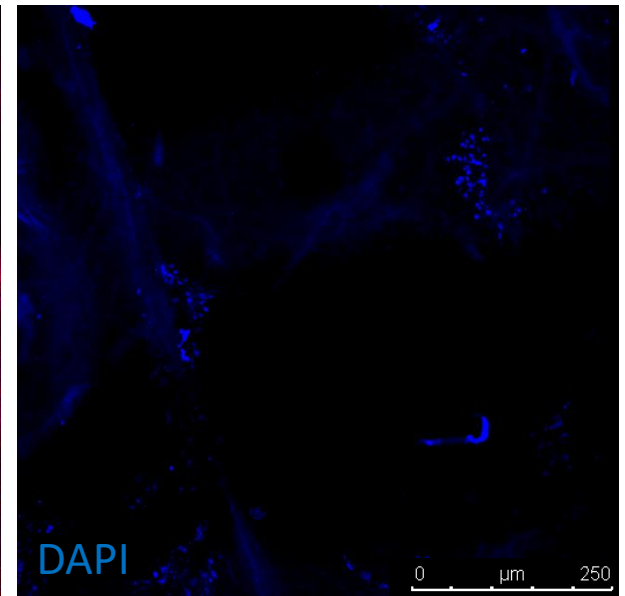
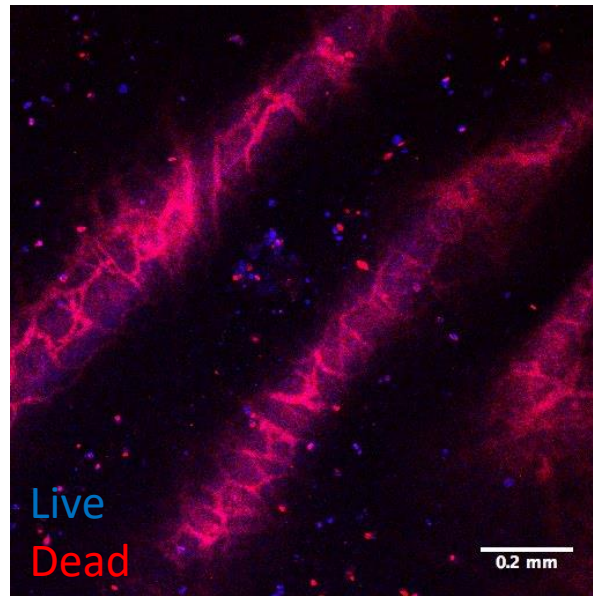
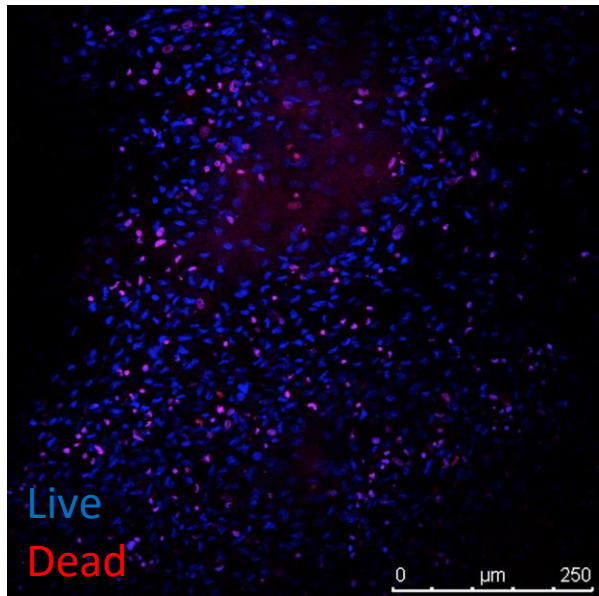


Implant in Rat
VML Injury



with George Christ, UVA BME

Biocompatibility and Alignment



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