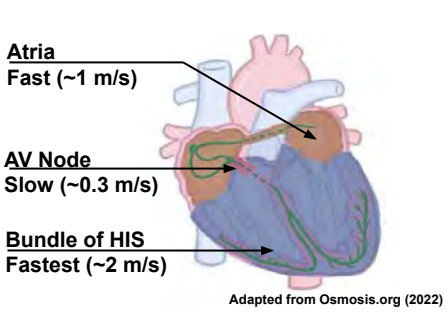
Controlling Conduction Velocity of Engineered Heart Muscle

Christopher Robert Warren [1], Michael Peters [2], K. Kit Parker [2]
[1] Princeton University, [2] Harvard University
NSF DMR-1559890

Concepts & Problem

- Cardiac tissues feature varying degrees of fiber alignment which affects their conduction velocity (CV).
- To engineer a heart for children we need the ability to control tissue conduction velocities.

Hypothesis: We can control the conduction velocity of engineered Heart Muscle



Adapted from Osmosis.org (2022)

No Scale Bars Provided
Vargo-Gogola (2016)

Methods

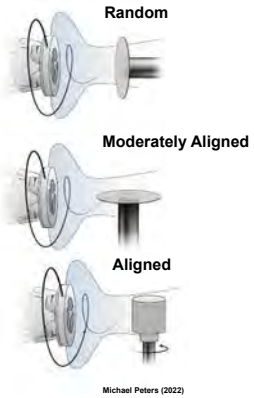
Aim 1: Fabricate a Fiber-chip

- Create nano-fibers with different organizations
- Build a chip platform to house the nano-fibers
- Use electron microscope to check chip quality

Aim 2: Test the Fiber-chip conduction velocity

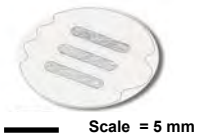
- "Seed" cells onto the Fiber-chip platform
- Determine conduction velocity with calcium imaging

1.1 Spin Fibers

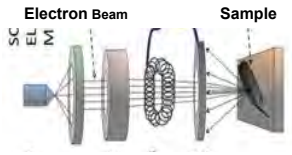


Michael Peters (2022)

1.2 Build Fiber-chips

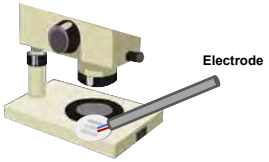


1.3 Check chip quality



2.1 Seed Fiber-chips

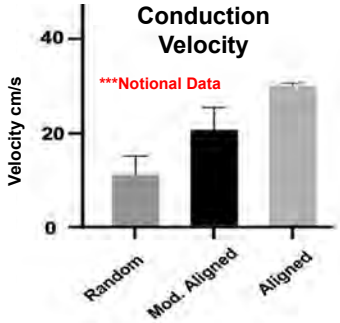
2.2 Determine CVs

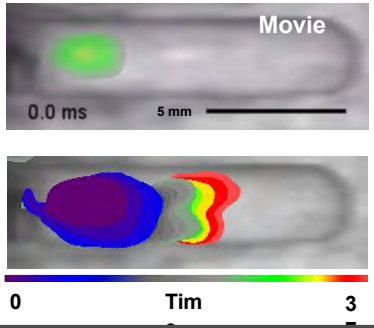


Results

We can build tissues with tunable CVs

- Fiber alignment allows for control of tissue CV
- Sets stage for creating in-vivo cardiac patches
- Paved path to build 3D *in vitro* "heart-on-a-chip"





Controlling Conduction Velocity of Engineered Heart Muscle

Christopher Robert Warren [1], Michael Peters [2], K. Kit Parker [2]
[1] Princeton University, [2] Harvard University
NSF DMR-1559890

Biography

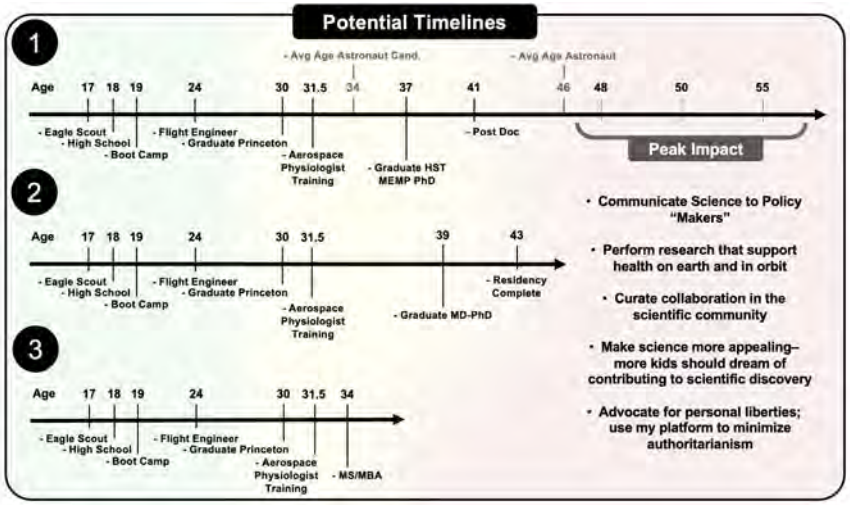
Christopher served as a Marine Corps Flight Engineer and now studies Electrical and Computer Engineering at Princeton University. In honor of the folks who have shaped Christopher's understanding of the world—those who have crossed his path, thus altering its trajectory forever—he vows to eternalize their influence. With their guidance (and a touch of luck), his research efforts in the field of healthcare innovation will help improve the human experience worldwide.

Lessons Learned from REU

This summer has taught me how to apply the skills I have developed as a student and Marine Corps Flight Engineer toward translational tissue engineering research.

Career Progression – REU Inspired

My research experience and my discussions with Professor Kit Parker has helped me dial-in three career paths that I am considering,



Titles I'll hold at 55

- Professor
- Astronaut
- Biotech Entrepreneur
- Aerospace Physiologist

Meta Goals

- Improve regenerative medicine
- Facilitate multiplanetary human survival
- Curate a liberty-centric society