Rehabilitation Engineering

Goal: restore mobility, independence & health to individuals with disabilities through advances in science and technology
CREATE
Center for Rehabilitation Engineering + Assistive Technology

Nashville (downtown 2 miles north of campus)

engineering.vanderbilt.edu/create
1. Studying the science of human movement (biomechanics)
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2. Developing assistive tech (prostheses, exoskeletons, smart clothing)
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3. Performing experiments to measure benefits & refine devices
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4. Training next generation of engineers, scientists & innovators
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Research Groups Within CREATE

Zelik & Goldfarb Labs
biological insights motivate design & control

assistive devices as tools to probe biological function
biological insights motivate design & control

assess performance

control performance

assistive devices as tools to probe biological function
CREATE extended family (VUMC clinical collaborators)

Gerasimos Bastas, MD, PhD
(care for prosthetic users)

Leon Scott, MD
(orthopedics, stress fracture)

Stacy Stark, DO
(pediatrics, cerebral palsy)

Chrissy Durrough, PT, DPT, NCS
(spinal cord injury)

Aaron Yang, MD
(low back pain, rehabilitation)
Zelik Lab

Research Projects for Prospective PhD Students (Fall 2018)
Robotics + Biomechanics

Restoring bio-inspired ankle-knee coupling for prosthetic users

**Example Project 1**

Lab-based robotic actuator + prosthetics + biomechanics → enhance how assistive power is transmitted from the device to user, & better understand human ankle-knee muscles (gastrocnemius)

**Outcome Measures**

- Kinematics & Kinetics
- Metabolic Rate
- Preference Survey
- Ground Reaction Forces
- Muscle Activity

**Aim I:** Parameter Sweeps to Find Optimal Behavior...
- Train
- Train
- Train
- Test

... by varying ankle-knee spring stiffness and set point, & net positive work

**Aim II:** Gait With Optimal vs. Without Gastroc.
- Train
- Test

ABAB reversal experiment design

- Bowden Cable Transmission
- Actuator Unit
- Gastrocnemius Controller
- Experimenter Interface

**Thigh Exo-Interface**
- Prosthetic Liner
- Artificial Gastrocnemius
- Prosthesis (Powered or DER)
Vanderbilt powered ankle prosthesis + enhanced foot/toe design + biomechanics → enhance ambulation for prosthetic users on inclines, stairs and uneven terrain, & better understand biological ankle-foot dynamics