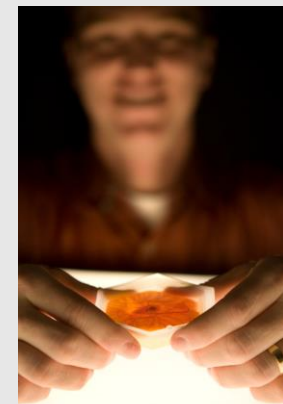
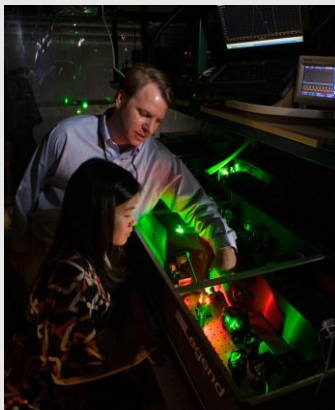


BIOMEDICAL ENGINEERING CORNELL UNIVERSITY



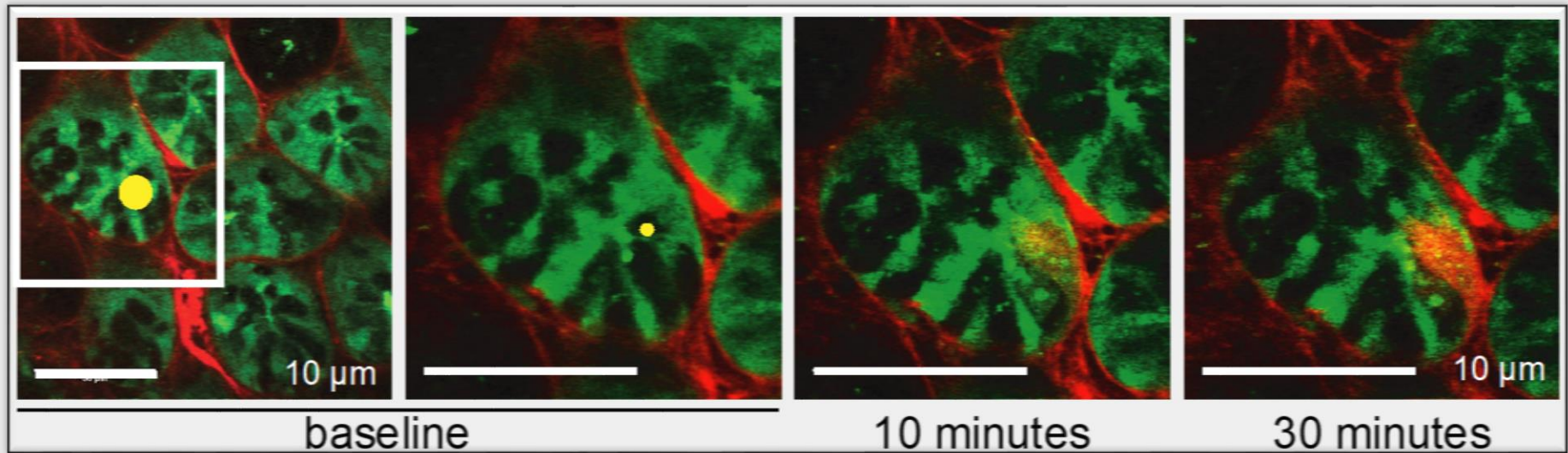
What Makes BME Different...

...from the life sciences?

- Quantitative/Analytical
- Controlling processes
- Driving change
- Restoring/Improving function

...from other engineering disciplines?

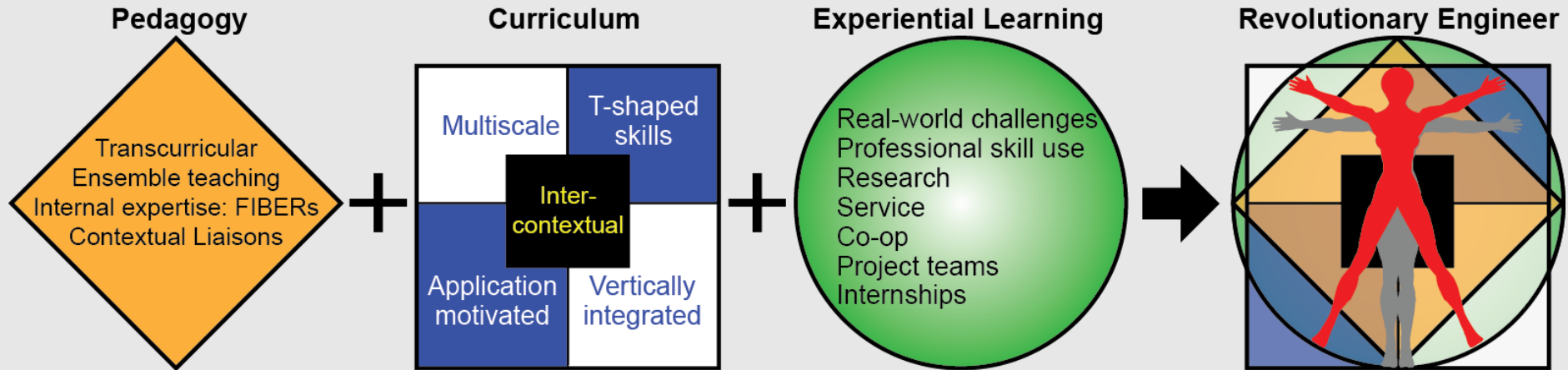
- Engineering for human health applications
- Variability/Uncertainty
- Rapid innovation cycle
- Moving targets (dynamic/organic processes)



BME as Architects and Engineers

- Able to represent and analyze complex engineering systems
 - From Block diagrams to control feedback networks
 - From Mathematical modeling to computational simulation
 - CAD, Manufacturing design, device integration, validation
- Articulate natural design principles that meet function
 - Multi-scale (cells to organ system)
 - Dynamic, sloppy
 - Soft, hard, circuitry
- Incorporate Experimental Design for knowledge creation
 - Hypothesis generation and experimental methodology
 - Statistical testing and interpretation
- Human health constraints for engineering solutions
 - Breaking the rules
- Practice creativity in solving problems

Integrated BME Major Vision



- Trans-curricular Pedagogy and Course Development
- Innovation in education and assessment
- Vertically integrated “flipped” curriculum: Applications first
- Intercontextual, strategic synergy of repetition
- Capture experiential learning
- Community engagement
- Professional skills mastery (know how to add value)

Curriculum at a Glance

BME Design and Practice



Core
Engineering Analysis of
Biological Systems



Concentration
Specific Engineering
Expertise



Cornerstones
Applications and Fundamentals of BME

Engineering Core Curriculum

Core BME Sequence Strategy

- Multi-scale engineering understanding of the human system
 - Molecular to organ system scales
 - Feedback networks and variability/uncertainty
- Develop Engineering Skills for open problems
 - Needs based modeling and simulation
 - Robust engineering system design
 - Practice in creativity and range
- Deep Understanding of Human Health Factors that Impact Engineering Solutions
 - Immune response
 - Coagulation
 - Bacterial/viral infection
 - Wound healing
 - Regeneration

BME Concentrations

Molecular/Cellular
/Systems
Engineering

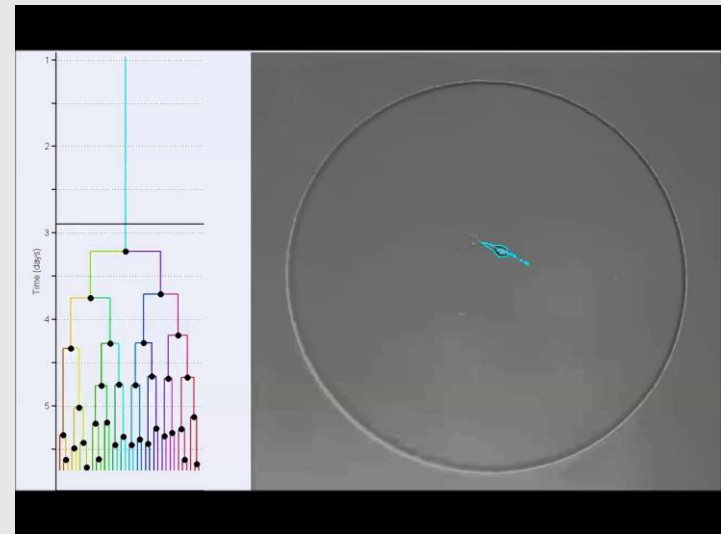
Biomaterials &
Drug Delivery

Biomedical
Imaging &
Instrumentation

Biomechanics &
Mechanobiology

Molecular/Cellular/Systems Engineering

- Data science/ simulation to understand how molecular and cellular coordination control tissue homeostasis and pathogenesis
- Engineering novel molecules to track and alter cell behaviors
- Creation of new culture models/systems to study diseases
- Precision medicine



Video courtesy of the Cosgrove Lab



Kelly W. (BS '18)
CBPartners, Analyst



Rohan Roy (BS '18,
MEng '18)
Weill Cornell / Sloan
Kettering / Rockefeller
University, MD – PhD
Candidate



Biomaterials & Drug Delivery (BMDD)

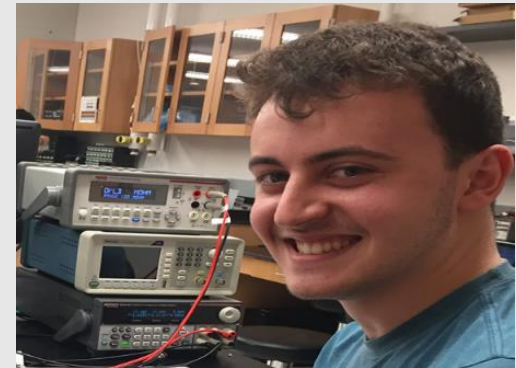
- Understanding how engineered materials interact with host biology
- Engineering/modifying new materials to control host responses – wound healing, immunity, biomechanics
- Engineering new delivery mechanisms within biomaterials for efficient drug release



Video courtesy of the Butcher Lab



Shweta M. (BS '19)
Merck, Associate
Scientist

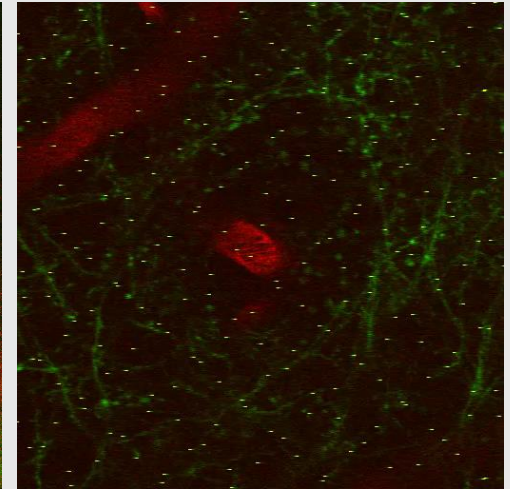
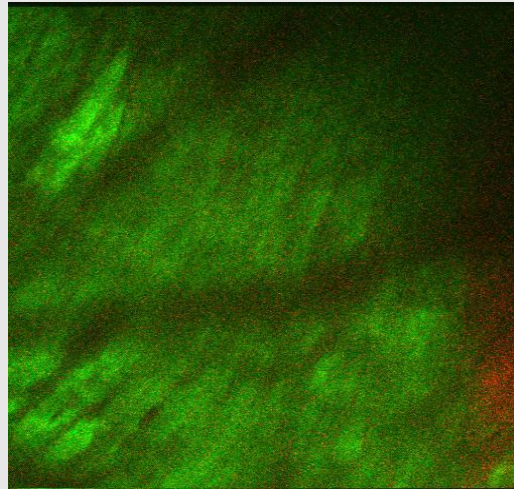


Alexander S. (BS '19)
Vanderbilt University,
PhD Candidate

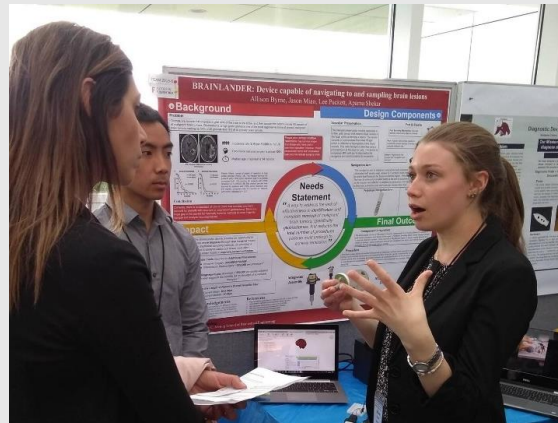


Biomedical Imaging & Instrumentation (BMII)

- Design and implement novel instrumentation for quantitative visualization of physiology/biology
- Direct manipulation of biological processes in vivo.
- Construction of algorithms to identify emergent features and predict clinical performance



Videos courtesy of the Schaffer-Nishimura Lab.



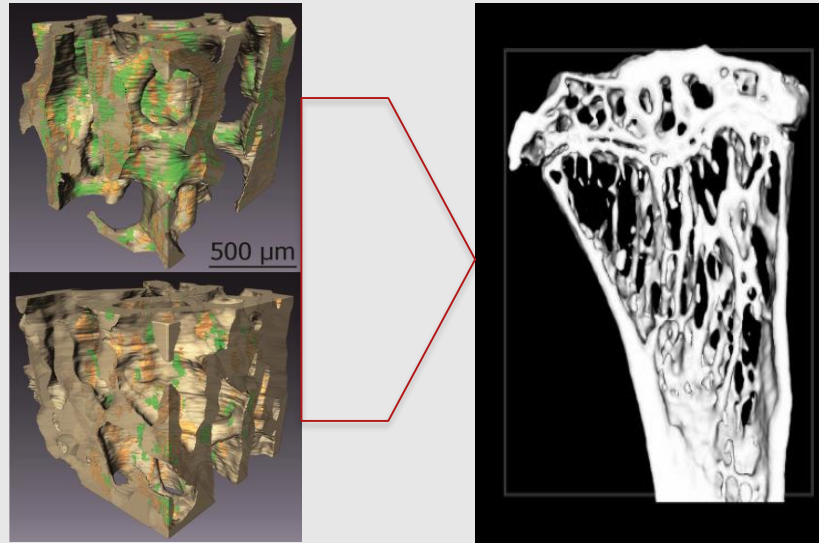
Allison B. (BS '18, MEng '19)
Stryker, *Regulatory Affairs Specialist*



Jordan H. (BS '18)
Harvard-MIT HST Program
PhD Candidate

Biomechanics and Mechanobiology (BMMB)

- Perform microstructural based analyses of tissue mechanical properties
- Design and implement novel mechanical testing and mechanical stimulation devices
- Understand and control cellular responses to mechanical forces



Images courtesy of the Hernandez and van der Meulen Labs.



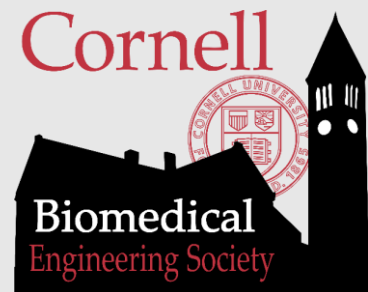
Shannon H. (BS '18)
Harris Orthopaedic Laboratory at
Mass General Hospital, *Research
Technician*



Haley A. (BS '19)
Toyota
*Crashworthiness
Engineer*

Experiential Learning

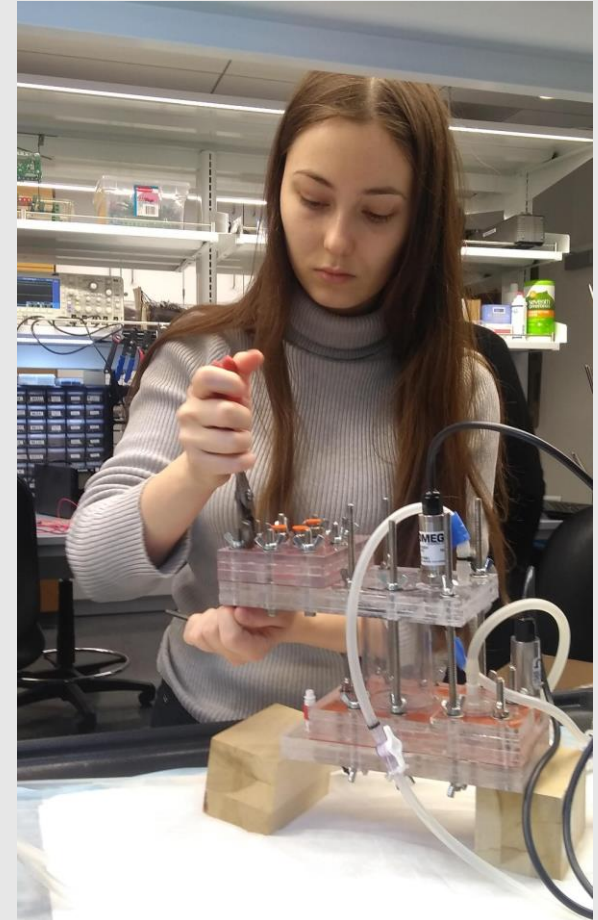
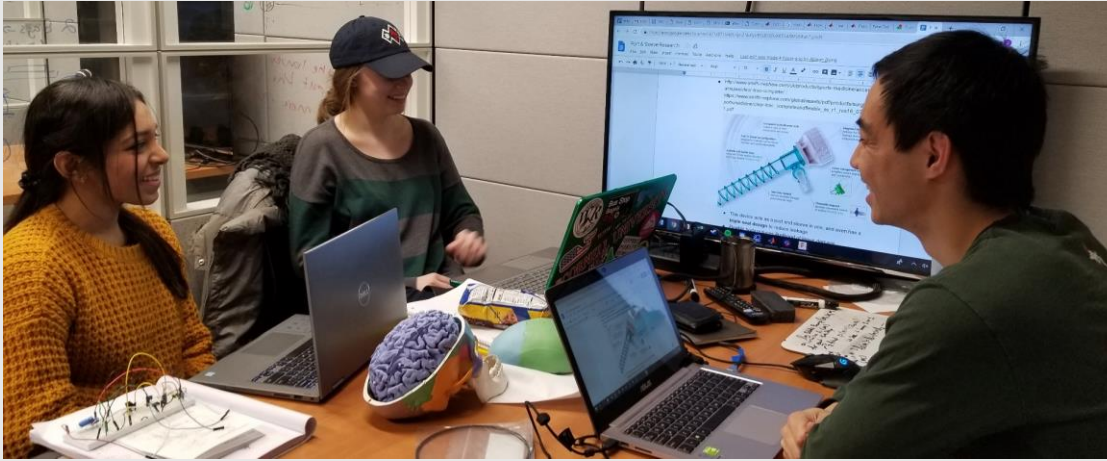
- Research/Teaching Assistants
- BMES Student Society
- Educational Outreach Activities
 - K-12 Education
 - Science Center
 - Engaged Cornell
- Project Teams
 - iGEM
 - Engineering World Health
 - BME DEBUT
 - CU Biomedical Devices



CornellEngineering

Nancy E. and Peter C. Meinig School of Biomedical Engineering

Ideate – Design – Build – Test



CornellEngineering

Nancy E. and Peter C. Meinig School of Biomedical Engineering



BME Design/Fabrication Strategy

- Training in biomedical instrumentation and data analysis
- Practical Apprenticeship experience specific to each concentration
- Two Semester Design sequence building technology for real biomedical problems
- Problems posed by industry, hospitals
 - Teams based on real complementary expertise
 - Authentic design, fabrication, and test facilities

BME Design Showcase



BME Paths

- Pre-Health Careers (Med, Vet, etc.)
- Study Abroad
- Co-Op or Internship
- Honors Thesis
- 4.5 Year BS/MEng
- Minors (CS, MAE, Genetics, etc.)
- BS/MEng/MBA



Questions?



CornellEngineering

Nancy E. and Peter C. Meinig School of Biomedical Engineering

