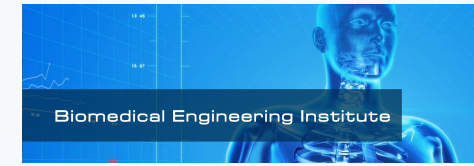


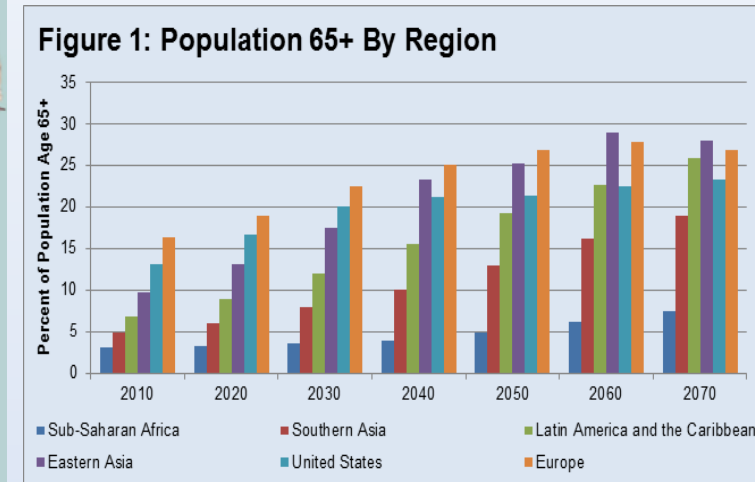
# Old Dominion University Biomedical Engineering Overview

Michel Audette Ph.D.  
Associate Professor,  
Graduate Program Director,  
Biomedical Engineering Institute  
[maudette@odu.edu](mailto:maudette@odu.edu)

# Why BME Minor/Grad Degree?



- **Exciting tangent** for Engineers with Electronics, Mechanical, or Chemical Eng., or Scientists with Biology, Chemistry, Maths, or CS: add **clinical understanding** or **engineering R&D** to their toolbox.
- Unique interface between **engineering** and **healthcare**: highly **altruistic career path**.
- Great range of **expertise**: electronics, software, mechanical & chemical design, & nanotech.
- Robust **job growth**, supported by demographics: aging population = more w. health issues.



# Undergraduate BME Minor



## **12 CH total – Supervised by Prof. Anna Bulysheva**

First course (3 CH):

- Biology students: Math course
- Engineering students: Physiology course

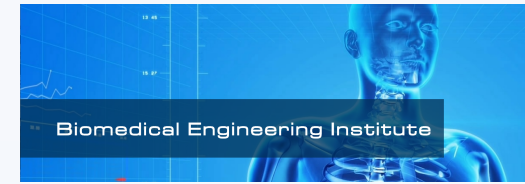
Two out of these four (6 CH):

1. BME 403 Mathematical Modeling in Physiology (3 CH)
2. BME 404 Introduction to Biomaterials (3 CH)
3. BME 405 Biomechanics ( 3CH)
4. BME 409 Introduction to Regenerative Medicine (3CH)

1 elective (3 CH, may be double counted with major).

- Linked BS/Minor-MS/PhD feasible: count 2 courses for grad degree.

# Graduate BME Programs



## MS/ME: 30 CH total

### • ***Choose 3 of 4 Core BME courses (9 CH):***

- BME 722 Mathematical Modeling in Physiology (3 CH)
- BME 720 Modern Biomedical Instrumentation (3 CH)
- BME 726 Biomaterials (3 CH)
- BME 792 Biomechanics (3 CH)

***MS with Thesis: BME electives (9CH),  
approved electives (6CH) , research (6CH).***

***MS w/o Thesis/ME: BME electives (12CH),  
approved electives (9CH).***

## Ph.D. 48 CH total

### ***Core BME courses (15 CH):***

- BME 822 Mathematical Modeling in Physiology (3 CH)
- BME 820 Modern Biomedical Instrumentation (3 CH)
- BME 826 Biomaterials (3 CH)
- BME 892 Biomechanics (3CH)
- BME 847 Responsible conduct in research (2 CH)
- BME 830- Predoctoral Fellowship Grant Writing (1 CH)

***BME electives (9 CH).***

***24 CH courses in total.***

***24 CH dissertation research.***



# Former BME Grad Students



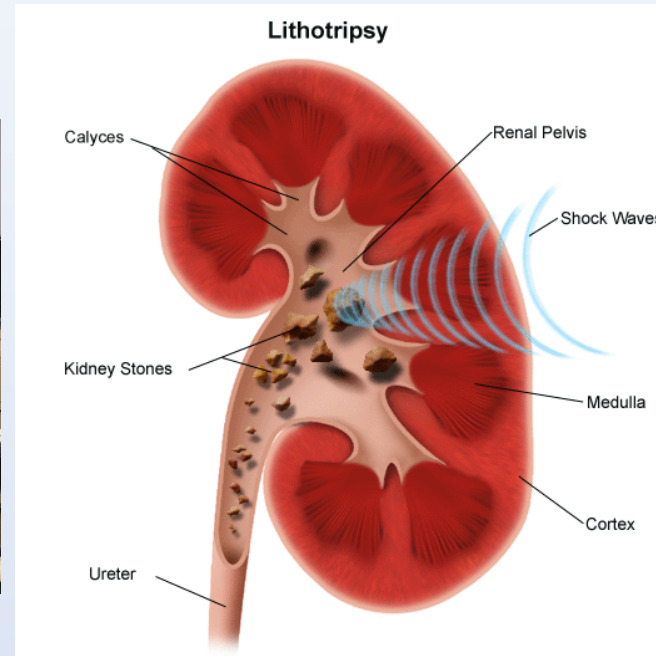
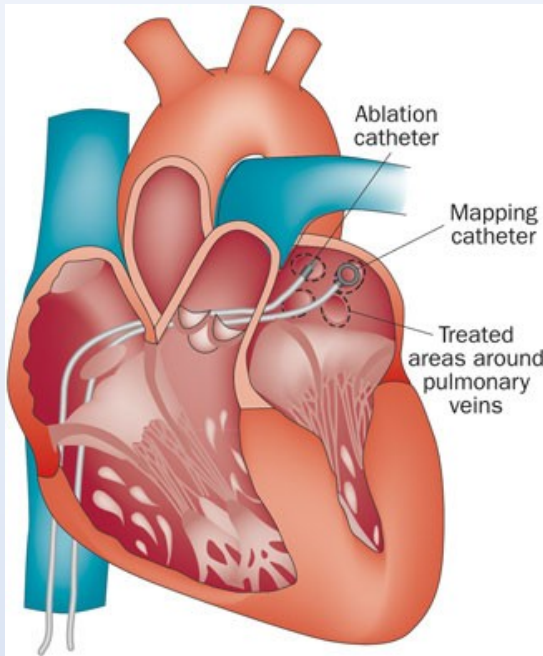
## Academic:

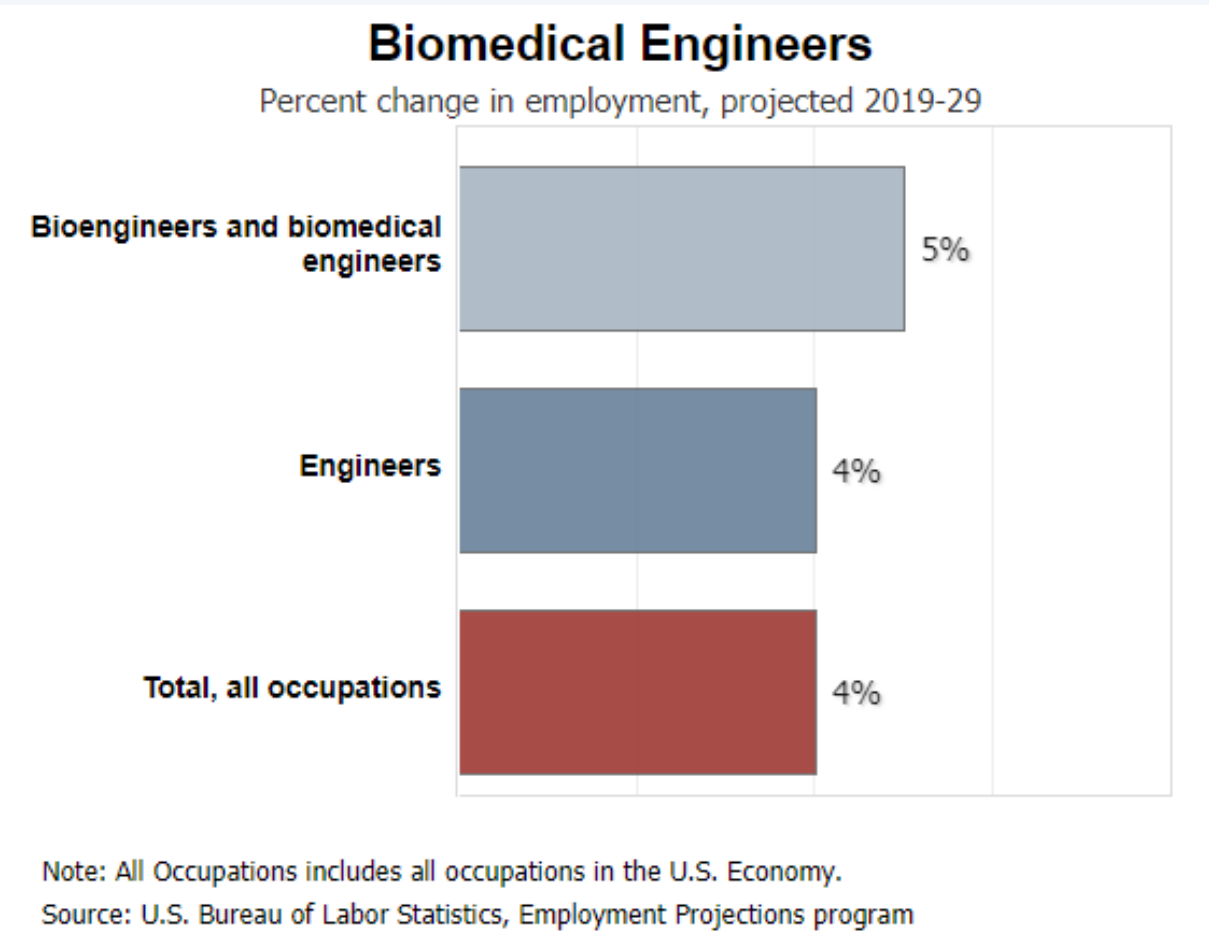
- Fei Xie PhD: Asst. Professor BME  
Chongqing Univ. (Cardiac ablation)
- Yalda Shahriari PhD: Asst. Professor BME,  
Univ. Rhode Island (Neural engineering)



## Industry & Military:

- Johanna Neuber PhD: Research Scientist, Sara Inc.  
(Colorado Springs) (Pulse & lithotripsy therapies).
- Nicholas Waytowich PhD: Research Scientist,  
Army Research Lab (Baltimore) (Cognitive assistance).



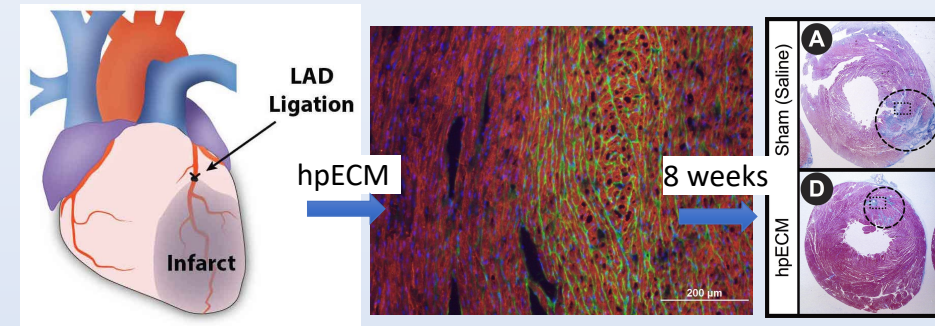
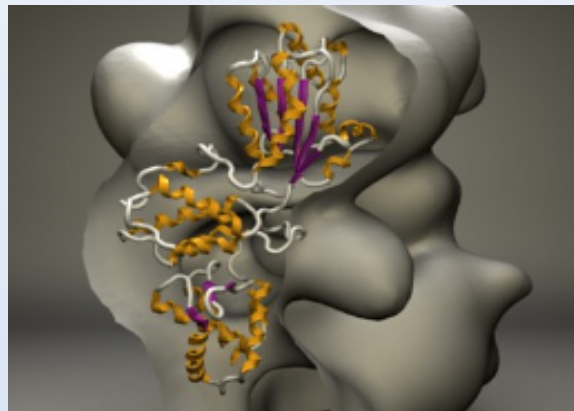
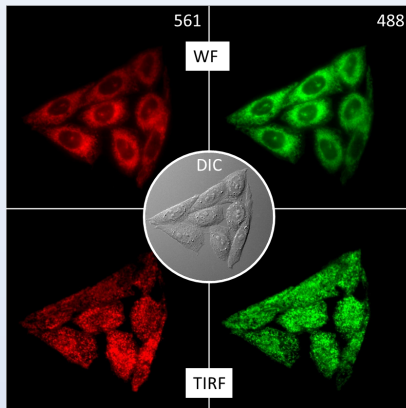
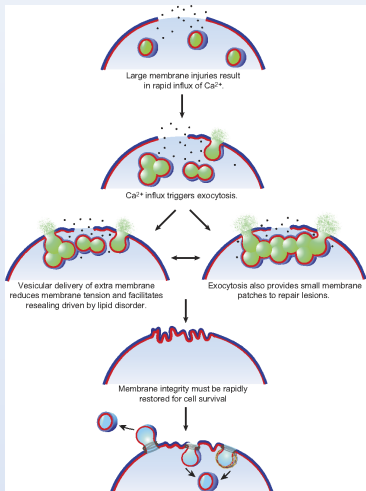
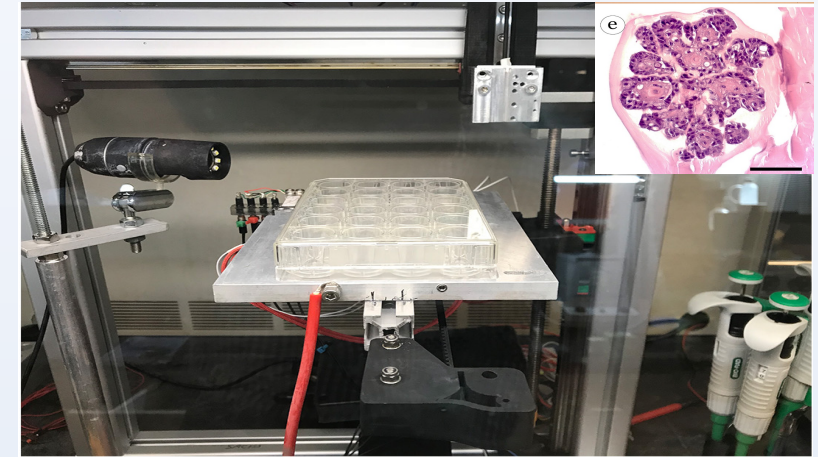
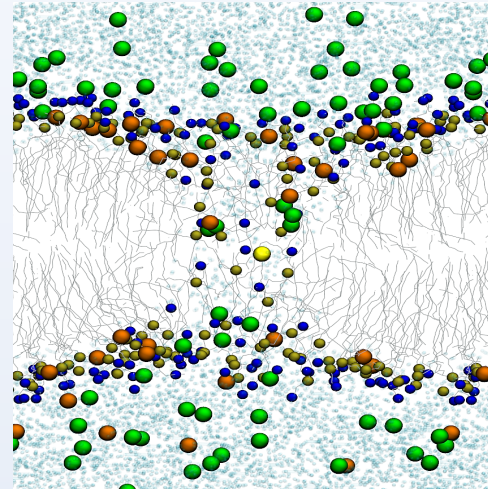
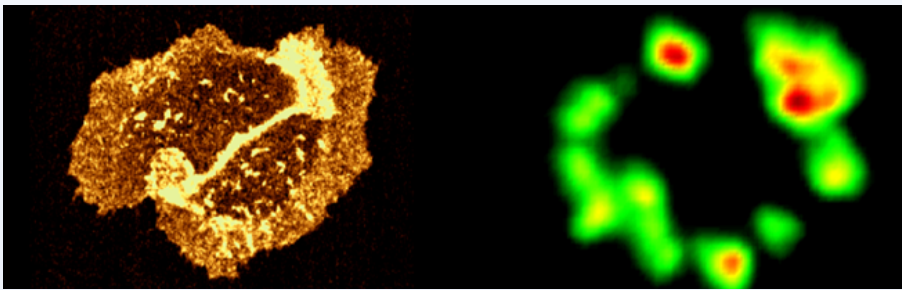


# BME Research at ODU

(This could be YOU!)



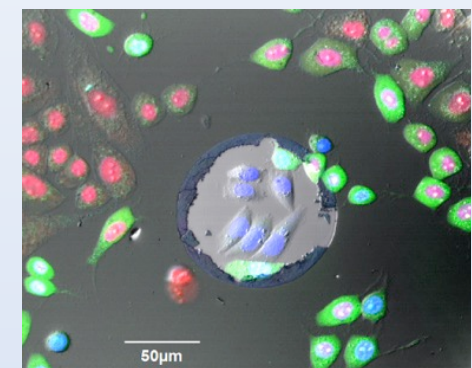
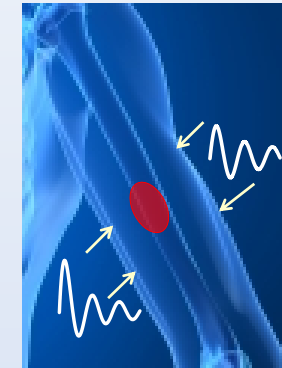
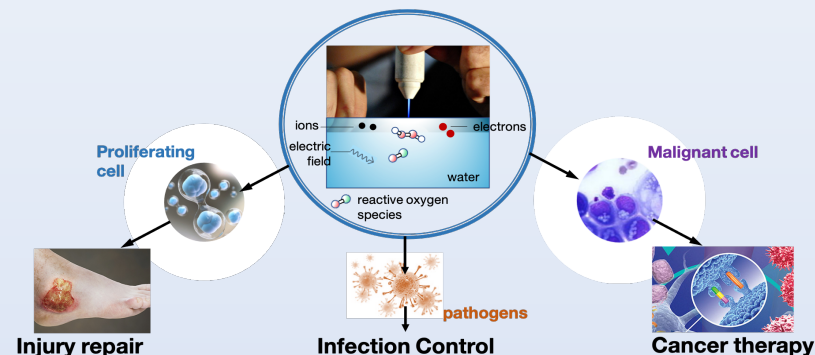
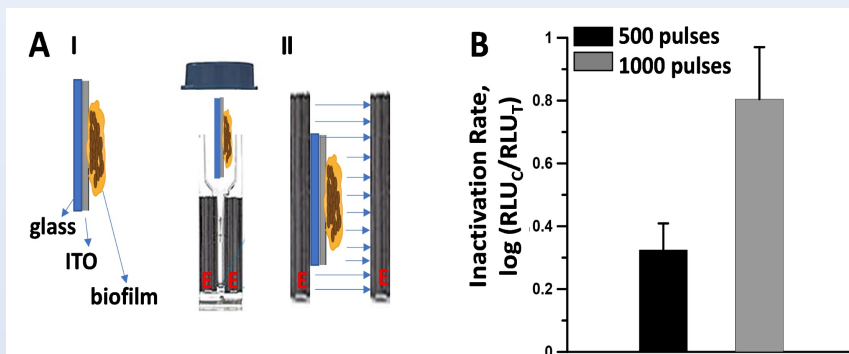
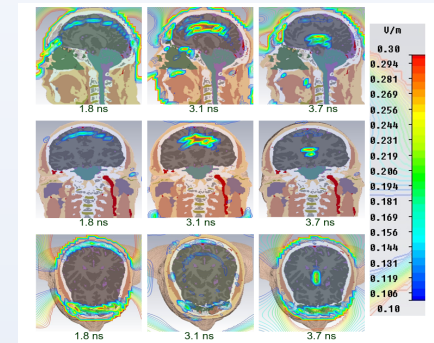
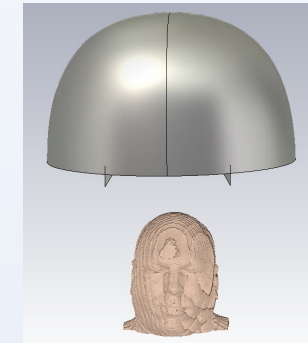
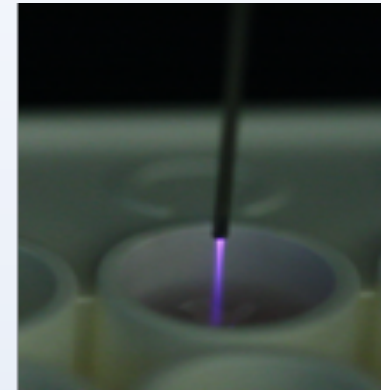
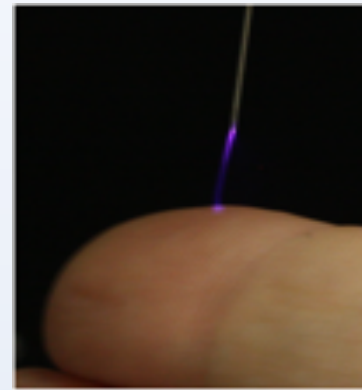
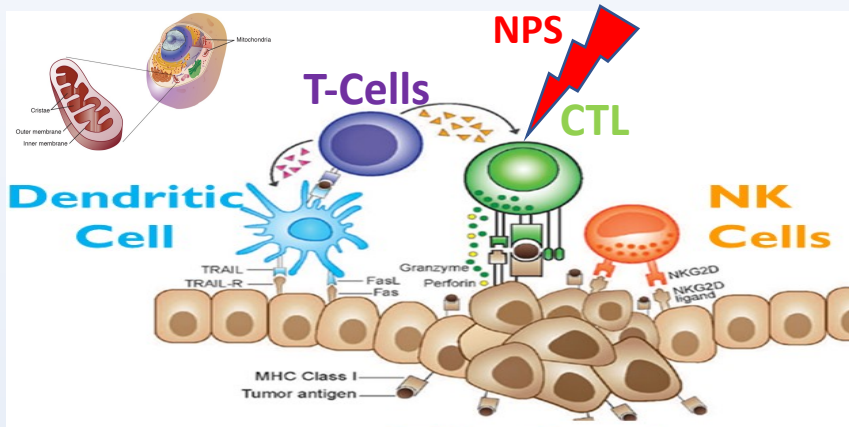
- Cellular Mechanics – Dr Maruthamuthu.
- Ion Transport in stressed membranes– Dr. Vernier.
- 3D Bioprinting via Stem Cells – Dr. Sachs.
- Post-stimulation Cell Membrane Repair- Dr. Pakhomova.
- Molecular Simulation – Dr. Wriggers.
- Gene Therapy & Regenerative Medicine – Dr. Bulysheva.



# Bioelectric & Plasma Therapies

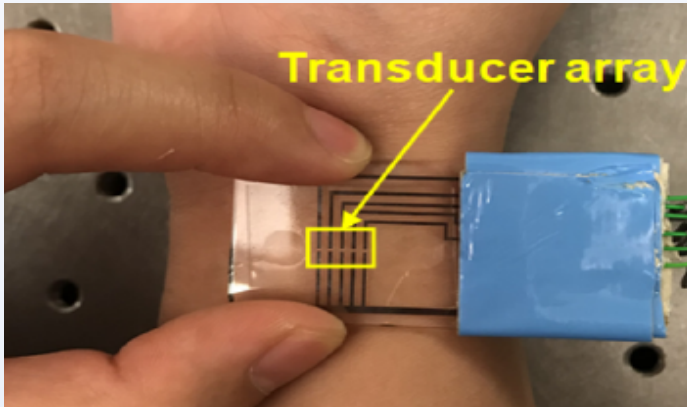


- Tumor death by Nano-Pulse Stimulation- Dr. Beebe
- Cold Plasma Therapies (tumors)- Dr. Jiang
- Antenna for Deep Brain Stimulation- Dr. Xiao
- Immune Activation (tumors, bacteria) by NPS- Dr. Muratori
- Plasma Therapies (injury, infection) – Dr. Kong
- Targeted Tissue Stimulation – Dr. Pakhomov.

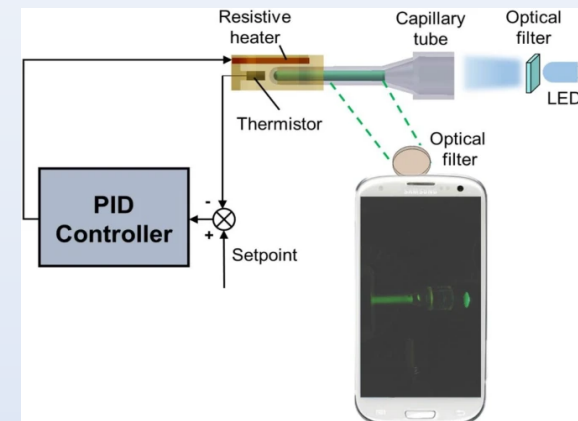
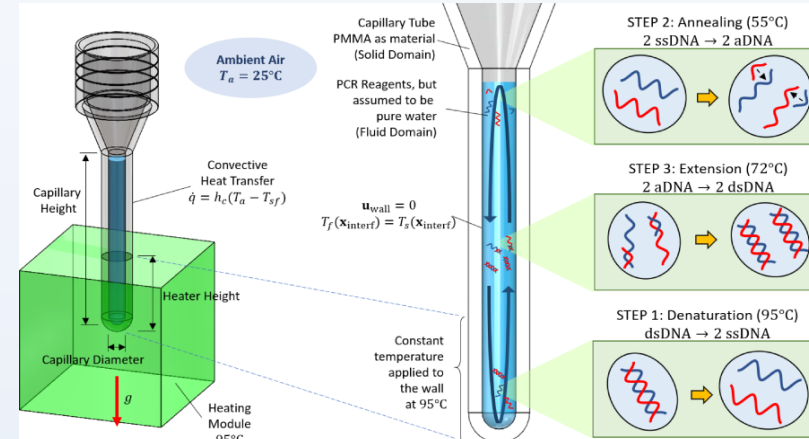
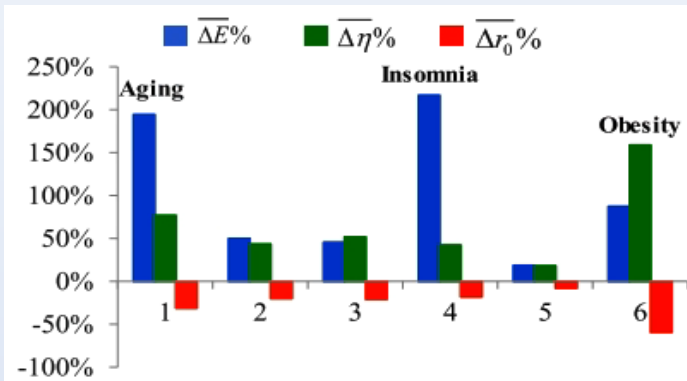




- Microsensors for vascular health- Dr. Hao.
- Polymerase Chain Reaction for copying of DNA – Dr. Baysal.



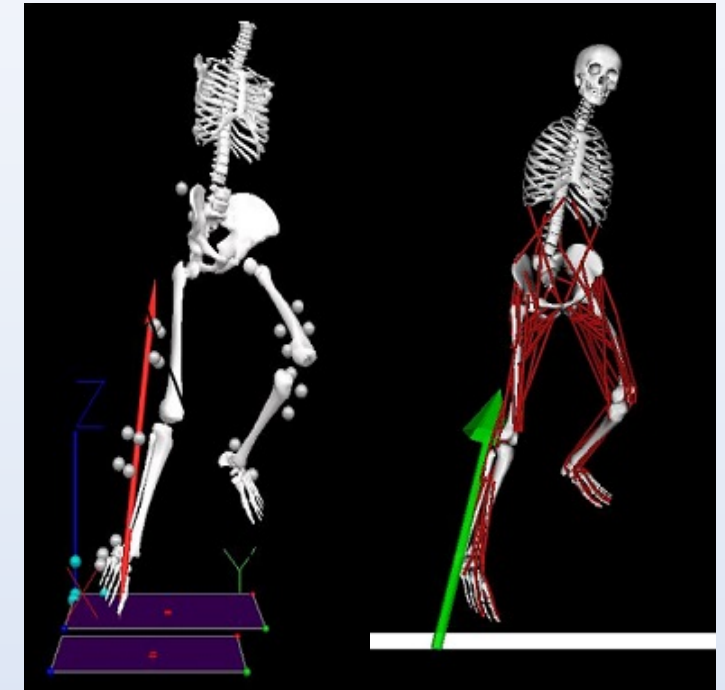
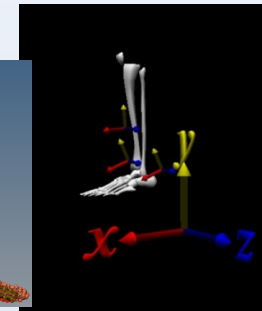
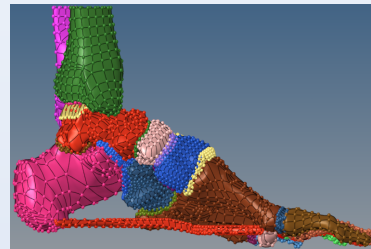
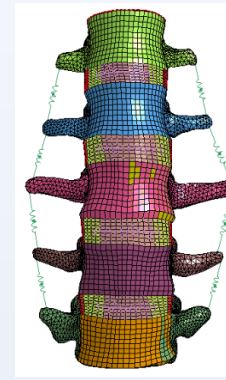
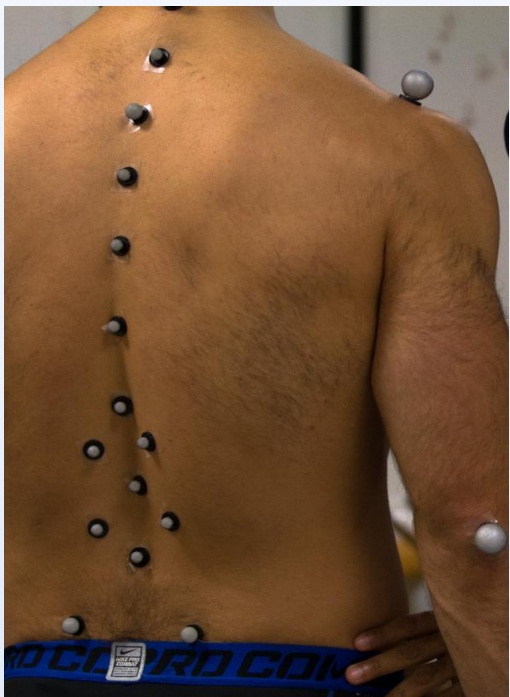
Micro tactile sensor



# Biomechanics



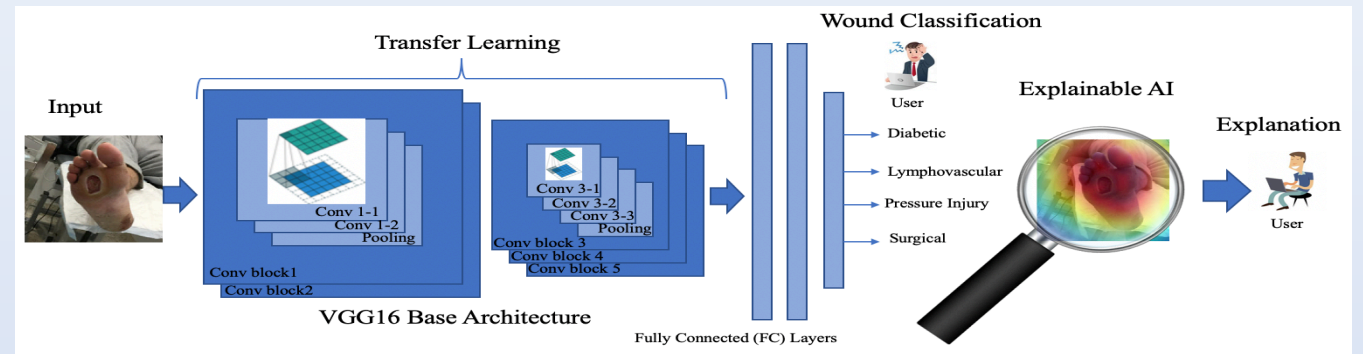
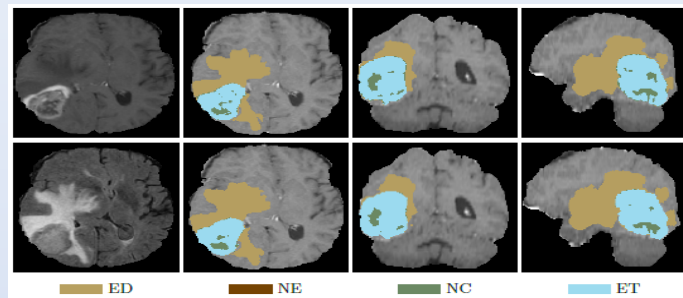
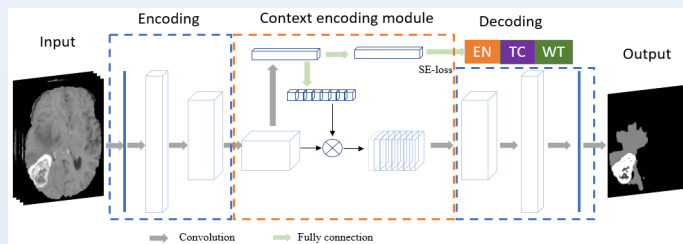
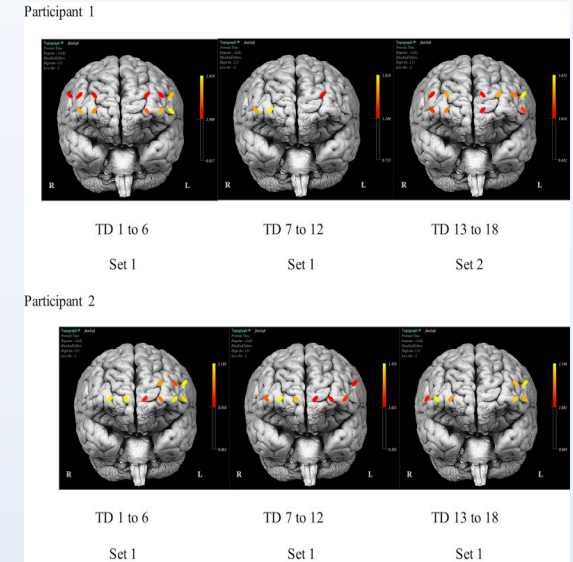
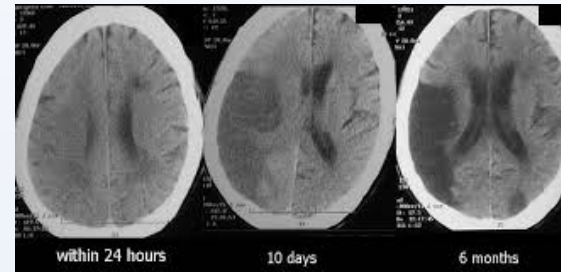
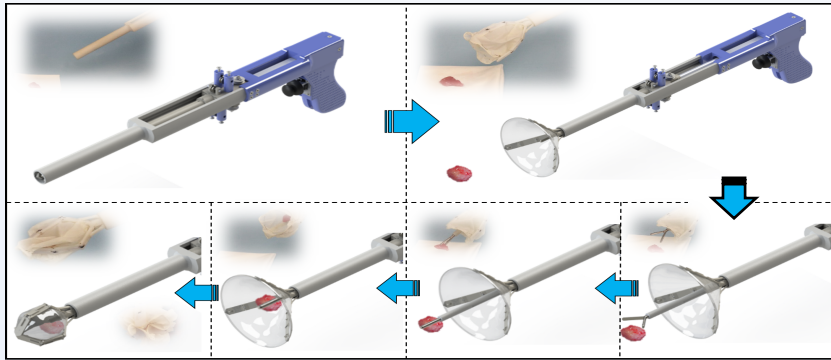
- Dynamics of spine and lower extremities- Dr. Kakar.      - Control of complex nonlinear motor system— Dr. Russell.
- Foot, ankle, spine, and knee biomechanics- Drs. Ringleb & Bawab.      - Gait in persons with special needs – Dr. Bennett.



# Therapy Planning, Simulation, & Delivery; Computer-assisted Diagnosis

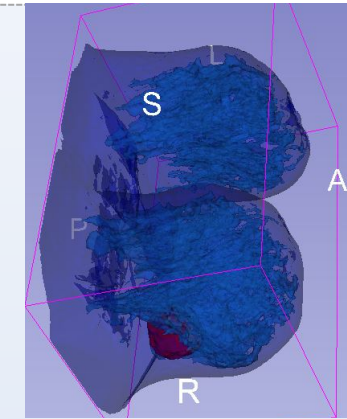
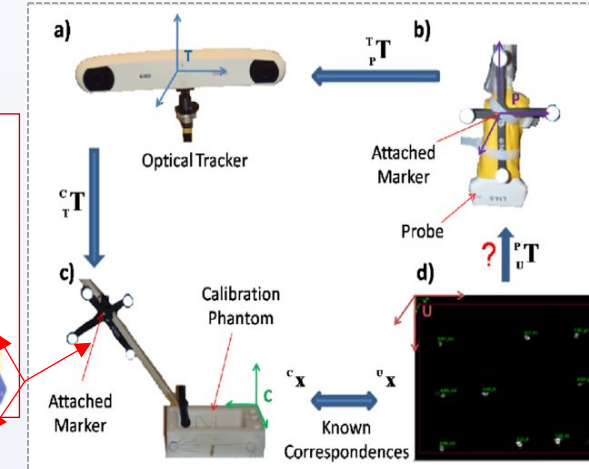
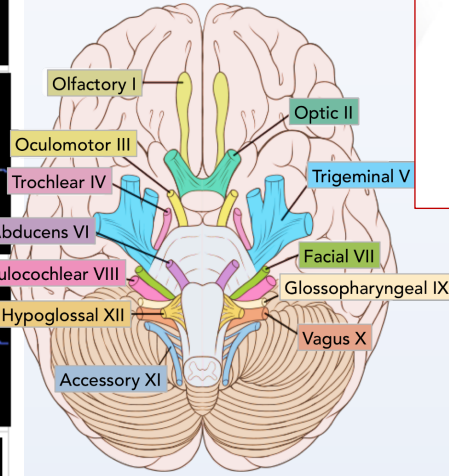
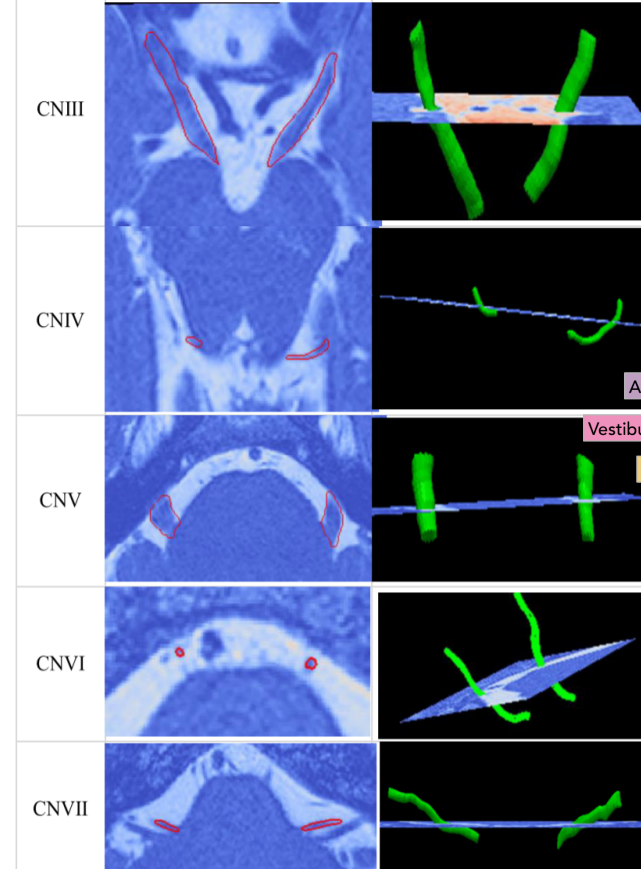


- Surgical robotics for breast tumor removal- Dr. Kaipa
- Image Analysis for Diagnosis Assistance- Dr. Iftexharuddin.
- Speech Intervention for Stroke-Induced Aphasia- Dr. Raimer.
- Learning in rehabilitation after brain injury- Dr. Johnson
- AI in healthcare: wound classification - Dr. Kuzlu





# My work: Medical Simulation & Surgery Planning & Navigation

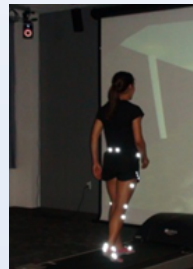
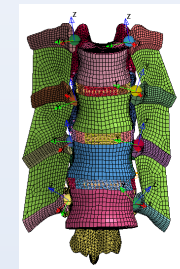
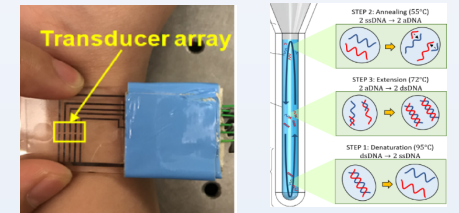
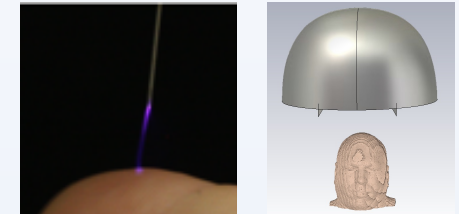
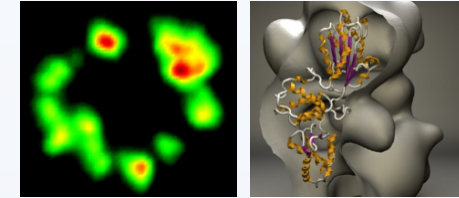
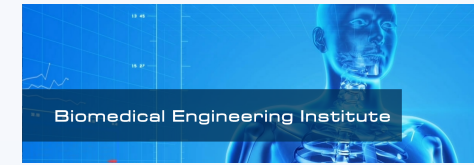


My group innovates in patient-specific medical simulation and surgery planning/navigation, so far with applications to brain, spine and breast surgery and to geriatric fall injury mitigation.

Michel Audette, Ph.D., Associate Professor, Computational Modeling and Simulation Engineering

# Summary

- Justification for BME. Minor: 12 CH; MS/ME: 30 CH; PhD: 48 CH
- Cellular & Molecular– biomechanics, bioelectrics, dynamics, stem cells.
- Bioelectric Therapy – electroporation, plasma, remote stimulation.
- Devices & Biosensors – microtactile sensors, portable DNA copy.
- MS Model, Biomechanics- human movement (spine, legs), motor control.
- Surgical planning, sim, delivery, robotics; computer-assisted diagnosis.





# Questions?



- Ask now, or email me: [maudette@odu.edu](mailto:maudette@odu.edu) on MS/ME/PhD or

Dr Bulysheva: [abulyshe@odu.edu](mailto:abulyshe@odu.edu) on BME Minor.

