Biomedical Engineering Research
Biomedical engineering is a research area in the College of Engineering at UNLV experiencing sustained growth. Our faculty has been involved in many related activities over the last decade. The combination of experimental and computational facilities within the college is a basis for future collaboration with other entities in Southern Nevada.

We would like to introduce you to some of our researchers. Please feel to contact us if we can help with your projects and initiatives.
Biomedical Engineering
Research Areas of Expertise

• Biosensors and actuators design
• Computational fluid dynamics of air flow and cardiovascular blood flow
• Micro- and nano-fluidics
• Nanoparticle and bio-molecule assembly
• Indoor air quality and contaminant transport
• Medical imaging
• Computer-aided diagnostics systems
• Telemedicine
• Medical data compression
• Lab-on-a-chip technologies toward biomedical diagnostics and analysis
• Orthopedic biomechanics
• Prosthetics systems engineering
• Bone fixation systems design and analysis
• Human factors and ergonomics
• Human force measurement
• Mechanical characterization of bones
• Evaluation of new orthodontic methods and materials
• Analysis and prevention of injuries due to shock or impact loads
• Technologies for people with visual impairments
• Music and audio technologies
Biomedical Engineering Research

Why UNLV?

• Las Vegas is a dynamic city with a population that includes multiple ethnicities and age groups.
• Las Vegas has attracted several organizations that are active in medical research including:
  • University of Nevada School of Medicine
  • Cleveland Clinic Lou Ruvo Center for Brain Health
• In addition to the College of Engineering, multiple entities within UNLV have been active in advancing biomedical research:
  • School of Allied Health Sciences
  • School of Community Health Sciences
  • School of Dental Medicine
  • School of Medicine
  • College of Sciences
• We continue to focus on establishing synergy between these entities to advance scientific knowledge and strengthen the economy of Southern Nevada.
Faculty Involved in Biomedical Engineering Research

Dr. R. Jacob Baker  
Professor, Department of Electrical and Computer Engineering

Dr. Yi-Tung Chen  
Professor, Department of Mechanical Engineering  
Co-Director, Center for Energy Research

Dr. Sarah Harris  
Associate Professor, Department of Electrical and Computer Engineering

Dr. Shahram Latifi, P.E.  
Professor, Department of Electrical and Computer Engineering  
Co-Director, Center for Information Technology and Algorithms (CITA)

Dr. Samir Moujaes  
Professor, Department of Mechanical Engineering

Dr. Brendan O’Toole  
Chair and Professor, Department of Mechanical Engineering  
Director, Center for Materials and Structures

Dr. Darrell Pepper  
Professor, Department of Mechanical Engineering  
Director, NV Center For Advanced Computational Methods

Dr. Emma Regentova  
Professor, Department of Electrical and Computer Engineering

Dr. Andreas Stefik  
Associate Professor, Department of Computer Science

Dr. Mohamed Trabia  
Professor, Department of Mechanical Engineering  
Associate Dean for Research, Graduate Studies & Computing

Dr. Evangelos Yfantis  
Professor, Department of Computer Science

Dr. Woosoon Yim  
Professor, Department of Mechanical Engineering  
Director of Intelligent Structures and Control Laboratory

Dr. Hui Zhao  
Associate Professor, Department of Mechanical Engineering
### Biomedical Engineering Research

**Additional Resources**

| UNLV School of Allied Health Sciences |
| UNLV School of Community Health Sciences |
| UNLV School of Dental Medicine |
| UNLV School of Medicine |
| UNLV College of Sciences |
| Cleveland Clinic Lou Ruvo Center for Brain Health |
Biomedical Engineering

Research Highlights
Biomedical Engineering Research

R. Jacob Baker
Professor, Department of Electrical and Computer Engineering
Phone: (702) 895-4125
Email: r.jacob.baker@unlv.edu

• Expertise
  • Digital microfluidics
  • Electrowetting
  • Capacitive sensing
  • Droplet position detection of immunohistochemistry experiments
• Capacitance to digital conversation for biological imaging
• CMOS integrated circuit microfluidics
Biomedical Engineering Research

R. Jacob Baker
Professor, Department of Electrical and Computer Engineering

Recent Publications

Biomedical Engineering Research

Dr. Yi-Tung Chen
Professor, Department of Mechanical Engineering
Co-Director, Center for Energy Research

Phone: (702) 895-1202
Email: yitung.chen@unlv.edu

• Expertise
  • Pulmonary air flow and cardiovascular blood flow modeling
  • Biosensor design
  • Pharmacokinetics
  • Biomolecular simulation
  • Computational fluid dynamics
  • Computational heat transfer and mass transfer
  • Medical image processing
  • Fluid and structural interaction
Recent Projects

• Computational fluid dynamics (CFD) studies of airflow in a digital reference model of the 17-generation airway (bronchial tree) were accomplished using numerical modeling, based on the anatomical model.
• The lung model consists of 6.744e6 unstructured tetrahedral computational cells. A steady-state airflow rate was used to simulate the transient turbulent flow regime using a large eddy simulation turbulence model.
• The nature of the secondary vortical flows, which develop in such asymmetric airways, was demonstrated to vary with the specific anatomical characteristics of the branching conduits.

Recent Publications

Dr. Sarah Harris
Associate Professor, Department of Electrical and Computer Engineering
Phone: (702) 895-4518
Email: sarah.harris@unlv.edu

- Expertise
  - Digital design, reconfigurable computing
  - System on a chip design
  - Embedded systems
  - Robotics, interfacing sensors, actuation
Biomedical Engineering Research

Dr. Sarah Harris
Associate Professor, Department of Electrical and Computer Engineering

Recent Publications

• Kakakhel, Z., Owen, R., Harris, S. and Harris, D., “MIPSfpga: An unobfuscated commercial MIPS core and SoC that runs Linux,” Embedded World Conference, February 2016, Nuremberg, Germany.


Biomedical Engineering Research

Dr. Shahram Latifi, P.E.
Professor, Department of Electrical and Computer Engineering
Co-Director, Center for Information Technology and Algorithms (CITA)
Phone: (702) 895-4016
Email: shahram.latifi@unlv.edu

- Expertise
  - Medical imaging
  - Computer-aided diagnostic systems
  - Data compression
Biomedical Engineering Research

Dr. Shahram Latifi, P.E.

Professor, Department of Electrical and Computer Engineering
Co-Director, Center for Information Technology and Algorithms (CITA)

Recent Projects

- “Cognitive Body Area Networks to Treat Obesity”, with Dr. Alona Angosta, School of Nursing, 2016.
- “Medical Image Compression”, A Graduate Class Project, 2014.

Recent Publications

- “Toward predicting medical conditions using k-nearest neighbors.” S Tayeb, M Pirouz, J Sun, K Hall, A Chang, J Li, C Song, A Chauhan, S Latifi, ..., (2017) IEEE International Conference on Big Data (Big Data), 3897-3903.
Biomedical Engineering Research

Dr. Samir Moujaes
Professor, Department of Mechanical Engineering
Phone: (702) 895-3265
Email: samir.moujaes@unlv.edu

• Expertise
  • Testing Portable Body Temperature Conditioner (PBTC) with computer-aided diagnostics systems
  • Testing thermal manikin for performance of PBTC under various controlled conditions

Above: Portable body temperature conditioner (PBTC) developed by Rocky Research and tested by Nevada School of Medicine and UNLV

Right: Thermal manikin tested by UNLV for the performance of the PBTC under various controlled thermal conditions
Dr. Samir Moujaes
Professor, Department of Mechanical Engineering

Completed Research Projects:
• “Characterization of a Conditioning Hypothermic/ Hyperthermic Portable Device for use in Field Installations”, US Army Office, University of Reno School of Medicine, November 13-Jan. 2015, $52,000.

Book Chapters:

Journal Papers:

Conference Papers:
Biomedical Engineering Research

Dr. Brendan O’Toole

Chair and Professor, Department of Mechanical Engineering
Director, Center for Materials and Structures
Phone: (702) 895-3885
Email: Brendan.Otoole@unlv.edu
Website: www.egr.unlv.edu/~bj/

• Expertise
  • Development of low-cost prosthetic hands
  • Strength and stiffness of bones
  • Design and analysis of composite orthotics
  • Experimental evaluation of orthodontic devices
  • Mitigation of impact-induced injuries

In collaboration with the Dental School, investigation of the effects of location, shape, and orientation of attachments for the retention of thermoformed orthodontic aligners.

3D printed prosthetic hand for a 5-year old girl who has Poland Syndrome
Biomedical Engineering Research

Dr. Brendan O’Toole
Chair and Professor, Department of Mechanical Engineering

Recent Projects
- Development of low-cost prosthetic hands
- Characterization of orthodontic devices and materials
- Evaluating effect of hibernation on bone strength in ground squirrels
- Shock absorbing properties of elastomeric mouth pieces
- Experimental evaluation of the failure of solder joints in dental wire connections
- Shear testing of orthodontic brackets
- Retention of thermoformed aligners with varying mounting brackets
- Design and fabrication of polymer composite Ankle Foot Orthosis (AFO)
- Experimental evaluation of the performance of AFOs in situ and in a laboratory environment
- Computational analysis and geometric optimization of titanium mesh implant structures for facial reconstruction

Recent Publications
Biomedical Engineering Research

Dr. Darrell Pepper
Professor, Department of Mechanical Engineering
Director, Nevada Center for Advanced Computational Methods
Phone: (702) 895-1056
Email: darrell.pepper@unlv.edu

- **Expertise**
  - Computational fluid dynamics, heat transfer, and species transport
  - Advanced computational techniques
  - Multi-physics modeling
  - Indoor air dispersion modeling
  - Biomedical / environmental fluid dynamics

Top: Contaminant transport within porous media.
Center: Species transport within a room with an open door.
Bottom: Velocity contours within a femoral artery experiencing pulsatile flow.
Recent Publications

Biomedical Engineering Research

Dr. Emma Regentova
Professor, Department of Electrical and Computer Engineering
Phone: (702) 895-3187
Email: emma.regentova@unlv.edu
Website: http://www.ee.unlv.edu/~regent/

- Expertise
  - Biomedical imaging
  - Hyperspectral imaging
  - Deep learning approach

In collaboration with Dr. M. Yang (COE) and Dr. B. St. Pierre-Schneider (Nursing): Quantification of protein cells distribution in microscope images in injured muscles

High-performance methods for sparse-view MRI and CT reconstruction

Cancer research: Detecting microcalcifications in digital mammograms

Quantification of white blood cells distribution in light microscopy images of injured muscles
Recent Publications

**Biomedical Engineering Research**

**Dr. Andreas Stefik**  
Associate Professor, Department of Computer Science  
Phone: (702) 895-3187  
Email: andreas.stefik@unlv.edu

- Expertise  
  - Software engineering  
  - Programming languages  
  - Empirical study design  
  - Statistics  
  - Accessibility  
  - Music and audio technologies  
  - Computer science education

Blind students at the Washington State School for the Blind learning to develop software by using the Quorum programming language.
Dr. Andreas Stefik
Associate Professor, Department of Computer Science

Recent Publications

- (Best Paper Award) “Computer Science Principles for Teachers of Blind and Visually Impaired Students,” Andreas Stefik, Richard Ladner, William Allee, Sean Mealin. SIGCSE 2019 (accepted).
Biomedical Engineering Research

Dr. Mohamed Trabia
Professor, Department of Mechanical Engineering
Associate Dean for Research, Graduate Studies & Computing
Phone: (702) 895-0957
Email: mohamed.trabia@unlv.edu
Website: www.me.unlv.edu/~mbt

- Expertise
  - Optimization of human-powered vehicle design
  - Bone fixation systems design and analysis
  - Fingertip force measurement and characterization
  - Electronic Braille reading system
  - Characterization of diabetic ulceration
  - Characterization of material models of tissues

Above: Contact area images for three separate subjects from video taken underneath the transparent walkway and processed binary images generated by coloration tracking algorithm.
Recent Publications


Approved Patents

• 8,617,221, “Apparatus and methods for bone fracture fixation.”

• 7,578,835, “Apparatus and methods for bone fracture reduction and fixation.”

• 7,235,077, “Bone fixation device and method.”
Biomedical Engineering Research

Dr. Evangelos Yfantis
Professor, Department of Computer Science
Phone: (702) 895-3536
Email: evangelos.yfantis@unlv.edu
Website: www.ICIS.cs.unlv.edu

- Expertise
  - Medical images and video
  - Telemedicine
  - Computer simulation of human anatomy
  - Minimally invasive methods using computer vision
  - Computerized Medical Forms Detection, Medical Records Project (DOE)
  - HCI Computer Vision Project (NASA)
Recent Publications

Biomedical Engineering Research

Dr. Woosoon Yim
Professor, Department of Mechanical Engineering
Director, Intelligent Structures and Control Laboratory
Phone: (702) 895-0956
Email: woosoon.yim@unlv.edu

- Expertise
  - Biosensor and devices
  - Mechanical implant design for OSA (Obstructive Sleep Apnea) patients

An experimental setup used to measure viscoelastic properties of a pig’s lower jaw and tongue mounted on a BOSE Dynamic Material Tester

Fit-Click assembly prototype with constant force spring

3D geometric model developed from patient’s CT scan

March 2019
Biomedical Engineering Research

Dr. Woosoon Yim
Professor, Department of Mechanical Engineering
Director, Intelligent Structures and Control Laboratory

Recent Publications

Dr. Hui Zhao
Associate Professor, Department of Mechanical Engineering
Phone: (702) 895-1463
Email: hui.zhao@unlv.edu

- Expertise
  - Fundamentals of micro- and nano-fluidics
  - Electrokinetic transport
  - Properties of nanoparticles and biomolecules
  - Development of techniques using electric fields to sort, separate, and immobilize cells and biomolecules
  - Lab-on-a-chip devices for automatic, fast detection and diagnostics
  - Biosensing

Top: In nanopore-based DNA sequencing, the side where DNA is placed is termed cis and the other side is referred to as trans.
Bottom: The fluorescence image on a) a smooth silicon substrate and b) the substrate with nano-antenna.
Biomedical Engineering Research

Dr. Hui Zhao
Associate Professor, Department of Mechanical Engineering

Recent Publications