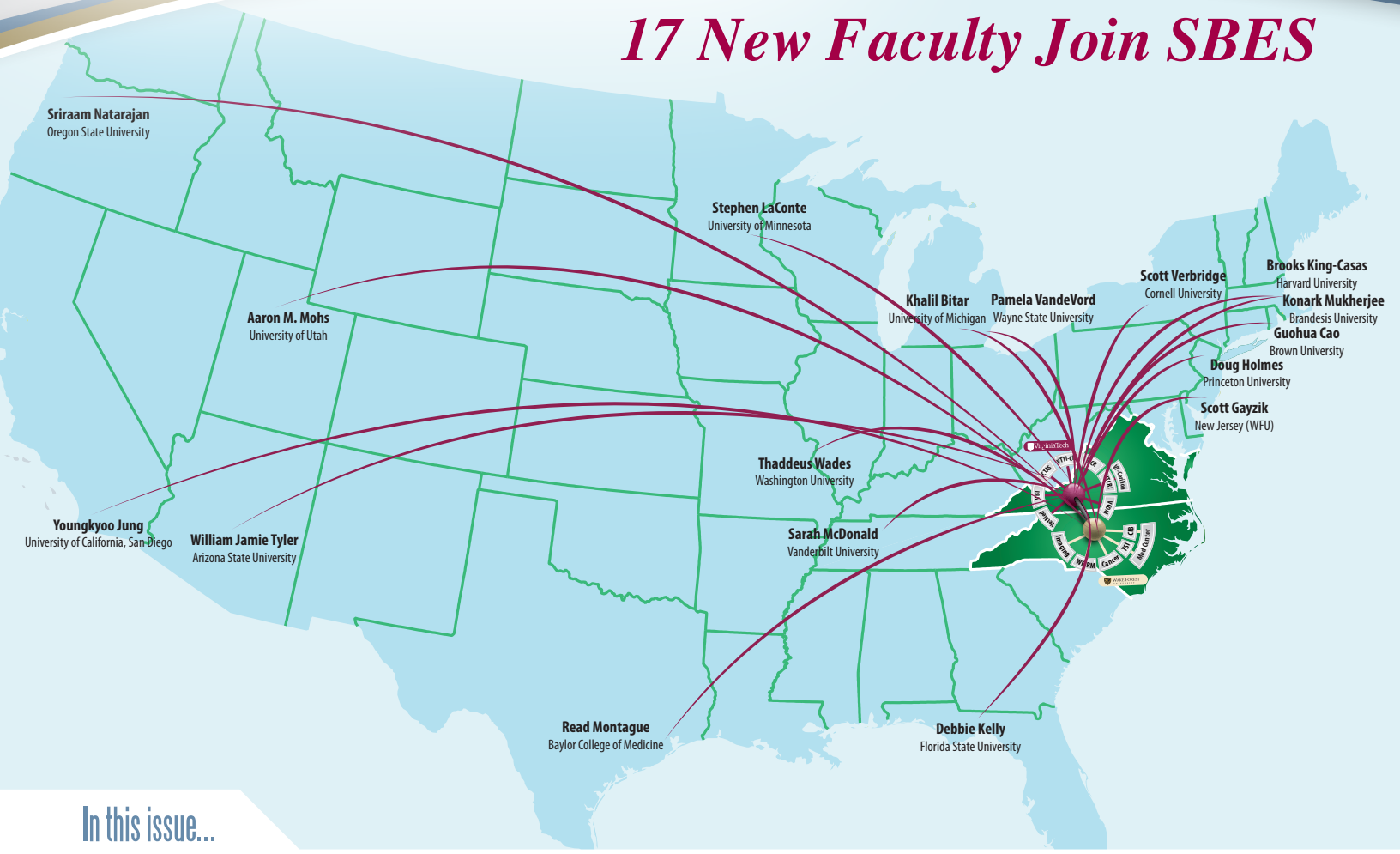
Virginia Tech
Wake Forest University
School of Biomedical Engineering and Sciences

newsletter
Fall 2011

17 New Faculty Join SBES



In this issue...

17 New Faculty Join SBES

Dr. Stefan Duma is the Head of the Virginia Tech –Wake Forest University School of Biomedical Engineering and Sciences.

You may recall last fall we embarked on an ambitious goal of hiring 20 new tenure track faculty into our biomedical engineering program, which we call the Virginia Tech – Wake Forest University School of Biomedical Engineering and Sciences (SBES). Through countless interviews and meetings, we were able to successfully recruit 17 outstanding new faculty to SBES. These 17 new hires came from excellent academic programs from around the country. Given the uniqueness of this recruitment accomplishment, we decided to focus our entire 2011 newsletter on these new faculty and their impressive credentials. Please take a few minutes and read the summaries of their research areas as we highlight the geographic diversity of their academic training.

We are not done yet! This fall we are advertising for 14 additional tenure track faculty positions in our biomedical programs. This is part of our overall strategy to hire 50 new tenure track biomedical engineering and sciences faculty over the next five years. The facing page lists our partners at Virginia Tech and Wake Forest University where the positions will be located. A complete advertisement detailing these 14 new positions will be available on our web page in September. Please encourage your best post-docs and PhD students to apply for the faculty spots that best fit their background.

Another exciting announcement is the beginning of our undergraduate education programs. Historically, we have been focused on research and graduate education, but this fall we launch our biomedical engineering minor program across all departments within the college of engineering at Virginia Tech. With over 6,000 undergraduate engineering students, Virginia Tech is a perfect fit for an elaborate biomedical engineering minor program that can benefit a wide range of students. In fact, one of our 17 new hires, Dr. Pam VandeVord, will oversee these efforts as our new Associate Department Head. We are developing a range of new undergraduate courses as well as biomedically focused senior design projects. More information on our undergraduate programs can be found in this newsletter.

I am excited to announce that our BMES student chapter received two awards this year for their impressive efforts. First, the student chapter received the Chapter Meritorious Achievement Award, which is given to only one chapter nationally each year. Second, they received the Fleetest Feet Award for the chapter with the most students who traveled the farthest to attend the national conference. Congratulations to our student chapter!

Finally, please stop our booth at BMES where we will have interactive displays that feature our current research projects. We are bringing over 100 faculty and graduate students that are presenting over 100 technical papers and posters. I hope you will have the opportunity to see one of these presentations and to stop by our booth. I look forward to seeing you all in Hartford!

Sincerely,

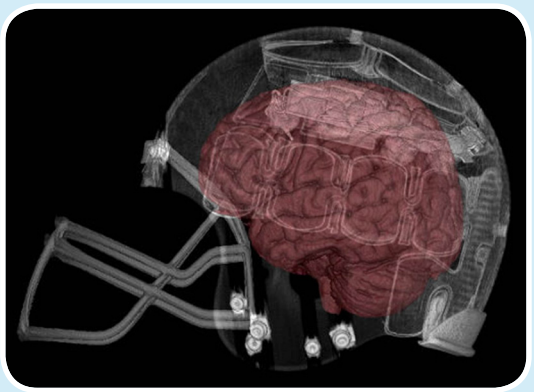
Stefan Duma

Stefan Duma, PhD

Professor and Head

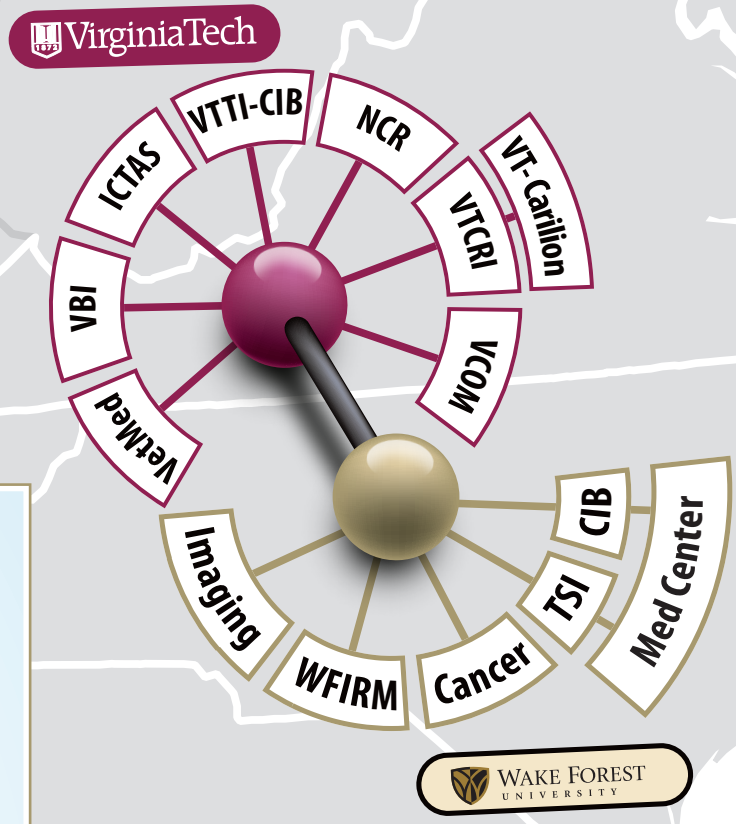
ABME Special Issue: Concussions

Recent research illustrates that there are nearly four million concussions each year that occur in the United States during sports related activities. In addition to sports, automobile and military impact events contribute significantly more concussions, or mild traumatic brain injuries (MTBI). Given this injury incidence, and the many unknown parameters surrounding these injuries, there are numerous active research projects aimed at reducing the risk of concussion injuries.



This fall the Annals of Biomedical Engineering (ABME) will release a special issue focused on concussions and MTBI that contains the current leading research in the areas of sports biomechanics, automobile safety, military impacts, and advanced imaging techniques. Associate Editor Stefan Duma and guest Associate Editor Joel Stitzel oversaw the submissions for this special issue. Over 20 full length manuscripts will be presented from leading scientists around the world. It is anticipated that this issue will serve as an excellent reference for years to come.

Our Biomedical Engineering Partners



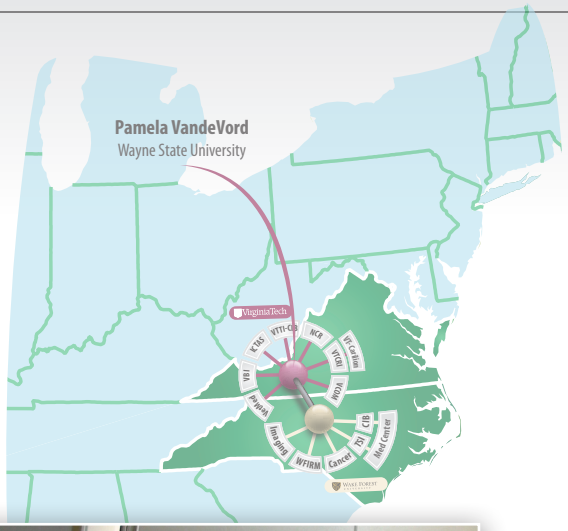
At Virginia Tech

VetMed	College of Veterinary Medicine
VBI	Virginia Bioinformatics Institute
ICTAS	Institute for Critical Technologies and Applied Sciences
VTTI-CIB	Virginia Tech Transportation Institute - Center for Injury Biomechanics
NCR	National Capital Region
VT-Carilion	Virginia Tech – Carilion Medical School
VTCRI	Virginia Tech – Carilion Research Institute
VCOM	Via College of Osteopathic Medicine

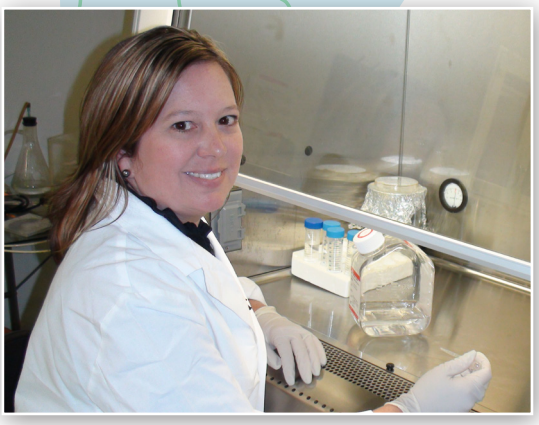
At Wake Forest University

Imaging	Center for Biomolecular Imaging, Biomedical Imaging Division
WFIRM	Wake Forest Institute for Regenerative Medicine
Cancer	Comprehensive Cancer Center
TSI	Translational Sciences Institute
CIB	Center for Injury Biomechanics
Med Center	Wake Forest University Baptist Medical Center

Pamela VandeVord



Pamela J. VandeVord, Ph.D. is an Associate Professor of Biomedical Engineering and a rehabilitation investigator with the Department of Veterans Affairs. Dr. VandeVord's research in neurotrauma focuses on the mechanism of injury to nervous system tissues. She is studying the fundamental questions concerning the mode of energy transfer to the brain during impact and blast exposure as well as the consequent damage or disruptive mechanisms at the cellular level. Dr. VandeVord investigates the cellular (neurons, astrocytes and microglia) response to overpressure generated from blast exposure. She received a Career Development Award from the Department of Veterans Affairs for her novel work in this area. Furthermore, Dr. VandeVord received the prestigious Presidential Early Career Award for Scientists and Engineers (PECASE) in 2010 for her innovative research. The award, which has been given annually by the White House Office of Science and Technology Policy, recognizes preeminent young scientists and engineers for their innovative research and leadership. Her research efforts will help understand how the brain is injured from blast providing a platform to design novel strategies to protect, identify and treat the injury. In addition to her tramatic brain injury (TBI) research, Dr. VandeVord has published several articles on nerve injury and regeneration. This research area utilized novel biomaterials to help repair injured nerves.



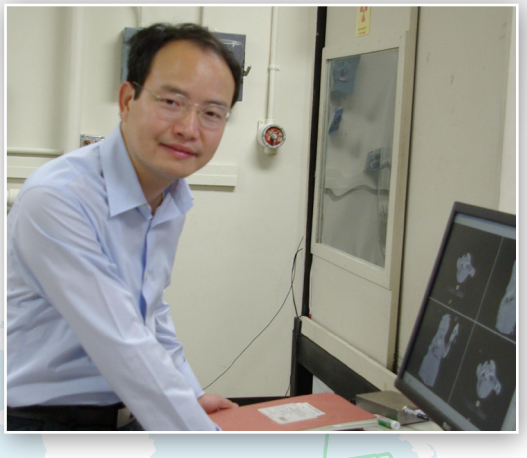
Besides her PECASE Award, she has been principal author or co-author of 33 research articles, and her research has won a first-place award at The Eighth World Congress on Brain Injury in 2010 and a third-place award at the American Society of Medical Engineering International Summer Bioengineering Conference in 2010. She is a member of the Society of Neurotrauma, the Society for Women Engineers, the Biomedical Engineering Society, and the Society for Biomaterials.

Scott Verbridge

Scott Verbridge, Ph.D., will serve as an Assistant Professor of Biomedical Engineering. During the past several years as a postdoctoral researcher at Cornell University, Dr. Verbridge has been applying his physics and engineering training towards studies of cancer. His particular interest has been to investigate, in-vitro, the physical, chemical and cellular drivers of the angiogenic switch by which tumors gain access to a blood supply. The broad goal of this research has been to leverage the degree of microenvironmental control enabled by engineered cancer models in order to gain insights that might improve clinical anti-angiogenic therapies.

At Virginia Tech he is excited to have the opportunity to continue with these studies in order to develop a broader understanding of cancer progression as it relates to cell-microenvironmental interactions. He will utilize complex cell culture platforms, combining microfabrication techniques with biomaterials, in order to study cancer evolutionary processes in the context of cellular response to microenvironmental stresses. A better understanding of these processes will undoubtedly lead to improved therapeutic strategies based on interventions targeted at the factors that drive the evolution of an aggressive tumor. Dr. Verbridge will furthermore utilize his expertise in nanotechnology gained during his PhD research, and specifically in the use of atomically thin graphene layers as mechanical structures, to develop new means of both controlling and studying cellular interactions down to the smallest biological size scales.

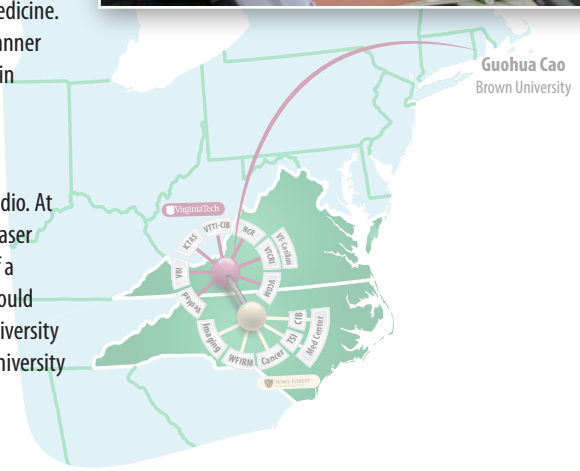
Guohua Cao

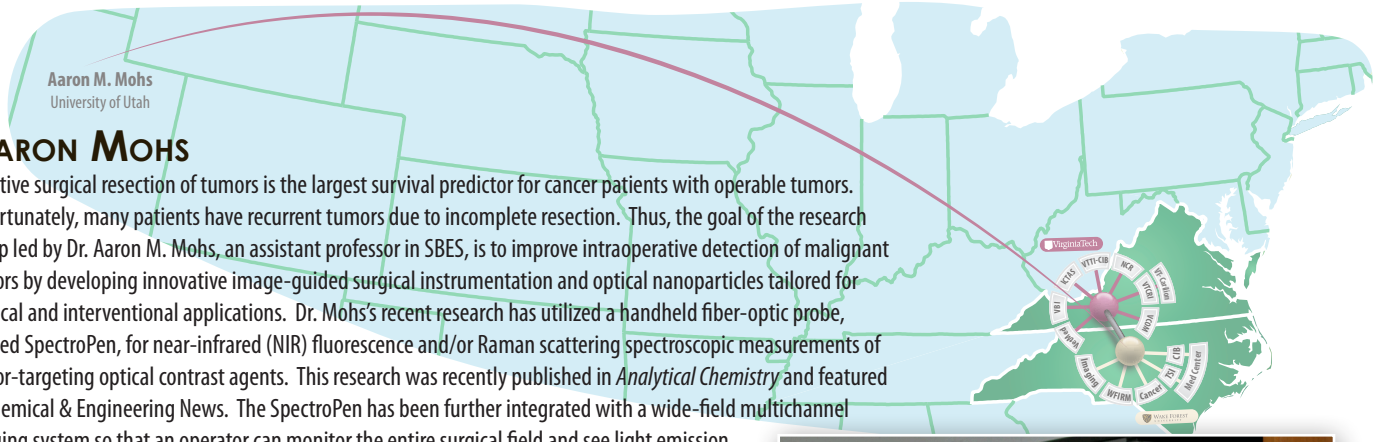


Dr. Guohua Cao an Assistant Professor of Biomedical Engineering, has worked as a research assistant professor and as both a postdoctoral scholar and fellow at Brown University and at the University of North Carolina at Chapel Hill in cutting-edge research related to biomedical engineering. He received a number of honors during this time. He earned the University of North Carolina's Postdoctoral Scholar Award for Research Excellence. In 2011, the Joint American Association of Physicists in Medicine and the Canadian Organization of Medical Physicists recognized his work with the Best in Physics Poster Award.

Among his major research projects, he has worked extensively on carbon nanotube x-ray technologies for cancer imaging and therapy. Within this area, he has led a multidisciplinary team from physics, biomedical engineering, applied sciences, and radiology on the development of the carbon nanotube dynamic micro-computed tomography (CT) scanner. The scanner is the world's best in obtaining dynamic high spatial and temporal resolution CT images of small animals. He has built two such state-of-art CT scanners for the biomedical research community, one installed at the UNC Biomedical Research Imaging Center, and another at the Department of Radiology at the University of Iowa Carver College of Medicine. He has also worked on developing a clinical-trial ready stationary digital breast tomosynthesis scanner for early breast cancer screening and a microbeam radiation therapy system for eradication of brain tumors.

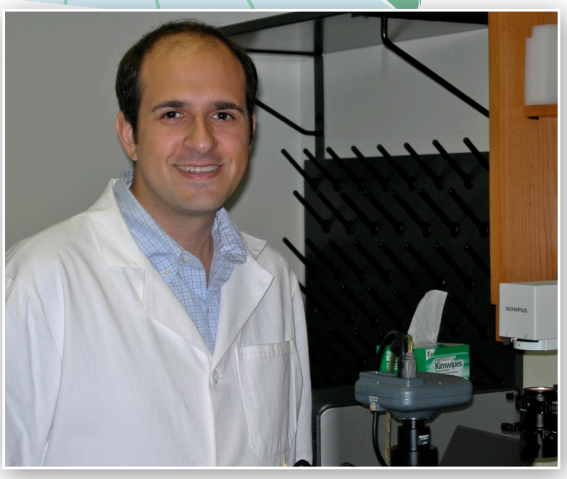
His work on developing carbon nanotube x-ray technologies has been featured in Nature, and the popular press, such as, The Economist, Technology Review, Discovery News, and German Public Radio. At Brown, Cao worked on early tumor detection with x-ray phase contrast imaging. He also studied laser enhancement of single bubble sonoluminescence, pioneering a study in search of laser heating of a sonoluminescing bubble to see if the deposition of laser energy into a sonoluminescing bubble would trigger thermo-nuclear fusion. Cao received his bachelor's degree in chemical physics from the University of Science and Technology of China in 1999 and his doctorate in physical chemistry from Brown University in 2005





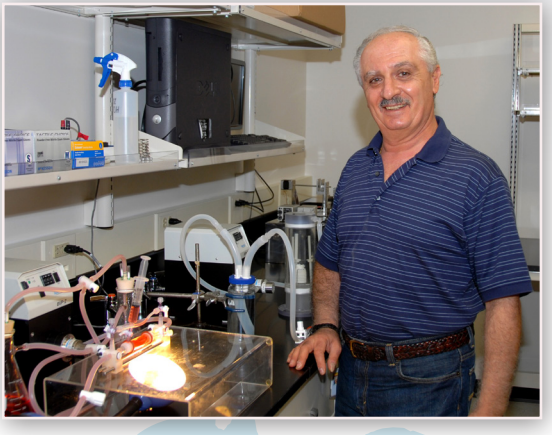
Aaron Mohs

Effective surgical resection of tumors is the largest survival predictor for cancer patients with operable tumors. Unfortunately, many patients have recurrent tumors due to incomplete resection. Thus, the goal of the research group led by Dr. Aaron M. Mohs, an assistant professor in SBES, is to improve intraoperative detection of malignant tumors by developing innovative image-guided surgical instrumentation and optical nanoparticles tailored for surgical and interventional applications. Dr. Mohs's recent research has utilized a handheld fiber-optic probe, termed SpectroPen, for near-infrared (NIR) fluorescence and/or Raman scattering spectroscopic measurements of tumor-targeting optical contrast agents. This research was recently published in *Analytical Chemistry* and featured in Chemical & Engineering News. The SpectroPen has been further integrated with a wide-field multichannel imaging system so that an operator can monitor the entire surgical field and see light emission from introduced contrast agents. Using the laser from the SpectroPen as a directed excitation source for the contrast agent, the surgeon can use the integrated system to locate a tumor, excise the tumor, and confirm removal. These technologies have shown promise in both mouse models of cancer and in canines with spontaneously occurring disease.



Dr. Mohs was recently awarded with an NCI K99/R00 Pathway to Independence Award in Cancer Nanotechnology Research. This grant supports future adaptation of the image-guided surgical instrumentation for minimally-invasive procedures and development of nanoparticles with fluorescence that specifically activates in the tumor microenvironment. The Virginia Tech - Wake Forest University SBES program in collaboration with the Comprehensive Cancer Center of Wake Forest University, and the Translations Sciences Institute provides the ideal environment to facilitate this multidisciplinary, collaborative, and translational research. He most recently completed his postdoctoral training as a Cancer Nanotechnology Distinguished Fellow in the Wallace H. Coulter Department of Biomedical Engineering at Emory-Georgia Tech.

Khalil Bitar



Dr. Bitar is the director of the Gastrointestinal (GI) Program at WFIRM. The GI program is a translational program that utilizes regenerative medicine approaches to potentially treat patients with deficiencies in the physiological functions of the GI tract. The program will utilize basic science information and apply it to the bioengineering and implantation of functional GI constructs generated from autologous cells. The program goals are intended to help pediatric, adult and geriatric patients.
Specific interests are:

- To study signal transduction pathways involved in gastrointestinal smooth muscle cells, and in particular, to examine agonist-induced recruitment of signal transduction molecules to the membrane of these cells.
- To study thin filament regulation of smooth muscle activity and provide a regenerative medicine approach to the treatment of gastric motility disorders in an ever expanding aging population.
- To develop regenerative medicine approaches to manufacture replacement parts for the human gastrointestinal tract. This has already resulted in manufacturing of different components. We have preliminary results indicating that bioengineered constructs from human IAS cells were able to co-culture with progenitor enteric neural cells. These human constructs were implanted successfully under the skin and in situ in nude mice. The bioengineered constructs were not rejected and were able to maintain all the characteristics of IAS.

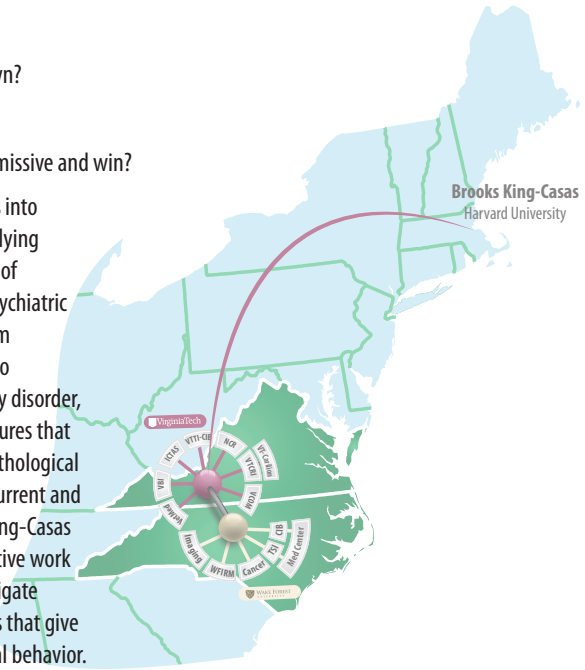
These proofs of concept reinforce a strong belief that this direction of our research offers new insight and possible therapeutic models (either direct injection or autologous implantation) for GI motility (fecal incontinence, sluggish motility associated with aging, LES) and possibly urinary incontinence. This also offers a new outlook for providing a better quality of life to children afflicted with aganglionic disorders (e.g., Hirschprung's disease).

Brooks King-Casas

Dr. Brooks King-Casas's lab addresses two broad areas of inquiry: (i) neural basis of valuation and learning in social settings, and, (ii) abnormalities of social valuation. He seeks insight into neural computations underlying normative social behavior using methods of decision neuroscience, behavioral economics, and social psychology. These approaches, when jointly brought to bear on complex social phenomena, provide tractable and clear answers about how humans make decisions about one another. To date, his experiments have addressed questions including:

- How do two people trust one another?
- How do individuals balance their own interests with the interests of others?
- How do people work together to enforce social norms, and when does this break down?
- Why are charitable instincts inhibited by the presence of others?
- Why is it more important for some individuals to be aggressive but lose, than be submissive and win?

He also seek insights into computations underlying social abnormalities of psychopathology. Psychiatric illnesses, from autism spectrum disorders to antisocial personality disorder, include primary features that can be studied as pathological social decisions. In current and planned work, Dr. King-Casas will leverage normative work in this area to investigate neural computations that give rise to aberrant social behavior.



Sarah McDonald

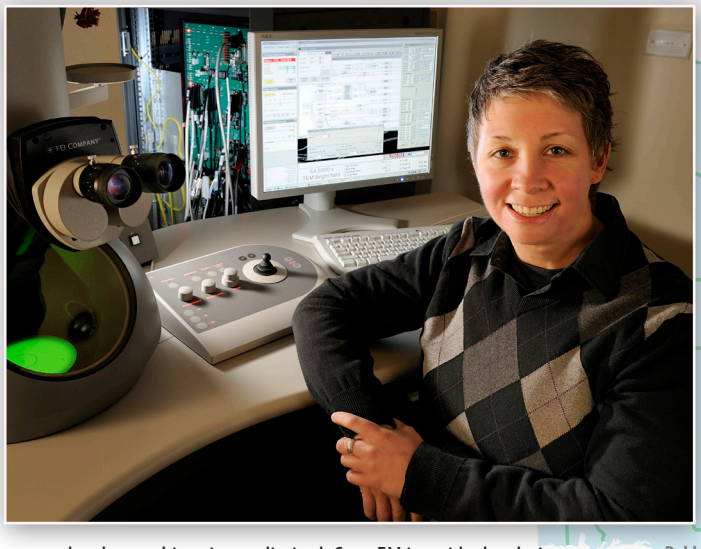
Understanding how viruses evolve as they replicate and spread in the human population is fundamentally important for effective disease control. Viruses with segmented, RNA genomes can undergo reassortment during co-infection, resulting in progeny with segments derived from more than one parent. These exchanges allow viruses to acquire advantageous genes and rapidly adapt to selective pressures. Yet, segment exchange between divergent strains requires that critical protein-protein interactions be maintained during viral replication. As such, gene reassortment is a mixed blessing-the advantage of increasing diversity is balanced by the disadvantage of unlinking co-evolved proteins that operate best when kept together. Dr. McDonald's lab research seeks to better understand the mechanism of gene reassortment for rotaviruses, which are segmented, double-stranded RNA viruses and important causes of severe gastroenteritis in young children. Specifically, we employ sequence-based and structure-function approaches to investigate the influence of viral protein-protein interactions on (i) the generation of rotavirus reassortants during co-infection and (ii) the fitness of reassortant strains in nature. These studies will enhance our ability to predict strain emergence and aid in rational vaccine design.

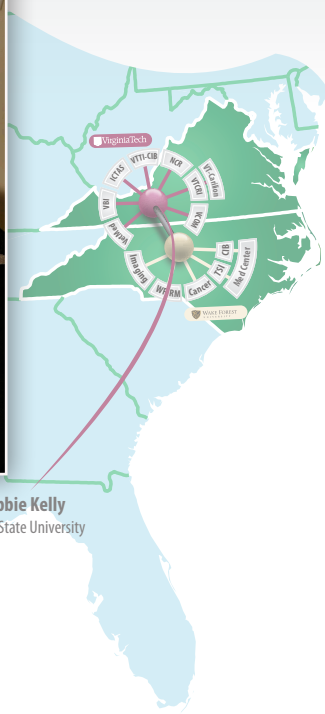
Jamie Tyler

Jamie Tyler studies fundamental properties of synaptic transmission, how these properties are modified by experience, and how best to control neuronal activity for making nervous systems more efficient.

In his primary area of focus, developing novel methods for the control of neuronal activity in intact brain circuits. To this end, he is engineering methods, devices, and applications for the use of pulsed ultrasound in the noninvasive remote control of brain activity. Dr. Tyler's expects his work to provide a backbone for the design and implementation of brain stimulation therapies useful in managing a host of neurological diseases. In a second set of investigations, he aims to better understand the manner by which natural activity patterns modify the strengths of sensory inputs. Here, the focus is on primary sensory circuits in the rodent olfactory system to study experience-mediated changes in sensory input gain and how these changes participate in the production of different behaviors.

Debbie Kelly





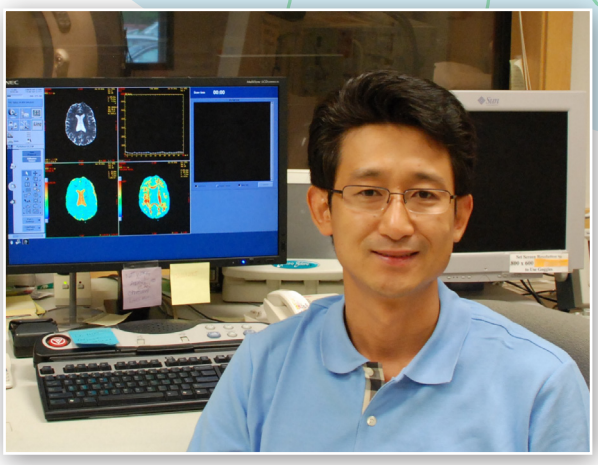
Debbie Kelly
Florida State University

Dr. Kelly's research focuses on developing innovative methodologies to examine cellular machinery using cryo-Electron Microscopy (EM). In particular, She is interested in using a combination of structural and functional tools to understand how signaling pathways influence human development and disease.

Many important cellular events are mediated by large, dynamic complexes, which are impractical for NMR studies or are too unstable for crystallization. Therefore, structural information on many macromolecular machines is very limited. Cryo-EM is an ideal technique to visualize protein assemblies, such as ribosomes, at sub-nanometer resolution. Still, a major obstacle in the field is that many active cellular complexes are too labile or in too low abundance for conventional purification schemes.

To address this issue, they developed the monolayer purification method and the functionalized Affinity Grid, that make it possible to rapidly purify complexes from crude cell lysates directly onto an EM Grid. These novel techniques provide a powerful approach for gathering structural information of functional cellular machines and allow us to examine biological processes in a completely new way. Dr. Kelly is now applying this technology to isolate rare stem cells from normal and cancerous tissues. This requires affinity matrices that can be used in conjunction with microfluidic devices to capture and image cells under various growth conditions. She anticipates the knowledge gained from this line of research will shed light on the early events of stem cell commitment and of cancer formation.

Youngkyoo Jung
University of California, San Diego

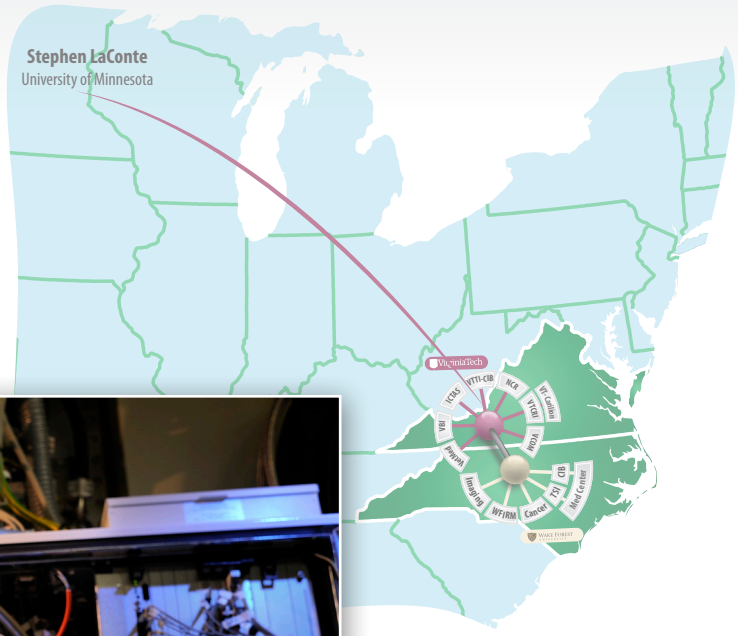


Youngkyoo Jung

Magnetic resonance imaging (MRI) is a non-invasive tool that can aid in the diagnosis and basic scientific understanding of our body system. The technology can also assess brain activation patterns evoked by specified stimuli by the means of functional MRI (fMRI). Dr. Youngkyoo Jung received his Ph.D degree from the University of Wisconsin–Madison where his research was focused on methods for high resolution neurological magnetic resonance imaging. His research interests also extended to parallel imaging, where he developed a novel method to accelerate data acquisition speed. His postdoctoral research at University of California, San Diego, was focused on cerebral blood flow imaging and high resolution functional MRI. His research in San diego was dedicated to developing a new cerebral blood flow imaging method and extending it to applications such as fMRI and white matter perfusion. As an MRI physicist at Wake Forest School of Medicine, his primary research interest is focused on technical developments of neurological applications, such as high resolution fMRI, blood flow imaging, and diffusion tensor imaging acquisition and reconstruction methods. These areas are essential for understanding physiological mechanisms of the brain and investigating pathophysiology in various cerebrovascular and neurodegenerative diseases. In the field of MRI physics he has been published 12 original research papers, presented 44 conference abstracts, and invented 3 patents licensed to GE Healthcare.

Stephen LaConte

Research in the LaConte lab is devoted to advanced neuroimaging acquisition and data analysis approaches, aimed at understanding and rehabilitating neurological and psychiatric diseases. A major focus of the lab is an innovation in functional magnetic resonance imaging (fMRI) which we developed and call "temporally adaptive brain state" (TABS) fMRI. The inception of TABS arose from two major recent advances in neuroimaging, namely 1) the recognition that multi-voxel patterns of fMRI data can be used to decode brain states (determine what the volunteer was "doing" – e.g. receiving sensory input, effecting motor output, or otherwise internally focusing on a prescribed task or thought) and 2) continued advances in MR imaging systems and experimental sophistication with fMRI that have led to the emergence of real-time fMRI as a viable tool for neurofeedback.

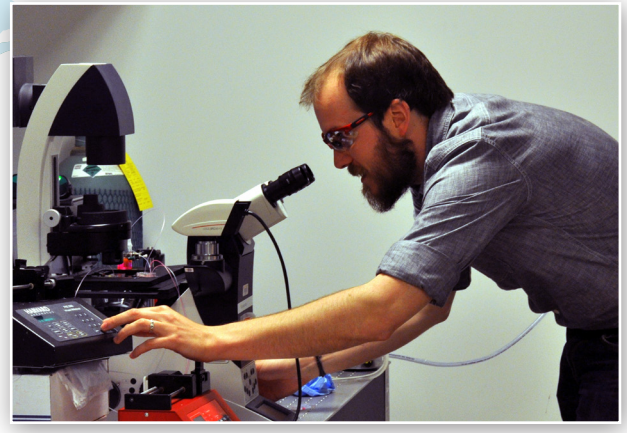


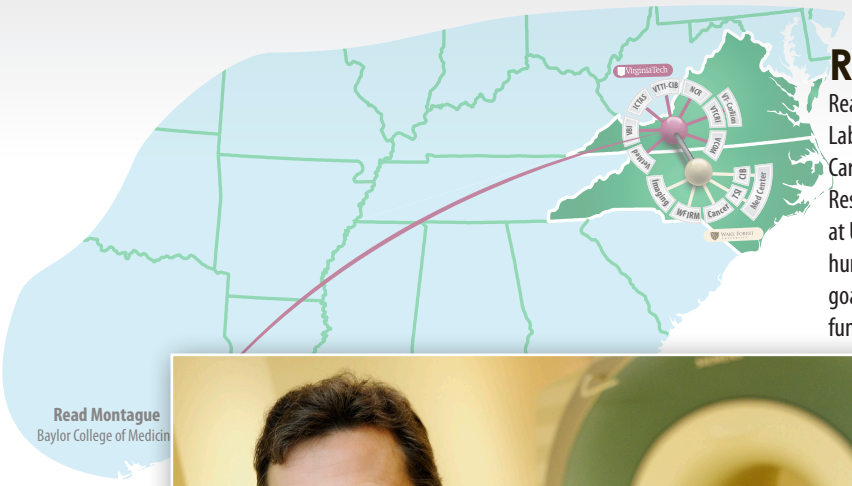
Doug Holmes

Douglas P. Holmes received his doctorate in polymer science and engineering in 2009 from the University of Massachusetts, Amherst, and spent the next two years as a postdoctoral research associate at Princeton University. During his doctoral studies he developed rapid, responsive surfaces inspired by the snapping leaves of a Venus flytrap, and studied the wrinkling and folding of ultrathin polymer films.

At Princeton, he worked on elasto-fluid interactions in the Complex Fluids Group. He investigated the mechanics of surface area regulation of cell membranes including the absorption of vesicles and the formation of tethered nanotubes. Holmes also studied deformations and dynamics of thin, elastic plates in response to nonhomogenous strains. These dynamical responses include the bending, twisting, and snap-buckling of soft materials films, and were used in the creation of a flexible, self-regulating microfluidic device.

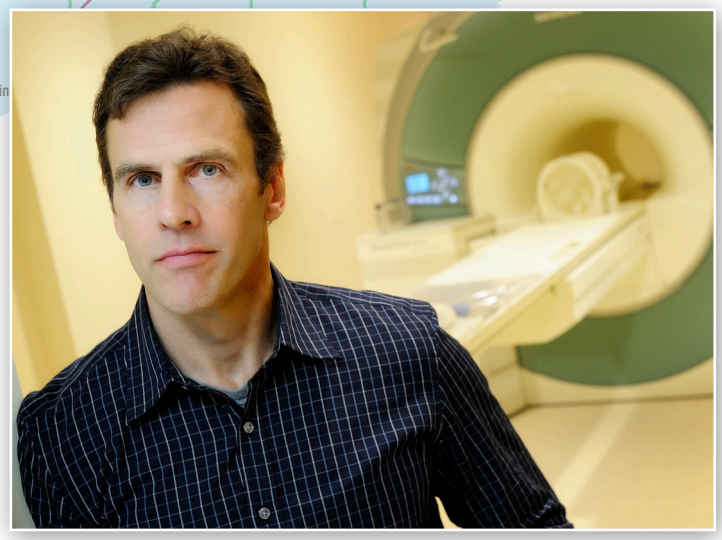
His research has been published in the *Proceedings of the National Academy of Sciences, Physical Review Letters, Advanced Materials,* and *Soft Matter*, and his work has been featured in the popular press, including: "Erasing wrinkles, the physicists' way," *Science News*; "Physicists tackle wrinkles," Discovery News; "Ironing out the wrinkles," Physics; "Venus flytrap inspires snapping lens, " Discovery News; and "Snappy Transition: Venus flytrap inspires new materials," Science News.





Read Montague

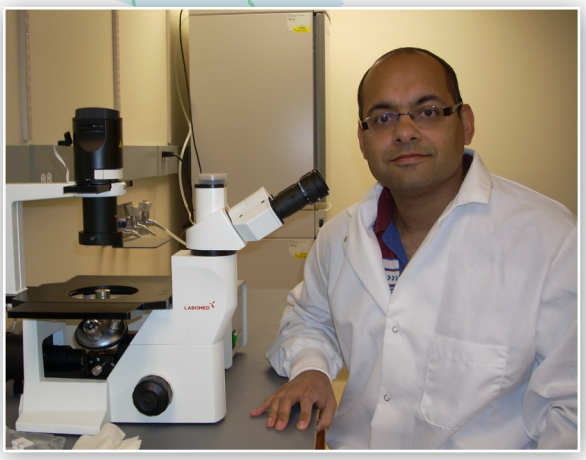
Read Montague is the founding Director of the Human Neuroimaging Laboratory and the Computational Psychiatry Unit of the Virginia Tech Carilion Research Institute. He also holds a Wellcome Trust Principal Research Fellowship at The Wellcome Trust Centre for Neuroimaging at University College London. Dr. Montague's work centers broadly on human social cognition, decision-making, and willful choice with a goal of understanding the detailed underlying neurobiology of these functions in health and disease. Montague's work particularly focuses on computational neuroscience – the connection between physical mechanisms present in real neural tissue and the computational functions that these mechanisms embody. His laboratory uses theoretical, computational, and experimental approaches to these issues. In particular, the group now employs novel approaches to functional neuroimaging, new biomarkers for mental disease, spectroscopy, real-time voltammetry, and computational simulations. Montague also directs the Roanoke Brain Study (RBS), a project aimed at understanding decision-making through the lifespan and its relationship to brain development, function, and disease. Work in the laboratory is supported by the National Institutes of Health, National Science Foundation, The Kane Family Foundation, Autism Speaks, The MacArthur Foundation, The Dana Foundation and the Wellcome Trust.



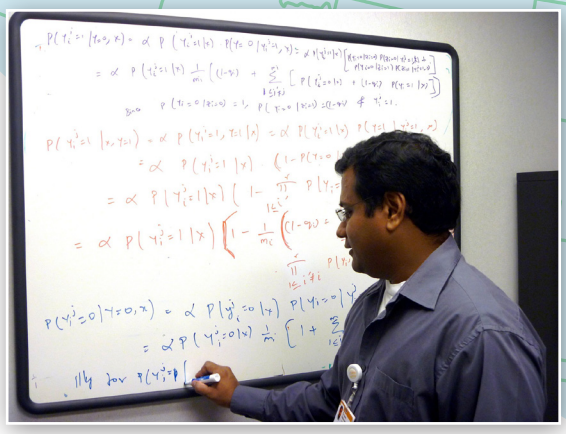
Konark Mukherjee

Role of Synaptic-signaling in neuro-development.

Neurodevelopment proceeds through a series of events culminating into formation of productive neuronal network. One of the key final steps in neurodevelopment is refinement of transient connections i.e. strengthening and weakening/ elimination of transient synapses, which depends on their individual activity. These highly plastic changes in transient synapses require activity-dependent signaling. Proteins involved in synaptic plasticity are obvious effector molecules involved in synaptic pruning or refinement. The goal of Mukherjee Laboratory is to investigate the role of synaptic molecule in neurodevelopment. Current projects use both mouse and fly models to address this issue, with an emphasis on pre-synaptic protein CASK. Mutations in CASK are often associated with X-linked mental retardation and ponto-cerebellar hypoplasia. The major thrust of the laboratory is to develop cell biological assays using primary neuronal culture to dissect out the pathways that are crucial for neurodevelopment.

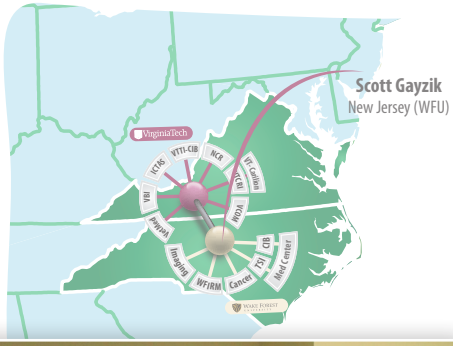


Sriraam Natarajan
Oregon State University



Sriraam Natarajan

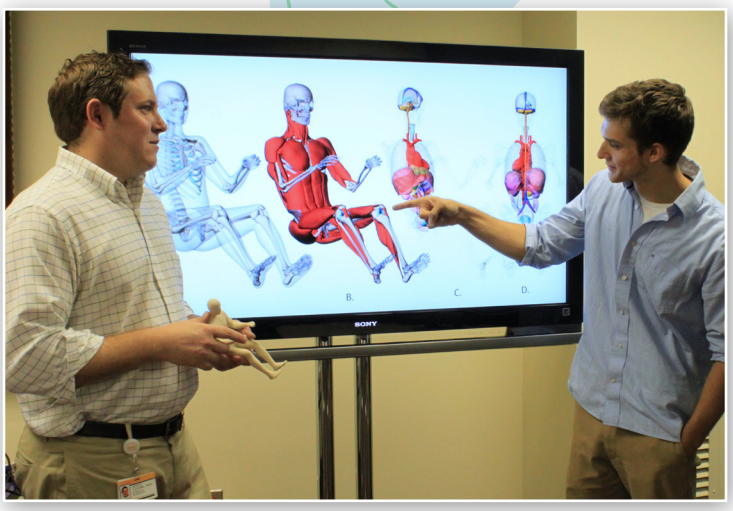
Dr. Natarajan is interested in making smart machines that can be used reliably by humans in everyday life. Artificial Intelligence (AI) has made tremendous progress since the days of expert systems and has advanced the research in several areas - cognitive science, natural language processing, game theory, machine learning, speech recognition, activity recognition and decision-theory to mention a few. Historically, AI has used either the logical approach (to address structured problems) or the statistical approach (to handle uncertainty). Recent years have witnessed a tremendous development of techniques to handle large-scale, structured and uncertain domains. His research interests lie in the advancement and application of algorithms from the exciting combination of logical and statistical AI in several related areas and can be divided into three intersecting themes - (i) Efficient Statistical Relational Learning: Traditional machine learning approaches assume that examples are generated uniformly and independently from a large pool of data. This assumption may not be applicable in several real-world problems. Instead, it is common to observe rich relational structure in data. For example, in the medical domain, a strong relationship exists between doctors, patients, symptoms, diagnoses, and prescribed drugs. He considers the problem of learning in the presence of rich, multi-relational, semi-structured data. (ii) Decision Theoretic Learning: The goal of Reinforcement Learning (RL) is to build learning agents that are connected to their environments through perception and action. They use RL in two different kinds of problems - one in which the agent explores the environment and learns to act and the second in which an expert provides training to the agent and the agent learns to mimic the expert. (iii) Application of the above ideas for bio-medicine - in particular, he is interested in predicting heart attacks of patients in adulthood given their attributes in their early youth. He is also working on developing smart communicative devices for people with Dementia, Alzheimer's, Autism etc.



Scott Gayzik

Dr. Scott Gayzik joined the SBES faculty in July of this year. His areas of expertise are computational biomechanics, geometric morphometrics, and medical imaging applications in biomechanics. He previously worked as a senior research associate in the Virginia Tech – Wake Forest Center for Injury Biomechanics. An alumnus of both Virginia Tech and Wake Forest, Dr. Gayzik received his undergraduate and Master's degrees in the department of Mechanical Engineering at Virginia Tech. He later completed his PhD work in the Center for Injury Biomechanics at Wake Forest ('08). His dissertation focused on the development of a computationally-based injury metric for predicting lung contusions.

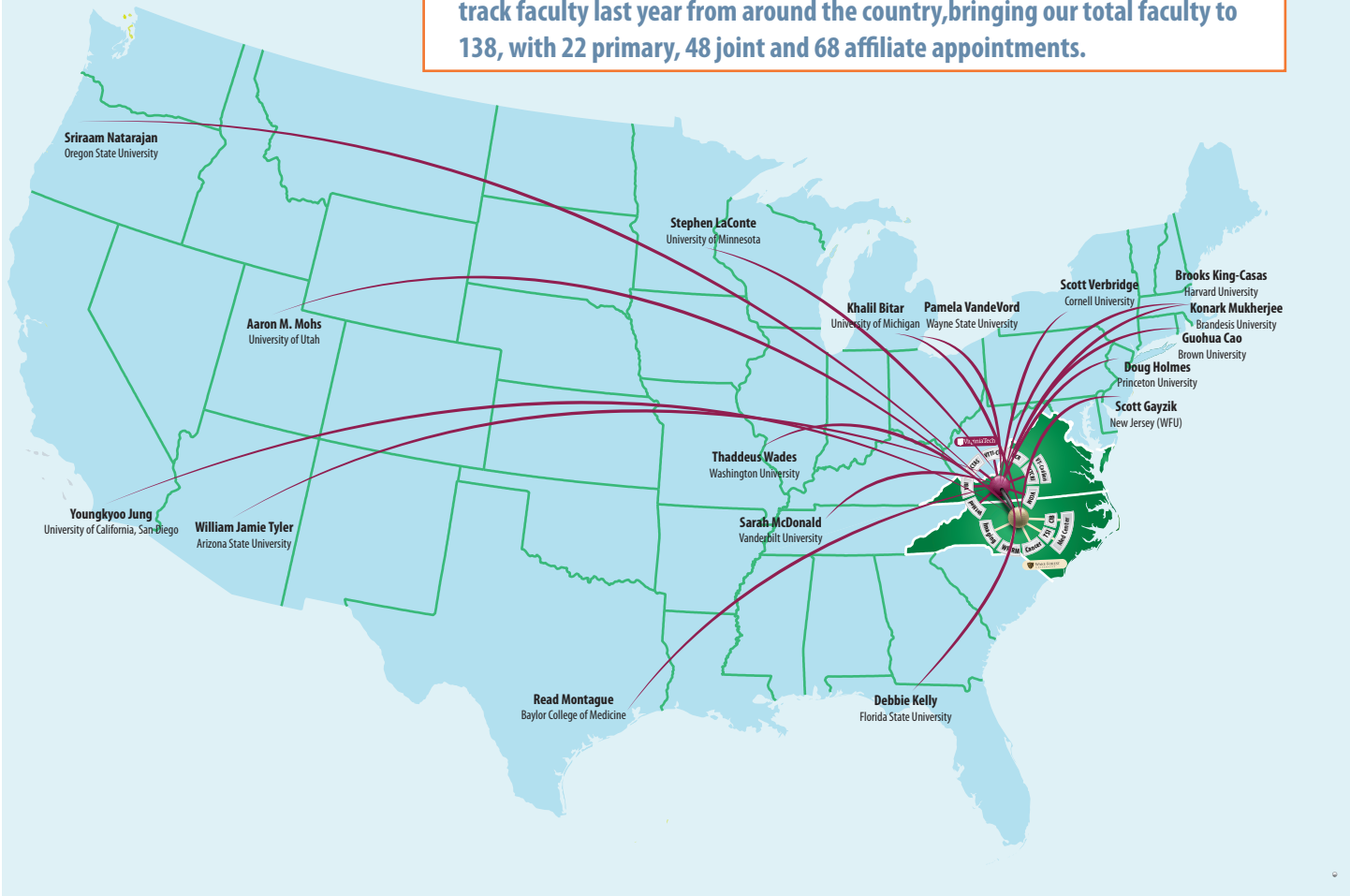
Dr. Gayzik's current research focuses on the Global Human Body Models Consortium (GHBMC) project, where he serves as technical lead of the Integration Center at Wake Forest University. The project's goal is to develop the next-generation family of computational human body models for injury prediction and prevention in simulated impact environments. It is sponsored by a consortium of ten automotive manufacturers and suppliers and will enter its second phase in late 2011. He is the recipient of several awards in the field of computational biomechanics, including the Best Student Paper at the Stapp Car Crash Conference. Dr. Gayzik and his team at Wake Forest were also recently awarded the 2010 Mimics Innovation Award for their work the GHBMC project.



Thaddeus J. Wadas

Thaddeus J. Wadas received his B.S. degree in Biology and a second major in Chemistry from King's College, Wilkes-Barre, Pa. He pursued graduate study at the University of Rochester, Rochester, NY where he received his M.S. and Ph.D. degrees in Chemistry under the supervision of Richard Eisenberg, Ph.D. His Ph.D. work focused on the synthesis and characterization of luminescent Pt(II) acetylide complexes for photo-induced charge transfer and light-to-chemical energy conversion. On completion of his Ph.D. he moved to the Washington University School of Medicine in St. Louis, MO to pursue postdoctoral studies with Carolyn Anderson, Ph.D. and develop targeted radiopharmaceuticals for diagnostic imaging and radiotherapy. In 2005 he was the recipient of a National Institutes of Health National Research Service Award (NRSA) Fellowship to study bone metastasis imaging with copper-64-labeled peptides, in 2009 he was promoted to the position of Instructor at the School of Medicine and in 2011 he joined the Department of Cancer Biology at the Wake Forest School of Medicine. Additionally, he serves as an Associate Editor of the American Journal of Nuclear Medicine and Molecular Imaging, he is an ad hoc reviewer for the Prostate Cancer Society of Australia, and he is a member of the Wake Forest Comprehensive Cancer Center and the Society of Nuclear Medicine's Web Site Task Force. His current research interests include the application of combinatorial display methods to radiopharmaceutical development and the use of nanoparticles in multimodal imaging agent development.

Our Biomedical Engineering program added 17 new tenured and tenure track faculty last year from around the country,bringing our total faculty to 138, with 22 primary, 48 joint and 68 affiliate appointments.



2 SBES Faculty Receive NSF Career Awards

Rafael Davalos

Davalos, a primary biomedical engineering faculty member, co-invented irreversible electroporation (IRE), a new minimally invasive technique to kill tissue by delivering a series of low-energy electric pulses to the targeted tissue. He will specifically look at whether IRE procedures can be adapted for the destruction of special tumors called glioblastoma multiforme, the most common and aggressive type of primary brain tumor in humans. The median survival for people diagnosed with these tumors is only 15 months. The team, includes Tom Ellis from the Neurosurgery Department at Wake Forest & John Rossmeisl & John Robertson at Virginia-Maryland Regional College of Veterinary Medicine, & Paulo Garcia at Virginia Tech, has already helped several canine patients with brain tumors.

"One of the reasons for the poor survival is that glioma cells typically infiltrate up to two centimeters beyond the volume of visible tumor," Davalos explained. Since the electric field dissipates from the electrode, the process gives rise to regions of reversibly electroporated cells outside the ablation zone. These cells may then be more susceptible to the uptake of drugs.

"We propose to assess IRE's capacity to treat infiltrative cells within this reversible zone when combined with chemotherapeutic agents. Treatment of malignant gliomas is also limited by insufficient delivery of drugs due to the blood-brain-barrier. Therefore, this plan will also investigate whether IRE can be applied to mediate blood-brain-barrier disruption to aid in the delivery of chemotherapeutic agents," Davalos said.

Alexander Leonessa

Leonessa, an assistant professor of mechanical engineering and core biomedical engineering faculty, is developing a small device that could use functional electrical stimulation on the paralyzed vocal folds of stroke patients or others who have lost the ability to talk, or even swallow and breathe properly. "The device has the potential of improving the quality of life for patients with vocal paralysis, or neuromuscular disabilities, including traumatic brain injury, multiple sclerosis, cerebral palsy and Parkinson's disease," he said.

Leonessa plans to develop a portable, noninvasive device that can be adjusted to each patient. The device itself would be no larger than an iPod, clipped to the belt, and have small wires leading to a patch over the patient's throat. An Atlanta-based tech company will help develop the device, which will come later in the five-year study if the use of electrical stimulation on the vocal folds holds promise for muscle and nerve rejuvenation.

"Breathing and swallowing have received much attention for patients with vocal fold paralysis, but vocalization is still considered an open problem with unresolved issues due to the complexity of the larynx and the difficulties in stimulating the relevant muscles, without invasive surgeries, given their depth in the neck," said Leonessa. "The proposed development of a robust control strategy in cooperation with voice-driven data acquisition and a novel electrode array for stimulation purposes will provide a solution to these issues."

Faculty

Our Biomedical Engineering program involves 138 faculty:
70 tenure track biomedical engineering faculty (22 primary and 48 joint appointments)
68 affiliate biomedical engineering faculty at Virginia Tech and Wake Forest University.

Anthony Atala, MD
Professor, *Clinical Translation of Regenerative Medicine*
SBES Core/WFIRM

Bahareh Behkam, PhD
Assistant Professor, *Biophysics, Microbial Motility and Adhesion, Medical Devices*
SBES Core/ME

Khalil Bitar, PhD
Professor, *Regenerative Medicine Gastrointestinal Translational Prgram*
SBES Core/WFIRM

J. Daniel Bourland, PhD
Professor, *3D Radiation*
SBES Core/Radiology

Guohua Cao, PhD
Assistant Professor, *Medical Imaging, Medical Physics*
SBES Primary

David Carrol, PhD
Associate Professor, *Nanotechnology, Molecular Materials*
SBES Core/Physics

George Christ, PhD
Professor, *Muscle Physiology, Bioreactors*
SBES Core/ WFIRM

Rafael Davalos, PhD
Associate Professor, *Microdevices, Electroporation, Biotransport*
SBES Primary

Raffaella De Vita, PhD
Assistant Professor, *Constituitive Modeling, Cardiovascular Mechanics*
SBES Core/ESM

Tom Diller, PhD
Professor, *Bioheat Transfer, Thermal Sensors*
SBES Core/ME

Daniel Dudek, PhD
Assistant Professor *Biomaterials/ Bioinspiration*
SBES Core/ ESM

Stefan Duma, PhD
Professor & Head *Auto Safety, Sports, Military, Biomechanics*
SBES Primary

Mike Friedlander, PhD
Director, Virginia Tech Carilion Research Institute *Neurosciences*
SBES Core/ VTCRI

H. Clay Gabler, PhD
Professor, Center for Injury Biomechanics *EDR, Crash, Alcohol Studies*
SBES Primary

Skip Garner, PhD
Director, Virginia Bioinformatics Institute *Applied computational biology*
SBES Core/ VBI

Scott Gayzik, PhD
Assistant Professor, *Computational Modeling, Imaging, Biomechanics*
SBES Primary

Yaorong Ge, PhD
Assistant Professor, *Imaging Informatics & Decision Support*
SBES Primary

Aaron S. Goldstein, PhD
Associate Professor, *Biomaterials, Tissue Eng. Mechanotransduction*
SBES Core/CHE

J. Wallace Grant, PhD
Professor, *Mathematical Modeling of Inner Ear, Vestibular Mechanics*
SBES Core/ESM

Craig Hamilton, PhD
Interim BME Chair and SBES Associate Head, *Cardiovascular MRI, Biosignal Processing*
SBES Primary

Warren Hardy, PhD
Associate Professor, Center for Injury Biomechanics *Neurotrauma, Thorax, Spine*
SBES Core/ME

Ben Harrison, PhD
Assistant Professor *Tissue Engineering*
SBES Core/WFIRM

Doug Holmes, PhD
Assistant Professor, *Soft Material Mechanics, Biomimetic Structures*
SBES Core/ESM

Youngkyoo Jung, PhD
Assistant Professor, *Magnetic Resonance Imaging Physics*
SBES Core/ Radiology

Debbie Kelly, PhD
Assistant Professor,
Visualizing Molecular Architecture
SBES Core/ VTCRI

Robert Kraft, PhD
Assistant Professor,
Quantitative MR Imaging
SBES Primary

Brooks King-Casas, PhD
Assistant Professor,
MRI and Decision Neuroscience
SBES Core/ VTCRI

Stephen LaConte, PhD
Assistant Professor,
VT Carilion Research Institute
Neurosciences
SBES Primary/ VTCRI

YongWoo Lee, PhD
Associate Professor,
Biomedical Applications for Nanotechnology & Disease
SBES Primary

Alexander Leonessa, PhD
Associate Professor,
Human robot interactions
SBES Core/ME

Thurmon Lockhart, PhD
Associate Professor,
Locomotion Research, Balance, Biomechanics
SBES Core/ISE

Chang Lu, PhD
Associate Professor,
Microfluidics for single cell analysis
SBES Core/ChE

Michael Madigan, PhD
Associate Professor,
Dynamics & Control of Human Movement
SBES Core/ESM

Roop Mahajan, PhD
Director, Institute for Critical Technologies and Applied Sciences
Nanomedicine
SBES Core/ ICTAS

Sarah McDonald, PhD
Associate Professor,
Rotavirus Replication and Evolution
SBES Core/ VTCRI

Aaron M. Mohs, PhD
Assistant Professor,
Nanotechnology, Image-guided Surgery, Molecular
SBES Primary

Read Montague, PhD
Director, *Human Neuroimaging Lab & Computational Polychiatry Unit*
SBES Core/VTCRI

Konark Mukherjee, PhD
Assistant Professor,
Role of Synaptic-signaling in Neuro-development.
SBES Core/VTCRI

Michael Munley, PhD
Associate Professor,
Radiation Effects, Molecular Imaging, Radiation Therapy
SBES Core

T.M. Murali, PhD
Associate Professor,
Computational Systems Biology, Network Algorithms, Data Mining
SBES Core/CSE

Amrinder Nain, PhD
Assistant Professor
Cellular dynamics Aligned deposition of polymeric nano/microfibers
SBES Core/ME

Sriraam Natarajan, PhD
Assistant Professor,
Artificial Intelligence, Machine Learning, Probabilistic Modeling
SBES Core/TSI

Maury A. Nussbaum, PhD
Professor, *Occupational Biomechanics & Ergonomics, Balance, Aging*
SBES Core/ISE

Padma Rajagopalan, PhD
Associate Professor, *3D Tissue Mimics, Polymeric Scaffolds, Biopolymers*
SBES Core/CHE

John Robertson, PhD
Professor,
Cancer therapy, Organ Transplantation/ Regeneration
SBES Core/Vet Med

John Rossmeisl, PhD
Assistant Professor,
Novel Therapies for Malignant Glioma
SBES Core/Vet Med

Christopher Rylander, PhD
Assistant Professor, *Optical Devices for Imaging & Therapeutics, Biotransport*
SBES Primary/ME

M. Nichole Rylander, PhD
Associate Professor,
Nanotechnology, Bioheat Transfer, Cancer Therapies
SBES Primary/ME

Faculty Cont.

Pete Santago, PhD
Professor,
Image & Signal Analysis, Mach. Learning & Pattern Recognition
SBES Primary

Justin Saul, PhD
Assistant Professor,
Biomaterial Scaffolds, Controlled Release Systems
SBES Primary

Katherine Saul, PhD
Assistant Professor, *Musculoskeletal Biomechanics & Control, Human Movement*
SBES Primary

Thomas Smith, PhD
Professor,
Orthopaedic
SBES Core/Orthpaedic

Jake Socha, PhD
Assistant Professor, *Internal Flow Sys. in Animals Gliding Flight in Vertebrates*
SBES Core/ESM

Shay Soker, PhD
Associate Professor, *Stem Cell, Vascular Biology*
SBES Core/WFIRM

Jessica Sparks, PhD
Assistant Professor, *Liver Biomechanics, Impact Injury, Surgical Simulation*
SBES Primary

Anne E. Staples, PhD
Assistant Professor,
Biological Fluid Dynamics, Biomechanics
SBES Core/ESM

Joel Stitzel, PhD
Professor, Center for Injury Biomechanics
Modeling, Imaging, CIREN
SBES Primary

Mark Stremler, PhD
Associate Professor,
Fluid Mechanics in Microscale and Biological Systems
SBES Core/ESM

William Jamie Tyler, PhD
Assistant Professor,
Neurosciences
SBES Primary/VTCRI

Pamela VandeVord, PhD
Associate Professor,
Cellular Injury, Neurotrauma and Biomaterials
SBES Primary

Mark Van Dyke, PhD
Associate Professor,
Biomaterials
SBES Core/WFIRM

Scott Verbridge, PhD
Assistant Professor,
Engineering the Cancer Microenvironment
SBES Primary

Pavlos P. Vlachos, PhD
Professor, *Fluid Biomechanics, Cardio and Vascular Flow Analysis*
SBES Core/ME

Thaddeus Wadas, PhD
Assistant Professor,
PET, Molecular Imaging, Radiochemistry
SBES Core

Ge Wang, PhD
Samuel Reynolds Pritchard Professor, *X-Ray & Computed Tomography, Inverse Problems*
SBES Primary

Abby Whittington, PhD
Assistant Professor
Biopolymers, Controlled Release Drug Delivery
SBES Core/ChE and MSE

Christopher Wyatt, PhD
Associate Professor,
Biomedical Image Analysis
SBES Core/ECE

Yong Xu, PhD
Associate Professor,
Optics, Computational Electrodynamics
SBES Core/ECE

Jason Xuan, PhD
Associate Professor,
Systems & Computational Biology, Bioinformatics, Cancer Research
SBES Core/ECE

James Yoo, MD, PhD
Associate Professor
Tissue Engineering
SBES Core/WFIRM

Dr. Hengyong Yu, PhD
Assistant Professor
Computed tomography, Medical Image Processing
SBES Core/Radiology

BMES Chapter Wins Meritorious Award

Cara Buchanan, Club Co-President 2010-2011

The VT-WFU BMES Student Chapter has been selected by the BMES Student Affairs Committee as the 2011 recipient of the BMES Student Chapter Meritorious Award. This award is given to the student chapter that shows evidence of outstanding work performance in enhancing BME professional awareness and education of their members, among other qualities throughout the year. To be competitive for the Meritorious Achievement Award, it is expected that the chapter qualify in all major sections of chapter development (Administration, Programs, Professional Development, Public Relations, and Department Development) and present significant and unusual progress in contributing towards the biomedical engineering profession and education. The award will be presented to the chapter during the annual BMES Meeting this fall in Hartford, CT.

A BMES member from the Wake Forest campus, Julie Steen giving an oral presentation at the symposium.

The Virginia Tech-Wake Forest University BMES Student Chapter is a graduate student-run organization that was founded in 2009 to promote personal and professional development of students in the SBES department. The chapter mission is to encourage the development, dissemination, integration, and utilization of knowledge in biomedical engineering. This is achieved through a variety of chapter activities including service projects, community outreach, social events, and professional development. Currently, there are 65 chapter members, 41 of which are national members who participate annually at the national BMES meeting. Undergraduate recruitment will become a focus in the next few years with help from the upcoming BME minor at Virginia Tech and undergraduate researchers in our labs. Each fall, new officers are nominated and elected by the members of the student chapter, with four student-appointed officers at each campus.

Professional Development

One of the main responsibilities of the VT-WFU BMES Student Chapter is to plan the annual SBES Graduate Student Research Symposium. Responsibilities for the symposium include booking the venue, organizing abstracts, planning the event schedule, and finding sponsorship. On May 12, 2011, the VT-WFU BMES Student Chapter hosted the annual SBES Graduate Student Research Symposium in Blacksburg, VA. This was the second year that the event has been organized by the chapter, in which 27 graduating students gave oral presentations and over 50 students presented posters on topics including biomechanics, biomedical imaging, cell and tissue engineering, and other emerging technologies. Over 150 students and faculty from both campuses were in attendance at the symposium, including researchers from the Wake Forest Institute for Regenerative Medicine, the WFU Comprehensive Cancer Center, and the Virginia-Maryland Regional College of Veterinary Medicine. The 2011 SBES Symposium industry sponsors included Cook Medical, the National Biomedical Engineering Society (BMES), Medtronic, and Materialise. Representatives from each company and organization attended the symposium and were provided exhibition tables to interact with students and faculty during the poster sessions. To further promote professional development, the chapter also plans seminars each semester where SBES alumni, faculty, or other affiliates present current research and career opportunities.

BMES Chapter members served as judges and showcased biomedical engineering at the New River Valley First Lego League Tournament.

Community Outreach and Service Projects

BMES members are actively involved with the local scientific community by volunteering at numerous science fairs and tournaments to engage and interest young children in biomedical engineering. Exhibitions have included demos such as making hydrogel scaffolds used to regenerate tissue in the lab, extracting DNA from apples to learn about molecular analysis, examining changes in body temperature using a thermal camera, and measuring brainwave activity playing the brain game. The chapter also participates in community service projects such as VT's Big Event and Operation Christmas Child. To learn more about the VT-WFU BMES Student Chapter and view upcoming events, please visit our website. www.sbes.vt.edu/bmes

WFU EMBS Chapter Wins the Outstanding Performance Award

Jennifer Jordan, Club President 2010-2011

Jennifer Jordan, Meghan Vidt and Melissa Daly

The Wake Forest University Engineering in Medicine and Biology Society (EMBS) student club was named the 2010 recipient of the Outstanding Performance Award for a Student Club or Chapter from the IEEE-EMB Society. Three student members of the club's executive board (Jennifer Jordan, Meghan Vidt, and Melissa Daly) traveled to Buenos Aires, Argentina to receive their award at this year's EMB Conference. Criteria for award selection is competitive, and based on the educational promotion, community outreach and other activities. The Wake Forest EMBS club is honored to be chosen as this year's winner, and excited about the subsequent international recognition it brings to the SBES program.

Key to the award selection was our professional development activities that provide students with a variety of perspectives from academic and industry professionals from various stages of their careers. This fall our student membership shared some of their research with the community through the IEEE section meeting presentations. Furthermore, with the generous funding provided by the EMBS Chapter Activities Funding Program, the WFU EMBS student club invited members of the Winston-Salem IEEE section to serve as panelists for a discussion with students. Each of the four panelists shared their unique experiences as engineers in the medical industry.

The EMBS Executive Committee recognized the club's diverse activities including the prolific outreach to our neighboring community. The EMBS students have volunteered with a variety of local and national organizations. With the strong encouragement of SBES to continue serving our local community, our students have found volunteering to be rewarding and fun – not to mention a chance to spend time outside of the lab! In addition to education and professional development, these community service activities serve to enrich the personal development of the students and establish awareness of the need for continual community engagement.

Our 2nd Annual Penny War raised over $200 dollars which allowed us to provide home cooked meals for residents at the Winston-Salem Ronald McDonald House and purchase much needed bed linens for five rooms. Additionally, we hosted a booth at the regional Girl Scout Science, Technology, Engineering, and Mathematics (STEM) Education Day. We used this opportunity to interactively present information to young girls about biomedical engineering and opportunities for women in science. Club members also represented EMBS at a local elementary school's career day by discussing engineering and current research done by SBES students. Our club has chosen to work with the Second Harvest Food Bank of Northwest North Carolina which provides food for hungry people in 18 counties by providing a community garden maintained by volunteers. True to engineering fashion, our students wanted to become involved in all processes which meant getting our hands dirty!

We are looking forward to another year of successful activities, demonstrating our commitment to promoting biomedical engineering, leadership, and advancing the application of engineering to medicine and biology! We invite you to visit our website for the latest news and activities: http://ewh.ieee.org/sb/winston_salem/wfubmc/.

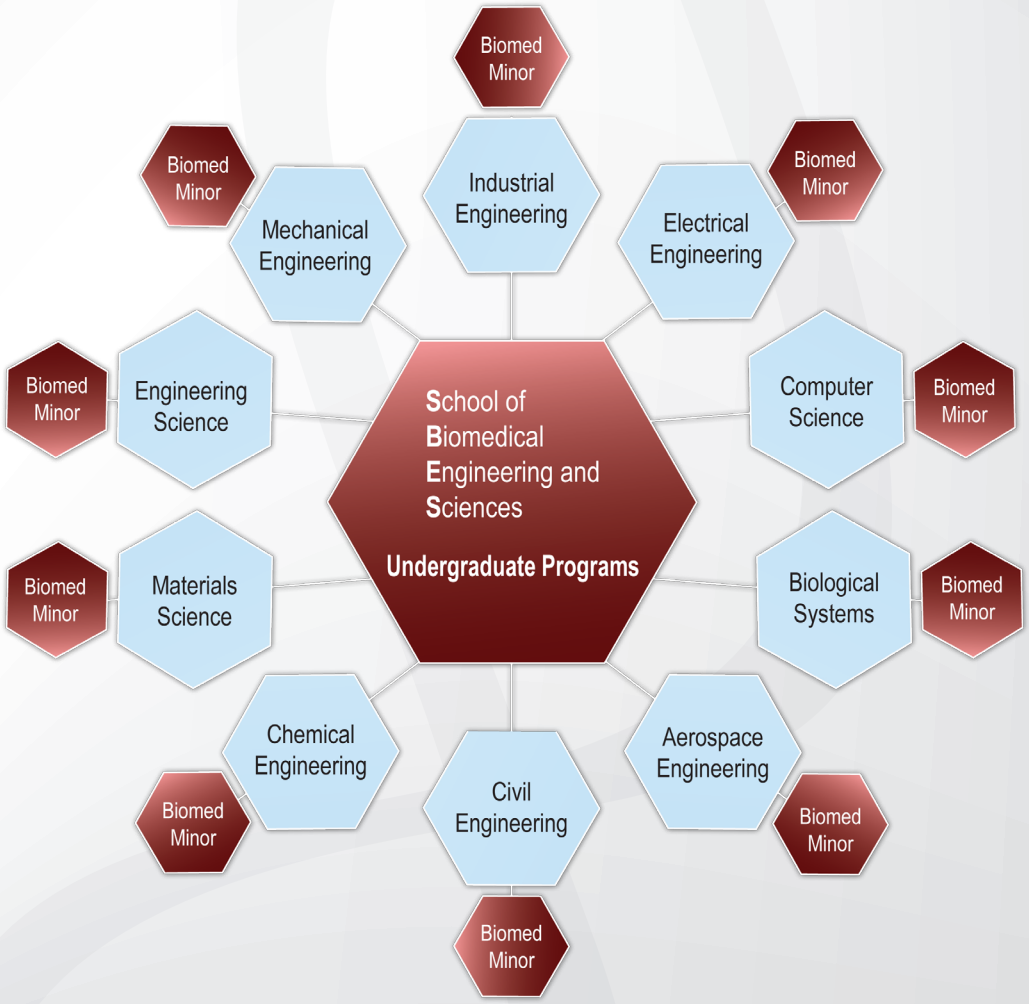
EMBS Chapter volunteers at the Community Garden for Second Harvest Food Bank.

SBES Announces Biomedical Minor for Undergraduates

SBES student Tea Andric (left) working with undergraduate Abasha Lewis.

We are extremely excited about the progress of our future Biomedical Engineering undergraduate degree program. The first phase of the process has been approved and SBES will begin offering minors of Biomedical Engineering in all of our current College of Engineering Departments. This highly selective minor program will allow our department to engage top undergraduate students in the College of Engineering. As an introduction, students will be required to enroll in a new course entitled Introduction to Biomedical Engineering, which will be offered in the spring semester. This course will introduce students to the broad spectrum of research areas that fall under the umbrella of biomedical engineering, emphasizing the multidisciplinary nature of biomedical engineering and the need for collaboration between clinicians, engineers, and life scientists. In addition to this course, students will be required to take a medical physiology course and choose from several biomedical relevant technical electives. A biomedical senior design topic will complete the 18 hours required to earn the minor. Updates will be posted on our website as we continue to advance as a top ranked program. Looking forward to a successful year ahead!

Pamela VandeVord, Ph.D.
Associate Professor
Associate Department Head for Undergraduate Programs



Virginia Tech
Wake Forest University

School of **Biomedical Engineering and Sciences**

BMES STUDENT CHAPTER WINS FLEETEST FEET AWARD

2010 BMES

The **VT-WFU BMES chapter** has been awarded the **BMES Fleetest Feet Award** for traveling the most miles to attend the 2010 BMES Meeting in Austin, TX! This award was founded in 1992 to promote and expand student participation in the BMES Annual Meeting. Our chapter brought **73 students** to the BMES annual meeting. The total mileage traveled was **80,231 miles!** The award will be presented to the VT-WFU chapter at the 2011 BMES National Meeting this fall in Hartford, CT.

2011 BMES

We are bringing over **100 biomedical engineering faculty and graduate students** from Virginia Tech and Wake Forest University for the BMES conference in Hartford, CT. These faculty and graduate students will present over **100 papers and posters** highlighting their recent research accomplishments. Please look for these papers and stop by our booth (101-103-105) to learn more about our program.

Stefan Duma
editor

Pam Stiff
co-editor

Cyndi Keister
Alex Parrish

Wake Forest University School of Medicine

VirginiaTech *Invent the Future*®

Photos by Stefan Duma, Alex Parrish, Pamela M. Stiff, Department of Creative Communications, Wake Forest University Baptist Medical Center and Virginia Tech.

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INSTITUTE *for* CRITICAL TECHNOLOGY *and* APPLIED SCIENCE *Virginia Tech*