

Doubled our Faculty

31 to 76 Total: 12 to 25 Primary

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Doubled our Faculty



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

Over the past three years we have hired 45 tenure track faculty into our biomedical engineering program. This has doubled our faculty from 31 to 76 total faculty and from 12 to 25 primary faculty. Throughout this newsletter you will see short summaries of the new hires from last year. It has been an exciting time of extreme growth as part of our plan to add 50 faculty over 5 years. While these faculty numbers are indeed quite large, they are reasonable within the context of the size of the Virginia Tech College of Engineering which

has over 330 tenure track faculty and over 8,000 undergraduate and graduate students. When our growth plan is complete next year, biomedical engineering faculty will comprise approximately 25% of all engineering faculty and be on par with many of the larger programs across the country.

Now our focus will shift to recruiting more graduate students and post-docs as our new faculty research programs begin to develop. To this end, we have re-organized our research topics into the following seven theme areas: Biomedical Imaging, Tissue Engineering, Biomechanics, Cardiovascular Engineering, Nanomedicine and Nanobioengineering, Neuroengineering, and Translational Cancer Research. These areas are further discussed in this newsletter.

I am also excited to announce that our program will be recognized twice at BMES this year in Atlanta. First, for the second year in a row, our student chapter will receive the Fleetest Feet Award for the chapter with the most students

who traveled the farthest to attend the national conference. Second, Dr. Steve Rowson and I will receive the Annals of Biomedical Engineering Editor's Choice Award for our paper entitled "Development of the STAR Evaluation System for Football Helmets: Integrating Player Head Impact Exposure and Risk of Concussion," which received the most citations and downloads last year.

Finally, please stop by 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 Atlanta!

Sincerely,

Stefan Duma, PhD
Harry C. Wyatt Professor and Department Head

Youth Football Study Launched

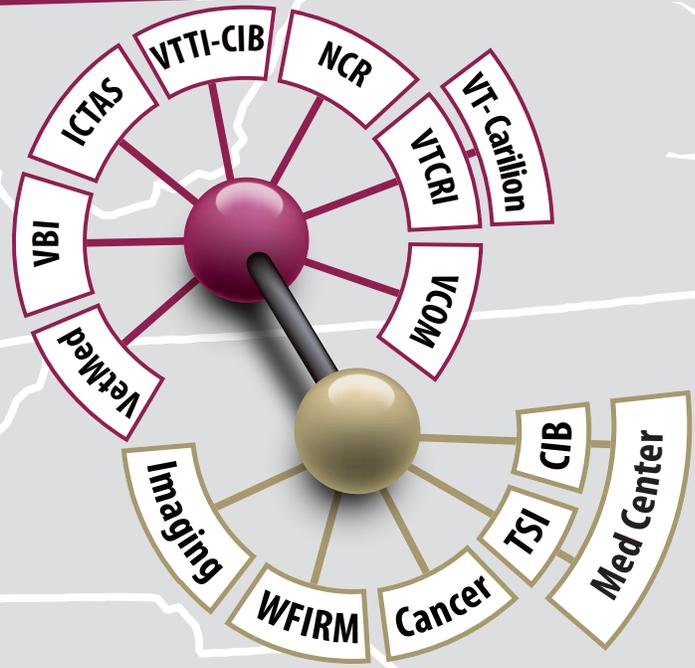


Dr. Duma Instruments the Helmets of Youth Football Players for the First Study Collecting Data on Pediatric Head Accelerations.

Despite the fact that 70% of football players are under the age of 13, very little research exists on this population. Last year we initiated a pilot study where we instrumented the helmets of seven youth players (seven and eight years old). Using a custom designed 12 accelerometer array we captured for the first time their head impact accelerations. We published the results in the Annals of Biomedical Engineering (ABME) in the spring with a paper entitled "Head Impact Exposure in Youth Football." In the six months since its publication it has been downloaded over 3,000 times and as of this writing it still remains number one on the ABME downloads chart. This study was instrumental in Pop-Warner making substantial changes to their practice schedules to reduce head impact exposure.

Based on the success of this pilot study, Virginia Tech and Wake Forest University have partnered in a larger study of youth football that includes six teams across Virginia and North Carolina. The study is called the Kinematics of Impact Data Set (KIDS) and includes over 200 players with instrumented helmets. The teams span the entire youth age population of 6 years to 13 years old. Advanced neuropsychological and imaging modalities are part of the research plan. It is anticipated that this research will provide the foundation for future youth helmet designs as well as the diagnosis and treatment of concussions for pediatric patients.

Our Biomedical Engineering Partners



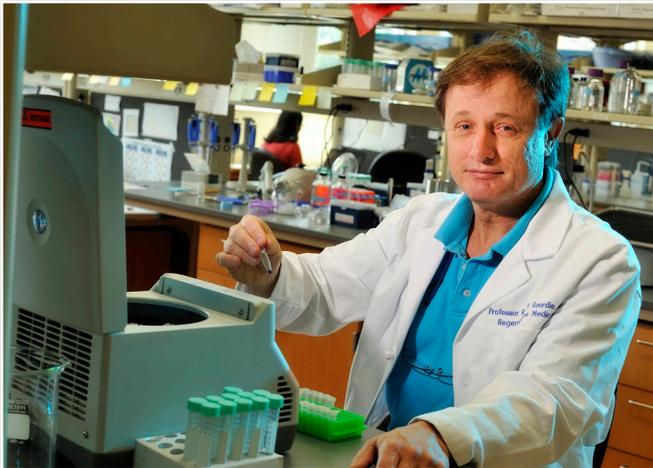
At Virginia Tech

- 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





ROBERT G. GOURDIE

Cells are connected to each other by channels called gap junctions. These connections literally form a cellular internet, enabling information to move across tissues - contributing to processes that include the beating of our heart and the generation of our thoughts and actions. The failure of this network can lead to a variety of diseases, including heart attacks

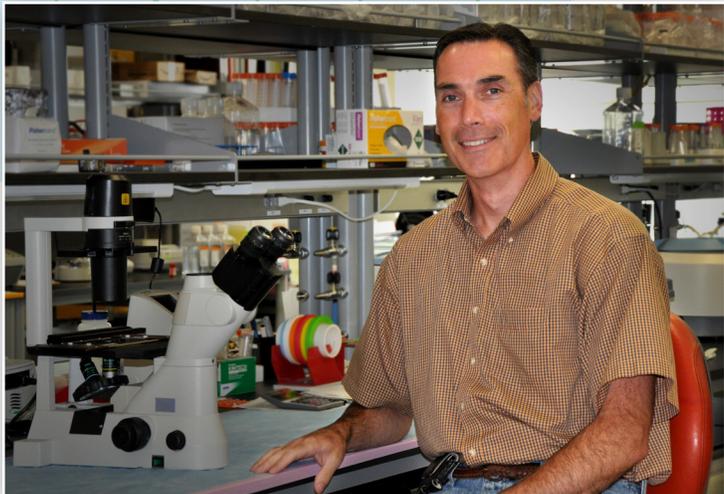
and epilepsy. Dr Gourdie work focuses on the how gap junctions work, how gap junctions are altered in disease states and how these connections between cells can be targeted for the benefit of tissue engineering and regenerative medicine. He has published more than 100 scientific papers and holds multiple patents. Based on a gap junction targeting drug invented in his lab, Dr Gourdie co-founded FirstString Research Inc with his post-doc fellow Gautam Ghatnekar. FirstString has completed Phase 1 clinical trials on the therapeutic and Phase II clinical trials are ongoing. He has received numerous grants from the March of Dimes, National Science Foundation and National Institutes of Health, including a Basil O'Connor Award, an NSF Early Career Award and an NIH Program Project Grant. His work is presently funded by two NIH R01 grants. Dr Gourdie's lab places strong and ongoing emphasis on mentoring in research, with trainees over the years that have included high school and graduate students, medical students, Residents and Fellows, post-docs and junior faculty.

MARK VAN DYKE

Mark Van Dyke, Ph.D., has joined Biomedical Engineering as an Associate Professor. Dr. Van Dyke comes from the Wake Forest University School of Medicine where he holds an appointment in the Department of Orthopaedic Surgery, and has been active in teaching and research in the fields of biomaterials and tissue regeneration. He received his degree from the Department of Materials and Chemical Engineering at the University of Cincinnati and has previously held positions in academia, industry, and non-profit research labs. Dr. Van Dyke is an inventor or co-inventor on more than 20 issued US patents and more than 60 national and international patents pending, many related to keratin biomaterials and their application to trauma and tissue engineering. He is co-founder of KeraNetics LLC, a start-up company developing keratin biomaterial technologies for clinical therapies.

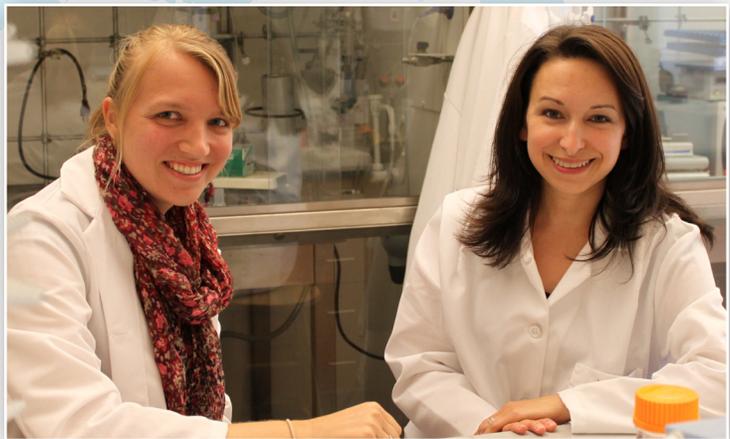
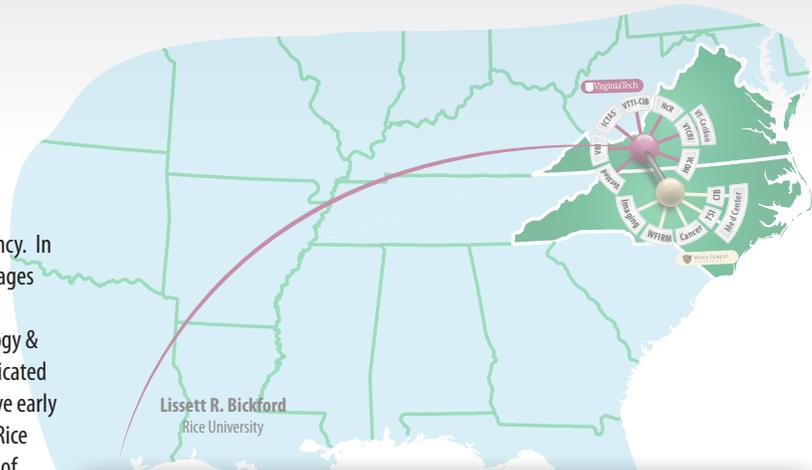


Dr. Van Dyke's research focuses on natural biopolymer systems, most predominantly, keratin-based biomaterials. While his lab has investigated many potential clinical applications, current research is focused on the structure-property relationships of keratin proteins and their specific interactions with biological systems. In particular, Dr. Van Dyke's group is investigating the nature of protein self-assembly and the material properties that arise from keratin nanostructures. Moreover, the influence these materials have on cell behavior, in particular cell adhesion and biomechanics as well as mesenchymal stem cell differentiation, is a current focus. A strong clinical context will be maintained through a continuing association with Orthopaedic Surgery at Wake Forest.



LISSETT R. BICKFORD

Several promising cancer therapies never achieve their full potential because of their inability to effectively localize at the site of malignancy. In an effort to compensate for this, patients are often given greater dosages that lead to unnecessarily high levels of systemic drug exposure and, correspondingly, increased medical costs. In the Translational Oncology & Nano/Pharmacoengineering Laboratory, Dr. Lissett R. Bickford is dedicated to developing minimally invasive and less toxic approaches to improve early cancer detection and treatment. Dr. Bickford received her Ph.D from Rice University where she worked closely with clinicians at The University of Texas MD Anderson Cancer Center to develop nanoparticle-based assays for the rapid detection of breast cancer cells in human breast tissue. As a postdoctoral research associate in the Lineberger Comprehensive Cancer Center and the Department of Chemistry at the University of North Carolina at Chapel Hill, she developed and led novel strategies and medical devices for the treatment of inflammatory breast cancer. Dr. Bickford plans to collaborate with physicians at Wake Forest University Baptist Medical Center to address limitations in current cancer care by focusing on three areas: 1) development and validation of selective, nontoxic nanotherapies, 2) design of medical devices for local cancer treatment, and 3) improvement of heterogenous preclinical cancer models for accurately evaluating treatment efficacy.



ALEXEI MOROZOV

Dr. Alexei Morozov's goals are to understand the neuronal circuits underlining emotions (fear, anxiety, empathy, and happiness) and to contribute to brain interventions in patients with abnormal emotional traits in mental disorders like PTSD, depression, psychopathy, autism and schizophrenia.

The research cycle in the lab involves three steps: 1) identification or narrowing down the neuronal circuit elements (specific neuron types and/or their synaptic connections) implicated in emotional traits relevant to the disease, 2) engineering tools and developing methods for manipulating the identified elements, and 3) testing efficiency of the manipulations in controlling emotional behaviors. By reiterating the cycle, he expects to obtain empirical means and rules to control neuronal circuits that determine emotions.

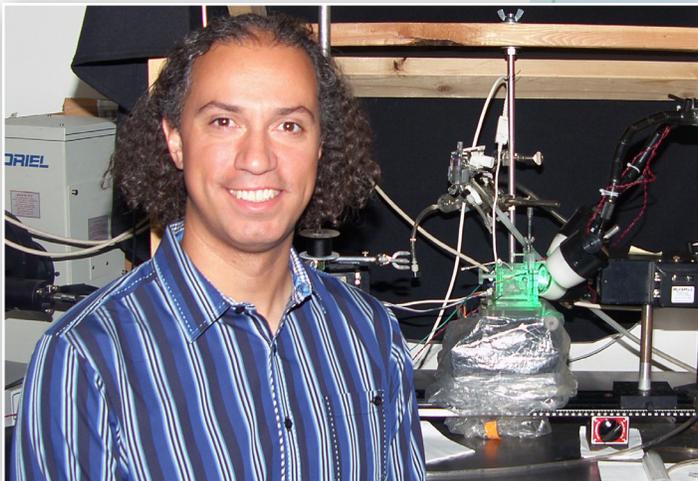
Currently, the lab focuses on how empathy-like behaviors in mice alter neuronal circuits. Using a mouse model of emotional trauma, induced by exposing animals to a cage-mate in pain and thereby eliciting vicarious perception of pain, his group identified hyper-function of NMDA receptor (NMDAR) in the circuit between the anterior cingulate cortex (ACC), which is correlated with empathy and pain, and the amygdala, which is responsible for control of emotions. Optogenetic manipulation of the specific inputs in slice physiology confirmed that the NMDAR hyper-function develops in the circuit- and behavior-specific manner. The lab is now testing a hypothesis that the increased NMDA receptor function is causally linked to behavioral symptoms of emotional trauma (risen emotionality and depression) by manipulating NMDA receptor and the ACC input to the amygdala.



MASOUD AGAH

Dr. Masoud Agah is the founding director of the VT MicroElectroMechanical Systems (MEMS) Laboratory. He has centered his research around three major thrusts: Micro/Nano Fabrication, Micro Analytical Chemistry, and BioMEMS/NEMS. In the first thrust, his group has pioneered technologies to develop three dimensional microfluidic structures in different substrates including silicon, glass, and elastomers. In the second thrust, Dr. Agah has focused his efforts on the development of miniaturized gas chromatography instruments (μ GCs) for environmental monitoring and breath-based medical diagnostics applications. In 2008, he received the National Science Foundation CAREER Award for introducing the concept of GC Matrix potentially capable of separating and identifying more than 100 compounds in a gaseous sample in just a few seconds. In the third thrust, his group is utilizing 2D and 3D microfluidic devices along with atomic force microscopy to determine the mechanical and electrical signatures of cells down to a single cell level with and without chemotherapeutic stimulus, to study cell-cell and cell-microenvironment interactions, and to decipher the

association of molecular and mechanical events that lead to cancer and its progression. One of the major aims of this thrust is to recognize physical differences between normal and abnormal cells and to develop biomedical microdevices that can isolate, enrich, and identify cells according to their disease stage. Dr. Agah's research will enable physicians to make better diagnostic and treatment decisions based not only on an individual's genetic fingerprint but also a biophysical signature. Dr. Agah has received the Virginia Tech's College of Engineering Outstanding New Assistant Professor Award in 2009, the Graduate School's Outstanding Dissertation Advisor Award in 2010, and the College of Engineering's Faculty Fellow Award in 2011, and has been recognized by the Office of Vice President for Research as "Scholar of the Week."

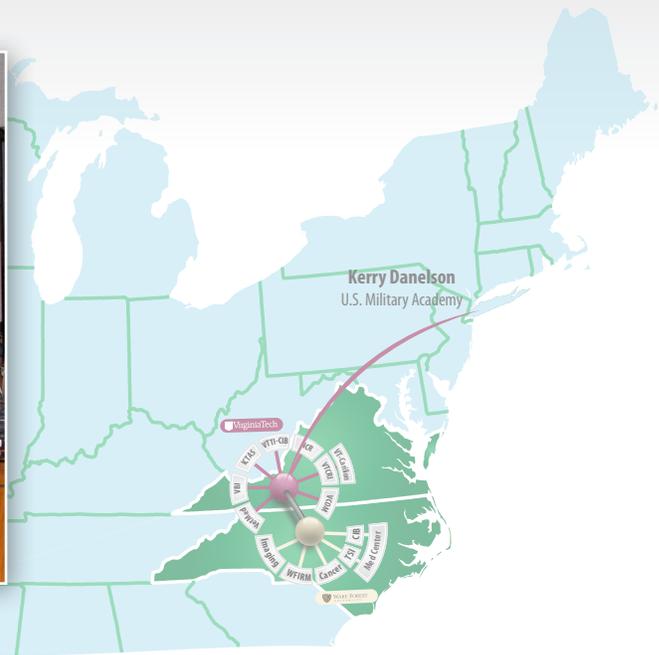
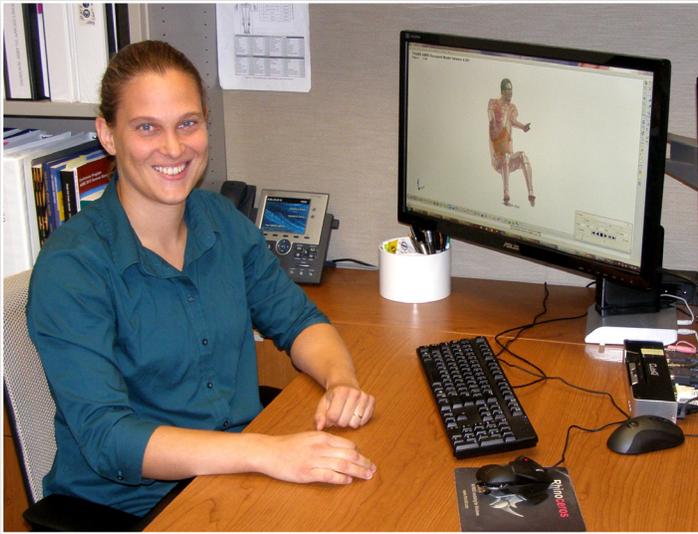


STEVEN POELZING

Steven Poelzing, Ph.D. will serve as an Associate Professor of Biomedical Engineering and faculty member of the Virginia Tech Carilion Research Institute. He studied sodium channel biophysics at Case Western Reserve University as a Post-Doctoral Fellow and established his own research program at the University of Utah as an Assistant Professor.

Dr. Poelzing's laboratory has contributed extensively to understanding the mechanisms by which both genetics and environmental factors contribute to the pathogenesis of sudden cardiac death. In particular, his laboratory focuses on abnormal calcium handling and the role of connexins, sodium channels and the extracellular space in the generation of lethal cardiac arrhythmias. These studies have attracted both numerous internal funding sources and an NIH R01. He is excited to join the Virginia Tech team to combine forces and obtain greater insights into how the cellular distribution of proteins modulates cardiac function.

The laboratory is also working on the use of sinusoidal low-amplitude voltage signals for quantifying cardiac electrophysiology. Dr. Poelzing's unique approach to a very well established field of inquiry earned him an NIH R21 Exploratory/Developmental Research Grant Award. With this work, he hopes to be able to quickly characterize which proteins are functioning abnormally by a single test, rather than testing each protein individually or scanning the personal genome for anomalies.



KERRY DANELSON

Dr. Kerry Danelson received her M.S. and Ph.D. from the Wake Forest SBES program with a concentration in injury biomechanics. The focus of her dissertation work was on reconstructing real world motor vehicle crashes with computer simulations to investigate finite element injury metrics for pulmonary contusion. Her current research focus is on automotive and military injury biomechanics. As part of a project sponsored by Toyota, she is reconstructing real world motor vehicle crashes with computer simulations. Using Toyota's Total Human Model for Safety (THUMS), a human body computer model, as the vehicle occupant the research team can investigate occupant kinematics and stress or strain in the tissues. These computer simulations demonstrate different injury mechanisms and are conducive to variation studies that investigate the effect of crash parameter change on occupant outcome. Additionally, she is interested in understanding blast injury mechanisms to help in the design of vehicles and soldier equipment. To further this research interest, she will be participating in the collaborative WIAMAN effort to create an Anthropometric Test Device (ATD), commonly known as a crash test dummy, for use in military testing and design.



STEVEN ROWSON

Steven Rowson, Ph.D., is a Research Assistant Professor of Biomedical Engineering and research faculty within the Center for Injury Biomechanics. His research focuses on investigating the human tolerance to impact loading, with interests in: brain injury, skull fracture, protective design, and safety evaluation systems. His primary focus is geared towards investigating the causation and prevention of concussion. For the last 6 years, Dr. Rowson has been instrumenting the helmets of football players with accelerometer arrays in efforts to collect data that can biomechanically characterize concussions. In 2011, Dr. Rowson developed the STAR Evaluation System, which evaluates the ability of football helmets to reduce the probability of concussion, and disseminates the results to the public so that consumer can make informed decisions when purchasing helmets. This work has resulted in a paradigm shift in the way consumers purchase football helmets, as well as how helmets are designed. His current work involves translating this research to investigate concussion in pediatric populations.



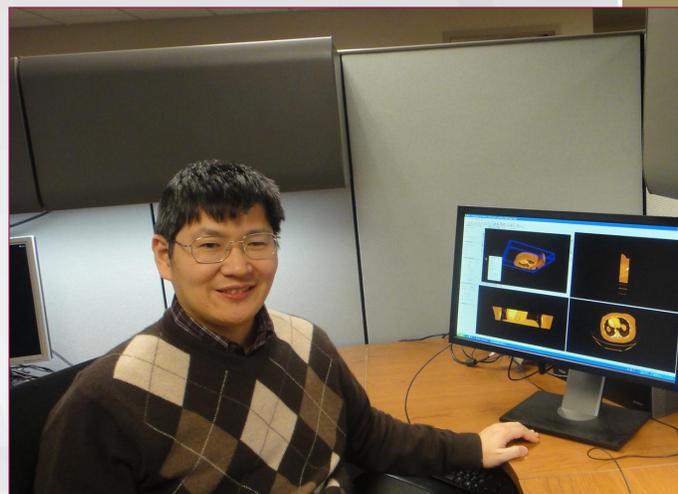
2 SBES Faculty Receive NSF Career Awards

HENGYONG YU

Yu, an Assistant Professor of Radiology and core biomedical engineering faculty, is developing compressive sensing (CS) based interior tomography theory and algorithms. “The CS-based interior tomography is extremely attractive in many biomedicine applications, where we need to handle large objects, minimize radiation dose, suppress scattering artifacts, enhance temporal resolution, reduce system cost, and increase scanner throughput,” Yu said.

“Traditional computed tomography (CT) theory cannot exactly reconstruct an internal region-of-interest (ROI) only from truncated projections associated with x-rays through the ROI because this interior problem does not have a unique solution in an unconstrained setting”, Yu explained. In 2009, Yu and Wang (an endowed professor in our school) proposed the concept of CS-based interior tomography and proved that exact interior reconstruction is achievable with an interior scan if the ROI is piecewise constant, which is subsequently extended to the case of piecewise polynomial ROI. CS is a general principle for image recovery regularized by a sparsity constraint. Yu plans to advance CS-based interior tomography theory and develop novel algorithms for a general linear transform, in whose domain the imaging object has the maximum sparsity.

“Because the proposed CS-based interior tomography is a rather general approach, it may open a new field and have a long-lasting impact on many tomographic modalities. The results can be generalized to spectral CT and other tomographic imaging modalities such as PET, SPECT, MRI, etc,” said Yu.



RAFFAELLA DE VITA

De Vita, an assistant professor of engineering science and mechanics and core biomedical engineering faculty, is characterizing the mechanical properties of the utero-sacral and cardinal ligaments supporting the uterus and vagina. These ligaments are severely altered during pregnancy, vaginal delivery, and aging ultimately causing pelvic floor disorders.

Pelvic floor disorders such as urinary incontinence, fecal incontinence, and pelvic organ prolapse represent a major public health concern in the United States affecting one third of adult women. Despite the high incidence, these disorders are rarely talked about and remain poorly understood.

“This CAREER project will transform surgical reconstruction methods and post-operative rehabilitation protocols by offering fundamental knowledge of the structural and mechanical properties of utero-sacral and cardinal ligaments,” said De Vita. Currently, these ligaments are either adjusted in ad-hoc manner or replaced using synthetic tapes for enhancing the suspension of the uterus and vagina.

“Through my collaboration with the Department of Obstetrics and Gynecology at the Walter Reed National Military Medical Center, I will keep myself abreast of the challenges in female pelvic medicine and reconstructive surgery and contribute firsthand to the care and management of pelvic floor disorders,” explained De Vita. Her research will serve in establishing science-based guidelines and specific protocols for the treatment of pelvic floor disorders in order to provide better care for millions of adult women affected by these disorders.



GE WANG, SELECTED AS AMERICAN ASSOCIATION OF PHYSICISTS IN MEDICINE FELLOW FOR 2012

We are pleased to announce that Dr. Ge Wang has been selected as an American Association of Physicists in Medicine Fellow for 2012. The category of Fellow is established to honor members who have made significant contributions through one or more of the following: Service to the AAPM, advancement of medical physics knowledge based upon independent original research or development, medical physics educational activities, especially in regard to the education and training of medical physicists, medical students, medical residents and allied health personnel, and leadership in the practice of medical physics.

Ge Wang received MS and PhD in ECE from State University of New York, Buffalo, in 1991 and 1992. He was on faculty with Mallinckrodt Institute of Radiology, Washington University at St. Louis, 1992-1996; with University of Iowa, 1997-2002; and since then has been Pritchard professor, the Director of the SBES Division / ICTAS Center for Biomedical Imaging, Virginia Tech. His interests include x-ray tomography, optical tomography, and other inverse problems. He authored/co-authored over 300 articles in peer-reviewed journals such as IEEE Trans, PRL, PNAS, and Nature, including the first paper on spiral cone-beam CT, the first paper on bioluminescence tomography, and the first paper on interior tomography. He with his co-inventors has over 30 patents and disclosures. He is the founding Editor-in-Chief for International Journal of Biomedical Imaging, Associate Editor for IEEE Trans. Medical Imaging, IEEE Trans. Biomedical Engineering, IEEE Fellow, SPIE Fellow, OSA Fellow, AIMBE Fellow, and AAPM Fellow.



Ge Wang, Ph.D.

NICHOLE RYLANDER, RECIPIENT OF THE 2012 Y.C. FUNG YOUNG INVESTIGATOR AWARD



Marissa Nichole Rylander, Ph.D.

Marissa Nichole Rylander is the recipient of the 2012 Y.C. Fung Young Investigator Award. The Fung Award recognizes young investigators who are committed to pursuing research in the field of biomedical engineering and who have made substantial contributions to the field. The American Society of Mechanical Engineering's Bioengineering Division presents the award.

Rylander, who joined the Virginia Tech faculty in 2006, is conducting novel research at the interface of bioheat transfer, nanomedicine, biomedical optics, tissue regeneration, and cancer engineering. She received the Outstanding New Assistant Professor Award in 2008 and the Faculty Fellow Award in 2010 for excellence in research, teaching, and service.

Her innovative research combining nanotechnology, laser therapy, and dynamic imaging to study tumor progression and to develop novel cancer treatments led to the National Science Foundation naming her one of its CAREER Award recipients in 2010. The CAREER grant is allowing Rylander to further develop and use a novel sensing system she co-invented called the "holey scaffold." This patented device is the first system capable of minimally invasive and non-destructive light sensitive, molecular sensing, and control of biological and transport processes within living organisms. She uses the scaffold to measure dynamic nanoparticle mass transport, temperature, cell viability, heat shock protein expression, and reactive oxygen species production in real-time within an in vitro tumor in a bioreactor or an in vivo tumor within a mouse. She uses a variety of nanoparticles including carbon nanotubes, novel embodiments of carbon nanotubes and fullerenes, and carbon nanohorns in combination with laser irradiation. Rylander's goal is to have her treatment model used by clinicians to determine appropriate nanoparticle properties and laser parameters to achieve selective and effective cancer treatment.

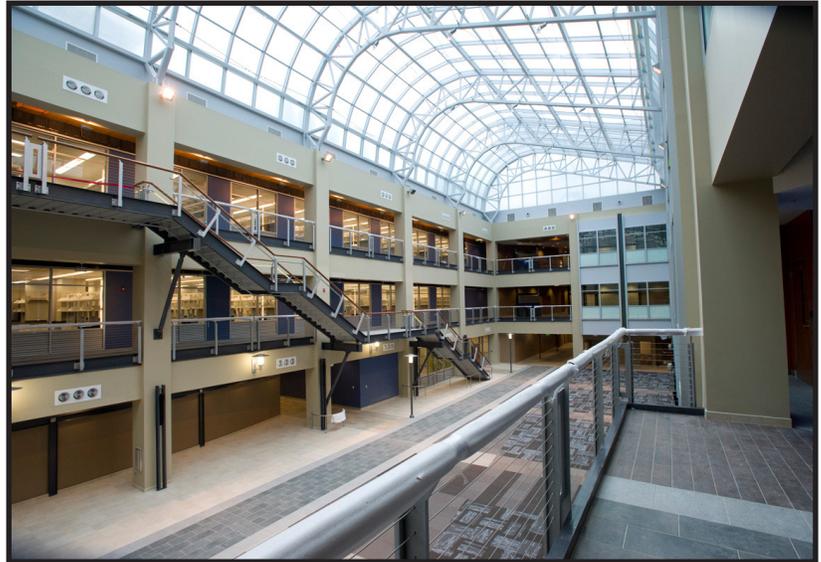
She has received numerous grants from the National Institute of Health and National Science Foundation with total funding of \$8,989,855. She has published 40 peer reviewed articles in high ranking journals such as Proceedings of the National Academy of Science, Nano Letters, Cancer Research, Biomaterials, and Tissue Engineering. She was a session chair for the ASME Summer Bioengineering Conference Biotransport Division for the past four summers and is serving on the ASME NanoEngineering for Medicine and Biology Steering Committee which will identify opportunities to engage the community in the application of nanoscience and nanoengineering to medicine and biology.

BME NOW HOUSED IN NEW BIOTECH PLACE BUILDING FOR WAKE FOREST RESEARCHERS

The new Biotech Place research building is a 242,000 square foot historic structure comprised of two adjoined former R.J. Reynolds Tobacco Company buildings that have been redeveloped into modern biotech research space. The renovation was handled by Wexford, a prominent developer of urban research parks. The first building has 5 floors and was constructed in 1937 with a distinctive glass block exterior. The second building has 3 floors and was constructed in 1963 with a brick façade. A large atrium with glass ceiling provides a very open, airy feel to the space. Biotech Place is the latest development in the Piedmont Triad Research Park, with a long term vision of developing 165 acres in the heart of Winston-Salem.

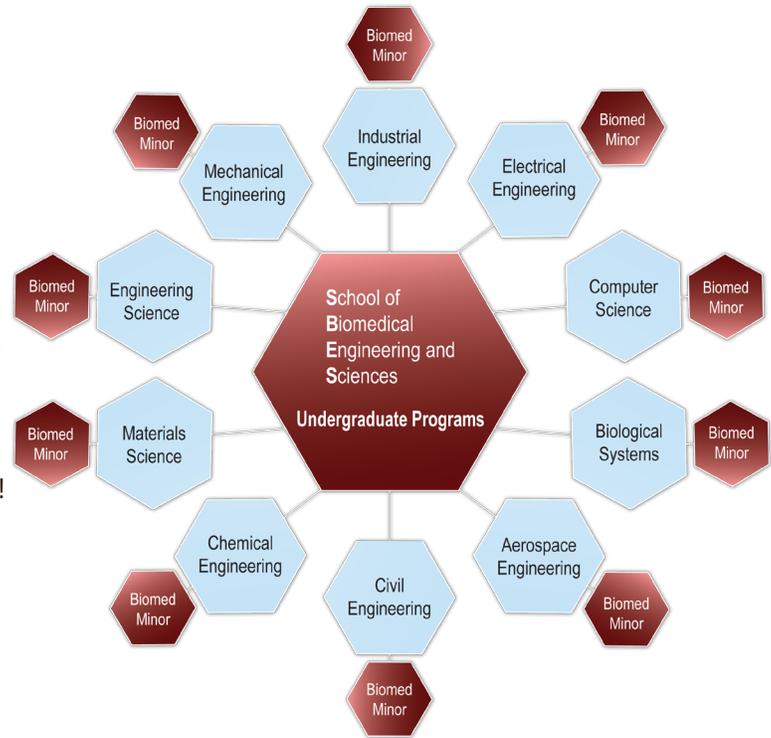
Wake Forest Baptist Medical Center is the largest tenant at Biotech Place. Some departments that have relocated are Biomedical Engineering, Physiology/Pharmacology, Immunology and Microbiology as well as the Childress Institute for Pediatric Trauma. The Piedmont Triad Research Park's marketing and administrative offices have also relocated to Biotech Place. Other tenants are Carolina Liquid Chemistries, Allegacy Federal Credit Union, and small start-up companies.

The biomechanics faculty, staff, and students of SBES Winston Salem moved into Biotech Place in March 2012 and have 10,000 square feet with three large lab areas and a machine shop. The Chair along with 5 other faculty, 3 administrative personnel and 15 biomechanics students took part in the move. The imaging and informatics faculty remain on the main hospital campus. Biotech Place has a large auditorium and 2 other small conference rooms that have video conference capabilities. Conference room 157 will be the main SBES classroom. In addition to those 3 conference rooms there are 12 other state-of-the-art conference rooms that have projectors and LCDs installed for meetings.



Undergraduate Biomedical Engineering Education Minor to be offered soon

Undergraduate biomedical engineering education is on the move at Virginia Tech! This past year had many 'firsts' for SBES. Our first undergraduate course entitled Introduction to Biomedical Engineering (BMES 2104) was offered spring semester. Students from all over the College of Engineering enrolled to learn about how biomedical engineering combines the understanding of engineering analysis and how the human body functions as a complex system in order to design medical interventions to help protect, identify and/or treat diseases and injuries. Several SBES faculty helped teach the course and demonstrated about their area of expertise leads to the diversity of our BME discipline. Another first for SBES was the College of Engineering approval of our new Biomedical Engineering undergraduate minor program. This highly selective minor program will allow our department to engage top undergraduate students in the College of Engineering. In addition to specific coursework, students will be required conduct undergraduate research in areas related to biomedical engineering. We expect that students graduating with a biomedical engineering minor attached to their VT engineering major will be highly attractive to both top ranked graduate and medical schools as well as biomedical industries! Be sure to take a look at our undergraduate education webpage for updates (<http://www.sbes.vt.edu/undergrad.php>) and I am looking forward to another successful year!



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



Undergraduate student Meghan Canter (center) and her mentors Bahareh Behkam (left) from Mechanical Engineering and SBES and Birgit Scharf (right) from Biological Sciences. Meghan is part of an interdisciplinary team working on developing a distributed network of bacteria-propelled microrobots (BacteriaBots) for targeted drug delivery applications.

WFU EMBS Student Chapter Activities in 2011-2012

The Wake Forest University Engineering in Medicine and Biology Society (EMBS) continued to provide a diverse, enriching program of activities that earned the club the Outstanding Performance Award from the IEEE-EMB Society in 2010. In further recognition of the club's accomplishments, we have been invited to send a representative to help plan and lead a workshop, entitled "Student Chapter Initiation and Development", at the 2012 EMB Conference. We are pleased to send the EMBS Club president, Dustin Crouch, as the WFU representative to help lead this workshop.

The EMBS club sustains an active and vital partnership with the Winston Salem IEEE Section, whose membership includes engineers in industry and academia. EMBS members attend monthly seminars presented by local and regional engineering leaders, with lunch generously provided by the Section. As in previous years, student members presented their research to the community at one of the lunch seminars. This year, Ashley Weaver, Qawi Telesford, Philip Brown, and Dustin Crouch shared their research activities and project directions with the Section. The EMBS club and IEEE section also teamed up at Forsyth Tech Community College to recruit student members to the IEEE.



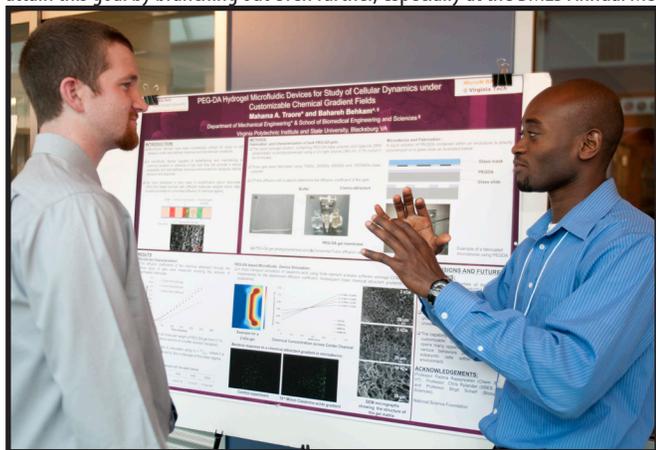
SBES students and prospective students socialize at the annual SBES recruitment reception.

The EMBS club hosted many other professional development, community outreach, and social activities. Dr. Yaorong Ge, an SBES associate professor, delivered an engaging lecture on his research in Biomedical Informatics. Our executive team collaborated with the BMES student club to provide donations to Operation Christmas Child and host lab tours for local youth organizations. A beginning-of-the-year cookout, Halloween luncheon, and monthly happy hour social event provided opportunities for students across the department to mix and mingle.

VT-WFU BMES Chapter Activities in 2011-2012

The VT-WFU Biomedical Engineering Society (BMES) organization is a BMES chapter founded to help bridge the gap between the two campuses and foster communication and collaboration among various research groups. In this past year, we have continued to nurture this relationship both academically and socially. We started off the year by organizing a camping trip to bring together new members of the society and ended with our 11th Annual SBES Student Symposium held at Wake Forest Biotech Place.

The symposium is our largest hosted event and requires year round planning. This past year has been our most successful yet! Our members have established brilliant connections with local companies to help fund the symposium through the years. Not only have we kept existing relationships strong, we've continued to bridge new connections with more companies. In 2011, we had four companies sponsor and attend the symposium. This year, two additional companies sponsored the event making the financial burden of hosting the symposium even less. Our goal is to have the symposium fully funded by outside sponsorship. This coming year we hope to attain this goal by branching out even further, especially at the BMES Annual Meeting in Atlanta.



A. Traore describing his research to K. Sheets at the 11th Annual SBES Student Symposium held at Wake Forest Biotech Place.

We have expanded our outreach and mentoring programs this year. We have served as mentors and provided laboratory tours for the First Lego League and the Kids' Tech University programs to promote science, technology, engineering, and mathematics (STEM) in K-12 students. We have also hosted several events to promote the SBES graduate program to undergraduate students.

Our organization is mostly comprised of graduate students. This is due to neither campus housing a biomedical engineering undergraduate program. At Virginia Tech, SBES has started offering courses in the biomedical field aimed towards undergraduate engineers. As the interest of biomedical engineering grows, we plan on recruiting younger members by hosting tables at campus events. In addition to the 67 graduate students of our organization that attended the BMES annual meeting in Hartford in 2011, we were able to fund two undergraduate students to attend this conference. These students are fully active within the organization and will be paramount in obtaining our goal of recruiting younger members.

SBES RESEARCH AREAS

Our 76 faculty are involved in a many biomedical and bioengineering research areas. This image uses a series of interconnected neurons to illustrate our seven primary research areas and how topics in each area can be related to others. From cancer treatment to imaging to biomechanics, the technical foundations are applicable to many areas. More information on faculty involved in each of these seven research areas can be found on our web site www.SBES.vt.edu

Biomechanics

- Biophysics
- Cardiovascular Biomechanics
- Ergonomics & Rehabilitation Engineering
- Injury Biomechanics
- Microscale Biomechanics
- Molecular & Cellular Biomechanics
- Organ & Whole Body Biomechanics

Translational Cancer Research

- Biotransport
- Cancer Detection & Therapy
- Electrobiology
- Minimally Invasive Surgery
- Nano/Pharmacoengineering
- Targeted Drug Delivery

Neuroengineering

- Membrane Transport
- Neural Network Behavior
- Neuroimaging
- Neurotrauma
- Synaptic Transmission / Plasticity
- Traumatic Brain Injury

Research Areas

Nanomedicine and Nanobioengineering

- Biomembranes
- Bio-MEMS and Microfluidics
- Biomimetics
- Cellular Dynamics
- Molecular Medicine
- Nanomedicine
- Tumor Microenvironments

Cardiovascular Engineering

- Cardiac Arrhythmia Mechanisms
- Cardiac Electrophysiology & Ion Transport
- Cardiovascular Disease Mechanisms
- Cellular/Molecular Mechanisms of Connexins
- Fluid Mechanics and Transport
- Gap Junction Remodeling

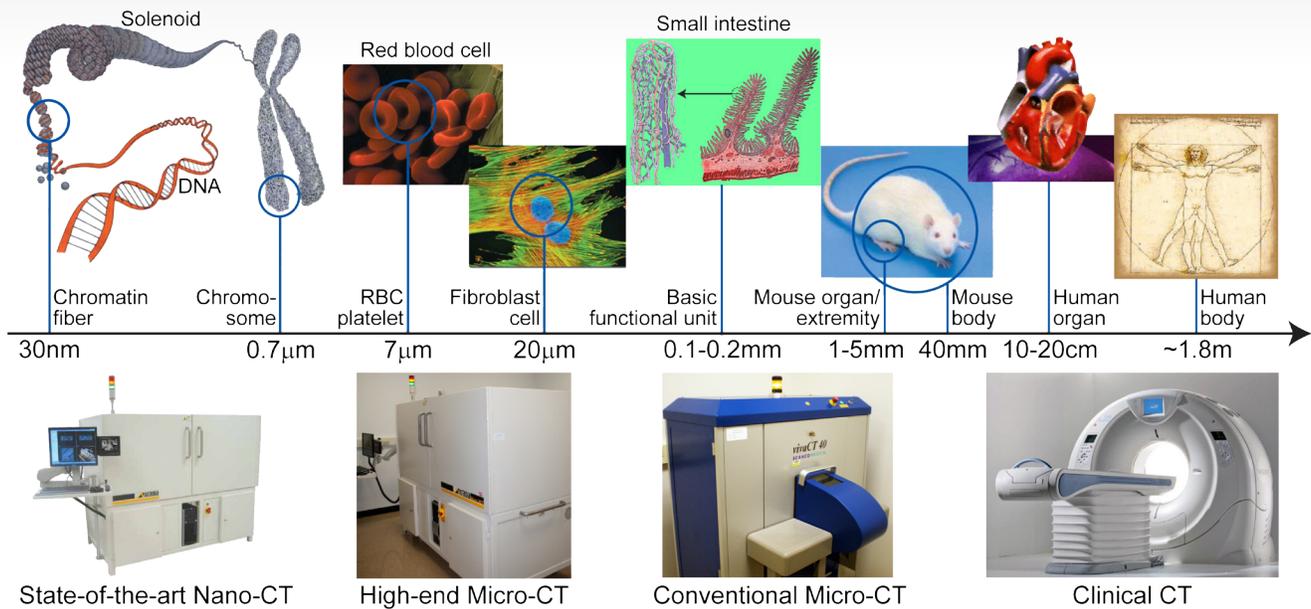
Tissue Engineering

- Biomaterials
- Musculoskeletal Tissue Engineering
- Regenerative Medicine
- Scaffold Fabrication & Engineering
- Tumor Engineering Platforms
- Vascular Regeneration
- Whole-Organ Tissue Engineering

Biomedical Imaging

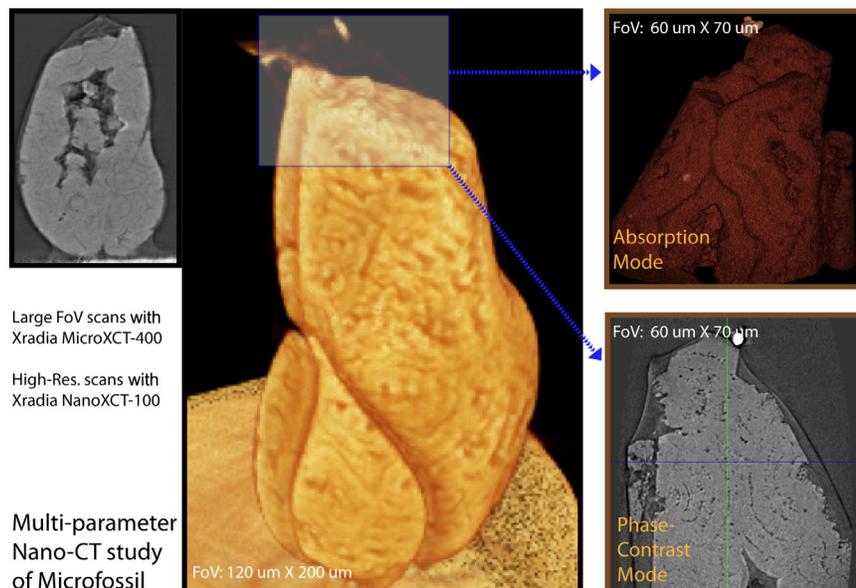
- Emerging Imaging Methods
- Image Guided Intervention
- Magnetic Resonance Imaging
- Medical Physics
- Multi-scale CT
- Optical Molecular Imaging / Biophotonics
- X-ray Computed Tomography

MULTI-SCALE COMPUTED TOMOGRAPHY FACILITY



SBES Advanced Multi-scale Computed Tomography Facility (SAM-CT) is supported by an NIH SIG grant (RR025667), an NSF MRI grant (CMMI0923297), and an SBES internal funding, in collaboration with Xradia (<http://www.xradia.com>). Apart from clinical CT scanners available at our medical schools in Wake Forest University and Virginia Tech, we have a Scanco micro-CT scanner, an Xradia micro-CT scanner and an Xradia nano-CT scanner. Collectively, these scanners cover image resolution and sample size over 6 orders of magnitude. This x-ray imaging capability is the state-of-the-art in the university setting around the world.

The Scanco scanner has resolution up to $16\mu\text{m}$ with a 20-38mm field of view. The Xradia micro-CT scanner, purchased using an NIH SIG grant in 2008, is the highest resolution micro-CT system on the market. It produces $0.5\mu\text{m}$ resolution, and allows sample sizes up to 100mm diameter. The Xradia nano-CT scanner, purchased using an NSF-MRI grant in 2009, has 50nm resolution. It supports tomographic imaging in either the attenuation or Zernike phase contrast mode. We have a dedicated space for these systems in the Institute for Critical Technologies and Applied Sciences (ICTAS) Building A, adjacent to the Nanoscale Characterization and Fabrication Lab (NCFL) which hosts Virginia Tech's other cutting-edge; Imaging systems under one roof.



The SAM CT Facility has been widely used, and produced important interdisciplinary research results. The work by Drs. Shuhai Xiao's group and Dr. Ge Wang's group was chosen as the cover image of *Geology* Volume 40, which is on the origin of intracellular structures in Ediacaran metazoan embryos. In a latest case, the work by Dr. Eric Hoffman's group and Dr. Ge Wang's group was submitted to *PNAS*, which is on non-destructive assessment of pulmonary acini in a mouse lung.

Large FoV scans with Xradia MicroXCT-400
High-Res. scans with Xradia NanoXCT-100

Multi-parameter Nano-CT study of Microfossil

FoV: 60 μm X 70 μm
Absorption Mode

FoV: 60 μm X 70 μm
Phase-Contrast Mode

Faculty

Our Biomedical Engineering program involves 138 faculty:

76 tenure track biomedical engineering faculty (25 primary and 51 joint appointments)

68 affiliate biomedical engineering faculty at Virginia Tech and Wake Forest University.



Masoud Agah, MD
Associate Professor,
*MEMS, Microfluidics, and
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EDR, Crash, Alcohol Studies
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*Applied computational
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*Biophysics, Microbial
Motility and Adhesion,
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Thermal Sensors*
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SBES Core/Radiology



Daniel Dudek, PhD
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Bioinspiration*
SBES Core/ ESM



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Medicine*
SBES Primary/VTCRI



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*Medical Imaging, Medical
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*Auto Safety, Sports,
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*Role of Synaptic-signaling
in Neuro-development.*
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Virginia Tech

Wake Forest University

School of Biomedical Engineering and Sciences

BMES STUDENT CHAPTER WINS FLEETEST FEET AWARD 2 YEARS IN A ROW

2012 BMES

We are bringing over **100 biomedical engineering faculty and graduate students** from Virginia Tech and Wake Forest University for the BMES conference in Atlanta, GA. 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.

2011 BMES

The **VT-WFU BMES chapter** has been awarded the **BMES Fleetest Feet Award** for traveling the most miles to attend the 2011 BMES Meeting in Hartford, CT! This award was founded in 1992 to promote and expand student participation in the BMES Annual Meeting. Our chapter brought **69 students** to the BMES annual meeting. The total mileage traveled was **36,442.6 miles!** The award will be presented to the VT-WFU chapter at the 2012 BMES National Meeting this fall in Atlanta, GA.

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editor

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co-editor

Cyndi Keister
designer



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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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