Plenary Talk – I

Lily Yang, MD. PhD.
Professor of Surgery and Radiology
Nancy Panoz Chair of Surgery in Cancer Research
Winship Cancer Institute
Emory University School of Medicine
Atlanta, GA

Image-guided and targeted cancer therapy using theranostic nanoparticles

Lily Yang, MD, PhD is a professor of surgery and radiology and a prominent researcher. Dr. Yang is also a member of the Cancer Cell Biology Research Program at Winship Cancer Institute. She holds professional memberships with American Association for Cancer Research, American Society of Nanomedicine and National Cancer Institute Alliance for Nanotechnology in Cancer. She has been serving as a Chartered and Ad-hoc Member in the NIH grant review panels. Dr. Yang received her medical training in China at West China University of Medical Sciences and then in the Chinese Academy of Preventive Medicine. She received her PhD degree in Molecular and Cellular Biology Program at Brown University. Dr Yang's research interests focus on the development of novel targeted cancernanotherapeutics and imaging methods using multifunction drug carriers to address the major challenges in clinical oncology of early cancer detection, targeted drug delivery, assessment of therapeutic response using non-invasive imaging, and image-guided surgery.

Plenary Talk – II

Jamboor K. Vishwanatha, Ph.D.
Regents Professor and Vice President
Founding Director, Texas Center for Health Disparities
Principal Investigator, National Research Mentoring Network, Mentorship and Networking Core
Center for Diversity and International Programs
University of North Texas Health Science Center
Fort Worth, Texas USA

Bone-targeted Nano Devices for Prostate Cancer Therapy

Dr. Vishwanatha is a Regents Professor and Vice President, and Founding Director of the Texas Center for Health Disparities at the University of North Texas Health Science Center at Fort Worth. He is a principal investigator of the National Research Mentoring Network, a NIH Common Fund initiative to provide mentorship, networking and professional development for a diversified biomedical and behavioral workforce. He is also a principal investigator of the NIH Specialized Center of Excellence in Health Disparities.

Dr. Vishwanatha received his Ph.D. in biological sciences from the University of South Carolina in 1983. Dr. Vishwanatha's research is in cancer molecular biology, experimental therapeutics and nanotechnology. His laboratory is investigating genetic markers that predict development of aggressive prostate and breast cancers, and nanotechnology-based therapies for breast and prostate cancers. His research is funded by NIH, DOD and other agencies.

Dr. Vishwanatha is actively involved in mentorship and networking programs to diversify the biomedical research workforce, and has mentored numerous undergraduate and graduate students from under represented groups in biomedical sciences. As the founding director of the Texas Center for Health Disparities, a Specialized Center of Excellence funded by the National Institutes of Health, he has directed health disparity research, education and community outreach programs. For the past 12 years, he has organized the annual Texas Conference on Health Disparities that attract national speakers and participants. He serves on the external advisory committees for University of Puerto Rico-Cayey, PR; St. Mary's University, San Antonio, Texas; Alabama State University, Montgomery, Alabama; and Savannah State University, Savannah, Georgia. He has been an active member of the AAMC GREAT Group, SACNAS and ABRCMS.

Plenary Talk – III

Kunal Kate, Ph.D.
Assistant Professor
Department of Mechanical Engineering
247 Shumaker Research Building
University of Louisville
Louisville, KY

Material Process Design for Additive Manufacturing in Medical Applications

Kunal H. Kate is an Assistant Professor of mechanical engineering at the University of Louisville and has seven plus years of experience in *design-for-materials, process optimization, digital manufacturing and design for advanced manufacturing.* He comes with a broad knowledge of design and modeling using material properties such as thermal, rheological, physical and mechanical properties as well as equation-of-state variables (PVT) and extensive experience of processing ceramic and metal powders, as well as polymers. His work involved in design-to-manufacturing with manufacturing processes such as PIM, extrusion, injection molding, SLM, and fused filament fabrication (FFF) that has resulted in conceiving a high-impact program at University of Louisville as reflected in his 18 peer-reviewed publications. His current research area is primarily focused on design and developing 3D printing material systems of polymer-filled composites and to understand the interrelationships between material composition, process conditions and design geometry for a broad range of automotive and healthcare applications.

Plenary Talk – IV

Rakesh K. Singh, Ph.D.
Professor and Vice-Chair for Graduate Education,
Director of Immunology, Pathology, and Infectious Disease Graduate Program
Department of Pathology and Microbiology
College of Medicine
University of Nebraska Medical Center
Omaha, NE

Nano-based approaches for targeting of host-tumor Interaction: novel strategies for cancer therapy

Dr. Singh is a Professor of Pathology and Microbiology at the University of Nebraska Medical Center, Omaha, NE. Dr. Singh earned his Ph.D. from Banaras Hindu University, Varanasi, India. Dr. Singh completed his postdoctoral training at the University of Texas M.D. Anderson Cancer Center, Houston in the laboratory of Dr. Isaiah J. Fidler. Dr. Singh joined the faculty of the University of Nebraska Medical Center in 1995 as Assistant Professor of Pathology and Microbiology, and he has been Professor since 2008. The focus of his study is to investigate the role of host-derived factors in regulating tumor-stromal interactions during tumor angiogenesis, growth, and metastasis and develop targeted therapeutics. He is the Vice-chair for Graduate Education, Program Director for Immunology, Pathology, and Infectious Disease Graduate program and serves as a mentor for medical students, graduate students, and the postdoctoral fellows. He has received several awards including Joseph P. Gilmore Outstanding Investigator Award 2006, Distinguished Scientist 2006, University of Nebraska Medical Center, Outstanding Achievement Award 2006, College of Medicine, University of Nebraska Medical Center, and UNMC Outstanding Faculty Mentor for Graduate Students Award 2015 Omaha, NE.

Special talk on 'Research Innovation and Entrepreneurship'

Michael Chambers, J.D., Ph.D.
Assistant Vice President for Research Innovation
University of South Alabama
Mobile, AL

Innovation: Past, Present and Future

Dr. Michael Chambers is the Assistant Vice President for Research Innovation at the University of South Alabama. He co-founded and led InnoRx Pharmaceuticals (ocular drug delivery) until negotiating its sale to SurModics (NASDAQ: SRDX) and then founded Swift Biotech (ovarian cancer diagnostics). Prior Chairman of ProUroCare, a public company based in Minneapolis, he has served on the boards of InQ Biosystems, Gene Capture, BioAlabama and the Economic Development Partnership of Alabama.

He founded the Gulf Coast Angel Network, co-founded 1702 (a networking and mentoring organization) and was named "Start-Up Executive of the Year" in 2014 by Alabama LaunchPad. Active in the community, he served as Chairman of the Mobile Chamber of Commerce in 2014. An active Rotarian he was awarded the Service Above Self Award in 2015 for leading humanitarian efforts in Central America for women and children.

He has served as a grant reviewer for the National Science Foundation and serves as an industry mentor on a current team selected to the national I-Corps program cohort. Dr. Chambers is the Principal Investigator for both the I-Corps program at USA that was announced by NSF in August 2017 and USA's IUCRC in Digital Forensics. He has a law degree from the University of Alabama and a Ph.D. from the University of Geneva in Switzerland where he was a Rotary International Scholar and a Swiss Confederation Fellow.

The role of secretory phospholipase A_2 and PLA2 receptor expression in modulating the delivery and anticancer activity of lipid-nanomedicines in a xenograft model of human prostate cancer

Robert D. Arnold, "Rusty"
Associate Professor, Department of Drug Discovery and Development and Director of Specialized Pharmaceutical & Experimental Center for Translational Research & Analysis, Auburn University Harrison School of Pharmacy

Nanoparticle drug carriers, such as pegylated liposomes, entrap drug stably, alter drug disposition, improve antitumor activity and minimize toxicity. However, control of their drug-release kinetics has limited their clinical potential. Secretory phospholipases A_2 ($sPLA_2$) are excreted and over expressed in a variety of tumors, *e.g.*, up to 22-fold in prostate. These enzymes degrade phospholipids preferentially at the *sn-2* ester position and have been hypothesized as targets to control drug release from lipid-based nanoparticles, such as liposomes. We ***hypothesized*** that over expression of $sPLA_2$ and its receptor (PLA2R) can modulate the degradation and uptake of $sPLA_2$ responsive liposomes (SPRL), thereby increasing the rate and extent of drug release, enhancing their antitumor activity and limiting non-target tissue toxicity. Utilizing electrospray ionization mass spectrometry (ESI-MS) we determined the effect of $sPLA_2$ on the degradation of individual and combinations of lipids to their respective lysophospholipids and fatty acids. The *in vivo* specificity and antitumor activity of secretory phospholipase A_2 response liposomes (SPRL) in human prostate (PC-3) cancer cells and those where phospholipase A_2 receptor (PLA2R) expression was knocked down (PC3-PLA2R-KD) was determined in athymic mice. Mice were treated intravenously (5 mg/kg, Q1W x 5) with doxorubicin (DOX) containing SPRL or SSL formulations. Multispectral optoacoustic tomography (MSOT) and IVIS (bioluminescence, fluorescence and x-ray imaging) were used to monitor tumorigenesis, *i.e.,* blood flow, tumor/tissue oxygenation, tumor growth, and deposition of nanoparticles non-invasively. The distribution, deposition and degradation of SPRL and SSL labeled with deuterated lipids were determined by ultra-high performance liquid chromatography – tandem mass spectrometry (UHPC-MS/MS). A time-dependent increase in tumor deposition was observed following treatment with SPRL and SSL relative to free DOX. Although a significant increase in tumor deposition of SPRL *vs.* SSL was not observed, a decrease in rate of accumulation and an increase in antitumor activity (decrease tumor volume and increase in survival) were observed ($p \leq 0.05$). MOST was used to show alterations in oxygenation in tumor with growth and suggests deposition is increased in areas that were more normoxic. The effect of PLA2R-KD suggests increase in SPRL metabolism (total lipid, d70-DSPC and breakdown to lysophospholipid, d35-LPC and increased antitumor activity compared to SSL formulations; $p \leq 0.05$). Utilizing a combination of non-invasive imaging strategies combined with mass spectrometry we demonstrated that $sPLA_2$ and PLA2R alter the degradation and activity of SPRL formulations compared to SSL, but not overall tissue/tumor distribution. These data also suggest that PLA2R expression may be used as a marker to personalize treatment with different nanomedicines. These nanotherapeutics are representative of a variety of next generation targeted drug carriers. More importantly, similar approaches may be utilized to non-invasively identify disease, phenotype or grade tumors, and monitor treatment mediated effects.

*This work was supported by NIH, R01EB016100, Auburn University Internal Grants Program, the Auburn Laboratory for Imaging Animal Systems (**ALIAS**), the Auburn Univeristy Specialized Pharmaceutical and Experimental Center for Tranlational Research and Analysis (**SPECTRA**) and Auburn University Initiative in Cancer Research (**AURIC**).*

Smart nanomaterials for targeted drug delivery

Allan E. David
John W. Brown Assistant Professor, Department of Chemical Engineering, Auburn University

Nanomaterials have drawn increasing attention in the biomedical field for their potential diagnostic and therapeutic applications. In addition to control of material dimensions on the nanometer length scale, functionalization of the surface with "smart" ligands that provide environment-responsive performance is also generating tremendous interest. Clinical translation of these technologies, however, has been low, primarily due to large variabilities in *in vivo* performance and safety. This is a significant barrier that can most effectively be overcome if the design

of nanomaterials is based on an understanding of the structure-property relationship of nanomaterials and their interactions with biological systems. This talk will present some of the work done in developing “smart” nanoparticles and nanocomposites for application in drug delivery. We will examine the role of particle size and surface modification on the cellular uptake and toxicity of superparamagnetic iron oxide nanoparticles (SPIONs), which have been used clinically as contrast agents for magnetic resonance imaging (MRI). We will also discuss the potential of microenvironment-responsive nanocomposites for controlled delivery of vaccines.

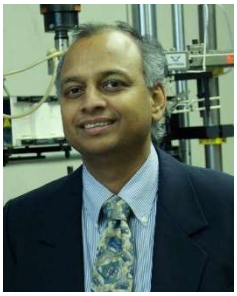
Polymeric Tissue Scaffolds and Biomaterials: Issues and Opportunities

Derrick Dean
Integrated Bioengineering and Advanced Materials (1-BEAM) Center, Alabama State University

Our laboratory is focused on the fabrication of polymeric tissue scaffolds. Our work seeks to understand how tissue scaffolds mimic the size scale, chemistry and functionality of the extra cellular matrix. This work is poised at the interface of nanotechnology, materials engineering and the life sciences. Our approach utilizes nano and microfabrication techniques to develop bioactive, multifunctional tissue scaffolds in which we control surface chemistry, spatiotemporal interactions, impart developmental cues and structural stability. The efficacy of our scaffolds is investigated through studies of the interactions of cells with our scaffolds. This talk will briefly describe the current issues and opportunities in the field as well as some of our recent efforts to elucidate the processing-structure-property relationships of some polymeric tissue scaffolds.

Bio and Nanophased Fiber Reinforced Composites for Structural Use

Mahesh Hosur, Shaik Zainuddin
Materials Science and Engineering Department, Center for Advanced Materials, Tuskegee University



High performance lightweight materials are made of composites which constitute at least two different synergistic materials, a load bearing fiber normally made of glass, carbon or Kevlar® and the other one, a matrix (thermoset or thermoplastic polymer) which holds the fibers together to give unique properties that are different from the constituent materials. In recent years, a third phase consisting of nanofillers such as nanoclay, carbon nanotubes, nanoparticles made of metals and metal oxides, has been added to improve the properties of composites at very small weight loadings. While the composites give tremendous weight advantages and tailorability over conventional metallic materials, they are not sustainable or biodegradable. Hence, factors such as greater environmental awareness, societal concern and depletion of petrochemical resources together provide an impetus to develop new materials and products that are based on natural fibers, waste materials, and biopolymers. Biocomposite materials provide a significant competitive advantage for manufacturers over traditional reinforcing fibers such as glass and resins such as polyesters as product reuse or recycling at the end of life becomes the norm. The presentation will cover two prime areas of research work done at Tuskegee University: Structural Nanocomposites and Advanced Green Composites. Under Structural nanocomposites area, research work was carried out to introduce different types of nanoparticles in thermoset and thermoplastic polymers, which were subsequently used to fabricate fiber-reinforced composites and characterized. Under advanced green composites area, work was focused on developing bio-based polymers, use of fully degradable biopolymers in processing natural fiber reinforced composites, extraction of lignin and cellulose from different biomass and their use as reinforcements in polymers and synthesis of novel resin systems. This presentation address will present highlights of some of the research activities carried over in recent years. *Support from National Science Foundation through EPSCoR, CREST, HBCU-RIA grants is acknowledged*.

Molecular imaging of cells and tissues using spectral imaging approaches

Silas J. Leavesley
Departments of Chemical and Biomolecular Engineering, Pharmacology and Center for Lung Biology, University of South Alabama

Cell physiology and pathophysiology fields have found increasing need to understand the complex, multiplexed, and spatially and temporally-localized nature of cell signaling events. Similarly, clinical diagnostic and imaging fields have found increasing need to understand the molecular basis for disease stratification and progression. Spectral imaging is a technique that was originally developed by NASA and the DoD for satellite and remote sensing applications that has potential to fulfill the molecular detection needs of both the biomedical research and clinical diagnostic communities. The technique combines aspects of spectroscopy and imaging by acquiring spectroscopic data for each pixel in an image and allowing spectroscopic analysis to be performed on individual pixels or regions. Spectral imaging approaches hold great promise for a range of biomedical research and clinical diagnostic fields, where the ability to simultaneously analyze spectroscopic changes across many features in an image is invaluable. Such analysis can yield critical insight into the molecular composition of cells and tissues, molecule-molecule interactions, and nano-scale events. We have worked to develop spectral imaging technologies and analysis approaches to address a range of biomedical applications, from research microscope platforms to clinical endoscopy, from monitoring intracellular signaling in 5 dimensions to colorectal cancer detection. In this talk we will demonstrate new spectral imaging technologies we have developed as well as approaches to apply spectral imaging for molecule-specific studies in cells and clinical diagnosis of tissues.

Molecular engineering of myofibrils in vivo

Ryan Littlefield
Department of Biology, University of South Alabama

Purpose: The basic contractile unit of striated muscle, the sarcomere, self-organizes through the precise assembly of actin (thin) and myosin (thick) filaments. Comparative studies have shown that although the basic architecture of sarcomeres are highly conserved, evolution has generated a wide variety of specialized muscle types and contractile behaviors. To examine what governs sarcomere architecture, my lab uses the model organism *Caenorhabditis elegans* (*C. elegans*), which develop obliquely-striated, "single-sarcomere", and non-striated (smooth) muscles. By understanding this self-organization process and determining the molecules that specify sarcomere architecture in vivo, it will be possible to reconstitute and modify this process in vitro to make novel contractile systems. Methods: We are using CRISPR-Cas9 mediated homologous recombination to generate fluorescently-tagged and mutant myofibrillar proteins. The lab uses these transgenic strains to characterize myofibril assembly at the molecular level. To determine the role of myosin motors during sarcomere assembly, we generated a "headless" mutant of the muscle myosin isoform myo-3 where the ATPase motor domain is detached from the filament-forming tail domain. We used molecular and behavioral assays to verify the modification of genomic DNA and characterize muscle function within the transgenic strains and high-speed confocal and super-resolution light microscopy to observe the assembly and dynamics of myofibril components in intact, live worms. Results: Transgenic strains containing fluorescently-tagged alleles of thin filament (troponin I and tropomodulin) and thick filament (myosin isoforms myo-3 and unc-54) components show normal myofibril assembly and muscle function. In the "headless" myo-3 strain, the absence of the motor domain has minimal impact on thick filament assembly and muscle function; however, the organization of the actin filaments is altered, such that the thin filament lengths appear shorter, yet remain fully overlapped with the unc-54 myosin heads. Conclusion: CRISPR-Cas9 gene editing is a powerful new tool to observe *C. elegans* myofibril assembly and self-organization in fine detail. The appearance of shorter thin filaments in the absence of the myo-3 myosin motor domain shows that interactions between thin and thick filaments are important for the precise determination of thin filament lengths. Our results show that myosin contributes to thin filament arrangement during myofibril assembly.

Characterization of surface markers expressed on exosomes derived from tumor cells in varying culture conditions

Steven McClellan, Mary Patton. Jaroslav Slamecka, Ajay Singh
USA Mitchell Cancer Institute Department of Basic & Translational Sciences, University of South Alabama

Introduction: Extracellular vesicles have become a major focus of study in many fields of both basic and clinical research. The smallest of these particles, exosomes range from 50-200nm in size. Traditional flow cytometers generally struggle to resolve individual exosomes. We have leveraged the precision of the acoustic focusing cytometer Attune™NxT to analyze individual exosomes for the expression of a variety of surface markers using multi-color staining. Methods: Exosomes were isolated via differential ultracentrifugation from several cancer cell lines as well as primary tumor cells cultured from patient samples. The cells were maintained in a variety of culture conditions (media with or without FBS, normoxia versus hypoxia) to compare the relative expression of surface markers. Directly labeled monoclonal antibodies were used in a variety of combinations to identify true lipid bi-layer exosomes from debris using markers such as CD9, CD63 and CD81 as well as the lipophilic styryl dye FM 1-43. Oncological related surface markers such as CD44, CD184, CD202b and EGFR were also evaluated. Particles isolated at varying centrifugal forces were measured via dynamic light scattering, to attempt to relate measured size to forward and side scatter parameters. Results: The use of ultra-filtered sheath fluid (25nm pore size) resulted in extremely low background noise, facilitating the resolution of individual exosomes. Compared to conventional flow cytometers, the Attune™NxT uses far less sheath fluid making the time consuming task of ultra-filtration feasible. Narrow beam shaping optics (10mm X 50mm) along with the particle alignment precision afforded by acoustic focusing allow for optimal detection of small particles. Diluting exosome preparations far enough enables the measure of single particles, avoiding what is often referred to as the “swarm” effect of multiple particles traversing the laser beam spot simultaneously. Exosome preparations of varying size were able to be detected using traditional forward and side scatter parameters. 405nm side scatter excitation provided a moderate improvement over 488nm side scatter. Cells are routinely cultured in serum free media to prepare exosomes for western blot or mass spec proteomic analysis. We sought to characterize the expression of surface markers on exosomes prepared from both conditions and found very little variation between the two groups. Differences in marker expression were seen when comparing cancer cells grown in either normoxic or hypoxic conditions.

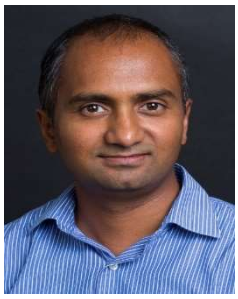
Testing novel antimicrobials using 3D printed scaffolds

Shreekumar R. Pillai
Professor, Biological Sciences and Associate Director, Center for Nanobiotechnology Research, Alabama State University

Many challenges remain in the development of new drugs and testing platforms for resistant bacterial infections. Although there are several 2D monolayer tissue models they cannot reproduce *in vivo* complex environments, with several studies reporting discrepancies in cell signaling pathways and drug responses between 2D or 3D culture conditions. Additive manufacturing (AM) technology is a potential solution for constructing complex 3D biocompatible structures via automated deposition of molecules on a substrate using computer-aided design/computer-aided manufacturing (CAD/CAM) technology.
In our previous studies, we have gained expertise in testing novel antimicrobial agents for the treatment of bacterial infections. In partnership with the University of Louisville, we are now exploring the development of 3D printed scaffolds for growing keratinocytes and epithelial cells. We are also exploring the use of commercially available scaffolds for the same purpose. Here, we will present some of our results on growing keratinocytes and epithelial cells on 3D scaffolds, followed by infection with bacterial pathogens and their inhibition by using novel nanomaterials.

Bioenergetics of the self-organizing forces across endothelial cells

Dhananjay Tambe
Mechanical Engineering, University of South Alabama



Background: Biological cells are no exception to the laws of physics. One such law is that of energy conservation. However, this fundamental law has not been assessed quantitatively in cells. As a result, it is unclear how much effort (or mechanical work) does a cell put into doing routine tasks such as (a) adhesion to the substrate, (b) adhesion to the neighbors, (c) migration and (d) cytoskeletal contraction. Enabling the measurement of such mechanical work is crucial to put the cellular energy conservation can be under the microscope. Innovation: We demonstrate that Monolayer Stress Microscopy (a novel in vitro platform to measure local mechanical forces around a cell [Ref. 1-2]) enables a novel and straightforward quantification of the mechanical work that each cell in an advancing monolayer does on its substrate, UT, and on its neighbors, US. Experimental system: We report mechanical work by individual cells within advancing monolayers of three cellular systems: pulmonary artery endothelial cells (AEC), pulmonary microvascular endothelial cells (MEC), and pulmonary vein endothelial cells (VEC). These three cellular systems are known to exhibit remarkable functional and molecular heterogeneity [Ref. 2-4]. Results and Conclusion: Although each cellular system had an advancing front, the AEC with their uniform cobblestone morphology and negligible motion were most quiescent and VEC with their non-uniform mesenchymal morphology and non-coherent motion were least quiescent. The forces that each cellular system exerted on the substrate and on neighbors were remarkably heterogeneous. Heterogeneity was also present in the patterns of mechanical work. But compared to the patterns of UT, the patterns of US appeared to have stronger spatial correlations. The farther cells were from being quiescent, the more strongly they were engaged in mechanical work. The mechanical work of the fastest and most coherently moving cells – the MEC – were least sensitive to the cellular size, distance from the advancing front. Surprisingly, and again in contrast with AEC and VEC, the MEC with spatially homogeneous motion appeared to exert greater mechanical effort. This unanticipated behavior appeared to be steered by the unique ability of the MEC to orient the intercellular traction more strongly along the cell-cell boundary. Taken together, we demonstrate a straightforward method to quantify mechanical work in adherent cells. We discovered a unique physical behavior of MECs that may find applications in tissue engineering and drug discovery.

Silver shield against UVB induced skin carcinogenesis

Nikhil Tyagi, Sanjeev K Srivastava, Sumit Arora, Sachin K Deshmukh, Yousef Omar, Zohaib M Ijaz, Ahmed Al-Ghadhban, James E Carter, Ajay P Singh and Seema Singh
Mitchell Cancer Institute, University of South Alabama

Exposure to ultraviolet (UV) radiation from sun remains the foremost epidemiological cause of skin malignancies, which account for more than a million new cases each year in the United States alone. Direct exposure of skin to UV radiation causes DNA damage, which if not corrected, leads to accumulation of carcinogenic mutations over time and results in transformation of cutaneous cells. Hence, there is a pressing need for the development of a novel, safe and effective preventive approach to combat UV radiation induced deleterious effects. In this regard, we have tested the chemoprotective role of silver nanoparticles (Ag NPs) against UV radiation-induced skin damage. AgNPs were synthesized by reduction-chemistry and characterized for their physicochemical properties. Synthesized AgNPs were well tolerated by human immortalized keratinocytes (HaCaT) cells and their pretreatment protected them from UVB-irradiation-induced apoptosis along with significant reduction in cyclobutane-pyrimidine-dimer formation. Moreover, AgNPs pre-treatment led to G1-phase cell-cycle arrest in UVB-irradiated HaCaT cells. AgNPs were efficiently internalized in UVB-irradiated cells and localized into cytoplasmic and nuclear compartments. Application of AgNPs on the skin of SKH-1 hairless mice drastically reduced (88.8 %) the incidence of squamous cell carcinoma formation upon repetitive UVB (180 mJ/cm^2) exposure for 29 weeks. Furthermore, in a comparative analysis of direct and indirect UVB-protection efficacy of AgNPs against known active ingredients of commercially available sunscreens viz. zinc-oxide (ZnO) and titanium-dioxide (TiO2) nanoparticles, we observed that UVB-reflective/absorption abilities was the highest for TiO_2-NPs followed by Ag- and ZnO-NPs. However, only Ag-NPs were active in protecting HaCaT cells against direct UVB-induced DNA-damage by repairing bulky-DNA lesions and also protecte HaCaT cells from UVB-induced oxidative

DNA damage. In contrast, ZnO- and TiO_2-NPs not only failed in providing any direct protection from DNA-damage, but rather enhanced oxidative DNA-damage by increasing ROS production. Together, our findings raise concerns about safety of ZnO- and TiO_2-NPs and establish superior protective efficacy of Ag-NPs.

Economical Processing and Property Optimization of High Temperature Polymer and Fiber Nanocomposites

Shaik Zainuddin, Mahesh Hosur, Mohammed Uddin, Naidu Seetala and Shaik Jeelani
Materials Science and Engineering, Tuskegee University

High temperature carbon fiber reinforced bismaleimide composites (CFRBCs) have been used for making 30-50% airplane parts in the Air Force F-22, F-35, C-17 and Boeing 780. However, the autoclave mold processing method utilized for manufacturing these parts is not cost effective and energy efficient. Therefore, the goal of this joint effort between Tuskegee University, AFRL, and Grambling University is to develop alternate cost-effective and relatively energy efficient method/s to manufacture these parts and utilize the same for large scale production. Here, we present one such CFRBC processing method developed which is cost effective and relatively energy efficient. In addition, results obtained from the mechanical and thermal tests of the processed CFRBC will be discussed.
