presence of beta-amyloid plaques stimulates the changes in the phosphorylation of Tau. This work was supported by an Undergraduate Research Grant from UMW.

RHO-GDP DISSOCIATION INHIBITOR AFFECTS GROWTH AND AFLATOXIN PRODUCTION IN *ASPERGILLUS FLAVUS*. Stephen Matherlee[1], Claudia Bernaschina[1], Gregory OBrian[2], Gary A. Payne[2], and Michael S. Price[1,2], [1]Dept. of Biology & Chemistry, Liberty University, Lynchburg. VA, [2]Dept. of Plant Pathology, NC State University, Raleigh, NC. Regulation of aflatoxin (AF) production is complex, involving transcriptional and post-transcriptional regulation focused mainly through the pathway specific transcriptional regulator *aflR*. An investigation into the nature of the transcriptional regulation of AF production by comparing conducive and non-conducive culture conditions revealed a clade of genes with a similar transcription profile to that of *aflR*. One of these genes, a putative Rho-GDP dissociation inhibitor, was characterized by gene deletion and shown to regulate AF production in *Aspergillus flavus*. The protein encoded by this gene, Afrdi1, showed 45% identity to Rdi1p in *S. cerevisiae*. The Δ*Afrdi1* mutant exhibits a severe growth defect on minimal medium, a moderate growth defect on complete medium, and a temperature sensitive phenotype. Moreover, the Δ*Afrdi1* mutant produces 97.3% less toxin than wild type. Inferences from *S. cerevisiae* reveal a possible link between AfRdi1 and RasA, which has been shown to regulate sterigmatocystin production in *A. nidulans*.

Biomedical and General Engineering

FEMTOSECOND LASER USE IN MEDICAL THERAPEUTICS: KEY ADVANTAGES AND LIMITATIONS OF NONLINEAR OPTICAL TISSUE INTERACTIONS. William R. Calhoun III[1,2] & Ilko K. Ilev[2], [1]Virginia Commonwealth University, Richmond VA 23298 and [2]Department of Biomedical Physics, Office of Science and Engineering Labs, U.S. Food and Drug Administration, Silver Spring MD 20993. Some of the most commonly performed surgical operations in the world, including laser-assisted in-situ keratomileusis (LASIK), lens replacement (e.g. cataract surgery), and keratoplasty (cornea transplant), now employ Femtosecond Lasers (FSLs) for their extreme precision, low energy and ablation characteristics. The application of FSLs in medical therapeutics is a recent development, and although they offer many benefits, FSLs also stimulate nonlinear optical effects (NOEs), many of which were insignificant with previously developed lasers. In order to improve the understanding of FSL-tissue interactions related to NOEs stimulated during laser beam propagation though corneal tissue, research investigations were conducted to determine how corneal tissue properties including corneal layer, collagen orientation and collagen crosslinking, and laser parameters including pulse energy, repetition rate and numerical aperture affect second and third-harmonic generation (HG) intensity, duration and efficiency. The results of these studies revealed that all laser parameters and tissue properties had a substantial influence on HG. The dynamic relationship between optical breakdown and HG was responsible for many observed changes in HG metrics. The results also demonstrated that the new generation of therapeutic FSLs has the potential to generate hazardous effects if not carefully controlled. This work was supported by the Oak Ridge Institute for Science and Education.

SOFT ELECTRODE SYSTEMS CAPABLE OF INTEGRATING ON THE AURICLE AS BRAIN-COMPUTER INTERFACE. Dong Sup Lee & Woon-Hong Yeo, Department of Mechanical & Nuclear Engineering, Virginia Commonwealth University, Richmond VA 23284. Non-invasive electrodes for recording of electroencephalograms on the scalp offer the diagnosis of neurological disorders and brain-computer interfaces. However, the existing devices using conductive gels are not usable for more than a few days due to side effects such as the skin irritation and irreversible degradation of electrical properties at the skin interface. To overcome the limitations, we introduce a set of electrodes and interconnects composed by a soft, foldable collection of open fractal mesh that adequately mounts on the complex surface topology of auricle and mastoid for high performance and long-term monitoring of electroencephalograms. Computational and experimental studies constitute the fundamental aspects of the bending and stretching mechanics suitable on highly irregular and textured surfaces. Cell level tests and thermal imaging studies demonstrate the biocompatibility and confirm wearability throughout daily activities including exercise, sleeping, and bathing. Experiment includes a text speller via steady-state visually evoked potential-based brain-computer interfaces.

FIBRONECTIN FIBRILLOGENESIS MEDIATES TGF-β1-INDUCE EMT IN MAMMARY EPITHELIAL CELLS. Lauren A. Griggs[1], Roshni Malik[1], Nadiah Hassan[1], Brittany A. Martinez[1], Lynne W. Elmore[2] & Christopher A. Lemmon[1], [1]Department of Biomedical Engineering, [2]Department of Pathology, Virginia Commonwealth University, Richmond VA 23284. Epithelial to Mesenchymal Transition (EMT) is a biological process characterized by a phenotypic switch in epithelial cell sheets into motile and invasive mesenchymal cells. During cancer progression, carcinoma cells seize the EMT regulatory circuity to initiate metastasis. This work investigates the role of the microenvironment in the induction of EMT. We examine the relationship between assembly of the extracellular matrix protein fibronectin (FN) into insoluble fibrils and the occurrence of EMT. We believe that increased tissue stiffness drives FN assembly, which exposes cryptic binding sites for various growth factors, such as Transforming Growth Factor-Beta1 (TGF-β1), and creates a high concentration of these growth factors at the cell surface, which in turn drives EMT. When mammary epithelial cells were co-treated with the FN assembly inhibitor and TGF-β1, EMT was notably inhibited. Addition of soluble FN to culture medium in a dose response alone was unable to induce EMT. Furthermore, increasing cell contractility increased FN assembly, but did not cause cells to undergo EMT, suggesting that growth factor localization to FN was required for EMT. On the other hand, inhibition of contractile forces decreased TGF-β1 induced FN assembly and blocked EMT. This work highlights novel targets in the tumor microenvironment for cancer therapy.

EFFECT OF VISUAL BIOFEEDBACK ON GAIT BALANCE SYMMETRY DURING ELLIPTICAL TRAINER EXERCISE. Trisha J.Massenzo[1] & Peter E. Pidcoe[2], [1]Department of Biomedical Engineering, Virginia Commonwealth University, Richmond VA 23284 and [2]Department of Physical Therapy, Virginia Commonwealth University, Richmond VA 23298. The aftereffects of a stroke can greatly influence parameters of gait, such as decreasing cadence, decreasing balance and stability and increasing the time spent on the non-paretic limb. Modern rehabilitation techniques are transitioning from compensatory actions to constraint-induced therapy. This widely implemented technique promotes neuroplasticity by constraining use of the paretic limb to perform daily activities of living. Both manual therapy and robotics can be implemented during this therapeutic approach to promote brain remodeling. Although manual therapy and robotics are widely used, there are a few disadvantages. Manual therapy poses a high physical demand on therapists, which may directly limit duration of therapy due to fatigue. Robotics offers a solution to this problem, but comes as a costly alternative and limits independence of the patient while gait training. In consideration of the benefits and disadvantages of these therapeutic approaches, a low-cost visual biofeedback system was constructed to allow users to independently adjust kinetic postural parameters. A pilot study was performed on a sample set of healthy participants to determine the effect of visual biofeedback. Four visual representations were also developed and were tested to determine which produced the best performance determined by index of symmetry values. Results proved visual biofeedback during kinetic weight training to be effective and found that one visual representation performed significantly better than the other three representations.

ELECTROPSINNING OF ARABINOXYLAN AS A NOVEL NANOFIBER SCAFFOLD. Donald C Aduba, Jr.[1], W. Andrew Yeudall[2] & Hu Yang[1,2], [1]Department of Biomedical Engineering, Virginia Commonwealth University, Richmond, VA 23284 and [2]Massey Cancer Center, Virginia Commonwealth University, Richmond, VA 23298. Research strategies in developing polysaccharide carbohydrate biomaterials for wound healing have steadily grown over the last decade. Arabinoxylan (AXF) is a carbohydrate polymer derived from cereal grains. However, their potential for clinical applications has yet to be fully realized. It is a polysaccharide comprised of a linear xylose backbone with arabinose units that are ester linked to ferulic acid. AXF is hydrophilic and possesses tunable swelling properties for fluid absorption. Polysaccharides have also been shown to increase macrophage proliferation necessary to ingest bacteria, debris and other infection causing agents. Therefore, AXF may be a suitable polymer to develop a wound dressing material for wound healing applications. This study aims to demonstrate the feasibility of electrospinning AXF to nanofibers and investigate the physical and biocompatible properties of the resulting nanofiber constructs. Gelatin (GEL) was blended with AXF to facilitate nanofiber formation and provide a natural polymer host tissues can readily accept after injury. Blends of GEL to AXF were successfully electrospun and characterized in terms of nanofiber morphology, tensile properties, pore size, degradation, molecular

composition and fibroblast cellular response. The work shows the potential of this novel scaffold for wound dressing development.

DESIGN AND CREATION OF A NOVEL DEVICE TO INDUCE VERGENCE EYE MOVEMENT TO QUANTITATIVELY STUDY THE DIFFERENCE AMONG PATIENTS WITH MTBI. Jacob Jaminet & Paul A. Wetzel, Virginia Commonwealth University, Richmond, VA 23220. Mild traumatic brain injury (mTBI) can affect different areas of the brain including those that are necessary for sight. The vergence eye system is the visual system responsible for depth perception. In order to study the effects of mild traumatic brain injury on vergence eye movements, a novel device was created. A mirror galvanometer is used to reflect a laser spot along a thin membrane plane. The laser spot moves along the visual midline of the viewer to a depth between 10 cm and 100 cm. A previously used program was used to control the mirror galvanometer so that a variety of movements could be programmed into the device. These movements cause the eyes to rotate 10.7° from midline. This device will be used to induce vergence eye movements that can then quantifiably measure the difference in convergence, accommodation, and pupillary constriction. This device will be used to identify the severity of mTBI between patients.

LICHEN INSPIRED SOLAR ENERGY SYSTEM. Jerney B. Davis & Jacquelyn K. Nagel, Department of Engineering, James Madison University, Harrisonburg VA 22807. The Climate Adaptable Solar Energy (CASE) System, as designed by a prior engineering capstone team, is a design inspired by lichen and applies biological concepts of protection and energy conversion to achieve adaptability. Adaptability addresses the performance reduction due to changing environmental conditions. Lichen is a composite organism of algae and fungus. Dye sensitized solar cells (DSSC) are an organic and sustainable method of obtaining electrical energy from light, and mimics algae in lichen. This research aims to vet the previous team's DSSC design for the CASE system. Four different DSSC designs were constructed and tested in various conditions to measure the efficiency in converting electrical energy, protection for the dye, and compact design. Preliminary results indicate that connection to the cells is more important than surface area exposed to the sunlight, and the cells incorporating Parafilm as a protective cover and alligator clips provide the most efficient and consistent voltage. The Parafilm and alligator clip design will be used in future experiments with the CASE system to improve future sustainable energy options.

ARABINOXYLAN FOAMS FOR WOUND DRESSING APPLICATIONS. Donald C Aduba, Jr.[1], W. Andrew Yeudall[2] & Hu Yang[1,2], [1]Department of Biomedical Engineering, Virginia Commonwealth University, Richmond, VA 23284 [2]Massey Cancer Center, Virginia Commonwealth University, Richmond, VA 23298. Fabrication of an ideal wound dressing material is critical in managing healing post-injury. Wound dressing materials have been developed to help treat acute, moderately exudating wounds by creating a moist microenvironment conducive to tissue regeneration while preventing infection at the injury site. An ideal wound healing material must possess the following properties to help aid wound management. It must be an occluder and have good biocompatibility. It should have mechanical strength for insulation, wound protection and exudate removal from the injury site. Lastly, it must be absorptive, impermeable to bacteria and inexpensive. Many current wound dressing materials on the market possess the aforementioned properties but none have used arabinoxylan as a base material. Arabinoxylan should be considered as a wound dressing because of its high porosity and swelling properties which allow easy absorption and retention of wound exudate. This allows the injury site to stay moist. Similar carbohydrate based polymers as arabinoxylan have also shown an ability to modulate immune response which is critical during the inflammation stage of wound healing. The goal of this study is to investigate and highlight the material and biocompatible properties of arabinoxylan foams as a potential wound dressing material. D.A. is a recipient of SREB-State Doctoral Fellowship.

Posters

SUSTAINABLE MANUFACTURING THROUGH BIO-INSPIRED DESIGN. Jacquelyn K Nagel[1], Chris Graves[1], Austin Underhill[1], Katie McCullar[2] & Katie Kelly[3], [1]Dept. of Engineering, [2]Dept. of Biology, [3]Dept. of Integrated Science & Technology, James Madison Univ., Harrisonburg VA 22807. Bio-inspired design, or biomimicry, is an approach to innovation by taking nature's patterns, forms, functions, processes, and materials and using them to develop engineering solutions. Biological systems exhibit multi-functionality from form and not material which offers inspiration for product life-cycle management. The goal is to better understand the connection between form and function as found in nature to re-design semi-recyclable products. Through application of bio-inspired design, to the manufacturing and disposal lifecycle phases, product recyclability is increased through minimization of material diversity while still achieving desired functions. One inspiring biological morphology that has been utilized across multiple biological kingdoms and in this research is variations in hardness and flexibility found in alternating layers that are used to provide strength, durability, distribution channels, and protection. Another inspiring morphology considered in this research is found on the neck membrane of the exoskeleton of a dragonfly, which consists of intricate folding that provides the functions of stiffness, elasticity, and low friction smoothness which increases maneuverability of the dragonfly's head. These multi-function forms have resulted in the redesign of a semi-recyclable product fabricated using additive manufacturing to create a product that is made from a single material yet still achieves all necessary functions.

Botany

AN ANALYSIS OF INFRASPECIFIC VARIATION WITHIN *ELEOCHARIS* TENUIS (CYPERACEAE). Lane D. Gibbons & Conley K. McMullen, Dept. of Biol., James Madison Univ., Harrisonburg VA 22807. The presence of subtle and often