(HSPs), protects animals from such biological challenges. Furthermore, not only are HSPs being applied to avian stress research on a limited basis, methods currently being employed by ornithologists to measure them do not allow them to be precisely quantified. These methods, based on colorimetric protein detection, only permit subjective comparisons to be made among samples. The objective of this project was to determine the efficacy of an alternative colorimetric HSP60 detection method that allows objective quantification, which would allow more meaningful analyses to be carried out of the factors that contribute to stress. Blood samples were collected from 16 House Sparrows at the University of Mary Washington campus during the spring of 2008 and 2009. Indirect and trap Enzyme-linked immunosorbent assays (ELISA) were used to measure HSP60 protein levels in them. Both methods detected HSP 60 proteins in the samples, but the trap ELISA was found to be more sensitive and showed less variability than the indirect ELISA. Funds were provided by Mrs. Thyra Valade Memorial Fund and UMW Undergraduate Research Fund. Thanks to V. Zimmermann, K. McAndrew & A. Dougherty for collecting samples.

BISPHENOL A INTERACTS WITH ESTROGEN RELATED RECEPTOR GAMMA TO REGULATE PRODUCTION OF C-FOS AND PS2 GENE PRODUCTS. Shannon Tucker. Department of Biology, University of Mary Washington, Fredericksburg, VA 22401. Bisphenol A (BPA) has been linked to breast carcinoma in humans for over 20 years, yet the mechanism by which BPA causes breast cancer has yet to be determined. We propose a novel mechanism by which bisphenol A acts through the estrogen related receptor γ (ERRγ), to upregulate potentially cancerous proto-oncogenes such as pS2 and c-fos. Our results show that blocking either the estrogen receptors (ER) or ERRγ, (by use of fulvestrant and 4-hydroxytamoxifin, respectively) in human breast cells reduces the levels of c-fos protein and pS2 in cells exposed to carcinogenic levels of BPA, with the greatest reduction occurring in the ERRγ blocked cells. Moreover, when both of these receptors are blocked, our results showed even lower amounts of c-fos (72.4% lower than control) and levels of pS2 proteins were undetectable. With further research, these results could finally explain the positive correlation between levels of BPA and breast cancer.

Biomedical and General Engineering

LACK OF EFFECT ON CELL-MEDIATED IMMUNITY FOLLOWING IN VIVO EXPOSURE TO ELECTROSPUN POLYCAPROLACTONE. C.E. McLoughlin1, M.J. Smith2, G.L. Bowlin1, & K.L. White, Jr.2 1Department of Biomedical Engineering, Virginia Commonwealth University, Richmond, VA 23284, 2Department of Pharmacology and Toxicology, Virginia Commonwealth University, Richmond, VA 23284. Studies in our laboratory have focused on the effects on the immune system following in vivo exposure to electrospun polycaprolactone (EPCL). We are investigating the role of fiber diameter of EPCL, specifically comparing EPCL with average fiber diameter of 1.7um (“microfibrous”) compared to 225nm (“nanofibrous”).

The results presented demonstrate a lack of effect of EPCL on cell-mediated immunity, evaluated using the anti-CD3 T-cell proliferation and the mixed lymphocyte response assays following exposure to microfibrous EPCL. In addition both forms of EPCL have been evaluated in vivo with the delayed-type hypersensitivity (DTH) response. Neither microfibrous nor nanofibrous EPCL adversely affected the DTH response. Additional studies will include evaluation of both forms in not only young but also elderly animals.

APPLICATION OF HRV FREQUENCY DOMAIN METHOD ON RESPIRATORY RATE OF MECHANICALLY VENTILATED ADULTS. N.Y. Isti Arief, Paul A. Wetzel[1], Mary Jo E. Grap, & Curtis N. Sessler Department of Biomedical Engineering, Virginia Commonwealth University, Richmond, VA 23284. The Frequency domain method of heart rate variability (HRV) has been commonly used as an indicator of the physiological state of the cardiac and autonomic nervous system; a valuable tool for non-communicative, vulnerable population such as the mechanically ventilated. This study explores the relationship between respiratory sinus arrhythmia (RSA) and HRV by utilizing the frequency domain method on 10 intubated, sedated, mechanically ventilated adults. Correlation analysis was performed on power spectral density (PSD) estimates derived from heart and respiratory rate tachograms. Results showed modest overall correlation ($R = 0.74$, $SD = 0.17$, $p < 0.0001$), consistent with expectations for this population. This result supports the exploration for respiratory rate tachogram PSD as a potential tool for supplemental non-invasive autonomic nervous system indicator.

STRUCTURAL OPTIMIZATION FOR A NANO-FLUIDIC SYSTEM MIMICKING THE TRANSPORT THROUGH NUCLEAR PORE COMPLEX. Jae H. Lee & Ramana M. Pidaparti, Deptartment of Mechanical Engineering, Virginia Commonwealth University, Richmond VA 23284. A bio-inspired nano-fluidic system mimicking the nuclear pore complex (NPC) is investigated for fluidic transport by optimizing the geometry. In general, nuclear pore complex contains very distinct geometrical components to allow various macromolecules very effectively through the pore. In order to understand and design fluidic systems for drug delivery and other applications, this study explored the optimization of a central plug location of NPC for achieving the maximum velocity for fluidic transport. The simulation is repeated for the different positions and length to get the output velocity. The approach involves conducting fluid simulations with ANSYS software and optimizing the results using EXCEL software. Based on the results obtained, one configuration of the central plug location achieved maximum velocity through the modeled nano-fluidic system.

OCULOMOTOR CONTROL IN PATIENTS WITH PARKINSON'S DISEASE. George T. Gitchel M.S. Department of Biomedical Engineering, Virginia Commonwealth University, Richmond, VA 23284. There have been few studies investigating the eye movement behavior of Parkinson's disease patients during fixation. This study objectively measured the eye movements of 36 patients with Parkinson's disease, and 20 age matched controls. Stimuli consisted of ten standardized text passages first organized by Miller and Coleman. In addition, subjects followed a randomly displaced step jump target motion. Pendular nystagmus was found

in all Parkinson's subjects, with an average frequency of 7.44 Hz. Saccadic peak velocity and duration along the main sequence were not statistically different from controls. A slower rate of reading was also noted in the Parkinson's group in terms of characters per minute, but with no more regressions than normal. Rate of square wave jerks was also found to be normal. This suggests that the hallmark feature of eye movements in Parkinson's disease is a pendular nystagmus during fixation, and all saccadic activity to be normal.

THE DESIGN AND VALIDATION OF A COMPUTATIONAL RIGID BODY MODEL OF THE ELBOW. E.M. Spratley, M.S., J.S. Wayne, Ph.D. Dept. of Biomedical Engineering, Virginia Commonwealth University. The use of computational modeling is an effective and inexpensive way to predict the response of complex systems to various perturbations. However, not until recently has this technology been used to predict the behavior of physiological systems, specifically the human skeletal system. To that end, a computational model of the human elbow joint was developed using computed topography (CT) scans of cadaveric donor tissue, as well as the commercially available software package SolidWorks™. The kinematic function of the joint model was then defined through 3D reconstructions of the osteoarticular surfaces and various soft-tissue constraints. The model was applied toward a cadaveric experiment performed by Fern et al that measured the significance of coronoid process fractures, lateral ulnar collateral ligament ruptures, and radial head resection in elbow joint resistance to varus displacement of the forearm. Kinematic simulations showed that the computational model was able to mimic the physiological movements of the joint throughout various ranges of motion including flexion/extension and pronation/supination. Quantitatively, the model was able to accurately reproduce the trends, as well as the magnitudes, of varus resistance observed in the cadaveric specimens. Additionally, magnitudes of ligament tension and joint contact force predicted by the model were able to further elucidate the complex soft-tissue and osseous contributions to varus elbow stability.

DEVELOPMENT OF A RIGID BODY COMPUTATIONAL MODEL FOR INVESTIGATION OF WRIST BIOMECHANICS. Benjamin J. Majors & Jennifer S. Wayne, Ph.D. Department of Biomedical Engineering, Virginia Commonwealth University, Richmond, VA 23284. The wrist is one of the most complex joints in the human body because of the number of bony and soft tissue structures present to accomplish the activities of daily living. The goal of this study was to develop a computational model of the wrist joint complex where joint motion and behavior is dictated by highly accurate three dimensional articular contact, ligamentous constraints, muscle loads, and external perturbations. Validation of the model was achieved by comparing predicted results from the model to the results of a published cadaveric experiment that analyzed wrist function under effects of various surgical procedures. The results showed similar trends and magnitudes between the computational model and the cadaveric experiment. While some differences were seen, the model can still be used to predict overall biomechanical function of the wrist joint complex.

A COMPARATIVE ANALYSIS OF METHODS FOR BASELINE REMOVAL IN PRETERM INFANT RESPIRATION SIGNALS. Pallavi Ramnarain & Paul A. Wetzel, Ph.D. Department of Biomedical Engineering, Virginia Commonwealth University, Richmond, VA 23284. Baseline drift removal is an critical step in preprocessing data for event detection applications. The goal of this work was to compare five different methods for basline drift removal in preterm infant respiration signals. These included a linear spline approximation, a cubic spline approximation, a recurrent neural network approach, a first derivative based approach and a second derivative based approach. Respiration was measured using a thermistor embedded in infant nasal cannula. All five methods were compared using the same event detection algorithm to evaluate their effectiveness at drift removal. The most effective method for this application was the second derivative method.

Botany

THE *FLORA OF VIRGINIA* PROJECT: A 2009-2010 UPDATE. Marion B. Lobstein, Dept. of Biol., NVCC, Manassas, VA 22205. Virginia, for its landmass, has the most diversity of vascular plant species of any state in the United States. It had the first flora, the *Flora Virginica* in 1739, yet does not have a modern *flora*. The Virginia Academy of Science for over eighty years has supported efforts to produce a modern *Flora of Virginia*. In 2001 the Foundation of the *Flora of Virginia*, Inc, was formed in 2001 and in May 2002 received 501(c) 3 status. Progress continues to be made on the efforts to develop a *Flora of Virginia* including fund-raising and public outreach efforts. Work on the content of the Flora of Virginia including the nearly 300 of the core illustrations have been commissioned, completed, and funded by VAS funds. Grants from Robins Foundation and Old Dominion have been obtained for the Project during this past year. The Academy, including the Fellows, continues to provide essential support including financial for this Project. Other progress includes completion of treatments of the dichotomous keys of 190 of the 199 vascular plant families in Virginia and the first step in developing species and genus descriptions has been completed. The second step of herbarium work on descriptions is complete and the third and final step of species genus descriptions is 94% completed. The projected publication date is late 2012 or early 2013.

ANTIOXIDANT ANALYSIS OF SELECTED TEMPERATE SPICES. Erinda Stefi & Michael H. Renfroe, Dept. Biology, James Madison University, Harrisonburg VA 22807. There is a growing interest in natural antioxidants due to their major role in human health. Spices are main targets when searching for antioxidants. The addition of antioxidants in people's diets is very important in preventing degenerative diseases such as cancer, cardiovascular, neurological diseases and cataracts. The purpose of this research project was to determine the hydrophilic and lipophilic antioxidant content of seven Mediterranean spices: basil, oregano, sage, thyme, rosemary, marjoram and mint. The antioxidant content of each spice was directly related to the drop in ABTS absorbance upon the addition of the spice extract to the HAA and LAA reagents. A standard curve was established by measurements of known concentrations of trolox, a