Plasma medicine is a new, rapidly growing field. Applications of non-equilibrium plasmas in medicine include skin sterilization [1], wound sterilization and healing [2, 3], blood coagulation [4, 5] and more [2, 6]. There is a variety of discharges and their applications. Several studies show implementation of dielectric barrier discharge (DBD) plasma treatment. All the reported results show the importance of media and environment on sterilization efficiency, especially the presents of liquid [7, 8]. In many cases, liquid is not only being present during the treatment but the plasma actually goes through liquid before going to the biological organism. For example, during wound treatment, blood plasma is present which is interacting with the discharge [9]. Due to the apparent importance of the liquid ever-present during the treatment, we decided to treat liquid directly, apply it to microorganisms and living tissue, and analyze the resulting microorganism inactivation efficiency and mechanism. In this study we investigate bacterial inactivation via transferred DBD plasma treatment. In contrast to direct and indirect methods, where plasma either contacts the surface being treated or is removed a few millimeters from it, here liquid was first treated with DBD plasma separately and then after certain time delay this treated liquid was applied to a contaminated surface with irregular topography. This method is compared to direct plasma treatment. Effectiveness and efficiency of transferred plasma treatment will be presented and potential chemical and biological mechanisms will be discussed.

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BES02: FUNCTIONAL NEAR INFRARED SPECTROSCOPY (FNIRS): AN EMERGING NEUROIMAGING TECHNOLOGY WITH IMPORTANT APPLICATIONS FOR THE STUDY OF SOCIAL ANXIETY DISORDER

Anootnara Talkul (Drexel University), Lisa Hayley Glassman (Drexel University), Meltem Izzetoglu (Drexel University), James D. Herbert (Drexel University)

Social anxiety disorder (SAD) is one of the most common psychiatric disorders diagnosed in the United States. The generalized subtype of SAD is typically chronic and debilitating, and associated with decreased quality of life and significant impairment in social and vocational functioning. Considering its prevalence, there has been increased attention to SAD over the past three decades among both researchers and clinicians. Most existing treatments for social anxiety (both pharmacologic and psychotherapeutic) emphasize a reduction of anxiety and avoidance, but neglect to focus as much on improving long-term social performance and relapse prevention. Moreover, underlying treatment mechanisms are poorly understood, and few
data exist to support optimal matching of treatments to patient characteristics. Functional near-infrared spectroscopy (fNIRS) is a promising new technology that has already demonstrated utility in the study of normal human cognition. fNIRS can measure hemodynamic changes in the brain corresponding to cognitive activity. fNIRS technology allows for the study of brain activity under both laboratory and field conditions, and is portable and less susceptible to movement artifacts relative to established neuroimaging technologies. The individual is allowed to move and use non-verbal expressions (e.g., hand gestures, head nods) during actual anxiety provocation in real settings, which can potentially lead to more useful data. Additionally, replication studies are limited with established technologies due to the high cost and unavailability of equipment (Davidson, 2002), whereas fNIRS is much less expensive, with near zero run time cost, and hence is more suitable for repeated studies. fNIRS is also less time-consuming to set up and less invasive in administration compared with other neuroimaging techniques such as EEG, PET, or fMRI. This study aims to: 1) investigate frontal hemispheric activity during baseline and active anxiety states in generalized social anxiety using fNIRS technology; 2) determine if baseline fNIRS readings can predict response to two different cognitive behavioral treatments; and 3) explore the reliability and accuracy of frontal lobe fNIRS data during anxiety states in social anxiety by comparing outputs to subjective reports of anxiety. Plans for the study are currently nearing completion, and data collection will begin soon. Thus, the application of fNIRS technology to the study of social anxiety disorder may provide more reliable and valid data that can help in building a better understanding of the neurocognitive aspects of this common disorder that is currently not currently possible with the applications of existing neuroimaging technologies.

**BES03: MICRO AND NANO SURFACTANT STABILIZED GAS BUBBLES AS ULTRASOUND CONTRAST AGENTS**

*Shweta Naidu Chitoor (School of Biomedical Engineering & Health Sciences)*

Ultrasound contrast agents have widely been used in Medical Imaging to enhance the contrast of structures in our body. They can be used to study the location of tumors and also deliver drug at the specific sites. The poster focuses on the development of SE61 micro- and nano- surfactant stabilized gas bubbles. The gas core is made up of perfluorocarbon and stabilized by mixture of two surfactants- Span 60(Sorbitan Monostereate) and TPGS (Vit E- nonionic surfactant). When ultrasound is transmitted into the body and
encounters the bubbles with different acoustic impedance, it reflects a characteristic echo (ultrasound backscatter) giving contrast enhancement in sonogram. The micro-bubbles with mean diameter between 1.5-2.6 µm are stable and provide contrast enhancement (23-27dB). Nano-bubbles with mean diameter 350-450 nm are prepared and provide contrast enhancement between 20-25 dB at lower doses. The second part of the study involves studying the effects of salt concentration and surfactant ratios on the population of nano-bubble. Due to difficulty in counting the number of nanobubbles, the increase or decrease in the amount of nanobubbles produced will be compared by means of turbidity analysis (absorbance scan) at 610nm. Also zeta potential, dose and time responses (relative enhancement) are studied for both micro and nano-bubbles.

BES04: PREPARATION AND ANTIBACTERIAL ACTIVITY OF ELECTROSPUN CHITOSAN/FORMIC ACID SOLUTION CONTAINING SILVER NANOPARTICLES
Tianjiao Cai (Drexel University), Caroline Schauer (Drexel University)

Chitosan is a natural nitrogen-rich polysaccharide with a variety of useful properties such as biocompatibility, biodegradability as well as aqueous absorption capabilities. Mid molecular chitosan with Trifluoroacetic acid (TFA) were successfully prepared nanofibers through electrospinning. Silver nanoparticles were processed to enhance the antibacterial properties. Due to the fact that silver particles dissolved, in the solution, TFA was replaced by formic acid. Isopropanol was added to overcome the surface tension force. After two-step crosslink, the electrospinning fibers were insoluble in basic, acidic and aqueous solution. The ultimate goal is to distribute silver particles in chitosan fibers. Through antimicrobial tests and chemical analysis, the change in mechanical properties and the inactivation of bacteria will be defined.
A polymeric ultrasound contrast agent loaded with doxorubicin has been developed. When triggered by ultrasound, it undergoes size reduction enabling extravasation through the leaky tumor vasculature, promoting accumulation within the interstitium. This study investigates the use of this agent in a rat liver cancer model. Results are compared with drug loaded nanoparticles and free doxorubicin. Microbubble ultrasound contrast agents (1.2 µm) and 200 nm nanoparticles were prepared containing 14-C labeled doxorubicin. Microbubbles, nanoparticles, a combination of the two, or free doxorubicin were administered intravenously in ACI rats bearing Morris 3924a hepatomas, concomitant with tumor insonation. Plasma doxorubicin levels were measured over 30 minutes and in organs and tumors after 4 hours, 7 and 14 days. Tumors were measured upon sacrifice and evaluated with autoradiography and histology. Animals treated with microbubbles had significantly lower peak plasma concentrations (0.4661 ± 0.0684%/ml) compared to free doxorubicin (3.0328 ± 0.6120%/ml, p=0.0019). After 14 days, levels in the heart were significantly lower in animals treated with microbubbles compared to free doxorubicin (0.1676%/g tissue vs. 0.3198%/g, p=0.0088). Tumors treated with microbubbles showed significantly higher drug levels than tumors treated with free doxorubicin after 4 hours (4.1739± 0.8397 ng/mg tissue vs. 0.4162± 0.0969 ng/mg tissue, p=0.0472). These tumors showed no significant increase in size over 14 days and significantly less growth than tumors treated with free doxorubicin (p=0.0390). Doxorubicin loaded ultrasound contrast agents provided enhanced, sustained drug delivery to tumors while reducing peak plasma drug concentrations, lowering doxorubicin concentrations in the heart and arresting tumor growth.
There have been many approaches in the field of biofabrication, Tissue Engineering, and Regenerative Medicine to fabricate a building block (scaffold) which is unique to the target tissue/organ that facilitates cell growth, attachment, proliferation, and or differentiation. Currently, many techniques that will fabricate three-dimensional scaffolds; however, there are advantages, limitations, and specific tissue focus of each fabrication technique. The focus of this initiative is to utilize an existing technique and expand the library of biomaterials which can be utilized to fabricate three-dimensional scaffolds rather than focusing on a new fabrication technique. An expanded library of biomaterials will enable the Precision Extrusion Deposition (PED) device to construct three-dimensional scaffolds with enhanced biological, chemical, and mechanical cues that will benefit tissue generation. Computer aided motion and extrusion drives the PED to precisely fabricate micro scaled scaffolds with biologically inspired: porosity, interconnectivity, and internal and external architectures. The high printing resolution, precision, and controllability of the PED allows for closer mimicry of tissues and organs. The PED expands its library of biopolymers by introducing an Assisting Cooling (AC) device which increases the working extrusion temperature from 120ºC to 250ºC. This paper investigates the Precision Extrusion Deposition with the integrated Assisting Cooling’s capabilities to fabricate three-dimensional scaffolds that support; cell growth, attachment, and proliferation. Studies carried out in this article utilized a biopolymer whose melting point is established to be 200ºC. This polymer was selected to illustrate the newly developed device’s ability to fabricate three-dimensional scaffolds from a new library of biopolymers. Three-dimensional scaffolds fabricated with the integrated AC device should illustrate structural integrity and ability to support cell attachment and proliferation.
The collagen fibres of the heart valve are critical to providing the tissue the mechanical properties to meet its function. Although the tensile behavior of the whole leaflets of heart valves has been assessed in many studies, there is limited information detailing properties of individual collagen fascicles and their interactions. In a previous study, we measured and reported the nonlinear and viscoelastic properties for a group of human Achilles’ tendon fascicles. The behavior of the collagen fiber bundles as a whole are influenced by the thin membrane connecting them. Knowledge of the structural and biomechanical properties at this “mesostructural” scale (fascicle-level) can improve the quality of our heart valve models and from that engineered replacements. Studying the failure of these tissues potentially deepens our understanding of the heart valve pathologies. Designed based on previous work in Achilles tendon testing, this device we are presenting is capable of assessing the properties of the individual components of the tissue and membranes. Our current work presents apparatus suited for testing and imaging individual fascicles. While commercially available testing devices cost on the order of thousands of dollars, our device has been built under a $200 budget.

Hyaluronic Acid (HA) is a high molecular weight glycosaminoglycan normally found in the extracellular matrix and joints of the body. Elevated levels of this molecule have been found in the serum during liver disease and in wound fluid during the tissue repair process. Detection of this biomarker at concentrations in the microgram per liter range could be useful for monitoring tissue repair or early detection of liver disease. Normal detection methods including ELISAs and capillary electrophoresis can detect HA in this range but the techniques take a few days and require multiple preparation and separation steps. Surface-enhanced Raman scattering (SERS) could be an alternative detection tool as the Raman signal gives a specific signature stemming from the molecular vibrations in the molecule and has been shown to provide enhancement factors ranging
between $10^6 - 10^{12}$. SERS is a surface detection technique so it requires HA to come in close proximity to the nanoparticles. However, due to its intrinsic negative charge HA does not readily adsorb to metallic surfaces. To overcome this, a SERS substrate was developed using thermally treated printable nanoparticle silver ink as the base component and a self assembling monolayer of cysteamine that facilitates immobilization of HA on the surface. More specifically the trans conformation of cysteamine allows the carboxyl group of HA to attach to the amine group of the ligand. SERS analysis can be used to monitor the concentration of cysteamine trans conformers in order to optimize HA attachment. SERS analysis also shows an increase in HA Raman band intensity when immobilized to the substrate as compared to free HA on the substrate. In addition the correlation between HA concentration and relative peak heights will be discussed. Finally, HA was detected at concentrations one order of magnitude lower than previous SERS studies. This method presents an alternative to conventional detection techniques that can aid in the direct detection of biomarkers in biological fluids.

BES09: MODELING AND TISSUE PARAMETER EXTRACTION CHALLENGES FOR FREE SPACE BROADBAND FNIR BRAIN IMAGING SYSTEMS

Ebraheem Sultan (Drexel University), Khushali Manseta (Drexel University), Adil Khwaja (Drexel University), Kambiz Pourrezaei (Drexel University), Afshin Daryoush (Drexel University)

Fiber based functional near infra-red (fNIR) spectroscopy has been considered as a cost effective imaging modality. To achieve a better spatial resolution and greater accuracy in extraction of the optical parameters (i.e., $\mu_a$ and $\mu'_s$), broadband frequency modulated systems covering multi-octave frequencies of 10-1000MHz is considered. Accurate measurements of amplitude and phase of the frequency modulated NIR signals (670nm, 795nm, and 850nm) is reported here using free space optical transmitters and receivers realized in a small size and low cost modules. The tri-wavelength optical transmitter is based on vertical cavity semiconductor lasers (VCSEL), whereas the sensitive optical receiver is based on APD photodiodes combined with transimpedance amplifiers. This study also has considered brain phantoms to perform optical parameter extraction experiments using broadband modulated light for separations of up to 3cm. Analytical models for predicting forward (transmittance) and backward (reflectance) scattering of modulated photons in diffused media has been
modeled using Diffusion Equation (DE). The robustness of the DE modeling and parameter extraction algorithm was studied by experimental verification of homogeneous diffused media phantom. In particular, comparison between analytical and experimental models for narrow band and broadband has been performed to analyze the advantages of our broadband fNIR system.

BES10: KINETIC ESTIMATION OF PLASMA STERILIZATION PHENOMENON
Mohammad Haider Hasan (AJ Drexel Plasma Institute), Alexander Fridman (AJ Drexel Plasma Institute)

Atmospheric Pressure Non-Thermal Plasma Discharge has been observed to have strong antimicrobial properties. In an effort to understand the mechanism of the discharge's inactivation of microbes, a limited chemical kinetic estimation was made as a first step toward a fully descriptive and detailed model. The goal for this phenomenological estimation was to identify components of plasma discharge that were most influential on the exposure time required for complete sterilization. This estimation is currently capable of predicting the sterilization times of an airborne microorganism sterilization setup and a surface sterilization setup on agar within one order of magnitude. The plasma species included in this estimation are monatomic oxygen, ozone, hydroxyl radicals, and ultraviolet radiation, nitric oxide, and nitrogen ions. Using empirical data, reaction rate coefficients were developed to describe the rate at which microorganisms will inactivate when in presence of each of these plasma specie. Using the reaction rate coefficients and calculated concentrations of each plasma specie, the estimation predicts the plasma exposure time needed for complete sterilization.

BES11: REMOTE ROBOTIC 'AIR SURGERY' VIA INTEGRATION OF MOTION SENSING USING ROS
Yogesh Prasad Balajee (Drexel University), Dhairya Pujara (Drexel University), Harshad Tadas (Drexel University)

Problem Statement: (i) The case of most surgeries in a general hospital are delayed or postponed because of the non availability of certain doctors/surgeons. (ii) Occurrence of an emergency protocol whilst the best of surgeons are located elsewhere thus complicating the situation. (iii) The
amount of physical stress undergone by surgeons for performing a surgery. (iv) Practically realizing a low cost motion sensing equipment to perform surgery. Proposed Solution: Telemedicine, an influencing surgical training, allows mentoring, proctoring & teleconferencing, and is increasingly being applied to carry out remote surgical procedures. Redefining telemedicine, we propose a thought where on one end we have the surgeon operating from a remote location 'in free air' with the aid of motion detector cameras on one end and a surgical robot performing the operation on a patient at the other. This could potentially lift a great deal of stress on doctors and surgeons around the world. It also means that patients may have access to top surgeons without having to travel.

The Experimental Components:

Kinect for Xbox 360 platform: A controller-free gaming experience designed by Microsoft. Based around a webcam-style add-on peripheral for the Xbox console, it enables users to control and interact with the Xbox 360 without the need to 'touch' a game controller, through a natural user interface using gestures and spoken commands. The newly released Kinect has triggered one to many developers and hobbyists to crack the device since its inception in early November 2010. Also, since the product is commercial, the price is very affordable.

ROS (Robot Operating System): An open-source, meta-operating system for the robot. It provides the services you would expect from an operating system, including hardware abstraction, low-level device control, implementation of commonly-used functionality, message-passing between processes & package management. The Kinect device coupled with the platform of ROS seems to be a potentially powerful tool for a broad spectrum of motion sensing as well as image processing applications. Kinect’s camera: Primarily, it does two things: generate a three-dimensional image of the objects in its field of view, and recognize human beings among those objects. The color VGA video camera aids in facial recognition and other detection features by detecting three color components: red, green and blue. Microsoft calls this an 'RGB camera' referring to the color components it detects. A depth sensor, which is an infrared projector and a monochrome CMOS sensor work together, to see the room in 3D regardless of the lighting conditions.

The Robot: This will be the actual 'surgeon' performing the live operation on the patient, the input for which will come from a control unit. The robotic arm, links, manipulators and the end effectors are required to be designed and calibrated for precision and accuracy.

Control room (remote location): Here the surgeon will prepare himself for the surgery. The Kinect will capture the image of the surgeon and will align itself to specifically follow the hand direction and head movements. All he needs to do is wave his hands in front of the Kinect and start performing the operation in mid-air and the end result is the robotic arm aping the surgeon's exact action. Operation room
The patient will be operated by a robotic instrument which performs the tasks received from the remote surgeon. Since it eliminates the fact of a human performing surgery, it also eradicates with it the risk of infection.  

Future Research: (i) Although remote surgery can be established, there is however the problem of the surgeon to 'feel' the subject as he operates. This proves to be a challenging problem posed and we are currently looking into developing a system which can give feedback to the surgeon. (ii) Efforts to increase the resolution of the camera used and eventually replace the Kinect with a more specific instrument as it is not entirely ready for an actual surgery level. (iii) Setting up a high performance network to compensate lag time between the robot and surgeon using dedicated asynchronous transfer mode (ATM) telecommunication technology[4].  

Claims: (i) PrimeSense (the chip producer behind the Kinect) have released an SDK to the general public. Some things, like the drivers, were completely open sourced, while others, like skeleton tracking, user extraction and hand tracking are available free of charge. (ii) The Kinect has been successfully been programmed to perform various complex tasks like 3D image reconstruction, SLAM algorithm solving, Pattern recognition, Voice recognition etc.  

References:  

BES12: NOVEL 16S RRNA SEQUENCE DETECTOR FOR RDP’S NAÏVE BAYES CLASSIFIER  
Yemin Lan (Drexel University)

High-throughput, next-generation sequencing technology has enabled the in-depth study of metagenomes, which is the genomic material present in environmental samples. To analyze the diversity of organisms in a metagenomic sample, the 16S rRNA gene is typically used for its highly conserved structure between species and genera, and its hyper-variable regions provide species-specific signatures that are useful for source identification and annotation. Currently, RDP's (the Ribosomal Database Project) classifier, which is based on the naïve Bayes classifier, is the most widely used tool to classify 16S rRNA sequences due to its speed and relatively high accuracy. The naïve Bayes classifier is a supervised algorithm that relies on a database of known 16S rRNA sequences. However, because most environmental samples contain up to 90% of species not previously sequenced and therefore for not in database, a
supplemental method is necessary for discovering such novel sequences from the data. To resolve this, RDP currently uses bootstrapping to assess a confidence level to the classifier's assignment, which can be used to determine novelty or correct assignment at each taxonomic level, but we have found that the bootstrap confidence is variable with DNA read-length and is difficult to interpret. Through detection theory, we determine the optimal thresholds to determine novelty for 100bp, 250bp and 500bp read lengths. By evaluating a detection threshold at each read length, we can develop a read-length independent detector. By using 5-fold cross-validation to develop our detection threshold and then testing it on an independent dataset, we determine that the novel 16S detector we design for RDP’s classifier has an accuracy of 54%-69% on genus level, and 51%-84% on phylum level, where longer reads correspond to higher detection accuracy. A similar comparison approach is designed using another naïve Bayes classifier’s likelihood score, and the result shows that the detection using bootstrap has a higher accuracy than likelihood score on lower taxonomic levels, as well as keeps a comparable accuracy on higher levels.

BES13: RANDOM INDEXING TO REDUCE FEATURE DIMENSIONS USED IN TAXONOMIC CLASSIFICATION OF NEXT-GENERATION READS
Tze Yee Lim (Drexel University), Gail Rosen (Drexel University)

In taxonomic classification of metagenomic reads, increasing the length of n-mer exponentially increases computational cost for text-mining and naive Bayes classifier approaches. Thus, we proposed random indexing that reduces the multi-dimensional DNA-wordspace by representing each genome with a genome semantic vector, a summation of shorter random vectors, where each random vector represents each word occurrence. Instead of representing each genome by $K=4^n$ words, it is now represented by a much shorter length $K'$. The idea is that the high $K$-dimensional space can be reduced to a lower $K'$-dimensional subspace, with little loss in accuracy. Hence, $K'$ needed to be appropriately selected such that the genome semantic vectors obtained still preserved its structure. We specifically investigate two key parameters affecting accuracy, namely the random vector’s sparse composition and length. We found that random vectors composed mainly of zeros, with a low number of non-zero values sprinkled randomly in the vector, yielded an optimal performance. Also, preliminary investigation of the combination of trits and random vector length suggested the best combination of number of nonzero entries:random vector length to
be 20:4000. Overall, random indexing showed much promise to avoid the curse of dimensionality, which will allow long n-mers to now compute quickly while maintaining accuracy of some classification approaches.

BES14: COMBINING GENE PREDICTION METHODS TO IMPROVE METAGENOMIC GENE ANNOTATION
Non G. Yok (Drexel University)

Traditional gene annotation methods rely on characteristics that may not be available in short reads generated from next generation technology, resulting in suboptimal performance for metagenomic (environmental) samples. Therefore, in recent years, new programs have been developed that optimize performance on short reads. In this work, we benchmark three metagenomic gene prediction programs and combine their predictions to improve metagenomic read gene annotation. We not only analyze the programs’ performance at different read-lengths like similar studies, but also separate different types of reads for analysis, including intra- and intergenic regions. The main deficiencies are in the algorithms’ ability to predict non-coding regions and gene edges, resulting in more false-positives and false-negatives than desired. In fact, the specificities of the algorithms are notably worse than the sensitivities. By combining the programs’ predictions, we show significant improvement in specificity at minimal cost to sensitivity, resulting in 6% improvement in accuracy for 100bp reads with 1% improvement in accuracy for 200bp reads and above. To correctly annotate the start and stop of the genes, we find that a consensus of all the predictors performs best for shorter read lengths while a unanimous agreement is better for longer read lengths, boosting annotation accuracy by 2-8%. To optimize the performance for both prediction and annotation accuracies, we conclude that the consensus of all methods (or a majority vote) is the best for reads 400bp and shorter, while using the intersection of GeneMark and Orphelia predictions is the best for reads 500bp and longer.

BES15: GENERATING NUMERICAL MODEL GRIDS OF MARSHES WITH THE USE OF LIDAR DATA
Ramona Stammermann (Drexel University)

The main research will focus on the development of a numerical approach to study sediment transport processes in marshes. Marshes are highly variable with very small spatial scales. Integration of tidal channels with widths of only a few meters is required to provide enough volume for the tidal prism
of the respective marsh. Therefore a high resolution numerical grid will be necessary to resolve the modeled marsh area. Marshes have a large geospatial extent, no exact boundaries, and are often difficult to access. Thus, remote sensing technologies like LiDAR (Light Detection And Ranging) can be a helpful tool to provide data for topography and the location of tidal channels and other structures. For our study areas we utilized high resolution LiDAR data (2x2m) which is available for the Blackbird Creek and St. Jones reserves in Delaware. LiDAR measures the highest elevation of existing elements, including ground, structures, and vegetation. The tidal flats are mostly covered by dense vegetation, but the ground elevation is needed for the model set up. Our goal is to develop an approach that adjusts the existing LiDAR data by subtracting the height of the respective vegetation cover using a season adjusted correction, thus generate a Digital Terrain Model (DTM) that represents only the ground elevation. The DTM will be used to map the respective topography on the model grid. It is favorable for the model that grid elements in areas with strong currents are aligned with the flow. Therefore the location of the main tidal channels is required. Analysis of LiDAR data in the marsh resulted in heights between -0.5 and 0.5m for water surface elevations. This information can be used to extract the outline of the first, second and third order channels as polygons, which are used to triangulate the model grid appropriately.

BES16: A NUMERICAL APPROACH TO STUDY SEDIMENT TRANSPORT PROCESSES IN MARSHES OF THE DELAWARE BAY
Ramona Stammermann (Drexel University)

Wetlands and marshes belong to the most productive ecosystems in the world and play a major role in maintaining the health and function of their adjacent water bodies, e.g., estuaries, bays and rivers. They keep the water body clean, provide a significant ecological resource for terrestrial and aquatic animals and plants, and are a major coastal defense against flooding by sea. Type and composition of tidal marshes are mainly determined by the hydro-period, the time and depth of inundation. The hydro-period depends on two factors, the water level and marsh ground elevation. Sediments have a major influence on the marsh ground elevation due to erosion and deposition processes. Hence our numerical approach concentrates on studying sediment transport processes in marshes, utilizing the two-dimensional hydrodynamic numerical model system MARINA2D. Its modular structure includes models for currents, sediment transport, salt
and heat transport, and waves, hence covers the needs for simulating the processes of interest. To achieve this, a two-step approach is chosen: 1) set up of a global model of the Delaware Estuary to produce boundary conditions for sub-models of marshes; 2) set up of localized sub-models, each covering a single tidal marsh in the Delaware Bay to study sediment transport processes in marshes. Based on the need for respective steering data, two marshes were chosen, which are already involved in long term monitoring programs: the St. Jones and Blackbird Creek Reserves on the Delaware side of the Bay, monitored by the Delaware Department of Natural Resources and Environmental Control (DNREC). The model can be used to study general transport patterns in terms of suspended sediment concentration, erosion and deposition, and to locate areas specifically prone to erosion in case of storm events. Sensitivity studies with high and low sediment concentrations can provide insights into the effect of sediment availability on marsh development.