to nearby myofibrils as desmin act as scaffold around the Z disk. We develop an elastic model of the sarcolemma and its links through costameres to the contractile apparatus based on our results.

2099-Pos

Spatial Correlation of Speckle Fluctuations Reveals Thickness and Features of the Ocular Surface Tear Film

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Here we present Fluctuation Analysis of Spatial Image Correlation (FASIC), a non-invasive method for evaluating the complex dynamics of the tear film surface by spatial correlation analysis. Tear film stability and its interaction with the corneal surface play an important role in maintaining ocular surface integrity and quality of vision. Dry Eye Syndrome (DES) refers to abnormalities of tear film secretion and/or stability diagnosed by conventional methods such as the Schirmer test and tear break-up time (TBUT). Several different physical methods have been developed to measure non-invasively the structure and function of the tear film including high-speed videokeratography and dynamic wavefront aberrometry. Interferometry and optical coherence tomography are amongst new proposed methods to measure tear film thickness that have remained in research phase.

With FASIC, a series of images are obtained using a laser illumination and a cMOS camera. The spatial correlation is calculated for every frame. A sinusoidal background due to interference of the tear film appears in this spatial correlation together with other features. We have developed a mathematical model to obtain the thickness of the tear film from this sinusoidal background. The model includes the macroscopic dynamics of small lipid droplets in the tear film. Consistent data with live animal model and human clinical study has been obtained. The authors gratefully thank the support from NIH grant numbers: PHS-5P41-RR003155 and P50-GM076516.

2100-Pos

A Bluetooth Device for Wireless Communication of in vivo Data from Freely Moving Research Animals

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Collecting neurophysiological data through electrodes can impact behavior when the animal is connected to wires and less able to move. In Parkinson's disease there is a clear link between reduction in dopamine availability and Parkinson's symptoms, which include tremor, slowness of movement and postural alterations. To better study the link between dopamine release in the basal ganglia and motor behavior, we are developing the implementation of a Bluetooth wireless technology for the measurement of neurotransmitter release. Data of dopamine release can be collected by means of fast scan cyclic voltammetry in which voltage ramps between 450 mV and +1000 mV are applied at a rate of ~300 V/s to a carbon fiber electrode (CFE) implanted in the striatum. The oxidation and reduction currents can be converted to cyclic voltammograms to identify the dopamine signal. The voltage ramp signals are wirelessly delivered to a remote unit connected to the implanted CFE and the resulting currents are amplified and sampled at 44.1 kHz at the remote unit. Using stereo headset protocol to transmit the data back to the computer, a recording bandwidth of ~1.3 kHz has been achieved. As usual, the voltammetric current collected before dopamine release is subtracted from the voltammetric signal collected after dopamine release within the computer to extract the net oxidation and reduction currents due to dopamine release alone and to generate the cyclic voltammogram. We anticipate that this technology will be useful for the study of the mechanisms of Parkinson's disease and possibly other electrophysiological recordings from freely moving research animals.

2101-Pos

Modeling the Relative Effects of Biofouling, Fibrous Encapsulation and Microvessel Density on Implanted Glucose Sensor Performance

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The formation of a foreign body capsule around implanted sensors is purported as a key contributor to sensor failure. A number of different processes during the wound healing sequence not only decrease the vascular density proximal to sensor but also provide diffusive and bioactive barriers to the transport of analytes from the few remaining vessels that are near the implanted sensor. While a number of surface treatments have mediated this response, the relative contributions of the different stages of wound healing to the attenuation of sensor response have yet to be elucidated. A 1D partial differential equation model was constructed to examine glucose transport through the interstitium and assess the effects that different results of the inflammatory and wound healing processes will have on glucose transport to the sensor surface. By incorporating the effects of biofouling, macrophage adhesion, and fibrous encapsulation, we have been able to recreate subcutaneous glucose traces with attenuated signals and delayed responses that mimic those seen in previous experiments. Such a tool will allow us to probe the characteristic traits of the foreign body capsule (avascularity, dense fibrous matrix, inflammatory cell presence, etc.) to gain a better understanding of what aspects of the wound healing process contribute most to sensor failure. With a more thorough knowledge of the relative contributions of the wound healing process to the decrease of sensor effectiveness, researchers can more rationally address issues of biocompatibility in the design of subcutaneous sensors.

2102-Pos

Jet-Fluid Effects on the Stented-Flow Structure in the Cavity of Cerebral Aneurysm

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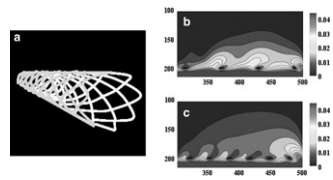
The endovascular treatment of cerebral aneurysms using coils and stents, which are metal mesh cylinders, provides a promising alternative to open surgery. Although various analyses on the property of stented flow have been presented [1,2], the flow reduction mechanisms are not completely understood.

Our numerical simulation indicates that the jet flow through stent struts can reduce near the aneurysm mouth but increases the flow speed far from the mouth (Fig. 1). In this work, based on this observation, we reveal the effect of the phenomenon that the pulsed jet flow drives the fluid with different velocity on the flow structure in the aneurysm cavity. As a result, we found a possibility that the shape of aneurysm may induce the self-oscillation of jet flow. We expect that our findings introduce new strategies in stent development and improve the endovascular treatment of cerebral aneurysms.

[1] Biondi, A., et al., Neurosurgery, 61, 460-468 (2007)
[2] Appanaboyina, S., et al., Int. J. Numer. Meth. Fluids, 57, 475-493 (2008)



(a) Stent image. (b,c) Velocity distribution of stented flow.

2103-Pos

Development of Non-Viral Gene Delivery Carriers for Ischemic Heart Disease (IHD)

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Ischemic heart disease (IHD) or coronary artery disease (CAD) is a leading cause of death in the United States resulting in a major financial burden to the health care system and is projected to be one of the main contributors to disability by 2020. The poor prognosis of IHD is directly related to a build-up of atherosclerotic plaque that produces narrowing of the coronary artery lumen. The rupture of the artery and/or narrowing of the artery lumen results in myocardial ischemia, which can lead to myocardial infarction or death of the heart muscle tissue. Current treatments include bypass surgery, angioplasty, stent implantation, and pharmacotherapy but unfortunately many patients with IHD remain refractory to pharmacological treatments and are unsuitable candidates for surgical interventions. Also, restenosis of the vessel lumen due to neointimal hyperplasia is a recurrent problem. Gene therapy is a promising alternative to traditional treatment strategies since the delivery of angiogenic cytokines can stimulate neovascularisation in a process known as therapeutic angiogenesis. To this end, we have designed, synthesized, and characterized novel biodegradable polymeric carrier systems for the delivery of therapeutic angiogenic plasmids. The polymers were found to have a MW of ~3.2 kDa. A gel retardation assay showed condensation of DNA at N/P ratios higher than 20/1. The particle sizes of the polymer/DNA complexes were 100-231 nm with surface charges of 0.8-20 mV. Preliminary data with the reporter gene luciferase showed that the complexes produced significantly higher transfection efficiencies and lower cytotoxicities in several cell lines as compared to

the control. Thus, these novel nonviral carriers are very efficient, versatile, and biocompatible polymers for nonviral gene delivery.

2104-Pos

Measurement of Linear Compressibility in Transpalpebral Tonometry

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We have measured the force required to depress the palpebrum over the center of the cornea in human patients and found that the curve is linear to within the accuracy of our measurements (R-value=0.9991). The motivation of this measurement is its clinical relevance to the development of a device to measure the intra ocular pressure in patients at risk for glaucoma without touching the cornea. This class of device has promise for patient-operated tonometry, including glaucoma monitoring in third-world counties. We find that non-linearity in the compressibility develops proportional to the distance of the center of the point of application of force from the center of the cornea. We show that this non-linearity can give rise to uncertainty in determination of the compressibility, with values up to 30% as compared to the well-aligned case with values typically 4%. We show that the compressibility value varies from subject to subject because of its three sources: the palpebrum, the cornea supported by the intra ocular pressure and the retropulsive structures. We find that the linearity of the compressibility of the compound structure and therefore of each of its constituents is intrinsic. We conclude that the understanding of the linearity of the compressibility indicates feasibility of this class of tonometer for glaucoma monitoring.

2105-Pos

Concentration and Removal of Waterborne Bacteria for Easy Detection

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In the past decade a significant amount of research and development has been geared towards water treatment and distribution, especially in low income areas. Large fractions of this research have focused on waterborne contaminant removal, such as filters and flocculation agents, and biosensors designed to detect waterborne threats. In low income areas many of the currently used treatment methods are not suitable as they commonly are more expensive and difficult to maintain. Problems have also been observed with biosensors including a very low sensitivity, making it difficult to get accurate readings when low bacteria concentrations are present. In an attempt to address both of these problems in conjunction with one another, we have been studying the effects of a natural compound extracted from the Opuntia ficus-indica cactus as a flocculation and concentration agent for bacteria suspended in water. This material, known as mucilage, has proven to be an effective tool for aggregating and removing the sediment kaolin, and has also demonstrated flocculation of E. coli, B. cereus and B. subtilis. In bacteria treated columns thus far, the response in mucilage treated columns was almost immediate and large flocs were observed to form both with the naked eye and using a light microscope. Removal rates of up to 97% were also observed. Current tests with B. anthracis (fully attenuated) also demonstrate a great potential for mucilage in the fields of water treatment and biosensors. The aggregated bacteria that are formed within the column settle to the bottom forming a compact pellet that can then be removed for testing with biosensors. This type of flocculating agent has the potential to be very valuable in both of these fields because it is inexpensive, sustainable and easy to process and use.

2106-Pos

Size Distributions of Quantum Dots and Colloidal Gold Nanoparticles Using Analytical Ultracentrifugation

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Colloidal gold and quantum dot nanoparticles are currently an area of significant interest in the biomedical field with important applications in the diagnosis and treatment of human disease. The hydrodynamic diameter of nanoparticles is a critical parameter in the development of potential diagnostic and therapeutic agents. Electron microscopy and light scattering methods have been used predominantly in the past to determine particle sizes, but analytical ultracentrifugation sedimentation velocity is a technique that has been gaining more attention as it provides significantly higher resolution particle size distributions. Here, we apply the sedimentation velocity technique to commercially-available stocks of colloidal gold and quantum dot nanoparticles. The size-distributions obtained from this method are compared to those obtained from dynamic light scattering measurements conducted in parallel. Further, comparison of changes in particle sedimentation rate affected by increasing solution density was employed as an alternative method to densimetry in order to determine the particle partial specific volume- a parameter requisite for determining molecular weights. This work demonstrates the utility of the sedimentation velocity technique for the characterization of nanoparticles.

2107-Pos

Magnetic and Fluorescence Detection of Hybridized DNA Assemblies Immobilized onto a Hall Device

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The development of a dual detection platform to probe and discriminate nucleic acid base-pairing events through a combination of fluorescent and magnetic signatures may significantly impact the performance and dimensions of biomedical sensing devices. Toward this aim, investigations on the selective and controlled assembly of DNA duplex formation onto a micro-scale Hall device will be addressed. The biological assembly is composed of three distinct components. The first component is a streptavidin-coated magnetic nanobead (350 nm mean diameter) pre-conjugated with both biotinylated and fluorescently labeled ssDNA. The second component is thiolated ssDNA that was selectively immobilized onto photolithography prepared Au patterns on a fabricated Hall sensor. The third component is the label free target ssDNA sequence for detection, which is complementary to both the biotinylated and thiolated DNA sequences. The device readout consists of a decrease in voltage across the Hall junction due to the biologically assembled magnetic nanobead, as well as a redundant fluorescence signature. The Hall device sensitivity is approaching single nanobead bead detection. Support: NIH NIGMS GM079592.

2108-Pos

Refractometry Measurements for Industrial Quality Control

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A knowledge of the optical properties of liquid substances is useful in enhancing the understanding of their unique characteristics. Properties such as refractive index, refractivity, and phase velocity have been used to assess the purity of liquids. We utilized measurements from a Digital Refractometer to detect and quantify the contamination of liquids such as drinking water, wine, and other beverages. We used antifreeze, ethylene glycol, and propylene glycol as contaminants. Results show that the level of contamination increases linearly with refractive index and that a contamination level of 1 % is detectable. The application of this technique in industrial settings will improve the detection of contamination of beverages.

2109-Pos

Dielectric Relaxation Spectroscopy and Dark-Field Imaging Based Quantification of Amyloid-Beta Fibrillization Via Transparent Nanogap Electrodes

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Since the precise role of amyloid-β aggregates in causing the neurodegenerative diseases is still unknown, understanding of amyloid-β fibrillization is a focus of interest for the development of innovative therapeutic and diagnostic applications. The fibrillization of amyloid-β has similar growth characteristics of polymeric nanoparticles and current monitoring methods show only qualitative or static information. Here we describe a non-invasive real-time monitoring of nanoscale amyloid-β fibrillization by simultaneous Dielectric Relaxation Spectroscopy and label-free dark-field imaging. First, the hydrodynamic radius is characterized by DRS, which can reflect the averaged radius of fibrilized amyloid-β, and we observe an increase from 19 to 21 nm during 48 hours. Second, scattering intensity from DF imaging allowed us to visualize and quantify the fibrillization with respect to the incubation time of amyloid-β. The total intensities were consistently increased and this change showed a good agreement with the change of hydrodynamic radii. Consequently, real-time observation and quantification of changes in