

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 countries. 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 bio-medical 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.

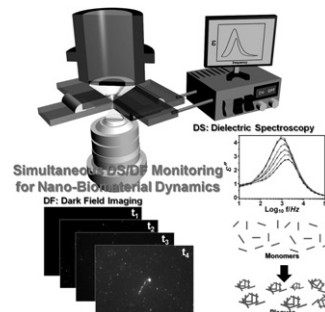
#### 2109-Pos

##### 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- $\beta$  aggregates in causing the neurodegenerative diseases is still unknown, understanding of amyloid- $\beta$  fibrillization is a focus of interest for the development of innovative therapeutic and diagnostic applications. The fibrillization of amyloid- $\beta$  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- $\beta$  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 fibrillized amyloid- $\beta$ , 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- $\beta$ . 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



both hydrodynamic radii and optical properties were performed simultaneously. Such a dual-mode technique may prove valuable for elucidating the mechanism of amyloid fibrillization and ultimately for designing possible diagnostic methods.

## Biophysics Education

### 2110-Pos

#### Strategies for Successful Diversity Participation in Biophysics Research

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In the summers of 2008 and 2009, two individual students from the Michigan Louis Stokes Alliance for Minority Participation (MI-LSAMP) Summer Undergraduate Research Academy (SURA) program joined the Ayres' Electronic and Biological Nanostructures Laboratory for an 8-week 40 hours per week research experience. As their tasks were essentially the same as those of the resident students, an expedited learning curve was essential for productivity. Both students, even in the time-limited circumstances, produced outstanding and viable research contributions. The SURA08 student quickly developed authentic skills in atomic force microscopy that enabled him to produce clear images of growth-factor derivatized nanofibers within a central nervous system prosthetic that are, as far as we know, the first of their kind to be reported. The SURA09 student contributed specialized expertise in Nuclear Magnetic Resonance spectroscopy that has enabled a new series of complementary NMR experiments that enhance the scanning probe investigations. The work contributed by both students has been published or accepted in high impact referred journals. In this presentation, we explore the strategies of the MI-LSAMP Summer Undergraduate Research Academy program that resulted in the observed successes. These include:

- Selection criteria for both students and faculty mentors. The students are screened for evidence of high motivation as well as good academics during the application process. The faculty mentors are screened for evidence of a direct interaction approach as well as an active research program. The importance of biophysics/bioengineering/biomedical research as a motivating force is discussed.
- An immersion experience that includes support at many levels. The SURA program requires 8-week dormitory residence at the research host university. SURA program personnel invest approximately 40 hours per week in providing classroom support for meeting professional research expectations, and evening social support for friendship and teaming.

### 2111-Pos

#### Advanced Undergraduate Laboratory in Biological Physics

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We have developed a new one-semester senior laboratory course as part of our undergraduate Biological Physics stream at Simon Fraser University. This course, designed for students with either a Physics or Biology background, comprises two parts. The first half of the course entails modules to give the students hands-on experience with basic molecular and cell biology and leading-edge biophysical techniques: DNA electrophoresis and topology-dependence of mobility; cell growth; light scattering and spectroscopy; microscopy and cell

motility; optical tweezers; and fluorescence correlation spectroscopy (FCS). The experimental goals and learning outcomes of these modules will be presented. In the second half of the course, students propose and carry out independent research projects that include biological and quantitative measurement components. The experiences of the students and their feedback will also be presented.

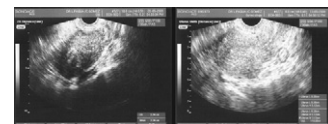
### 2112-Pos

#### Disappearance of Tumors by the Action of Sound

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**Background:** Starting with observations of tumours which had disappeared following treatment with alternative therapies, the main objective of this work was to discover the underlying physical phenomenon that occurs in such instances. **Method:** Patients with tumours were treated with sound therapy. The methods included a newly developed technique using the Tibetan bowl and the Tibetan bell. **Results:** The tumours disappeared totally in the majority of patients. **Conclusions:** The only phenomenon that could explain such tumour disappearances is the *annihilation of pairs*. These results challenge the following: a) The concept of the physical constitution of living matter and, b) the real constitution of the human being.



### 2113-Pos

#### Teaching Basic Electrophysiology with the Aid of a Computer Program

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**Objective:** Understanding the basis of electrophysiology is essential to the formation of a student of biological sciences. A solid base on the fundamental concepts paves the way for a better comprehension of more complex phenomena. We implemented a computer program (LabAXON) that simulates the electrical activity of an axon in a user friendly format. This program helps the student to understand the generation of the action potential and the effects of extracellular ionic concentration and stimuli waveform.

**Methods:** This program was based on the classical Hodgkin and Huxley formalism. LabAXON allows the students to reproduce the basic experiment these Nobel prize-winning scientists performed on the squid giant axon. Important concepts such as Chronaxia curve, Current-Voltage relationship and Ion Reversal Potential can be explored in an interactive way. A user-friendly interface permits a rapid change of parameters and the ability to see the effects on-line. Also we created a workbook with a list of exercises that covers the essential points of the lecture.

**Conclusions:** The processes that take place at the membrane set the stage for several concepts that will come out in the following years of the student's education: how drugs interact with channels, effect of ionic imbalance, refractoriness of the membrane, to name a few. Computer simulations help to reinforce those topics in the student in a self paced manner. It constitutes an excellent aid for the medical educator. LabAXON and the companion workbook are freely available on our departmental website.