Poster location	Suffix	Topic	Title	Author(s)	Abstract
8	Fatimah Adisa	Physical Science and Engineering	Exploring Single Celled hPSC Viability Using Alginate Hydrogels	Fatimah Adisa; Thomas Richardson, PhD; Ipsita Banerjee, PhD	Human pluripotent stem cells (hPSCs) have the ability to self-renew and become any cell type in the body through stage-wise differentiation mimicking development, making them ideal for drug discovery and treatment of several degenerative diseases such as Alzheimer's and Type 1 Diabetes. Before hPSCs can be manufactured on a large scale, research must first focus on preventing or minimizing dissociation-induced hPSC cell death. Current research in our lab focuses on the use of peptides (HAV10, ADT10, HAV6, and ADT6) to prevent this cell death. In order for these peptides to be effectively presented to the hPSCs during cell culture and growth, they must be attached to a supportive substrate. Alginate hydrogel beads were used as a supportive substrate to simulate the use of a 3D platform. Overall, the higher sequenced peptide-conjugated hydrogels (ADT10, HAV10) better supported hESCs and their proliferation. They showed strong initial and continued support of hESCs. These hydrogels also maintained the pluripotency of hESCs upon culture and encapsulation. Identifying the best peptide for use in an alginate hydrogel can lead to research of the in vivo use of these hydrogel capsules and identification of any synergistic effects that come from combining peptides at different concentrations.
22	Joseph Albro	Physical Science and Engineering	Remote and Automatic Data Analysis	Joseph Albro; Jeremy Levy, PhD	An approach to data analysis that allows researchers to view the results of an experiment remotely and in real time.
38	Alexandra Beebout	Physical Science and Engineering	Materials Computation of Magnetic Properties of Cobalt Nanoparticles	Alexandra Beebout	Magnetic nanoparticles are useful in a variety of applications: data storage, biotechnology, medical imaging, magnetic fluids, catalysis, and environmental remediation. Cobalt is of particular interest as it is most widely used in hard drives and has potential to be used as a high-temperature coating in solar panels. Our research explores magnetic and energetic properties of the four observed structures of cobalt nanoclusters. We performed density functional theory (DFT) calculations on the software known as Vienna Ab initio Simulation Package (VASP) using pseudopotential plane wave method. Energy optimization calculations were performed using projector augmented wave method and a conjugate-gradient algorithm which relaxed the ions into their instantaneous ground state. From the calculations we obtained ground-state energy and magnetic moment values for all four crystal structures: FCC, HCP, icosahedral, and epsilon. These values were calculated for three different cluster sizes, N=13, N= (55,57,59), and N=(147,153). Our results indicate that the icosahedral structure is the most stable, as its relaxed structure consistently exhibits the lowest energy. Furthermore, we observe that as the cluster size increases in the relaxed structures, the energy and magnetic moment per atom decrease. Smaller particles therefore impart a much higher magnetic moment and energy per atom.
1	Tyler Bray	New Research Tools and Techniques	Development of a 3D Printed, Low Cost Thumb Prosthetic	Tyler J. Bray; Skip Meetze; Jon Schull, PhD; Alexander M. Spiess, MD	Nearly 700 people lose their thumb due to a traumatic amputation every year in the United States. This is especially a problem when you consider that approximately two-thirds of hand functions involve the thumb. While surgical repair by replantation or toe-to-thumb transfer is an option sometimes in the US, this is not always the case. Typically, patients are stuck choosing between spending thousands of dollars on a prosthetic thumb or not having one at all. Our team considered the situation of individuals outside the United States with greater economic and more conservative cultural constraints. We utilized the technologies of 3D scanning, 3D printing, and CAD to develop a low cost, culturally appropriate and functional thumb prosthetic. We used skin toned, flexible plastic and custom sizing techniques to produce the final design. The device should allow for optimal use of residual sensation and movement of the thumb's CMC joint. This movement should enable the user to oppose to other fingers and grab objects easier, helping to restore normal hand function at a production cost of less than US$10.
15	Nowa Bronner	New Research Tools and Techniques	Examination of Two Tet-On Constructs with Sh95 in the Visual Cortex	Nowa Bronner, Oliver Schluter	One focus of the Schluter laboratory is determining the role of postsynaptic density protein-95 (PSD-95) in long-term synaptic plasticity during physiological and pathological learning. Experiments have been conducted using homologous recombination and the LoxP and Cre system to knock-down the expression of PSD-95, but those systems have limits: they both knock-down expression of PSD-95 but cannot turn it back on. An inducible system would allow for more flexibility in conducting experiments. The Tet-On system has been used in the past to turn off and on the expression of proteins. This experiment tested the efficacy of the Tet-On system with sh95. Two different Tet-On constructs and a positive control were injected into the visual cortex of mice, and its transfection ability and inducibility was examined using a stereomicroscope. The Tet-On system was turned-on by feeding the mice doxycycline. The two test constructs had a significantly smaller area of transfection and dimmer green fluorescence, and red fluorescence was absent, indicating the Tet-On system did not work. The positive control's transfection rate and knock-down capability were tested as well. The result of the western blot on the positive control suggested a knock down effect but statistically insignificant due to a small sample size.

Poster location	Suffix	Topic	Title	Author(s)	Abstract
37	Katherine Brosky	Physical Science and Engineering	Sequential Infiltration Synthesis for Hierarchical Nanostructure Coating	Jung-Kun Lee, PhD; Fangda Yu; Katherine Brosky	The efficiency of solar cells depends on the attachment of the perovskite layer and how well metal particles can lay in the perovskite to increase conductivity. In order to create a higher efficiency solar cell, nano-morphologies are manually created between the substrates surface and the perovskite layer. Sequential Infiltration Synthesis is a delicate process that uses polymer solutions to create nanostructure morphology on a substrates surface. The primary aim of this article is to contribute to the understanding of the impact of a homopolymer blend to Sequential Infiltration Synthesis. Specifically, understanding how the homopolymers PS and PMMA can interact in solution to create a pitted morphology. The pitted morphology was expected due to the 1:1 mol ratio of PS:PMMA in solution. Additionally, the pitted morphology is due to the wettability, and hydrophilic and phobic nature of each polymer in the system. In other words, the hydrophobic nature of PS and hydrophilic nature of PMMA will repel and attract during wetting to create a pitted morphology. This process proves pitted morphology can be achieved at a nano-
51	Grace Brueggman	Physical Science and Engineering	Reaction Times to Intracortical Microstimulation in a Person with Tetraplegia are Similar to Those of Peripheral Tactile and Visual Stimuli in Able-bodied Subjects	Grace Brueggman; Jeffrey Weiss; Robert Gaunt, PhD; Jennifer Collinger, PhD	Brain-computer interfaces (BCI) can decode neural activity recorded from microelectrodes and enable people with paralysis to control a robotic limb. Intracortical microstimulation (ICMS) of primary somatosensory cortex (S1) can generate tactile percepts and may be useful for restoring sensory feedback and improving BCI control. However, it is unknown how quickly a person can react to ICMS and we expect that ICMS-based feedback will be most useful if reaction times (RT) to ICMS are comparable to RT to natural tactile stimuli. A subject with a C5/C6 spinal cord injury (SCI) was implanted with four microelectrode arrays. We tested RT to single-electrode ICMS of S1. We compared the SCI subject's ICMS RT to visual RT and tactile RT measured with surface electrical stimulation of the index finger in the SCI subject and 3 able-bodied subjects. We found that the SCI subject's RT to ICMS were faster than tactile RT and comparable to visual RT. In able-bodied subjects, visual RT were faster than tactile RT. Our preliminary findings suggest that RT to ICMS are at least equivalent to RT from tactile input, making ICMS an attractive option for providing temporally relevant sensory feedback to a person for robotic limb control.
31	Levi Burner	New Research Tools and Techniques	Integrating Functional Electrical Stimulation Control and IMU-Based Limb Angle Estimation for Drop Foot Correction	Levi S. Burner; Nitin Sharma, PhD	Over 800,000 strokes are reported annually and a common side effect of stroke is drop foot, which causes a foot to drag or slap on the floor during walking (swing phase). Current solutions include using single channel Functional Electrical Stimulation (FES) and a ground contact sensor. When the ground contact sensor detects the foot has lifted off the ground, the FES system activates and stimulates the peroneal nerve (to elicit dorsiflexion) so that the foot rises and clears the ground. Another sensing solution is to use electromyography to predict gait posture of a subject and apply stimulation at an appropriate time. The goal of this research is to develop a wearable real-time foot drop correction system that can be attached to an individual. It uses inertial measurement units (IMUs) attached to the thigh, shank, and foot for predicting limb angles during gait. It also has a method to apply FES using a commercial stimulator. The motivation for a multiple IMU system is to obtain more comprehensive sensory information on limb postures and thus the ability to provide multi-channel FES. Compared to existing single channel drop-foot systems, this will facilitate a high fidelity multi-channel control of multiple muscles that govern gait.
13	Brittany Chamberlain	Translational Life Science	Using In Vivo Microscopy to Assess the Role of Striatal Medium Spiny Neurons in Compulsive Behavior and Response to Pharmacological Treatment	Brittany L. Chamberlain; Sean C. Piantadosi, BS; James Hyde, PhD; Susanne E. Ahmari, MD, PhD	Obsessive Compulsive Disorder (OCD) is characterized by intrusive obsessive thoughts and perseverative compulsive behaviors. Elevated striatal activity has been observed in OCD patients through neuroimaging, and this striatal hyperactivity is also present in mice with a compulsive grooming phenotype (Sapap3-knockout mice) compared to wild-type controls. Using head-mounted mini-microscopes for in vivo calcium imaging, we sought out to determine the role of medium spiny neurons (MSNs), the principal striatal cell type, in compulsive behavior in Sapap3-knockout mice. Furthermore, we sought to determine the function of individual MSN subtypes in relation to striatal hyperactivity and compulsive grooming. We also investigated the effects of a first-line OCD pharmacotherapy, the SSRI fluoxetine, on striatal activity. Sapap3-knockout mice were injected with a genetically-encoded calcium indicator in the striatum to enable visualization of calcium activity in an awake, behaving animal. Preliminary data suggests that striatal activity is elevated in Sapap3-knockout mice at the onset of a grooming event, shown by increased calcium activity during grooming in Sapap3-knockouts but not wild-type controls. Treatment with the SSRI fluoxetine reduced grooming behavior as well as calcium activity overall in striatal cells. Ongoing research is aimed at determining the roles individual striatal subtypes in compulsive behavior and its treatment.

Poster location	Suffix	Topic	Title	Author(s)	Abstract
45	Abraham Cullom	New Research Tools and Techniques	A High-Throughput Model for Biofilm Dispersal-Based Studies Of Evolution In Bacterial Biofilms	Vaughn Cooper, PhD; Christopher Marshall, PhD; Abraham Cullom	Biofilms are a ubiquitous bacterial lifestyle in which congregated microbes construct and reside in polymer structures, create a shared pooled of extracellular DNA and proteins, and even evolve to form distinct ecological niches within the biofilm. They pose clinical concerns because of their elevated resistance to disinfectants and antibiotics, which may be hundreds or even thousands of times higher than those of bacteria in planktonic phase. Thus, examining the ecology and evolution of biofilms has implications for both medicine and our fundamental understanding of science. Here, we developed a novel platform for studying biofilms that incorporates all stages of the biofilm lifestyle. We designed a tray with a series of wells in which pipette tips may be easily placed to act as the biofilm attachment surface. Bacteria are required to transfer from one pipette tip to another from day to day. An 11-day series of transfers of Pseudomonas fluorescens showed the development of heritable morphological diversity, indicating that this system is capable of capturing distinct evolutionary trajectories. Compared to similar models, ours is very simple to use and has a high throughput. As such, it has exciting applications in education, experimental
65	Taylor DaCanal	Physical Science and Engineering	Developing Cementitious Materials for Analogue Experiments in Hydraulic Fracturing	Taylor DaCanal; Andrew Bunger, PhD	One of the challenges of hydraulic fracturing is the containment of the fracture to grow in the desired formation(s). Vertical containment is controlled by the features in layered rock. In order to gain a better understanding of the characteristics of bounding layers, mechanically analogous materials made of Portland cement, aggregate, and other additives were designed to mimic sandstone and shale. Sandstone mixes had a high water to cement ratio and a low sand to cement ratio and an air entrainment admixture to obtain a mix that was high in porosity and stiffness. Shale had a low water to cement ratio and a high sand to cement ratio to obtain a low porosity and stiffness. The Young's modulus of each specimen was estimated using ultrasonic testing and the porosity was estimated based on weight-volume relationships for saturated and oven-dried specimens. Results yielded that the variation of Young's modulu and porosity between the sandstone and shale were not high enough. We propose the use of a higher sand to cement ratios for shale and higher water to cement ratios for sandstone. Different materials such as gypsum material for sandstone and cement paste for shale could be tested to potentially obtain desired ratios.
27	Bianca De	Translational Life Science	Downregulation of CXCR-1 and CXCR-2 on Human Neutrophils in Extracorporeal Recirculation through Hollow Fibers with Immobilized IL-8	Bianca De, Alexander D. Malkin, William J. Federspiel, John A. Kellum, Kai Singbartl	chemotaxis down its gradient. When IL-8 spills into the bloodstream, neutrophils migrate into healthy tissues and release proteolytic factors, causing organ damage. At high IL-8 concentrations, neutrophils down-regulate expression of CXCR-1 and CXCR-2, decreasing the migratory response. This study tests a scaled-down extracorporeal recirculation setup that passes blood through hollow fibers with immobilized IL-8 on the lumen surface, then through an adsorbent fiber module that scavenges leached IL-8. The concentration of IL-8 leaching into recirculated 5% Bovine serum albumin (BSA) solution was measured with ELISA. After one hour of recirculation, the 5% BSA contained 32pg/mL IL-8, indicating that the scavenging module successfully adsorbed the IL-8 leached from the fibers. CXCR-1/2 down-regulation on recirculated neutrophils was compared to baseline receptor expression using immunostaining and flow cytometry. CXCR-1 expression decreased to 58% of baseline and CXCR-2 expression decreased to 56% after 60-minute recirculation. Expression of CXCR-1 and CXCR-2 recovered to 116% and 112% of baseline respectively after 105-minute incubation. Free IL-8 in solution or more exposure to immobilized IL-8 may extend downregulation. In future studies the functional impact of downregulation and the ideal recovery period will be investigated.
18	David Denberg	Basic Life Science	Incorporating Cellular Mechanics of Contractility and Cell Adhesion into 3D Finite Element Models of Embryonic Epithelial Morphogenesis	David Denberg; Lance A. Davidson, PhD; Spandan Maiti, PhD	processes including: gastrulation, convergent extension, neurulation in vertebrates, and ventral furrow formation in Drosophila. The early deformation of epithelia lead to the development of many higher order biological structures. Cells in epithelial sheets form junctions with their neighbors which tie their surfaces together. Cytoplasmic actin filaments connect cells through adherens junctions allowing forces to be transmitted between cells even as tight junctions serve to inhibit the movement of fluid, and thus solutes and other larger molecules, between the partitioned spaces. Quantitative and computational models of epithelial sheet mechanics can help us understand how cell biological processes coordinate mechanical forces to drive embryo shape change. For example, cell-cell adhesion and cytoskeletal interactions influence both individual cell and tissue shape. Mechanotransduction, or the linking of mechanical forces to electrochemical signals, may also regulate developmental growth. This study investigates the mechanical behavior of epithelial sheets from a computational perspective. Based on experimental data collected on amphibian embryonic mechanics we develop a novel finite element model to explore cell dynamics of an epithelial sheet undergoing convergent extension.

Poster location	Suffix	Topic	Title	Author(s)	Abstract
81	Nathan Fleming	Physical Science and Engineering	Spatial Memory Maintenance in Dorsal Premotor Cortex	Nathan Fleming; Nicholas Pavlovsky; Aaron Batista, PhD	Learning a skill begins with a high degree of variability in performance. Previous studies have linked variability in neural activity during the delay period to variability in responses during eye movement. A laboratory version of a demanding motor task is a “delayed reach task” where a monkey must prepare, but withhold, a specific movement, until instructed to reach toward the cued target. A 96-channel electrode array collected simultaneous neural activity during the delay period. A population vector algorithm (PVA) decoding technique was then used to estimate the direction of the impending reach from the firing rates of the neurons. We analyzed 105 reach trials using 30 well-tuned neurons (as defined by a cosine fit R2 value above 0.33) to find correlations between decoded and actual reach locations. Early and middle portions of the delay period demonstrated low correlation values (R=0.08 and R=0.05 respectively). However, in the final third of the delay period, the correlation between the PVA’s decoded reach and the actual reach angle rose to similar values (R=0.20) to those found in pre-frontal cortex (R=0.22). These results can help improve the reaction time and accuracy of motor responses in patients using neural prosthetics.
9	Chelsea Flower	Physical Science and Engineering	Determining Through-Culm Wall Properties of Bamboo Using the Flat-Ring Bending Test	Chelsea Flower	essentially as a naturally occurring fiber-reinforced composite, however it holds the stigma known as “Poor-man’s timber”. This is because there is not yet a means to assess the properties and performance of bamboo as there are for conventional materials, such as concrete and steel. This research explores bamboo’s unique, tapered structure by means of a modified Flat-Ring Flexure test. The culms of five different genera were cut into flat specimen, and tested, horizontally in either 3 or 4-point flexure. The modified samples were cut at specific parts of the cross-section to test the effects of the through-culm wall thickness on the Modulus of Rupture. This can eventually be connected to the effects of physical properties, such as fiber content. The longitudinal fibers, which account for bamboo’s high-tensile strength are denser towards the outside of the culm. From the experiments, one can see that the increase in fiber content causes a more brittle failure. Additionally, the effects of fiber content on MOR were more prominent in the thicker-walled species. Eventually, a field-accessible characteristic test can be developed based on the relationship between mechanical and physical properties.
23	Madalyn Fritch	Physical Science and Engineering	Modulating Inflammation through Cartilage-derived Extracellular Matrix for Potential Treatments of Cartilage Disease	Madalyn R. Fritch, Rocky Tuan, Hang Lin, He Shen	ultimately results in osteoarthritis (OA). Initiation of OA starts with pathologic activation of chondrocytes, followed by activation of macrophages from a nonpolarized, M0 state to a polarized, M1 state. M1 macrophages produce pro-inflammatory factors, thus furthering degeneration of cartilage. Soluble ECM has been previously shown to induce M2, anti-inflammatory phenotype. This study further investigated the therapeutic potential of soluble, articular cartilage extracellular matrix (cECM) on cartilage health and macrophage (M0/M1) state. M0 and M1 macrophage conditioned media effects were evaluated on human cartilage-derived and hMSC-derived chondrocytes in 3D cultures and quantified via real time PCR. M1-like macrophages increased degenerative markers of articular chondrocytes and hMSC-derived chondrocytes in 3D scaffold culture. cECM supplementation in M0 and M1 media did reduce both M1 and M0 macrophage inflammatory cytokine secretion, but not significantly for M1-like macrophages. Soluble cECM addition to macrophage culture did improve some chondrogenic gene expression in M0 media treated engineered cartilage, but did not significantly rescue chondrogenic gene expression in M1, pro-inflammatory media treated engineered cartilage. Therefore, cECM may be a promising preventative treatment to maintain healthy cartilage phenotype in an already non-inflammatory state.
39	Keerthi Gnanavel	Physical Science and Engineering	Simulating the Natural Gas Filling Rate of Fuel Tanks Packed with Metal-organic Framework Adsorbents	Keerthi K. Gnanavel; Christopher E. Wilmer, PhD	a more balanced energy system that utilizes alternative energy sources. This project seeks to improve the storage density of absorbed natural gas, which uses a sand-like bed of metal-organic frameworks (MOF) particles to concentrate the gas at low pressures. As a result, similar gas density in a compressed tank at 200 bar can be observed in an ANG tank at 100 bar or less. MOFs can be chemically synthesized to resemble grains of fine sand. MOF grains harbor trillions of nanoscale pores that allow for adsorption of gas molecules. The project consisted of a computational tank filling process. Flow rate was given by a compressor. The process was terminated when the tank achieved its desired pressure. The variables recorded during the process were time, mass delivered, tank pressure, and flow rate. MATLAB made the analysis convenient. Future work would include heat dynamics between the fluid and MOF. Safety regulations would require precise cooling to prevent unwanted combustion. If interest and funding were concentrated on this topic, an improvement in transportation would be observed and society would be closer to improved energy management.

Poster location	Suffix	Topic	Title	Author(s)	Abstract
53	Shayla Goller	Physical Science and Engineering	Complex 3D Tissue Assembly Using Flat High-density Cell Sheets	Shayla Goller; Uma Balakrishnan; Lance Davidson, PhD	The traditional method to establish complex tissue geometry is to use a scaffold, but seeding scaffolds often results in a relatively low cell density, which interferes with alignment, assembly, and interaction between cells. Self-assembly methods avoid many of the problems associated with scaffold use; however, bioprinting and microextrusion subject cells to high strains that can lower cell viability. We have developed a scaffold-free method using centrifugation to fabricate cell sheets of high density and viability from primary embryonic cells of *Xenopus laevis* . Centrifugation allows for creation of thin laminar sheets of approximately 5,000 cells and 158±19.8 µm thick that maintain the cell density of native tissues, and remain viable for > 24 hours. In this study, we explore methods of combining these cell sheets to create complex tissues. Sequential centrifugation and co-culturing allow us to combine tissues into large, dense structures useful for future tissue engineering applications.
67	Shushma Gudla	Physical Science and Engineering	Nanomolar Drag Reducing Polymers (DRPs) Reduce Near-wall Margination of Rigid RBCs in Microchannels: A Potential Therapy for Sickle Cell Disease (SCD)	Shushma Gudla; Daniel Crompton, BS; Jonathan H. Waters, MD; Marina V Kameneva., PhD	causing red blood cells (RBCs) to become rigid 'sickled' cells. Sickled RBCs (S-RBCs) readily adhere to endothelial cells causing vaso-occlusions and tissue necrosis. SCD complications may be related to the natural hemorheological (Fåhraeus) effect, where normal deformable RBCs move toward the blood vessel center, leaving less or non-deformable cells (i.e. platelets, leukocytes, old RBCs, and S-RBCs) to marginate near vessel walls, which makes them more likely to enter daughter branches at vessel bifurcations. This creates a concentrated core of deformable RBCs, and a thin near-wall layer of less deformable cells, traditionally known as the 'cell-free-layer' (CFL) in microvessels. Blood-soluble drag-reducing polymers (DRPs) additives have previously been shown to reduce the CFL, increasing the near-wall concentration of normal deformable RBCs. For SCD patients, this would result in more normal RBCs and less S-RBCs entering vessel branches. Our study used branched microchannels and normal and rigidified (heat-treated) RBCs to mimic microvessels and S-RBCs. Results show that DRPs increased normal RBCs exiting single branch outlets by over 10%. This confirm DRP's potential to prevent vaso-occlusion in small vessels by allowing S-RBCs to bypass the microvasculature through arterio-venous shunts.
34	Ruben Hartogs	Basic Life Science	Effect of PNS-ECM Hydrogel on Functional Recovery after Peripheral Nerve Injury	Ruben Hartogs; Christine Heisler; Kathryn LaBelle; Travis Prest; Bryan Brown, PhD	than 900,000 peripheral nerve reconstructions are performed every year on the upper extremities alone, but the current standard of care procedures generally only result in partial restoration of function. Peripheral Nerve Matrix (PNM) is a decellularized porcine-derived peripheral nerve specific extracellular matrix hydrogel currently under investigation in the application of peripheral nerve injuries. This study aims to quantify the use of an injectable hydrogel derived from porcine peripheral nerve-specific ECM on crush-type injuries to the sciatic nerve of Lewis rats, and compares the effect of various PNM treatments on leg function through kinematic analysis. Lewis rats were split into groups and given no injury, a sham injury, a crush injury, or a transection injury. The treatment group received a crush injury followed by an injection of PNM into the injury site. Each week after injury rats were run on a motion-tracking system and their gait analyzed by tracking leg joint positions using Simi Motion Analysis software. Using these tracking points, ankle height at toe off was calculated using Excel 2016 and the ratio between the, treated vs. untreated leg was found.
43	Christine Heisler	Translational Life Science	Effect of Peripheral Nerve-specific Extracellular Matrix Hydrogel on Functional Recovery after Peripheral Nerve Injury	Christine Heisler, Kathryne LaBelle, Ruben Hartogs, Travis Prest, Bryan Brown	life. Peripheral Nerve Matrix (PNM), a peripheral nerve-specific extracellular matrix hydrogel promotes repair after peripheral nerve injury; the current study will investigate the effect of PNM on functional recovery after sciatic nerve crush injury. We hypothesize that PNM will expedite functional recovery, affecting Sciatic Functional Index (SFI) measurements between crush injury groups. In this study, forty-six adult Lewis rats received surgical treatment as follows: crush no treatment (C-NT), crush with PNM injection (C-PNMI), a negative control, and three positive controls. To model sciatic nerve crush injury, a surgical clamp (2 mm) exerted 500 g of force on the nerve for 60 seconds. Each week after injury, SFI data was captured. Our results indicate that SFI values differed between C-PNMI and the negative control ($p = 0.0134$), and that SFI values differed between positive and negative controls ($p < 0.0001$); however, PNM had no effect on SFI between C-NT and C-PNMI. In future studies, we will add more subjects until intended sample size ($n = 8$). Additionally, we will perform a Schwann cell migration assay to investigate the regenerative effect of PNM on the local microenvironment.

Poster location	Suffix	Topic	Title	Author(s)	Abstract
59	Grace Held	New Research Tools and Techniques	Study the Effect of Non–polar Solvents as an Electrolyte on the Dissolution of Polysulfides in Li-S Batteries	Grace H. Held, Pavithra Murugavel Shanthi, Prashant N. Kumta	capacity. Sulfur is less expensive than LIB technology components (4 $kg−1 compared to 100 $kg−1), while also having a greater theoretical energy density than LIB (2600 Whkg-1 for Li-S compared to 350 Whkg-1for LIB). One issue with LSB is the reduction of elemental sulfur results in insoluble polysufides (PS). Dissolution of the PS into polar electrolyte causes the loss of active material and capacity fade of the LSB. To minimize PS dissolution, nonpolar solvents may be added to the electrolyte. To study the effect of various nonpolar solvents in LSBs, ten solvents were mixed 50:50 (vol%) with 1.8 M LiCF3SO3 and 0.1 M LiNO3 to create 45 unique cosolvent and 10 single solvent electrolytes. The electrolytes were added to symmetric Li-Li cells and their ionic conductivity was measured between 100,000 Hz to 0.001 Hz at 10 mV on a Gamry G Potentiostat. Combinations (50:50 vol%) of polar-nonpolar solvents such as cyclohexane:1,3-dioxolane, cyclohexane:n-methyl-2-pyrrolidone, toluene:tetrahydrofuran, toluene:1,2,-dimethoxyethane, toluene: tetraethylene glycol dimethyl ether, and toluene: n-methyl-2-pyrrolidone showed promising values of ionic conductivities suitable as LSB electrolytes. A detailed study of the chemical and electrochemical properties of these novel electrolyte candidates are underway.
83	Shawn Hinnebusch	Physical Science and Engineering	Process of Inserting Optimized Lattice Structure for Selective Laser Sintering	Shawn Hinnebusch; Albert To, PhD	mass cuts the building time needed for production, which makes (AM) a more competitive option. The first step in optimizing the part was establishing a loading condition in ANSYS to simulate the forces on the faces that have an applied load. After the part was optimized, a mesh could not be generated to estimate the stress levels. By making a uniform lattice structure, a mesh was generated, but stress convergence still failed at singularity points between the lattice and the shell. By using the topology optimization software, many designs were created and narrowed down to four. This was done by using ANSYS tetrahedral patch independent meshing to estimate the stress levels. To find the accuracy of this mesh compared to the mesh that reached convergence, a uniform cubic lattice structure was tested using a convergence mesh and a tetrahedral patch independent mesh. It was found that the stress could be estimated to about 10%, allowing designs to be narrowed down. Future work will consist of printing parts for testing to compare with the predicted FEA results.
5	Ryan Hoehl	Basic Life Science	Histone De-acetylase Inhibitor Drug Vorinostat Induces Apoptotic Cell Death In Nevo-melanocytic Cells from Patients of Large/Giant Congenital Melanocytic Nevi	Ryan Matthew Hoehl; Janki Rajesh Patel; Dipanjan Basu, PhD; Claudia Salgado, MD, PhD; Miguel Reyes-Mugica, MD	tumors present at birth called congenital melanocytic nevi. The risk of melanoma increases with large/giant congenital melanocytic nevi (L/GCMN), with lesions greater than 40 centimeters posing the highest risk. Giant nevi are difficult to treat, as surgical excision often requires multiple procedures and elimination of all transformed cells is nearly impossible. It is important to consider treatment options adjunct to surgery towards elimination of transformed cells. Recently, Histone de-acetylase inhibitor drugs (HDACi) have been found to induce apoptosis in melanocytic neoplasms via suppression of Micropthalmia transcription factor (MITF). In this project we tested the effect of Vorinostat, one of the FDA approved HDACi's, in vitro on nevo-melanocytic cells isolated from three L/GCMN patients carrying oncogenic mutation in NRAS. Treatment with Vorinostat caused a change in cellular phenotype and subsequent apoptotic cell death with a concomitant reduction in MITF at mRNA and protein levels. Apoptotic cells were identified using ethidium bromide and acridine orange staining and Western blot. Based on these results, it can be suggested that Vorinostat may be a potentially viable adjunct therapy to surgery for treatment of L/GCMN.
10	Le Huang	Physical Science and Engineering	Whole Body Cardiovascular and Respiratory Modeling for ECMO Training Simulator	Le Huang; Sanjeev Shroff, PhD	studies have shown that simulation-based training, with the ability to replicate human physiologic responses, is associated with improved clinician performance and patient outcomes than traditional training methodologies. The objective of this project is to develop a comprehensive mathematical model of the human cardiovascular and respiratory systems with central nervous regulation that can interface with ECMO. We report our progress towards accomplishing this objective – specifically, modeling of the hemodynamics of the closed-loop cardiovascular system. Each heart chamber was modeled as a time-varying elastance and pressure-dependent internal resistance. Systemic and pulmonary arterial circulations were modeled as an asymmetric T-tube model and a single tube model, respectively. Systemic and pulmonary venous circulations were modeled using resistor-capacitor networks. The entire cardiovascular system was characterized by 20 coupled differential equations. Pressure, volume, and flow at various cardiovascular sites were calculated by solving these differential equations and compared to normal (baseline) human physiologic data. The mathematical model adequately simulates the physiologic baseline state for all waveforms in both shapes and magnitudes. We are currently adding respiratory and central nervous regulatory system models to this baseline cardiovascular model.

Poster location	Suffix	Topic	Title	Author(s)	Abstract
24	Naomi Joseph	Physical Science and Engineering	Semi-Automated Segmentation of Glioblastomas in Brain MRI Using Machine Learning Techniques	Naomi Joseph, Hongliang Ren	Physicians employ Magnetic Resonance Imaging (MRI) in order to diagnose glioblastomas. The segmentation of the tumor is a crucial step in surgical planning. Clinicians manually segment the tumor voxel-by-voxel; however, this is very time consuming. Hence, extensive research has been conducted to semi-automate and fully-automate this segmentation process. This project explores manual segmentation and makes use of k-means clustering technique for semi-automated segmentation. The accuracy of the k-means clustering segmentation was measured using the Dice Coefficient (DC). The results show that k-means clustering provides high accuracy for the segmentation of the enhanced region of tumor (which appears bright in the T1 post contrast MR image) and hence, it can be efficiently used to speed up manual segmentation.
40	James Kern	Physical Science and Engineering	Biocompatibility and Functionality Assessment of a Novel Nitinol Tongue Prosthetic Device to Treat Dysphagia	James Kern; Yanfei Chen; Youngjae Chun, PhD	United States alone up to 16.5 million senior citizens may require treatment for this issue. While there are a variety of treatment options available there is currently no implantable medical device to treat dysphagia. Therefore, we are working to develop a mechanical prosthetic tongue which can be placed within the mouth similar to a denture to improve the swallowing motion. The goal of this study was to determine if specific polymers of interest possessed the desired biocompatibility to be incorporated into this medical device. To assess the biocompatibility keratinocyte cells were cultured on three polymers; platinum silicon, polydimethylsiloxane (PDMS) and carbon silicone for 24, 48 and 72 hours respectively. Several SEM and fluorescence images were then taken of each polymer sample. To quantify these images the average cell count on each polymer was obtained from the SEM images, while the average corrected total cell fluorescence (CTCF) of each polymer was determined through software (ImageJ) analysis of the fluorescence images. The results from the study indicated that each polymer of interest displayed favorable biocompatibility properties with PDMS displaying substantially higher cell proliferation.
54	Trevor Kickliter	Physical Science and Engineering	Computational Assessment to Correlate the Evolution of Wall Stress over Time with the Location of Dissection in the Ascending Thoracic Aorta	Trevor Kickliter; Kory J. Blose, PhD; Justin S. Weinbaum, PhD; Thomas G. Gleason, PhD; David A. Vorp, PhD	dissection is hemodynamic forces that exceed the bonding strength between layers of the vessel wall. Current diagnostic markers for dissection are inadequate, making it difficult to decide when surgical intervention is warranted. Therefore, the primary goals of this study were to examine changes in ATA wall stress over time and to assess the correlation of peak wall stress (PWS) with the location of dissection. 3D geometries were reconstructed from CT scans collected from multiple patients at 1-4 time points, and the wall stress field on the ATA was determined using finite element analysis. The stress fields for individual patients were compared between consecutive time points, and the location of PWS was compared to the clinically-documented site of dissection. From these analyses, the PWS did not match the site of dissection of any of the patients studied. Moreover, while the PWS and mean wall stress changed negligibly over time, the stresses at corresponding locations changed between time points. These results suggest that PWS fails to correlate with dissection and that the stress field in the ATA gradually evolves with time.
68	Katerina Kimes	Physical Science and Engineering	Binder Jet 3D Printing of Magnetocaloric Ni47Mn17Ga8Cu28 Foams for High-efficiency Cooling	Katerina Kimes, Erica Stevens, Amir Mostafaei, Markus Chmielus	and environmentally-friendly than traditional refrigeration methods. This is due to the magnetocaloric effect (MCE) which causes the material to exhibit an adiabatic temperature change when exposed to a magnetic field. By increasing the surface area of these materials by creating something like a metal foam, the refrigeration capabilities of these materials can be enhanced. Powder bed binder jet printing is a relatively simple and cost-effective method of creating samples with controlled porosity. This study focuses on a magnetocaloric Ni47Mn17Ga8Cu28 Heusler alloy. Powder was alloyed from raw elements, printed, and sintered at different temperatures to link densification to sintering temperature. Three samples of different densities were selected and imaged using optical microscopy and scanning electron microscopy. The magnetic and thermal properties were also analyzed using both room temperature and high temperature vibrating sample magnetometry and differential scanning calorimetry. These measurements were used to determine the effect of porosity on the functionality of the material and how it compares to traditionally researched single crystals.

Poster location	Suffix	Topic	Title	Author(s)	Abstract
84	Joseph Kocik	Physical Science and Engineering	Deterministic Space Networking and Time-Triggered Ethernet Modeling	Joseph Kocik; Alan George, PhD	Space computing systems rely on deterministic networking to precisely control sensors and perform maneuvers. Time-Triggered Ethernet (TTE) is a promising networking technology of prime interest to the space community, because of its ability to allow traffic in three classes to coexist under one protocol, allowing diverse traffic of differing levels of criticality. To investigate TTE, a hardware testbed was simulated using a systems simulation software tool called VisualSim. The simulation contained four nodes and two bridges in two configurations. The first, multihop, had two nodes connected to each bridge and the bridges connected. The second, dual-channel, had all four nodes connected to each bridge. A variety of simulation experiments were run ensuring the system behavior adhered to the protocol. High-priority, time-triggered traffic's latency only deviated by nanoseconds in accordance to system design. The dual-channel configuration was shown to have lower latency and standard deviation of latency then multihop. across traffic classes. Dual-channel's lower latency is justified due to traffic only needing to pass one bridge, and the decreased standard deviation demonstrates another potential benefit of routing traffic to avoid multiple bridges in a TTE system. Further work will be undertaken to verify these results in a hardware testbed.
52	Kayla LeMaster	Physical Science and Engineering	Microparticle Treatment of Periodontitis: Analysis of the Effect of Sex Hormones on Disease Outcomes and Correlated Immune Response	Kayla LeMaster	associated alveolar bone decays. Although initiated by bacteria in the mouth, the disease is propagated by the body's inflammatory immune response. Regulatory T cells (Tregs) are immune cells that can bring the periodontal environment to homeostasis when present in sufficient numbers. For this reason, we have developed degradable polymer-based microparticles for the controlled drug delivery of three factors (TGF-β, IL-2, and rapamycin) crucial to the local induction of Tregs. These tri-factor microparticles are administered in a periodontitis murine model that includes male and female mice to assess the influence of female sex hormones on the treatment. The three factors are separately encapsulated using a single or double emulsion fabrication technique and administered to mice. After 30 days, the mice are sacrificed and the maxillae are dissected and defleshed, imaged microscopically and analyzed via ImageJ software. We observed higher average disease amelioration from the microparticle treatment in mouse bacteria-induced periodontitis, yet bone loss in the treated mice was not statistically significant (as per a one-way ANOVA test) to that of non-diseased control mice, suggesting that the treatment successfully reversed the progression of the disease.
75	Hannah Liu	New Research Tools and Techniques	Four-Point Fortune Teller-inspired Origami Grasper for Increased Dexterity and Less Tissue Damage in Minimally Invasive Surgery	Hannah Liu; BokSeng Yeow, BS; Hongliang Ren, PhD	Current two-point grasper devices employed in minimally invasive surgery (MIS) manipulate tissue but induce concentrated areas of compression rather than uniform deformation along the instrument, incurring tissue injury cases. This paper proposes an alternate four-point fortune-teller inspired device to provide high dexterity and maximal grip under loading conditions and compares three methods of opening/closing actuation. Publications of origami-inspired devices were consulted for design conceptualization. Paper and 3D printed models were created to compare the actuation methods regarding force output, range of motion/area coverage, position/orientation, and grasping capability. A variation of the fortune-teller fold was designed to rectify issues within MIS by being able to grab tissue at four points, implying larger coverage and possibilities for greater force control, distribution, and dexterity. A "smaller inverted fortune teller" opening actuation method experimentally increases coverage area from 2.25 cm2 to 10.56 cm2. A twisting actuator closes the device best, compared to a tendon driven method, with a force output magnitude of ~1 N and ability to grasp a 28-gram object. While there are future concerns—flat foldability, self-deploying mechanisms, force output magnitude—these methods/designs utilize relationships between different folds and provide potential for an instrument that can optimize manipulation and decrease tissue damage.
58	Andrew Lynn	Translational Life Science	Interstitial Cystitis: A Rodent Model	Andrew Lynn, Rebecca Bergmann, Bronagh McDonnell, Lori A. Birder, F. Aura Kullmann	unknown; however, the result is chronic pelvic pain often associated with frequent urination. Stress amplifies these symptoms. The purpose of this project was to use a rodent model to create reproducible symptoms that are consistent with those found in IC patients with the future aim of investigating mechanisms underlying the development and progression of the disease. To this end, we have imposed a stress paradigm (1, 3, 6, and 10-day water avoidance stress or WAS) in Wistar Kyoto rats which are predisposed to stress. Parameters analyzed included abdominal pain and urinary function (volume and frequency), and were measured through behavioral pain testing with Von Frey filaments and 24-hour urinary observation respectively. Results have shown that an increase in voiding volume and frequency was achieved with the 10-day group. Visceral and Somatic pain sensitivity was also shown to decrease around the 6-day mark. Our findings demonstrate that chronic psychological stress alters bladder function and pain sensitivity, similar to observations in human patients with IC. Future studies will investigate molecular markers, from tissues taken throughout the study, in this model.

Poster location	Suffix	Topic	Title	Author(s)	Abstract
66	Kyler Madara	Physical Science and Engineering	Modeling Interferon Response in Pandemic H1N1 Influenza Virus Infected Mice Using Gene Expression Data	Kyler R. Madara; Jason E. Shoemaker, PhD	Innate immune response is essential for viral clearance during infection. However, there are drawbacks to this response. Inflammation caused by cytokines, such as interferon, can cause adverse and sometimes deadly effects. Developing an engineering model of the interferon response dynamics can help researchers understand the potential drawbacks of a powerful immune response. The purpose of this project is to model the inflammatory interferon response to pandemic H1N1 (pH1N1) influenza virus infection in mice using gene expression data. Not only does the model capture experimental dynamics, but the parameters and equations adhere to basic biological and mass-action principles. Introducing target and infected cell fractions into the model allows simulated interferon production to stop after the virus is destroyed. Changing the parameter associated with interferon production suggests a nonlinear sensitive relationship between parameter changes and model behavior; interferon production spikes with small changes in viral titer. This suggests that regulating interferon production to decrease viral titer would not work due to a more inflamed host response. Overall, this model simulates interferon production on levels deeper than the eye-test. This model could be used to conduct deeper sensitivity analyses to identify targets for future drugs and vaccines.
82	Nikhil Malik	Physical Science and Engineering	Fouling Resistant Membranes Using Catalytic CuO Nanoparticles	Nikhil Malik, Raj Gupta, Micheal Ginter, Manish Kumar	water recovery but suffer from high-energy usage. Major reasons for high-energy usage include membrane fouling and concentration polarization (CP). We propose a simple technique to address both CP and fouling challenges. Once a foulant layer is formed on the RO membrane, an in-situ generation of molecular oxygen “bubbles” is released near the membrane surface impart convective disturbances in the dense cake layer. This convective mechanism leads to disruption of the cake layer, increase in porosity, and finally, dispersion of the particulate matter. Additionally, bubbles can generate jet flows and oscillating wall motion to impart cleaning action. We have shown that with polydopamine (PDA) – metal oxide nanoparticle (NP) surface coated composite RO membranes, fouling can be completely reversed upon pulse injection of ppm levels of H2O2 in the feed without hindering or stopping membrane permeation.
19	Maria Francesca Ysabelle Martinez	Basic Life Science	Histone Acetyltransferase CBP Increases Activation of SCF FBXL19 Ubiquitin E3 Ligase by Acetylation and Stabilization of FBXL19	Maria Francesca Ysabelle Mendiola Martinez, Jianxin Wei, Su Dong, Rachel M Bower, Anastasia M Jacko, Kangning Yao, Yutong Zhao, Jing Zhao	new SCF (skp, cullin, F-box) E3 ligase subunit, FBXL19, targets a cell membrane receptor and small GTPases for their ubiquitination and degradation, while the molecular regulation of its stability remains unclear. Here we show that the stability of FBXL19 is mediated by a balance of its ubiquitination and acetylation. We found that FBXL19 was an unstable protein with a half-life around 2.8 h. In vivo ubiquitination assay revealed that FBXL19 was polyubiquitinated. Treatment of cells with a proteasome inhibitor, MG-132, prolonged FBXL19 half-life, suggesting that FBXL19 degradation is mediated in the ubiquitin-proteasome system. Further, we showed that FBXL19 was also modified by acetylation. Increased acetylation of FBXL19 by a histone deacetylase inhibitor, TSA, reduced ubiquitination of FBXL19. An acetyltransferase, CBP, was identified to catalyze FBXL19 acetylation. Inhibition of CBP reduced FBXL19 stability, while it was increased in CBP-overexpressed cells. The data indicates that CBP-mediated acetylation reduces ubiquitination and stability of FBXL19. Our study reveals a new molecular model for regulation of SCF E3 ligase activation by acetylation and stabilization of F-box protein.
2	Carrinton Mauney	New Research Tools and Techniques	ECM Hydrogel Injection for the Treatment of Stroke	Carrinton Mauney; Harman Ghuman, BS; Julia Donnelly; Andre R. Massesini, PhD; Stephen F. Badylak, DVM, MD, PhD; Michel Modo, PhD	impairments. Inductive biomaterials, such as an extracellular matrix (ECM) based hydrogel, recruit host cells to repopulate tissue cavities. Different concentrations of ECM hydrogel (0, 3, 4, and 8 mg/mL) were injected into the lesion cavity of stroke. Histological analysis at 1, 14, and 90 days post-injection evaluated the invasion of host cells, their phenotypes, as well as glial scarring. An 8 mg/mL ECM resulted in maximum cell invasion at 1 day, but the total number of cells retained within the ECM significantly dropped by 90 days. A poor biodegradation was evident. In contrast, the 3mg/mL ECM resulted in a decreased amount of cell invasion, but an improved biodegradation was achieved by 90 days. Lower concentrations of ECM hydrogel therefore potentially provide more favorable conditions for tissue repair. The use of biomaterial to repair brain tissue therefore provides exciting new vistas to eventually treat stroke patients.

Poster location	Suffix	Topic	Title	Author(s)	Abstract
16	Shane McKeon	New Research Tools and Techniques	Co-registration of In Vivo and Ex Vivo Human MRI Brain Images	Shane D. McKeon; Anusha Rangarajan; Minjie Wu, PhD; Nadim Farhat; Tales Santini, MD; Sossena Wood, MD; Tamer Ibrahim, MD; Milos Ikonomovic, MD; Julia Kofler, MD; Oscar Lopez, MD; Bill Klunk, MD; Howard Aizenstein, MD, PhD	Recent development in in-vivo imaging, allows us to measure amyloid burden in the living brain. Correlating the amyloid deposition with ex-vivo histology will provide a better understanding of the accuracy and characteristics of the in vivo scan. Developing the registration methodology must account for the time gap between the in-vivo and postmortem MR scans creating structural discrepancies, geometrical deformation due to dehydration, and MR signals that are negatively affected by the reduced proton density within fixed tissue. This intermediate ex-vivo MRI could bridge the time gap and will allow for a 3D image in the same MR space as the in-vivo MR structural image. To make the two scans more comparable we first stripped the in-vivo scan of the skull using the segmentation function within Statistical Parametric Mapping (SPM12). The in-vivo was registered to the ex-vivo using both a linear and non- linear registration methods. The two results were compared to see which produced a superior alignment. After each step of image modification and registration the alignment became gradually better. The most successful alignment came after a non-linear registration which registered the ex-vivo tissue deformation more closely to the in-vivo image.
32	Louis McLinden, III	New Research Tools and Techniques	AC Hall Effect Measurement System for Developing Efficient Thermoelectric Materials	Louis McLinden; Sangyeop Lee, PhD	Thermoelectric materials can produce an electric potential from a temperature difference. Consequently, thermoelectric energy conversion can be used to convert the waste heat into useful electric power. However, thermoelectric energy conversion has not been widely used due to its poor efficiency of energy conversion. In order to, improve the efficiency, it is critically required to analyze the transport of electrons and holes in thermoelectric materials. Two important properties related to charge transport are charge carrier density and charge carrier mobility. These two properties can be experimentally characterized by Hall Effect measurement. Most of the current Hall Effect measurement setups use DC magnetic field, but this method sometimes causes large error especially for semiconductors with low electron mobility. This is a problem because emerging thermoelectric materials such as conducting polymers exhibit low electron mobility. The purpose of this experiment was to use AC magnetic field in the setup, since it is very effective in eliminating this error. A power supply delivers an alternating current to the electromagnets. An AC magnetic is created by the alternating current. A Lock-In amplifier is then used to amplify the signal at the reference frequency. From these values, the Hall coefficient can be calculated to determined.
55	Jacob Meadows	Physical Science and Engineering	Preliminary Development of a Low-cost Flexible Endoscope for Robotic Minimally Invasive Nasopharyngoscopy	Jacob Meadows; Bok Seng Yeow; Hongliang Ren, PhD	Minimally invasive surgery (MIS) has become increasingly common because of the improved patient safety and comfort that comes from using smaller incisions and more advanced technology in the operating room. Smaller incisions put the patient at lower risk of blood loss and infection as well as decrease recovery time. Therefore, it is of significant clinical interest that minimally invasive techniques be explored for all types of surgical procedures. In diagnosing nasopharyngeal carcinoma (NPC), a head and neck cancer arising in the nasopharynx most common in East Asia and Africa, minimally invasive techniques may be employed via a transnasal approach to surveil the nasopharynx with increased safety and patient comfort. Because NPCs are most common in regions with typically lower access to expensive healthcare resources, it is important to develop a lower cost and rapidly-producible tool for robotic nasopharyngoscopy to diagnose NPCs. The developed preliminary endoscope employs simple two degree-of-freedom, ninety-degree bending and actuation methods that allow for low-cost manufacturing as well as customizability for specific clinical circumstances. The device was characterized in terms of its bending ability and through a mock operation test via a rapidly-prototyped phantom model.
69	Jessica Montone	Physical Science and Engineering	Nanomechanical Probes of Sketched LaAlO3/SrTiO3 Single-Electron Transistors	Jessica Montone; Feng Bi, PhD; Mengchen Huang, PhD; Jung-Woo Lee, PhD; Hyungwoo Lee, PhD; Chang-Beom Eom, PhD; Patrick Irvin, PhD; Jeremy Levy, PhD	Nanoscale devices that manipulate single electrons present an exciting platform for the observation of electronic and mechanical effects. By utilizing the locally tunable metal-insulator transition at the interface of LaAlO3/SrTiO3, we can create single-electron transistors using conducting atomic force microscope (c-AFM) lithography. The piezoelectric nature of LaAlO3/SrTiO3 gives way to an expected coupling between mechanical motion and electric charge within the device. We can test this effect by applying pressure to the device using an insulating AFM tip while measuring changes in electron density. A cryogenic AFM system is used to examine these effects, as many of the most interesting properties of these devices are only observed at low temperatures.
35	Ashley Morris	Basic Life Science	Abiotic Drivers of the Phenotypic Variability of Lemnaceae	Ashley Morris; David Conover; Joshua Armstrong; Martin Turcotte, PhD	micro geographic variation (within a pond) of species composition and phenotypic variation. We tested how shading and water depth impact common aquatic plants (duckweed). Duckweed density is often high near the shore and low in the center of ponds. We chose variables we predicted both could greatly impact resource availability and might better explain species distribution as opposed to other forces (e.g. wind) and could cause phenotypic responses. We used a partial reciprocal transplant experiment in addition to a shade manipulation to explore the impact of shading, water depth, and location of origin on the phenotypes of two duckweed species (*Lemna minor* and *Spirodela polyrhiza*). Both water depth and shading significantly impact duckweed morphology in ways that seem consistent with maintaining resource acquisition. Traits like SLA and root length increased with increasing depth and SLA and percent water content increased when in shade. We experienced a lack of origin effect suggesting that phenotypes are rapidly changing. In the future we plant to incorporate competition to understand how changes in phenotype may effect an individuals ability to compete.

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49	Nora Mosch	Basic Life Science	Understanding the Role of p59Oasl2 in Infection and Cancer	Nora C. Mosch; David F. Anthony; Arundhati Ghosh, PhD; Saumen Sarkar, PhD	The immune system works constantly to keep invading viruses and bacteria from harming the human body. It even prevents the spread of cancerous cells. Specialized cells called macrophages recognize these threats and neutralize them. There are two types of specific macrophage phenotypes, M1 and M2, induced with specific signals. Using bone marrow derived macrophages, the study determines the differences between these immune cells in a Wild type mouse (Wt) and a knockout mouse for p59Oasl2 gene (an Interferon inducible gene). In order to determine whether this protein has any role in immune system, a detailed characterization was done on M1 phenotypes of Wt and KO mice. Expression of genes such as, Irf1, IL1β, iNOS were studied at the RNA and protein level by employing qPCR analysis and western blot technique respectively. The differences between gene expression between Wt and KO M1 cells can lead to the understanding of the role of p59Oasl2 in infection and cancer.
85	Bridget Moyer	Physical Science and Engineering	Synthesis and Characterization of Atomically Dispersed PT on Metal Oxide Supports	Bridget Moyer; Leo DeRita; Philip Christopher, PhD	Reducing demand for metal oxide-supported precious metals like Pt is imperative to meet demands for sustainable and efficient novel catalysts. One approach to reducing demand is to produce atomically dispersed Pt catalysts on supports like CeO2 to maximize precious metal utilization. This can be achieved by adjusting the weight loading and pH of each batch systematically, adding the precursor solution dropwise, and calcining the synthesized material. Using IR spectroscopy, we were able to characterize unique Pt- and Ce-CO stretches to study the impact of varying synthesis parameters on the production of atomically dispersed Pt.
72	Nathaniel Myers	Translational Life Science	Thermoresponsive NIPAAm-Based Gel for Targeted Delivery to the Retina	Nathaniel Myers, Michael Washington	Synthesis of poly(N-isopropylacrylamide) (pNIPAAm) non-degradable gel scaffolds for controlled drug delivery has been increasingly studied in recent years due to their desirable thermoresponsive phase behavior. The thermoresponsive nature of the pNIPAAm gels allow for a liquid injection at room temperature and subsequent gelation once exposed to physiological conditions. Consequently, many fields such as orthopedic and regenerative medicines have adapted this delivery system by incorporating comonomers to alter various physical and chemical properties of pNIPAAm gels. For this reason, we hypothesized that pNIPAAm copolymerized gels would serve as an ideal candidate for intraocular gene delivery applications involving viral vectors. As shown in previous studies, copolymers that incorporate hydrophilic acrylic acid (AA), degradable α- acryloyloxy-β,β-dimethyl-γ-butyrolactone (DBA), and thermoresponsive NIPAAm have ideal phase transition temperatures and degrade into portions small enough to be exported and processed by the kidney. We hypothesize that the incorporation of an alternative hydrophilic comonomer, N-(2-hydroxypropyl) methacrylamide (HPMA), will offer similar phase transition and degradation behaviors while granting postpolymerization functionalization opportunities for gene therapy delivery applications.
88	David Nascari	Translational Life Science	Saline-soluble Extracellular Matrix Fraction as a Treatment for Glioblastoma Multiforme	David Nascari; Mark Murdock, BS; Jordan Chang, BS; George Hussey, PhD; Nduka Amankulor, MD; Johnathan Engh, MD; Stephen Badylak MD, PhD, DVM	Gliobastoma Multiforme (GBM) is the most common and lethal primary CNS tumor. Glioma cell invasion is associated with the remodeling of surrounding parenchymal extracellular matrix (ECM), suggesting that the native non-neoplastic microenvironment is not ideal for maintenance and proliferation of these neoplastic cells. We observed that the saline-soluble fraction of porcine urinary bladder-derived ECM (UBM-SSF), devoid of the structural macromolecules found in ECM, markedly decreased the viability of primary glioma cells in vitro. Fluorescent videos confirmed that UBM-SSF treated glioma cells showed Caspase-3-mediated apoptosis, while similarly treated CHME5 cells did not. Furthermore, glioma cells exhibited decreased migration and proliferation in the presence of these matrix-embedded cues. In preliminary animal studies, large primary glioma tumors in the flanks of athymic nude mice were resected and replaced with either either UBM-SSF or Matrigel® (a commercial neoplastic ECM). After 7 days, UBM-SSF resection sites showed very little tumor regrowth compared to dramatic recurrence seen in the Matrigel® control sites. These findings indicate that non-neoplastic ECM contains potent homeostatic regulators capable of abrogating a malignant phenotype. Delivering soluble fractions of ECM to a tumor site may represent a novel approach to cancer therapy, sidestepping traditional cytotoxic therapies.
46	Laura Obregon	New Research Tools and Techniques	Use of Natural Language Processing to Highlight Key Information in Electronic Medical Records and Reduce Cognitive Burden on Clinical Providers	Laura Obregon; Harry Hochheiser, PhD	Data from Electronic Medical Record systems (EMR) has potential to ensure timely and quality care delivery. EMRs are dense to read and may lead to cognitive burden on the clinician, consequently missing important clinical data that may signal future patient health problems. We aim to develop a strategy for identifying and highlighting factors in clinical notes to reduce the cognitive load and ultimately increase the efficiency of the clinician. The Natural Language Toolkit (NLTK) and regular expression (re) libraries in Python were used to highlight information relevant to clinical care. Sample notes were tokenized, parts-of-speech tagged, and noun phrases extracted through chunking of manually selected sentence structures. Ontology driven concept extraction was performed by mapping noun phrases to terms from SNOMED-CT, with using the Python library PyMedTermino. Terms extracted from PyMedTermino will be reviewed to extract a preferred SNOMED-CT concept for each text span, then reviewed for accuracy and

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11	Qihang Ou	Physical Science and Engineering	Time Dependent Hydraulic Fracture Initiation in Limestone and Shale	Qihang Ou	The technology of hydraulic fracturing is used to improve the productivity of the natural gas and oil from petroleum reservoirs. The process involves injection of high-pressure fluid into wellbores to create cracks within the rocks for the purpose of providing flow pathways and stimulating production of natural gas or oil. We are testing whether the hydraulic fracture will be initiated in a delayed manner due to continuous pressurization after some time period if pressure-induced tensile stress is insufficient to cause the instantaneous breakdown. We used a pump to pressurize fluid (water) in a wellbore with a constant pressure with the confinement provided by a 3-axis loading frame, and the time was observed. We did both confined and unconfined tests on limestone, and only confined tests were performed on shale. We conclude that for limestone, the higher the pressure applied on specimen, the faster the hydraulic fracture initiation/breakdown occurred. Under confinement a similar qualitative behavior is observed, but larger values of the confining stress are required to generate initiation for a given initiation time. For the shale, the relationship between delayed time and applied pressure should be similar, but a trend was not discernable because of wide-variability of shale samples.
60	Kalon Overholt	New Research Tools and Techniques	Modeling Osteoarthritis in a Bone-Cartilage Bioreactor	Kalon J. Overholt, Riccardo Gottardi, Rocky S. Tuan	We aim to validate the design of a new bioreactor system for co-culture of bone and cartilage tissue to recapitulate the unique physiology of the joint surface in vitro by creating separate microenvironments for each tissue type. Our bioreactor system will enable in-depth study of the crosstalk between cartilage and bone and the role it plays in osteoarthritis (OA). To evaluate the system's capacity to host native osteochondral tissue, explants from pig knee joints were cultured in the bioreactor for 7 days using separately circulated tissue-specific media. The samples were subjected to live/dead viability assays and histological staining which demonstrated that both bone and cartilage maintain cell viability after 7 days. Analysis of glycosaminoglycan (GAG) loss from cartilage showed that after 2 days of high loss, GAG loss from explants cultured in bioreactors reaches comparable levels to loss from explants in standard tissue culture plates. These findings indicate that conditions in the bioreactor are adequate for tissue maintenance over 7 days. To begin modeling an inflammatory pathway of OA, explants in bioreactors were perfused with TNF-α, an inflammatory cytokine associated with OA. Explants were assayed for tissue specific changes in viability, GAG loss, histology, gene expression, and enzymatic products.
63	Janki Patel	Basic Life Science	Role of Niche Factors Regulating Transcription of Self-Renewal Genes in Cells from Pediatric Neoplasm Neurocutaneous Melanocytosis	Janki Patel; Dipanjan Basu, PhD; Claudia Salgado, MD, PhD; Miguel Reyes-Mugica, MD	Self-renewal is the property of stem cells in normal tissues and cancer whereby stem cells maintain their pluripotency or multipotency over subsequent cell divisions. Recently, tumor stem cells have been recognized as the major source of all cell types present in a given tumor. These cells are drug-resistant, grow clonogenically and are capable of tumor re-population after chemotherapy. However, the endogenous factors regulating self-renewal in a particular tumor appear to depend on tumor niche. Neurocutaneous melanocytosis (NCM) is a rare congenital pediatric neoplasm which when symptomatic, is fatal despite surgical interventions and conventional chemotherapy. In this study we investigated the role of two growth factors (bFGF and IGF1) abundantly found in NCM tumor niche, in the transcription of a panel of self-renewal genes. Our results show, each growth factor induced expression of a different set of self-renewal genes in NCM cells and melanoma when compared with normal melanocytes. However, the gene Bmi1 was induced by both growth factors across the NCM and melanoma cells tested. This induction was prevented by treatment with inhibitors of bFGF and IGF1 signaling. Small molecules targeting Bmi1 or bFGF/IGF1 signaling could be potential therapeutic candidates preventing tumor re-growth in this particular tumor.
79	Nima Patel	Basic Life Science	Detrimental Effects of Traumatic Brain Injury on Attentional Set-shifting Behavior in Female Rats	Nima Patel; Heather Tennant, BS; Kristin Free, BS; Ihuoma Njoku, BS; Jacon Leary, BS; Megan LaPorte, BS; Melissa Nicholas; Patricia de la Tremblaye, PhD; Naima Lajud, PhD; Jeffrey Cheng, BS; Anthony E. Kline, PhD; Corina O. Bondi, PhD	Traumatic brain injuries (TBIs) are a significant healthcare burden, with cognitive impairments being a major component of long-term disability. Previously, we demonstrated that a controlled cortical impact (CCI) injury produced impairments in executive function and cognitive flexibility in the attentional set-shifting test (AST), a cognitive paradigm analogous to the Wisconsin Card Sorting Test. Females represent over 40% of TBIs, yet this group is largely understudied in models of brain trauma. We thus hypothesized that executive function in female rats will be impaired after TBI. Isoflurane-anesthetized, normal cycling, adult female rats were subjected to CCI (2.8 mm cortical depth, 4 m/s) or sham injury. Four weeks post-surgery, rats were tested on the AST, which involves a series of increasingly difficult tasks, including simple and compound discriminations, reversals, and intra- and extradimensional (ED) shifts. TBI produced significant deficits in ED set-shifting and reversal learning, seen as increased trials to reach criterion and total errors ($p's<0.05$). When separated by estrous stage, TBI rats in both diestrus and proestrus performed similarly worse than sham counterparts. These findings demonstrate executive function and behavioral flexibility deficits in our animal model of TBI in females, rendering assessments using pharmacological and rehabilitative therapies post-TBI both timely and necessary.

Poster location	Suffix	Topic	Title	Author(s)	Abstract
25	Henry Phalen	Physical Science and Engineering	Differential Activation of Rest-state Cortical Networks in First-episode Schizophrenia-spectrum Psychosis	Henry Phalen; Brian Coffman, PhD; Dean Salisbury, PhD; Ervin Sejdic, PhD	Schizophrenia is a chronic mental disorder that can result in particularly disabling cognitive, physical, and emotional symptoms. Understanding differences in cognitive function between individuals with Schizophrenia and those without the disorder could lead to improvements in treatment and diagnosis. In this study, we used a machine-learning clustering technique, non-negative matrix factorization (NMF), to analyze phase-synchrony graphs from Magnetoencephalography (MEG) data. Five minutes of rest-state data were collected from 31 individuals with first-episode schizophrenia-spectrum psychosis and 22 healthy controls. The first principal component of signals from 40 Brodmann areas of each hemisphere were bandpass filtered into the alpha (8-12Hz) frequency band and phase synchrony was calculated between regions to create weighted, undirected synchrony graphs. These graphs served as the input for NMF which provided component subgraphs and timeseries corresponding to the relative activation of each subgraph in the input graphs. Interestingly, without a priori knowledge in the input, many of these subgraphs displayed regional neural clustering. Four of the subgraphs also exhibited a significant decrease in median energy between the groups, and three of these four also showed significant decreases in median entropy. The use of NMF to analyze MEG data shows promise for use in analyzing clinical hypotheses about Schizophrenia.
76	Maria Pongibove	New Research Tools and Techniques	Widespread Age-associated Alterations in White Matter Connectivity in First Episode Psychosis	Maria Pongibove; Finnegan Calabro, PhD; Beatriz Luna, PhD	This study aimed to examine alterations in white matter connectivity in first episode psychosis patients in comparison to controls using Diffusion Spectrum Imaging data. Participants included 40 first episode psychosis patients ages 14-28, and 29 matched controls ages 14-35. DSI data was analyzed using a QSDR model to extract voxel wise QA0 values. QA0 values were extracted for each of 80 regions of interest based on a standardized Tractography Atlas Patients showed lower QA0 values in nearly every ROI, suggesting global white matter alterations. To understand the underlying structure of the data, a Principal Component Analysis (PCA) was performed. Components were then assessed for age, group, and age*group effects. The first component captured roughly 90% of the total variance in the dataset, and showed a significant group by age interaction (p=0.00155). Upon inspection, we see controls' QA0 values decrease as age increases, which is consistent with the supported developmental trend. Patients on the other hand do not follow this trend; their QA0 values were suppressed at early ages, and did not change as a function of age. This study shows first episode psychosis patients exhibit global decreases in white matter integrity, providing evidence to support global dysconnectivity.
41	Evan Poska	Physical Science and Engineering	Kinetics of Self-folding Shape-memory Polymers Activated by Local Resistive Heating	Evan M. Poska; Moataz Elsisy, MS; Mostafa Bedewy, PhD	The purpose of this project is to characterize the kinetics and direction of self-folding of pre-strained polystyrene (PSPS) films, which result from local shrinkage using resistive heating. A temperature gradient across the thickness of this shape memory polymer induces folding along the line of contact with heating wire. Varying the wire properties and current changes the degree of folding and extent of local material flow. This method can be used to create practical 3D structures. Sheets of PSPS and non-pre-strained styrene were cut to 10 × 20 mm samples and their angles were plotted with respect to time, as obtained from in situ videography. In addition, the use of polyimide tape (Kapton) was investigated for controlling the direction of self-folding. Results show that folding happens on the opposite side of the sample with respect to the tape, regardless of which side the heating wire is on, or whether gravity is opposing its motion. Given the tunability of fold times and extent of local material flow, heat-assisted folding is a promising approach for manufacturing complex 3D lightweight structures by origami engineering. Future work will include redesigning the experimental setup to enable sequential self-folding.
6	Catherine Pressimone	Basic Life Science	The DNA Binding Motifs in Shu Complex Proteins, Csm2, and Psy3, are Critical for Error-free DNA Repair	Catherine A. Pressimone, Benjamin W. Herken, Stephen K. Godin, Kara A. Bernstein	The budding yeast Shu complex is critical for promoting Rad51-dependent DNA repair. The Shu complex is a heterotetramer composed of four proteins: Shu1, Shu2, and the Rad51 paralogs Csm2 and Psy3. Biochemical analysis has revealed that Csm2 and Psy3 are the DNA-binding subunits of the Shu complex, but the in vivo biological function of the DNA-binding domains of Csm2 and Psy3 has remained unknown. We created csm2 (csm2-KRRR) and psy3 (psy3-KRK) DNA-binding mutants at their endogenous locus and promoter and analyzed these mutant strains for DNA repair defects both independently and when combined. Consistent with the idea that DNA-binding of the Shu complex is critical for DNA repair, we find that cells with disruption of either Csm2 or Psy3 DNA-binding demonstrate increased sensitivity to the DNA alkylating agent methylmethane sulfonate (MMS), with DNA damage sensitivity being most pronounced in the double DNA-binding mutant, csm2-KRRR psy3-KRK. Furthermore, we show that csm2-KRRR and psy3-KRK single mutant cells exhibit significantly higher MMS-induced mutation rates using a CAN1 mutagenesis assay, with this effect being exacerbated in the double mutant csm2-KRRR psy3-KRK. These results demonstrate that the DNA-binding of Csm2 and Psy3 are critical for the Shu complex function in repair of MMS-

Poster location	Suffix	Topic	Title	Author(s)	Abstract
14	Rahul Ramanathan	Translational Life Science	Comparative Analysis of the Destabilizing Effects of Anterior Versus Posterior Releases on the Thoracolumbar and Lumbar Spine	Bryan Rynearson, MD; Rahul Ramanathan; Marcus Allen, BS; Nicholas Vaudreuil, MD; Kevin Bell, PhD; Patrick Bosch, MD	Historically, anterior-based procedures have been indicated for adolescent idiopathic scoliosis (AIS) curves of the lumbar spine. Originally described by Dwyer et al. in 1969 using cables and vertebral body screws, the anterior approach had been the mainstay of surgical deformity correction in AIS for decades. However, the posterior approach has gained popularity in recent years since the advent of transpedicular screw fixation with dual rods. Clinical evidence suggests contemporary posterior correction procedures are not only safe but achieve equal if not improved deformity correction without loss of integrity over time compared to their anterior counterparts. Quantitative comparisons regarding the corrective potential of these two surgical approaches are difficult to make from clinical studies alone, given the heterogeneity in fusion systems utilized and magnitude of the chosen surgical resection. Moreover, these studies fail to detail release procedures, especially for the posterior approach, which further limit the generalizability of these conclusions. Biomechanical comparisons of anterior and posterior surgical releases have been performed in the thoracic spine, but not in the thoracolumbar/lumbar spine. The aim of this study was to quantify the destabilizing effects of anterior discectomy (full and partial) as compared to partial facetectomy and full posterior release in the thoracolumbar/lumbar spine.
3	Rafael Rodriguez	New Research Tools and Techniques	Combining Metal Nanomeshes and Nanostructured “Hazy” Glass as an Alternative to Transparent Conducting Oxides	Maxwell Lindsay, Rafael Rodriguez, Sajad Haghanifar, Paul Leu	Thin film solar cells based on hydrogenated amorphous (a-Si:H) or microcrystalline silicon (µc-Si:H) still remain among the most promising technologies to advance the photovoltaic market, as they offer reductions in manufacturing costs, material usage, and processing time. However, these cells have yet to exceed 10% efficiency. Different approaches have been developed to boost their efficiency. Transparent conductive oxides (TCOs) are an important component in this regard, as they provide excellent transmission and haze factor (> 80%) over the visible spectrum and low sheet resistance (< 100 Ω/sq). However, they introduce complexity and high cost to the thin film solar cell manufacturing process. This work proposes an alternative to common TCOs by combining the concepts of nanostructured glass and metal nanomeshes. The former of these provides the necessary optical properties, and the latter provides the necessary conductivity. We were able to fabricate devices with sheet resistances as low 3-12 Ω/sq, haze factors of above 80%, and total transmittance values of 58%-70% for the entire visible spectrum.
20	Christina Rogers	Basic Life Science	Biodiesel Production from Wastewater Microorganisms: Effect of Biosolids Drying Methods	Christina Rogers, Larissa Gaul, Daniel Cha	Annually, municipal wastewater treatment facilities in the US produce millions of tons of biosolids waste that must be safely disposed of. However, lipids can be extracted from the biosolids via a transesterification process to produce biodiesel. In the transesterification reaction, the phospholipids in cell membranes of sludge microorganisms react with an alcohol, such as methanol, and a catalyst, such as sulfuric acid. This produces fatty acid methyl esters, which are the building blocks of biodiesel. With a high enough biodiesel yield as compared to energy/material input required, this technology provides the opportunity for biodiesel to be extracted from what would otherwise be waste. The content of the biosolid waste varies greatly depending on how intense the treatment method used is, and what, if any, chemicals were used. As such, biodiesel yield could be strongly related to the organic makeup of the sample tested, rather than the drying methods used leading up to testing. The goal of this experiment, other than demonstrating the transesterification process, is to determine whether less intense drying methods will result in a higher yield of biodiesel, and if sample makeup has a large influence in biodiesel yield from transesterification.
17	Katherine Rohde	New Research Tools and Techniques	Correction of Gibbs Ringing Artifact in DW-MRI with Biomemetic Brain Phantom as Ground Truth	Katherine Rohde	Diffusion-weighted magnetic resonance imaging (DW-MRI) is an area of intense study in brain mapping. However, its results are corrupted by a strong Gibbs ringing (GR) artifact, which has previously been studied primarily through qualitative image analysis. This study seeks to quantify the effectiveness of GR correctional algorithms through the use of a physical brain phantom acting as ground truth. The phantom is composed of constant-density chambers over which MRI signals are expected to be constant. Two correctional methods were analyzed: Gaussian filtering (GF) and Local Subvoxel-shifts (LS). Visually, LS appeared to outperform GF in diminishing GR in human DW-MRI images, while GF contributed to greater spatial resolution loss. However, in the phantom data, GF exhibited the lowest coefficient of variation over constant-density chambers, and displayed the lowest percent difference from the expected frequency curve. Although LS appeared to fully diminish GR in the DW-MRI images, the artifact was still clearly present in the phantom data, indicating that visual analysis alone is insufficient in evaluating the effectiveness of GR correctional algorithms. Further investigations involving a Monte Carlo simulation and other correctional methods such as TV and TGV are required to determine which method best diminishes GR without losing precision.

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28	Eva Roy	Translational Life Science	The Role of Neutrophil Extracellular Traps in Mitochondrial Biogenesis in Cancer	Eva Roy; Hamza Yazdani, MD; Allan Tsung, MD	Neutrophils are one of the principal cells in defending the immune system. However, it is becoming evident that neutrophils forming extracellular trap (NETs) play an important role in tumor progression. Mitochondrial biogenesis is a novel mechanism by which cancer cells enhance ATP synthesis to meet their increased metabolic demand for growth, invasion, and metastasis. The experimental approach consisted of injecting both wild type and PAD4 KO (NET depleted) mice with colorectal cancer cells both subcutaneously and via spleen. We found a 3-fold increase in the tumor volume (p=0.01) of a control mice compared to PAD4 KO mice. PAD4 KO tumors showed significantly decreased proliferation rates and increased apoptosis as evident by immunofluorescent staining for Ki67 and TUNEL compared to control mice. In-vitro, stressed cancer cells show increase in neutrophil recruitment and NETs formation. There was a 2-folds increase in mitochondrial biogenesis of the cancer when MC38 cells were cultured with stimulated neutrophil media of a control mice. There was a significant increase in the ATP production of the cancer cells cultured with stimulated neutrophil media of a control mice (P<0.01). In conclusion, our findings suggest that NETs are playing a role in increasing mitochondrial biogenesis leading to tumor progression.
36	Roisin Sabol	Basic Life Science	Identifying Rare Genetic Variants in Treatment-Refractory Major Depressive Disorder	Roisin Sabol; Lora McClain, PhD; Patricia Shaw, MS; Anna Maria Segreti, BS; David Finegold, MD; Lisa Pan, MD; David Peters, PhD	Introduction: Major depressive disorder (MDD) is a common and devastating disease. Most MDD patients respond to traditional pharmacotherapy; however, treatment-refractory MDD (TR-MDD) affects up to at least 15% of the depressed population. TR-MDD is a multifactorial disorder, incorporating both environmental and genetic risk factors. Several metabolic pathways, such as serotonin, dopamine, and folate, have been previously associated with psychiatric disorders, including TR-MDD. We explored the contribution of rare autosomal variants (MAF<1%) in the genes of these pathways in 85 Caucasian TR-MDD patients. Methods: TR-MDD cases were whole exome sequenced and, after quality control, allele frequencies of selected variants in genes from the aforementioned pathways were compared to non-Finnish European allele frequencies from the Exome Aggregation Consortium (ExAC) using Fisher's Exact Test. We used a p-value cutoff corresponding to a false discovery rate (FDR) of 0.05 to address multiple comparisons. Results: Seven of 47 rare variants investigated were significantly more frequent in the TR-MDD cohort after multiple comparisons adjustment; 9 variants were absent in ExAC. In silico assessment predicts these variants may result in deleterious effects based on protein molecular properties and sequence homology. Conclusion: These analyses suggest rare gene variants in folate, serotonin, and dopamine pathways increase risk for TR-MDD.
33	Forrest Salamida	New Research Tools and Techniques	Predicting Phase Behavior of Organic-Salt-Water, Two-Phase Systems Using the AIOMFAQ Model	Eric Beckman, PhD; Giannfranco Rodriguez, PhD	The two most common methods of desalination are distillation and reverse osmosis (RO), the latter of which requires facilities where energy consumption accounts for nearly 50% of operational costs. Yet, distillation is no better; only 15% of the bottled water operators in the industry use distillation in comparison to the nearly 40% who use RO due to lower costs. These conditions have led researchers on a quest for more efficient alternatives. The scope of this project is to determine the feasibility of using reactive chemical extraction to desalinate water. This new method of desalination will use less energy than currently required and increase the availability of clean and safe drinking water. For it to work, an organic compound with the following qualities must be designed: 1) Reversibly reacts with water under reasonable conditions 2) Impedes the transfer of salt across the water-organic phase barrier The AIOMFAQ model was combined with the Newton-Raphson method in a computer model that predicts the phase behavior of organic-salt-water mixtures. The program allows one to define an organic molecule by the type and number of functional groups in it.
47	Eliza Schally	New Research Tools and Techniques	In Vitro Characterization of Melatonin-loaded Conducting Polymer Coatings for Neural Electrodes	Eliza Schally; Asiyeh Golabchi, PhD; Kevin Woeppel, BS; Ian M. Taylor, PhD; X. Tracy Cui, PhD	Implantable neural microelectrodes provide a means of recording activity from the nervous system and reducing the burden of neurological disease and injury in afflicted individuals. However, chronic degradation in signal quality caused by mechanical failure of the probe or inflammatory tissue responses poses a challenge. Conducting polymers such as polypyrrole (PPy) can address this challenge by improving the electrochemical function and biocompatibility of neural electrodes. Melatonin has been shown to have anti-inflammatory effects in the nervous system by many mechanisms including inhibiting the caspase-1 cell death pathway and scavenging reactive oxygen species, so a method for local melatonin release at neural electrode implantation sites is desirable. It has been reported that electrodes coated with conducting polymer-dopant systems show improved stability in chronic stimulation and can form reliable electrically controlled drug release systems. We have found that PPy doped with sulfate-functionalized mesoporous silica nanoparticles (SfMNPs) shows potential for electrically controlled drug release. This PPy/SfMNP coating is promising because the drug may be loaded post-electropolymerization via cyclic voltammetry at a potential that is below the fouling potential of melatonin as opposed to being polymerized directly into the coating, avoiding irreversible oxidation of the drug.

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56	Jonathan Scott	Physical Science and Engineering	Interactions between Waveform Shape and Visuomotor Response Properties in Prefrontal Cortex	Jonathan A. Scott, Sanjeev B. Khanna, Matthew A. Smith	Cortical brain computer interfaces (BCI) have proven to be a valuable research tool for investigating the brain. BCIs rely upon the population of neurons being recorded. Therefore, understanding how these neurons interact and are connected could improve the ability of BCIs. How putative inhibitory (narrow spike width) and excitatory (broad spike width) neurons communicate, particularly in prefrontal cortex (PFC), has not been closely examined. PFC has been implicated in many different cognitive functions, including eye movement generation. We were interested in how excitatory and inhibitory subpopulations communicate during the sensorimotor transformation from processing a visual stimulus to making an eye movement. Populations of PFC neurons were recorded simultaneously using multielectrode arrays, while subjects performed a conventional memory guided saccade task. We used a waveform classifier previously used in our lab to determine the probability of a given neuron being either inhibitory or excitatory. After classifying neurons as either excitatory or inhibitory, we examined how these subpopulations' response properties differed. Using our waveform classifier, we were reliably able to separate narrow (inhibitory) and broad (excitatory) waveforms. When examining these subpopulations as a function of their visual-motor response properties, we found that movement related neurons were more likely to be inhibitory.
44	Hilary Serbin	Translational Life Science	Examining the Evolutionary Role of an Ancestral Enhancer Regulating a Novel Signaling Pathway	Hilary Serbin; Sarah Smith, PhD; William Glassford, PhD; Winslow Johnson, PhD; Mark Rebeiz, PhD	Novel morphologies are observed across the animal kingdom, from the bat wing to the beetle horn. Often correlated with the evolution of novelty is the expansion of signaling pathway activity. This is hypothesized to occur due to changes in the regulatory enhancers of signaling pathways, but examples are lacking. To understand this we examined a recently evolved novel morphology, the posterior lobe, which is a cuticular projection on the genitalia of male fruit flies within the *D. melanogaster* clade. Underlying the evolution of the posterior lobe is a temporal expansion of expression of unpaired (upd), a component of the JAK/STAT signaling pathway. To examine the evolution of upd we identified and characterized the regulatory enhancer of upd and determined that the enhancer pre-dated the evolution of the posterior lobe. This indicates that evolutionary changes occurred upstream of this enhancer in order to temporally expand upd's expression in lobed species. In addition, we determined the ancestral role of the enhancer, which was to drive an early wave of upd expression in the genitalia of both lobed and non-lobed species. Overall, this suggests that evolutionary changes are not necessarily occurring to the regulatory enhancers of signaling pathways during the evolution of novelty.
70	Karl Sewick	Physical Science and Engineering	Low Loss Surface Plasmon Propagation at Single Interface for Anisotropic Media (Metamaterials)	Karl Sewick; Hong Koo Kim, PhD	Conventional plasmonic structures are incapable of providing sufficient support for surface plasmon propagation, revealing the need for unconventional structures. In this research, we derive the governing equations for a metallodielectric metamaterial structure in the most fundamental geometry (single interface with air) of the phenomenon. With this in mind, we attempted to improve attenuation over the conventional silver-air interface case. In traditional silver-air systems, propagation distance remains far under 100μm due to absorption in the metal side of the system. In simulation, we observed propagation distances of up to ~250μm, far better than isotropic media, with more available testing. Even longer propagation lengths are expected to be attainable when the dielectric tensors of metamaterial are further optimized. We also provided thorough analysis of the waves, vector fields, and surface profiles to improve the understanding of relevant parameters for metamaterials' use in low loss surface plasmonics. The research reveals high loss at UV, low loss at IR wavelengths. The propagation is also dependent on matching dielectrics between SiO2 and the metamaterial's dielectric normal to the interface with minimal imaginary part. A tradeoff relationship exists between propagation length and lateral confinement of surface plasmons: the longer propagation results in poor spatial confinement.
61	Fathima Shabnam	New Research Tools and Techniques	Assessing Cytocompatibility of Novel High Ductility Magnesium Alloys	Fathima Shabnam, Jingyao Wu, Abhijit Roy, Prashant N. Kumta	Magnesium-based alloys have attracted considerable attention in the last decade due to its ability to degrade in vivo, biocompatibility and suitable mechanical properties. Currently, however, there are no studies reported to evaluate the cytotoxicity of magnesium-based alloys on airway epithelium cells. The aim of this study is to assess the in vitro cytotoxicity of our proprietary patent pending ultra-high ductility (UHD) magnesium alloys specifically aimed at tracheal stent application. In this study, pure Mg, AZ31, and three alloys with different compositions of lithium, aluminum, and zinc are tested. MTT testing and DAPI & F-action staining was performed to determine the effects of degradation products of these novel alloys with different dilution ratios on the human bronchial epithelial cell line (BEAS-2B). ICP-OES data and the MTT results show a potential impact of lithium on the cell viability. Through DAPI & F-Actin staining, it can be seen that the alloys do not have an adverse impact on the morphology. The in vitro experiments, combined with the in vivo experimentation that is currently proceeding, will elucidate the biocompatibility of each alloy, and will also help ascertain the suitability of these novel ultra-high ductility (UHD) alloys for tracheal stent applications.

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50	Hemali Shah	Basic Life Science	Longitudinal Neurodevelopment of Mesolimbic Network Connectivity Throughout Adolescence	Hemali Shah; Vishnu P. Murty, PhD; David Montez, PhD; Will Foran, MS; Bea Luna, PhD	Adolescence is characterized by increased reward-seeking behavior, which is thought to be the result of increased mesolimbic dopamine system activity. This system has been associated with a variety of psychiatric disorders that emerge during adolescence, including addiction and schizophrenia. Research has yet to fully characterize the functional properties of this network in normative populations, however, making it difficult to understand how it contributes to disease. Our study was designed to characterize neurodevelopment of the mesolimbic dopamine system across healthy adolescents in rewarding and neutral contexts. Using longitudinal fMRI data acquired during rewarded antisaccade and resting state tasks, we implemented a background connectivity approach to characterize the system. Data was analyzed from 74 healthy individuals ranging from age 10 to 30. We characterized connectivity across the ventral tegmental area (VTA), nucleus accumbens (NAcc), and dorsolateral prefrontal cortex (dlPFC). Our results indicate that there are no developmental differences in VTA connectivity with the NAcc and dlPFC in neutral contexts ($p>0.10$); however, developmental differences emerged in rewarding contexts ($p<0.001$). Specifically, connectivity within this network was strongest during adolescence and decreased into adulthood. These results indicate that mesolimbic engagement is highly context-dependent, reinforcing the notion that adolescence is the peak time for dopamine activity.
77	Yousif Shwetar	New Research Tools and Techniques	Assessment of Patient Hemodynamics Pre-Left Ventricle Assist Device Implant to Determine Chance of Right Ventricular Failure	Timothy N. Bachman, Christopher B. Link, Michael Boisen	Left ventricular assist devices (LVAD) support patients suffering from left sided heart failure. However, approximately 20% of them will experience right ventricular failure (RVF) following implantation. We analyzed waveforms from pre-operative standard clinical Right Heart Catheterization (RHC). The analysis was performed using custom MATLAB programs generating an average representative beat. In addition to standard RHC measures of systolic/diastolic/mean pressures, the maximal rate of arterial pressure change with respect to time (dP/dt, a measure of RV contractility) and pulmonary vascular compliance (Cp) (defined as stroke volume divided by pulse pressure) were determined. Thirty-two patients were enrolled (25 male, mean age 54±13, range 23-73, RVF mean age 55±18, without RVF mean age 53±13). Five patients were classified as RVF. Mean time from RHC to implant was 10±11 vs 7±7 days for those with vs without RVF, respectively. A statistically significant difference was recorded for right atrial pressure (18±6.8 vs 10.3±5.2 mmHg, P=0.019). Remaining parameters showed no significance between patients with and without RVF. In conclusion, it is feasible to prospectively assess dP/dt and Cp for LVAD patients with and without RVF. Future work involves continued enrollment to assess a larger sample size, studying multiple other time points during the perioperative period.
64	Rachel Sides	Basic Life Science	Stimulation of Elastic Fiber Proteins by Mesenchymal Stem Cell-derived Factors	Rachel Sides; Kaori Sugiyama; Aneesh Ramaswamy, MS; David Vorp, PhD; Hiromi Yanagisawa, PhD; Justin Weinbaum, PhD	of elastic fiber components can lead to cardiovascular disease. Our group has shown in previous work that mesenchymal stem cell (MSC) delivery preserves elastic fibers in the context of aneurysm. In this study, three-dimensional fibrin tissue constructs were used to determine if elastic fiber production would be elevated in response to MSC-derived secreted factors (MSCSF) and to characterize the specific elastic fiber components upregulated. After 20 days of exposure to MSCSF, smooth muscle-cell (SMC) based tissue constructs exhibited evidence of elastin, fibrillin-1, and fibulin-5 by indirect immunofluorescence; a qualitative increase in elastin was observed upon MSCSF stimulation. qPCR analysis demonstrated that MSCSF quantifiably increased fibulin-5 and the elastin crosslinking protein lysyl oxidase. Taken together, MSCSF is capable of upregulating multiple proteins involved in elastic fiber formation. By stimulating production of elastin organizational proteins, MSCSF therapy presents a promising avenue toward increased elastic fiber formation. Additional preliminary studies supported the viability of wild-type mouse
86	Andrew Sivaprakasam	Physical Science and Engineering	Investigating Wheelchair Seating Parameters and Their Effect on Ramp Propulsion	Andrew Sivaprakasam; Sarah Bass, BS; Deepan Kamaraj, MD, MS; Alicia Koontz, PhD	Introduction: Manual wheelchair users rely entirely on their upper-body strength to transport themselves, and ascending sloped terrain provides an additional demand that may be mitigated if the wheelchair user could use a different wheelchair configuration 'on-the-fly'. This study investigates how four different configurations with varying footprint and seat position used on different slopes affect the user's cadence and velocity. Methods: Seven manual wheelchair users completed a set of propulsion trials on three different inclines (level, 3, and 6 degrees) within a Computer-Assisted Rehabilitation Environment (CAREN), using each of the four tested configurations: seat anterior/short footprint (AS), seat anterior/long footprint (AL), seat posterior/short footprint (PS), and seat posterior/long footprint (PL). Results: Cadence and velocity were not significantly affected by wheelchair configuration. However, a significant 13% decrease in cadence was found in the AL configuration between 3 and 6 degree inclines, while a 33% decrease in velocity was found in the PS configuration. Conclusion: The PS configuration is least stable, which may explain the significant decrease in velocity at higher inclines. The AL configuration is most stable, which could explain the decrease in cadence to maintain a reasonable velocity up the steeper slope.

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80	Abigail Snyder	Basic Life Science	Assessment of Human Stem Cell Retention and Host Cell Invation in an Implanted Seeded Tubular Scaffold	Abigail M. Snyder; Katherine L. Lorentz; Antonio D'Amore, PhD; Justin S. Weinbaum, PhD; William R. Wagner, PhD; David A. Vorp, PhD	Cardiovascular disease is the primary cause of death worldwide. Treatment often involves revascularization, which could benefit from the availability of a tissue engineered vascular graft (TEVG). The Vorp laboratory has developed a TEVG based on seeding mesenchymal stem cells (MSCs) into a biodegradable, biomimetic scaffold. After 8 weeks in vivo, the seeded scaffold remodels into a TEVG that lacks the initially seeded MSC but contains host vascular cells; the specific time frame for the MSCs leaving the graft is largely unknown. We hypothesized that the seeded MSCs depart the graft during the first 4 weeks post-implant coincident with host cell repopulation of the scaffold. MSC-seeded scaffolds were implanted into the abdominal aorta of Lewis rats. After 1 or 4 weeks in vivo, the grafts were explanted then examined using immunofluorescent chemistry. A qualitative decrease in human nuclear antigen (indicating seeded MSC) was observed from 1 to 4 weeks while calponin (indicating smooth muscle cells) increased. Alpha-smooth muscle actin (smooth muscle cells) and von Willebrand Factor (endothelial cells) were present at both time points. These results reveal host recellularization of the TEVG at the early time points of 1 and 4 weeks and the early
48	Oliver Snyder	New Research Tools and Techniques	Arbitrary Texture Simulation with One Degree of Freedom Normal to the Surface Using a Loudspeaker	Oliver Snyder; George Stetten, MD, PhD; Roberta Klatzky, PhD	To advance haptic research and technology and enhance consumer immersion, the authors are developing an affordable Texture Simulation Device (TSD) to simulate 2D texture of a surface, by actuating with a single degree of freedom (DOF) normal to the surface, in response to motion tangential to the surface. The TSD will potentially have uses in virtual reality applications such as textiles marketing, as well as in basic psychophysics research. With the goal of creating an affordable and reasonably high-quality simulation of surface textures, a 5" loudspeaker forms the primary 1-DOF actuator and a Raspberry Pi 3 (RPi) is used as the controller. Three sensors provide input to the simulation. To sense position, a choice between a computer trackpad and a linear soft potentiometer (LSP) is provided. The trackpad returns 2D position but communicates slowly, whereas the LSP returns only 1D position but allows for faster feedback. The third sensor is an optical distance sensor to provide the vertical displacement of the speaker cone. A 3D printed scaffold was created in SolidWorks and glued to the speaker cone to provide a sturdy platform for the position sensors. The device is functional, although texture quality has limitations that must still be
73	Nicholas Strauch	Translational Life Science	Improving Fabrication of Topographically Actuating Vascular Grafts	Nicholas Strauch; Ya Gao; Sachin Velankar, PhD	Small caliber synthetic vascular grafts fail rapidly due to platelet adhesion to the artificial graft surface. To combat this, a method has been developed utilizing topographic surface actuation to reduce platelet deposition onto the graft surface. With this method, cylindrical tubes whose lumen alternates between a wrinkled and a smooth state were created. These tubes consisted of a stiff inner film bonded to a soft outer tube. While a preliminary in-vivo porcine experiment demonstrated the effectiveness of this mechanism, the fabrication was difficult with poor reproducibility, and none of the materials used were medical grade. The goal of the work presented was to improve the manufacturing methods and materials to generate a more clinically relevant product. The desired graft would expand 10% between 80 and 120 mmHg and have wrinkles under 100 µm wavelength. Silastic® MDX4-4210 and DOW Corning® MG7-9900 silicones were chosen for their medical utility and mechanical properties. Improved procedures of dip coating and molding were developed. The resulting tubes were created using an MDX film and a 1:6 MDX/MG tube, producing a graft with wrinkles at 60 µm wavelength. Expansion was 11% between 80 and 130
12	Sarah Tolaymat	Physical Science and Engineering	Optimization of Storage Conditions and Evaluation of Stored Drag Reducing Polymer (DRP) Solutions for Use in Preclinical Animal Studies	Sarah Tolaymat; Daniel Crompton, BS; Marina V. Kameneva, PhD	Drag reducing polymers (DRPs) have been shown to have numerous positive effects in the vascular system in vivo. Animal studies demonstrated that intravenous or intraperitoneal nanomolar concentrations of DRPs increased survival from severe hemorrhagic shock, significantly improved cardiac and TBI caused brain ischemia, reduced inflammation, and decreased I/R injury and metastasis. One limitation of DRP progress toward pre-clinical trials is a lengthy preparation process and relatively quick degradation of molecules in solution. It was previously found that concentrated DRP solutions stored at 4.5°C are subject to degradation after 7-10 days. The effect of freezing DRP solutions on their drag reducing properties and the speed of their degradation was evaluated in turbulent flow. Polyethylene oxide powder (Sigma-Aldrich®), dissolved in saline and frozen at -80°C, was tested against control samples refrigerated at 4.5°C. DRP solutions were thawed at room temperature and then tested in a turbulent flow system. Pressure was recorded during constant flow before and after DRP injection and drag reduction was calculated as % of the pressure change. Compared with control, the drag reducing effect was only slightly lower (less than 5%) in the frozen DRP solution, indicating that freezing DRPs may be a viable long-term storage solution.
26	Junbo Wang	Physical Science and Engineering	The Equivalents between Reynolds Number and Rayleigh Number in Cylinder	Junbo Wang	In natural convection, the Nusselt number is correlated with Prandtl number and Rayleigh number. In forced convection, the Nusselt number can be expressed as a function of Prandtl number and Reynolds number. Lemlich and Hoke in 1956 utilized the concept of equivalent by finding Nusselt number distribution on natural convection over a haot cylinder is similar to the forced convection. Both Rayleigh number and Reynolds number are dimensionless quantities in fluid mechanics used to help predict flow patterns in different fluid flow situations. Acrivos illustrated the following equivalence between different dimensionless group that result the same local Nusselt number. By finding the equivalent between Rayleigh number and Reynolds number, it could be easier to predict the same Nusselt number between natural convection and forced convection. To achieve this goal, TACC Stampede was used to run to get simulations. Comparing the correlation for Ra vs Nu and Re vs Nu and find the equivalents between Re and Ra.

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42	Philip Williamson	Physical Science and Engineering	The Effect of Zeolite Additives on Ion Conductivity of Gel-polymer Electrolytes	Philip A. Williamson, Pavithra M. Shanthi, Ramalinga Kuruba, Prashanth J. Hanumantha, Prashant N. Kumta	Non-woven fiber mattes based on poly(vinylidene fluoride-co-hexafluoropropene) (PVDF-HFP) and polyacrylnitrile (PAN), both with and without ZSM-5 additives, were prepared by electrospinning at room temperature and pressure. Gel-polymer electrolytes (GPE) were prepared from these mattes by soaking in a solution composed of 1.8M lithium triflate (LiCF3SO3) and 0.1M lithium nitrate (LiNO3) in a 50:50 by volume dioxolane/dimethoxyethane (DOL/DME) solvent. The effects of zeolite additives on the fiber microstructure in the mattes as well as the conductivity of the prepared gel-polymers is evaluated. The morphology of the electrospun mattes was studied with scanning electron microscopy. ZSM-5 particles were found to mix poorly with PVdF-HFP, as distinct particles were present in the microstructure, while PAN and a composite 50:50 PVdF-HFP/PAN mixture mixed well with the zeolite, incorporated the particles into their fibers. Conductivity values were derived using electrochemical impedance data produced by applying an AC voltage of 10mVRMS to a Li/GPE/Li coin cell with a frequency ranging from 100kHz to 10mHz. ZSM-5 was found to have a negligible effect at room temperature on the conductivity of the gel-polymer electrolytes prepared from the electrospun polymer mattes.
57	Marissa Wolfe	Physical Science and Engineering	The Effect of Process Parameters on the Tensile Strength of 3D Printed ABS and PLA	Marissa Wolfe	3D printing offers the flexibility to change the design, material, and process parameters for specific 3D printed samples. However, adjusting these settings can change the mechanical properties of the piece being printed. This research analyzed the effect of print angle, layer thickness, nozzle diameter, and infill percentage on the tensile strength of 3D printed ABS and PLA thermoplastic samples. Despite the inherent differences in material properties and functions of ABS and PLA, it was interesting to observe that they both followed similar trends in response to changing process parameters. From this set of experiments, it was clear that for specific parameters PLA always had higher ultimate tensile strength (UTS) and Youngs modulus than ABS. Despite this difference in strength, they both shared similar trends. Both increased UTS as nozzle diameter increased. They also both increased strength as infill percentage increased. Based on the data, for the samples printed at a 45 degree print angle, the ultimate tensile strength increased with increase in layer thickness. However, the affect of layer thickeness was inconclusive among the samples printed at a 0/90 degree print angle.
71	Sarah Wolfe	Physical Science and Engineering	Perovskite/TIO2 Interface Effects on Memory Properties	Sarah Wolfe	This summer, I explored how the thickness of the two different layers in a bi-layer ReRAM (Resistive Random Access Memory) device effect the electrical properties of the device. The device structure used was: Glass substrate coated with FTO, TiO2 layer, Perovskite layer, and Au top electrodes. For this experiment several different conditions were tested: two different MAPbI3 thicknesses, 200 and 400 nm, and three different TiO2 thicknesses, 0 nm, 6nm, and 12 nm. Three different tests were performed: I-V sweep, retention, and endurance tests. The I-V test was the main focus of my analysis because I observed how the addition of TiO2 changed the set/reset voltage, on/off current ratio, and general appearance of the I-V curve. I found that the addition of TiO2 makes the bias that activates the hystaris loop change, from positive to negative. Secondly the thicknesses of both layers effects the on/off current ratio. A thicker TiO2 layer gives a larger ratio but a thicker MAPbI3 layer yields a smaller ratio. Thirdly neither layer's thickness had an effect on the set/rest voltage, it was consistently around -1.5 V. From this summer's research the ideal dimensions for a MAPbI3/TiO2 bi-layer ReRAM devices is: MAPbI3-200 nm and TiO2-12 nm.
74	Shumeng Yang	Translational Life Science	The Effects of an Osteoarthritis Unloader Brace on Knee Joint Space during Gait	Shumeng Yang; Kanto Nagai, MD, PhD; William Anderst, PhD	Introduction: Osteoarthritis (OA) is one of the most common joint conditions in the US. OA unloader braces are intended to reduce pain by unloading the medial compartment of the knee. The purpose was to quantitatively evaluate the effects of a DonJoy unloader brace on joint space during walking. It was hypothesized that medial compartment joint space would increase and ground reaction force (GRF) decrease with the brace. Methods: 10 OA patients were tested by walking on a treadmill for three trials with, and three trials without the brace. CT scans of the femur and tibia were reconstructed into 3D models. Tibiofemoral motion was determined using a validated model-based tracking process from X-ray biplane radiographs. Data: The medial tibial plateau was divided into 9 regions, and the region with smallest joint space was selected for analysis. Joint space and GRF were measured over the first 40% of the gait cycle, and the differences were evaluated using two-way repeated-measures ANOVA. Results/Conclusion: Brace use increased joint space by an average of 0.27 mm (p=0.004), while there was no significant difference in GRF (mean 1.9% body weight, p=0.15). This suggests the brace reduces medial compartment loading in OA-damaged areas of the joint.

Poster location	Suffix	Topic	Title	Author(s)	Abstract
7	Kangning Yao	Basic Life Science	SCF FBXL19 Ubiquitin E3 Ligase Mediates Cdc42 Degradation	Kangning Yao, Jianxin Wei, Su Dong, Rachel M Bower, Anastasia M Jacko, Yutong Zhao, Jing Zhao	Cdc42 is a small GTPase within the Rho family, which regulates cellular functions including cell morphology, endocytosis, and cell cycle. However, the molecular regulation of Cdc42 stability remains unclear. To study Cdc42 protein stability, we treated mouse lung epithelial cells (MLE12) with a protein synthesis inhibitor CHX and examined levels of Cdc42 using Western blotting analysis. It turned out that Cdc42 is an unstable protein with a half-life of around 4 h. To investigate which pathway mediates Cdc42 degradation, MLE12 cells were incubated with either proteasome inhibitor (MG132) or lysosome inhibitor (Leupeptin) in the presence of CHX. Our study showed that MG132, not Leupeptin, dramatically prolonged the half-life of Cdc42, indicating that Cdc42 is degraded in the proteasome. Further, we found that overexpression of a ubiquitin E3 ligase subunit, FBXL19, reduced Cdc42 protein levels, without altering its transcript. However, unexpectedly, the ubiquitination of Cdc42 was reduced in the FBXL19-overexpressed cells, while it was increased in FBXL19-downregulating cells. It is possible that FBXL19 targets an unknown E3 ligase, which induces Cdc42 ubiquitination and degradation. Our future studies will focus on the molecular mechanisms by which FBXL19 regulates Cdc42 stability and the effects of FBXL19 on the Cdc42-mediated cellular functions.
21	Kira Zack	Basic Life Science	Isolating and Characterizing Seven Bacteriophages on Bacterial Host Microbacterium Foliorum	Haley Aull; Alyssa Betsko; Emily Kukan; Kira Zack; Deborah Jacobs-Sera; Graham Hatfull, PhD	Our research focuses on the discovery of bacteriophages, which are viruses that infect bacteria. They are highly mosaic in nature, meaning that they can easily participate in horizontal gene transfer. It is known that phages are abundant in soil, so by processing environmental samples and selecting for phages that infect a specific bacterial host, we isolated interesting and diverse phages. We focused on the isolation and characterization of phages that infect the host Microbacterium foliorum, a member of the Actinobacteria phylum. Phages Espinosa, Kale, Ludgate, Peep, Aubergine, Casey, and Pajaza were all isolated in Pittsburgh, PA. The phages were characterized using restriction enzyme digests, electron microscopy, and DNA sequencing. Preliminary genome annotation and nucleotide similarity identifies Espinosa, Kale, Ludgate, Peep, and Aubergine to be members of Subcluster EA1. At the nucleotide level, they share 96% to 98% identity across their genomes. Phages Casey and Pajaza were found to be part of Subcluster EA3 and at the nucleotide sequence they share 99% identity across their genomes. We will continue to search for phages that infect Microbacterium foliorum and other bacterial hosts. Through this characterization, we hope to better understand diversity of these phages and their functions.
62	Eric Zhang	New Research Tools and Techniques	Collagen Fiber Orientation Mapping with Fourier Ptychography Polarized Light Microscopy	Eric Zhang; Bin Yang, PhD; Ian A. Sigal, PhD	Detailed and accurate collagen fiber microstructure information is critical for understanding eye biomechanics, physiology, and pathology. Rich structural information of the optic nerve head (ONH), in the back of the eye, can be obtained using polarized light microscopy (PLM). However, PLM, like other conventional microscopy techniques, suffers from the tradeoffs between field of view (FOV) and resolution. Typically, the way around this tradeoff is to stitch multiple high resolution images into one with large FOV. However, this renders image acquisition and post-processing time consuming and prone to artifacts. Recently, Fourier ptychographic (FP) imaging was developed to bypass tradeoffs by utilizing phase retrieval and aperture synthesis techniques. With FP, high resolution and large FOV may be achieved without mosaicking. We prototyped an FP-PLM imaging system to obtain simultaneous high resolution and large FOV images of ONH collagen fiber orientation.
78	Thomas Zhang	New Research Tools and Techniques	A Novel Method and ImageJ Plugin for Signal Isolation in Image Analysis	Thomas D. Zhang; Thomas P. Matson; Lingqing Xu, PhD; Williams Saunders	The analysis of colocalization between two antigens of interest is an important part of visual analysis of protein distribution. However, visual analysis alone is insufficient. Quantitative colocalization analysis utilizes algorithms to determine the degree of association between the proteins of interest by analyzing isolated fluorescence signals. However, when the protein of interest is highly abundant and distributed throughout the cell, existing colocalization software are unable to accurately eliminate the background and isolate the signal, leading to inaccurate interpretations of colocalization of the proteins. In this study, we explored methods to isolate the fluorescence signal from immunofluorescence images of highly distributed proteins. We used ImageJ to generate a binary image representative of the protein distribution in the original image. We then created a plugin using the binary image to efficiently eliminate the background and isolated the fluorescence signal while preserving the nuanced intensities of the image. The resultant images could then be used in existing colocalization software. We demonstrated this method by analyzing images of actin, a highly-distributed protein, in HeLa cells with and without focal adhesion disruptions. This novel method for background elimination and signal isolation can allow for more accurate analysis of colocalization in the cell.

Poster location	Suffix	Topic	Title	Author(s)	Abstract
29	Jimmy Zhang	Translational Life Science	The Physiological Role of Mitochondrial Amidoxime Reducing Component 2	Jimmy Zhang; Bin Sun, MD; Mark T. Gladwin, MD; Courtney Sparacino-Watkins, PhD	Mitochondrial amidoxime reducing component 2 (mARC-2) is a novel molybdenum-containing enzyme found in most eukaryotic organisms, including humans. While the exact function of mARC-2 is not clear, studies have suggested a role in lipid homeostasis in the liver. We previously established that moderately aged male mice have decreased body weight, fat mass, fasting glucose, and insulin levels when feed a normal chow (NC). Therefore, we are now testing the effects of mARC-2 deletion on body composition, glucose, and insulin levels in male mice fed a high fat diet (containing 60% kcal energy from fat), using mARC-2 knock out (KO) mice and the well-established high fat diet (HFD) mouse model of diet-induce obesity. We found that all mice feed the HFD, regardless of mARC-2 genotype (wildtype, heterozygous, or KO), show a higher body weight than genetically identical littermates feed a NC. However, mARC-2 KO mice feed a NC have lower body weights than both wildtype and heterozygous littermates. Similarly, mARC-2 KO mice feed a HFD have a lower body weight than wildtype and heterozygous littermates on HFD. Our data support a role of mARC-2 in lipid metabolism and could have important implications in obesity, diabetes, or fatty liver diseases.
87	Daniel Zheng	Physical Science and Engineering	Trigger Rate Monitoring for the Atlas Experiment at CERN	Daniel Zheng	ATLAS is one of two general-purpose detectors at the Large Hadron Collider (LHC). It investigates a wide range of physics processes, probing previously unreachable phenomena such as the Higgs boson, the heavy strong sector, and possible new physics such as supersymmetry. To digest the enormous readout of data from the detector, ATLAS uses an advanced “trigger” system to tell the detector which events to record and which to ignore. “Xmon” is a trigger rate monitoring tool that predicts trigger rates through a pileup regression. By comparing predicted rates with actual rates, ATLAS trigger shifters can more accurately spot errors in the data-taking process. Xmon runs in the ATLAS Control Room and ensures the optimal function of the detector.