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Sorted by Poster Number				
Name	Poster Number	Poster Abstract	Poster Title	Authors
Naomi Anderson	1	<p>For decades, the artificial glaciers in Ladakh, North India, have been trumpeted as useful water-harvesting devices for subsistence farming communities. In this context, the massive masonry structures link low-tech, vernacular hydrological thinking with design innovation to create a popular climate-adaptive design solution. While these interventions appear to provide promising new strategies for year-round water harvesting in this dry desert region, very little data exists to substantiate, quantify, or contradict the project claims. This paper interrogates these structures through the lens of the design disciplines and considers the functional aspects of a prototypical artificial glacier system. Six different artificial glacier systems were studied over a period of two summer months, revealing a variety of design and construction approaches found in the field. These findings give rise to a number of design and engineering patterns that may be found in an archetypical artificial glacier system.</p> <p>Keywords: artificial glaciers, Ladakh, climate-adaptive design, infrastructure design</p>	Considering Artificial Glaciers: Climate-Adaptive Design for Water Scarcity	Naomi Anderson, Taylor Shipping, Carey Clouse
Glen Ayes	2	<p>The Laser Engineered Net Shaping (LENS®) method of additive manufacturing with Inconel 625 and Inconel 718 powders deposited onto low carbon steel substrates was employed. Utilizing the Taguchi method, 9 experiments of each powder were deposited based on an L9 orthogonal array with processing parameters laser power, laser speed, and powder feed rate studied, each at 3 levels. Unevenness, wall height, and middle height of the samples were measured and implementation of grey relational grade analysis and ANOVA identified the</p>	Optimization of Processing Parameters of Additively Manufactured Inconel 625 and Inconel 718	Glen Ayes, Zhenyu Liu, Guofeng Wang, and Brian Gleeson

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		<p>optimum level and contribution of each parameter on deposit geometry. Results revealed optimum levels for Inconel 625 and Inconel 718 as: laser power (300 W), laser speed (35 in/min or ~14.8 mm/s), and powder feed rate (15 rpm or ~0.225 g/s), and laser power (330 W), laser speed (35 in/min or ~14.8 mm/s), and powder feed rate (12 rpm or ~0.18 g/s), respectively. Powder feed rate was shown to have the greatest effect on deposit geometry for 625, and laser speed for 718, with contributions of 49.6% and 44.0%, respectively. Also, energy area density (EAD (J/mm<sup>2</sup>)) and energy mass density (EMD (J/g)) were calculated and EAD v EMD was graphed in order to predict failure or relative evenness.</p>		
<p>Julianna Bachinsky</p>	<p>3</p>	<p>Background: The impact of bacteria on corneal epithelial cell biology isn't well studied. <i>Serratia marcescens</i> is a leading cause of bacterial keratitis and clinical isolates are highly cytotoxic to human corneal epithelial cells. We observed that <i>S. marcescens</i> induced epithelial bleb formation in human corneal limbal epithelial cells (HCLE) and human keratinocytes in vitro. This study was designed to identify bacterial genes required for bleb formation. Methods: A mariner transposon library of keratitis isolate K904 was screened for mutations that inactivated the bacterial bleb induction in HCLE cells. Results: ~7,000 mutants have been screened by microscopic inspection of HCLE cells exposed to bacterial mutants. Of the 7,000 mutants tested, 5 were consistently defective in inducing bleb formation. Two of the Bleb- isolates had transposons that map to different loci in an uncharacterized gene in <i>S. marcescens</i> corresponding to SMDB11_3859 in sequenced strain DB11. A deletion mutation of the SMDB11_3859 gene was generated and the resulting mutant was defective in bleb formation. Complementation of the <math>\Delta</math>SMDB11_3859</p>	<p>Beauty and the Bleb: Isolation of Bacterial Genes Required To Induce Epithelial Cell Bleb Formation</p>	<p>Julianna M. Bachinsky; Kimberly M. Brothers, PhD; Nicholas A. Stella; Robert M.Q. Shanks, PhD</p>

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		open reading frame mutant confirmed the role of this gene in bleb induction. Conclusions: The SMDB11_3859 gene is required for inducing epithelial cell blebs. This screen will identify bacterial factors involved in this host-pathogen interaction.		
Laura Bechard	4	High ankle sprains, or ankle syndesmosis injuries, account for 10% of all ankle sprains. The recovery time for an ankle syndesmosis injury can take 6 weeks or more. Sports medicine specialists are currently investigating ways to improve rehabilitation of athletes with ankle syndesmosis injuries. Unfortunately, there is currently very little information regarding the complex joint formed by the tibia, fibula, and talus. The MJT FRS 2010 robotic testing system can dynamically manipulate a cadaveric specimen to test joint biomechanics in vitro. However, the current system is incapable of testing a lower leg specimen. A customized fixture was designed to fasten a full lower leg specimen to the robotic testing system. A mechanical digitizer measured the position of landmarks on the fixture and the specimen at neutral position, 10 Nm dorsiflexion, 0° plantarflexion with 10 Nm external rotation (ER), 10° dorsiflexion with 10 Nm ER, and 30° plantarflexion with 10 Nm ER. The three-dimensional distance between landmarks of the fixture and the specimen and two points on the tibia remained less than 0.5 mm for all trials, meeting design criteria. The fixture allows future tests of the ankle syndesmosis to be conducted.	Design of Customized Lower Leg Specimen Fixtures for 6 DOF Robotic Testing System	Laura E. Bechard; Kevin M. Bell, PhD; MaCalus V. Hogan, MD; Richard E. Debski, PhD
Shannon Biery	5	Alloy 625 (also Inconel 625) is a Nickel-based superalloy used in high temperature, strength applications. In this study, we investigated the oxidation behavior, at a temperature 700 °C, of additive manufactured Alloy 625 with two different porosities. The sample coupons were manufactured by powder bed binder jet printing (PB-BJP),	Oxidation of Nickel-Based Superalloy 625 Prepared by Additive Manufacturing in Exone M-Flex 3D Printer	Shannon Biery; Amir Mostafaei; Erica Stevens; Markus Chmielus, PhD

		<p>during which powder was deposited layer-by-layer and selectively joined with binder. The samples were then cured to remove excess binder. By sintering under vacuum atmosphere with two different holding temperatures, 1220 °C and 1260 °C, the samples were densified attaining a porous and non-porous state, respectively. The oxidation experiment was performed at 700 °C in an air atmosphere. The samples were examined before and after oxidation by optical microscopy and scanning electron microscopy equipped with energy dispersive spectroscopy. Complex oxide scales composed of Cr<sub>2</sub>O<sub>3</sub>, NiCr<sub>2</sub>O<sub>4</sub> and NiO formed on the surface of the oxidized porous samples; however, formation of an oxide layer on the outer surface of the non-porous samples was delayed. In fact, the rough surface and micropores of the porous samples provided fast diffusion paths for oxygen, accelerating the formation of the oxide layers. Therefore, non-porous samples sintered at higher temperatures to provide a higher resistance to high temperature oxidation.</p>		
<p>Miranda Boca</p>	<p>6</p>	<p>Piezoelectric materials produce an electric charge when mechanically deformed and can be deformed by an electric charge. This dual property can be used to harvest power from movement and provide a shock sensor; uses that range from recharging pacemakers with a heartbeat to firing an airbag during collisions. Piezoelectric materials have mostly been inorganic in the past, but this project looks to investigate organic monomers. Calculating the coefficient was tedious; automating that process opens up the ability to find trends and monomers that give high piezoelectric responses. I created the accelerated piezoelectric evaluator (APE) which is a program that uses the coordinates from a dimer system to return piezoelectric coefficients. This process takes a fraction of</p>	<p>Accelerated Piezoelectric Evaluation (APE)</p>	<p>Miranda Boca, Keith A. Werling, Daniel S. Lambrecht</p>

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		<p>the time it took previously and is repeatable. APE finds two monomers from the set of coordinates and then distances them from one another along a hydrogen bond between them. It then uses the Q-Chem program package to calculate potential energy curves. The piezoelectric coefficient along the hydrogen bond axis is calculated via the second derivative and dipole moment. Preliminary results are consistent with previously calculated values. APE can be interfaced with other approaches such as genetic algorithms for new material discovery.</p>		
Danielle Broderick	8	<p>Over the course of four years, the University of Pittsburgh’s Human Engineering and Design club (in culmination with senior design projects across multiple engineering disciplines) have constructed a water pipe system totaling around approximately 3,000 meters of pipe, with 80,000 gallons of storage, delivering clean water to roughly 4,000 underprivileged Panamanian villagers in the Cerro Patacón area. The local government and water supply company (IDAAN) in Panama City have recognized the work of Pitt’s students and wanted to assist in further projects. Prior to donating funds and other recourses, IDAAN requested up-to-date as built designs and inventories. This summer, a trip to Panama City was planned in order to be familiarized with the extensive water system built in Cerro Patacón and create the desired final deliverables. All materials were presented to representatives from IDAAN and local citizens. Topographic data of a nearby village, Mocambo, was also collected and brought back to the University of Pittsburgh to analyze feasibility of extending the water system to this location. Overall, this project has helped maintain the University’s relationship with the local Panamanian government and create the groundwork for future senior design projects.</p>	<p>Cerro Patacón Water System and Mocambo Feasibility Analysis</p>	<p>Danielle Broderick</p>

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<p>Zachary Campbell</p>	<p>9</p>	<p>Ionic liquids have intrinsic molecular properties such as negligible vapor pressure, high thermal stability, high ionic conductivity and the ability to solvate compounds of widely varying polarity which cause favorable interactions with CO<sub>2</sub>, indicating that they may be good candidates for carbon capture. Interactions between specific ionic liquid pairs and CO<sub>2</sub> were analyzed at different levels of theory to discern the level of theoretical calculation required to be comparable to experimental results. This analysis includes energy decomposition analysis and vibrational spectra calculations. The energy decomposition analysis provides data such as charge transfer between CO<sub>2</sub> and the cations and anions within the ionic liquid, intramolecular polarization, electrostatic and Pauli repulsion, and geometric distortion. We show that the asymmetric stretch mode of CO<sub>2</sub> provides a sensitive probe of the solvation environment, which can be probed via infrared spectroscopy combined with computation. Moreover, ultrafast 2D IR spectroscopy combined with molecular dynamics simulations probes CO<sub>2</sub> solvation dynamics.</p>	<p>Unraveling the Molecular Mechanism of CO<sub>2</sub> Solvation in Ionic Liquids with Computation and Experiment Combined</p>	<p>Zachary M. Campbell; Eric J. Berquist; Thomas Brinzer; Krista K. Bullard; Sean Garrett-Roe, PhD; Daniel S. Lambrecht, PhD</p>
<p>Sarah Casne</p>	<p>10</p>	<p>Nanoparticles (NPs) are becoming fundamental in consumer products and industrial processes. However, there are no current standards of toxicity testing for these NPs, making their long term effects unknown. Since NPs have many advantages, further experimentation investigating their toxicity is preferred instead of simply discontinuing their use. Robust, low-cost, and sustainable testing methods are vital in this investigation. This research aims to correlate toxicity to surface chemistry with experiments involving amorphous and crystalline silica (SiO<sub>2</sub>) as well as correlate toxicity to NP structure with experiments involving nickel and SiO<sub>2</sub> nanomaterials. 3T3 fibroblasts are used as a toxicity</p>	<p>The Ugly Side of Nano: Toward Understanding Nanoparticle Toxicity</p>	<p>Sarah Casne, Julie Hartz, Sharlee Mahoney, Thomas Richardson, Ipsita Banerjee, PhD, Goetz Vesper, PhD</p>

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		model for these experiments.		
Tamara Cherwin	11	<p>The wing patterns on butterflies represent one of the best opportunities for understanding the mechanisms by which developmental pathways diverge and generate phenotypic variation. In the butterfly <i>Heliconius erato</i>, red color pattern variation is driven by differential expression of the transcription factor <i>optix</i>. Recent genomic analysis shows a 65 kB region about 150kb downstream of <i>optix</i> that is highly differentiated between major red wing pattern types and is thought to contain important cis-regulatory elements. Unfortunately, high levels of divergence from the <i>H. erato</i> reference genome limits inferences from whole genome sequencing approaches. We developed a long-range PCR strategy to finely describe this region and identify specific alleles associated with red color pattern. We successfully amplified 8-10 kB regions in nine out of the ten races and species that were targeted. Preliminary analysis of a subset of these amplicons revealed over 500 fixed SNPs clustered in discrete regions, providing us with promising targets for binding site analysis. Our results demonstrate that long-range PCR coupled with Nextgen sequencing will be a valuable tool for rapidly acquiring the high-resolution necessary for binding site identification.</p>	Searching for Cis-Regulatory Elements Associated with Red Pattern Phenotypes in <i>Heliconius Erato</i>	Tamara Cherwin; Marta Vargas, MS; Carlos F. Arias, PhD; W. Owen McMillan, PhD
Eric Chou	12	<p>In the nursing home (NH) setting, circumstances may arise to put a patient at higher risk for falls. These include medication safety issues, inefficient transitions of care, the patient's history of health problems, and more. The complex care needs of older patients, combined with the accumulation of conditions, means that the NH population is particularly vulnerable to harm from errors in care. Using data derived from 20 semi-structured interviews on NH clinicians' perceptions of medical safety, and retrospective observational data from 5 NH's, this</p>	Toward an Informatics Intervention to Address Medication Safety "Weak Spots" in the Nursing Home	Eric Chou, Richard D. Boyce

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		<p>mixed methods study is investigating vulnerabilities in the NH clinical workflow (“weak spots”). The processes and actors involved with 15 weak spots were graphically modeled using Unified Modeling Language. These were reduced to 6 distinct types amenable to a records-based intervention in the NH setting. Weak spots were chosen to be operationalized based on availability of data, practicality of intervention, and novelty of the error. The weak spots address sudden stoppage of medication, unintentional weight loss, patient history of vertigo, patients taking diuretics while struggling with mobility, prolonged exposure to psychotropics, and co-exposure to antibiotics and anticoagulants. We are now analyzing factors related to these 6 weak spots to inform the design of an clinical intervention.</p>		
Gabrielle Ciotti	13	<p>La-related Protein 1 (LARP1) is an RNA-binding protein that regulates mRNA transcript stability. LARP1 is significantly overexpressed in ovarian, lung and breast cancers, where it stabilizes oncogenic transcripts and is associated with metastasis. Although its molecular mechanisms are still unclear, LARP1 is thought to indirectly regulate mRNA translation by binding to poly-A binding protein (PABP), a key regulator of mRNA translation. Most proteins that bind to PABP do so through a conserved sequence of amino acids known as a PABP-interacting motif (PAM). We hypothesized that a sequence in LARP1 that resembles a PAM mediates the binding between LARP1 and PABP and that mutation of this motif will reduce or eliminate their association. To test this hypothesis, we conducted in vitro GST-pulldown experiments using GST-PABP fusion proteins as bait. For prey, we designed LARP1 constructs comprised of two conserved domains of LARP1 with mutations in the putative PAM. Pull-downs conducted with LARP1 point</p>	<p>Characterizing Interactions Between La-Related Protein 1 and Poly(A) Binding Protein</p>	<p>Gabrielle Ciotti, Roni M. Lahr, Hiba Al-Ashtal, Andrea J. Berman, PhD</p>



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		mutants and PABP demonstrate that this predicted PAM-like sequence within LARP1 acts like a traditional PAM for facilitating the LARP1-PABP interaction. Characterizing the nature of the LARP1-PABP complex suggests a model for how LARP1 associates with transcripts to regulate their stability and translation.		
Charles Hansen	16	The steadily rising global population concomitantly increases the demand for bulk industrial chemicals, such as ammonia and methanol, as well as for clean energy. Hydrogen is one of the primary feedstocks for a majority of the bulk chemical production and energy applications. It is currently produced from natural gas (>95% methane) via methane steam reforming. Separating hydrogen from the product mixture requires expensive and energy consuming downstream processes. Alternatively, decomposition of methane to produce hydrogen and solid carbon avoids the production of carbon dioxide and addresses the issue of gas separations while utilizing cheaply available natural gas. A nickel catalyst, active for the thermocatalytic decomposition of methane, was synthesized by a sol-gel process to yield nickel nanoparticles (<10nm) dispersed inside the hollow core of a 35-50nm diameter silica shell. The catalyst was characterized by X-ray powder diffraction and transmission electron microscopy. An emerging technique referred to as chemical looping – periodic reactor operation between methane decomposition and oxidative catalyst regeneration – was employed to increase the catalytic lifetime. Overall, the catalyst displayed exceptional stability for hydrogen production in a chemical looping environment with a promising yield for utilization in industrial applications while fundamentally minimizing the carbon footprint of hydrogen production.	Clean and Efficient Production of Hydrogen Via Chemical Looping	Charles J. Hansen; Amey S. More; Götz Vesper, PhD
Joshua	17	The issue of water scarcity is a growing concern across the	Graphene-Based Electrodes	Joshua Hammaker;

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Hammaker		<p>world. Conventional wastewater treatment plants are proving to be incapable of treating many types of synthetic wastewater, specifically persistent organic pollutants (POPs) that are polluting the water supply and contributing to further scarcity. Incorporating electrochemical advanced oxidation processes (EAOPs) has shown promise in treating POPs in wastewater. This work looks to incorporate the most promising EAOP, namely electro-Fenton, into wastewater treatment. The optimization of the electrolysis reaction was explored through the improvement of electrode materials since they control the oxidant generation such as H<sub>2</sub>O<sub>2</sub> at the cathode. Monolayer graphene cathode material was first tested for H<sub>2</sub>O<sub>2</sub> production and returned very low values, close to zero. This was attributed to the very low specific surface area of the monolayer graphene. Since carbon brushes have proved to be very efficient to promote H<sub>2</sub>O<sub>2</sub> electrogeneration, it was then proposed to coat these brushes with graphene and a binder (Nafion®) in order to increase their effectiveness. Though getting consistent results was quite a challenge due to the low stability of the graphene coat, the optimized parameters were determined as follows: 0.05% of Nafion® mixed with 2 mg/mL of graphene.</p>	<p>in Electro-Fenton Process for Treatment of Synthetic Industrial Wastewaters</p>	<p>Emmanuel Mousset, PhD; Olivier Lefebvre, PhD</p>
Chelsea Guan	19	<p>Eukaryotic DNA is organized into chromatin. The basic unit of chromatin is the nucleosome, which consists of two copies of histones H2A, H2B, H3, H4, and 147 base pairs of DNA. Nucleosomes pose a barrier to DNA-templated processes, but cells can overcome this barrier by post-translationally modifying histones. A key platform that controls- these modifications is an acidic patch between H2A and H2B that serves as an "interaction hub" for chromatin-binding proteins. We previously found that the acidic patch regulates histone modifications, such as</p>	<p>Exploring Roles for the Nucleosome Acidic Patch in Eukaryotic Gene Expression</p>	<p>Chelsea M. Guan; Christine E. Cucinotta; Karen M. Arndt, PhD</p>

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		<p>the mono-ubiquitylation of lysine 123 on H2B (H2Bub). H2Bub associates with active transcription, and, when defective, results in cancer. Here, we focus on elucidating the functions of the acidic patch by integrating histone H2A mutants into the yeast genome and exploring the mechanism behind H2Bub. To test if H2Bub modification machinery binds directly to the acidic patch, we exploited a known interaction between the acidic patch and the BAH domain of Sir3. We hypothesized that overexpressing the BAH domain would reduce H2Bub levels. However, we did not observe reduced H2Bub levels, as the BAH domain alone was not nuclear-localized. These experiments will shed light on regulatory mechanisms for chromatin transactions, which are critical to all eukaryotes.</p>		
Garrett Grube	20	<p>Glaucoma is the second leading cause of irreversible blindness worldwide. It is a degenerative disease caused by gradual neural tissue deterioration at the optic nerve head. Increased intraocular pressure (IOP) has been identified as the main risk factor for glaucoma [1]. However, the link between IOP and glaucoma development is not fully understood, because the effects of IOP vary from person to person and eye to eye. Although several elements contribute to the eye's mechanical response to IOP, such as elastin, proteoglycans and collagen, it is collagen that determines the response at high loads [2]. Thus, to understand how an eye is affected by IOP, it is necessary to understand collagen mechanics. Collagen is often organized in the form of crimp—wavy, bands of fibers. The mechanics of collagen crimp is determined by the architecture and particular orientation of its constitutive fibers. Developing Software to Parameterize Collagen Crimp Fibers explores the ability to measure such properties as to enable better</p>	<p>Developing Software To Parameterize Collagen Crimp Fibers</p>	<p>Garrett D. Grube, Ning-Jiun Jan, Ian A. Sigal</p>

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		prediction of crimp mechanics, and thus an eye’s reaction to IOP. Ultimately, using this understanding of crimp mechanics, the biomechanical effects of IOP on the eye can be better understood—shedding light on how to prevent glaucomatous vision loss.		
Garrett Green	21	The primary objective of this research is to test a biosensor capable of detecting estradiol in a cell-free system; the biosensor will report the presence of the target analyte through selective transcription of a reporter protein—eGFP. The estradiol sensitive system is based on an estradiol-responsive T7 polymerase (ERT7) that should have a higher transcriptional activity in the presence of the small molecule estradiol. This research also addresses one major problem with previously reported cell-free extract systems—leaky expression of reporter proteins that can yield a false-positive result. T3 and T7 polymerase decoy oligonucleotides were designed that mimic T3 and T7 RNA polymerase (RNAP) promoter regions. The RNAPs bind to the decoys which limits the amount of transcribed reporter protein, potentially reducing noise. Pardee et al. found that cell-free expression systems can be freeze dried onto paper and stored for extended periods of time while maintaining their activity. By combining Pardee’s advancement with the estradiol-sensitive mechanism, this project aims to create unique low-cost rapid-testing paper diagnostic strips.	Testing of Biosensor Paper Diagnostic Strips	Garrett Green; Konstantin Borisov; Robert Donahoe; Alexander Szul; Apurva Patil
Madison Goss	22	The T-box family is an evolutionarily conserved family of transcription factors with members sharing a similar DNA binding domain – the T-domain. In vitro, therefore, these factors can bind similar sequences. The Chapman lab is interested in understanding how related transcription factors function when they are expressed in the same cells during development. In addition to having unique	T and TBX6 Misexpression Impacts Normal Mouse Development	Deborah Chapman, PhD; Madison Goss

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		<p>areas of expression, T and Tbx6 are co-expressed in the primitive streak during mouse embryogenesis. Loss-of-function studies revealed that T is required for maintenance of the primitive streak, the source of mesoderm, while Tbx6 is required for the formation of somites, the precursor tissue of the ribs, vertebrae, skeletal muscle and dermis. Using a gain-of-function approach we are examining how changing the levels and locations of T and Tbx6 in the embryo alters normal development. We are using whole mount in situ hybridization to first verify that we are achieving misexpression and second to examine marker gene expression to characterize how misexpression of T/Tbx6 impacts normal development. Our previous studies revealed a competition between co-expressed T-box factors Tbx6 and Tbx15/18. Ultimately, we hope to test how changing the relative levels of T and Tbx6 in the primitive streak affects mesoderm formation.</p>		
Ernestina Gambrah	24	<p>A blastN comparison reveals non-palindromic highly conserved start associated 13bp sequences (called SASs for short) in each of the Cluster K phages that infect Mycobacterium smegmatis mc2155. These 13bp repeats - 5'-GGGATAGGAGCCC -are located just before the predicted translation start codon of non-structural genes and contain 5'AGGAG 3', an essential part of the Shine-Delgarno sequence, a ribosomal binding site (RBS). It has been hypothesized that these regions play a role in translational regulation. This project seeks to identify the function of SASs in Adephagia by inserting the SAS and flanking base pairs into an mCherry reporter vector that contains no signaling sequences for transcriptional or translational regulation. Pink fluorescence was observed when this vector and the SAS for gene 38 were transformed into neb5a cells, indicating that our</p>	<p>Exploring the Function of Start-Associated Sequences in Cluster K Phage Adephagia</p>	<p>Ernestina F. Gambrah; Rebecca Brown; Ching-Chung Ko; Deborah Sera-Jacobs; Graham F. Hatfull, PhD</p>

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		sequence contains the promoter- like sequence and that the system is compatible in E. coli. The next step is to put the construct into M. smegmatis mc2155 cells to observe baseline fluorescence. Once established, the sequence can be modified to pinpoint the exact length of the RBS in the SAS.		
Hannah Fernau	25	Static fatigue is a property of materials to fail after a period a time when subjected to a load less than that required to break them instantaneously. This property can help predict such things as the lifetime of a structure or the initiation of a hydraulic fracture. Currently, it is only possible to test static fatigue by leaving samples under static load for long periods of time, which can last from hours to decades. Therefore, it is difficult to test a large number of samples. We propose that the static fatigue law for constant load tests can be extended to load-ramp tests, dramatically reducing the duration of experiments, but also increasing the complexity of interpreting the results. Experiments involved comparative testing of two types of granite in 3-point bending under constant load and linearly increasing load until the samples failed. The results from the two types of tests were then compared using a proposed theory linking the two testing methods. Preliminary results show that the parameters characterizing the theoretically predicted relationship between loading rate and the load at failure can be used to predict the rate of decrease in the life of the structure.	Effect of Loading Rate on Breakage of Granite	Hannah Fernau; Andrew Bunger, PhD
Cyrus Eason	26	The shear punch test is a powerful miniature testing method for measuring the plastic flow-related mechanical properties of small-scale samples. These properties can be measured through the linear relationship that has been shown to exist between shear strength data, obtained with this testing method, and uniaxial tensile strength. This work seeks to measure the accuracy and	Miniaturized Shear Punch Testing of Plastic Flow Behavior of Metal and Alloy Thin Foil Specimens	Cyrus Eason

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		reproducibility of results obtained with a low-cost shear punch fixture, and to confidently use said fixture for testing and comparing properties of unique nanocrystalline materials created through linear plane-strain machining against their unmodified material properties to characterize the effects of this machining process on these properties.		
Robert Donahoe	27	The primary objective of this research is to test a biosensor capable of detecting estradiol in a cell-free system; the biosensor will report the presence of the target analyte through selective transcription of a reporter protein—eGFP. The estradiol-sensitive system was based on an estradiol-responsive T7 polymerase (ERT7) that should have a higher transcriptional activity in the presence of the small molecule estradiol. This research also addresses one major problem with previously reported cell-free extract systems—leaky expression of reporter proteins that can yield a false-positive result [1]. T3 and T7 polymerase decoy oligonucleotides were designed that mimic T3 and T7 RNA polymerase (RNAP) promoter regions. The RNAPs bind to the decoys, which limit the amount of transcribed reporter protein, potentially reducing noise. Pardee et al. found that cell-free expression systems can be freeze-dried onto paper and stored for extended periods of time while maintaining their activity [1]. By combining Pardee’s advancement with the estradiol-sensitive mechanism, this project aims to create unique, low-cost, rapid-testing, paper diagnostic strips.	Applying Cell-Free, Paper-Based Sensors for Biological Testing and Protein Transfer	Alexander Szul; Apurva Patil; Garrett Green; Konstantin Borisov; Robert Donahoe
Peter Dimitrion	28	Induced pluripotent stem cell (iPSC) technology allows generation of patient-specific samples. However, iPSC research is hindered by the cost and time of quality control. We explored the ability of Raman molecular imaging (RMI) as a method for quality control. RMI is	Raman Spectroscopy as Reagentless Workflow Enhancement in Human iPSC Research	Peter Dimitrion; Lora McClain; Yun Zhi; Leonardo D’Aiuto, PhD; Heather Kirschner; Shona

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		<p>widely used in other scientific disciplines and recently has been applied to cellular differentiation processes, but its reliability as an iPSC differentiation monitor has not been explored. Five cell lines were analyzed in biological triplicate via Raman spectroscopy (RS) as iPSCs, neural progenitor cells (NPCs), and iPSC-neuron lysates. Partial least squares discriminant analysis (PLSDA) was used to determine cellular identity. Accuracy matrices, determined using PLSDA scores, showed 95% accuracy when distinguishing between iPSCs, NPCs, and neurons. The accuracy by which RS-PLSDA could identify cell lines ranged from 85% to 100%. Intra-individual ranged from variations 0.7% to 16.9%. Within class variations ranged from 2.6% to 28.8%. From the data, we can conclude that RS can distinguish cell lysates of iPSCs, NPCs and neurons reliably. The intra-individual and class variations may be a product of heterogeneous cultures. This study shows the potential for RMI as a non-invasive, semi-automated method for iPSC differentiation protocols.</p>		<p>Stewart, PhD; Patrick Treado, PhD; Vishwajit Nimgaonkar, MD, PhD</p>
<p>Brittany Dey</p>	<p>29</p>	<p>The current understanding of bacteriophage host range is limited to the host used for isolation. However, to gain a better understanding of what drives bacteriophage evolution, it is essential to discover the mechanisms regulating host range determination. Previous studies demonstrated the importance of bacteriophage tail fiber proteins in maintaining host specificity. These studies showed that Mycobacteriophage Halo, initially isolated on Mycobacterium smegmatis and unable to infect Mycobacterium tuberculosis, broadened its host range to M. tuberculosis by acquiring a point mutation in its tail fiber protein. Interestingly, the mutant adsorbs more efficiently to M. smegmatis than the wild-type phage. To investigate this, a GFP-fused tail fiber protein was constructed. This protein was then expressed and purified</p>	<p>Investigating the Role of Tail Fiber Proteins in Bacteriophage Host Preference</p>	<p>Brittany Dey, Rebekah M. Dedrick, Deborah Jacobs-Sera., Graham F. Hatfull</p>



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		<p>in Escherichia coli. After purifying the wild-type protein, the point mutant was constructed. This mutant GFP-tail fiber protein will also be purified. The binding of both the wild-type and mutant proteins to M. smegmatis will be analyzed by comparing their fluorescence at the bacterial surface. Based on previous results, it is hypothesized that the fluorescence of the mutant protein will be more abundant and brighter than the wild-type. This data will expand knowledge regarding bacteriophage host specificity, improving the application of bacteriophages as biological tools.</p>		
Cory Hayes	31	<p>Bacteriophages replicate by entering into one of two cycles: lytic or lysogenic. In lysogeny, the phage integrates its DNA into the host genome, and creates a prophage. Prophages can confer immunity to the host that protects against further infection, termed homoimmunity. Most commonly, homoimmunity in mycobacteriophages is caused by the expression of a repressor, which binds to infecting phages that have similar repressor machinery as the lysogen. Immunity assays are a powerful tool for studying superinfection immunity patterns, directly utilizing phenotypes to recognize repressor-mediated immunity relationships, and to identify novel immunity mechanisms that are not predictable. Published research determined that Cluster A immunity is predominantly repressor-mediated. We attempted to improve the resolution by performing assays on untested groups within Cluster A, and observed evidence of repressor-mediated immunity. This was replicated with the untested cluster N phages and lysogens. Again, Repressor-mediated immunity was observed. Finally, diverse panels of mycobacteriophages were tested on A and N lysogens. Whereas the Cluster A lysogens matched predicted behavior of repressor-mediated immunity, the cluster N</p>	Examining Immunity Patterns Within Cluster A and Cluster N Mycobacteriophages	Cory Hayes, Travis Mavrigh, Bryony Brown, Deborah Jacobs-Sera, Welkin Pope, Graham Hatfull

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		lysogens displayed superinfection immunity to a wide spectrum of phages. Future studies will test a larger variety of phages against a broad collection of lysogens to identify new immunity mechanisms.		
Claire Healy	32	Oxidative damage to the mitochondria is a major source of toxicity in cells and contributes to diseases such as Huntington's (HD), Parkinson's (PD), and Alzheimer's (AD). An excess of reactive oxygen species (ROS) can damage DNA, lipids, and proteins, and/or interfere with cell signaling pathways. Nitroxide-containing compounds exhibit antioxidant activity due to their ability to scavenge radical species including ROS. These compounds can effectively prevent oxidative damage and thereby have therapeutic potential. We hypothesize that improving the pharmacokinetic profile of nitroxides via a "prodrug" approach, would allow for optimal delivery into the mitochondria as well as elicit protection against oxidative and proteotoxic stress. We have synthesized and evaluated two new nitroxide analogs, CH636.004 and CH636.025. Preliminary biological results indicate that both compounds have the ability to scavenge radicals and prevent oxidative damage in astrocytes. Further biological evaluations and the development of new analogs are currently being investigated.	Synthesis and Evaluation of Nitroxide Prodrugs in Astrocyte Protection	Claire Healy; Tanja Krainz, PhD; Depti Pant, B.S; Rehana Leak, PhD; Peter Wipf, PhD
Erin Higgins	33	As technological demands increase, DRAM has been scaled to increase memory density and though it is necessary, it causes errors. If a bad cell is surrounded by a bad bit pattern, in this study "000" or "111", the cell becomes unusable. While error correction code (ECC) can correct some of these errors, it is being discovered that some of them are more persistent. The current way of dealing with these cells can often leave an entire chip unusable. Due to these issues, this research introduces several new techniques for dealing with bad cells and	Avoiding Bad Bit Patterns for Unreliable DRAM Memory Cells	Erin Higgins

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		<p>correcting them without marking an entire chip as unusable. The first technique involves compressing data and stuffing inverse bits to remove bad patterns from weak cells. The second technique involves flipping every other bit to correct the errors. And the third flips every third bit to remove bad patterns. The results of this study show that these techniques are extremely effective. Flipping every third bit corrects the error almost 99% of the time. This study is a good starting point for discussing how to address the issue of memory errors and thinking about how to combine these techniques to fix errors 100% of the time.</p>		
Jonathan Hightower	34	<p>The aim of this project is to develop a cost-effective, high-performing, environmentally-friendly catalyst that can be used to make technologies such as fuel cells and metal-air batteries more commercially-viable alternative energy options. The hydrogen oxidation reaction (HOR) at the anode of these devices is fast, but the oxygen reduction reaction (ORR) at the cathode is very slow, making these technologies inefficient. Platinum is the best-performing ORR catalyst so far, but it is also an expensive and scarce material. In this experiment, Metal-Organic Frameworks (MOFs) were used as precursors to ORR catalysts because of their low cost, good stability, and high surface area. ZIF-8 went through postsynthetic exchange (PSE) with <math>Mn(Ac)_2 \cdot 4H_2O</math> dissolved in methanol to give ZIF-8 (Zn/Mn) so that manganese, which is good for the ORR, would be introduced into the ZIF-8 framework. Elemental analysis revealed that manganese was between about 3-8% by weight of the sample. After PSE, ZIF-8 (Zn/Mn) then underwent pyrolysis in an argon atmosphere. Cyclic Voltammetry experiments showed that the catalyst was reactive in an oxygen atmosphere, but formed <math>H_2O_2</math> through a 2-electron reaction pathway rather than</p>	<p>Postsynthetic Metal Ion Exchange of ZIF-8 for the Catalysis of the Oxygen Reduction Reaction</p>	Jonathan Hightower

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		forming H <sub>2</sub> O through a 4-electron reaction pathway, meaning that this catalyst was less efficient in catalyzing ORR than platinum.		
Amy Howell	35	Biofouling is the accumulation of biological matter (proteins, cells, etc.) on a fluid-contacting surface. Anti-biofouling surfaces are those which resist bio-debris accumulation. Medical devices such as catheters, blood vessel grafts, vascular stents, artificial heart valves, and dialysis membranes provide motivation for anti-biofouling research since protein biofouling on these devices can trigger blood coagulation, leading to device failure or other serious complications. Common anti-biofouling strategies involve altering the surface energy of the fluid-contacting material by adding a polymer coating that is either hydrophobic or hydrophilic. The Li lab has recently reported unique surface properties of materials coated in a perfluoropolyether (PFPE) polymer commercially known as ZDOL. The ZDOL coating creates surfaces that are simultaneously hydrophilic and oleophobic (oil repelling), or more attractive to water than oil. Very few surfaces have thus far been identified with this quality. We believe surfaces that are more attractive to water than oil have the potential to display anti-biofouling properties. If a surface is unattractive to the hydrophobic domains in a protein, the protein may be more likely to remain soluble and less likely to adhere to the surface. This research presents the preliminary evaluation of ZDOL and other PFPE polymers as potential anti-biofouling coatings.	Evaluating Perfluoropolyether Polymers for Anti-Biofouling Applications	Amy Howell; Lei Li, PhD
Eamonn Hughes	36	Powder bed binder jet 3D printing is one of the many additive manufacturing methods that has the potential to revolutionize the manufacturing process through the production of finalized parts with complex shapes not possible via traditional manufacturing. However, the microstructure and properties of parts made by this	Influence of Powder Atomization Techniques and Sintering Temperature on Densification of 3D Printed Alloy 625 Parts	Eamonn Hughes; Amir Mostafaei, MS; Markus Chmielus, PhD

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		<p>method are not well understood. We examined three types of Alloy 625 powders: vacuum-melted argon atomized (AA), air-melted nitrogen atomized (NA), and air-melted water atomized (WA). Samples were printed using an ExOne M-Flex printer and sintered under vacuum at 1220 °C, 1240 °C, 1250 °C, 1260 °C, and 1270 °C for 4 hours. Before sintering, WA samples were significantly less dense than AA or NA samples (43% vs. 53% and 55% respectively) likely due to a lower packing density of the irregularly shaped WA powder particles. After sintering, WA samples achieved their highest density of 95% at 1250 °C, AA samples 99.5% at 1260 °C, and NA samples 99.2% at 1260 °C. Furthermore, WA samples showed signs of melting at <math>\geq 1240</math> °C while gas atomized (GA) samples showed melting at <math>\geq 1270</math> °C. These results indicate that WA samples sinter faster and at lower temperatures than GA samples though to lower final densities.</p>		
Christina Hwang	37	<p>Toxin-antitoxin (TA) systems, widespread throughout bacterial genomes, are small modules with a stable toxin that targets an essential cell process and a labile antitoxin that inhibits the toxin's activity. A type III TA system was shown to be a phage abortive infection (abi) system that conferred resistance to phage infection. Mycobacteriophage Fruitloop has a type II TA system, a feature uncommon in mycobacteriophages. We hypothesized that the TA system confers greater immunity for Fruitloop lysogen, preventing a wider range of superinfection in addition to immunity conferred by its repressors. Immunity assays were conducted to search for immunity that could possibly be explained by the TA system. Bacteriophage Recombineering of Electroporated DNA (BRED) was used to delete the TA system, and a mutant lysogen was made. Various phages infect wild-type Fruitloop lysogen less efficiently but display renewed</p>	Investigating a Toxin-Antitoxin System in Mycobacteriophage Fruitloop	Christina Hwang; Ching-Chung Ko; Deborah Jacobs-Sera; Graham F Hatfull, PhD

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		ability to infect mutant lysogen, suggesting that the TA system may be responsible. To further confirm this, work is being done to transform a constitutively expressed plasmid with the TA system into mutant lysogen to observe if immunity can be restored. Ultimately, we want to characterize the functions and mechanisms of Fruitloop's TA system and understand the potential significance of a phage carrying one.		
Mike Iasella	38	Our goal was to understand how the collagen microstructure in the eye changes with mechanical loading. Specifically, we developed a method to quantify how the collagen fiber waviness, or crimp, changes with uniaxial stretching. We demonstrated this with a fresh lamb eye from a local abattoir. Anterior sclera samples 30 microns thick were stretched in the anterior-posterior direction, while imaged under a microscope. Image analysis was used to determine collagen fiber orientation. Fiber waviness was defined as the standard deviation of the fiber orientation. A total of 7 levels of stretch were analyzed. Six regions of interest were manually identified in all stretch levels, and the fiber waviness in each region at each stretch level quantified. We found that the waviness of the collagen decreased with stretch (linear regression, $P < 0.01$ ). The results show that as the sclera is stretched, the collagen fibers become less wavy and uncrimp, as expected. Future studies will focus on the rates of the collagen uncrimping and how these rates vary between regions of the eye or with disease.	A Method To Study the Effects of Uniaxial Stretch on the Microarchitecture of Ocular Collagen Fibers.	Michael Iasella; Ning-Jiun Jan, PhD; Ryan O'Malley; Ian A. Sigal, PhD
Christopher Jambor	39	Classical industrial engineering principles are combined with computer optimization to develop a tool to aid healthcare professionals in optimally designing cost-effective health system pharmaceutical distribution networks. A multi-hospital health system is defined using a three-echelon inventory model with a warehouse that	Optimal Design of a Pharmaceutical Distribution Network	Christopher M. Jambor

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		<p>offers centralized pharmaceutical storage for all hospitals, pharmacy storage at each of the hospitals and storage cabinets on each inpatient unit at each hospital. At the macro level, use of a central warehouse that serves multiple hospitals is compared to a decentralized process using individual hospital pharmacies for pharmaceutical receiving and bulk storage. At the micro level, a centralized cart-fill process is compared to unit-level ADC storage for within hospital pharmaceutical distribution. Given hospital bed count and medication information, the tool optimizes storage and inpatient medication order filling processes. Efforts mainly involved quantifying key medication order filling cost drivers. Prior literature was supplemented by data and domain knowledge provided by Geisinger Health System staff. A pharmaceutical distribution cost model was designed in Excel and serves as a basis for the development of three optimization models for warehouse location, transport routing, and pharmaceutical delivery pathway determination. Future data collection will improve cost driver estimation and guide optimization model enhancements.</p>		
<p>Mohamed Kashkoush</p>	<p>40</p>	<p>Silicon-based solar cell efficiency is limited by silicon's high optical reflectivity, where typically over 30% of incident light is reflected. Minimizing the amount of reflected light serves to maximize the amount of absorbed photons in the silicon semiconductor, thus increasing the quantity of excited electrons per unit of incident light. This creates a more dense electric current across the cell's p-n junction, leading to an overall increase in the cell's power conversion efficiency. Black silicon, named as such because of its black appearance to the naked eye, can be more accurately described by the nanostructures that form its surface.</p>	<p>Black Silicon Fabrication for Photovoltaics</p>	<p>Mohamed Kashkoush</p>

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		<p>These structures vary from high aspect ratio nanoneedles to low aspect ratio nanopyramids with antireflective optical properties. In addition, black silicon has been shown to absorb light in the near infrared wavelength range (up to 1000 nm). Black silicon morphology has been shown to occur through a unique self-organizing and mask-less process, avoiding many production costs inherent to other current absorption-enhancing processes. This purpose of this study is to show how varying Inductively Coupled Plasma Reactive Ion Etching (ICP RIE) etch parameters can affect the geometrical morphology and antireflective properties of black silicon.</p>		
<p>Christopher Kaufman</p>	<p>41</p>	<p>Trauma to the retina or to the optic nerve leads to retinal ganglion cell (RGC) death and irreversible vision loss due to the inability of the central nervous system (CNS) to regenerate after injury. We currently lack a therapeutic platform that can alter the default healing response in the CNS to promote functional tissue repair over scarring. Extracellular matrix (ECM) technology has been successful in promoting functional tissue repair in numerous tissues. The goal of this study is to develop injectable ECM hydrogels to minimize secondary tissue damage and to preserve visual function after ocular trauma. Decellularized ECM bioscaffolds were enzymatically digested to create injectable hydrogels. RGCs were isolated and cultured with ECM and microglial or macrophage preconditioning. Microglia and macrophage phenotypes, RGC survival, and axon regeneration were analyzed. Rats received unilateral optic nerve crushes (ONC), followed by injection of different age- and tissue-specific hydrogels. RGC survival and axon regeneration were analyzed by immunohistochemistry. Age- and tissue-specific ECM hydrogels differentially modulate macrophage infiltration, microglial activation and RGC</p>	<p>Using Injectable Extracellular Matrix Hydrogels To Treat Ocular Trauma</p>	<p>Christopher Kaufman, Yolandi van der Merwe, Anne Faust, Asma Naqvi, Apoorva Kandakatla, Fardeen Mehdi, Vibha Reddy, Kevin C. Chan, PhD, Kia M. Washington, MD, William R. Wagner, PhD, Stephen F. Badylak, MD, PhD, DVM, Michael B. Steketee, PhD</p>



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		survival and axon regeneration in vitro and in vivo. Urinary bladder ECM increased RGC survival after ONC. Injectable ECM hydrogels hold promise for ameliorating RGC cell death and axon degeneration after ocular trauma.		
Nathan Kendsersky	42	Many human diseases, especially neurodegenerative conditions, are attributed to protein misfolding and aggregation, due to the decline of cellular quality control mechanisms with age. Heat shock proteins (Hsp), critical components of the quality control machinery, are protein chaperones that recognize nascent or misfolded proteins and initiate folding or prevent misfolding. One chaperone, Hsp70, is an ATP-dependent protein that requires Hsp40 to stimulate its ATPase activity and subsequent folding of substrates. We previously reported that an Hsp70 agonist, 115-7c, decreases $\alpha$ -synuclein aggregation in a neuronal cell model of Parkinson's disease. To identify improved Hsp70 agonists, we screened new 115-7c analogues. To this end, we purified Ssa1 and Ydj1, <i>Saccharomyces cerevisiae</i> (yeast) orthologs of human Hsp70 and Hsp40, and examined the effects of 115-7c analogues on Ssa1 ATPase activity through a steady state ATPase assay. Our data indicate that several derivatives of 115-7c also stimulate Ssa1 ATPase activity in the presence of Ydj1. Additional 115-7c analogues are currently being examined and enhanced Hsp70 agonists will be tested in the neuronal cell model of Parkinson's disease. Identifying improved Hsp70 agonists will provide a better understanding of the structure-activity relationship of Hsp70 chemical agonists and will ideally lead to new treatments for neurodegenerative disorders.	The Role of Small Molecule Hsp70 Agonists in Neurodegenerative Diseases	Nathan Kendsersky; Peter Wipf, PhD; Jeffrey L. Brodsky, PhD
Yuval Krimer	43	Magnetic Shape-Memory Alloys (MSMAs) exhibit a reversible plastic deformation of up to 10% upon the application of a magnetic field. Yet, their production as	Additive Manufacturing of NI-MN-GA Magnetic Shape-Memory Alloys: The	Yuval L. Krimer, Jakub Toman, Markus Chmielus

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		<p>single crystals is rather expensive and time consuming, and shapes are very restricted. In this study, we are investigating the use of selective laser melting (SLM) to additively manufacture Ni-Mn-Ga MSMA, and the effect of the linear energy on their properties. 5 layer samples were printed at different laser power of 200 W, 250 W, and 300 W, using a travel speed of 2.5 mm/s. The phase transformations and Curie temperature were determined via differential scanning calorimetry (DSC) and a vibrating sample magnetometer (VSM). Broad exothermic and endothermic peaks in the DSC measurements were correlated to the martensite phase transformation. Similarly, VSM results show a continuous magnetization increase from room temperature until the drop in magnetization at the Curie temperature. Even though previous tests indicated only small composition gradients within the samples, these differences might be enough to cause a wide range of martensite phase transformation temperatures in each sample and even room temperature martensite modulations. Additionally, mechanical constraints might hinder the phase transformation, thus adding to peak width.</p>	<p>Influence of Linear Energy on the Martensite Phase Transformation</p>	
Joseph Mort	46	<p>Bacteriophages carry genes for tRNAs, supplementing translation during phage infection. Usually phage tRNA genes are arranged as tRNA subclusters (tRSC). In their tRSCs, phages also have genes for small stable RNA molecules of unknown function, which we hypothesize may regulate translation. To search for these small RNAs, we chose the mycobacteriophage Wildcat. Wildcat carries 25 tRNA genes, a large tRNA gene number for its genome size. The tRSCs in Wildcat also have gene-sized stretches of unannotated genome that we predict may contain unrecognized genes encoding small RNAs. To test this, expression plasmids of the Wildcat tRSCs were made and</p>	<p>Seeking Small RNA Molecules in Mycobacteriophage Wildcat</p>	<p>Joseph Mort; Ethan Graham; Craig Peebles, PhD</p>

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		<p>moved into <i>M. smegmatis</i>. RNA from these strains was extracted and analyzed by northern blots with probes complementary to the tRSCs. We find that tRSC1 expresses an annotated transfer messenger RNA and two tRNAs plus at least two additional small stable RNAs. We have verified the expression of these RNAs in Wildcat-infected cells. Ultimately, we hope to test whether these novel small RNAs regulate translation or exert some other function in the cell. Discovering the function of small RNA molecules may provide valuable insights into how translation is regulated.</p>		
Amber Mori	47	<p>Background. Fifty-eight percent of adult cell phone users in the US own a smartphone. Understanding smartphone use by research participants can provide valuable information to increase participant recruitment and retention. Purpose. To describe participant cell phone use in a behavioral weight-loss intervention using smartphones to self-monitor nutrition and exercise and respond to ecological momentary assessment prompts. Methods. Participants from the EMPOWER study completed a 13-item questionnaire at baseline to assess cell phone usage (e.g., phone type, frequency of use). Descriptive statistics were performed for each item. Results. The sample (N=167) was 50.37±11.56 years old, mostly female (88.0%) and white (80.1%), with 16.11±3.38 years of education. Of the sample, 35.2% used an Apple iPhone, and 50.9% used Verizon as their phone carrier. The majority (61.1%) of smartphone users were ≥50 years, and 95.1% had home wireless internet access. While 77% of participants reported cell phone use several times/day, only 50.9% (n=82/161) viewed themselves as experienced smartphone users. Discussion. Findings show limited experience with smartphones, which has several implications for study participation including</p>	<p>Cell Phone Use among Adults Participating in a Study Requiring Extensive Smartphone Use</p>	<p>Amber Mori; Meghan Mattos, MSN, CNL; Lora E. Burke, PhD, MPH, FAHA, FAAN</p>

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		training prior to participation and providing financial support for data plans. Future studies would benefit from a better understanding of participant experience with smartphones, especially those requiring their use.		
Carl Morgenstern	48	<p>With the falling cost and rising efficiency of solar panels, more households are beginning to generate their own power. This confounds the existing power distribution system, forcing power companies to adapt. Duquesne Light, the primary power company of Pittsburgh, has detailed schematics of their distribution system. Unfortunately, these schematics were drawn in the early 90s, and are only useful as a rough guide. New power distribution (PD) modeling software has given utilities the ability to design their systems to avoid failures and also to accommodate more solar panel generation at consumer homes. The goal of this project was to convert Duquesne Light’s AutoCAD schematics into OpenDSS (an open source PD program) models. The AutoCAD schematics were drawn only as a visual reference, complicating the procedure and requiring manual edits to create valid electrical circuit models that OpenDSS can solve. After a few edits were made to the drawing, we could use the Visual Basic (VB) scripting capabilities of AutoCAD to extract all the relevant data into two CSV data files. A Python script then used the collected data to create an OpenDSS file to reproduce an AutoCAD schematic.</p>	Duquesne Light Power Distribution Model Creation	Carl Morgenstern; Thomas McDermott, PhD
Meredith Meyer	50	<p>The purpose of this study is to determine the effect of different patterns of visual field occlusions, peripheral or central, on standing balance. Particularly, which visual field dominates in balance tasks and the differences between older and younger adults. An understanding of these effects will, when compared to subjects with ocular pathologies, allow for an identification of the actual mechanisms of balance impairments resulting from vision</p>	The Effects of Central and Peripheral Visual Field Loss on Standing Balance in Adults	Rakie Cham, PhD; Caitlin O’Connell; Meredith Meyer

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		<p>loss. Two types of vision loss of particular interest are age-related macular degeneration (ARMD), which leads to central visual field loss and glaucoma, which causes peripheral visual field loss. This research will be valuable in developing strategies for reducing fall occurrences in older adults possessing these visual impairments. Study subjects completed a balance test during their visit using an Equitest posture platform (NeuroCom, Inc.) at the University of Pittsburgh Medical Center for Balance Disorders and postural sway was measured using center of pressure (COP). Results suggest that peripheral vision has a greater impact on balance than central vision, especially when proprioception is unreliable. Also, there is a possibility that with increasing age, the importance of peripheral vision over central vision intensifies. Further research will compare these results to patients with ARMD or glaucoma.</p>		
<p>Jill McDonnell</p>	<p>51</p>	<p>Damage Associated Molecular Pattern Molecules (DAMPs) are endogenous molecules able to initiate an innate immune response. This process commonly involves activation of pattern recognition receptors, such as Toll-Like Receptors (TLRs). The high-mobility group box 1 (HMGB1) protein is a highly conserved and prototypic DAMP. Upon release from damaged or stressed cells it acts as a pro-inflammatory cytokine by activating a wide variety of TLRs, such as TLR2, 4, and 9. While TLR2 and TLR4 can easily be studied through mouse models, TLR10 is only presents in humans. Therefore, not much is known about TLR10 except that it is found mainly in lymphoid tissue. Some reports have demonstrated a link of TLR10 to TLR2 and TLR4 biology. Here we report that TLR10 is expressed in primary human hepatocytes, and that stress, such as bacterial or hypoxic stress leads to its upregulation in message and protein levels. Furthermore,</p>	<p>Novel Interactions with Damage-Associated Molecular Pattern Molecules</p>	<p>Jill McDonnell, Nicole Martik-Hays, Kimberly Ferrero, MS, Venkata Sashi Gollapudi, MS, Peng Deng, MS, Tunliang Li, David Geller, MD, Timothy Billiar, MD, Eileen Bauer PhD</p>

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		co-immunoprecipitation studies demonstrate protein to protein interaction between TLR10 and HMGB1. Our findings of TLR10 as novel HMGB1 partner open new insights into the receptor's role in innate immune signaling.		
Alannah Malia	52	Municipal solid waste (MSW) is generated everyday with the majority being disposed into landfills. Landfills take up a large amount of space and require excessive amounts of resources to maintain. For this reason, waste-to-energy systems are gaining in popularity and usefulness as a way to reduce the volume of MSW. Additionally these methods produce energy which can be put back into the power grid, making these processes beneficial in multiple ways. Places such as Singapore which have little extra space to create landfills are especially interested in waste-to-energy processes. Using a program known as iThink, a dynamic systems model can be created that can analyze and simulate the potential use of the various methods in mega cities like Singapore. Life cycle assessment is useful to determine potential environmental and economic impacts of the waste-to-energy systems. Used together, dynamic systems models and life cycle assessment provide a multi-faceted and well rounded look at the impact the waste-to-energy methods could potentially have in megacities around the world. This will allow policy makers to be better informed in their decision making processes as well as regarding the possible consequences that can take place after implementing certain policies.	Simulating Waste-to-Energy Processes Using Life Cycle Assessment and Dynamic Systems Modeling	Alannah Malila, Diana Hoang
Andrew Loughner	53	Nanoparticles offer fascinating new possibilities to tailor materials properties and develop novel, more sustainable and efficient industrial processes. However, the recovery of very small nanoparticles (<10 nm) during synthesis and their subsequent deposition onto supports is challenging, costly, and time consuming. We have developed a quick	A Simple, Efficient, and Transferable Approach for High-Yield Separation of Nanoparticles	A. Loughner, C. Ewing, G. Vesper

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		and efficient salt recrystallization method by which stable nanoparticles can be recovered from solution, deposited onto supporting material, and protected against thermally-induced growth. We demonstrate the utility of this method by separating 6 nm SiO <sub>2</sub> from solution using NH <sub>4</sub> Cl and depositing 4 nm Pt onto silica supports using NH <sub>4</sub> HCO <sub>3</sub> . In each case, almost complete recovery of nanoparticles was achieved. This general approach to nanoparticle recovery is not only transferable to different salt/nanoparticle combinations, but also improves synthesis efficiency and can lead to more versatile synthesis procedures.		
Chuqi Liu	54	The purpose of this project was to design and construct a PIN Diode Driver to control the PIN diode for use as an RF switch in a Magnetic Resonance Imaging (MRI) coil device. When forward DC is applied to the PIN diode, it allows an RF signal to go through. When DC is disconnected, the RF signal can still pass for a short period of time if no reverse DC is applied. This is called carrier lifetime. This property is utilized in one of the detuning elements later. The PIN Diode Driver we designed has two modes, one is manual mode and the other is System mode. The system mode can use the trigger signal (+5V as 1 and 0V as 0) as input signal to control the PIN diode on or off. The goal for our output is +5V for forward bias and -12V for reverse bias. When our PIN diode driver is in the off mode, only -19.92dB (1%) of energy passing through the PIN diode. When the PIN diode driver is in the on mode, about -0.69dB(85.3%) of energy is passing through the PIN diode.	PIN Diode Driver Design for Nuclear Magnetic Resonance Radiofrequency Lab	Chuqi Liu, BD; Edwin Eigenbrodt, PhD
Huaxiu Li	55	Functional tricuspid regurgitation(FTR) is one of the main clinical conditions associated with tricuspid valves(TV). For tricuspid regurgitation(TR) patients, blood flows backward into the right atrium when right ventricle contracts during each cardiac cycle since the TV cannot	The Flowloop Study of Tricuspid Regurgitation Valves	Hwa Liang Leo, PhD; Nguyen Yen Ngoc; Huaxiu Li

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		<p>close fully. More specifically, FTR refers to TR occurring secondary to the left-sided heart disease without the presence of organic lesions of the TV apparatus. The dilation of the tricuspid annulus (TA) is the primary indicator of FTR, and currently in many occasions surgeons correct the dilated TA using annular rings which is called TV annuloplasty. Restoring TA geometry through tricuspid annuloplasty will result in better coaptation of leaflets. Research has shown that ring annuloplasty displays better distribution of the tension on the annuloplasty suture line and more standardized annular reduction. It also helps to restore annular diameter as well as the three dimensional geometry of the TA in a fixed systolic position. In this project, various ways of suturing a porcine TV to a plastic ring were investigated and compared. In addition, proper coaptation of the leaflets in the flow loop was confirmed.</p>		
<p>In Young Lee</p>	<p>56</p>	<p>Bacteriophage genomes, like any other genomes produce a restriction digest pattern that identifies it as unique. However, the cluster D mycobacteriophages failed to produce the digestion patterns predicted according to their genome sequences. Based on HPLC analysis data, we hypothesize that a certain percentage of thymine bases on these genomes are modified. To identify the exact modification, Troll4 DNA, a cluster D phage, is in the process of being analyzed by NMR and Mass Spectrometry at University of Florida. Simultaneously, we are identifying the possible gene(s) responsible for this modification. One candidate is gene 68-a thyX homolog-of Troll4. Gene 68 was chosen because thyX converts uracil to thymine through methylation, and gene 68 is conserved throughout the cluster D. To test this candidate, we attempted to knock out gene 68 using BRED (Bacteriophage Recombineering of Electroporated</p>	<p>Identification of Base Modification and Identification of Gene Responsible for Modification</p>	<p>In Young Lee; Ching-Chung Ko; Rebekah Dedrick, PhD; Deborah Jacobs-Sera; Graham Hatfull, PhD</p>



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		DNA) without success. One possible explanation is that gene 68 is essential for the viability of Troll4. For further investigation, we will look for ways to alter the gene 68 expression level and analyze the change in ratio of modified thymine to unmodified thymine as the evidence of gene 68's involvement.		
Alex Lederer	57	Transcription, the first step of gene expression, is the process by which a DNA sequence is read by an RNA polymerase enzyme to create RNA products that have structural roles or serve as messages for protein synthesis. Since eukaryotic organization of DNA into a highly compact chromatin structure acts as an obstacle for the polymerase, organisms have developed special machinery to alter the chromatin template and regulate transcription. An example of such protein machinery is the Paf1 complex, which associates with the polymerase to promote chromatin modification and facilitate gene expression. Recent genome-wide studies have uncovered an extensive network of noncoding RNAs, which are created during transcription but do not become translated into protein products. Many of these noncoding RNAs are thought to regulate the expression of neighboring protein-coding genes. To investigate the role of the Paf1 complex on the greater transcriptome, microarray assays were performed in an <i>S. cerevisiae</i> paf1 mutant background. Using computational methods, we aim to explore the impact of this deletion on gene expression, including noncoding RNA expression. Our findings will lead to the development of new hypothesis-driven questions regarding the role of the Paf1 complex in transcription regulation and gene expression.	Using Computational Methods To Investigate the Role of the <i>S. Cerevisiae</i> PAF1 Complex in Transcription	Alex Lederer; Mitchell Ellison; Travis Mavrich; Karen Arndt, PhD
Jonathan Lapin	58	Bacteriophages are viruses that specifically infect bacterial hosts and rank among the most numerous biological entities in our biosphere. DNA primase is the	Characterization of a Non-Canonical Translational Pattern for DNA Primase in	JJ Lapin; Deborah Jacobs-Sera; Welkin H. Pope, PhD; Graham F.

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		<p>enzyme responsible for synthesizing short RNA primers, allowing for the attachment of DNA polymerase and the initiation of DNA replication. In the majority of phage and bacterial genomes, primase is encoded by one gene and expressed as one protein; however, in Cluster A phages, it is seemingly encoded by two genes. In phage L5, adjacent genes, gp57 and gp58, are in overlapping translational frames and encode for both the C-terminal and N-terminal regions, respectively, of the primase. The proposed hypothesis is that a non-canonical translational mechanism is at play to form a single polypeptide rather than these two sequences encoding two separate polypeptides, which later come together to form a complete primase. In order to elucidate the mechanism behind L5 primase expression, these two genes will be cloned into E. coli and expressed in M. smegmatis, then analyzed by SDS-PAGE and mass spectroscopy to determine the true biochemical behavior of these overlapping sequences. Currently, we have the primase region of L5 PCR amplified and purified, and the pET21a vector purified and linearized. We are proceeding with cloning.</p>	<p>Cluster A Mycobacteriophages</p>	<p>Hatfull, PhD</p>
<p>Emma Sullivan</p>	<p>59</p>	<p>Tantalum (Ta) thin films are used in a variety of applications, including but not limited to microelectronics. Strength, reliability, and corrosion resistance at high temperatures are all important factors that make Ta a valuable material to study. Ta thin films can take the form of either a stable bcc <math>\alpha</math> phase or a metastable tetragonal <math>\beta</math> phase. The phase transformation from <math>\beta</math>-Ta to <math>\alpha</math>-Ta and the resultant stresses from deposition and transition have been studied for decades but are not entirely understood. However, a better understanding of how stresses develop and how phases form during the processing of thin films is essential for designing new components with new</p>	<p>Influence of Sputter Power and Wafer Plasma Cleaning on Stress and Phase Formation of As-Deposited Tantalum Thin Films</p>	<p>Emma Sullivan; Amir Mostafaei, MSc; Markus Chmielus, PhD</p>

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		<p>properties or dimensions. Specifically, changing processing parameters, such as the sputter power used during sputter deposition, will change the microstructures that develop within the film. In this present study, these processing parameters were investigated by sputtering a series of thin films, adjusting sputter power and wafer plasma cleaning parameters, and observing the resulting stresses and phases present. The thin films were then characterized using XRD, thickness measurements, resistivity measurements, and substrate curvature measurements. These results were then compiled to draw conclusions about the influence of processing parameters on stress and phase formation.</p>		
<p>Sarah Shaykevich</p>	<p>62</p>	<p>Brain-computer interfaces (BCIs) can provide insight into the neuroscience of learning. Users learn to control a BCI by modulating neural activity in a manner that can effectively move an onscreen cursor. Although we know that neural activity patterns change with learning, the details of the relationship between learning and changes in population-level neural activity are not well understood. Previous studies have indicated that as a monkey learns a BCI task, he forms and then improves a mental map of the relationships between inputs from different neurons to effectively control the cursor. To gain insight into this process, we tested the hypothesis that an improvement in control will be accompanied by a change in neural tuning, followed by a stabilization of the tuning. Over several days, a monkey learned to control a BCI cursor under a nonintuitive mapping from neural activity to cursor kinematics. As his control improved and then stabilized, his neural tuning changed less between consecutive days. Initially, on less successful days, many neurons underwent large changes, suggesting a search for an effective combination of neural activity patterns. On</p>	<p>Learning Coincides with Stability in Neural Tuning</p>	<p>Sarah F Shaykevich; Emily R Oby, PhD; Aaron P Batista, PhD</p>

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		more successful days, few channels showed changes, implying refined recall of the proper neural activity required to control the cursor.		
Shruthi Shankar	63	One of the biggest issues health practitioners face today is the surge in virulent bacteria with antibiotic-resistant capabilities, which has resulted in fewer and less effective antibacterial treatments. The Small World Initiative, through global student collaboration, attempts to discover novel antibiotic producers within local soil environments. This study focused on discovering bacteria that produce antibiotics against safe relatives of the ESKAPE pathogens, which are six species that present a great clinical threat due to their antibiotic resistance. Bacteria from two different soil samples were analyzed for colony morphological variation, which was greatest on PDA and R2A media. Two isolates, SS-PDA-1 and ECB-R2A-1, produced the largest zones of inhibition against Gram-positive bacteria and were therefore chosen from the group of antibiotic producers for further study. They were characterized via microscopy, including Gram staining, and via sequencing of the 16s rRNA gene. Cell metabolites were extracted with ethyl acetate and also tested for antibiotic activity. Both isolates were found to be rod-shaped. SS-PDA-1 was Gram-positive while ECB-R2A-1 was a Gram-negative member of Pseudomonas. Future work will focus on purification and analysis of antibiotic compounds present in the cell extracts, to determine chemical structure and whether or not active compounds are novel antibiotics.	Bacteria Isolated from Pittsburgh Soil Inhibit Growth of Gram-Positive Pathogen Relatives	Shruthi Shankar; Emily Brindley; Jean Schmidt, MSc
Stephanie Sexton	64	Anterior Cruciate Ligament (ACL) injuries are one of the most common types of knee injuries. The anterolateral capsule is often under diagnosed in conjunction with ACL injuries. The purpose of this study was to determine the surface strain of the anterolateral capsule in response to	Surface Strain in the Anterolateral Capsule of the Knee	Stephanie Sexton, Daniel Guenther, MD, Kevin Bell, PhD, Sebastian Irrarrazaval, MD, Ata Azar, MD,

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		<p>multiple loading conditions in the ACL intact and deficient knee during 30°, 60° and 90° of flexion. It was hypothesized that the greatest surface strain in the anterolateral capsule will be found at a 90-degree flexion angle with a combined internal rotation torque and anterior tibial load. Six subjects were tested in 10 physiologically relevant loading conditions at 30°, 60° and 90° of flexion with the ACL intact and deficient. Data was collected using DMAS motion capture software and peak maximum principal strain was computed with ABAQUS. Overall, the results were that the peak maximum principal strain was highest when the ACL was deficient, at higher knee flexion angles, and at four loading conditions: Anterior Tibial Load, Combined Anterior Tibial Load with Internal Rotation Torque, Internal Rotation Torque, and Combined Internal Rotation Torque and Valgus Torque. In conclusion, the anterolateral capsule is an important knee stabilizer when the ACL is deficient.</p>		<p>Freddie Fu, MD, Volker Musahl, MD, Richard Debski, PhD</p>
<p>Rachael Rush</p>	<p>65</p>	<p>Bacteriophages (phages) are viruses that infect bacteria. They are the most genetically diverse organisms on the planet, making them valuable tools in exploring different genomic mechanisms. Phages have two life cycles, lytic and lysogenic. Lytic phages kill the cell via lysis during replication, whereas temperate (lysogenic) phages typically integrate into their host genome using the bacterial genome's origin of replication and machinery. However, temperate mycobacteriophage RedRock lacks any apparent integration machinery and instead has a putative partitioning cassette. Partitioning systems consist of ParA and ParB genes, as well as ParS sites. They are used to ensure that daughter cells maintain copies of plasmids during replication, thus suggesting that RedRock is maintained as an extrachromosomal prophage during lysogeny. This information led to the question of how</p>	<p>Characterizing the Replication System of Mycobacteriophage RedRock</p>	<p>Rachael E. Rush, Travis N. Mavrich, Rebekah M. Dedrick, Daniel A. Russell, Deborah Jacobs-Sera, Graham F. Hatfull</p>

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		these phages replicate during lysogeny. My goal is to try to characterize the replication patterns of RedRock, Gladiator and Alma, three par cassette phages. We have yet to identify an origin of replication within mycobacteriophages, and since these phages do not have an integration cassette they must be replicating differently during lysogeny. The characterization of RedRock’s replication machinery will be useful for the development of genetic tools and provide valuable insight into phage diversity.		
Alec Rosenbaum	66	Thus far, one of the most major obstacles in the design and implementation of a functional neuroprosthetic capable of sophisticated motions, high degrees of freedom, and high precision is an equally capable control mechanism. In order to establish a control mechanism based on nerve signals originating in the brain, but being detected in extremities (specifically upper extremities in this case), the first step is to be able to measure these nerve signals. Work has been conducted that will allow for accurate in-vivo measurements of nerve signals from non-human primates. This work focuses on how a novel set of hardware interfaces with a controlling computer in order to change modes on the chip, record signals, and evaluate data in real-time. This interface has been built from scratch to meet the specific protocols of this novel chip and to meet the specific needs of the team that use said chip.	A Software Interface To Complement Original Hardware Capable of 10-Channel Simultaneous Recording and Analysis	Alec Rosenbaum
Brian Rhindress	67	Modern social robotics involves the creation of machinery to interact with humans in the human world. After all, people communicate with each other via non-programmatic mediums: touch, sound, sight, etc. At the same time, contemporary technology is pushing ever towards mobile platforms. Mobile computing and robotic platforms are popular due to their potential versatile	Design and Implementation of Portable, Social Robot on Android	Brian Rhindress; Fangwen Tu, MS; SS Ge, PhD

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		<p>applications, scalability and ease of control. If technology is moving in both of these directions, there is some motivation to combine social and mobile robotics. Using hardware and software interfaces created by master's student Chang Poo Hee as a foundation, we present a proof of concept for a mobile social robot. To show some element of people-likeness, the design considerations for the robot were: simple artificial intelligence enabling conversational ability, emotional detection of human counterparts, memory of past interactions, ability to learn, and navigational abilities. With these considerations in mind, a robot was created and completed this use case: 1. Introduce yourself to the robot &amp; tell something about yourself. 2. Tell the robot how you are feeling &amp; have it react accordingly 3. Say goodbye &amp; part ways with the robot 4. Have a new conversation with the robot and it remembers you.</p>		
Kaitlin Piper	68	<p>Research has shown a link between low socio-economic status (SES) and higher acute respiratory infection (ARI) rates, but the mechanisms leading to these inequalities remain unknown. We conducted a systematic review of peer-reviewed literature and found that differential rates of underlying chronic conditions, crowding, vaccination, smoking, breastfeeding, cooking-fuel quality, and nutrition status are documented mediators of the SES-ARI relationship. We are using these findings to constrain the range of factors tested as causes of observed poverty-associated disparities in influenza hospitalization rates. Using an agent-based modeling framework, the Framework for Reconstructing Epidemiological Dynamics (FRED), we are testing if proposed mechanisms, including crowding and health behaviors, are able to generate observed area-level disparities in influenza hospitalization rates in New Haven County, CT. By simulating an influenza</p>	<p>Using a Systems-Based Framework To Understand the Causes of Respiratory Infection Inequalities</p>	<p>Kaitlin Piper, Supriya Kumar, Samantha Rowden, David Galloway, James Hadler, John Grefenstette</p>

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		outbreak in a realistic, census-matched population, agent-based models can serve as a counterfactual library in which to test competing hypotheses regarding the possible causes of influenza inequalities. Determining which factors have the greatest explanatory power will enable us to prioritize interventions that have the largest impact on reducing persistent influenza disparities.		
Shil Patel	69	Rett syndrome (RTT) is an X-linked neurodevelopmental disorder characterized by loss of function mutations in the transcriptional repressor methyl-CpG binding protein 2 (MeCP2). Recent MRI studies have suggested region specific alternations of myelin may exist in patients with RTT. Since oligodendrocytes (OLs) are the glial cells responsible for myelination of central nervous system (CNS) axons, we sought to investigate the effect of MeCP2 deletion on basic OL biology within the developing mouse CNS using MeCP2 knockout mice. No significant differences were found in the number or morphology of CC1+ mature OLs, suggesting unaffected proliferation and differentiation of oligodendrocyte precursor cells (OPCs) to OLs. Minor increases were observed in the major myelin protein MBP while PLP and MOG were unaffected suggesting that CNS myelination is intact. Electron microscopy (EM) of the corpus callosum at post natal day 28; a pre-symptomatic time point, depicted normal myelin thickness and ultrastructure in MeCP2 knockout mice. In conclusion, loss of MeCP2 fails to demonstrate a direct effect on OPC proliferation, differentiation or myelination at time points prior to symptom onset. Ongoing studies will examine myelination in MeCP2 knockout mice at later time points to address whether myelin abnormalities may occur secondary to significant neuronal dysfunction.	Loss of MeCP2 Does Not Directly Affect CNS Myelination in the Developing Mouse Brain	Shil Patel, Jenna Gaesser, Kelly Urbanik, Sharyl L.Fyffe-Maricich
Olivia Parks	70	Recent evidence suggests a critical role for IL-22 in	The Role of IL-22 Signaling	Olivia B. Parks;



		<p>mediating gut barrier integrity and controlling intestinal inflammation. The intestinal secretory paneth and goblet cells help mediate gut barrier defense against intestinal inflammation. We hypothesized that IL-22 attenuates lipopolysaccharide (LPS)-mediated intestinal inflammation and that IL-22RA1 signaling influences paneth and goblet cell production. To test this, intestinal epithelial cells (IEC-6) were treated with IL-22Fc, stimulated with LPS, stained for NF-kB translocation and pro-inflammatory cytokines were analyzed by quantitative PCR (qPCR). Wild-type mice were treated with IL-22Fc or IgG intraperitoneally 2x/wk from p10-p28 and paneth and goblet cells were stained and quantified. Paneth and goblet cells of p28 intestinal-deficient IL-22RA1 mice (Il22ra1fl/fl x villin-cre) were also stained and quantified. We discovered IL-22Fc administration decreased NF-kB nuclear translocation and IL-6 in vitro. IL-22Fc supplementation significantly increased the number of goblet and paneth cells and decreased TLR4 expression in wild-type mice. Furthermore, in naive p28 IL-22RA1 villin cre+ mice, there was a significant decrease in goblet and paneth cells. In conclusion, IL-22 administration attenuates pro-inflammatory responses in intestinal epithelial cells, decreases murine ileal TLR4 expression and influences goblet and paneth cell number, raising the potential of IL-22 as a novel therapeutic approach to intestinal inflammation.</p>	<p>on the Secretory Cells Within the Intestine</p>	<p>Congrong Ma; Pawan Kumar, PhD; Jay K. Kolls, MD; Misty Good, MD</p>
<p>Deepti Pant</p>	<p>71</p>	<p>Astrocytes are an abundant type of glial cell and maintain neuronal homeostasis. In neurodegenerative diseases, both neurons and astrocytes exhibit oxidative stress. However, astrocytes are less susceptible to oxidative toxicity than neurons. Astrocytes respond to sublethal oxidative stress with endogenous adaptations that lead to protection against subsequent challenges, a</p>	<p>Severely Stressed Astrocytes Tolerate Paraquat Despite Inhibition of Multiple Endogenous Defenses</p>	<p>Deepti B. Pant, Amanda M. Gleixner, Rehana K. Leak, PhD</p>

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		<p>phenomenon known as preconditioning or tolerance. However, it is not known if astrocytes can adapt to severe oxidative stress, or stress that is high enough in concentration to kill some fraction of the cellular population. We hypothesized that astrocytes surviving high concentrations of the oxidative poison paraquat can tolerate a second exposure to paraquat better than stress-naïve astrocytes. In support of our hypothesis, we discovered that astrocytes surviving one hit of paraquat completely resisted the second hit, unlike naïve astrocytes. The stress tolerance was so robust that inhibition of multiple defensive proteins, such as heat shock proteins 32 and 70, the antioxidant glutathione, and the kinases ERK, Akt, and JNK failed to abolish the effect. These results demonstrate that the phenomenon of preconditioning can be extended from sublethal to severe stress for this cell type. Improved survival under conditions of severe injury may allow astrocytes to support neighboring neurons more effectively.</p>		
Adalena Nanni	72	<p>The Chapman lab is interested in how two transcription factors, T and Tbx6, regulate mesoderm formation in the mouse. T and Tbx6 are part of the T-box family, and are related through a conserved DNA binding domain – the T-domain. Because they share a common DNA binding domain, all family members can recognize a similar sequence, 5'-AGGTGT-3', at least in vitro. To understand how T-box factors regulate developmental processes across species, we and others are attempting to identify T-box target genes. The availability of public data sets, including chromatin immunoprecipitation (ChIP) and expression studies, allow for an in silico identification of T-box targets. To this end, I have manipulated published data through several python programs to find genes with</p>	In Silico Identification of T-Box Targets	Adalena Nanni; Deborah Chapman, PhD

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		<p>our target sequence pattern. The various functions of these python programs include: transcribing the data into FASTA formatted files, searching FASTA data to find pattern matches, and, using Ensembl’s Representational State Transfer (REST), identifying homology matches between the mouse, chicken, frog, and zebrafish genes. The next step will be to computationally compare these genes with pattern matches to ChIP-seq data to find overlapping genes. These potential targets will be verified using in vitro and in vivo techniques in the lab.</p>		
Sam Mostofa	73	<p>Schizophrenia is a disorder whose symptoms often arise during adolescence and include compromised cognitive functions. These cognitive functions depend upon gamma oscillations, which are altered in the dorsolateral prefrontal cortex (DLPFC) of schizophrenia subjects. Gamma oscillations depend upon recurrent feedback between inhibitory cells expressing the calcium binding protein parvalbumin (PV) and excitatory pyramidal cells. Most PV cells are surrounded by a condensed form of extracellular matrix known as the perineuronal net (PNN) and decreased expression of PNN markers and PV has been reported in schizophrenia. Since schizophrenia is a neurodevelopmental disorder, understanding the normal trajectory of PV cell and PNN development could provide insight to the disease mechanism. To assess this in the DLPFC, immunohistochemistry for PV and two PNN markers was performed on 28 non-human primates spanning 7 age groups. We observed that PNN and PV markers reach adult levels at different ages. Specifically, PV expression plateaued during childhood, whereas the expression of PNN components reached adult levels during late adolescence. The contrast in developmental trajectories of PNN components and PV levels suggests that in schizophrenia stunted PNN development during</p>	<p>Developmental Trajectory of Perineuronal Nets in the Prefrontal Cortex</p>	<p>Sam Mostofa; Aaron Fogolio; Raissa Berry; John Enwright, PhD; David Lewis, MD</p>

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		adolescence could elicit downstream alterations in PV cells that may ultimately contribute to the cognitive pathology seen in schizophrenia.		
Luke Ziegler	76	<p>Study: Sickle-cell disease (SCD) causes abnormal shape and rigidity of red blood cells (RBCs) due to a pathological hemoglobin (HbS) which, when sickled, results in vaso-occlusion, tissue hypoxia and many other severe and painful events. Current treatments for SCD are limited and cause serious complications. Pharmacotherapy with hydroxyurea leads to leukopenia and thrombocytopenia while repeated blood transfusions cause alloimmunization in over 50% of patients. In this work, we propose to replace HbS with healthy donor Hb, and subsequently return these modified RBCs to the patient. Methods: Proof-of-concept experiments are being performed using healthy donor RBCs. Removal of endogenous Hb is carried out by lysing the RBCs with a low-osmolarity solution. Encapsulation of exogenous donor Hb into the lysed RBCs is accomplished through a multi-step process, designed to capture normal hemoglobin and then to reseal the RBCs. Results: At this stage of the protocol development, the experimental RBCs contain ~5.5 g/dl total intracellular Hb compared to ~1.75 g/dl original intracellular Hb leftover present in the control RBCs. Based on these reproducible results, encapsulation of much higher concentrations of Hb is assumed and currently under examination in on-going studies. In addition, rheological and morphological properties of these modified RBCs are being tested.</p>	Modification of Sickle RBCS by Replacement of Inherited HBS with Healthy Donor HB	Luke A. Ziegler; Katrina B. Zougari; Salim E. Olia, BSE; Jonathan H. Waters, MD; Marina V. Kameneva, PhD
Benjamin Yeh	77	Efficient conversion of CO <sub>2</sub> from various emission sources into valuable chemicals has the potential to reduce net CO <sub>2</sub> emissions from fossil fuels usage. The goal of this project was to find promising Lewis pair functional groups for functionalization in MOF for further CO <sub>2</sub>	Screening a Variety of Catalytic Lewis Pair Moieties for Their Hydrogen and Carbon Dioxide Binding Energies	Benjamin Yeh

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		<p>hydrogenation; specifically, searching for Lewis pairs that can bind H<sub>2</sub> stronger than CO<sub>2</sub> by screening H<sub>2</sub> and CO<sub>2</sub> binding energies on various Lewis pairs using the Gaussian 09 software. We found that the stronger the electron withdrawing group (F &lt; Cl &lt; Br &lt; CN &lt; CF<sub>3</sub> &lt; NO<sub>2</sub>), the stronger both H<sub>2</sub> and CO<sub>2</sub> will bind. The weaker the electron donating group (benzene ≈ CH<sub>3</sub> &lt; OCH<sub>3</sub> &lt; OH &lt; NH<sub>2</sub>), the stronger H<sub>2</sub> and CO<sub>2</sub> will bind. We also found that reducing the distance between the Lewis acid-base sites decreases (weakens) the CO<sub>2</sub> binding energies due to steric hindrance. Combining this fact and the trend mentioned earlier, we are able to come up with promising Lewis pair catalysts that will bind H<sub>2</sub> more strongly than CO<sub>2</sub> without potentially poisoning the Lewis acid-base site from CO<sub>2</sub>. The target binding energy range is -0.6 to 0.0 eV for H<sub>2</sub> and -0.3 to 0.0 eV for CO<sub>2</sub>.</p>		
<p>Isaac Hong Wong</p>	<p>78</p>	<p>Computational fluid dynamics (CFD) studies of the arteries require a specified blood flow waveform as input, but the waveforms reported in literature are obtained from healthy, young individuals. Our aim is to identify variation in blood velocity waveform shapes in the elderly population, and determine the impact of these variations on computed wall shear stresses (WSS). We obtained spectral Doppler ultrasound scans of both internal carotid arteries from 352 patients, with a mean age of 69 ± 15 years, and grouped them by waveform shapes. A representative waveform was chosen from each group as input for a CFD study using a parametrically constructed model of a human intracranial aneurysm. Time averaged WSS distributions, as well as those at the time of maximum velocity and the diastolic notch, were reported. The relative distribution of high and low WSS were mapped similarly across the different groups, but some groups displayed different absolute stress values. At the</p>	<p>Effect of Variations in Blood Velocity Waveforms on Wall Shear Stresses in an Intracranial Aneurysm</p>	<p>Isaac Wong; Michael J. Durka, MS</p>

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		time of maximum velocity, the waveform with the sharpest systolic rise and quickest subsequent fall resulted in considerably higher WSS. At the time of the dicrotic notch, the waveform with a double systolic peak, and the one with a gradual systolic rise resulted in higher WSS.		
Anna Williams	79	According to the Environmental Protection Agency, the release of CO <sub>2</sub> into the atmosphere causes environmental problems including: global temperature changes, the rising of sea levels, an increase in intensity of storms and heat waves, and harm to water supplies, agriculture and wildlife. Therefore, new technologies need to be developed and implemented to help decrease the amounts of CO <sub>2</sub> released into the atmosphere. A promising new technology, Chemical Looping Combustion (CLC), allows for the sequestering of pure CO <sub>2</sub> gas before it enters the atmosphere. CLC uses two separate reaction stages, oxidation and reduction, which are realized in two separate reactors: an oxidizer, or “air reactor”, and a reducer, or “fuel reactor”. The aim of the present project was to use CLPO utilizing a “structured bed”, i.e. a packed bed reactor with several packed sections, separated by quartz wool, containing different components able to undergo oxidation and reduction. The basic concept behind the structured bed is that the products from the first bed will react with the second bed to yield the desired product: syngas. By varying the gas flow rates or the type and amount of material in each ‘packing’, the structured bed can be tailored to control the final products produced.	Structured Bed Reactors for Chemical Looping Processes	Anna Williams; Goetz Vesper, PhD
McKenzie Warshel	80	Background: America has the highest teen birth rate compared to all other industrialized countries. The Maikuru: Teen Mother Mentoring Program provides a mentor to adolescent mothers to promote health and	Mentorship of Teen Mothers and its Effect on Depression and Self-Worth	McKenzie Warshel

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		<p>well-being, educational attainment, and positive self-worth. Objective: To examine depressive symptoms and sense of self-worth in teen mothers enrolled in intervention. Methods: Young mothers, 19 years or younger, with only one child are eligible to participate and are paired with a mentor who guides her through the program. Teen mothers and mentors attend six weekly group sessions, continuation groups each month, and follow-ups every three months. Data is self-reported, and depression is assessed using the Center for Epidemiologic Studies Depression Scale for Children. The sense of self-data was taken from a questionnaire with agreeing or disagreeing with a set of statements such as “At times I think I am no good at all” and “My life is just right”. Outcomes: The majority of participants in the study were African-American. After mentorship, depression in teen moms decreased from 78% to 65% and self-satisfaction increased by 11%. Conclusion: Teen mothers’ sense of self-worth is of public health significant because one million teenage girls become pregnant each year in the United States.</p>		
<p>Abigail Wang</p>	<p>81</p>	<p>Although obsessive-compulsive disorder (OCD) is a severe mental disorder affecting 2% of the population worldwide, the underlying pathophysiology of the disorder remains unclear. However, it is understood that dysregulation of the cortico-striatal-thalamo-cortical (CSTC) circuitry is implicated in disease causation. SAPAP3 is a postsynaptic scaffolding protein that is highly expressed in the synapse, and the SAPAP3 knockout (KO) mouse is an animal model that shows behavioral abnormalities relevant to OCD. In addition, the SAPAP3 gene has been shown to be associated with a risk for OCD in clinical genetic association studies. We aimed to both replicate previous findings characterizing the SAPAP3 KO</p>	<p>Characterization of SAPAP3 Knockout Mice during Adolescence and Adulthood: Relevance to Obsessive Compulsive Disorder</p>	<p>Elizabeth Manning, PhD; Abigail Wang; Susanne Ahmari, PhD</p>

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		<p>mouse phenotype and to further investigate the emergence of these behaviors. Mice were tested beginning at 5 weeks in a number of OCD-relevant behavioral paradigms such as basal grooming, stimulated grooming, open field exploration, operant reversal learning, elevated plus and zero mazes, and light/dark box. Preliminary analysis suggests that abnormal behaviors in the SAPAP3 KO mouse may emerge much earlier than previously described, and ongoing studies aim to characterize new behaviors that may be relevant to the disease model.</p>		
<p>Jacob Wallace</p>	<p>82</p>	<p>Optical coherence tomography (OCT) is a non-invasive imaging modality allowing for real time visualization of the optic nerve head (ONH) structures in the back of the eye in 3D. The complexity of the ONH structure and varying OCT image quality in-vivo make it not trivial to analyze OCT images. The purpose of this study was to improve the quantification of in-vivo monkey ONH deformation in OCT scans by removing motion artifacts due to breathing rate and heart rate, marking radially, and reconstructing 3D surfaces. Repeatability of radial markings was calculated from the standard deviation between 3 repeated marking sets on 10 random virtual sections from each of 3 OCT scans for 4 commonly used ONH structures: anterior lamina cribrosa (ALC), internal limiting membrane (ILM), Bruch’s membrane (BM), and Bruch’s membrane opening (BMO) with mean marking differences of 8.02 <math>\mu\text{m}</math>, 9.38 <math>\mu\text{m}</math>, 3.56 <math>\mu\text{m}</math>, and 7.18 <math>\mu\text{m}</math>, respectively. This improved method was shown to be more time-efficient with good repeatability for the radial marking. The results of this study will enable future studies to better characterize pressure-related ONH deformations in pathological conditions, such as glaucoma.</p>	<p>Using Radial Methods To Improve 3D Quantification of In-Vivo Monkey Optic Nerve Head Deformations from Optical Coherence Tomography Images</p>	<p>Jacob Wallace; Huong Tran; Jeremy Teichmann; Andrew Voorhees; Jennifer Ten Eyck; David Tsui; Jon R. Drobitch; Yiyao Shi; William Walters; Bo Wang; Matthew A. Smith, PhD; Elizabeth Tyler-Kabara, MD, PhD; Joel S. Schuman, MD; Gadi Wollstein, MD; Ian A. Sigal</p>



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Michael Urich	83	<p>The neural connections of the mammalian motor cortex are relatively unknown. Understanding these connections may explain the neural circuit response in neurodegenerative conditions and provide insight into how to treat them. We developed a standard method for quantifying neuronal projections from motor cortex circuitry in the mouse brain. We used custom-written MATLAB software to mark structural points of interest in the sample brain and in a standardized reference brain to align to a standard coordinate space. We developed an algorithm in FIJI to threshold images of neuronal projections so that only pixels of a minimum brightness are present. With MATLAB, we import the thresholded images and select a defined anatomical region of the brain to analyze. Using our alignment procedure, we are able to generate a cutout of the precise brain region we wish to study, with significantly reduced noise. With this specialized image, we are able to run a range of tests to quantify intensity of projections from the injection site to specific brain areas, as well as to determine correlations between topographically-related projections in motor and sensory areas of the mouse brain. Our algorithms and analysis were successful in measuring the neuronal connectivity of brain regions.</p>	<p>Quantification of Axonal Projections from Topologically Related Areas of Motor and Sensory Cortex in Transgenic Mice</p>	<p>Michael Urich; Bryan M. Hooks, PhD</p>
Rachel Upadhyay	84	<p>The success of the disposal of nuclear waste in a deep borehole depends on the integrity of the borehole plug. Bentonite clay has been proposed as a key plugging material; its effectiveness hinges critically upon its intrusion into near-borehole cracks associated with the drilling process. In order to understand and optimize this crack intrusion, a device was constructed with a cylindrical chamber representing the borehole and an adjacent adjustable-width slot representing the near-borehole crack. Bentonite clay pellets are placed into the</p>	<p>Well Plugging with Clay-Based Minerals: Characterizing the Intrusion of Beontnoite into Near-Wellbore Cracks</p>	<p>Rachel Asit Upadhyay; Andrew P. Bunger, PhD</p>

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		<p>center chamber and the entire cavity is filled with water so that the pellets hydrate and swell, intruding into the slot. Results indicate that the bentonite clay pellets do not fully plug the slot. We propose a model where intrusion is limited by (1) the free swelling potential intrinsic to the system comprised of the bentonite pellets and the hydrating fluid and (2) resisting shear force along the walls of the slot. Narrow slots have a smaller volume for the clay to fill than wider slots, but wider slots present less resistive force to clay intrusion. These two limiting factors work against each other, leading to a non-monotonic relationship between slot width and intrusion length.</p>		
Mingzhi Tian	85	<p>Image matching, a common technique in Computer Vision to identify objects, persons, locations, etc., is widely used in both military and civilian applications. For common image matching algorithms, results may vary when the raw images are captured under different lighting conditions. To reduce the unwanted influence from ambient lighting, we propose a novel method to match images that contain features associated with an inherent direction. The new method uses an established ridge detection algorithm to reduce the raw images to sets of ridge points, each point defined by its orientation and location. To perform ridge matching, we find the pair-wise transform between every ridge point from one image and every ridge point from another. The result is a point cloud in transform space. The correlation between two sets of ridge points is equivalent to the density of the point cloud, computed by convolving the point cloud with a blurring kernel. The best match is found as the location in transform space at which the correlation reaches global maximum. We tested the new method on images sampled from a high resolution image of the human palm</p>	<p>Ridge Matching Based on Maximal Correlation in Transform Space</p>	<p>Mingzhi Tian; Jihang Wang; John Galeotti, PhD; Samantha Horvath; George Stetten, MD, PhD</p>

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		and obtained accurate results.		
Joseph Takahashi	86	<p>Syndesmosis injuries (high ankle sprains) compromise the integrity of the distal tibia, fibula, and talus. The objective of this study was to develop a protocol to measure fibula motion using a motion capture system (DMAS7) and assess accuracy and repeatability of the methodology. A mechanical digitizer was designed to register anatomical landmarks for creation of coordinate systems and marker triads were designed to be attached to the tibia and fibula to track their rigid body motion. Repeatability was determined by digitizing a bolt multiple times and accuracy was assessed by evaluating a 2 mm displacement (digitizer) and 50 mm translations and 150 rotations (kinematics). An ankle specimen was tested to determine baseline kinematics for physiologic testing. The digitizer was accurate to 0.15 mm and repeatable to 0.11 mm, kinematics were accurate to <math>\leq 0.66</math> mm (1.32% error, displacement) and <math>\leq 0.24</math> degrees (1.86% error, rotation), and variation between trials of physiologic testing was on average 0.21 mm. Based on low percent error of displacement and rotation, the system accuracy was deemed acceptable, and the low variability between physiologic tests indicated the method was repeatable. After additional validation of the DMAS7, this methodology can be used to test syndesmotic injuries and repair procedures.</p>	Quantifying Tibiofibular Kinematics Using DMAS7 Motion Tracking System To Investigate Syndesmotic Injuries	Joseph M Takahashi; Kevin M Bell, PhD; MaCalus V Hogan, MD; Richard E Debski, PhD
Matthew Sybeldon	87	<p>Electroencephalography (EEG) brain computer interfaces (BCI) are an emerging noninvasive input modality for disabled users to access the communicative resources afforded by a computer. However, these signals are often susceptible to nonstationary noise processes that reduce the performance of a classifier used to infer user intent. Examples of such nonstationarities are variable medical device noise and user fatigue. Frequent calibration is</p>	Development of an Adaptive Brain Computer Interface to Automatically Address Nonstationary EEG Data	Matthew Sybeldon

		<p>therefore required to continue system usage. As such, there is motivation to develop an adaptive BCI system to reduce calibration requirements for the user. Ensemble learning through the Learn++.NSE algorithm has been found to be suitable for this task due to its ability to selectively utilize past calibration information. This capability permits an ensemble learner to provide continued performance using shorter calibration sessions. The performance of the ensemble classifier was compared to a classifier trained on the most recent calibration data and a classifier that naïvely combines all past calibration data. The area under the curve (AUC) of the receiver operating characteristic was compared between the three classifiers using various calibration session lengths for a subsequent test session. The ensemble learner proved capable of achieving higher AUCs using shorter calibration durations.</p>		
Garrett Swarm	88	<p>One important aspect to consider during reservoir simulation involves the interaction between a growing hydraulic fracture (HF) and pre-existing cemented natural fractures (NFs). The minerals that occupy the natural fractures have strengths which differ from the main reservoir rock. The hypothesis is that strong cement will promote direct crossing of NFs while weak cement will lead to the HF being diverted to grow along the NF. The laboratory investigation focuses on determining an experimental threshold between behavior associated with weak and strong cement. In order to differentiate between strong and weak cement, a series of tests were conducted on a variety of adhesives to determine their tensile strengths. The test specimens were created by utilizing a specified adhesive to bond three identical mortar blocks. The adhesive, which was applied over the entire interface, simulated a fully cemented NF. During</p>	Interaction between Hydraulic Fractures and Fully Cemented Natural Fractures of Varying Strength	Garrett Swarm; Wei Fu, MS; Andrew Bunger, PhD

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		<p>the experimental procedure, vertical and horizontal confining stresses were applied on the specimen. While under loading, a glycerin-dye mixture was pumped into the specimen to hydraulically induce a fracture. The experimental results showed that the two strongest adhesives promoted direct crossing while three weaker adhesives diverted the HF along the NF.</p>		
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