Sorted by Poster Number				
Name	**Poster Number**	**Poster Abstract**	**Poster Title**	**Authors**
Christopher Borland	1	In the research presented in this paper, we examine a nondestructive testing (NDT) technique based on the propagation of highly nonlinear solitary waves (HNSWs) to determine the stiffness of tennis balls. The objective is to create a handheld device that will allow players and manufacturers to determine the serviceability of tennis balls. HNSWs are compactly supported lumps of energy that can propagate in one-dimensional (1D) granular chains composed of contacting elastic particles [1]. The most common way to generate a HNSW is by impacting the first particle of the chain with a striker. When an object is placed in contact with a granular chain, and it is probed with a HNSW, three waves are typically produced: the incident solitary wave (ISW) generated by the impact of the striker and then two waves generated by the reflection of the ISW at the object-chain interface. These two waves are the primary (PSW) and	Non-Destructive Evaluation of Tennis Balls Using Highly Non-Linear Solitary Waves	Christopher Borland; Piervincenzo Rizzo, PhD

		secondary solitary waves (SSW). The amount of time in between the ISW and PSW or ISW and SSW is called the time of flight (TOF). With the exception of a particular brand used for soft surfaces, we found that HNSWs could observe a difference between serviceable and non-serviceable balls.		
Kaylan Kerrigan	2	Lambert-Eaton myasthenic syndrome (LEMS) is an autoimmune disorder affecting the presynaptic P/Q-type Ca2+ channels crucial to neurotransmitter release at the neuromuscular junction (NMJ), resulting in muscle weakness. The most common treatment of LEMS is a K+ channel blocker (3,4-DAP). This treatment has dose-limiting side effects and does not completely reverse symptoms. We previously reported a novel Ca2+ channel agonist, GV-58, that, when combined with 3,4-DAP, elicits a supra-additive effect that completely reverses the deficit in neurotransmitter release in LEMS model NMJs. We have synthesized two new analogs, KK-75 and KK-76, in an effort to further improve upon the	Synthesis and Evaluation of Calcium Channel Agonists with Applications in Lambert-Eaton Myasthenic Syndrome (LEMS)	Kaylan J. Kerrigan; Michael Frasso; Stephen D. Meriney, PhD; Man Wu, MS; and Peter Wipf, PhD

		bioactivity of GV-58 and will report on their synthesis and preliminary biological evaluation.		
Joseph A. Pugar	3	The control over the topography of a surface has several applications, most specifically in bioengineering systems. The internal surfaces of many internal conduits, e.g., blood vessels, intestines, etc., are highly textured, and the overall goal of this project is to mimic this texture in blood vessels to reduce bio adhesion. At present, synthetic blood vessels use polyethylene, vinyon (a porous material), and what is most popular now, Teflon. Although usable, naturally self-sealing, and has the tendency to foul less than other materials, one problem is that it is quite stiff compared to real vessels and still fouls eventually. The specific goal of this summer project was to develop methods to fabricate synthetic cylindrical blood vessels with highly wrinkled inner surfaces. One approach to this problem is designing the surface of the inner radius of the grafts to eject adhered biomaterial given natural pressure variations of human	Surface Topography of Complex Surfaces	Joseph A. Pugar

		pulse. Surface topography can be influenced by multiple contributors. The influence tested in this summer's research was the buckling of a stiff surface when adhered to a thicker, softer substrate. The result is a surface that can be made to wrinkle and unwrinkle to de-adhere any adhered material such as platelets or other bio-mass.		
Xianglin Liu	4	The Green's function of an electron scattered by a single potential is essential for a multiple-scattering theory (MST) based electronic structure calculation. Robust solver for this single site Green's function has been developed for non-relativistic system, as well as for spherical potential relativistic system, but works on a relativistic full potential (FP) solver are still unsatisfactory. Here, a new method to obtain this relativistic-FP Green's function in analogy with the non-relativistic MST has been implemented using the so called sine and cosine matrices technique. Compared to the previous relativistic-FP method, no matching on the boundary is needed and coupling of partial	Relativistic Single-Site Green's Function for Full Potential Scattering	Xianglin Liu, Markus Eisenbach, Yang Wang, G. Malcolm Stocks

		waves is not limited to $\Delta l=0$ in this new method. As an example, the density of states (DOS) of copper has been calculated using both integrals of the Green's function and the Krein theorem, and the agreement is shown. This work will be the basis for developing a MST based relativistic ab initio electronic structure calculation method.		
Jen-Feng Hsu	5	Diamond micro/nanocrystals, are trapped in a magnetic trap. This system of levitated diamond is pumped down to a partial vacuum of 10^-6 Torr with the aid of a position sensitive detection and feed-back cooling. This well-characterized mechanical system can potentially be useful for quantum measurement between mechanical and spin degrees of freedom.	Cooling and Self-Excitation of a Diamond Nanocrystal in a Magnetic Trap	Jen-Feng Hsu; Brian D'Urso, PhD
Megan Kirkendall	6	"Quantum simulation of important Hamiltonians could lead to new insights into quantum matter, for example, high-temperature superconductors. The 2DEG at the LaAlO3/SrTiO3 interface (1) exhibits a wide variety of phenomena, including a tunable	Probing Simulated 1D Quantum Materials Using Single Quantum Channels	Megan Kirkendall; Patrick Irvin, PhD; Hyungwoo Lee, PhD; Sangwoo Ryu, PhD; Chang-Beom Eom, PhD; Jeremy Levy, PhD

		metal-insulator transition, magnetism, strong spin-orbit coupling, and superconductivity. These properties can be controlled at extreme nanoscale dimensions using a conductive-AFM writing technique (2). Here, we describe experiments in which 1D lattice structures are created at the LaAlO3/SrTiO3 interface and investigated using low temperature magnetotransport. These devices will allow us to modify the effective interactions between Cooper pairs and quasiparticles in the lattice and represent an early demonstration of the potential of this solid-state quantum simulation platform. 1. A. Ohtomo and H.Y. Hwang, Nature 427, 423 (2004) 2. C. Cen et al., Nat. Mater. 7, 298 (2008)"		
Michelle Tomczyk	7	Pioneering advances in the growth and characterization of perovskite thin films have allowed the research motif of semiconductor heterostructures to be extended to strongly-correlated electron liquids. In contrast to high-mobility III-V heterostructures, which exhibit ballistic transport in the micrometer range, oxide	Micrometer-Scale Ballistic Transport in Complex-Oxide-Based Nanowires	Michelle Tomczyk; Guanglei Cheng, PhD; Jeremy Levy, PhD

		interfaces are diffusive with an orders-of-magnitude shorter two-dimensional coherence length, which appears to limit the range of observable quantum phenomena. We report evidence for micrometer-scale quantum interference in quasi-one-dimensional (quasi-1D) LaAlO3/SrTiO3 nanowire cavities. These cavities exhibit quasiperiodic conductance oscillations as a function of gating that are characteristic of few-mode Fabry-Perot quantum interference, indicating that the elastic scattering length exceeds that of the cavity. In the superconducting phase, the oscillations are strongly enhanced, leading to full modulation of the critical current. In the non-superconducting paired-electron state, quantum oscillations are suppressed in amplitude, but in-phase with those of the superconducting state. In the normal, unpaired phase, the conductance oscillations shift with applied magnetic field. The micrometer-scale quantum coherence, persisting in quasi-1D geometries in three distinct		

		correlated electronic phases of LaAlO3/SrTiO3, opens new opportunities for investigating quantum transport in strongly correlated mesoscopic systems.		
Mengchen Huang	8	We report the development and characterization of graphene/LaAlO3/SrTiO3 heterostructures. Complex-oxide heterostructures are created by pulsed laser deposition and are integrated with graphene using both mechanical exfoliation and transfer from chemical-vapor deposition on ultraflat copper substrates. Nanoscale control of the metal-insulator transition at the LaAlO3/SrTiO3 interface, achieved using conductive atomic force microscope lithography, is demonstrated to be possible through the graphene layer. LaAlO3/SrTiO3-based electric field effects using a graphene top gate are also demonstrated. The ability to create functional field-effect devices provides the potential of graphene-complex-oxide heterostructures for scientific and technological advancement.	Electric Field Effects in Graphene/LAALO3/SRTIO3 Heterostructures and Nanostructures	Mengchen Huang; Giriraj Jnawali, PhD; Jen-Feng Hsu; Shonali Dhingra, PhD; Hyungwoo Lee, PhD; Sangwoo Ryu, PhD; Feng Bi, PhD; Fereshte Ghahari, PhD; Jayakanth Ravichandran, PhD; Lu Chen; Philip Kim, PhD; Chang-Beom Eom, PhD; Brian D'Urso, PhD; Patrick Irvin, PhD
Lu Chen	9	Broadband terahertz (around 10 THz) generation and detection at 10 nm scales has recently been	Broadband THZ Spectroscopy of Single Nanoscale Objects	Lu Chen; Giriraj Jnawali, PhD; Mengcheng Huang; Hyungwoo Lee,PhD;

		demonstrated using LaAlO3/SrTiO3 nanostructures created by conductive atomic force microscope lithography. This unprecedented control of terahertz radiation, on a scale of four orders of magnitude smaller than the diffraction limit, provides a powerful technique to investigate a variety of nanoscale objects. Here we report broadband THz spectroscopy of single gold nanorod with plasmonic resonance in the near infrared. When light polarization is parallel to the long axis of the Au nanorod, both the THz signal and spectral amplitude enhanced a lot, which is related to the plasmonic coupling with induced THz radiation at the junction.		Sangwoo Ryu,PhD; Jacob P. Podkaminer; Chang-Beom Eom, PhD; Patrick Irvin, PhD; and Jeremy Levy, PhD
Qing Guo	10	The emergence of an in-plane ferromagnetic phase at LaAlO3/SrTiO3 interface as a function of mobile interfacial carrier density has been directly observed by using magnetic force microscopy (MFM). With Kerr rotation imaging technique, we can study the dynamics of the ferromagnetic domain by doing time-resolved experiments in both room temperature and low temperature.	Development of a Kerr Microscope for Imaging Interfacial Oxide Ferromagnetism	Qing Guo; Jianan Li; Feng Bi, PhD; Mengchen Huang; Chung-Wung, PhD; Chung-Wung Bark, PhD; Sangwoo Ryu, PhD; Chang-Beom Eom, PhD; Patrick Irvin, PhD; Jeremy Levy, PhD

Yun-Yi Pai	12	Conductiveatomic force microscope (cAFM) lithography can create a wide range of nanostructures based on the LaAlO /SrTiO system, including field effect transistors\footnote{C. Cen, S. Thiel, J. Mannhart, and J. Levy, Science \textbf{323}, 1026 (2009).} , singleelectron transistors\footnote{G. L. Cheng, \textit{et al.}, Nature Nanotechnology \textbf{6}, 343 (2011).} and superconducting nanoelectronics\footnote{J. P. Veazey, \textit{et al.}, Nanotechnology \textbf{24}, 375201 (2013).}. However, the operating range of gated devices is often limited by tunneling through insulating barriers. Using insitu Au deposited on top of LaAlO , we create vertical field-effect devices with significantly lower leakage due to the large bandgap of LaAlO. We describe the fabrication process for vertical fieldeffect nanodevices and show representative transport measurements both at room temperature and low temperatures.	LaAlO3/SrTiO3 Field Effect Nanodevices Using In-Situ Grown AU Top Gates	Yun-Yi Pai, Dong-Wook Park, Mengchen Huang, Anil Annadi, Hyungwoo Lee, Chang, Beom Eom, Patrick Irvin, Jeremy Levy
Yuhe Tang	13	“Coulomb Drag” experiment represents a powerful approach	1D Coulomb Drag	Yuhe Tang; Michelle Tomczyk; Mengchen Huang;

		for investigating electron correlations. Due to strong geometrical constraints of 1D systems and large low-temperature permittivity of SrTiO3, correlated transport in coupled LaAlO3/SrTiO3 nanowires should be especially interesting and it still remains unexplored within the context of quantum transport. Here we propose to examine 1D electronic correlations in a proximally coupled nanowire system. Two parallel nanowires will be created in LaAlO3/SrTiO3 heterointerfaces with C-AFM lithography. Coulomb drag measurements will be taken by injecting drive current (Idrive) in one wire (drive wire) and measuring the induced voltage in the other wire (drag wire) with a lock-in amplifier. There are numerous theories that can potentially be tested here, including Majorana edge states, which are predicted to emerge from strongly coupled nanowires in the absence of superconductivity. The preliminary writing test data has showed the possibility to create two parallel nanowires with an		Chung-Wung Bark, PhD; Sangwoo Ryu, PhD; Chang-Beom Eom, PhD; Patrick Irvin, PHD; Jeremy Levy, PhD

		interwire distance of 25nm. The ability to create strong correlations between distinct nanowire systems has potential relevance for future quantum technologies and translating fascinating ideas concerning topology and fractional charge into physical reality.		
Thomas Brinzer	14	Ionic liquids, or room temperature molten salts, have recently emerged as potential candidates for next-generation carbon capture solvents. Recently, we showed that carbon dioxide can be used as a vibrational probe for multidimensional ultrafast infrared spectroscopy experiments to extract ionic liquid solvent dynamics, using a series of 1-butyl-3-methylimidazolium ionic liquids as a test system. Here, we extend these spectroscopic methods to study the effects of imidazolium alkyl chain length and temperature on the relative timescales of anion and cation motion around carbon dioxide. An Arrhenius-type analysis suggests that the structure and dynamics of the CO2 solvation shell may change compared to	Chain Length and Temperature Effects on Solvation Dynamics of Carbon Dioxide in Ionic Liquids	Thomas Brinzer, Zhe Ren, Clinton Johnson, Sunayana Mitra, Emma Coate, Sean Garrett-Roe, PhD

		that of a charged analogue, thiocyanate (SCN-), when the imidazolium alkyl chain length becomes short. Such a change in solvation dynamics could have important implications for the transport properties (e.g., mass transport or conductivity) of short-chain ionic liquids. Additionally, by utilizing the bend-stretch coupling of CO2, we have been able to probe the temperature dependence of ultrafast CO2 bending mode fluctuations at equilibrium in real-time in these ionic liquids, information which has only previously been accessible using off-equilibrium vibrational energy relaxation measurements.		
Shivendra Tripathi	15	Graphene is the most intriguing material of the 21st century. It serves as the basis material for observing some of the most engrossing quantum phenomenon such as Quantum Hall Effect, Shubnikov-de Hass Oscillations to say a few, experimentally. LaAlO3/SrTiO3 (LAO/STO) is its contemporary with an equally wonderful range of fascinating physical phenomena, namely formation	Graphene on LaAlO3/SrTiO3 : Exploring Novel Phenomenon at Two Dimensions	Shivendra Tripathi, Giriraj Jnawali,PhD, Lu Chen, Mengcheng Huang, Jen-Feng Hsu, Brian D' Urso, PhD, Patrick Irvin, PhD, Jeremy Levy, PhD

		of two dimensional electron gas (2-DEG) at the interface of LAO/STO, Superconductivity and Ferromagnetism. In this work, we have tried to combine these two influential members of condensed matter physics, particularly in the past decade, by utilizing a novel approach of using Hyflon AD (2,2,4-trifluoro-5 trifluoromethoxy-1,3 dioxole) as a support layer for transferring and patterning Graphene on LAO/STO. Graphene Hall bar structure has been patterned using photo-lithography to study the transport and gating behavior in Graphene/LAO/STO system. Hyflon AD also doesn't seem to interfere with the local tuning of the LAO/STO interface between conductive and insulating state using our characteristic technique c-afm lithography. This approach opens up the possibility for the exploration of vast majority of phenomenon in Graphene-Complex oxide Heterostructures.		
Eric Berquist	17		Quantum Chemical Calculation of Electron Paramagnetic Resonance Parameters	Eric J. Berquist; Daniel S. Lambrecht, PhD
Michael Hartmann	18		Electronic Absorption Behavior of Gold and Gold-Copper Alloy	Michael Hartmann; Hannu Hakkinen, PhD; Jill E.

			Nanoclusters	Millstone, PhD; Daniel S. Lambrecht, PhD
Lauren Marbella	19		Controlling Nanoparticle Compositions Atom-by-Atom: Chemical Mechanisms of Noble Metal Nanoparticle Alloy Formation	Lauren E. Marbella and Jill E. Millstone
Tuguldur Odbadrakh	20		Vibrational Spectroscopy of the Charge Defect in Cryogenically Cooled H+(H2O)N=1,4,21	Tuguldur T. Odbadrakh; Kenneth D. Jordan, PhD; Joseph A. Fournier; Conrad T. Wolke; Mark A. Johson, PhD
Patrick Straney	21		Mechanisms of Metal Deposition on Colloidal Gold Nanoparticle Substrates	Patrick J. Straney; Lauren E. Marbella; Christopher M. Andolina, PhD; Thomas Nuhfer, PhD; Jill E. Millstone, PhD
Adam Argondizzo	22		Band Edge Carrier Dynamics in TIO2 Photocatalysis.	Adam Argondizzo; Hrvoje Petek, PhD
Cong Wang	23		Three Dimensional Coherent Multiphoton Photoemission Spectroscopy	Cong Wang, PhD candidate; Xuefeng Cui, PhD; Sean Garret-Roe, PhD; Hrvoje Petek, PhD
Guanglei Cheng	24		Electron Pairing Without Superconductivity	Guanglei Cheng, PhD, Michelle Tomczyk, Shicheng Lu, Josh Veazey, PhD, Mengchen Huang, Patrick Irvin, PhD, Sangwoo Ryu, PhD, Hyungwoo Lee, PhD, Chang-Beom Eom, PhD, C. Stephen Hellberg, PhD, Jeremy Levy, PhD.
Chitra Gautham	25		Time-Resolved Two-Photon Absorption of Polaritons	Chitra Gautham, MS, Mark Steger, MS, David Snoke, PhD, Ken West, PhD, Loren

				Pfeiffer, PhD
Bradley Slezak	28	It is suspected that a collection of bacteria, traveling in a solitary wave, will increase the temperature of their local surroundings. Considering the size of the wave (around 250 microns) and an expectation for a small temperature gradient, a sensitive temperature sensor with a small spatial footprint is necessary. The Nitrogen Vacancy Center in diamond has optically addressable spin states with a zero field splitting that is temperature dependent; these states can be coherently manipulated using a microwave field. By utilizing these properties in a nanometer-scale sized diamond, which can be completely immersed in the wave, we should be able to measure the temperature distribution with minimal disturbance to the system.	Prospects of Measuring the Temperature of a Bacterial Solitary Wave with Nitrogen Vacancy Centers	B.R. Slezak, V.P. Bhallamudi, P.C. Hammel, M.V. Gurudev Dutt
Mark Steger	29		Propagation of Long-Lived Polariton Condensates: A Means to Polariton Cats?	Mark Steger, MS;Chitra Gautham, MS; David Myers, MS; David Snoke, PhD; Loren Pfeiffer, PhD; Ken West, PhD
Binbin Tian	30		Landau Levels in Strained Optical Lattices	Binbin Tian, PhD candidate, Manuel Endres, Postdoc, David Pekker, Professor
Sylvia Ujwary	31	This project focused on the role	The Use of Self-Assembled	Sylvia Ujwary; Feng Bi, PhD;

		of self-assembled monolayers (SAMs) on organic field effect transistors (OFETs). Specifically, we were interested in understanding the mechanism for how SAMs affect the threshold voltage (Vth) of OFETs. SAMs often have a complex effect on the properties of OFETs; they can change both the threshold voltages of transistors as well as the charge of the carrier density and on/off current ratio. Therefore, the effect that SAMs have on OFETs is not completely understood.	Monolayers in Organic Field Effect Transistors	Jeremy Levy, PhD
Vikesh Siddhu	32		Additivity of Quantum Information Channels	Vikesh Siddhu, Robert B Griffiths, PhD
Ryan Sayer	33	Interactive tutorials which build on students' prior knowledge can be useful tools to enhance student learning of quantum mechanics. We have been investigating student difficulties with the quantum mechanics pertaining to the double-slit experiment in various situations. This poster will discuss the development and evaluation of a Quantum Interactive Learning Tutorial (QuILT) which makes use of an interactive simulation to improve student understanding. We summarize common	Developing and Evaluating a Tutorial on the Double-Slit Experiment	Ryan Sayer; Alexandru Maries, PhD; Chandralekha Singh, PhD

		difficulties and discuss the extent to which the QuILT is effective in addressing them in two types of courses.		
Emily Marshman	34	We are developing and evaluating a quantum interactive learning tutorial (QuILT) on a quantum eraser for students in upper-level quantum mechanics. The QuILT exposes students to contemporary topics in quantum mechanics and uses a guided approach to learning. It adapts existing visualization tools to help students build physical intuition about quantum phenomena and strives to help them develop the ability to apply quantum principles in physical situations. The quantum eraser apparatus in the gedanken experiments and simulations students learn from in the QuILT uses a Mach-Zehnder Interferometer with single photons. We also discuss findings from a preliminary in-class evaluation.	Developing a Quantum Interactive Learning Tutorial (QUILT) on a Quantum Eraser	Emily Marshman, PhD, Chandralekha Singh, PhD
Scott Crawford	35	Small gold nanoparticles (~144 – 314 gold atoms) exist at an exciting interface between molecular and metallic electronic structures. These particles have the potential to elucidate	Ligand-Mediated “Turn On,” High Quantum Yield Near-Infrared Emission in Small Gold Nanoparticles	Scott E. Crawford; Christopher M. Andolina, PhD; Ashley M. Smith; Lauren E. Marbella; Kathryn A. Johnston; Patrick J. Straney; Michael J.

		fundamental physical principles driving nanoscale phenomena and to be useful in a wide range of applications. Here, we study the optoelectronic properties of aqueous, phosphine-terminated gold nanoparticles (core diameter = 1.7 ± 0.4 nm) after ligand exchange with a variety of sulfur-containing ligands. No emission is observed from these particles prior to ligand exchange, however the introduction of sulfur-containing ligands initiates photoluminescence. Further, small changes in sulfur substituents produce significant changes in nanoparticle photoluminescence features including quantum yield, which ranges from 0.14 to 3.81% depending on substituent. Interestingly, smaller ligands produce the most intense, highest energy, narrowest, and longest-lived emissions. Radiative lifetime measurements for these gold nanoparticle conjugates range from 44 to 2590 µs, indicating that even minor changes to the ligand substituent fundamentally alter the electronic properties of the		Hartmann; Jill E. Millstone, PhD

		luminophore itself. These results clarify the critical role of surface chemistry in the luminescence of small metal nanoparticles, and largely rule out other possible mechanisms such as discrete (Au(I)-S-R)n¬ impurities or differences in ligand densities and/or core diameters. Taken together, these experiments provide important mechanistic insight into the relationship between gold nanoparticle near infrared emission and pendant ligand architectures, as well as demonstrate the pivotal role of metal nanoparticle surface chemistry to tune and optimize emergent optoelectronic properties from these nanostructures.		
Mitchell Groenenboom	36	Sodium borohydride (NaBH4) is a common chemical reducing agent with applications ranging from pharmaceuticals to fuel cells. Recent investigations have found that NaBH4 and its derivatives can also reduce carbon dioxide into formate in aqueous solutions. In order to elucidate these aqueous phase mechanisms, we characterized reaction processes involving hydride transfers from BH4– and	Aqueous Phase CO2 Reduction with Sodium Borohydride: An Ab Initio Molecular Dynamics and Nudged-Elastic Band Mechanistic Study	Mitchell C. Groenenboom; Yinan Kang; Kyle A. Grice, PhD; John A. Keith, PhD

		BH3OH– to CO2 using a methodology combining Nudged-Elastic Band (NEB) methods with ab initio molecular dynamics (AIMD) simulations. Hydride donation from BH4– occurs through a two-step mechanism with activation barriers of 11 and 5 kcal/mol, respectively. BH3OH– hydride donation has significantly lower activation energy of 4 kcal/mol via a dissociative Sn1 mechanism. These studies provide mechanistic insight into aqueous phase CO2 reduction with strong hydride donors.		
Jindong Ren	37	The Kondo effect, a widely studied phenomenon in which the scattering of conduction electrons by magnetic impurities increases as the temperature T is lowered, depends strongly on the density of states at the Fermi energy. It has been predicted by theory that magnetic impurities on free-standing monolayer graphene exhibit the Kondo effect and that control of the density of states at the Fermi level by external means can be used to switch the effect on and off. However, though transport data for Co adatoms on	Experimental Observation of Kondo Effect for Magnetic Adatoms on a Monolayer Graphene	Jindong Ren, PhD; Haiming Guo, PhD; Jinbo Pan, PhD; Yu Yang Zhang, PhD; Xu Wu, PhD; Hong-Gang Luo, PhD; Shixuan Du, PhD; Sokrates T. Pantelides, PhD; Hong-Jun Gao , PhD

		graphene monolayers on several substrates have been reported, there exists no evidence for a Kondo effect. Here we probe the role of the substrate on the Kondo effect of Co on graphene by combining low-temperature scanning tunneling microscopy and spectroscopy measurements with density-functional-theory calculations. We use a Ru(0001) substrate which is known to cause graphene to ripple, yielding a moiré superlattice. The experimental data show a sharp Kondo resonance peak near the Fermi energy from only Co adatoms at the edge of atop regions of the moiré pattern. The theoretical results show that the variation of the distance from the graphene to the Ru substrate, which controls the spin polarization and local density of states at the Fermi energy, is the key factor for the appearance of the Kondo resonance. The results suggest that rippling of graphene by suitable substrates is an additional lever for tuning and selectively switching the appearance of the Kondo effect.		
Anil Annadi	38	I will describe research in our	Superconductivity in LAO/STO	Anil Annadi

		group on superconductivity in LAO/STO nanowires: dimensionality and crystallographic perspective.	Nanowires: Dimensionality and Crystallographic Perspective	
Olivia Lanes	39	Once operational, the Hatridge Lab will focus its research on superconducting microwave circuits as a quantum information platform. We first construct experiments to prove the feasibility of microwave photons as flying quantum bits (qubits) and, eventually, use them to entangle larger systems of stationary Josephson-junction (JJ) based superconducting qubits. To do this, we will need to amplify microwave signals efficiently and coherently, so that the information content of the light may be extracted. We will develop JJ-powered superconducting parametric amplifiers, focusing on achieving performance close to the quantum limit.	Quantum Information with Flying Coherent States	Olivia Lanes, Tzu-Chiao;MS,Xi Cao;MS, Michael Hatridge; PhD
Wattaka Sitaputra	41	Surfaces of a homoepitaxially grown TiO2-terminated SrTiO3(001) layer were studied in situ with scanning tunneling microscopy/spectroscopy. It was found that arrays of nano-scale lines which are electronic by nature were formed on the	Effects of Oxygen Stoichiometry on Topographic Imaging of TiO2-Terminated SrTiO3(001) Surfaces by Scanning Tunneling Microscopy	Wattaka Sitaputra, PhD; Randall M. Feenstra, PhD; Marek Skowronski, PhD

		surfaces grown with a very slightly Ti-rich and oxygen deficient condition. A contrast of these lines depend strongly on tunneling bias and oxygen partial pressure during the growth. At the same bias voltage, these lines can appear with dark or bright contrast depending on oxygen pressure during the growth. On the other hand, with the same oxygen partial pressure, the line can also turn bright or dark depending on the bias voltage. These features are believed to originate from a varying oxygen stoichiometry across the surface which cause atomic rumples and a difference in local density of states, unlike an additional layer of atoms as in the case of previously observed nanolines.		
Devashish Gopalan	42	Graphene-covered copper surfaces have been exposed to borazine, (BH)3(NH)3, with the resulting surfaces characterized by low-energy electron microscopy. Although the intent of the experiment was to form hexagonal boron nitride (h-BN) on top of the graphene, such layers were not obtained. Rather, in isolated surface areas, h-BN is found to form micrometer-size	Formation of Hexagonal Boron Nitride on Graphene-Covered Copper Surfaces	Devashish P. Gopalan; Patrick C. Mende; Sergio C. de la Barrera; Shonali Dhingra; Jun Li; Kehao Zhang; Nicholas A. Simonson; Joshua A. Robinson; Ning Lu; Qingxiao Wang; Moon J. Kim; Brian D'Urso; Randall M. Feenstra

		islands that substitute for the graphene. Additionally, over nearly the entire surface, the properties of the layer that was originally graphene is observed to change in a manner that is consistent with the formation of a mixed h-BN/graphene alloy, i.e. h-BNC alloy. Furthermore, following the deposition of the borazine, a small fraction of the surface is found to consist of bare copper, indicating etching of the overlying graphene. The inability to form h-BN layers on top of graphene is discussed in terms of the catalytic behavior of the underlying copper surface and the decomposition of the borazine on top of the graphene.		
Jun Li	44	We extend our previous model for graphene-based SymFETs to simulation of tunneling current in vertical 2D transition metal dichalcogenide (TMD) heterostructures. Two tunneling modes, which we denote like-band tunneling and unlike-band tunneling, are identified and explained. NDR and steep I-V slope were predicted, in agreement with prior theoretical results from Xing and from Vogel. Simulation of recent	Simulation of Tunneling Characteristics in Vertical TMD Heterostructures	Jun Li, Sergio de la Barrera, Randall Feenstra, PhD

		experimental results were performed. Qualitative agreement was found, with discrepancies explained and challenges in the simulation clarified. A new model is proposed to interpret the recent I-V results for WSe2/epitaxial graphene from Prof. Robinson's group, based on our recent low-energy electron microscopy (LEEM) measurements.		
Patrick Irvin	47	A probe microscope allows one to scan a physical probe near a surface and is suitable for measuring a variety of types of fields and forces. Here we present a scanning probe microscope integrated with a dilution refrigerator that is designed to operate at milliKelvin temperatures in high magnetic fields. In addition to being used as an atomic force microscope to measure sample topography, the microscope can be used as a "scanning gate" to locally perturb samples.	MilliKelvin Scanning Probe Microscope	Patrick Irvin, PhD, Yun-Yi Pai, Megan Kirkendall, Jeremy Levy
Darshil Gala	48	Electro-forming of resistive devices is the one-time programming step that transforms a uniformly conducting structure into a filamentary-switching memory	Investigation of Threshold Switching in TaOx -based RRAM Devices Using Transient Thermometry at Low Temperatures	Darshil K. Gala,Masters Student, Abhishek A. Sharma,PhD Student; Dasheng Li, Masters Student; Jonathan M. Goodwill, PhD Student; James A. Bain, PhD;

		device. One of the challenges that Resistive Random Access Memories (RRAM) face is the lack of understanding and control of this process. The characteristics of TiN/Ta/TaOx/TiN resistive-switching crossbar devices with amorphous 88 nm TaOx functional layer have been investigated at low temperatures. Quasi-DC I-V characteristics have been measured for stage temperatures in the 10-300 K range (the true device temperature is higher due to Joule heating). At all temperatures, the I-V curves show an S-type negative differential resistance region and a "snap" corresponding to threshold switching. We determine the true temperature of the device right before the current flow constriction. The true device temperature extracted at the point of switching using a transient thermometry was 150 K for a stage temperature of 10 K. Widely accepted interpretation of the electro-formation is the creation and diffusion of oxygen		Marek Skowronski, PhD

		vacancies resulting in a narrow metallic filament. The activation energies of vacancy diffusion are 1.0±0.1 eV. The corresponding jump frequency at 150 K is 10-20 s-1, implying that the oxygen vacancies will only move once between atomic sites every 1020 s. This clearly eliminates vacancies as taking part in the initial filamentation. To further explore the mechanisms that are involved in the transient filament formation event, we measure the incubation times associated with the forming process at different stage temperatures indicate that the thermal activation is minimal between 10 K and 100 K.		
Sheng Huang	49	3D nonlinear waveguide array in chalcognide glasses toward photonic topologic insulator.	3D Non-Linear Waveguide Array in Chalcognide Glasses toward Photonic Topologic Insulator	Sheng Huang, Ya-wen Huang, Kevin Chen
Kevin Gasperich	51	Fixed-node diffusion Monte Carlo (DMC) is a relatively low-scaling method (~$O(N^3)$) that can be used to accurately calculate energies of systems that are too large to address with other post-Hartree-Fock techniques. DMC yields the exact energy (within a systematically-improvable statistical uncertainty) of a system whose wave function has	Diffusion Monte Carlo Trial Wave Functions for Multireference Systems	Kevin E. Gasperich; Michael J. Deible, PhD; Melody Kessler; Kenneth D. Jordan, PhD

		a given nodal surface. DMC is thus a very useful tool for systems whose true nodal surfaces can be closely-approximated. For systems with strong multireference character, it often becomes more difficult to describe a 'good' nodal surface (i.e., one that resembles the true nodal surface and produces an accurate DMC energy). Small systems which illustrate this behavior are square-planar H_4 and the beryllium atom and dimer. We evaluate several trial wave functions for these systems to develop a better understanding of the nodes of multireference systems.		
Edward Beall	52	Single molecule conductance measurements utilizing the application of AC voltage were shown to improve the signal-to-noise ratio of low current (low conductance) measurements as compared to the DC bias method. The modulated bias protocol is being used to determine the single molecule conductance of nucleic acid homo- and heteroduplexes, with the long-term goal of studying redox-active moieties in precise	A Scanning Tunneling Microscope Break Junction Method with Continuous Bias Modulation	Edward Beall; Xing Yin, PhD; David Waldeck, PhD; Emil Wierzbinski, PhD

		3D arrangements on nucleic acid scaffolds. In addition to improved signal-to-noise, our preliminary results indicate that the AC method can be used to reveal dynamics during molecular junction formation.		
Jonghan Kwon	53	Bipolar resistive switching in oxide-based devices (metal/oxide/metal) has attracted widespread attention in recent years due to its potential application in next generation nonvolatile memory technology. The devices exhibit two non-volatile resistance states and switching between them can be accomplished by application of electrical pulses with opposite polarities. The low-resistance state is attributed to the formation of a conductive path that connects both electrodes. The high-resistance state corresponds to a rupture of this path, forming a high-resistance gap. Although extensive research has been conducted to understand nature of the resistive switching, the switching mechanisms are still debatable. Here, we adopt an in situ biasing transmission electron microscopy (TEM) technique to	State-of-the-Art Characterization of Bipolar Resistive Switches	Jonghan Kwon, PhD student; Abhishek A. Sharma, PhD student; Yoosuf N. Picard, PhD; James A. Bain, PhD; Marek Skowronski, PhD

		report microstructural changes associated with resistive switching events using a model TiO2-based resistive switch. Also, we studied microstructural changes occurring under constant electrical bias and demonstrate unambiguous evidences of three elementary processes essential for switching: (i) creation of oxygen vacancies by electrochemical reactions at low temperatures (<150 oC), (ii) their drift in the electric field, and (iii) their coalescence into planar faults (and dissociation from them). Furthermore, we used an in situ biasing electron holography to provide direct visualization of potential/charge distribution in the nano-scale RRAM devices. These advanced electron microscopy based characterization will shed light on revealing the underlying switching/failure mechanisms of resistive switches, thereby promoting its eventual commercialization.		
Gage Tiber	54	A wavemeter measures the wavelength of a laser. Our design is a Michaelson Interferometer with mirrors that travel along the beams by 26 cm, causing the	Part-Per-Million Resolution Optical Wavemeter	Gage Tiber;Robert Brooke; Timothy Ireland; Isaac Davies; Julie Gillis; Chris Zaccagnini; Theodore Corcovilos, PhD

		optical path length of the interferometer arms to change, and creating about 1 million interference fringe oscillations. These oscillations are detected with a photodiode and counted using digital circuitry. Using a temperature-stabilized Helium-Neon reference laser with accurately known wavelength, an unknown laser's wavelength can be determined with part-per-million resolution by comparing the number of fringes of the two lasers. We control the wavemeter using an Arduino microcontroller which runs the mirror motor, calculates the wavelength from the fringe measurement, and displays the results. We also use digital temperature, pressure, and humidity sensors to correct for the index of refraction of air, giving us the true vacuum wavelength of the unknown laser. Here, we describe the optical, electronic, and mechanical aspects of the wavemeter design.		
Robert Brooke	55	Arduino is an inexpensive open-source micro-controller platform designed for quick development and easy interfacing, making it	Arduino-Based Laboratory Instruments for an Undergraduate Laser Cooling Experiment	Robert W.A. Brooke, Isaac Davies, Timothy Ireland, Gage Tiber, Julie M. Gillis, Theodore A. Corcovilos, PhD

		ideal for novice programmers and instrument designers. Arduino boards have analog inputs, digital I/O pins, pulse width modulated outputs, and serial communication capabilities. The boards are programmed with standard C/C++ code. The Arduino streamlines the design of both analog and digital data acquisition and control when compared to circuits using discrete components and is powerful enough to run complex algorithms and control routines. Most importantly, Arduino is flexible enough with its versatile inputs and outputs for a wide variety of instrument designs, is fast enough and has a high enough resolution for research-quality instruments, and allows instruments to be built well below their commercial cost. We present several instruments that showcase the versatility of the Arduino platform: a temperature controller, a laser stabilizer, an optical wavelength meter, and a UV fluorometer.		
Yasemin Basdogan	56	The ever-increasing global production of greenhouse gases prompts the urgent need for	Toward Ab Initio Modeling of CO2 and Electroreduction on α-Sn, β-Sn, and SnO2 Particles	Yasemin Basdogan; James Dean; Karthikeyan Saravanan; John A. Keith,

		conversion into less-harmful substances. Energetically efficient electrochemical conversion of CO2 into other, more useful products has been a hot topic of recent research. Previous investigations by Bocarsly et al. reported noticeably low overpotentials for CO2 conversions to formate on polycrystalline tin electrodes. Interestingly, electrochemical conditions were found to promote the formation of tin oxide overlayers on the electrode surface, and these surfaces have been attributed to the catalysis of CO2. As a starting point toward in situ computational modeling of this system, we carried out density functional theory calculations to determine various tin and tin oxide structures that would be energetically accessible at electrochemical reaction conditions via Pourbaix diagrams. We report convergence criteria necessary for ab initio modeling of electrochemical reactions on these surfaces. Future work will address the adsorption energies of CO2 reduction reaction intermediates and mechanisms.		PhD

Qian Sun	57	The release of double-stranded DNA (dsDNA) after oxidative stress leads to inflammasome maturation. Activation of AIM2 inflammasome and caspase-1 in mouse hepatocytes (HCs) was previously shown by us to play a protective role by up-regulating mitophagy after redox stress. After redox stress, cytoplasmic HMGB1 was known to up-regulate autophagy and serve as a protective mechanism against mitochondrial dysfunction. Here, we hypothesize that HMGB1 interacts with AIM2 to activate caspase-1-mediated mitophagy in HCs. Results: Hypoxia/reoxygenation triggered enhanced association between AIM2 and HMGB1, as well as increased caspase-1 activity in WT HCs, but not in HC-HMGB1-/- cells, suggesting a role for HMGB1 in regulating caspase-1. Autophagy levels were increased in WT HCs after hypoxia/reoxygenation. Similar to our previous results in AIM2-/- HCs, HC-HMGB1-/- HCs showed impaired autophagic flux and increased mitochondrial volume compared with WT after hypoxia/reoxygenation,	HMGB1 Interact with AIM2 to Upregulate Autophagy and Prevent Hepatocytes from Cell Death After Redox Stress	Qian Sun, PhD, Timothy R Billiar, MD, Melanie J Scott, PhD

		suggesting a role for HMGB1 in up-regulating mitophagy. HC-HMGB1-/- HCs also showed increased apoptosis/necrosis in comparison with WT, confirming a protective role of HMGB1. Conclusion: Our data suggested that HMGB1 plays a protective role in HCs by upregulating mitophagy through interacting with AIM2. Our study links HMGB1 with AIM2 and stress-induced autophagy, which improves our understanding of how adaptive responses are regulated after redox stress.		
Dominique Barbeau	58	All double-stranded DNA bacteriophages encode a specialized set of proteins that allows progeny phages to escape the current host cell at the end of the lytic cycle. At a minimum, this lytic cassette consists of a holin and an endolysin. The mycobacteriophages encode an additional lytic protein, a lysterase, in order to overcome the waxy, mycolic acid-rich cell wall of their mycobacterial hosts. These lytic enzymes may have therapeutic potential, as previous work has shown that both endolysins and lysterases have antimicrobial activity on	Exploring the Antimicrobial Activity of the Mycobacteriophage-Encoded Lysterases	Dominique J. Barbeau, BA; Graham F. Hatfull, PhD

		their native host species when added exogenously. However, for the vast majority of endolysins studied, these proteins have only antimicrobial activity on the native hosts of the bacteriophages that encode them. Lysterases have never been tested on bacteria outside of the mycobacteria until now. Here we show that two lysterases have antimicrobial activity on a range of bacteria, and we begin investigating novel lysterase target molecules, as some of the susceptible bacteria, such as Propionibacterium acnes, lack the known mycolic acid-containing targets.		
Zachary Swan Sigma Xi awardee	59	The relative impact of HIV infection on recruitment and function of mononuclear phagocytes, particularly macrophages, in lymphoid and gut tissues remains ill-defined. Here we did cross-sectional analyses of myeloid DC (mDC), CD103+ DC, plasmacytoid DC (pDC) and macrophages in LN and ileum of rhesus macaques with acute and chronic SIV infection and AIDS. In LN significant differences were only evident when comparing	Macrophage Accumulation in Gut Mucosa Correlates with Disease Progression in SIV-Infected Rhesus Macaques	Zachary D. Swan, M.S.; Elizabeth R. Wonderlich, Ph.D.; Simon M. Barratt-Boyes, Ph.D.;

		uninfected and AIDS groups, with loss of mDC and CD103+ DC from peripheral and mesenteric LN, respectively, and accumulation of pDC and macrophages in mesenteric LN. In contrast, there were 4-fold more CD163+ macrophages in lamina propria and 40-fold more CD163+ macrophages in Peyer's patches in ileum of macaques with AIDS compared to chronic infection lacking disease. Macrophages exceeded pDC and CD103+ DC by 10- to 17-fold in ileum of monkeys with AIDS but were at similar frequencies as DC in chronic infection. Gut macrophages in macaques with AIDS expressed IFN-α and TNF-α consistent with cell activation. CD163+ macrophages also accumulated in gut in acute infection but lacked expression of IFN-α and TNF-α. These data reveal a strong relationship between inflammatory macrophage accumulation in gut mucosa and disease and suggest a role for macrophages in AIDS pathogenesis.		
Hillary Cleveland-Rubeor	60	In the developing embryo, sheets of polarized epithelial cells undergo changes in shape and	Bundle Up Actin1 Investigation of Actin Bundling by Shroom	Hillary Cleveland-Rubeor, BA; Ryan Corbo, BS; Andrew P. VanDemark, Ph.D.; Jeffery

		organization to form complex structures such as branched tubule networks and the central nervous system. Apical constriction and convergent extension are some cellular behaviors that drive morphological changes of the developing embryo. The Shroom proteins are at the center of these changes to cell morphology through organized re-arrangement of the actin cytoskeleton. Shroom proteins directly bind actin with the Shroom Domain 1 (SD1). Rock is recruited to actin through direct binding with Shrm's SD2, where Rock phosphorylates non-muscle Myosin II, leading to contractility of actin. Shrm2, Shrm3 and Shrm4 all localize to different populations of actin within different cell types. We have found that in addition to binding actin, Shrms cause F-actin strands to bundle into larger cords. Early stages of bundling show an ordered helical structure. More dense bundles exhibit a less ordered architecture. While Cryo-EM has been used to solve the structure of F-actin, as well as proteins in		D. Hildebrand, Ph.D.

		complex with F-actin, to this date there are no structures of bundled actin. We will use Cryo-EM, to solve the structure of bundled actin bound by the SD1 of Shrms.		
Zhiwei Feng	61	Transient receptor potential vanilloid type 1 (TRPV1), a heat-sensitive calcium channel protein, is considered to be in the hub of neuron inflammatory signal pathways, and is one of the most potential therapeutic targets for neuroinflammation. We obtained a series of diarylurea analogues against human TRPV1 through pharmacophore search, of which eleven compounds showed superior activity at low to nM range. Then, we utilized molecular docking to explore the detailed interaction between TRPV1 and these compounds. Particularly, we identified key residues of TRPV1 that played important roles for the recognition of these small molecules. Interestingly, the R2 group replaced by para-fluoro led the antagonist to a partial agonist, which was further validated by our short term molecular dynamics (MD)	Multifunctional Diarylurea Small Molecules as Modulators of Inflammatory Pathways with Potential Therapeutics for Neuroinflammation	Zhiwei Feng, PhD; Shifan Ma, MS; Yu Zhang, MS; Ziheng Hu, MS; Peng Yang, PhD; Qin Tong, MD; Lirong Wang, PhD; Xiangqun Xie, PhD

		simulation. Importantly, compound 14, our best TRPV1 antagonist, also showed moderate binding to the cannabinoid receptor 2 (CB2), which is also an attractive target for immune diseases. In addition, compound 1 and some diarylurea analogues were predicted to target at C-X-C chemokine receptor 2 (CXCR2) for potential therapy of chronic inflammatory diseases. These findings provide novel strategies of simultaneously targeting two or more inflammation-related proteins for the treatment of a range of inflammatory disorders including neuro-inflammation and neurodegenerative diseases with synergistic effect.		
Yu Zhang	62	Stem cell has been known as a popular target for drug discovery due to its fundamental role in regenerative medicine and organ integrity maintenance. The fate of stem cells is mainly determined by the cell cycle process. Proper cell cycle progression is guaranteed by regulation of cyclin-dependent kinases (CDKs) via activation by binding with cyclins and inhibition by binding with CDK	Novel Agonists Targeting Protein-Protein Interface of INK4C for Hematopoietic Stem Cell Expansion	Yu Zhang, MS; Zhiwei Feng, PhD; Shifan Ma, MS; Ziheng Hu, MS; Tao Cheng, PhD; Yingdai Gao, PhD; Peng Yang, PhD; Xiangqun Xie, PhD

		inhibitors (CKIs). It has been reported that the Protein-Protein Interactions (PPI) of the INK4(CKI)-CDK4/6-cyclinD complex plays a significant role in cell cycle regulation, especially for hematopoietic stem cell (HSC). PPI, once considered 'undruggable' because of their flat interfaces and lack of deep binding sites, are now regarded as one of the most potential targets for the next generation of therapeutic treatment. In this work, we performed computational modeling of the PPI between p18 and CDK6, and carried out virtual screening for inhibitors of the PPI. Biological assays utilizing either mouse or human HSC also showed that these small molecule PPI inhibitors have inhibitory activity against p18. These results could help us understand more about the role of PPI small molecules in HSC regulation.		
Huong Tran	63	Elevated intraocular pressure (IOP) is the main risk factor for glaucoma. However, the effects of IOP on the optic nerve head (ONH) in-vivo and how it leads to neural tissue damage remain poorly understood. Our goal was	In-Vivo Intraocular Pressure Changes Cause Non-Linear Deformations of Optic Nerve Head Structures	Huong Tran, BS ; Jeremy Teichmann, BS; Andrew Voorhees, PhD; Jacob Wallace, BS; Jennifer Ten Eyck, BS; David Tsui, BS; Jon R. Drobitch, BS; Yiyao Shi, BS; William Walters, BS; Bo

		to measure in-vivo deformations of ONH resulting from acute changes in IOP. ONHs of 3 monkeys were scanned with optical coherence tomography (OCT) across 4 IOP levels. Anterior lamina cribrosa (ALC) and scleral canal at Bruch's membrane opening (BMO) were manually marked. Matlab routines were used to determine the BMO major and minor axes and median ALC depth. Increasing IOP in-vivo deformed the scleral canal and LC in a non-linear fashion. Increasing IOP from 5-8 mmHg to 15 mmHg contracted the scleral canal and brought the LC further away from the scleral canal in all 3 eyes. Elevating IOP from 15 to 30 mmHg continued to contract the scleral canal while displacing the LC more anteriorly in 2 out of 3 eyes. Increasing IOP from 30 to 50 mmHg changed the shape of scleral canal while moving 2 out of 3 LCs shallower. Future studies will include more monkeys and IOP levels to obtain a more comprehensive understanding of pressure-induced deformations in glaucoma.		Wang, BS; Matthew A. Smith, PhD; Elizabeth Tyler-Kabara, MD; Joel S. Schuma
Zhihao Sun	64	In eukaryotes, about one third of	Examining the Endoplasmic Reticulum	Zhihao Sun, G. Michael

		all the proteins are synthesized at the endoplasmic reticulum (ER). Due to errors in post-translational processes, protein misfolding occurs frequently. To maintain ER homeostasis, eukaryotes have evolved a quality control (QC) mechanism termed ER-associated degradation (ERAD) to degrade misfolded proteins. Although most aberrant proteins in the ER are degraded by ERAD, some can still escape ERAD and are degraded by vacuolar proteases after delivery from the ER. However, it remains elusive how these substrates escape ERAD. To address this, we constructed a malfolded membrane protein SZ* with a well-characterized ERAD signal to investigate how proteins are chosen for ERAD or post-ERQC. Initial characterization shows that SZ* is degraded by both the proteasome and vacuolar proteases. Both the ER-resident E3 ligase Doa10 and a cytosolic E3 ligase Rsp5 are involved in degradation of SZ* indicating two QC checkpoints: ERAD by Doa10 and post-ERQC by Rsp5. Surprisingly, increasing the	Quality Control Checkpoint with a Novel Model Substrate	Preston, and Jeffrey Brodsky, PhD

		expression level increases the targeting of SZ* to ERAD, which negatively correlates with the detergent solubility of the protein. Based on these results, we hypothesize that the ERAD machinery selects aberrant membrane proteins with high aggregation propensity while those with lower aggregation propensity are targeted for post-ERQC.		
Meghan Sullivan	65	Defects in DNA repair genes cause genomic instability, a hallmark of cancer. Homologous recombination (HR) is a major pathway for the repair of DNA double-strand breaks (DSBs). Germline mutations in genes encoding several key proteins in HR, including the RAD51 paralogs, have been linked to hereditary cancers. The RAD51 paralogs are known to interact with RAD51 through two discrete complexes, RAD51B-RAD51C-RAD51D-XRCC2 (BCDX2) and RAD51C-XRCC3 (CX3). The distinct roles of the BCDX2 and CX3 complexes within HR, however, remain unclear. RAD51C is unique among the RAD51 paralogs, as the sole paralog in both complexes.	Cancer-Associated RAD51C Mutations Disrupt Homologous Recombination Complexes	Meghan R. Sullivan, Stefanie Böhm PhD, Jared Baird, Stephen K. Godin, and Kara A Bernstein PhD

		Additionally, RAD51C has been described in a third novel HR complex, PALB2-RAD51-RAD51C-BRCA2. By studying somatic and germline mutations in RAD51C linked to cancer, we sought to understand how they impair HR. Through yeast-two/three-hybrid and co-immunoprecipitation experiments, we isolated RAD51C mutations that disrupt interactions within the BCDX2, CX3, or PALB2-RAD51-RAD51C-BRCA2 complexes. The cancer-associated mutations that differentially disrupted one or two of the three complexes can be used to isolate the individual roles of BCDX2, CX3, and PALB2-RAD51-RAD51C-BRCA2 within HR.		
Ann-Catherine Stanton	66	Bacteriophages have to compete against one another to infect the same host cell when there are large amounts of phage present. There are multiple different aspects that can influence whether a phage outcompetes another or not, including burst size, size of the genome, and lifestyle. To begin to explore this competition in a laboratory environment, the same amount of two different phages were	Mycobacteriophage U2 Outcompetes Cluster C1 Phages MOMO, LRRHOOD, and ALICE	Ann-Catherine Stanton; Welkin H. Pope, PhD; Deborah Jacobs-Sera; Graham F. Hatfull, PhD

		added to the same culture of Mycobacterium smegmatis mc2 155; the number of plaque forming units and the optical density of the culture were followed throughout the experiments. In three parallel experiments, Subcluster A1 phage U2 competed against Subcluster C1 Momo, LRRHood, and Alice. The preliminary data shows that U2 outnumbered the other phages by one order of magnitude. This may be due to U2's smaller genome size, or its ability to adsorb better. An unexpected result is that U2 appears to have formed a temperate version of itself by repairing its immunity repressor through homologous recombination with LRRHood or Alice. In the future, experiments will be done using different phages, and will be extended for a longer period of time.		
Christian Gauthier	67	Bladder pain and frequent micturition are symptoms commonly encountered in patients with interstitial cystitis and incontinence. An underlying mechanism for these symptoms is abnormal processing of sensory stimuli from the urinary	Specialized Sensory Cells in the Urethral Epithelium	Christian Gauthier; F. Aura Kullmann, PhD

		tract to the central nervous system (CNS). Sensory input from the urethra (flow, stretch, irritation, infection) is critical to bladder function. However it is not understood how information from the urethra is detected and transmitted to the CNS. We hypothesize that specialized paraneurons within the urethral epithelium can detect and transmit specific sensory information. Our research characterized a class of paraneurons distinguished by their serotonergic (5HT) content, employing immunohistochemistry and confocal microscopy techniques in rodent urethral tissue. Paraneurons, epithelial cells and sensory nerve fibers were stained using specific antibodies against 5HT, cytokeratin 17 and CGRP, respectively. We found 5HT cells distributed along the entire urethral epithelium with highest density in the mid urethra. Morphology differences were noted between regions of the urethra: proximal and distal urethrae had 5HT cells with short dendrites in seemingly random orientation; mid urethrae had		

		larger cells with elongated dendrites. Sensory nerve fibers wrapped around all cells and appeared to form synapses, suggesting that serotonergic paraneurons may participate in detection and transmission of sensory information.		
Lu Yang	68	Maintenance of telomere integrity is important to prevent cancer and premature aging. However, how DNA damage at telomeres is repaired is largely unknown. KillerRed is a unique fluorescent protein which can induce reactive oxygen species on light illumination. Here, by fusing KillerRed to TRF1, we could induce oxidative DNA damage specifically at telomeres. Repair of oxidized base damage or single-strand breaks (SSBs) is initated by PARP1, which is a DNA nick sensor protein. PARP1 binds to the nick efficiently and synthesizes poly(ADP-ribose) (PAR) to facilitate DNA repair. Surprisingly, we found that poly(ADP)ribosyaltion at telomeres is largely dependent on tankyrase1 but not PARP1. Tankyrase1 is recruited to damage sites at telomeres efficiently to facilitate	Telomere DNA Damage Repair is Initiated by Tankyrase1-Mediated Poly-ADP-Ribosylation	Lu Yang ,Luxi Sun, Rong Tan, Ying Gao, Patricia Lynn Opresko, Arthur S. Levine, Li Lan, Satoshi Nakajima.

		poly(ADP)ribosylation of TRF1 after damage. And this PAR signal could further recruit repair proteins to the damage sites. Treatment of either siTNKS1 or TNKS inhibitors inhibits PARyaltion of TRF1 and the recruitment of repair proteins. Our data have uncovered a novel function of tankyrase1 to initiate DNA repair at telomeres		
Zain Mehdi	69	Extracellular matrix (ECM) is the microenvironment within the body that that is critical for maintaining homeostasis. Its dysregulation influences neoplastic progression in many cancer types, including malignant glioma. The complex network of proteins and macromolecules arranged in tissue-specific architecture plays a crucial role in glioma metastases and proliferation. Emerging evidence suggests that ECM can drive phenotypic plasticity of macrophages across the M1/M2 spectrum. Therefore, we sought to investigate if ECM derived from glioma tissue retains distinct biochemical and physical properties that can regulate macrophage phenotype during glioma progression.	Role of ECM and Macrophages in Glioblastoma Progression	

		Furthermore, understanding this role may help understand effective methods of treating the incurable glioblastoma as well as other cancer types.		
Jose Posada	70	Hospital readmissions are costive and potentially preventable. Approximately 3.3 million of adult patients were readmitted to hospitals within 30 days of discharge in 2011 with an estimated cost for the hospitals of 3.3 billion dollars according to the Center for Medicare and Medicaid Services. Up to 79% of readmissions can be potentially preventable. Most current tools for predicting 30-day readmissions only rely on structured data such as the number of inpatient visits in the last 6 months, demographic information, etc. However, most detailed patient symptoms, findings and diagnosis are locked in clinicians' reports that are in free-text form. We have developed the System for Hospital Adaptive Readmission Prediction and Management system (SHARP) that employs cTAKES, an open-source natural language processing (NLP) platform, to extract clinical	Inpatient 30-Day Readmission Prediction Using cTAKES	Jose D. Posada and Fuchiang (Rich) Tsui

		findings from clinicians' reports, and applies machine-learning algorithms to identify patients with risk of 30-day readmissions. We have developed a new module for cTAKES that extracts the contextual information such as if a symptom is acute or chronic from a report. We compared the performance of SHARP using cTAKES with the new module and MedLEE, a state-of-the-art NLP tool, by applying them to freetext clinician reports of heart failure (HF) patients at UPMC.		
Gregory Brunette	71	Brain microdialysis (BM) monitors neurochemical concentrations for clinical and research applications. However, BM probe implantation elicits an inflammatory tissue response, altering the sampled microenvironment. Microglia mediate this response. Normally ramified, microglia become activated in response to injury, assuming globular morphology and extending new processes towards the injury. These morphological indicators are used in image analysis to quantify the degree of microglial activation and tissue disruption.	Dexamethasone Attenuates Microglial Activation during Brain Microdialysis as Revealed by 2-Photon Microscopy	Gregory J. Brunette; Takashi D.Y. Kozai, PhD; Andrea S. Jaquins-Gerstl, PhD; Alberto L. Vazquez, PhD; Adrian C. Michael, PhD; X. Tracy Cui, PhD

		This study assesses the potential of dexamethasone (DEX), a glucocorticoid with anti-inflammatory effects, to mitigate microglial activation during BM. BM probes were implanted in mice with GFP-expressing microglia. Probes were perfused with artificial cerebrospinal fluid (aCSF), or DEX in aCSF. Two-photon microscopy was performed simultaneously. Previously established metrics of microglial activation, transition (T)-stage morphology and microglial (M)-directionality indices, were calculated for each microglial cell by tracing or counting cellular processes, respectively, based on their orientation with respect to the implant. Following implantation (6.5 hours), continuous retrodialysis of DEX resulted in significantly less activated T-stage index values 25-225 µm from the probe. Furthermore, microglia receiving DEX had M-directionality index values significantly closer to the ramified value 75-175µm from the probe. These results suggest DEX is a promising agent to improve the validity of BM		

		sampling.		
Sreeroopa Som	73	Approximately 80% of the genome is transcribed, yet only 2% is translated into proteins. ~30,000 long-noncoding RNAs (lncRNAs) with largely unknown functions were newly identified through large next-generation sequencing. Our lab recently discovered that insulin-like growth factor (IGF1) regulates hundreds of lncRNAs. We used publically available data from The Cancer Genome Atlas (TCGA) to identify potential biologically significant IGF1-regulated lncRNAs. Analysis of annotated lncRNAs in TCGA data through cBio Portal revealed twelve IGF1-regulated lncRNAs dysregulated in breast cancer. Our top target, SHNG15, is overexpressed in 7% of patients and is highly enriched for aggressive basal-like subtype. SNHG15 was knocked-down in MCF-7 and MDA-MB-231 cells using siRNA; reduced expression was confirmed via qPCR. Proliferation assays were conducted following siSNHG15 treatment. Reduction of SNHG15 through RNAi significantly decreased proliferation. siRNA treatment yielded 90%	SNHG15, an IGF1-Regulated lncRNA, is Overexpressed in Aggressive Breast Cancer Subtypes and is Necessary for Cell Proliferation	Sreeroopa Som; Adrian V. Lee PhD; David N. Boone PhD

		knockdown of SNHG15, but did not alter expression of snoRNA in its intron, suggesting SNHG15 itself is necessary for full proliferation. Publically-available TCGA data only reflects a minor cohort of all lncRNAs because it was published before the mass annotation of lncRNAs in ENCODE. Our study demonstrates the need to reanalyze TCGA data with updated annotations to better understand cancer genomics and lncRNA biology.		
Sandeep Subramanian	74	Biological resources required in experimental biology such as antibodies and cell lines are expensive and their effectiveness, among other things, is critical to the success of the experiment. Such resources are sometimes donated by one researcher to another through personal communication between the two. There is no previous study to our knowledge on the extent to which such donations are made, nor is there a central resource that connects antibody seekers with donors. We addressed this gap with the following three components of our work. We developed a web-	Antibody Exchange: A Web Resource To Facilitate Donation of Antibodies and Other Bioresources	Sandeep Subramanian, BTech; Madhavi Ganapathiraju, PhD

		portal called BioResource-Exchange (http://tonks.dbmi.pitt.edu/brx) where biologists can post information about an antibody, cell line or DNA construct that they need or can donate. Next, we developed text mining algorithms to extract information about antibody donations including the name of the antibody, its donor, and his/her affiliation by parsing the acknowledgements sections in publications. We developed two algorithms – a rule based algorithm and a bootstrapped relation-learning algorithm that achieved average accuracies of 56.8% and 62.21% respectively. Third, we created a dataset of 44 expert-annotated acknowledgements sections that will serve as the gold standard dataset to evaluate this class of algorithms and are releasing the dataset for further research on this task.		
Fateemah Saleem	77	Multi-Operator Standardization: Application for an in vitro morphology analysis Scholar: Fateemah Saleem School: Allendale Columbia School, Rochester, NY, USA Mentors:	Multi-Operator Standardization: Application for an In Vitro Morphology Analysis	Vera Donnenberg, PhD; Albert Donnenberg, PhD; Noah Donnenberg; David McFall;Jieming Zhang; Fateemah Saleem

		Vera Donnenberg, PhD; Albert Donnenberg, PhD; Noah Donnenberg; David McFall Site: Cancer Biology (Hillman Cancer Center) Abstract: The epithelial to mesenchymal transition (EMT), important in cancer invasion, is accompanied by characteristic changes in the cell's morphology. During EMT, cuboidal epithelial cells elongate into fibroblastoid cells. It is difficult to quantify cell morphology. We determined whether 3 independent observers can accurately and consistently measure cell morphology associated with EMT. Length was found to be the most consistent and reproducible metric for the effect of TGFβ. Width was more difficult to standardize and measured inconsistently. After sufficient training where all observers measured the same cells together, the width was consistent and displayed no significant statistical variability. The ratio provided a robust parameter to determine statistical differences in morphology in TGFβ treated cells. Length, width and ratio		

		measurements are appropriate metrics for the effect of TGFβ on cell morphology, but absolute length and width measurements must be standardized. After a sufficient training period, observers can consistently measure the relative changes in cell length and ratio accompanying EMT.		
Annie Watson	78	Background: A pathologic hexanucleotide repeat expansion in the regulatory region of C9ORF72 causes frontotemporal dementia (FTD) or amyotrophic lateral sclerosis (ALS). In addition to features of dementia, behavioral abnormalities can be present among mutation carriers. It is uncertain whether a proportion of individuals clinically diagnosed with psychoses bear pathologic C9ORF72 expansions in the absence of dementia. Aim: To screen for C9ORF72 repeat expansions among individuals diagnosed with functional psychoses such as schizophrenia (SZ) / schizoaffective disorder (SZA), and to describe the clinical features of individuals with the mutation. Results: Pathogenic C9ORF72 repeat expansions	C9ORF72 Repeat Expansions that Cause Frontotemporal Dementia Are Detectable among Patients with Psychosis without Dementia.	V. Nimgaonkar1, G. Coppola2, A. Watson3, M. Pribadi2, K. Chowdari3, S. Clifton3, J. Wood3, B. Miller4

		were detected in two pairs of related individuals following a survey of 740 participants in a psychiatric genetic research study. The mutation carriers included two siblings with schizophrenia, another unrelated individual with schizoaffective disorder and her non-psychotic mother. All the mutation-bearing patients with SZ/SZA had severe, florid illness, but did not provide a history suggestive of dementia or ALS. Conclusions: A small proportion of patients with SZ/SZA bear C9ORF72 repeat expansions. The patients show atypical psychotic features without the typical cognitive features of dementia.		
Zhaojun Sun	79	Immune checkpoint inhibitors show great promise as therapy for advanced melanoma, heightening the need to determine the most effective use of these agents. Here, we report that programmed death-1(high) (PD-1(high)) tumor antigen (TA)-specific CD8(+) T cells present at periphery and at tumor sites in patients with advanced melanoma upregulate IL10 receptor (IL10R) expression. Multiple subsets of peripheral	IL-10 and PD-1 Cooperate To Regulate Tumor Antigen-Specific CD8+ T Cells in Melanoma Patients.	Zhaojun Sun, PhD; Julien Fourcade, PhD; P, Ornella Pagliano, MS; Joe-Marc Chauvin, PhD; Cindy Sander, MS; John M. Kirkwood, MD; and Hassane M. Zarour, MD

		blood mononucleocytes from melanoma patients produce IL10, which acts directly on IL10R(+) TA-specific CD8(+) T cells to limit their proliferation and survival. PD-1 blockade augments expression of IL10R by TA-specific CD8(+) T cells, thereby increasing their sensitivity to the immunosuppressive effects of endogenous IL10. Conversely, IL10 blockade strengthened the effects of PD-1 blockade in expanding TA-specific CD8(+) T cells and reinforcing their function. Collectively, our findings offer a rationale to block both IL10 and PD-1 to strengthen the counteraction of T-cell immunosuppression and to enhance the activity of TA-specific CD8(+) T cell in advanced melanoma patients.		
Rashed Harun	80	Dysfunction in dopamine (DA) neurotransmission often underlies cognitive and behavioral impairments following traumatic brain injury (TBI). In this study, we used the control cortical impact (CCI) rodent model of TBI to study the effects of injury on regional DA neurotransmission using an DA monitoring technique called fast-	Controlled-Cortical Impact Produces Region-Specific Dysfunction of Stimulated DA Neurotransmission in the Dorsal Striatum that Can Be Reversed with Chronic Methylphenidate Treatment	Rashed Harun, BS; Miranda J. Munoz; Kristin M. Hare; M. Elizabeth Brough, Amy K. Wagner, MD

		scan cyclic voltammetry. We also explored the potential neurorestorative effects of chronic methylphenidate (MPH) treatment (2wk, 5mg/kg/day) after CCI. Electrically stimulated DA neurotransmission was simultaneously monitored in the nucleus accumbens (NAc) and dorsal striatum (D-STR) in naïve or injured rats 2wks post-CCI. A majority of naïve animals exhibited DA responses in the D-STR (8/9); however, only 1/8 CCI animals exhibited a response in the D-STR. Remarkably, 6/7 CCI rats chronically treated with MPH exhibited responses, and response amplitudes tended to be higher than even naïve animals ($p=0.067$). Quantitative modeling of the data suggests that the effect of chronic MPH treatment after CCI enhances stimulated DA release ($p<0.005$) and maximal reuptake rate ($p<0.005$) compared to naïve animals. This work suggests there are regiospecific impairments in DA neurotransmission after brain injury that is similar to the degenerative pattern observed in PD, and it demonstrates that		

		chronic MPH treatment after brain injury can have robust neurorestorative effects.		
Johnathan Maynard	82	Malignant arrhythmia is one of the leading pathologies linked to sudden cardiac death. Methods to understand normal and pathological heart function are crucial in identifying the causes of such conditions. Ultrasound (US) elasticity imaging can provide the dynamics of mechanical contraction and propagation with appropriate spatio-temporal resolution through recordings of the rate of mechanical strain. Under approval from the IACUC of the University of Pittsburgh, two male New Zealand white rabbits where sacrificed and their hearts were immediately perfused. US was used to image along the anterior side of the heart. A 2D normalized, phase-sensitive cross-correlation based speckle tracking algorithm was used to track tissue motion frame to frame allowing for the calculation of displacement and tissue deformation. Average strain in the axial direction of muscle tissue surrounding each chamber was then observed and	Visualization of Perfused Rabbit Heart Mechanics Via Ultrasound Elasticity Imaging	Johnathan Maynard

		compared over time. Periods of contraction, negative strain, and periods of relaxation positive strain, were identified and reflect current understanding of the cardiac cycle with atrial contraction at the end of diastole and ventricular contraction during systole. In conclusion, US elasticity imaging is a useful modality by which to assess contractions in the isolated heart.		
Abigail Wang	83	Obsessive-compulsive disorder (OCD) affects 2% of the population worldwide, and although dysfunction in cortico-striatal-thalamo-cortical (CSTC) circuitry has been implicated in the disorder, specific causative mechanisms are unclear. SAPAP3 is a postsynaptic scaffolding protein that is highly expressed in the striatum, and the SAPAP3 knockout (KO) mouse has previously been described to show behavioral abnormalities relevant to OCD. We aimed to replicate previous behavioral findings in this model, and extend these to investigate other factors that are critical in OCD, including the age of onset, sex differences, and cognitive	Characterization of SAPAP3 Knockout Mice during Adolescence and Adulthood: Relevance to Obsessive Compulsive Disorder	Elizabeth Manning, PhD; Abigail Wang; Susanne Ahmari, PhD

		changes. Mice were tested beginning at 5 weeks in tasks assessing different aspects of OCD-relevant behavior, including compulsive grooming, cognitive flexibility, and anxiety. Preliminary analysis suggests that abnormal behaviors in the SAPAP3 KO mouse may emerge much earlier than previously described. However, changes in anxiety-related behavior have not been replicated by our group. Ongoing studies to assess avoidance-related behavior may clarify these discrepancies. Future studies will use this model to investigate the contribution of different CSTC circuits to different OCD-relevant behaviors, using advanced neuroscience tools such as optogenetics and designer receptors exclusively activated by designer drugs (DREADDs).		
Jeffrey Cheng	84	Introduction: Continuous environmental enrichment (EE) improves neurobehavior after traumatic brain injury (TBI). One mechanism for the benefit is increased neurogenesis. Delayed and abbreviated EE, which is akin to clinical rehabilitation also enhances neurobehavior	Delayed and Abbreviated Environmental Enrichment after Experimental Traumatic Brain Injury Increases Hippocampal Neurogenesis	Jeffrey P. Cheng, BS; Naima Lajud Avila, PhD; Corina O. Bondi, PhD; Anthony E. Kline, PhD

		comparably to early and continuous exposure; however, its effect on hippocampal neurogenesis is unknown. Hypothesis: Delayed and abbreviated EE is sufficiently robust to induce hippocampal neuroplasticity after TBI. Methods: Anesthetized adult male rats received a cortical impact and were randomly assigned to either standard housing (TBI+STD), continuous EE (TBI+EE), or delayed and abbreviated EE (TBI+EE, 3 day delay, 6 hr day). BrdU was provided twice per day for 3 days and the rats were sacrificed 10 days later. The brains were immunostained for BrdU or triple immunofluorescence for BrdU, DCX and NeuN. Results: Continuous EE lead to a 91% ($p \leq 0.05$) increase in BrdU labeled nuclei density in the subgranular zone of the dentate gyrus when compared to STD. Abbreviated EE resulted in a 156% increase ($p \leq 0.01$) relative to STD. Conclusion and significance: Abbreviated EE with a 3 day delay effectively induced hippocampal neurogenesis after TBI, which supports the		

		hypothesis. These findings elucidate a possible mechanism for the benefits observed with both continuous and delayed-and-abbreviated EE.		
Megan LaPorte	85	Antipsychotic drugs (APDs) are provided to alleviate clinical traumatic brain injury (TBI)-induced agitation. Because administration of APDs will likely only occur during rehabilitation, we sought to investigate the effect of HAL and EE on behavior after TBI. Fifty-three anesthetized male rats received a cortical impact or sham injury and then were randomly assigned to receive either EE or standard (STD) housing. HAL (0.5 mg/kg) and saline vehicle (VEH; 1.0 mL/kg; i.p) were administered 24 hours after surgery and every day for 3 weeks. Motor and cognitive function was assessed on days 1-5 and 14-19, respectively. No differences were observed between the TBI STD-housed HAL and VEH groups in either beam walk (p=0.68) or water maze (p=0.67). The TBI+EE+VEH group was significantly better in both motor and cognitive function relative to the TBI+STD+VEH	Environmental Enrichment Attenuates the Deleterious Effects of Haloperidol after Experimental Traumatic Brain Injury	Megan J. LaPorte, BS; Christina M. Monaco, BS; Kaitlin A. Folweiler, BS; Anna M. Greene, BS; Elizabeth A. Ogunsanya, BS; Jacob B. Leary, BS; Justine M. Koehler, BS; Kristen E. Free, BPHIL; Jeffery P. Cheng, BS; Anthony E. Kline, PhD

		group (p=0.0024). Moreover, the TBI+EE+VEH group was better than the TBI+STD+HAL group on both motor and cognition (p's<0.05). However, TBI+EE+VEH did not differ from TBI+EE+HAL. These data show that EE is beneficial after TBI and also show that HAL produces substantial motor and cognitive deficits. Lastly, the findings indicate that EE can attenuate the detrimental effects of HAL, but HAL in turn limits the efficacy of EE.		
Junyue Shen	86	Previous studies in both humans and mice have indicated that overactivation of the lateral orbitofrontal cortex (lOFC) is related to the pathophysiology of obsessive compulsive disorder (OCD). Normalization of both neural activity and abnormal behaviors has also been observed following clinically effective treatment. Using the Slitrk5 knockout (KO) mouse model, which was previously shown to exhibit behavioral changes relevant to OCD, we sought to investigate the role of the lOFC in different aspects of OCD-relevant behaviours using designer receptors exclusively activated by designer drugs	Investigation of the Role of Lateral Orbitofrontal Cortex in OCD-Like Behaviors Using Designer Receptors Exclusively Activated by Designer Drugs (DREADDS)	Junyue Shen; Elizabeth Manning, PhD; Susanne Ahmari, MD, PhD

		(DREADDs). Unlike previous studies, 5.5 month old Slitrk5 KO mice did not show excessive grooming resulting in facial lesions, and lOFC inhibition did not affect this. In contrast, KO mice showed anxiety related behavior in a light-dark box and open field arena, and this anxiety was alleviated by chronic lOFC inhibition in the open field. Ongoing studies will seek to examine the effects of lOFC inhibition on compulsive grooming at later ages when a stronger phenotype is present. Understanding the role of the lOFC in different aspects of the symptoms of OCD will help to guide the development of treatments targeted to that region including deep brain stimulation.		
Alexis Lukach	87		Rhythm Experience and Africana Culture Trial (REACT!): A Culturally Salient Intervention To Promote Neurocognitive Health in Older African Americans	Alexis J. Lukach, BA; M. Kathryn Jedrziewski, PhD; George A. Grove, MS; Dawn J. Mechanic-Hamilton, PhD; Gavin Steingo, PhD; Shardae S. Williams, BS; Mariegold E. Wollam, BS; Kirk I. Erickson, PhD
Teresa Capasso	88	Hereditary hemorrhagic telangiectasia (HHT) is a genetic disorder characterized by an	Characterization of Alk1 Ligands in Zebrafish	Teresa Capasso, Elizabeth Rochon, and Beth L. Roman

		increased tendency for patients to develop arteriovenous malformations (AVMs), direct connections between arteries and veins that lack an intervening capillary bed. AVMs are highly susceptible to rupture and can result in bleeding and stroke. Heterozygous mutations in *ACVRLI,* which encodes the TGF-β type 1 receptor ALK1, lead to HHT2. Two ALK1 ligands have been identified in biochemical assays, bone morphogenetic proteins BMP9 and BMP10. However, the relevance of these ligands to ALK1 signaling in vivo and HHT is unknown. To understand the role of BMP9 and BMP10 in vascular development and HHT, we characterized mRNA expression patterns and generated loss-of-function models in zebrafish. As in mammals, *bmp9* is expressed only in liver, and *bmp9* mutants have no overt phenotype and are fertile. Due to a genome wide duplication in the teleost lineage, zebrafish have two Bmp10 ligands: Bmp10 and Bmp10-like. *bmp10* is expressed in the heart and liver, and *bmp10-like* only in the heart. *bmp10* mutants have		

		no embryonic phenotype but exhibit edema and hemorrhage around 1.5 months, and external vascular phenotype correlates with cardiomegaly, sarcomere disorganization, and cardiomyocyte mitochondrial swelling. This phenotype suggests high output heart failure secondary to decreased vascular resistance, as seen in some HHT patients with liver AVMs. *bmp10-like* heterozygous mutants are viable to adulthood; analysis of *bmp10-like* homozygous mutants is pending, but transient *bmp10-like* knockdown suggests an embryonic requirement in cardiac development. Combined *bmp10* mutation and *bmp10-like* knockdown generates embryonic lethal cranial AVMs identical to those in *acvrl1* mutants. Together, our results suggest that Bmp10 and Bmp10-like function redundantly as Alk1 ligands to prevent AVM formation embryonically, but Bmp10-like cannot compensate for loss of Bmp10 at later times. Additionally, we discovered a previously unknown role for *bmp10*-like in early larval cardiac		

		development. Current studies are focused on characterization of cardiovascular phenotypes in *bmp10* and *bmp10-like* mutants, analysis of genetic interactions, and biochemical dissection of ALK1 ligand requirements. Identification of BMP10 as the critical ALK1 ligand in vivo is the first step towards development of ligand-based treatment for HHT.		