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| **First Place Winners - Oral** | **Name** |
| Natural Sciences/Engineering | **Alec Richardson** |
| **ACOMPUTATIONAL MODEL OF ELECTROACTIVE POLYMNER ASSISTED LEFT VENTRICULAR CONTRACTION**  Faculty Mentor: Kim Cluff  College of Engineering  Left ventricular systolic dysfunction (LVSD) is classified as asymptomatic heart failure and is the most common cause of heart failure comprising about 60 percent of patients. LVSD is associated with reduced left ventricle (LV) contractility, and can therefore be diagnosed in patients with a reduced ejection fraction (EF). The purpose of this research is create and analyze three separate computational models of LV contraction. One model will illustrate normal LV contraction while another model will show LV contraction with systolic dysfunction. The third model will show restoration of normal LV contraction by incorporating a ventricular assistive device (VAD) into the model made from electroactive polymers. The three models will be set up in COMSOL Multiphysics 4.4 using the Fluid Structure Interaction (FSI) and MEMS modules. Currently, only the model illustrating normal LV contraction is being considered. To reduce computing time, the left ventricle is modeled in 2D, and the geometry is consistent with end-diastole LV dimensions. Material properties for both the blood and myocardium were found from literature. Additionally, initial conditions and most boundary conditions were determined through literature. The model is being computed using a time-dependent study, allowing transient analysis of the fluid-structure interaction. After computing the results, a measurement tool in COMSOL will be used to determine the end-diastole and end-systole areas. Using these measurements, the EF will be determined for each of the three models. Normal EF values range from 55-75% and an EF of less than 40% is generally diagnosed as heart failure. Overall, a successful model will show the electroactive polymer assisting in the contraction of the left ventricle while restoring normal EF values. This research is a foundation for emerging technologies that will give hope to those with LVSD and heart failure | |
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| Social Sciences/Humanities | **Emily Matta** |
| **THE FIRST AMERICANS: NATIVE AMERICAN VOTING BEHAVIOR TODAY**  Faculty Mentor: Dinorah Azpuru, Neal Allen  Fairmount College of Liberal Arts and Sciences  Among the most critically neglected ethnicities when studying political behavior, Native Americans are often lumped into the ‘Other’ category in national surveys and resulting datasets. Composing a rather small but unarguably important demographic, this absence of information has rendered studying Native American political participation notoriously difficult. By utilizing survey data from GSS2012, and identifying ethnicity variables that include Native Americans, I intend to analyze Indian electoral participation in the 2008 presidential election to shed light on how many Native citizens vote and what circumstances may affect how they vote. Do Native Americans vote with the same frequency as white voters? Why not? I hypothesize that Native Americans are less mobilized not only because of education and economic disparities, but because of a lack of trust in the United States federal government. If proven true, initiatives like President Obama’s Gen-I (Generation Indigenous) might improve the relationship between Native Americans and the federal government over time and subsequently increase voter turnout. | |
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| **Second Place Winners-Oral** | **Name** |
| Natural Sciences/Engineering | **Martina Salerno** |
| **LASER SURFACE MODIFICATION OF THE ORTHOPEDIC BIO-METAL, COBALT CHROMIUM ALLOY**  Faculty Mentor: Anil Mahapatro  College of Engineering  Post-surgical site infections are common after medical implant placement. Infections in tissue surrounding an implant can cause patient suffering, medical device failure, and can potentially spread systematically. Post-operational infection associated with orthopedic implants is a critical and escalating problem which demands urgent attention for a decrease of occurrences. Implant related infections can require a patient to undergo additional surgeries following the initial implant placement surgery. Another challenge that exists for implant placement, due to orthopedic injuries, is tissue integration. Each year, there are more than 30,000 revision surgeries partially due to poor orthopedic implant fixation with bone. In order to combat infection, biomaterials and functional coatings used for medical implants are evaluated either for their ability to resist infection (resist bacterial adhesion and biofilm formation) or for their ability for tissue integration (to support tissue cell adhesion and proliferation). No viable clinical technology currently exists to address both these issues simultaneously. Our hypothesis is that laser micro-nano machining can create surface topographies on orthopedic implant surfaces that could provide a platform for simultaneous tissue integration and therapeutic delivery for biofilm prevention. This study explores the role of laser micro-nano machining in creating surface topographies on an orthopedic relevant bio-metal, cobalt chromium (Co-Cr) alloy. Co-Cr alloys are extensively used for orthopedic and dentistry applications. Laser modified Co-Cr samples were compared to other laser modified bio-metals, such as titanium. Co-Cr alloy and Ti were cut into 1cm x 1cm squares and were then modified using a nanosecond pulsed laser. A CoherentTM Avia 355X nanosecond pulsed laser with pulse energy of 95 µJ, spot size of 130 µm, line width of 100 µm, scan rate of 200 mm/min, and repetition rate of 20 kHz was used to raster scan the coupons with an overlap of 23%. A lens with a focal length of 10 cm was used for the experiments with the actual experimentation done at a defocused distance of 0.5 mm. Bare metal (control) and surface modified samples were characterized using optical microscopy and scanning electron microscopy (SEM). Optical and SEM results clearly show a radically different surface morphology for laser patterned samples when compared to control samples. Since laser parameters were kept constant, response varied for each material type. At 300X magnification, SEM results clearly show a ~100 µm width of the raster patterned zone of varying geometry. Ti seems to have a more uniform surface pattern when compared to Co-Cr alloy suggesting a need to further optimize Co-Cr alloy laser parameters. In summary, our results demonstrate the effect of laser treatment in creating micro-nano structured surface topographies on Ti and Co-Cr alloy which can be subsequently modified to address current orthopedic clinical needs. | |
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| Social Sciences/Humanities | **Alissa Bey** |
| **THE ROLE OF SKIN COMPLEXION ON AFRICAN AMERICAN EMERGING ADULTS**  Faculty Mentor: Rhonda Lewis  Co-Authors: Rhonda Lewis  Fairmount College of Liberal Arts & Sciences  Past literature exploring the role of skin complexion within the African American community has produced conflicting results (Maxwell, Brevard, Abrams, Belgrave; 2015). The current study uses a mixed-method approach to expand on this literature by exploring the experiences of African American emerging adults and their perceptions on how skin complexion has shaped their lives. Data will be collected using a brief survey to gather information about the participants’ well-being and information regarding their own skin complexion. Focus groups will be conducted to further explore participants’ life experiences regarding skin complexion and how they believe it has shaped their experiences in emerging adulthood. A T-test will be run to assess the relationship between self-rated skin complexion, satisfaction with skin complexion and well-being measures. The information relayed by the participants during the focus group will be transcribed and coded to reveal any common themes surrounding their experiences with skin complexion. We hypothesize that common themes of lower well-being, dissatisfaction with skin complexion, and negative experiences based on skin complexion in emerging adulthood will be arise more often from individuals who self-rate their skin complexion at the very light or very dark end of the spectrum, more so than individuals that self-rate their skin complexion as medium. Future research and implications will be discussed. | |
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| **First Place Winners-Poster** | Name |
| Natural Sciences and Engineering | **Jerad Rogers** |
| **QUANTIFICATION OF ARTERIAL ELECTROMAGNETIC PROPERTIES FOR PERIPHERAL ARTERY DISEASE SCREENING**  Faculty Mentor: Kim Cluff  Co-Author(s): Balakumar Jayakumar, Jeremy Patterson, and Kim Cluff  College of Engineering  Peripheral artery disease (PAD) is a slowly progressive vascular disease characterized by abnormal narrowing of peripheral arteries through atherosclerosis. PAD often goes unnoticed and is heavily underdiagnosed due to its initially asymptomatic features and if not detected early enough can lead to critical limb ischemia or limb amputation. Current PAD screening options are limited to the clinical setting and require specialized equipment, specialized training in operation, specialized training for interpretation of the results, and lack the ability to screen for PAD in a simple, cost effective point-of-care manner.In this study, our objective was to create a novel, non-invasive, point-of-care screening patch for the early detection of PAD. To attain our objective, we tested our hypothesis that electromagnetic changes in the permittivity and permeability of blood can be used to detect blood-flow abnormalities of PAD with a simple wireless biosensor – applied like a small adhesive bandage. When activated by an external RF wave, the skin patch developed an electromagnetic field that penetrates into its surroundings. Using a Vector Network Analyzer (VNA), we were able to quantify the skin patch’s electromagnetic field interactions with its surroundings. Using a human arm phantom with vascular network, synthetic blood, and heart pump the skin patch was able to measure pulsatile blood flow as shifts in the sensor’s resonant frequency. The results were validated using an ultrasound pulse wave Doppler which detected 50 bpm on the arm phantom. The smart skin patch was able to detect pulsatile flow with 100% accuracy when compared to ultrasound. These results strongly suggest that the patch may be capable of measuring pulsating blood-flow in a point-of-care fashion which does not require specialized training or expensive equipment. What’s more, is that this biosensor does not have batteries, no electrical components, and has wireless communication. | |
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| Social Sciences/Humanities | **Thao Nguyen** |
| **EXAMINATION OF THE EFFECT OF ALLICIN ON THE GROWTH OF STAPHYLOCOCCUS AUREUS IN CULTURE**  Faculty Mentor: David McDonald  Co-Author(s): Lauren Johnson & Fawn Beckman  Fairmount College of Liberal Arts & Sciences  In order to explore the effectiveness of the garlic-derived chemical Allicin, we conducted inhibition assays on bacteriological plates using a commercially derived source of the chemical and also a freshly prepared solution. We incubated Staphylococcus aureus in the presence of these two sources of Allicin, commercially-acquired and freshly-prepared, and measured the size of their zones of inhibition. Our observations revealed that the zone of inhibition was much larger for the freshly-prepared solution of Allicin, compared to the commercially- acquired solution. These results suggest that a freshly prepared source of Allicin is much more effective at inhibiting the growth of Staphylococcus aureus than what can be obtained commercially. | |

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| **Second Place Winners-Poster** | Name |
| Natural Sciences and Engineering | **Sushrutha Nagaraj** |
| **STUDY OF BIOCOMPATIBILITY AND BIOMECHANICAL PROPERTIES OF COMPOSITE SCAFFOLDS FOR BONE REPAIR**  Faculty Mentor: Shang-You Yang  Fairmount College of Liberal Arts and Sciences  Bone repair is interrupted or stalled in nonunion fractures or bone void formation due to removal of bone tumor. The use of bone cements to anchor the free spaces between the bones to restore bone volume and promote bone healing has been a successful treatment modality. However these modalities do not work efficiently as the void fillers. These materials are usually brittle and cannot be reshaped for proper fit. The long-term objective of the study is to develop appropriate composite materials help resolve the biocompatibility and biomechanical problems mentioned above. The current project focuses on understanding the biocompatibility and biomechanical properties of some composites retrieved from a mice model. / The study involves the use of composite materials developed by a private collaborator (whose chemistry is protected). The biomechanical properties of the above mentioned composite polymer were analyzed through both in-vitro and in-vivo studies. The in-vivo studies involved the use of mice femur void model to understand the osteoconductivity of the scaffold by analyzing the variations of bone volume, bone density and total volume in the femur (thigh bone) of mice. / Twenty mice were chosen and divided into four groups of five mice. The first three groups were assigned a biomaterial and the last group was used as a control. The bio-composite scaffold was surgically inserted into the mid-shaft of mouse femur and the mice survived for six weeks before sacrifice. After the set period, the limb with implanted scaffold was harvested and microCT scan was performed to analyze the bone volume fractions and mineral densities within the scaffolds. The preliminary results suggest redevelopment and osteoconductivity in the composite scaffolds. After microCT, 3-point bending biomechanical test on the implanted limbs was performed using a Bose® electroforce testing apparatus. The final assessments of data will be accomplished in the near future. | |
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| Social Sciences/Humanities | **Clara Davidson** |
| **PROMOTING CHILDREN'S SOCIAL EMOTIONAL DEVELOPMENT THROUGH CLASSROOM CONSULTATION**  Faculty Mentor: Jamie LoCurto  Fairmount College of Liberal Arts & Sciences  Setting up and executing effective interventions is important to the advancement of a classroom of children, particularly those who are at risk. The DECA-P2 was administered as a screening tool to five classrooms at community childcare centers. Children were categorized as “TYPICAL” or at “NEED” based on their T scores on Total Protective Factors and Behavioral Concerns. Children in “NEED” received individualized behavioral interventions. All were rescreened to see how classroom consultation by a mental health specialist affected their social and emotional functioning. This study examines the differences between Pre and Post DECA-P2 scores for children in “NEED” compared to children who were “TYPICAL” at pretest. Those in “NEED” showed more improvements in protective factors and behavior concerns than their “TYPICAL” peers. The results support classroom consultation as an intervention to address individual children’s behavioral challenges while supporting the social and emotional development of all children in the classroom. | |