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Tanner Reeb	Anatomy and Cell Biology	ARHGAP29 Expression and Localization in Cutaneous Wound Healing
Jacob Schillo	Anatomy and Cell Biology-Genetics Program	Using forward genetic screens to discover drivers of cancer
Patrick Lansdon	Anesthesia	Gut microbiota influences the severity of neurological phenotypes in Drosophila voltage-gated sodium channel mutants
James Mrkvicka	Anesthesia	A forward genetic screen to identify modifiers of neurological phenotypes in Drosophila voltage-gated sodium channel mutants
Anh-Vu Do	Chemical and Biochemical Engineering	Combining Ultrasound and Intratumoral Administration of Doxorubicin-loaded Microparticles to Enhance Tumor Cell Killing
Rory Vose	Communication Sciences & Disorders	'Say What?': Development of a guide promoting healthy hearing habits for grain and livestock producers.
Megan Rossio	Communication Sciences and Disorders	Factors that influence hearing preservation behaviors in University of Iowa Students
Nazmin Eti	Human Toxicology	The Involvement of the Aryl Hydrocarbon Receptor in the Toxicity of Polychlorinated Biphenyls
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Wesley Goar	Pediatrics, Ophthalmology & Visual Sciences	Genetic evaluation of a large Israeli family with Nephrotic Syndrome
Ammar Al Khafaji	Pharmaceutics	Synthesis, Characterization, and Uptake Studies on the Solid Lipid Nanoparticles by the Nasal Mucosa
Mohammed Albarki	Pharmaceutics and Translational Therapeutics	Preparation of Poly D, L Lactic Co-Glycolic Acid (PLGA) Nanoparticles and Evaluation of Uptake Pathways Across the Nasal Mucosa
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SHU WAN	History	Disability and Chinese Exclusion in Late Nineteenth-Century California
Eddie Scott	Psychological & Quantitative Foundations	Parenting practices of adults formerly diagnosed with ADHD and their off-springs outcomes

ARHGAP29 Expression and Localization in Cutaneous Wound Healing

Tanner Reeb, *Anatomy and Cell Biology*

Despite every person incurring acute wounds on a regular basis, the genetics and molecular mechanisms regulating wound healing remain to be elucidated. Wound closure requires the concerted action of cellular proliferation, differentiation, and migration. Interferon Regulatory Factor 6 (IRF6) has been shown to regulate all of these processes, with IRF6-deficient keratinocytes displaying both a decrease in the expression of Rho GTPase Activating Protein 29 (ARHGAP29) as well as an increase in stress fibers. ARHGAP29 is a Rho GTPase Activating Protein with a high affinity for the small GTPase RhoA, a known regulator of stress fibers. However, despite our current knowledge about IRF6 and RHOA, little is known about how IRF6 regulates ARHGAP29 and the role of ARHGAP29 in cellular migration, adhesion, and wound healing. We hypothesize that ARHGAP29 is transcriptionally regulated by IRF6 and perturbation of this system will result in impaired wound healing. To test our hypothesis, we first characterized the expression and subcellular localization of ARHGAP29 in keratinocytes. Using immunofluorescence, ARHGAP29 was detected at the lamellipodia and filopodia as well as in fine puncta throughout the cytoplasm with the strongest expression surrounding the nucleus. In vivo, ARHGAP29 was observed throughout all layers of the epidermis, with the highest epidermal expression observed in basal keratinocytes. ARHGAP29 was also detected in dermal fibroblasts, myocytes, endothelial cells and sebocytes. Following wounding, ARHGAP29 was observed at the wound margin in keratinocytes and in inflammatory cells in the granulation tissue throughout the process of wound healing. Preliminary immunofluorescent staining of ARHGAP29 throughout the process of wound healing suggests an increase in the variability of ARHGAP29 expression in the keratinocytes of the leading edge of the migratory tongue when compared to unwounded tissue and closed wounds. To determine if ARHGAP29 is required for proper wound healing in vivo, we took advantage of a murine allele harboring a K326X orofacial cleft patient-derived mutation. Because homozygotes are embryonic lethal, we performed full thickness excisional wounds on heterozygotes and harvested them 4 and 7 days post-injury. Morphometric analyses revealed no significant differences at 7 days following wounding, suggesting that at that time point, 50% reduction of ARHGAP29 is sufficient for proper healing. Collectively, these results indicate that ARHGAP29 is expressed during wound healing in a number of cell types relevant to tissue repair. The reduced level of ARHGAP29 observed in our ARHGAP29 K326X mice is, however, still sufficient to heal a cutaneous wound. A keratinocyte-specific knockout of ARHGAP29 will be essential to understand the role of ARHGAP29 in cutaneous wound healing and to test the interaction between ARHGAP29 and IRF6. These findings will provide key information on the mechanism underlying wound healing and fill the gap linking the previously observed relationship between IRF6 and the RHOA pathway.

Using forward genetic screens to discover drivers of cancer

Jacob Schillo, *Anatomy and Cell Biology-Genetics Program*

DNA mutations in cancer can be classified as driver or passenger mutations. Driver mutations promote the growth of cancer, whereas passenger mutations do not promote growth. Discovery of the genes and mutations that drive/promote cancer growth is essential for finding future therapeutic targets. To determine drivers of cancer, our lab uses the well characterized Sleeping Beauty transposon system. The Sleeping Beauty system is designed to integrate transposons into the genome of a mouse or human cell line. These integrations can mimic DNA driver mutations if the cell harboring the insertion confers a selective growth advantage. We classify genes with multiple insertions in multiple cells as potential drivers of cancer. We further validate that the gene of interest does provide some selective growth advantage. Our lab has a focus on hepatocellular carcinoma (liver cancer) and melanoma (skin cancer). Using Sleeping Beauty in a mouse model, we have identified drivers of liver cancer, while using Sleeping Beauty in a human cell line, we have identified potential drivers of therapeutic drug resistance in skin cancer. The results of our work are important for elucidating the mechanisms that drive cancer and drug resistance and may lead to future therapeutic targets.

Gut microbiota influences the severity of neurological phenotypes in *Drosophila* voltage-gated sodium channel mutants

Patrick Lansdon, *Anesthesia*

It is widely acknowledged that mutations in genes encoding voltage-gated sodium (Nav) channels contribute to the etiology underlying various seizure disorders. Shudderer (Shu) is a dominant mutant allele of the *Drosophila* Nav channel gene, paralytic (*para*). *paraShu* exhibits neuronal hyperexcitability and severe seizure-like behavioral defects, including spontaneous jerking and heat-induced convulsion. Our microarray analyses indicated that genes involved in the innate immune response were significantly upregulated in *paraShu* mutants relative to wild-type flies. In accordance with the fact that the host immune system and commensal gut bacteria interact bidirectionally, we observed significant differences between gut microbiota of wild-type flies and *paraShu* mutants. Encouraged by these results, we investigated a potential role for the gut microbiota in *paraShu* phenotypes. Intriguingly, removal of microbiota by antibiotic administration significantly suppressed *paraShu* behavioral phenotypes while having no observable effect on wild-type behavior. Since the microbiota can influence the production of reactive oxygen species (ROS), we next examined the activity of CncC, a master regulator of antioxidant gene transcription in *Drosophila* and the homolog to mammalian Nrf2. Using a GFP reporter, we found that CncC activity was significantly increased in the gut following antibiotic treatment. Overall, our findings suggest that commensal bacteria modulate seizure severity in *Drosophila* Nav channel mutants by affecting oxidative stress conditions.

A forward genetic screen to identify modifiers of neurological phenotypes in *Drosophila* voltage-gated sodium channel mutants

James Mrkvicka, *Anesthesia*

Voltage-gated sodium (Nav) channels are essential for the generation and propagation of action potentials in neurons. Shudderer (Shu) is a dominant mutant allele of the *Drosophila* Nav channel gene, paralytic (para). paraShu exhibits neuronal hyperexcitability and severe seizure-like behavioral defects, including spontaneous jerking and heat-induced convulsion. We carried out an unbiased forward-genetic screen to identify genes that functionally interact with paraShu to influence the severity of its neurological phenotypes. Our working hypothesis was that the mutant phenotypes would be significantly altered when the activity of a gene functionally interacting with paraShu was reduced by 50%. We systematically deleted particular genomic regions by crossing paraShu to a panel of flies carrying molecularly defined chromosomal deficiencies. Of the 176 chromosome deficiencies we have thus far examined, at least six had a robust modifying effect on paraShu, and greatly reduced the severity of their neurological phenotypes. One candidate deficiency that covers the second chromosome genomic region 53E-53F11 was selected for further analysis. We found that an overlapping smaller deficiency, Df(2R)BSC433 (53F4-53F8) covering only 6 genes, phenocopied the original large deficiency. We next used RNAi-mediated knockdown of these 6 genes and among them identified Glutathione S-transferase S1 (GstS1) as a modifier of paraShu. Finally, we introduced a GstS1 null allele (GstS1M26) into paraShu and demonstrated that 50% reduction of GstS1 function in this system also results in the significant suppression of paraShu neurological phenotypes. We are now studying the underlying mechanisms belying the rescue effects of GstS1-downregulation upon paraShu phenotypes by utilizing the UAS/GAL4 binary expression system in combination with a UAS-GstS1-RNAi transgene. We expect to determine the spatiotemporal requirements for GstS1-dependent modification of paraShu phenotypes, and gain fundamental insights into its specific mechanisms of action in the fly nervous system.

Combining Ultrasound and Intratumoral Administration of Doxorubicin-loaded Microparticles to Enhance Tumor Cell Killing

Anh-Vu Do, *Chemical and Biochemical Engineering*

Melanoma is an incurable disease for which alternative treatments to chemotherapy alone are sought. Here, using a melanoma model, we investigated the antitumor potential of combining ultrasound (US) with poly(lactic-co-glycolic acid) (PLGA) microspheres loaded with doxorubicin (DOX). The aim was to achieve synergistic tumoricidal activity through direct and indirect US-mediated damage of tumor cells combined with sustained and potentially controllable release (when combined with US) of DOX from microspheres. An in vitro release assay demonstrated an ability of US to affect the release kinetics of DOX from DOX-loaded PLGA microspheres by inducing a 12% increase in rate of release. In vitro viability assays demonstrated that combining US with DOX-loaded PLGA microspheres resulted in synergistic tumor cell (B16-F10 melanoma cells) killing. Melanoma-bearing mice were treated intratumorally with DOX (8 µg)-loaded microspheres and subjected to US treatment at the tumor site. This treatment could significantly extend survival (mean survival (MS) = 22.1 days) compared to untreated mice (MS = 10.4 days) and most other treatments, such as blank microspheres plus US (MS = 11.5 days) and DOX (8 µg)-loaded microspheres alone (MS = 13 days). The findings that immune checkpoint blockade did not significantly extend survival of mice treated with DOX (8 µg)-loaded microspheres plus US, and that tumor-free

("cured") mice were not protected from subsequent tumor rechallenge suggests minimal involvement of the adaptive immune response in the observed antitumor activity. Nevertheless, the synergistic increase in survival of melanoma-challenged mice treated with the combination of US and DOX-loaded microspheres implicates such a treatment methodology as a promising additional tool for combatting otherwise currently incurable cancers.

'Say What?': Development of a guide promoting healthy hearing habits for grain and livestock producers.

Rory Vose, *Communication Sciences & Disorders*

In a 2015 Greater Plains Center for Agricultural Health (GPCAH) survey, farmers across the Midwest reported exposure to loud noises (>90 dBA) an average of 5 days per week, and almost half reported experiencing one or more symptoms of noise-induced hearing loss (NIHL). Because hearing loss can develop gradually, many farmers may miss or overlook the early signs of hearing loss, resulting in repeated and further damage. Although the prevalence of NIHL is high among Midwest farmers, the use of hearing protection and utilization of hearing conservation programs is low in these individuals. Further, since many farms are small family owned operations, hearing conservation is not widely enforced by Occupational Health and Safety Administration. The purpose of this project was to develop an informative and advisory guide that provides farmers with simple and practical tips to independently promote healthy hearing habits on their farm, in an easy and affordable way. A primary and secondary literature review of hearing conservation programs and NIHL among agricultural workers was conducted and aggregated into a booklet in collaboration with GPCAH. The hearing conservation approach employed by this booklet is targeting agricultural workers at risk for developing NIHL by encouraging hearing protective device use and noise control. Written at a 7-8th grade reading level, the guide provides awareness, education, and prevention of NIHL to grain and livestock farmers.

Factors that influence hearing preservation behaviors in University of Iowa Students

Megan Rossio, *Communication Sciences and Disorders*

Young people are regularly exposed to excessive noise from a variety of sources ranging from sporting events, to bars and nightclubs, to power tools, and personal music-playing devices. While many studies have found that a majority of participants are aware that exposure to loud sounds have the potential to cause hearing loss, few participants take consistent action to reduce exposure to loud sound or utilize hearing protection devices. Research even showed that a majority of participants believed that hearing loss would not be something that would affect them until they were older, which is an alarming fact considering the estimated prevalence of noise-induced hearing loss in adolescents in the US is estimated at 12.5%. The purpose of the current study is to collect information from University of Iowa students regarding their general understanding of the mechanics of hearing loss, situations in which students are exposed to excessive noise, their attitudes toward noise and hearing protection, what actions they regularly take to protect their hearing, and what might influence them to adopt healthy listening habits. By utilizing an online survey via Qualtrics, distributed by email to University of Iowa undergraduate and graduate students, data was collected from 282 students. In congruence with previous studies in this area,

it was found that even though a majority of respondents were aware that noise induced hearing loss is preventable (93%) and that hearing loss would significantly impact their lives (85%), 70% of the respondents reported that they did not regularly use hearing protection. It was found, however, that more than half of respondents (54%) would be more likely to utilize hearing protection if it were more cosmetically appealing. The data collected from this survey suggest there is a need to create hearing loss prevention education materials for college students that educate regarding the numerous options for hearing protection devices and, furthermore, strategies for hearing conservation aside from utilizing hearing protective devices.

The Involvement of the Aryl Hydrocarbon Receptor in the Toxicity of Polychlorinated Biphenyls

Nazmin Eti, *Human Toxicology*

The aryl hydrocarbon receptor (AhR) is a ligand-activated transcription factor involved in the regulation of biological responses to planar aromatic hydrocarbons, and also regulates xenobiotic-metabolizing enzymes such as cytochrome P-450. We have previously described the sequence of events following exposure to dioxin-like polychlorinated biphenyl (PCB) congeners like PCB126 that bind avidly to the AhR. Our hypothesis is that toxic manifestations following exposure to PCB126 are mediated through the AhR. To test this, we created an AhR knock out (AhR KO) model using CRISPR/Cas9. Comparison was made to wild type (WT) male and female Holtzman Sprague Dawley rats. Rats were injected by a single IP dose of corn oil vehicle or PCB126 in corn oil. After 28 days, a necropsy was performed to collect organs, and to analyze the expression of genes and changes leading to histopathology. As a result, PCB exposed WT rats showed significant weight loss compared to AhR-KO rats ($P < 0.0001$). Similarly, relative thymus ($P < 0.0001$) and absolute liver weights ($P = 0.0018$) were significantly lower than AhR-KO rats exposed to PCB. The expression of genes encoding enzymes related to xenobiotic and intermediary metabolism were unaffected in the AhR-KO rats following PCB exposure as opposed to WT where expression was altered. WT rats had altered levels of whole blood glutathione and decreased serum glucose, while KO rats showed no significant changes. Therefore, all adverse manifestations were observed in WT rats, while none were detected in AhR-KO rats, indicating the direct involvement of the AhR in the mediation of toxicity due to PCB 126 exposure. (Supported by NIEHS: P42ES013661; HD020676; HD079363)

Role of Gap Junction in Trabecular Meshwork Cell Division

Kyle Gonslaves, *Ophthalmology*

In the our lab, it has been shown that inducible pluripotent stems cells that have been induced to trabecular meshwork cell-like (iPSC-TM) have a unique ability to regenerate dysfunctional trabecular meshwork (TM) cells both in vitro and in vivo. In this project, we are looking to better understand the proliferative effects iPSC-TMs have in the trabecula meshwork via cell-to-cell contact in vitro. Previous research has shown that primary TM cells (pTM) need to have physical contact with iPSC-TM for the proliferative effects to occur; with this knowledge, we are inclined to investigate the role of gap junctions (GJ), specifically Connexin 43, as a means for the cells to share crucial information. Using CRISPER Cas-9 technology the GJA1 gene encoding connexin 43 was disrupted in TM5 cells (G1TM) resulting in loss of expression. G1TM cells were then co-culture with iPSC that are induced to be TM-like (iPSC-TM). Results

show that G1TM5 in contact with iPSC-TM had inhibited growth (71.5%) when compared to the control (100%). However, the G1TM when cultured alone showed increased growth when compared to the unaltered TM5 control. Ultimately, connexin 43 plays a role in the ability for iPSC to pass proliferative information to TM cells in vitro

Genetic evaluation of a large Israeli family with Nephrotic Syndrome

Wesley Goar, *Pediatrics, Ophthalmology & Visual Sciences*

Nephrotic syndrome (NS) is kidney disorder that causes excess protein excretion within urine. This leads to abnormally low levels of albumin in the body causing swelling throughout the body and a high concentration of lipids in the blood. Over time NS increases the chance of blood clot formation, infection, high blood pressure, high cholesterol, kidney disease, and kidney failure. NS is usually caused by damage to the glomeruli (blood vessels) of the kidney and is often treated with diuretic drugs, steroids, and nutritional change. To investigate the genetics of NS, our collaborators ascertained and collected samples from a large Israeli pedigree affected by familial NS. Genotypes were obtained for 15 samples using Affymetrix Genome-Wide SNP 5.0 arrays. In parallel, we performed whole exome sequencing on one of the affected family members to identify variants from the human reference genome. The genotyping data was analyzed with MERLIN to evaluate linkage under both dominant and recessive models of inheritance. This allowed us to identify regions of the genome that were consistent with segregation in the family. The exome data was then used to identify candidate disease-causing mutations in the linked regions in the family, and in the set of previously reported NS causing genes.

Synthesis, Characterization, and Uptake Studies on the Solid Lipid Nanoparticles by the Nasal Mucosa

Ammar Al Khafaji, *Pharmaceutics*

Nanoparticles have many proposed advantages for use in nasal drug delivery systems. Nanoparticles might improve uptake and efficacy and lower toxicity compared to the drug alone. Solid lipid nanoparticles (SLNs) were successfully synthesized using an emulsion/solvent evaporation method. The particles were fluorescently labeled with Nile Red, a fluorescent dye that can be measured spectrophotometrically, to quantify the number of particles taken up into the mucosal tissue. The particles were characterized for their size, shape, and Nile Red release behavior. The SLNs were spherical in shape with a diameter of ~150 nm. No burst release was observed, and ~50% of the loaded dye was released in 24 hr. In order to evaluate the uptake pathways for SLNs in the nasal tissues, endocytic mechanisms including; macropinocytosis, clathrin-mediated endocytosis, and caveolin-mediated endocytosis were investigated. The extent of SLN uptake was measured using excised nasal tissues obtained from cows. Uptake experiments in the presence and absence of specific chemical inhibitors of endocytic processes were used to evaluate changes in SLN uptake. The results indicate that SLN uptake in the nasal tissues was not affected by pretreating the tissues with different inhibitors, yet the measurement of significant uptake of SLNs into the nasal mucosa shows there are additional, yet to be identified pathways, used to transfer these nanoparticles into the nasal epithelium.

Preparation of Poly D, L Lactic Co-Glycolic Acid (PLGA) Nanoparticles and Evaluation of Uptake Pathways Across the Nasal Mucosa

Mohammed Albarki, *Pharmaceutics and Translational Therapeutics*

The nasal mucosa provides a noninvasive route for drug administration to the systemic circulation and potentially to the CNS. Nanoparticles made from biodegradable polymers, including PLGA, are of great interest for use in drug delivery systems due to PLGA's relative safety and ease of surface modification. Due to their small size, nanoparticles may provide improved targeting and transport through the nasal mucosa. However, the optimal nanoparticle size and surface properties for intranasal delivery are unknown. This study focuses on the preparation of PLGA nanoparticles and investigation of endocytic and exocytic mechanisms included in their uptake across the nasal respiratory and olfactory mucosae. Knowing these mechanisms will provide a much-needed understanding of nanoparticle trafficking which contributes to the design of effective particulate delivery system to deliver drugs or vaccines intranasally. In this study, PLGA nanoparticles (60 nm) containing the lipophilic fluorescent dye, Nile Red, were prepared using a surfactant-free nanoprecipitation method. Nanoparticle uptake into the nasal mucosa was determined by exposing excised tissues to nanoparticle dispersions for 30 or 60 minutes. The in vitro uptake of the nanoparticles by the nasal mucosal tissues revealed that the Nile Red-loaded PLGA nanoparticles were transported across the epithelial layer and accumulated in the sub-mucosal connective tissues. Further investigation of the endocytic mechanisms involved in nanoparticle internalization revealed that nanoparticle uptake is an energy-dependent process using multiple endocytic mechanisms. In order to evaluate nanoparticle exocytosis, RPMI-2650 cells, a human squamous cell carcinoma cell line derived from the nasal septum, was used to construct a cell layer comparable to nasal epithelial layer. Cells were grown on porous membrane inserts in an air-liquid interface (ALI) configuration where the medium was in contact with only the basolateral surface. The cultured layer integrity was evaluated by measuring the electrical resistance (TEER), expression of the tight junction protein (ZO-1) and the transport of markers molecules, atenolol and propranolol. The measurable transfer of PLGA nanoparticles into the nasal mucosal tissues indicate that they may be an efficient delivery vehicle for drugs with either local or systemic activities. However, additional evaluation for exocytic mechanisms involved in nanoparticle trafficking is needed for full understanding of the efficiency of this particulate delivery system.

Creative Works

sorry

Carley Cullen, *School of Art & Art History; Media, Social Practice and Design*

My work for the past three years has consisted of interactive art exhibitions about mental health awareness. In the progressive world we live in, topics that were typically viewed as taboo in the past are now being exposed. The stereotypes that surround mental health concerns have not yet reached that same level of exposure. I find myself called to help dissolve the stigma surrounding anxiety and depression through artistic manifestations of my own experiences with anxiety. Art is an effective form of empathy; my goal is to create a deeper understanding and acceptance for mental health concerns, specifically anxiety, in the Iowa City community. My current project, "sorry" is a multi-media installation with a combination of letterpress printed collages, digital collages, and three animations. Two of the three animations document the process of creating the printed collaged blocks. They show both a gradual buildup of printed matter and their deconstruction. The third looped animation is a visual representation of how my anxiety manifests physically in my body. I think of my print collages as curations of moments in time: blips of emotion, flashes of anxiety pasted down to record a fleeting sentiment. Initially, I produced prints from line drawings sketched out in the midst of a panic attack and created prints from these drawings. These prints serve as a reflection of those moments, and their layering depicts how intricate and intertwined anxiety and its triggers can be. My goal in creating art in response to my experiences with anxiety is to establish a system of support for others with similar concerns. I want my project to thread seamlessly into communities surrounding Iowa City to promote mental health awareness, advocacy and solidarity using graphic design as the primary mode of visual communication.

Mathematical, Physical, and Engineering Sciences

A Bayesian Model Selection Approach to Multiple Comparisons

Javier Flores, *Biostatistics*

Consider the setting in which independent samples from several populations are taken for the purpose of between-group comparisons. Specifically, interest lies in the determination of clusters where mean levels are equal. To this end, multiple comparisons testing procedures are often employed. We formulate the hypothesis testing problem of determining equal-mean clusters as a Bayesian model selection problem. A comprehensive collection of models is formulated by specifying mean structures that represent all possible combinations of equal mean levels. The Bayesian information criterion is then used to approximate posterior model probabilities and posterior probabilities associated with pairwise mean equalities. Information from all competing models is combined through Bayesian model averaging in an effort to provide a more realistic accounting of uncertainty. An example illustrates how the Bayesian approach leads to a logically sound presentation of multiple comparison results.

What can be learned from rapid particle measurements during the Lake Michigan Ozone Study 2017 (LMOS 2017)

Megan Christiansen, *Chemical and Biochemical Engineering*

The collaborative field campaign, Lake Michigan Ozone Study 2017, occurred between May 22 - June 22, 2017. The campaign combined fixed ground site, mobile, aircraft, and ship measurements to better understand the regional and local summertime ozone episodes around Lake Michigan. The population of aerosols at the main ground monitoring site (Zion, IL) was continuously monitored using electrical particle counters with size measurement capabilities (Scanning Mobility Particle Sizer (SMPS) and Aerodynamic Particle Sizer (APS)). These continuous measurements are useful because they show how rapid events (smoke, dust, other pollution types, and wind shifts) impact the site. In this poster, we compare them to integrated aerosol filters taken at the site, which are more accurate but do not record rapid values. The 12 hr average of SMPS+APS instrument PM concentrations were well correlated with the aerosol filters, the mean PM_{2.5} concentrations were 5.71 μgm^{-3} and 5.17 μgm^{-3} respectively, and a correlation coefficient (r) of 0.89. High ozone events, days exceeding the NAAQS standard of 70 ppb, occurred on June 2nd and June 10-16. The PM_{2.5} was averaged over every hour of event and non-event days and the PM_{2.5} concentrations, and time of day, were 11.4 μgm^{-3} (19 UTC) and 5.9 μgm^{-3} (04 UTC) respectively. A significant diurnal variation of PM_{2.5} and total number concentrations were observed during the event periods with both peaking in the late afternoon hours. No significant variation was observed during the non-event periods.

Characterizing toxicity for industrial engineered nanomaterials

Brittany Givens, *Chemical and Biochemical Engineering*

Engineered nanomaterials (ENMs) are commonly used in many products in order to improve their quality and/or lifetime. This results in high exposure for employees manufacturing these products. We aim to systematically characterize ENMs that are commonly used in industrial processes for their toxicity according to the physicochemical properties and toxicity in vitro and in vivo. To date, we have worked with upwards of ten materials and found that many are non-toxic at the current industrial exposure levels using various cell-based and animal-based studies, including A549 cells in submersed culture and at the air-liquid interface, and female and male C57BL/6 exposed to aerosolized ENMs via nose-only inhalation. One material has been shown to be toxic both in vitro and in vivo, supporting the idea that rapid-in vitro screening can be used as a first-line prior to intensive animal studies.

Chemical Composition of PM_{2.5} in Zion, IL during the 2017 Lake Michigan Ozone Study (LMOS)

Dagen Hughes, *Chemistry*

The Lake Michigan Ozone Study 2017 combined airborne, ship, mobile, and ground based measurements to investigate the elevated ozone concentrations along the coast of Lake Michigan and to examine how coastal meteorology affects ozone production. Here, we focus on characterizing the chemical composition of fine particulate matter (PM_{2.5}) in Zion, Illinois and identifying its sources. The most significant contributor to PM_{2.5} was organic matter (averaging 57.9%), followed by sulfate (16.4%), ammonium (6.3%), nitrate (3.5%), and elemental carbon (3.3%). The average organic carbon-to-elemental carbon ratio was 12.25, suggesting a large contribution from secondary organic aerosol. Ozone concentrations exceeded the primary standard to protect human health (70 ppb) during a high-ozone event on June 02 and during a high-ozone period occurring from June 10 to June 16. PM_{2.5} concentrations were elevated during these two episodes relative to non-event periods. Moreover, the organic carbon-to-elemental carbon ratio on June 02 was 7.0—substantially lower than the ratios for the high-ozone period (13.8) and non-event periods (12.0)—indicating a larger contribution from primary combustion emissions. Additional organic species and metals will be quantified for use in source apportionment modeling to evaluate sources contributing to PM_{2.5} in Zion, Illinois.

Biochemical and Structural Investigation of the Dynamic Regulation Mechanism of Pyruvate Kinase M2 by Amino Acids

Suparno Nandi, *Chemistry*

Pyruvate kinase muscle isoform 2 (PKM2) catalyzes the terminal step in glycolysis and is a key enzyme in cancer metabolism. In glycolysis, PKM2 converts the substrates, phosphoenol pyruvate (PEP) and adenosine diphosphate to pyruvate and adenosine triphosphate (ATP). Cancer cells require ATP and glycolytic intermediates for cell function and proliferation, respectively. PKM2 activation results in an elevated ATP level, which enhances cellular processes in cancer cells. On the other hand, PKM2 inhibition increases the concentration of upstream glycolytic intermediates that aid in cancer cell proliferation. Previous studies identified various amino acids regulate the activity of PKM2 by binding to a hydrophilic binding pocket in the enzyme. However, the mechanism of regulation by amino acids is not understood. Our activity and ligand binding studies indicate that hydrophilic amino acids aspartic acid and asparagine activate PKM2 by enhancing its PEP binding affinity. In contrast, a hydrophobic amino acid valine inhibits

PKM2 by lowering its affinity for the substrate. Crystal structure of wtPKM2 bound to valine shows reduced number of H-bonds between valine and the binding pocket compared to the reported PKM2-serine complex. Using site-directed mutagenesis of residues in the amino acid binding pocket, followed by activity and binding affinity studies, we have determined that changing the polarity or charge of the environment decreases the activity of PKM2 by reducing its PEP binding affinity. Based on these structural and biochemical studies, we propose that polarity of amino acids together with the charge or polarity of the amino acid binding pocket plays an important role in the regulation of PKM2 activity.

**KNOWLEDGE DISCOVERY, INTEGRATION AND COMMUNICATION FOR
EXTREME WEATHER AND FLOOD RESILIENCE USING ARTIFICIAL
INTELLIGENCE: FLOOD AI ALPHA**

Yusuf Sermet, *Electrical and Computer Engineering*

Nobody is immune from extreme events or natural hazards that can lead to large-scale consequences for the nation and public. The National Research Council (NRC) report discusses the topic of how to increase resilience to extreme events through a vision of resilient nation in the year 2030. The report highlights the importance of data, information, gaps and knowledge challenges that needs to be addressed, and suggests every individual to access the risk and vulnerability information to make their communities more resilient. This abstracts presents our project on developing a resilience framework for flooding to improve societal preparedness with objectives; (a) develop a generalized ontology for extreme events with primary focus on flooding; (b) develop a knowledge engine with voice recognition, artificial intelligence, natural language processing, and inference engine. The knowledge engine will utilize the flood ontology to connect user input to relevant knowledge discovery outputs on flooding; (c)develop a data acquisition and processing framework from existing environmental observations, forecast models, and social networks. The system will utilize the framework, capabilities and user base of the Iowa Flood Information System (IFIS) to populate and test the system; (d) develop a communication framework to support user interaction and delivery of information to users. The interaction and delivery channels will include voice and text input via web-based system (e.g. IFIS), agent-based bots (e.g. Microsoft Skype, Facebook Messenger), smartphone and augmented reality applications (e.g. smart assistant), and automated web workflows (e.g. IFTTT, CloudWork) to open the knowledge discovery for flooding to thousands of community extensible web workflows.

Social Sciences and Education

Black Male Educators: The Before and Alternative Aftermath of Brown

Krista Walker, *Education Policy and Leadership Studies*

The historiography of African-American education demonstrates that black teachers have always been essential agents in the education of the entire black community. "African American educators created liberatory spaces...historically...by struggling against racist policy and an oppressive sociopolitical context to instill cultural consciousness, promote academic excellence, and provide the tools for racial uplift."(Frederick & View, 2009, p. 571). Specifically, Black male educators strived for equitable educational opportunities, pushed for equal access to resources, and basic human rights. Their history is not as visible, in the field dominated by women, but Black male educators demonstrated that they deliberately became laborers in an educational system meant to exclude and exploit them regardless of their tireless desire to increase educational attainment for their own communities. The Jim Crow laws of the 1870's forced black communities to navigate racial inequities within education policy, but these same racialized issues continued to persist even after the Brown vs Board of Education decision. "African American men, in particular, created positions for themselves as administrators of segregated schools in order to alter the goals of black education"(Warren, 2010, p. 125).The results of Brown meant to reconstruct the "separate but equal" policies of Plessy v Ferguson led to the reassignment and dismissal of thousands of black educators across the nation. This led to an increased effort to expand recruitment of minority teachers to address the gap that existed between minority teachers and minority students in the US educational system. This recruitment effort lasted from 1987 to 2012. The reverberations of the Brown decision have proven to be detrimental for all African American educators, especially males. This is so much so, that the numbers have dwindled significantly to less than 2% today.

Disability and Chinese Exclusion in Late Nineteenth-Century California

SHU WAN, *HISTORY*

During the history of immigration policy in the United States, the Chinese have suffered from long-term discrimination. The main aim of my essay is to illustrate how the conception of disability fit in with the Chinese Exclusion Acts and the changing view of Chinese immigrants who were characterized as a race having multiple defects after the milestone year 1882, when the evolution of discrimination against Chinese and other Asian migration was not terminated but reached its nadir. This essay is organized into three parts. In the first part, it discusses the interaction between social class and race in the anti-Chinese sentiments. In the second section, it discusses how biological and cultural racism shaped Chinese immigrants' experiences during the Exclusion era. Finally, the third section seeks to demonstrate visual, auditory and olfactory implications of the anti-Chinese sentiments.

Parenting practices of adults formerly diagnosed with ADHD and their off-springs outcomes

Eddie Scott, *Psychological and Quantitative Foundations*

Core symptoms of childhood Attention Deficit Hyperactivity Disorder (e.g., distractibility, impulsive responding,) often persist into adulthood and can have a negative impact on the individual's quality of life. The focus of the present study is to examine the impact of these symptoms on parenting. Three groups of participants (N = 105) who had children and were drawn from the midlife phase of a longitudinal study of ADHD were included: 1) Probands who manifested ADHD in childhood; 2) full, unaffected Brothers (i.e., not diagnosed with ADHD) of Probands; and 3) classmate Controls identified during the adolescent phase of the larger longitudinal study. Participants completed a parenting questionnaire and behavior ratings of their children. First, a factor analysis of the parent questionnaire revealed three orthogonal factors: 1) disengaged parenting (e.g. doesn't attend to child's misbehavior); 2) positive parenting (e.g. often speaking of the good things that the child does); and 3) negative parenting (e.g. reminding the child of all the things that they have done for them). Second, an analysis of variance (Group X Parenting Style) will be conducted. Third, Childhood Outcomes (dimensions of externalizing psychopathology) X Group will be examined. Results are expected to contribute to research on parenting in ADHD.
