Maya Armstrong
Research Mentor: Marcia Bockbrader, MD, PhD
Project Title: “Comparing Google Glass and Prism Therapy for Neurovision Rehabilitation after Stroke”
Project Abstract: Hemispatial (aka visuospatial, unilateral) neglect is characterized by reduced awareness of stimuli on one side of space, typically as a result of damage to one hemisphere of the brain (Plummer et al, 2003; Manning, 2009). The deficits associated with hemispatial neglect are not sensory but rather perceptual (Heilman et al, 1993). Failure to attend to objects within a portion of the visual field (contralateral to the lesion) can have debilitating consequences, reducing the patient’s ability to perform activities of daily living. After a right-hemisphere lesion, patients may walk into (or trip over) objects on their left sides; they may not notice words on the left side of a page or food on the left side of a plate. Spatial bias can be demonstrated using a number of simple written tests (eg, Behavioral Inattention Test [BIT], as in eg, Hartman-Maeir, 1995). Hemispatial neglect complicates both motor and cognitive recovery after stroke (Hartman-Maeir et al, 2001) and is associated with higher healthcare cost (Barrett et al, 2012). In addition, postural balance may be disrupted, potentially increasing risk for falls (Kerkhoff & Schenk, 2012). For these reasons, hemispatial neglect has been the target of a number of therapeutic approaches, which have been reviewed by various authors (Bowen et al, 2013; Fasotti and van Kessel, 2013; Priftis et al, 2013; Barrett et al, 2012). Currently, the standard approach to neurovisual rehabilitation is prism therapy, which has been reported to improve performance on simple neuropsychological tests (Rosetti et al, 1998) and to improve cued body orientation (Gossmann et al, 2013), postural balance (Nijboer et al, 2014), and the performance of activities of daily living (Mizuno K et al, 2011). However, the underlying mechanism of prism therapy is unclear (Van der Stigchel and Nijboer, 2013), and a recent Cochrane review concluded that “no rehabilitation approach can be supported or refuted based on current evidence from [randomized controlled trials]” (Bowen et al, 2013). However, the authors express cautious enthusiasm for cognitive rehabilitation approaches and recommend additional clinical trials. In this (ongoing) feasibility study, we compare the effectiveness of Google Glass therapy vs prism therapy in survivors of acute right-sided stroke with objective evidence of left neglect (based on BIT score). After being randomized to one of the two intervention groups, patients receive 10 30-minute sessions of therapy over 2 weeks of inpatient admission at Dodd Rehabilitation Hospital. After completing the therapy, the BIT is administered a second time. The outcome measure is improvement in BIT score, which will be compared between the two intervention groups. To date, participants continue to be recruited, and the study is ongoing. Initial data should provide an estimate of the effect sizes of Google Glass therapy and prism therapy. This information will be used to estimate the sample size needed for an NIH grant submission for a larger, longitudinal, randomized, controlled study to investigate comparative effectiveness of Google Glass vs prism therapy on neglect severity and functional outcomes (at 3, 6, 9, and 12 months post-stroke). In addition, experience from the feasibility study will help improve the physical design and implementation of the two interventions in order to accommodate patients with different mobility limitations.

Martins Ayoola-Adeola
Research Mentor: Adrian Suarez, MD
Project Title: “Insulin-like growth factor 1 receptor (IGF1R) tumor expression does not correlate with the presence of diabetes mellitus type 2 or administration of various antidiabetic drugs including metformin in a cohort of 266 women with endometrial cancer”
Project Abstract: Established risk factors for endometrial cancer (EC) include metabolic syndrome-related conditions such as obesity and diabetes mellitus (DM). Additionally, oral hypoglycemic drugs such as metformin have demonstrated an EC risk-reducing effect in epidemiologic studies. Thus, in a retrospective review of hysterectomy cases at the Ohio State University Wexner Medical Center, we aimed to examine these variables in relationship to carcinoma expression of insulin growth factor receptor 1 (IGF1R), a receptor that our group has previously demonstrated is related to body mass index (BMI), a surrogate marker for obesity. We examined 266 consecutive hysterectomy specimens for immunohistochemical expression of IGF1R, and examined whether a quantitative immunoreactivity score (IRS) for IGF1R expression was associated with the presence of diabetes, oral hypoglycemic drugs, or insulin administration. Diabetes mellitus type two was present in 89 patients (33.5%), any oral hypoglycemic drug was used in 63 patients (23.7%), metformin was used in 48 patients (18.1%, a subset of the oral hypoglycemic drug takers), and insulin was used in 23 patients (8.7%). None of these variables were significantly associated with high or low IGF1R expression (p = 0.808, 0.608, 0.205, and 0.920, respectively). Thus, contrary to our original
hypothesis, it is possible that the mechanism by which DM increases and metformin decreases risk for EC involves a pathway separate from IGF1R.

**Michael Baggett**  
**Research Mentor:** Dr. Timothy Hewett, PhD  
**Project Title:** “Effect of Shoe-Surface Interaction on Risk for High Ankle Sprain: A Cadaveric Study”  
**Project Abstract:** Synthetic field surfaces have grown in popularity over the last several decades, though the potential injury risks of these new surfaces have not been fully studied. Epidemiologic studies of American football indicate potentially higher rates of lower extremity injuries on synthetic turf. The proposed project will examine the differences in biomechanical forces and motions of the cadaveric foot and ankle between grass and synthetic field surfaces. Specifically, a pneumatic testing system will apply measured rotational forces to cadaveric lower legs fitted to football cleats on both grass and synthetic turf until failure of the distal tibiofibular syndesmosis, commonly known as a high ankle sprain, is achieved. Kinematic and kinetic data will be collected using specialized a motion analysis system and intra-articular strain gauges. After ligamentous failure, the cadaveric specimens will undergo autopsy, and all orthopaedic injuries will be documented. At this time, the testing system is under construction at a specialty manufacturer. Testing is expected to being soon. We hypothesize that the cadaveric lower legs will sustain a high ankle sprain at a lower applied rotational force on synthetic surfaces than on traditional grass.

**Steven Baum**  
**Research Mentor:** Patricia Gabbe, MD / Courtney Lynch, PhD, MPH  
**Project Title:** “A community-based approach for empowering pregnant women in resource-poor areas to improve maternal and infant outcomes: the Moms2B experience”  
**Project Abstract:** Community-based, group prenatal programs offer a unique opportunity to address health disparities, enhance early access to medical care, and improve maternal and child health outcomes. However, empirical evidence on the effectiveness of this type of intervention in improving maternal and child health outcomes is lacking. This paper aims to examine the effect of participation in an academic health center and community-based prenatal program on birth outcomes. We conducted a matched exposure cohort study. Exposed women (n = 71) were enrolled in Moms2B and delivered at OSU’s Wexner Medical Center in 2011-2014. Unexposed women (n = 71) were those who delivered at OSU’s Wexner Medical Center in 2011-2014 but lived in the same zip codes as Moms2B programs (43201, 43205, and 43227), but did not participant in the Program. Unexposed women were frequency matched to exposed women based on race/ethnicity due to the potential for residual confounding associated with that fact. Unexposed women were randomly selected from among all available women meeting the study’s eligibility criteria.

We found that exposure to the Moms2B program was associated with a decrease in preterm singleton delivery before 32 weeks of gestation (p<0.5). There were no recorded preterm births in the exposed population (n=71) before 32 weeks, as opposed to 4 recorded deliveries under 32 weeks in the unexposed population (n=71). In addition, a regression analysis examining the effect of Moms2B on gestational age at delivery suggest that exposed women deliver approximately ½ week later than unexposed women, after adjusting for race, age, insurance, smoking, history of preterm birth, and progesterone supplementation. This difference was not statistically significant. / / There was no statistically significant difference in rates of Medicaid usage between the two groups (exposed = 90.14%, unexposed = 83.10%) and history of preterm birth (exposed = 14.71%, unexposed = 20.00%). Rates of obesity between the two groups were also similar, and not found to be statistically significant (exposed = 43.33%, unexposed = 46.15%). Both groups showed no significant difference in rates of progesterone supplementation (exposed = 5.63%, unexposed = 8.45%). However, exposed mothers were younger (M = 25 years, SD = 6.19) than unexposed group (M = 29, SD = 8.24). This was found to be statistically significant.
Group prenatal care through the Moms2B program has a beneficial effect on reducing preterm births in an impoverished, low-resource, minority community. More research is needed to determine the mechanism for this beneficial effect.

Franklyn Boothe  
**Research Mentor:** L. Eugene Arnold, M.D., M.Ed.  
**Project Title:** “Ethnic Differences in Longitudinal Outcomes in ADHD: A 16 Year Follow Up Study to the Multimodal Treatment Study of Children with ADHD”  
**Project Abstract:** Ethnicity (including race) may influence outcomes of various disorders and response to treatment for both genetic and cultural reasons. A common mental disorder of childhood increasingly recognized in adults is Attention Deficit Hyperactivity Disorder (ADHD). The longitudinally followed sample of the Multimodal Treatment Study of Children with ADHD (the MTA) provides an opportunity to explore influence of ethnicity on long-term outcomes. Method: MTA 12-, 14-, and 16-year follow-up data were utilized to match African American subjects with randomly selected Caucasian subjects of the same sex, treatment group, and participant site. Members of the matched pairs were compared to evaluate ethnic effects on longitudinal symptom severity and functional outcomes.

Persistence of symptoms was determined from the Conners Adult ADHD Rating Scale by proband and parent. Results: There was no significant interaction between persistence of symptoms and ethnicity. Functional outcomes showed ethnic effects on WIAT reading scores, however there is possibility of a strong confound of socioeconomic status explaining ethnic differences. Significant results were obtained in subjects’ self-concept of sociability, but other domains tested did not exhibit a difference based on ethnicity. Conclusions: African Americans and Caucasians have similar tendencies for ADHD symptom persistence or desistence. Co-varying mother’s education, family income, and public assistance could likely explain a significant difference in reading achievement. These preliminary results need further analysis to truly understand the effects of ethnicity on ADHD outcomes.

Nevin Britto  
**Research Mentor:** Kim McBride, MD, MS  
**Project Title:** “An interstitial translocation in the MATR3 gene of chromosome 5 that is found in a higher proportion of families with congenital coarctation of the aorta”  
**Project Abstract:** Coarctation of the aorta (CoA) comprises 6-8% of congenital heart defects (CHD) with an incidence of 4/10,000 live births (Singh et al., 2015). While the exact etiology for most left ventricular outflow tract (LVOT) malformations such as CoA is unknown, a strong genetic component has been established (McBride et al., 2008). In order to better understand the genetic etiology of CoA, we have collected genetic samples from 282 patients with CoA or directly related to a proband with CoA. We sequenced this genetic material using next generation sequencing (NGS) techniques, and then ran the whole exome sequencing data output through a software tool called Churchill. Churchill aligns the sequence reads against the human reference genome, and then annotates the identified variants in order to help us identify the most clinically relevant variants (Kelly et al., 2015). Filtering the list of variants with the assumption of a de novo inheritance model and against a stringent list of genes known to be involved with heart development revealed a list of 8 variants across 5 genes that could be associated with CoA development. Out of these genes, the MATR3 gene was explored in most detail, with 4 different variants being present across 3 different families. Further analysis revealed a possible interstitial translocation occurring between Chromosome 1 and Chromosome 5, with a part of Chromosome 1 inserting in the MATR3 gene. Further study is needed to assess whether this translocation is related to the etiology of CoA, especially in light of the frequency with which it is present in the general population.
Kylie Bushroe  
**Research Mentor:** Julie C. Leonard, MD, MPH  
**Project Title:** “Mental Illness and Injury in the Pediatric Managed-Medicaid Population”  
**Project Abstract:** Few studies have investigated the relationship between traumatic injury and mental health in children with low socioeconomic status. Our objective was to compare mental health diagnoses before and after unintentional, non-fatal traumatic injuries in a managed-Medicaid population. We investigated children 18 years of age and under who were treated for traumatic injuries at Nationwide Children’s Hospital, Columbus, Ohio, between 2005 and 2015. Eligible children were enrolled in the hospital’s managed Medicaid program at the time of hospital admission and for at least one healthcare visit in the year prior to admission. Using data from the Nationwide Children’s Trauma Registry, EPIC, and the Medicaid billing database, we identified all healthcare visits one year prior to and one year following the injury. Poisson regression models estimated the rate of mental health diagnoses per the time observed. The median age of the pediatric cohort (n=2281) was 5.1 years (range: 0.4-18.9); 59.7% were male. A similar number of patients identified as White (42.1%) and Black/African American (40.4%). The top three causes of injury were falls (37.1%), burns (20.7%), and motor vehicle accidents (7.6%). The vast majority (94.7%) of patients had a Glasgow Coma Score (GCS) of ≥13 upon arrival in the emergency department while 1.6% had GCS ≤8. Nearly three-quarters (72.6%) had minor injuries, (Injury Severity Score (ISS): 1-8) while 4.8% had severe injuries (ISS >15). 148 patients, representing 95.8 mental health diagnosis per 1000 persons observed for 1 year, received a mental health diagnosis prior to injury and this increased to 195 mental health diagnosis, or a rate of 155.4 for every 1000 persons observed for 1 year, post-injury (Rate Ratio (RR): 1.62, 95% CI: 1.38-1.90). The unadjusted rate ratios comparing the following diagnoses changed significantly post-injury: disruptive behavior disorders (RR: 2.08, 95% CI: 1.14-3.80), learning/cognitive disorders (RR: 2.69, 95% CI: 1.79-4.04), sleep disorders (RR: 2.46, 95% CI: 1.14-5.32). Preliminary results suggest a significantly increased rate of mental health diagnoses in this pediatric Medicaid cohort. These results and planned further analyses will help to inform future studies investigating interventions for psychological symptoms following pediatric traumatic injury.

Wai-Tim Chew  
**Research Mentor:** Barbara Rogers, MD  
**Project Title:** “A Comparison on the Impact of Basal Insulin Dosing Strategies on Next-Day Surgery Blood Glucose Control”  
**Project Abstract:** Objective: The importance of perioperative blood glucose control has been increasingly emphasized as evidence mounts for an associated between intraoperative hyperglycemia and adverse surgical outcomes. Due to contradictory guidelines between the Wexner Medical Center at the Ohio State University, recommendations for the Society for Ambulatory Anesthesia, and guidelines from the Endocrine Society, this randomized controlled trial was begun to evaluate two evening basal insulin dosing strategies for achievement of target (79-179 mg/dL) preoperative fasting blood glucose (FBG) ranges on the day of surgery. / Methods: Patients with type 2 diabetes taking once-daily evening basal insulin were randomized into two dosing strategies: (1) take 50% of usual dose, or (2) take 75% of usual dose. Capillary blood glucose values were obtained the morning of surgery, and recorded at regular hourly intervals. / Results: No significant differences in target preoperative FBG achievement were detected among strategies. / Conclusions: There was no advantage between taking 50% usual dose or 75% usual dose in achieving target FBG.
Nisha Crouser  
**Research Mentor:** David Dean, PhD  
**Project Title:** “Culture of human mesenchymal stem cells on three-dimensional printed poly(propylene fumarate) (PPF) scaffolds”  
**Project Abstract:** Craniomaxillofacial implants are difficult to develop because of the nature of the site and the shape of the bone defects. Current osteofixation devices are linked with many problems due to rigid plate fixation and corrosion products. There are various strategies in developing cranial implants but this study looks at the possibility of producing extracellular matrix (ECM) on the surface of a 3D printed porous plastic scaffold and ultimately implanting it into the patient. The project aims to produce 25-50 µm ECM on the surface of poly(propylene-fumarate) (PPF) resorbable plastic scaffolds. The purpose of this part of the investigation was to translate the results from the 2D static proliferation study to a 3D model. The main goal was to allow sufficient proliferation of human mesenchymal stem cells to cover the entire surface of a small 3D printed poly(propylene fumarate) porous scaffold and ultimately a mandibular implant. It was found that significant proliferation of hMSCs could be obtained within one day of vacuum seeding, with even higher results at the end of one week. These findings were used in the development of a protocol for preparation of mandibular implants prior to surgical implantation in canine models. They represent one of the first steps toward developing an improved method of craniomaxillofacial implantation and bone regeneration.

Christopher Dall  
**Research Mentor:** Mark Angelos, MD  
**Project Title:** “Intermittent hyperoxic cycling augments cell survival proteins and exhibits decreased cellular injury following prolonged hypoxia in human inducible pluripotent derived cardiomyocytes”  
**Project Abstract:** The use of stem cell therapy for the failing heart has not achieved its therapeutic potential in large part due to the poor engraftment and survivability of implanted cells into the hostile environment of the ischemic heart. We hypothesized that hyperoxic/hypoxic cycling in human-induced Pluripotent Stem Cell Cardiomyocytes (hiPSC-CM) would better prepare cells for hypoxic environments. We exposed cells to 12 hours of hypoxia following hypoxic, hypoxic/normoxic cycling, and hypoxic/hyperoxic cyclic preconditioning. In the cell group exposed to hypoxic/hyperoxic signaling, we observed increased survival, decreased inflammatory damage as measured by superoxide production, and the induction of several protein pathways involved in the cell damage repair response pathway, including P38, AKT, DUSP, and VEGF. However, we did not observe increased induction of pENOS, HIF1α, or pERK, results that merit further study into the protein pathways activated in different cell groups following hypoxic damage. We have concluded that hypoxic/hyperoxic cycling may be a viable preconditioning method for treatment of the failing heart.
Jim Darnley  
**Research Mentor:** Robert Magnussen, MD, MPH  
**Project Title:** “ACL Reconstruction Using a Combination of Autograft and Allograft Tendon”  
**Project Abstract:** Anterior Cruciate Ligament (ACL) ruptures are a very common and serious injury of the knee. Modern reconstructive techniques are able to provide a stable ligament using autograft hamstring tendon, but there is a reported increased risk of revision seen in young patients who have small graft diameter. One potential solution to a harvested hamstring that is too small is augmentation with allograft tissue. The purpose of this project is to study the need for revision surgery and patient reported scores following ACL reconstruction using a hybrid autograft/allograft. It is believed that this procedure will not show an increased risk of revision surgery when compared to autograft reconstruction in age and sex matched patients. It is also believed that patient reported outcome scores of the hybrid reconstruction group will not be significantly different than those of the traditional autograft reconstruction. Patients that underwent this hybrid type of ACL reconstruction at OSU sports medicine will be identified using the prospectively collected MOON database. The data will be collected, analyzed, and compared to the results of those that were reconstructed with autograft tendon once the data becomes available from the MOON database.

Nicolas Delacruz  
**Research Mentor:** John Mahan, MD  
**Project Title:** “Taking the HEAT: Teaching pediatric residents to communicate with emotionally charged patients”  
**Project Abstract:** Effective communication skills are essential for physicians in order to deliver high quality, patient-centered care. Effective communication has been shown to positively impact many measures of healthcare outcomes, including patient safety, patient compliance, and patient satisfaction. Interacting with distraught patients in emotionally charged situations can lead to severe breakdowns in communication, and resident physicians are often not educated on how to properly navigate these scenarios. Purpose: Our objective was to evaluate the effectiveness of an educational workshop based on the Take the HEAT communication strategy. We also aimed to create a novel tool to evaluate residents’ skills in communicating with angry patients. Methods: Thirty-four first-year pediatric and internal medicine-pediatrics residents participated. The educational intervention used was a workshop based on the Take the HEAT strategy of communication. Communication skills were assessed through the use of standardized patient (SP) encounters at two time points, baseline and post-workshop. Encounters were scored using an internally created and validated assessment tool based on the HEAT paradigm. Results: After being exposed to our educational intervention, residents’ overall performance during the SP encounter significantly improved from baseline. Three of the four
aspects of communication that we scored showed significant improvement while one aspect showed a decline in performance from baseline. Conclusion: We concluded that interacting with emotionally charged patients is a skill that can be feasibly taught and developed in pediatric residents.

Jaspreet Dhillon  
Research Mentor: Julie Leonard, MD, MPH  
Project Title: “Estimates of Pediatric Spinal Cord Injury in the United States: Implications for Clinical Care and Research Planning”  
Project Abstract: Background and Objective: Pediatric spinal cord injuries (SCIs) are rare and result in great difficulty for clinical trial recruitment. Our objective was to provide an accurate estimate of the distribution of clinically eligible children with SCI through the use of a national electronic database. / / Methods: The Kids’ Inpatient Database (KID), the largest all-payer pediatric inpatient care database in the United States, was analyzed for the years 2006, 2009 and 2012. Our inclusion criteria mandated that children were <18 years with an SCI ICD-9 code. The exclusion criteria relied on common omission criteria for clinical trials such as sub-thoracic injuries, non-blunt trauma, open fractures, dislocations, cardiac arrest, substance use, pregnancy, and mental illness. In addition, patients with clinical outcome findings suggesting the SCI was not the chief cause of their admission (length of stay < 48 hours), or with an indiscreet level of injury, were omitted. The identified pediatric SCI population was then defined by demographic and geographic characteristics using means and frequencies. Results: Of the 2,484 children with SCI ICD-9 codes, 693 children fit the inclusion criteria for a clinical trial, generating an estimated total of 1,042 SCI cases nationwide over a 3-year timespan. Following previously documented trends, injuries were more common in the cervical spine (n = 516), occur in males (65.9%), and receive treatment in a non-children’s hospital. Injuries were most common in the South (n = 516), occurred in general urban teaching hospitals, and in hospitals that received only 1 SCI child per year (n = 294). Conclusions: The pediatric SCI population eligible for clinical trials represents one- third of all pediatric patients with SCI ICD-9 codes. They demonstrate regional localization to the South, with few patients receiving treatment at specialized care centers. These findings hold important implications for future steps in clinical care and clinical trial planning, as the distribution of patients should be assessed before considering patient recruitment.

Alyssa Drosdak  
Research Mentor: Irene Mikhail, MD  
Project Title: “Serum IgE results differ according to indication for peanut allergy testing”  
Project Abstract: Rationale: Children with eczema and other food allergies have a greater risk of peanut allergy, and comprise a large proportion of children tested for reasons other than a clear IgE mediated reaction. We aimed to understand the patterns in test results for children diagnosed with allergy to peanut based on indication for initial testing. Methods: A retrospective review was conducted on 1,993 charts spanning records from 2009-2015 in the EMR at Nationwide Children’s Hospital’s outpatient allergy clinic. Data collected included demographics, indication for initial testing, and results of serum IgE and skin prick testing. Results: Charts with “history of peanut allergy” were identified. Indications for testing included suspected IgE mediated reaction (n=281), eczema (n=125), and another food allergy (n=124). Mean age at initial allergy visit was 3.14 years. There was a slight male predominance (393 patients). Eczema patients were 1.8 times more likely (p=.05) to have peanut IgE > 15 kU/L than children with another food allergy and 4 times more likely (p=.0001) to have peanut IgE > 15 kU/L than
patients with suspected IgE mediated reaction. Surprisingly, patients without a previous IgE mediated reaction were 1.7 times ($p=.005$) more likely to have peanut IgE $> 2$ kU/L. No significant differences were noted in prevalence of positive skin prick testing between IgE reaction, eczema and other food allergy patients.

Conclusions: It is important for practitioners to be informed on the expected results of allergy tests in patients with different clinical presentations in order to consider food challenges when appropriate and reduce unnecessary food avoidance.

Amy Du  
**Research Mentor:** Fedias Christofi, PhD  
**Project Title:** “Preoperative, Intraoperative, and Postoperative Opioid Consumption in Patients Undergoing Anterior vs. Posterior Total Hip Arthroplasty”  
**Project Abstract:** Hip arthroplasty is one of the most common procedures in orthopaedic surgery. While the posterior approach to hip arthroplasty is the traditional approach, a new method of approaching the hip anteriorly to avoid tissue incision has been growing in popularity. Opioid administration in hip arthroplasty is another variable that has been shown to affect outcomes. In this paper, we explore whether accessing the hip from different points of entry (specifically anterior and posterior) can affect the amount of opioids necessary in the procedure.

Claire Durkin  
**Research Mentor:** Simon Lin, MD, CSDP  
**Project Title:** “Evaluation of Ultrasound Notes Using Lexical and Syntactical Readability Measures”  
**Project Abstract:** Objective: To evaluate the lexical and syntactic features of ultrasound reports using quantitative measures of language, and to classify groups of like-sentences based on their linguistic similarities and differences. Methods: The “impressions” section of all 23,324 ultrasound reports from Nationwide Children’s Hospital in 2014 was used to produce a corpus of 35,480 unique, clinically relevant sentences for analysis. Eleven lexical measures, which included 5 traditional readability indexes, and 5 syntactic measures, which described the grammatical correctness of the sentences, were evaluated. Three principal components were extracted out of these lexical and syntactic measures using factor analysis and sentences were binned into 27 classes based on these components. Results: Three principle components characterized 3 aspects of ultrasound sentences: sentence length, readability, and grammar. Classification results found that 17.1% of the sentences had severe readability problems. Of the sentences with poor readability, a majority was of average length and 16.6% also had poor grammar. Additionally, results demonstrated that short sentences tended to have poorer readability than long sentences. Discussion: Our results indicate that ultrasound reports are written at a level that is more complex than current health literacy recommendations for patient-targeted texts. Our analysis demonstrated that clustering sentences based on their lexical and syntactic similarities was a feasible and meaningful method for differentiating sentence types. Future research needs to be done to evaluate how these linguistic metrics relate to patient comprehension and outcomes, how writing styles differ between individual radiologists, and how they can be used as an educational, assessment, or automation tool to improve clinical writing. Conclusion:
Classifying sentences based on their quantitative lexical and syntactic features may be a viable option to differentiate between easy- and hard-to-read clinical texts.

Shannon Fayson  
Research Mentor: Noah Weisleder, PhD  
Project Title: “The Role of TRIM Protein E3 Ubiquitin Ligases in Facilitating Muscle Atrophy”  
Project Abstract: Muscle weakness resulting from muscle atrophy is the hallmark of muscular dystrophy and many other muscle-wasting diseases. Loss of muscle mass characteristic of muscle atrophy involves activation of the ubiquitin proteasome system leading to degradation of cellular proteins, particularly in the cell membranes of myocytes. Inhibiting ubiquitination decreases protein breakdown and can maintain the plasma membrane integrity of muscle fibers, enhancing myocyte survival. A unique family of E3 ubiquitin ligases known as the tripartite motif (TRIM) family has been shown to assist in muscle atrophy, suggesting these proteins may serve as future targets for developing better therapeutics. We plan to study the contribution of members of the TRIM family E3 ubiquitin ligases in muscle atrophy and test the hypothesis that targeting TRIM family proteins affect the muscle atrophy process. TRIM family genes will be overexpressed and knocked down in cultured myoblasts, which will be assessed for survival and changes in biochemical processes and signaling pathways.

Mary Gaugler  
Research Mentor: Daniel Coury, MD  
Project Title: “Impaired emotion regulation in children and youth with autism spectrum disorder and comorbid psychiatric disorders”  
Project Abstract: Children with Autism Spectrum Disorders (ASD) are frequently diagnosed with one or more comorbid psychiatric disorders. ASD and other psychiatric disorders often share common clinical features, causing uncertainty in regard to diagnostic boundaries. Emotion regulation (ER) is a growing topic of research in ASD and has been acknowledged as a possible factor in the development of psychiatric comorbidities. We hypothesized that children diagnosed with ASD and comorbid psychiatric disorders are more likely to present with greater impairments in ER as compared to ASD patients without concurrent psychopathology. Using a large, representative sample from the Autism Speaks Autism Treatment Network, we assessed ER in ASD patients with and without additional psychiatric diagnoses using the CBCL A-A-A Profile, as well as measures from the Vineland Adaptive Behavior Scales-II, the Aberrant Behavior Checklist, and a parent survey of child behaviors. Among 3163 children with ASD, 36.39% had at least one comorbid psychiatric diagnosis. According to the CBCL A-A-A profile, those with psychiatric comorbidity were 2.8 times more likely to have moderately deficient ER and 5 times more likely to have severely deficient ER than those without psychopathology. Children with comorbidities were significantly more likely to have problems with anxiety, aggression, attention, hyperactivity, irritability, and adaptive behavior. Impairment in ER is strongly related to the presence of psychopathology in ASD, with
variable implications for particular comorbidities. These findings allow us to recognize the predictive value of ER assessment in the clinical setting, but also to look critically at the assignment of comorbid diagnoses.

Andrew Hair  
**Research Mentor:** Laura Matrika, MD  
**Project Title:** “Laryngeal Injuries in the Intubated ICU Patient”  
**Project Abstract:** Endotracheal intubation is a life-saving procedure performed with high frequency in intensive care settings when other respiratory interventions prove ineffective or infeasible. Unfortunately, this critical intervention is not without complications. Due to the constant pressure that Endotracheal tubes (ET Tubes) must apply to the larynx to deliver adequate oxygen to the lungs, intubation frequently injuries to the larynx that may require additional intervention to solve and even contribute to extubation failure and a need for reintubation (Tadié, Jean-Marc et al.; House, Joyce C. et al.). Potential post-intubation injuries include erythema, ulceration, granuloma, and paralysis of the vocal folds and can occur very frequently. Erythema can occur in as many as 94% of patients, and granuloma can be noted in as many as 76% (Santos et al.). This high incidence suggests that there is room for improvement in this area. This study aims to illuminate some of the factors that may be related to intubation injuries, including patient age, duration of intubation, need for reintubation, size of endotracheal tube, need for tracheostomy, presence of orogastric/nasogastric tubes, and the concurrent use of proton pump inhibitors, especially over even short-term intubations. To examine these factors, laryngeal nasofibroscopic exams will be performed on recently intubated patients meeting study criteria. Recordings of these exams will be studied by Otolaryngologists to identify vocal cord erythema, ulceration, granuloma, and paralysis. Observed frequency of vocal cord pathology will then be examined for associations with deleterious factors.

Matthew Harbrecht  
**Research Mentor:** Terence Williams, MD, PhD  
**Project Title:** “Testing Strategies to Improve the Response of Novel Albumin-Conjugated Chemotherapies for Carcinomas”  
**Project Abstract:** Pancreatic Adenocarcinoma has a mere 5% five year survival rate and novel therapies are desperately needed to help treat this disease. One area of interest currently involves albumin-conjugated chemotherapies, such as nab-paclitaxel (Abraxane®), and finding ways to use them more efficaciously. One possible way to do this is through upregulation of Calveolin-1 (Cav-1), a cell membrane protein believed to play a role in albumin transport. This study examined gemcitabine, one chemotherapeutic agent currently used with Abraxane® in clinic, and the effects of different scheduling orders of the two drugs. Western blots were completed to look at Cav-1 expression after gemcitabine treatment as well as to examine the presence of proteins associated with cell death after different drug regimens. Colony forming assays were completed to examine different scheduling patterns in hopes to gain insight into the most efficacious way to give these chemotherapeutics. The results of the project seem to show an increase in Cav-1 expression after gemcitabine treatment and a higher efficacy when gemcitabine is dosed prior to Abraxane®. While many factors still need to be examined, such as the most effective time to dose these
drugs, the data appears promising and more tests of a similar nature should be completed. With such a dismal prognosis currently associated with pancreatic adenocarcinoma, these results will hopefully provide a guide to future experiments in order to continue to search for novel and more effective treatment plans.

**Terence Hillery**  
**Research Mentor:** Jennifer Bogner, PhD, ABPP  
**Project Title:** “Predicting Community Participation in Patients with Severe TBI through Laboratory Measures of Self-Regulation”  
**Project Abstract:**  
Traumatic brain injury (TBI) is primarily characterized by deficits in self-regulation and other executive functions, which are thought to be the principal sources of failure to transfer skills learned during rehabilitation to independence within the community (Cicerone, 2002). While neuropsychologic rehabilitation is successful in improving attention, memory and some executive functions (Cicerone et al., 2011), these gains have not been conclusively tied to greater community participation. Since diminished community participation is linked to diminished self-regulation (Cicerone 2002), tests of self-regulation and executive function may be better predictors of community participation. In this pilot study of 10 patients we take a look at the reliability of 8 different measures of self-regulation. We found that the reliability of the results between trials varied widely by test in our population of post-severe-TBI patients. The more reliable tests tended to have simple interfaces and offered the patient an iterated, binary choice. We conclude that investigators must pay close attention to the interface and design of self-regulation tests given to post-severe-TBI patients. Finally, we found no significant correlations between measures of self-regulation and functional outcome. The few correlations between neuropsychological measures and outcome measures never extended beyond one trial (of three), and may be explained by the high volume of neuropsychological data that was compared to outcome data.

**Mohammed Hindiyeh**  
**Research Mentor:** Nicholas Forand, PhD  
**Project Title:** “Moderated Mediation of Change in cCBT for Depression: Pupil reactivity and the acquisition of cognitive skills”  
**Project Abstract:**  
Background: Cognitive behavioral therapy (CBT) is an efficacious treatment for depression, however the mechanisms of change and moderators of change are not fully understood. High DLPFC activation indexed by pupil reactivity predicts poorer response to CBT and is a hypothesized biomarker of depressive rumination. Rumination is associated with repetitive, non-goal directed thinking, and pupil reactivity might predict who can successfully acquire the cognitive emotion regulation skills taught in CBT. Pre-treatment pupil reactivity might therefore moderate change processes in CBT. Methods: Participants (N=89) were randomized to 8-weeks of computerized CBT or waitlist. CBT skill change from weeks 0 to 3 was measured with the Competencies of Cognitive Therapy Scale (CCTS). Pupil reactivity was measured during an emotional word categorization/digit-
A sorting task that is sensitive to emotional information processing. Depression outcomes were assessed using the PHQ9. Mediation and moderated mediation (conditional process) analyses were conducted using a bias-corrected bootstrap resampling approach. Results: The CBT group showed greater symptom change than the control group, but there was minimal evidence that skill change mediated the effect of CBT. However, pupil reactivity significantly moderated the skill acquisition-symptom change pathway, such that participants with low to moderate levels pupil showed significant mediation of change through skill acquisition, whereas those with higher levels of pupil did not. Conclusions: These findings suggest that skill acquisition is a mechanism of change in CBT, but only for specific subgroups. Moreover, DLPFC activity, which may identify a ruminative trait of depression, is a potential biomarker for skill acquisition and its treatment effect in CBT for depression.

Brett Jennings

Research Mentor: Courtney Lynch, PhD, MPH

Project Title: “A community-based approach for empowering pregnant women to improve pregnancy outcomes in resource-poor areas: the Moms2B experience”

Project Abstract: Objective: Community-based, group prenatal programs offer a unique opportunity to address health disparities, enhance early access to medical care, and improve maternal and child health outcomes. However, empirical evidence on the effectiveness of this type of intervention in improving maternal and child health outcomes is lacking. This paper aims to examine the effect of participation in an academic health center and community-based prenatal program on birth outcomes. Methods: We conducted a matched exposure cohort study. Exposed women (n = 71) were enrolled in Moms2B and delivered at OSU’s Wexner Medical Center in 2011-2014. Unexposed women (n = 71) were those who delivered at OSU’s Wexner Medical Center in 2011-2014 but lived in the same zip codes as Moms2B programs (43201, 43205, and 43227), but did not participate in the Program. Unexposed women were frequency matched to exposed women based on race and ethnicity due to the potential for residual confounding associated with that fact. Unexposed women were randomly selected from among all available women meeting the study’s eligibility criteria. Results: There was no statistically significant difference in rates of Medicaid usage between the two groups (exposed = 90.14%, unexposed = 83.10%) and history of preterm birth (exposed = 14.71%, unexposed = 20.00%). Rates of obesity between the two groups were also similar, and not found to be statistically significant (exposed = 43.33%, unexposed = 46.15%). Both groups showed no significant difference in rates of progesterone supplementation (exposed = 5.63%, unexposed = 8.45%). However, exposed mothers were younger (25 vs 29 years, p<0.05). We found that exposure to the Moms2B program was associated with a decrease in preterm singleton delivery before 32 weeks of gestation (p<0.05). There were no recorded preterm births in the exposed population (n=71) before 32 weeks, as opposed to 4 recorded deliveries under 32 weeks in the unexposed population (n=71). In addition, a regression analysis examining the effect of Moms2B on gestational age at delivery suggest that exposed women deliver approximately ½ week later than unexposed women, after adjusting for race, age, insurance, smoking, history of preterm birth, and progesterone supplementation. This difference was not statistically significant. We were unable to examine the association with weight gain during pregnancy due to a large amount of missing data in the hospital medical record. Rates of breastfeeding at hospital discharge appear to be higher in women exposed to the Moms2B program (71.7% compared to 59.2% in unexposed women). However, this data was missing in a significant number of charts, so the effect was not shown to be statistically significant. NICU admission rates were similar. Conclusions: Group prenatal care through the Moms2B program has a beneficial effect on reducing preterm births in an impoverished, low-resource, minority community. More research is needed to determine the mechanism for this beneficial effect.

Lars Johnson

Research Mentor: Garey Noritz, MD

Project Title: “Overweight status in children with cerebral palsy”

Project Abstract: Cerebral Palsy (CP) is a group of disorders in which non-progressive disturbances in the fetal or infant brain cause deficits in the development of movement and posture which later affect the patient’s activity. These children face unique challenges regarding their nutrition. While it has been suggested that patients with CP who are very underweight (<20th percentile for CP norms) have poor health outcomes, to our knowledge there has not been an examination of health outcomes or costs for children with CP who are overweight. To examine this, we analyzed the healthcare cost and visit summary data provided by the Learn From
Every Patient (LFEP) project of Nationwide Children’s Hospital (NCH), part of the Ohio State University. The LFEP database is composed of over 200 data points on patients with cerebral palsy who are treated in NCH’s Comprehensive Cerebral Palsy clinic. The population of interest was children with Gross Motor Function Classification System level V CP (individuals with the most significant motor impairment) who feed through a gastrostomy tube. We hypothesized that these individuals would incur higher healthcare costs and show more frequent hospital stays and utilize more urgent and emergency care services than their normal-weight peers. The difference between these groups was not statistically significant, but the disparity present in our data highly suggests that there is a trend worthy of further research with a larger sample size.

Charisma Kaushik  
**Research Mentor:** Jeffrey Caterino, MD  
**Project Title:** “Functional Decline and Other Predictors of 30-Day Revisit in Patients with Dementia”  
**Project Abstract:** Hospitals and emergency departments (EDs) are having to adapt to meet the needs of an aging population. Older patients are more likely to present to the ED and have longer, more serious stays, with more adverse outcomes. This may be in part due to the higher incidence of chronic disease and cognitive impairment, namely due to dementia, which doubles the risk for admission. Our study sought to understand the risk profile of patients with dementia to understand what factors, namely functional decline, predict revisit in patients with dementia. We conducted a retrospective chart review of a cohort of patients diagnosed with dementia who were seen in the Ohio State University ED and/or discharged from OSU Wexner Medical Center. We created multivariable logistic regression models to identify high-risk features for repeat ED visit and readmission within 30 days of index visit. Only 9% of patients with dementia were initially discharged. Moreover, 25% returned to the ED or hospital within 30 days. Functional status significantly declined from a median of 8.5 (IQR 1-16) pre-admission to 14 (IQR 10-22) at discharge. Univariate analysis revealed that males were more likely to return within 30 days (OR 3.05(1.59-5.85); P=0.001). Dementia was a risk factor for higher rate of revisit. All hospital stays were associated with loss of functional status. Although functional decline could not predict revisit, it appeared that the healthier patients seemed to be more likely to return. Male gender was the only significant predictor of 30 day events.

Samantha King  
**Research Mentor:** Gary Smith, MD, DRPH  
**Project Title:** “ADHD Medication Exposure Among United States Children and Adolescents”  
**Project Abstract:** Importance: Attention Deficit Hyperactivity Disorder (ADHD) and prescription treatment is increasing. Unintentional overdose is the second leading cause of death in the United States. Exposure to ADHD medications can have serious and expensive consequences. Objective: This study investigates the epidemiologic characteristics of ADHD medication exposures among children 0 to 19 years old in the United States. Design: Retrospective analysis of data from the National Poison Data System from 2000 to 2014. Setting: The National Poison Data System is the collection data from calls made to Poison Control Centers serving the United States and its territories. Participants: Data from calls regarding ADHD medication exposures for children 0 to 19 years were analyzed. From 2000-2014, 156,365 calls were made to poison centers matching study criteria and were analyzed. Exposures: Calls made regarding single substance ADHD medication exposures within the population were retrospectively analyzed. Main outcomes and Measures: The study was designed to analyze demographic characteristics of the population, health care receive, medical
outcome, clinical effects, and geographic variation. The purpose was also to look for changes in number and rate of exposures over time nationally and regionally. Results: There were 156,365 calls to poison centers related to single substance Attention Deficit Hyperactivity Disorder exposures from 2000-2014, increasing 63.6%. The Southern region accounted for 43.2% of all exposures. The most common reason of exposure was therapeutic error most frequently due to inadvertently giving/taking the medication twice. Older children (13-19 years) were more frequently exposed due to intentional means. Most exposures (60.4%) did not result in health care facility treatment. There were 3 deaths reported but most calls did not result in serious medical outcomes. Conclusions and relevance: Increasing number of exposures followed the increasing trend in number of children diagnosed with ADHD and number of children prescribed medication. Differences in number of exposures within the US regions aligned with differences found in in diagnosis and prescriptions. The increase in exposures is likely due to increased availability and changing pill dispensing to a blister pack may decrease unintentional exposures. Decreasing these medication exposures will help to decrease a growing public health problem.

Michelle Knopp
Research Mentor: Jun Zhang, PhD
Project Title: “PET Imaging Using Low and Ultra-Low Dose Techniques in Clinical Care and Research”
Project Abstract: PET/CT imaging using 18F-FDG is an important, commonly used cancer imaging methodology to detect disease and to monitor therapeutic interventions. While considerable technological progress of PET/CT systems has occurred over the last decade the ability to potentially reduce the dosing of the imaging radiopharmaceutical tracer and thereby the ionizing radiation burden has not been reevaluated. This project investigated what happens when we reduce or simulate the reduction of dose to 1/10th the current OSUWMC standard of care. As the key to clinical imaging is often to determine the response to treatment or the “hotness” of a lesion we compared the standard of care semi-quantitate SUVmax values to 3 different conditions of dose reduction: 1) acquire only 10% of the data by reducing the bed position times, 2) cut the list-mode acquired data to only 10% of the data, and 3) actually inject only 10% of the dose. An initial comparison of a total of 14 lesions in 4 clinical patients of these various conditions revealed surprising results. We recognized that the deteriorate image quality due to low dose or count sparsity could be recovered by re-optimization of the optimal number of subsets used in the iterative reconstruction methodology. We identified large differences when the current manufacturer recommended reconstruction settings are used compared to those optimized for count scarcity. While the data currently are limited in scope, we believe that breakthrough radiotracer dose reduction appears possible without sacrificing quantitative accuracy of SUVmax at doses as low as 1/10th of current practice. Further methodology development and validation appear promising.

Taylor Koenig
Research Mentor: Peter Shields, MD
Project Title: “The Intra-method Reliability of Tobacco-Related Biomarkers 1-HOP, NNAL, and PGE-M in Smoker”
Project Abstract: 1-hydroxypyrene (1-HOP), 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanol (NNAL), and a metabolite of prostaglandin E2 (PGE-M) are biomarkers associated with tobacco exposure that have been correlated with lung cancer risk in smokers. Therefore, tobacco-related biomarker research offers new opportunities for the prevention and early detection of lung cancer. As these biomarkers are often analyzed from a single blood draw due to financial and logistical constraints, it is important to ensure their reliability over time. However, the intra-method reliability of 1-HOP, NNAL, and PGE-M is not well characterized. Using the levels of these biomarkers measured in 34 current smokers at baseline and at a 12 week follow-up visit, intraclass correlation coefficients (ICCs) were calculated for 1-HOP, NNAL, and PGE-M. ICCs for NNAL and PGE-M were 0.68 (P<.001) and 0.61 (P=0.004), respectively, indicating 68% and 61% of their respective variances are explained.
by between-person variability. The ICC for 1-HOP was 0.27 but did not achieve statistical significance (P=0.06). These results support NNAL and PGE-M as reliable measurements over 12 weeks, and suggest that 1-HOP is of low to moderate reliability over this time period due a substantial proportion of its variance, 21%, explained by within-person variability. We also examined whether participant characteristics were associated with tobacco biomarkers in this study. Age, sex, body mass index (kg/m2), and the number of cigarettes smoked per day were not associated with baseline levels of any tobacco-related biomarker under study. Overall, this study supports NNAL and PGE-M to be reliable measurements over a 12-week period in smokers.

**Anne Kunkler**  
**Research Mentor:** Jonathan Schaffir, MD  
**Project Title:** “Valuation of a Postpartum Symptom Inventory and its Relevance to Postpartum Mood”  
**Project Abstract:** Many women at the postpartum visit continue to experience bothersome physical symptoms. Although these symptoms are normal sequelae of physical changes of pregnancy, there has been little formal description of what is expected at the six-week mark. Additionally, there has been little assessment of how continued physical symptoms affect postpartum mood. To better understand what physical symptoms are considered normal at the six-week mark, a cohort of postpartum women were surveyed to establish a normal distribution of responses. We compared women with postpartum depression and those without in terms of their scores on this inventory. The most common physical symptoms experienced by the women in our study were back/hip pain (17.5%), headaches (17.2%), breast pain (14.5%), fatigue (12.1%), hemorrhoids (10.7%), change in libido (10.7%), and abdominal/pelvic pain (10.5%). There was no significant difference in reported somatic symptoms between women with and without post partum depression. However, women reporting less than excellent health had a significantly higher postpartum physical symptom score compared to those who reported that they were in excellent health (p<0.05). In conclusion, persistent somatic symptoms do not influence the experience of depression, but further research is needed to determine the effect of preexisting health issues.

**Dorothy Lakis**  
**Research Mentor:** Nicole Stoicea, MD, PhD and Sergio Bergese, MD  
**Project Title:** “MicroRNA: Journey from theory to practice as a CNS biomarker”  
**Project Abstract:** Many neurological diseases lack effective biomarkers for detection and tracking of progression. MicroRNAs (miRNA), small nucleotide sequences that control gene transcription, could potentially fill this void. Their widespread cellular action, stability in bodily fluids and proposed roles in pathogenesis make them good candidates. MiRNA is found in cerebrospinal fluid (CSF), the circulating fluid around the brain and spinal cord. This close proximity to the central nervous system (CNS) makes miRNA valuable clues to its microenvironment. CSF is relatively easy to access compared to tissue sampling, and is virtually contaminant and cell free. In an effort to showcase the viability and reliability of miRNAs use as a biomarker of neurological pathologies, a review article was completed. Alzheimer’s disease (AD), Parkinson’s disease (PD), multiple sclerosis (MS) and amyotrophic lateral sclerosis (ALS) were studied. Malignancies including glioblastoma and primary central nervous system lymphoma (PCNSL) were also included. Additionally, miRNA as a biomarker in traumatic brain injury (TBI) and HIV
encephalitis as well as psychiatric conditions like depression were studied. In all of these studies, dysregulated expression of various miRNAs were found when comparing diseased patient CSF to controls. While not the focus of this paper, various links between the specific dysregulated miRNA and the diseases studied were also discussed. This opens up the possibility of miRNA targeted treatments for many of these neurological pathologies. MiRNA targeted treatments have the potential to be very effect, acting directly on the dysregulated miRNA. An additional future avenue of study would also be to create a database of “normal” miRNA expression to which diseased CSF or serum miRNA profiles could be compared.

Michael Lause  
Research Mentor: Terence Williams, MD, PhD  
Project Title: “Novel PARP Inhibitor, BMN-673, in Combination with Radiation for Esophageal Cancer”  
Project Abstract: Esophageal cancer is associated with poor rates of disease control with existing therapy resulting in a 5-year patient survival rate of only 17%. Given this poor prognosis, there is an imminent need for target therapies that can serve to augment standard therapies, which include radiation therapy. A novel, and potent PARP1/2 inhibitor, BMN-673, was tested in vitro for radiosensitizing potential in multiple esophageal cancer cell lines. First, Alamar Blue dose-response assays were performed to determine the IC50 (the concentration of a drug required for 50% inhibition in vitro) for three esophageal cancer cell lines, KYSE-30, OE-33, and SK-4. As a single agent, BMN-673 did not exert substantial cytotoxicity. Finally, duplicate clonogenic assays were conducted for each cell line, revealing significant radiosensitization upon exposure to BMN-673 two hours prior to increasing doses of radiation therapy. The Dose Enhancement Factor was 1.70, 1.67, and 1.52 in the presence of BMN-673 treatment for the cell lines SK-4, KYSE-30, and OE-33, respectively. These results demonstrate that BMN-673 can serve as a potent radiosensitizing agent in multiple esophageal cancer cell lines in vitro. Ongoing work includes validating target inhibition and assessing downstream DNA damage response and DNA repair signaling by immunoblotting. In conclusion, we observe promising in vitro radiosensitization of BMN-673 in esophageal cancer cells. Further, research exploring the radiosensitizing potential of BMN-673 in vivo is essential to establish the efficacy of this approach for clinical testing.

J. Oliver Letham  
Research Mentor: Meng Welliver, MD, PhD  
Project Title: “Investigation of Lung Tumor Imaging during and after Stereotactic Body Radiation Therapy and its Correlation with Dosimetry and Clinical Outcome”  
Project Abstract: The purpose of this research is to analyze CT images of lung cancer nodules obtained during Stereotactic Body Radiation Therapy (SBRT) as well as the radiation dose accumulated within normal tissue in order to evaluate if quantifiable CT tumor characteristics and dose accumulation correlate to clinical outcomes. SBRT is an effective treatment for non-small cell lung cancer (NSCLC) and consists of high radiation doses of 50-60 Gy delivered in 3-5 fractions with great precision to the tumor volume. Kilo-voltage cone beam CT (KV-CBCT) images obtained before each fraction are analyzed to obtain the various tumor image parameters such as density, volume, mass, CT attenuation values, and tumor texture parameters. Dose accumulation to the treated volume and surrounding normal tissue is also performed. Our hypothesis is that
image parameters change during treatment and that texture analysis can be used to detect these changes and will correlate with treatment efficacy and overall survival. Preliminary results show there are statistically significant intratumor differences in texture features before and after the first SBRT session. Some changes in texture features after SBRT are different for patients without recurrence compared to patients with recurrence.

Daniel Li
Research Mentor: Kris Jatana, MD, FAAP
Project Title: “ATV-Related Head and Neck Injuries in U.S. Children Less Than 18 Years of Age, 1990-2014”
Project Abstract: Objective: To describe the epidemiology of all-terrain vehicle (ATV) related head and neck injuries among children in the United States. Methods: This was a retrospective analysis of data for children younger than 18 years of age from the National Electronic Injury Surveillance System (NEISS) of the Consumer product Safety Commission from 1990-2014. Sample weights provided by the NEISS were used to calculate national estimates of ATV-related head and neck injuries. Injury rates were calculated according to age group using US census population data. Results: An estimated 279,400 children younger than 18 years were treated in US hospital emergency departments for ATV-related head and neck injuries from 1990 to 2014. The number of injuries remained relatively constant from 1990-1997, increased by 143% from 1997-2007, then decreased by 37% from 2007-2014. The most commonly injured body parts were the head (51.0%) and face (32.2%). The most common diagnoses were concussions, closed head injuries (32.6%) and lacerations avulsions (32.6%). The most common injury mechanisms include falling off the ATV (30.0%), crashing the ATV (18.8%), and flipping the ATV (15.8%). Children in the 12 to 15 age group had the highest injury rate (2.7 per 10,000 population). Conclusions: Additional steps can still be taken to make ATV riding safer. Helmets should always be worn, non-essential ATV road use and passenger riding should be eliminated, and prevention efforts should more specifically target adolescents, who are more likely to engage in such risky behaviors, as well as their parents.

James Lin
Research Mentor: Simon Lin, MD, CSDP
Project Title: “A Simplified Pediatric Early Warning System that Relies Solely on Objective Measures”
Project Abstract: Introduction: Delayed intervention of deteriorating pediatric ward patients increases morbidity and mortality. We sought to develop a completely objective, automated real-time risk stratification tool to accurately identify high-risk pediatric inpatients before a serious clinical event. Methods: Electronic health record (EHR) data from 2011 to 2015 of inpatients in a quaternary children's hospital was retrospectively reviewed. Eligible patients were restricted to ward patients < 18 years old who had an emergency assessment consult, transferred to the pediatric intensive care unit (PICU), or experienced a cardiopulmonary arrest. Matched controls without deterioration
were used. Dynamic variables for model predictors were chosen based on local expert opinion and current literature. A predictive model was constructed using multivariate logistic regression, and three machine-learning methods were used to perform data classification. 5-fold cross validation was used to compare model performance. Results: 66,942 assessments from 701 cases and 1609 controls were compared. 8 dynamic variables were initially identified as candidates to predict deterioration. Removal of the 2 variables requiring subjective assessment or manual measurement (capillary refill and level of consciousness) only decreased the area under the receiver operating characteristic curve (ROC) from 0.94 (+/- 0.018) to 0.93 (+/- 0.018). At a threshold of 0.45 (out of 1.00), the false positive rate is 15%, with a sensitivity of 97% (+/- 0.8%) and specificity of 85% (+/- 1.1%). Conclusions: Our data suggest that we developed an accurate, automated ward risk stratification system that can identify deteriorating pediatric inpatients using objective variables collected from the EHR. Such a tool may help prevent cardiopulmonary arrests, critical deterioration, and unplanned transfers to the PICU. To our knowledge, an accurate early warning system independent of caregiver subjective measurements, has not been described. Prospective validation continues with a clinical implementation trial in our hospital – currently underway.

Rebecca Mehl
Research Mentor: Joseph Kitzmiller, MD, PhD, FCP
Project Title: “Designing retrospective candidate-gene models to identify genetic influences on the pharmacokinetics and pharmacodynamics of a novel tomato-soy nutraceutical product”
Project Abstract: Epidemiological and laboratory based studies demonstrate inverse relationships between fruit and vegetable intake and risk of certain cancers, including prostate cancer. Specifically, bioactive compounds in tomato and soy are hypothesized to impact prostate cancer risk and prevention. However, the relationship between intake and plasma concentrations tends to be poor, suggesting that additional environmental and genetic variables influence the kinetics (absorption, distribution, metabolism, and excretion) and dynamics (drug target and mechanism-related pathways) of the bioactive. In a recent study, dose-dependent increases in phytochemical concentrations were observed in patients (n = 60 males with prostate cancer) receiving a novel tomato-soy product. To investigate the contribution of genetics to changes in plasma carotenoid concentrations, a candidate-gene analysis technique, developed for pharmacogenomic applications, was applied to this nutrigenomic application. Several frequently occurring polymorphisms in genes including SOD2, ELOVL2, and ABCB1 were found to influence the change in plasma carotenoid levels after consumption of the tomato-soy product. Further analysis of results from this study will allow for greater understanding of the kinetics and dynamics of this tomato-soy nutraceutical product. This research will promote personalized care approaches for nutraceutical interventions.

Hiroko Miyagi
Research Mentor: Howard Werman, MD
Project Title: “Factors Contributing to Overtriage of Air Medical Scene Transports to a Level I Trauma Center”
Project Abstract: Introduction: Air medical transport of scene trauma patients is an important aspect of trauma care in delivering critically ill patients to trauma centers. Overtriage of less injured patients to trauma centers reduces the system efficiency and jeopardizes safety of air medical crews. Our objective was to determine which factors available to EMS providers in the field are strong predictors of overtriage of trauma patients by helicopter to a trauma center. Methods: A retrospective chart review of patient charts over a two year periods was performed for scene trauma patients flown into OSU Wexner Medical Center by MedFlight. Demographic and
clinical data was collected on each patient. Prehospital factors such as GCS, revised trauma score (RTS), intubation status, mechanism of injury, anatomic injuries, physiologic parameters and a combination of these factors were investigated to determine which triage criteria accurately predicted overtriage. Hospital factors such as ISS, length of stay, survival, and Emergency Department disposition were also collected. Overtriage was conservatively defined as a hospital stay of less than 24 hours in a patient who survives their injuries. A more stringent definition of overtriage including death, ISS > 15, patient taken to OR or ICU or receipt of blood products was also used to determine overtriage rates. Results: An overall overtriage rate of 34.83% was found using the conservative definition of overtriage. Furthermore, when the more stringent definition was applied, overtriage rates were as high as 85%. Positive predictive values indicated that patients who met both anatomic and physiologic criteria should be transported by helicopter because 94% of the time, patients had stays longer than 24 hours. No other criteria or combination of criteria had a high predictive value for overtriage. Conclusions: No individual triage criteria or combination of criteria examined demonstrated the ability to reliably reduce overtriage. Although helicopter transport and subsequent hospital care is costly and resource consuming, it appears that a certain level of overtriage must be maintained in order to limit the amount of undertriage of trauma patients.

Neha Nidhi
Research Mentor: Galina Dimitrova, MD
Project Title: “ROTEM”
Project Abstract: Rotational thromboelastometry (ROTEM) is utilized as a point of care viscoelastic test to measure hemostasis in whole blood, providing a real time, comprehensive assessment of the clotting process. ROTEM has been utilized in various medical procedures to achieve hemostasis and guide transfusions, including cardiac surgeries, known to be specifically associated with blood loss and bleeding complications. Some of these complications are associated with dilution of coagulation factors and red blood cells, hypothermia induced during surgery leading to reduced activity of coagulation factors and impairment of platelet function, massive transfusions, or surgical re-explorations precipitating infections, renal failure, and increased mortality. The focus of the literature review was to analyze the recent use of ROTEM and its specific parameters in the cardiac surgical setting. Over the years, there has been much debate in regards to the predictive value of the ROTEM test versus standard of care management for intraoperative and postoperative bleeding in cardiac surgeries. The most recent published articles emphasized the use of A10 on EXTEM and FIBTEM during CPB due to its strong correlations with fibrinogen and platelet levels post bypass, allowing faster clinical decisions to reach hemostasis. Numerous studies also supported the use of the HEPTEM assay for heparinized blood or unknown heparin levels since the presence of heparin in blood can affect the accuracy of other assays. An analysis of the current articles also highlights that ROTEM is associated with reduced transfusions, reduced costs, and increased reproducibility, being successfully utilized in the pediatric population as well. Based on the aforementioned existing data we are able to extend ROTEM use in spine surgical interventions, ongoing efforts being made in order to finalize the prospective project.

Griffin Olsen
Research Mentor: Kris Jatana, MD
Project Title: “Effect of positioning and retractor placement on endotracheal tube intracuff pressure during adenotonsillectomy in the pediatric patient”
Project Abstract: Background: Changes in head and neck position can lead to changes in intracuff pressure with the use of cuffed endotracheal tubes (ETTs). The current study prospectively measured intracuff pressure following endotracheal
intubation and during patient positioning for tonsillectomy and/or adenoidectomy. Methods: This study included patients less than 18 years of age undergoing tonsillectomy, adenoidectomy, or adenotonsillectomy with anesthesia provided using a cuffed ETT. After anesthetic induction and endotracheal intubation, patients were intubated and the cuff inflated to seal the airway during positive pressure ventilation. Intracuff pressure was recorded with the head in the neutral position. Following placement of a shoulder roll, the Crow-Davis retractor, and suspension from a Mayo stand, intracuff pressure was recorded again. Results: Intracuff pressure readings were recorded for 116 patients, ranging in age from 1 to 17 years (5.9 ± 0.4 years). Both increases and decreases in intracuff pressure occurred with positioning for tonsillectomy and/or adenoidectomy compared to the neutral position. There was a general trend toward an increase in mean intracuff pressure from 28.1 ± 2.5 cmH2O to 30.3 ± 0.9 cmH2O. In 18 patients (15.5%), the intracuff increased by more than 10 cmH2O with a maximum increase of 36.7 cmH2O. The intracuff pressure decreased in 44 cases (37.9%) while no change was noted in 15 patients (12.9%). Conclusion: Both increases and decreases in intracuff pressure may have clinical consequences with an increase resulting in the risk of damage to the tracheal mucosa and a decrease resulting in an air leak and the risk of airway fire if the inspired oxygen concentration is high.

Angela Onorato
Research Mentor: Amy Sturm, MS, LGC
Project Title: “Universal Screening for Elevated Cholesterol in Children: Assessment of Awareness and Adherence to Guidelines Among Ohio Pediatricians”
Project Abstract: Familial hypercholesterolemia (FH) is a common, inherited disease that leads to increased LDL cholesterol levels from birth and a severely increased risk of coronary heart disease. Guidelines for universal lipid screening in children were published in 2011, but assessment of awareness of and adherence to these guidelines among pediatricians has not yet been conducted. The current study surveyed 2102 Ohio pediatricians about their knowledge of the prevalence, increase in risk, LDL cholesterol values, and management options regarding FH. Additionally, their awareness of the national lipid screening guidelines and adherence to these guidelines was also assessed. Data from the 193 general pediatricians who responded was then analyzed. Overall, knowledge about FH was extremely low among general pediatricians. No question was answered correctly by more than one third of pediatricians. Only 73% of pediatricians were aware of the screening guidelines and very few (27%) were actually adhering to the guidelines. Even among those who had implemented the lipid screening guidelines, knowledge of LDL cholesterol values for which to suspect FH and the recommended age to consider the initiation of statin therapy was poor. A lack of interest in screening among patients was cited as a major barrier to these pediatricians following the screening guidelines. Physician and patient awareness regarding the prevalence and severity of FH needs to be increased in order to help improve adherence to screening guidelines and therefore the desired effectiveness of universal screening.

Tirth Patel
Research Mentor: Sashwati Roy, PhD
Project Title: “Delivery of miR-21 to Macrophages Using Lipid Nanoparticles to Promote Diabetic Wound Healing”
Project Abstract: Macrophages are important mediators of wound inflammation and healing. During the initial, inflammatory phase of wound healing, macrophages are of the pro-inflammatory M1 phenotype. As the healing process progresses, wound macrophages transition to the anti-inflammatory M2 phenotype, which aid in the resolution of inflammation and promotion of wound closure. MicroRNA-21 (miR-21) is known to promote the transition from M1 to M2 phenotype in wound
macrophages. Delivery of miR-21 to wound macrophages could potentially aid in the closure of chronic diabetic wounds. Here, we used mannosylated cationic lipid nanoparticles (LNPs) to specifically deliver miR-21 to macrophages. LNPs specifically delivered their payload to macrophages ex vivo. Quantitative PCR (qPCR) analysis of miR-21 expression in these cells further supports that miR-21 was delivered to macrophages. These data have important implications for the development of novel wound healing therapeutics.

Kristen Quinn
Research Mentor: Emmett Whitaker, MD
Project Title: “Neuroinflammatory Effects of Inhalational vs. Total Intravenous Anesthesia (TIVA) for Surgical Treatment of Hydrocephalus”
Project Abstract: Background: Millions of children undergo procedures with general anesthesia each year. The developing brain is extraordinarily sensitive, and injury can cause cognitive dysfunction that persists into adulthood. Traditionally, research on anesthetic agents has focused on apoptosis. Inflammation, however, may be a more appropriate focus for investigation. Inflammation after anesthesia exposure has been linked to many neuropathologic processes, such as postoperative cognitive dysfunction (POCD). To date, no known studies have examined the effects of anesthetics on neuroinflammation in the developing human brain. Hydrocephalus is a debilitating disorder characterized by elevated intracranial pressure as a result of excess production or inadequate resorption of cerebrospinal fluid (CSF). Though surgical CSF shunting procedures have extended the lifespan of patients with hydrocephalus, these patients continue to experience significant morbidity associated with their disease. Determining the safest anesthetic regimens for these patients is of paramount importance. Aim: The aim of this study is to establish a profile of neuroinflammation in children with hydrocephalus both before and after surgical treatment. Patients will be randomized to one of two anesthetic regimens, one suspected to be neurotoxic (isoflurane) and one that has not been linked neurotoxicity (TIVA with dexmedetomidine and remifentanil). Hypothesis: Children who receive isoflurane anesthesia will manifest neuroinflammation as evidenced by increased cytokine and proinflammatory microRNA (miRNA) levels compared to those who received total intravenous anesthesia (TIVA) with dexmedetomodine and remifentanil. Method: Fifty hydrocephalus patients, aged 6 months to 10 years old, receiving initial or revision ventriculoperitoneal shunt (VPS) placement surgery will be randomized to either general conventional anesthesia with isoflurane or TIVA. Twenty-five healthy children receiving standard isoflurane anesthesia and undergoing an MRI for non-neurologic pathology will serve as a control group. Conclusions: We expect isoflurane to cause systemic inflammation measured by serum cytokines, serum miRNAs, and CSF cytokines/miRNAs. We expect the inflammatory response to be significantly mitigated when TIVA is used instead of isoflurane. Our unique study design allows us to isolate isoflurane as the offending agent, suggesting that any inflammatory response is related primarily to isoflurane exposure.

Karen Ren
Research Mentor: Gary Smith, MD, DRPH
Project Title: “Children Treated for Lawn Mower-Related Injuries in US Emergency Departments, 1990-2014”
Project Abstract: Objective: Our objective for this study was to describe the epidemiology of lawn mower-related injuries to children in the United States. Methods: A retrospective analysis was conducted of data from children who were under 18 years of age in the National Electronic Injury Surveillance System of the
United States Consumer Product Safety Commission for 1990-2014. Results: An estimated 212,258 children under 18 years of age were treated in US hospital emergency departments for lawn mower-related injuries from 1990 through 2014, occurring at the rate of 11.9 injuries per 100,000 US children. The leading diagnosis was a laceration (38.5%) and the most common body region injured was the hand/finger (30.6%). Struck by (21.2%) and cut by (19.9%) were the leading mechanisms of injury. Children <5 years were more likely to be injured from contact with a hot surface compared with children 5 years and older. Children <5 years of age were more likely to be injured as bystanders compared with children 5 years and older. Patients injured as bystanders and passengers had higher rates of admission to the hospital. Of those injured as bystanders, 21.8% were admitted, while 18.8% of passengers were admitted. Nearly half (49.8%) of bystanders injured were hit by a projectile, compared with 15.1% of other patient types. Conclusions: Lawn mower-related injuries are an important cause of pediatric morbidity. The prevalence of these injuries evidences the inadequacy of current prevention methods. Passive protection provided by safer product design is most likely to prevent injuries related to lawn mowers. The voluntary standard ANSI/OPEI B71.1-2012 should be revised to include more rigorous performance testing and stricter safety standards regarding shielding against projectiles and prevention of hands and feet from penetrating under the mower and into the path of blades. Further, all ride-on lawn mowers should be equipped with an NMIR mechanism with the override switch behind the operator’s seat to require the operator to look behind the mower before mowing in reverse.

Cynthia Schwartz
Research Mentor: David Dean, PhD
Project Title: “Mechanical Modeling of Bone Tissue Engineered Scaffolds”
Project Abstract: One promising treatment of large skeletal segmental defects involves insertion of a seeded, resorbable, polymeric scaffold, designed to position cells in the defect site, facilitating host bone ingrowth. Scaffolds were 3D printed and degraded in NaOH in static and dynamic conditions to compare the degradation behavior. Mass, stiffness, and yield stress were tracked at time points. Swelling and FTIR were evaluated for the final static time point. The scaffolds dropped to around 33.14% of their original mass and stabilized in their mass loss around 8 days. Stiffness loss steadied around 10 days at 373.6 kPa, and yield stress around 6 days at 90.8 kPa. The scaffolds showed considerable swelling capacity after degradation. FTIR showed an increase in hydroxyl groups and a decrease in ester groups, which was expected. Experiments conducted under static and dynamic conditions appear to yield comparable results in terms of % mass remaining, stiffness, and yield strength. Scaffold degradation appeared to stop after several days; leaving a significant mass of the residual scaffold material (i.e., ~30%) undissolved even under the extreme chemical conditions provided by NaOH. It is likely that hydrolysis reactions are creating low solubility reaction products. Similarly, dried stiffnesses and yield strengths are maintained at lower but possibly significant levels. The presence of a residual scaffold with mechanical strength could have implications for bone regrowth.

Nicholas Scoville
Research Mentor: Peter Lee, MD, MPH, MS
Project Title: “The use of tissue engineered bioartificial muscle to study the effects of anoctamin 5 knockout in human skeletal and cardiac muscle”
Project Abstract: Anoctamin 5 (ANO5) has been implicated in muscular diseases such as dilated cardiomyopathy (DCM), limb-girdle muscular dystrophy (LGMD), and other nonspecific myopathies. However, the role of ANO5 in the pathophysiology of these diseases is not well understood. Additionally there has been success in the field tissue engineering with creation of 3D bioartificial muscle (BAM), as well as the use of BAMs to study different disease states. This project is exploring the use of BAMs to study the role of ANO5 in myopathies, both of the
skeletal muscle and cardiac muscle. There are essentially four goals for this summer project. First, become competent growing BAMs in culture. Second, infect human myoblasts (HMs) and human induced pluripotent stem cells (hiPSCs) with a gRNA lentivirus, using CRISPR/Cas9 technology, to knockout the ANO5 gene. Third, differentiate the HMs and hiPSCs into skeletal muscle cells and cardiomyocytes, respectively. Lastly, we would like to use various methods to study the consequences of knocking out ANO5.

Rishabh Sethia  
Research Mentor: Enver Ozer, MD  
**Project Title:** “Quality of life and functional outcomes of TORS without adjuvant radiation therapy for oropharyngeal cancer”  
**Project Abstract:** Objectives: To compare quality of life (QOL) of patients who underwent transoral robotic surgery (TORS) with adjuvant radiation therapy (RT), adjuvant chemoradiation therapy (CRT), or no adjuvant therapy in the treatment of oropharyngeal cancer. Study Design: Prospective cohort study. Methods: Medical records were reviewed for 112 patients treated for oropharyngeal cancers at a tertiary care academic center from April 2008 to July 2015. Patients were administered the Head and Neck Cancer Inventory (HNCI) to evaluate QOL preoperatively, and at 3 weeks, 3 months, 6 months, and 1 year post-surgery. QOL data was compared between 14 patients treated with TORS alone, 31 with adjuvant RT, and 67 with adjuvant CRT by a linear mixed effects model. Demographic, clinicopathologic, and follow-up data were also collected. Results: Mean follow-up was 35 months. The HNCI response rates at 3 weeks and 3, 6, and 12 months were 80%, 60%, 55%, and 46%, respectively. Eating scores for TORS alone were significantly higher than for adjuvant RT or CRT at 3 and 6 months post-surgery. Patients with TORS alone and adjuvant RT had higher social function when compared to adjuvant CRT at 3 months. There were no statistically significant differences (p < .05) in overall QOL, speech, or aesthetics at any time point. Conclusions: Patients with oropharyngeal cancer treated with TORS alone maintain higher QOL than with adjuvant RT or CRT in eating and social function following surgery. Adjuvant RT and CRT appear to negatively affect QOL, suggesting a potential need for deintensification of radiation or chemotherapy to preserve post-operative patient function.

Lena Shay  
Research Mentor: Tamar Gur, MD, PhD  
**Project Title:** “Prenatal Stress Leads to Gender Specific Placental Gene Changes”  
**Project Abstract:** Though preterm birth (PTB) is a significant cause of neonatal morbidity and mortality, the mechanisms and etiology have yet to be fully understood through biomedical research. Consequently, clinical efforts to reduce PTB have been largely unsuccessful. A leading theory regarding the etiology of PTB
is that microbial invasion of the amniotic cavity induces an inflammatory response, triggering early labor. As maternal stress is a well-known risk factor for PTB, we used a murine model of stress-induced PTB to examine novel relationships between prenatal stress exposure, intrauterine inflammation and changes in the microbiome, and preterm birth through an examination of gene expression changes in fetal brain and placenta, using qRT-PCR, and alterations in amniotic fluid cytokine levels, after prenatal stress exposure. This study shows elevated expression of interleukin-6, and monoamine oxidase a, and decreased expression of O-GlcNAc transferase in female offspring placetas compared to non-stressed female controls. Additional findings shown here include decreased expression of brain-derived neurotrophic factor in fetal brain after pre-natal stress exposure, and elevation of several inflammatory cytokines in amniotic fluid of stressed dams. Each of these findings bears significance, in relation to PTB, intrauterine inflammation, and fetal growth and development. Using these results, further investigation will be conducted to elucidate the downstream effects of the gene changes seen here and establish a mechanistic link between PTB, the intrauterine microbiome, and fetal development.

Cameron Sheehan  
Research Mentor: Charles Elmaraghy, MD, FAAP  
Project Title: “Tissue Examination of Pediatric Patients having surgery for Chronic Rhinitis”  
Project Abstract: Purpose: The objectives of this project were to correlate serum IgE to aeroallergens to tissue IgE levels taken from the turbinates of pediatric patients undergoing turbinate reduction. Methods: We recruited 20 children with chronic rhinitis at the time of turbinate reduction surgery. Symptoms were assessed using the Sinonasal Outcome Test (SNOT-22), and ImmunoCAP testing was performed to measure levels of IgE antibodies to a panel of aeroallergens both in the serum and in turbinate samples homogenized in phosphate buffered saline. Results: Patients ranged in age from 2 to 15 years (median 9), and the majority were male (74%). The prevalence of asthma was high at 35%. The most commonly rated severe symptoms were nasal congestion and runny nose. Serum analysis revealed IgE antibody levels >0.10 IU/ml to at least one aeroallergen in 67%. Testing for IgE antibodies in turbinate samples (n=18) also revealed positive results (>0.10 IU/ml). Nearly every sample had detectable IgE antibodies to Alternaria (18/18), oak (15/18), and ragweed (17/18). Ten patients had IgE antibodies to other allergens, and in this group 6 concurrently had serum positives consistent with systemic sensitization and 4 did not. Conclusion: The finding of low levels of IgE antibodies in patients without evidence of systemic sensitization could be consistent with the concept of local allergy or entopy; however, the low levels of IgE antibodies in nasal tissue from all patients make the results difficult to interpret.

Tyler Siekmann  
Research Mentor: Daniel Cohen, MD  
Project Title: “Racial Disparities in Cardiopulmonary Resuscitation for Out-of-Hospital Arrests in the Pediatric Emergency Department”  
Project Abstract: Cardiopulmonary arrest in children is a rare but devastating occurrence. Despite advancements in national guidelines for pediatric resuscitation, out-of-hospital (OOH) pediatric arrests continue to have dismal survival rates and neurological outcomes. In adult populations, disparities in cardiopulmonary resuscitation (CPR) are well documented for both medical interventions and
outcomes. However in pediatric patients, little is known about the existence of any racial or ethnic disparities in resuscitative care. This study analyzes all cases of out-of-hospital pediatric cardiac arrest in the Emergency Department of Nationwide Children’s Hospital (NCH) from October 2006- June 2015. Race, age, sex, insurance status, presenting cardiac rhythm, location of arrest and arrest etiology were analyzed to evaluate potential racial or other disparities that may be associated with CPR performance. In total, 261 OOH arrests were identified with only 18 patients surviving to hospital discharge, representing an overall survival rate of 7%. In this cohort, no significant racial disparities were identified either in survival outcomes or treatment measures including: duration of CPR performed, rounds of epinephrine delivered, total medications delivered and number of procedures performed. While no hospital based differences were observed, in comparison to Caucasians, Black/African American children were more likely to have in-home cardiac arrests and trends suggest they may have more un-witnessed arrests.

Kaity Spears  
**Research Mentor:** Irene Mikhail, MD  
**Project Title:** “Reasons for Peanut Specific IgE Ordering Among Community Physicians”  
**Project Abstract:** Rationale: In light of studies suggesting the importance of early introduction and exposure to peanut in sensitized individuals, this study seeks to understand how serum allergy tests are used by community physicians and the implications for patients. Methods: A retrospective chart review was performed of new patient visits to a pediatric, tertiary care referral allergy clinic between January 2009 and May 2015 with a diagnosis suggesting food allergy. From a total of 2,694 charts identified, 1743 were randomly selected. Of these, 927 met inclusion criteria. Results: Of the 631 patients evaluated for peanut allergy, 196 had serum testing prior to allergy evaluation. Only 61 patients (31%) had testing because of a suspected IgE mediated peanut reaction. Other reasons for testing included eczema (29.6%), other food allergy (20.9%), chronic rash (6.1%), gastrointestinal symptoms (4.6%), or relative with food allergy (2.5%). Of the patients diagnosed with peanut allergy based on serum testing, 32 (23.7%) were previously tolerating peanut. After the allergy evaluation, 96 were avoiding, 21 were told to introduce at home, 8 passed an office food challenge, 3 deferred a food challenge, 3 were told to avoid for other reasons, and 1 failed an office food challenge. After allergy evaluation the majority of patients (76%) continued to have a peanut allergy diagnosis, including 40% of the people who had previously tolerated peanut. Conclusions: Education is needed to guide allergy testing ordering practices among community doctors in order to i) eliminate testing that is not needed and ii) prevent potentially unnecessary diagnosis of peanut “allergy”.

Kristin Springer  
**Research Mentor:** Susan Ingraham, MD, PhD  
**Project Title:** “Comparative histopathology of two animal models of obstructive nephropathy”  
**Project Abstract:** This project aims to evaluate the ability of the kidney to maintain its function in the face of obstruction and/or physiological stress. Two animal models will be used for this study: the Megabladder Mouse (mgb), a unique genetic model that develops chronic and end-stage kidney disease secondary to a functional lower urinary tract obstruction, and a Unilateral Ureteric Obstruction (UUO) mouse, a genetically normal mouse which undergoes surgically-induced obstruction in one kidney. We hypothesize that the molecular changes resulting from injury vary depending on the acuity and type of obstruction. To test this, we are in the process
of performing comparative analysis of the histopathological changes in the kidney that result from different types and severities of obstruction via immunohistochemistry, in situ hybridization, and microscopy. Ultimately, a better understanding of these two animal models will aid in research aimed at the discovery of novel biomarkers for the diagnosis and treatment of congenital obstructive nephropathy.

**Laura A. Sullivan**  
**Research Mentor:** Peter H.U. Lee, MD, MS, MPH, Ph.D  
**Project Title:** “The effects of spaceflight on murine cardiac tissue and the role of MuRF1 in microgravity-induced cardiac atrophy”  
**Project Abstract:** As long-term spaceflight becomes moves closer to reality, it is important to consider the effects of microgravity on the cardiovascular system. Our study is designed to characterize the effects of spaceflight on the heart at the tissue level and to evaluate whether cardiac atrophy occurs in the context of microgravity. Based solely on the wet weights of wild-type (WT) mice, we found no significant difference between ground controls and flight mice after 21-25 days of spaceflight. Due to its role in protein degradation as well as in regulating cardiomyocyte development and cardiac mass, we hypothesized that the protein muscle ring finger-1 (MuRF1) may play a role in spaceflight-induced cardiac atrophy. We found no significant difference between cardiac mass in WT and MuRF1 knock-out (KO) mice that were flown aboard the International Space Station. However, there was a significant difference between ground control WT and MuRF1 KO mice. This suggests that MuRF1 may play a role in regulating cardiac mass but further analysis is needed to fully understand the effects.

**Donald Thomas**  
**Research Mentor:** Jingzhen Yang, PhD, MPH  
**Project Title:** “Factors Associated with Prolonged Recovery Following Sports-Related Concussions in the Pediatric Population”  
**Project Abstract:** The objectives of this study were to quantify the length of recovery time by week in a cohort of pediatric sports-related concussion patients, and to examine patient and injury characteristics associated with prolonged recovery. We hypothesized that younger age, female gender, increased number of prior concussions, more severe concussion, and higher symptom burden are significantly associated with prolonged recovery. Data was retrospectively analyzed using 2012-2014 Electronic Data Warehouse (EDW) from a concussion clinic at a children’s hospital in the Midwest. Patients aged 10-17 years who sustained a sports-related concussion and presented to the clinic within 30 days post-injury were included. Unadjusted and adjusted multinomial logistic
regression analyses were used to model the effect of patient and injury characteristics on prolonged recovery following sports-related concussions. The median recovery length was 17 days. Only 17.3% of patients in the cohort recovered within seven days, while 27% took longer than 28 days to recover. A total of 75% of patients experienced symptom resolution by day 30, while 5% were still experiencing symptoms after 71 days post-injury. Total symptom burden at injury and initial visit was also significantly associated with prolonged recovery. Patients who presented to the clinic on the same day as their injury or more than two weeks post-injury showed increased risk for prolonged recovery. Females were at greater risk for prolonged recovery than males (OR= 2.20, 95% CI= 1.60-3.03), while age and prior number of concussions were not statistically associated with recovery length. Greater symptom burden, high symptom scores, time to initial clinic presentation, and female gender are factors associated with prolonged recovery. Further research should focus on establishing objective measures of recovery and accounting for the treatment received during the recovery.

Courtney Tipton
Research Mentor: Sergio Bergese, MD and Nicoleta Stoicea
Project Title: “Postoperative Visual Analogue Scale Measurements in Patients Undergoing the Anterior and Posterior Approaches for Hip Arthroplasty”
Project Abstract: Hip arthroplasty is a common orthopedic surgery in the United States and may be performed using the anterior, posterior, or lateral approaches to the joint. Many studies have compared the advantages and complications of these approaches, especially anterior versus posterior. The aim of this study is to investigate the potential differences in postoperative pain between the anterior and posterior approaches for hip arthroplasty. It is hypothesized that there will be no difference in visual analogue scale (VAS) pain scores measured in the post-anesthesia care unit (PACU) between the two approaches, and such a finding would correlate with the literature. It is necessary to better understand the postoperative pain levels associated with each surgical approach used in hip arthroplasty, especially since high levels of postoperative pain could potentially lead to greater opioid use and postoperative delirium (POD).

Aaron Turnquist
Research Mentor: Michael Knopp, MD, PhD
Project Title: “Quantifying Differences in DCE and DWI MR Imaging between Low and High Grade Gleason Score Prostate Cancers”
Project Abstract: It is estimated that over 220,000 new cases of prostate cancer (PCA) will be diagnosed in 2015 making it the most common cancer among men and second in mortality1. The purpose of this study is to compare the Apparent Diffusion Coefficient (ADC) and Dynamic Contrast-Enhanced (DCE)–MRI pharmacokinetic parameters for higher risk and lower risk prostate cancers. Low and high risk cancers were differentiated using Gleason Score (GS), the current pathological standard for grading prostate cancer and other clinical findings. Thirty-two patients with diagnosed PCA underwent 3T MRI, were analyzed for DWI ADC, DCE amplitude and DCE Kep rate constant values to determine any significant difference between GS 6 and GS 7+ tumors. Regions of interest (ROIs) were placed based on radiologist and pathologist reviews for the cases, and by using T2WI for anatomical reference, DWI and DCE voxel appearance. Significant difference
in ADC, amplitude and Kep values were found between tumor suspicious and normal prostate ROIs with \( p \) values <0.05. A significant difference between subgroups was found between the ADC difference between tumor suspicious areas and physiologically normal tissue, \( p \) value 0.048. No significant difference in DCE pharmacokinetic parameters was found between low and high GS groups. In conclusion, tumors associated with a higher Gleason Score are more likely to have increased cellularity and density resulting in increased restriction demonstrated by decreased ADC values on DWI MRI. Future directions include determining a correlation between higher Gleason Score prostate cancer and heterogeneity of ADC and Kep map values within a lesion.

**Clem Wegman**  
**Research Mentor:** Ruchika Prakash, PhD  
**Project Title:** “Aging and the Behavioral and Neuro-structural Correlates of Trait Mindfulness”  
**Project Abstract:** Although mindfulness training represents a cost-effective method to mitigate the phenomena of cognitive decline, the neural mechanisms underlying the benefit of mindfulness on cognition, as well as the relationship between mindfulness and cognitive decline, remain unclear. As such, this study sought to examine age-related differences in the neuro-structural and behavioral correlates of mindfulness disposition. Trait mindfulness was assessed with the Mindfulness Attention and Awareness Scale (MAAS), cognition was assessed via the Stroop task, and cortical thickness was calculated from structural MRI data using Freesurfer software. Age related differences were observed on select measures of cognitive performance, but dispositional mindfulness was not found to underlie these effects. Additionally, no differences were seen in the MAAS-thickness relationship between groups. However, a comparison across groups revealed a negative relationship between mindfulness and cortical thickness in the right posterior cingulate cortex. These findings fail to support a relationship between dispositional mindfulness, aging, and cognition, although they provide further insight into the relationship between dispositional mindfulness and the neuro-circuitry underlying cognition.

**Justin Wildemann**  
**Research Mentor:** Patricia Fine, MD and Lorraine Wallace, PhD, FAAHB  
**Project Title:** “Can Caregivers Adequately Interpret Ages and Stages Questionnaire Items?”  
**Project Abstract:** Context: Nearly one-third of American adults are considered functionally illiterate. Unfortunately, a plethora of literature documents the exceedingly high reading demands and poor layout features of typical patient educational materials and questionnaires. In routine ambulatory settings, caregivers of young children are often required to complete a battery of tools to aide clinicians in assessing physical, social, and emotional developmental milestones. Objective: To assess caregiver understanding and interpretation of items contained within the Ages and Stages Questionnaire (ASQ). Misinterpretation of questionnaires, including the ASQ, can lead to inaccurate health reports, unnecessary questioning, and in extreme cases, unneeded medical
tests and referrals. Design: Cross-sectional survey using one-on-one interviews. Participants: Convenience sample of caregivers (n=76) of children aged zero to sixty months. Caregivers were asked to: (1) read individual ASQ items out loud and (2) rephrase individual ASQ items and/ or elucidate what the item asked. Caregivers were also asked to identify any particular words or phrases that should be revised to improve meaning of individual ASQ items. Results: 76 one-on-one interviews have been completed (88.3% female, majority ranged in age from 25-34 years). Preliminary findings indicate that two ASQ items are problematic, including: “Does your baby laugh or smile at you and other family members?” (rate of correct interpretation=59.2%) and “Does your baby stiffen and arch her back when picked up?” (rate of correct interpretation=28.9%). All other ASQ items assessed had substantially higher rates of correct interpretation (≈90%). Conclusions: ASQ questionnaires need to be rewritten to be better understood by child caregivers.

Jacob Williams
Research Mentor: Ginger Yang, PhD, MPH
Project Title: “Determining risk factors associated with new and subsequent injuries in collegiate football”
Project Abstract: Collegiate athletes have the highest rate of athletic injury in any age group, and about 40-50% of collegiate athletes sustain multiple injuries (1). Football is a particularly important sport to study, as it has one of the highest reported injury rates of any sport (2). While a body of literature has examined football injuries and associated risk factors, most of these studies do not analyze these injuries as initial or subsequent injuries (3). The purpose of this study was to develop methodology to accurately determine the rate of subsequent injury, and to use this methodology to describe and compare rates of initial and subsequent football injuries among Division I collegiate athletes. The total athlete-exposures during the study period were 67,564, resulting in an overall injury rate of 35.2 per 10,000 athlete-exposures. The rate of subsequent injury was higher than that of initial injury, with a rate of 45.28 (95% CI: 40.2, 62.5) per 10,000 athlete-exposures for subsequent injuries and 31.73 (95% CI: 27.3, 37.1) per 10,000 athlete-exposures for initial injuries. Overall, this study is unique in its application of a more accurate definition and calculation of athlete-exposures and thus subsequent injury rate. This allowed for the determination that athletes have a significantly higher risk of injury after they have already been injured once. Some potential contributing risk factors were identified, but future work should focus on better understanding why certain athletes are more likely to be injured than others after returning to play.

Brennan Wright
Research Mentor: David Flanigan, MD
Project Title: “Full-Thickness Cartilage Defects in Athletes and non-Athletes: A Retrospective Review”
Project Abstract: Full-thickness cartilage defects (Outerbridge grade 4) present a challenge to the patient and physician since these lesions do not heal well and their etiology is not well understood. Since athletes’ prevalence of cartilage defect is more than twice that of the general population, comparing their demographics and clinical features to the non-athletic population will provide a look at understanding this disease’s etiology. We reviewed 987 patients’ records and compared the non-athletic patient population to the athletic patient population.[1] We hope that these findings will help with prevention, diagnosis, and healing of the defects. The patients all underwent arthroscopic knee surgery by Drs. Flanigan, Kaeding, or Jones at the Ohio State University Wexner medical center between 2006...
and 2013. After data collection, we used Chi-Square test, two-tailed student’s t-test, Wilcoxon rank-sum test, and univariate logical regression to analyze the data. We found that athletes had surgery sooner than non-athletes (p<.001), non-athletes were more likely to have full-thickness defects (p=.049), non-athletes were more likely to have multiple full-thickness defects (p=.038) and multiple defects of any grade (p<.001), athletes were more likely to have concomitant ACL injury (p<.001), BMI was correlated with increased likelihood of full-thickness defects for athletes (p=.017) but not non-athletes (p=.85), smoking history had no correlation with lesion presence in either population, and increased age was associated with increased likelihood for a full-thickness defect (p=.002) or for multiple full-thickness defects (p<.001).

Alexander Yaney  
**Research Mentor:** Roman Skoracki, MD, FRCSC, FACS  
**Project Title:** “Surgical Cutting, Implant Placement and Fixation Guides”  
**Project Abstract:** This study involved the design and implementation of a mock surgery to finalize several aspects of a procedure for an ongoing study on craniomaxillofacial defects. Cadaveric specimen of the species Canis familiaris underwent a mock surgery to determine the optimal cutting and placement guide, surgical kit, and final procedure for the implantation of a 3D printed propylene fumarate (PPF) model to repair a surgically created mandibular defect. Live specimen of this species were then to undergo the finalized procedure to determine if the implant allowed both cosmetic and mechanical improvement over previous methods of mandibular defect repair. This surgery required obtaining a periosteal elevator, bone rasp, bone reduction forceps, reconstruction plates and screws, drill guides, a surgical drill and saw and other specialized surgical equipment. It also required a pre-operative CT scan in order to produce the cutting and fixation guides. We hypothesized that there would be a noticeable improvement over current standards. Due to several setbacks, we do not have data on our first two mock surgeries and our third and final mock surgery was performed unsuccessfully, so we currently have no data. There will be a survival surgery on October 14, 2015. After this procedure, along with daily monitoring of the canine’s status, x-rays will be taken weekly and CT scans will be taken once per month in an effort to determine the extent of bone growth and viability of the implant and specimen. It is our hope that this study will help transition this project to human clinical trials.

Stacey Zhang  
**Research Mentor:** Ciaran Powers, MD, PhD  
**Project Title:** “Identifying temporally differentiated microRNAs in patients following subarachnoid hemorrhage”  
**Project Abstract:** Aneurysmal subarachnoid hemorrhage (aSAH) is a devastating form of hemorrhagic stroke with 30-day mortality between 33-45%. Delayed cerebral ischemia (DCI) is the chief cause of morbidity and mortality in patients who survive the initial aSAH. DCI accounts for almost 50% of deaths in patients surviving to treatment of the ruptured aneurysm. The mechanisms for brain injury after aSAH and
the brain’s response to this injury are not fully understood in humans. MicroRNAs (miRs) are 22 to 25-nucleotide single-stranded RNA molecules that inhibit the expression of specific messenger RNA targets. In this work, miR profiling of human cerebrospinal fluid (CSF) from eight patients after aSAH was performed daily for ten days with the goal of understanding how aSAH may influence subsequent delayed cerebral ischemia. Using the nCounter Expression Assay, three specific clusters of miR that were differentially regulated over time as compared to normal human CSF (baseline) were identified. One cluster of miR demonstrated increased abundance over time and includes miR-1303 and -320e. A second cluster peaked early and then returned to baseline, including miR-92a and let-7b. The third cluster consisted of miRs that had decreased abundance compared to baseline and includes miR-541. Temporal changes in the abundance of specific miR’s in human CSF after aSAH provided novel insight into the role of miR’s in brain injury and the brain’s response to aSAH.

Christopher Zheng  
**Research Mentor:** Emmett Whitaker, MD  
**Project Title:** “S100β is Not Elevated in Brain After Isoflurane Exposure in Neonatal Piglets”  
**Project Abstract:** Anesthesia cannot be avoided in many cases when surgery is required, particularly in children. Recent investigations have raised concerns that anesthesia exposure in children may lead to neurodevelopmental deficits later in life. A number of animal studies have assessed the toxicity of anesthesia on the brain during the period of rapid growth and maturation by quantifying an increase in apoptosis. While apoptosis can be pathologic, it is also a normal physiologic process in the developing brain as part of neuronal pruning. Neuroinflammation, an arguably more important process in the generation of neuropathology, is the focus of our research. To study neuroinflammation in response to anesthesia, we developed a novel piglet model Piglets share a similar pattern of perinatal brain growth and myelination with human neonates. We focused on S100β, a multifunctional calcium binding protein expressed by astrocytes that has been found to be elevated in neuroinflammation and neurodegenerative disorders. We hypothesized that S100β would be elevated in isoflurane anesthesia-treated animals. Male Sus scrofa piglets, 10-14 days old at experimentation, were assigned to the control or isoflurane group (2% isoflurane for 3 hours). Perioperative conditions comparable to those experienced by humans were rigorously maintained for animals treated with isoflurane. Following 48 hours of recovery for the isoflurane animals, they were euthanized and perfused for tissue collection. Brain was then extracted and flash-frozen for later analysis. Hippocampal tissue was homogenized for western blot protein quantification. Relative S100β concentrations were measured. Isoflurane-treated animals did not demonstrate a significant increase in S100β in hippocampus when compared to controls. Brain injury after isoflurane exposure is not associated with a significant increase in brain levels of S100β, suggesting that previously documented deleterious effects of isoflurane are mechanistically independent of S100β-related pathways. Further research is required to elucidate the molecular mechanisms of anesthesia-induced neurotoxicity.