Online Proceedings

POSTER SESSION 1

Commons West, Easel 34

11:00 AM to 1:00 PM

Childhood Asthma Quality of Life, Family Functioning and Asthma Control

Elizabeth Anne Shipley, Senior, Early Childhood & Family Studies, Nursing
UW Honors Program
Mentor: Jennifer Sonney, Child, Family, and Population Health Nursing, UW School of Nursing

Asthma is the most common chronic disease among children, affecting almost 10% of children in the US. Standard treatment for persistent asthma is inhaled daily corticosteroids to reduce airway inflammation. Adherence to these controller medications is poor, with less than 50% of children consistently using them. Poor adherence leads to worsened asthma control, causing increased symptoms, exacerbations, school absences, and decreased quality of life. Poor asthma control has also been associated with impaired family functioning. The purpose of this study was to analyze the relationships between quality of life, family functioning and asthma control among school-age children with asthma and their parents. Thirty-three child-parent dyads (children ages 6-11 years) were enrolled in this study. Parents and children independently reported on asthma quality of life and the child's asthma control. Additionally, parents reported on family functioning using the McMaster Family Assessment Device, which assesses numerous family functioning domains. Our hypothesis is that poor asthma control will be associated with impaired family function and decreased asthma quality of life and that parent and child reports of asthma quality of life will differ significantly. Results from this study will provide insight into new potential opportunities for nursing interventions for children with asthma and their families.

POSTER SESSION 1

Commons West, Easel 36

11:00 AM to 1:00 PM

Sleep Hygiene Protocol in the Pediatric Pyschiatric Setting for Children Ages 5-9

Makenna Marie Berg, Senior, Nursing
UW Honors Program
Mentor: Jennifer Sonney, Child, Family, and Population Health Nursing, UW School of Nursing

Sleep in hospitalized children is disrupted by numerous factors including loud noises, light, assessments, medication administrations, and being away from their usual sleep routine and setting. Inadequate sleep can increase behavioral problems, increase stress, and increase length of stay. The goal of this project is to evaluate if an evidence-based sleep hygiene protocol in the Psychiatric and Behavioral Mental Health Unit at Seattle Children's Hospital promotes better sleep for the patients. The sleep hygiene protocol, a guided routine done prior to bedtime, is derived from a literature review on sleep routines in school aged children. A retrospective chart review will be conducted of seven patients from the unit ages 5-9 who use the sleep hygiene protocol. Data will include usage of sleep medication, hours asleep, and nighttime behavioral problems from before and after implementation of the sleep hygiene protocol. I am focusing on the effectiveness of the newly edited sleep hygiene protocol. Results from this study will be used to refine the sleep hygiene protocol so that it can be widely implemented in the PBMU and other units of the hospital.

POSTER SESSION 1

Commons West, Easel 35

11:00 AM to 1:00 PM

The Relationship between Asthma and Executive Functioning in School Aged Children

Alexis Dittoe, Senior, Nursing, Oceanography
UW Honors Program
Mentor: Jennifer Sonney, Child, Family, and Population Health Nursing, UW School of Nursing

Asthma affects over 6 million children in the United States. Asthma management requires a high level of executive functioning and self-regulation, including attention, planning, problem solving, and self-control. Executive functioning deficits, therefore, may impair asthma management capacity. Therefore, the purpose of this study is to describe the executive functioning of school aged children with asthma.

The executive functioning of 33 children ages 6 to 11 years with asthma was tested using the National Institute of Health Toolbox Cognition Battery. The battery assessed numerous executive functioning processes, including attention, inhibition, shifting, episodic memory, working memory, processing speed, receptive vocabulary, and language. Compared to the reference sample, children in this study exhibited significantly lower age-adjusted scores in attention and inhibition t(33) = 93.06, p = 0.001, shifting t(33) = 92.64, p = 0.003, and processing speed t(30) = 82.37, p = 001. They scored significantly higher in receptive vocabulary t(33) = 113.76, p = 0.000, and language t(30) = 119.80, p = 0.000. This study revealed significant differences in the executive functioning of school aged children with asthma, specifically deficits in attention, inhibition, and shifting. These functions can be instrumental in the consistent use of controller medications and as a result impact the effectiveness of asthma management. Implications of these findings may include developing asthma management strategies within the capacity of the child. Future studies should explore the possible causes for executive functioning deficits as well as interventions that align with the executive functioning capacity of school aged children with asthma.

POSTER SESSION 1

Balcony, Easel 104

11:00 AM to 1:00 PM

Phytochrome B's Impact on Resource Allocation in *Brassica rapa*

Joseph Edward (Joey) Zemke, Senior, Biology (General)
Washington Research Foundation Fellow
Mentor: Jennifer Nemhauser, Biology

Conservative estimates suggest that food production must increase by 60-70% by 2050 to keep up with population growth. This challenge to global food security is compounded by a lack of knowledge of how crop species will respond to a changing climate. The Nemhauser Lab has been studying how the photoreceptor Phytochrome B (phyB) directs the allocation of plant resources in response to environmental stimuli like elevated CO2. I have focused on studying this phenomenon in *Brassica rapa*, a member of the mustard family that includes a large variety of popular vegetables such as broccoli, cauliflower, Brussels sprouts, as well as varieties used for oil production. *B. rapa* plants with mutations in the phyB gene make fewer seeds, have a lower chloroplast density, photosynthetic rate, total chlorophyll levels, and stomatal index. To better understand how phyB is involved in seed yield, I am characterizing ovules and gynoecia (female reproductive organ) development in phyB deficient *B. rapa* plants. To understand how phyB plays a role in other processes relating to or impacting resource allocation such as chlorophyll levels, I will identify genes differentially expressed between wild type and phyB deficient *B. rapa* plants. This will ultimately lead to the identification of potential targets for engineering more resource-efficient and higher-yielding crop varieties.

SESSION 1L

MATHEMATICAL MODELING IN THE SCIENCES

Session Moderator: Elizabeth Thompson, Statistics

MGH 271

12:30 PM to 2:15 PM

* Note: Titles in order of presentation.

Interactive Construction and Exploration of Hexagonal Mosaic Knots

Kalen Mills, Fifth Year, Applied Computing, UW Bothell
Mentor: Jennifer McLoud-Mann, Engineering and Mathematics, UW Bothell

Mathematical knots are non-intersecting closed loops which may be tangled; links are knots that are possibly intertwined. These 3-dimensional paths often resist description, so mathematicians choose nice ways to describe them. One such way is to project them onto a plane. Even more, it is interesting to build knots in discrete ways such as placing them on tiles in a plane. In this poster we are considering hexagonal mosaic knots, knots that are projected on a plane tiled by the honeycomb hexagonal tessellation. In this way, knots can be built from a small collection of hexagonal tiles with loops. We create an interactive tool which presents hexagonal tile types, a grid on which to lay them, and options for analysis. The researcher uses a point-and-click tool to lay down a mosaic grid, and in so doing, creates an underlying data structure representing the segments contained in the mosaic. When requested, the software traverses this data structure like a linked list. In this manner, one may determine if the data structure represents a suitably connected hexagonal mosaic knot or if it contains dead ends or stray segments; that is, determine if a data structure represents a knot/link or not. This process helpfully assigns segments to their respective knots, distinguishing not only 'over' and 'under' but also 'self' and 'other'. We hope to continue exploring automatic generation of information about knots from their tiled representations. Once more developed, we hope to be able to answer more questions about the knot or link represented by the data structure. We also hope to continue exploring the use of rapid, flexible feedback from prototypes in aiding exploratory research.

SESSION 1M

HEALTHCARE

Session Moderator: Geoffrey Gottlieb, School of Medicine
MGH 284
12:30 PM to 2:15 PM

* Note: Titles in order of presentation.

Customizable Tactile Maps for the Visually-Impaired
Jerry Cao, Sophomore, Computer Science
Mary Gates Scholar, UW Honors Program
Shriya Kurpad, Sophomore, Computer Science
Emily R. Warnock, Junior, Computer Science
Kathryn J. Lum, Junior, Computer Science
Mentor: Jennifer Mankoff, Allen School of Computer Science & Engineering
Mentor: Megan Hofmann, Paul G. Allen School of Computer Science

This presentation seeks to summarize a solution to helping the visually-impaired navigate new areas. While previous solutions have been relatively successful, many lacked two key features that we hope our solution addresses: being affordable and allowing customization towards those with compounding disabilities. Our solution consists of two main parts: (1) a user-interface created for Fusion 360, a popular 3D-modeling application, that is built upon an existing framework detailed in Hofmann (2018) called PARTs (Parameterized Abstractions of Reusable Things), and (2) an optimization algorithm to generate maps that are tailored for its users. Through PARTs, we developed different variations of modular pieces of map (*e.g.*, roads, buildings, and sidewalks), which increases ease of customization. After the user specifies personal information and preferences through the PARTs UI—such as the width of their finger, their physical limitations, their understanding of braille, and their desired map features—the optimization algorithm will select the best combination of features from the PARTs database for that specific user. At the end of the process, users have a model of a tactile map in Fusion 360 which can be printed out with commercially-available 3D-printers. With 3D-printers becoming more affordable, this solution is significantly less cost prohibitive than other means of generating tactile maps, which required an initial investment upwards of a thousand dollars. Through user studies, we also test how blind users interpret these maps, which helps us guide design improvements in the future. In this presentation, we discuss the efficacy of our solution by comparing it to previous works and detail our plans to improve the system by making the PARTs user-interface more accessible and incorporating user feedback about the map itself.

SESSION 1M

HEALTHCARE

Session Moderator: Geoffrey Gottlieb, School of Medicine
MGH 284
12:30 PM to 2:15 PM

* Note: Titles in order of presentation.

Learning, Equipping and Preparing for Surgery: An Online Peri-Operative Cognitive-Behavioral Intervention for Adolescents and Parents
Meena Meyyappan, Senior, Neurobiology
Levinson Emerging Scholar, Mary Gates Scholar, Innovations in Pain Research Scholar, Undergraduate Research Conference Travel Awardee
Mentor: Jennifer Rabbitts, Anesthesiology and Pain Medicine

Modifiable psychosocial and behavioral factors place youth at risk for severe and persistent pain after major surgery. Opportunity exists prior to surgery to intervene with youth and families to prepare them for surgery including helping to manage distressing cognitions and teaching non-pharmacologic coping strategies, to reduce acute pain and prevent chronic post-surgical pain. This study aims to develop and evaluate a cognitive behavioral program in reducing acute and chronic pain in youth undergoing major surgery. In the pilot study, fourteen children ages 10-18 years (M= 14.5), 71.4% female, scheduled for major spine surgery, and their parents, were enrolled into the study. Enrollment rates were excellent with 88% (14 of 16) of families approached agreeing to participate in the study, with a range of 4 to 16 weeks (M = 6.3, SD = 1.3) until surgery at the time of enrollment. Teens and their parents completed three pre- surgical modules containing surgical preparation and relaxation tips during the month preceding surgery. Participants completed three post-surgical modules during the 6 weeks following surgery containing tips for managing pain and returning back to school and activities. Each module was accessed online and followed by a coaching phone call with a trained study team member to ensure comprehension of module content. All of the participants completed all pre-surgery and post-surgery modules within the prescribed time frame. Parents and teens completed assessments at four timepoints: 1 month pre-surgery, 1 week pre-surgery, 6 weeks after surgery, 3 months after surgery. The majority of parents and children (79%) completed the study phone calls within the prescribed time period. Preliminary results indicate excellent program feasibility. Further study must be done on patient outcomes to assess efficacy of the program in a larger population.

POSTER SESSION 2

MGH 206, Easel 177

1:00 PM to 2:30 PM

Effect of the Pollutant Methanol on the Survival and Heart Rate of *Daphnia magna*

Jacquelynn (Jacki) O'Maley, Sophomore, Biology Transfer Degree, Edmonds Community College
Isabella Chang, Sophomore, Biology, Edmonds Community College
Carla Talbaux, Sophomore, Biology, Everett Community College
Severin H. Robins, Junior, Extended Pre-Major
Mentor: Jennifer (Gwen) Shlichta, Biology, Edmonds College

Methanol is a common pollutant in freshwater ecosystems due to its widespread use in industrial operations, fuel, antifreeze, paints, and insecticides, and being a result of the burning of garbage. As a bioindicator species, *Daphnia magna* health indicates changes in aquatic ecosystem health. They are an important part of the food web, eating algae, and as a food source to insects and fish. No previous studies have examined the effects of the pollutant methanol on *Daphnia* heart function and mortality. This experiment examined the effects of varying methanol concentrations on heart function and mortality of *Daphniamagna*. It was hypothesized that methanol significantly affects the heart and mortality rate of *Daphnia*. Fifteen experimental biospheres were used in each trial, with three jars for each of the five concentrations. The biospheres were filled with deionized water and methanol in concentrations of 0 ppm (control), 822.6 ppm, 1644.5 ppm, 3289.0 ppm, 7119 ppm. In a second trial, the concentrations were 0 ppm, 822.6 ppm, 1644.5 ppm, 205.7 ppm, and 411.3 ppm. Heart and mortality rates were observed and recorded for each trial over 4-8 days. For each jar, videos were recorded for 15 seconds each and heart rate was counted, and mortality counted every other day. Based on the survival and heart rate differences, it was concluded that as methanol concentrations increase, the heart rate of *Daphnia* varied but didn't respond linearly to concentration levels. Additionally, higher concentrations of methanol negatively affect survivability, although the initial control groups had somewhat high death rates. This study highlights the negative impact of methanol pollution on *Daphnia* because a negative impact on *Daphnia* affects the whole freshwater ecosystem. Indeed, in Lake Washington, *Daphnia* represent a major source of nutrients for juvenile Sockeye Salmon, making *Daphnia* indispensable for their growth.

POSTER SESSION 2

Commons West, Easel 19

1:00 PM to 2:30 PM

Maternal Thyroid Dysfunction, Likely Gene Disrupting Mutations and the Impact on ASD Severity

Lauren Koko (Koko) Hall, Senior, Psychology
UW Honors Program
Mentor: Jennifer Gerdts, Psychiatry
Mentor: Raphael Bernier, Psychiatry & Behavioral Sciences

Autism Spectrum Disroder (ASD) occurs in one in every 59 children, yet the causal mechanisms remain widely unknown. Research is advancing through genetic testing as well through speculation of external environmental influences. Recent stuides have examined in greater depth gene by environment interactions and have found an impact on severity symptoms of ASD. This research follows the two-hit model of gene by enviornment effects and investigates the link of auoimmune disorders, specifically thyroid disfunction, Likely Gene Disrupting (LGD) mutations to genes related to ASD, and the relation to IQ and regression. Behavioral and cognitive data are collected using clinician-administered questionnaires and assessments. Those who carry an LGD mutation with exposure to maternal thyroid dysfunction lean towards a trend that show more severe behavioral phenotypes than those without an LGD mutation. These results spotlight the importance of gene by environment contributions in addition to mechanisms involved in the disorder. These findings may help improve future treatment and intervention for those with ASD.

POSTER SESSION 2

MGH 206, Easel 178

1:00 PM to 2:30 PM

Role of Host microRNAs in Modulation of Alphavirus Replication

Alina Ferguson, Senior, Biology (Physiology)
UW Honors Program
Mentor: Jennifer Hyde, Microbiology, University of Washington, School of Medicine

Venezuelan equine encephalitis virus (VEEV) is a mosquito-borne New World alphavirus, causing encephalitic disease in mammals. Increased circulation of VEEV in the Americas underlines the need to characterize alphavirus replication and develop countermeasures. The VEEV genome is a single-stranded RNA of positive polarity (+ssRNA). MicroRNA (miRNA) are small, cell-specific non-coding RNAs that aid in post-transcriptional regulation of gene expression. Previous studies have demonstrated that host miRNA can affect viral replication and pathogenesis by directly binding to the viral genome. Recent work on host miRNA in related alphavirus Eastern equine encephalitis virus (EEEV) found miRNA binding sites in the EEEV 3' non-translated region (NTR). Binding of the host miRNA enhanced pathogenesis. Prediction software miRDB identified potential miRNA binding sites in the 3' end of VEEV genome, including one for miRNA hsa-miR-1268. In this study, the impact of miRNA

interaction with its putative binding site on VEEV pathogenesis was investigated. We performed site-directed mutagenesis of VEEV strain TC-83 to engineer point mutations at the hsa-miR-1268 binding site in the 3' end. We are currently testing the impact of these mutations on viral replication by analyzing growth kinetics of wild-type and mutant viruses in cell culture. We anticipate that a mutation disrupting the interaction between hsa-miR-1268 and the predictive binding site on the +ssRNA genome will result in the decreased ability to replicate the viral genome and subsequently infect the host. Understanding the impact of the interaction may lead to novel mechanisms to prevent RNA virus replication.

POSTER SESSION 3

MGH 206, Easel 169

2:30 PM to 4:00 PM

Signal Speeds and Root Response: Roles of Auxin Receptors in *A. thaliana* Root Growth

Alexandra True (Alex) Koriath, Sophomore, Bioengineering
Mentor: Jennifer Nemhauser, Biology
Mentor: Roman Ramos Baez, Biology

All around the world, humans depend on cultivating plants for medicine, food, landscaping and building materials. Understanding how plants grow helps people make more informed decisions about what to grow and how best to grow it. The plant hormone auxin plays a key role in determining almost all aspects of plant growth and development. The Nemhauser Lab has previously determined that two versions of the receptors for auxin, *TIR1* and *AFB2*, function at different speeds in the model plant *Arabidopsis thaliana*. Currently, we do not know how this speed disparity affects specific plant functions. My hypothesis is that there are measurable differences in organism functions caused by this difference in molecular speed. In the past, full knockout mutants for *TIR1* and *AFB2* did not exist, making it difficult to answer this question. To complete my research, I developed these mutant plant lines, determined functions that can be quantitatively measured, and collected and analyzed the data. Because the auxin-signaling network affects so many plant functions, any additional information we can gain about how this network functions in the model organism helps us move towards a more complete understanding of plant growth. This could positively improve the efficacy of agriculture and other plant-based industries, as well as moving us towards other new discoveries in the field of plant growth.

POSTER SESSION 3

MGH 206, Easel 167

2:30 PM to 4:00 PM

Control of Lateral Root Development: Insight from Defects of Auxin Response Factor (ARF) Mutants

Meghan Wedeking, Senior, Biology (Physiology)
Mentor: Jennifer Nemhauser, Biology

In Arabidopsis thaliana the plant signaling hormone auxin is a major regulator of plant growth and development including the formation of lateral roots. Auxin controls the development of lateral roots by regulating the activity of transcription factors, known as Auxin Response Factors (ARFs). Because ARF7 and ARF19 mutants shows reduced formation of lateral roots, they are identified as master regulators of lateral root development. Using these ARF mutants, my project aims to understand how these regulators control early stages of lateral root development and gain insight into the role of auxin signaling in developmental specification. To investigate this, reporter lines are crossed with plant mutant lines of ARF7, ARF19, and both ARF7/ARF19 exhibiting a range of lateral root phenotypes, enabling accurate identification of lateral root specification and initiation stages. In mutants, we use bend assays to induce the lateral root developmental program in a synchronous manner. Seedlings are grown vertically on agar plates for 4 days, then turned 90 eliciting a gravitropic bend response at the root tip and leads to an eventual emergence of a lateral root at that the bent region. In mutants, temporal dynamics of lateral root program is quantified using fluorescence microscopy of reporters in synchronously induced lateral roots. Based on collected data thus far, the arf7 mutants (compared to wild type) exhibit slower onset of the specification reporter, suggesting the mutation has a temporal delay on developmental processes. As this project progresses, we will focus on temporal differences in expression of reporters that identify early specification and initiation stages of lateral root development via use of bend assays along with microscopy. Insights gained from these experiments will help us focus on stages and events in lateral root development that are impaired in arf mutants and thereby indicate on how auxin controls the developmental processes.

POSTER SESSION 3

MGH 206, Easel 165

2:30 PM to 4:00 PM

Deconstructing Transcriptional Repression: How Does Multimerization Influence the Dynamics of a Conserved Corepressor?

Samuel Juarez Solis, Senior, Biology (Molecular, Cellular & Developmental)
Mentor: Jennifer Nemhauser, Biology

Proper development of an organism relies on the tight regulation of gene expression in cells and errors can lead to diseases or improper growth. Corepressors interact with DNA-binding proteins and inhibit gene expression. In the model

plant *Arabidopsis thaliana*, the corepressor TOPLESS (TPL) is a member of a deeply conserved Gro/Tup1/TLE family. I am studying which helices in TPL monomers are necessary and sufficient for homotetramerization. Additionally, I'm investigating what proteins TPL interacts with to control repression, especially mediator components and histone deacetylases (HDACs), which previous studies have identified as potential interactors. I am using a protein-protein interaction assay known as the cytoplasmic split-ubiquitin system (Cyto-SUS). In my assay, a bait (TPL) and prey proteins hypothesized to interact with TPL are attached to two halves of ubiquitin. If the bait and prey successfully interact, then ubiquitin is reformed and a ubiquitin-specific protease cleaves a transcription factor to induce expression of genes producing adenine and histidine. Successful interaction is measured qualitatively by observing growth of yeast on plates that lack adenine and histidine. Only certain helices of TPL are observed to interact with full length TPL. Specifically, truncations that are sufficient to drive repression in a synthetic yeast assay are insufficient to multimerize. This means that the multimer state is not required for repression. Secondly, we found that the N-terminus of TPL directly interacts with mediator through MED21, suggesting that TPL regulates recruitment of RNA Polymerase II. Other corepressors of the Gro/Tup1/TLE family, like Tup1 found in yeast, and the mammalian homolog Transducin-like enhancer of split (TLE) are known to homotetramerize and interact with similar regulatory elements like TPL, including: HDACS and mediator components. Understanding homotetramerization of TPL and its role in repressive mechanisms is pivotal for comprehending how corepression works across eukaryotes.

POSTER SESSION 3

MGH 206, Easel 166

2:30 PM to 4:00 PM

AGL42 in Lateral Root Specification

Erika Amy Oki, Senior, Biochemistry
Mentor: Jennifer Nemhauser, Biology

Auxin is a plant hormone that promotes root branching which allows improved anchoring in the soil and nutrient acquisition. At the molecular level, auxin promotes the activity of auxin responsive transcription factors called ARFs. I hypothesize that AGL42, a MADS box transcription factor works with ARFs during lateral root formation. I used CRISPR to remove the entire AGL42 gene from the genome and characterize lateral root phenotypes in the mutant. I characterized that AGL42 is regulated by auxin signaling. This was done by spraying Arabidopsis seedlings with auxin and measure AGL42 expression levels by RT-qPCR. I predict that increasing the levels of auxin will positively impact AGL42 levels. Alternatively, AGL42 may not be an auxin-responsive gene but may itself interact with the ARFs to affect downstream auxin signaling. To test this hypothesis, I performed a co-immunoprecipitation (Co-IP) assay to determine whether the AGL42 and ARFs interact with each other. By better understanding the lateral root specification, specifically the role of AGL42, we can learn how to improve the architecture of different crop plants, increasing their ability to thrive even in harsh environments.

POSTER SESSION 4

Commons East, Easel 75

4:00 PM to 6:00 PM

A Comparative Behavioral Study of Eight Primate Species at Cocha Cashu Biological Research Station

Katerina Mitrofanova, Senior, Biology (General)
Elizabeth Rylance, Senior, Neurobiology
UW Honors Program
Mentor: Ursula Valdez, IAS, UW Bothell
Mentor: Jennifer Atkinson, Interdisciplinary Arts & Sciences, UW Bothell

Manu National Park in southeastern Peru is an incredibly biodiverse national reserve at the meeting point of the Tropical Andes and the Amazon lowland rain forest, and an important location for tropical ecology research. Cocha Cashu Biological Station is one of few research locations in the Neotropical rain forest in which mammal communities remain almost completely undisturbed by human impact, including hunting and road construction. As a result, mammal population densities and compositions accurately reflect their natural environmental state. Among these mammals are fifteen known species of primates, and as major seed dispersers they play a critical role in the stability of the ecosystem. The aim of this study was to learn more about the behaviors of eight primate species within the Cocha Cashu trail system, during September of the dry season, using quantitative and qualitative observational methods. We used the focal sampling methods to quantify the proportions of time spent on daily activities for each species, and created activity budgets from this data to compare time spent on each activity. We also collected data on troop size, social interactions, habitat, and location throughout the day in order to compare and contrast the different groups. We were correct in our prediction that most species spent the largest proportion of time moving and feeding, but varied in other activity categories such as curiosity and aggressiveness. We found that there was significant overlap in the habitats and resources used by different species, but there were notable differences in foraging behaviors, troop size, canopy level, and the time of day designated to different activities.

POSTER SESSION 4

MGH 258, Easel 179

4:00 PM to 6:00 PM

Defining Chronic Postsurgical Pain in a Pediatric Population

Lucas Chen, Senior, Biology (Molecular, Cellular & Developmental)

Innovations in Pain Research Scholar

Mentor: Jennifer Rabbitts, Anesthesiology and Pain Medicine

Chronic postsurgical pain (CPSP) develops in 10-50% of pediatric patients after major surgery. Despite potentially severe health implications, little literature exists examining the epidemiology and mechanisms of pediatric CPSP. A barrier to progress in this area is that while definitions of CPSP exist in adults, definitions do not include impact of pain on health related quality of life, a critically important aspect of pain assessment. Consequently, the objective of this research study is to develop a clinically meaningful definition of pediatric CPSP that incorporates measures of pain intensity and quality of life, which can be standardized across clinical and research populations. The aims of the study were to (1) identify and extract common elements of current definitions used for CPSP in the existing literature, and (2) identify clinically meaningful cutpoints for CPSP based on pain and quality of life, through secondary data analysis of two clinical research studies examining pediatric post surgical pain. Literature search found that existing studies employed inconsistent definitions of CPSP, limiting our ability to develop a literature-based definition. Our dataset included 179 adolescents 10-18 years old undergoing surgery for spinal and chest wall deformities. Measures included pain intensity (Numerical Rating Scale), quality of life (PedsQL) and pain interference (Visual Analog Scale) at 4 and 12 months post-surgery. We conducted scatter plots to visually inspect the associations among pain and health outcomes. Cluster analyses of pain and health-related quality of life identified four unique cluster groups differing on level of pain and functional impairment. Next steps will include determining cutoffs for pain and quality of life based on these cluster groups, and validating the newly proposed definition in an independent sample of youth undergoing surgery. A consistent definition for CPSP which incorporates both pain intensity and functional impact of pain will help guide future research and treatment.

POSTER SESSION 4

Balcony, Easel 108

4:00 PM to 6:00 PM

Transdifferentiation of Supporting Cells into Type ll Hair Cells in Adult Mice after Damage Requires Sox2

Amanda Nichole (Amanda) Ciani, Fifth Year, Speech & Hearing Sciences

Mentor: Jennifer Stone, Otolaryngology

Hair cells are sensory receptors responsible for hearing and balance in the auditory and vestibular systems. These cells are surrounded by supporting cells, which are non-sensory cells similar to glia. In non-mammals, hair cells get replaced after damage through conversion of supporting cells. Recent studies have shown supporting cells can also transdifferentiate into type ll hair cells in the vestibular system of adult mice. The signals that control hair cell regeneration in mammals are poorly understood. It is known that the transcription factor Sox2 is utilized for specification of hair cells in the neurosensory domain of the otocyst. This project tests the premise that Sox2 is required in adult supporting cells for their transdifferentiation into type II hair cells after damage. We used time specific gene deletion technology, CreER-LoxP, to delete the gene encoding Sox2 in supporting cells prior to damage. The mice used include the following alleles (genetic segments): 1) the floxed Sox2, or Sox2loxP/loxP allele, which enables Sox2 deletion when Cre is active; 2) the Sox9CreERT2 allele, which targets Cre expression to supporting cells; Sox9CreERT2 is tamoxifen-dependent, so the timing of Sox2 deletion is controlled by tamoxifen injection; and 3) the Pou4f3DTR allele , which enables hair cell killing upon injection of diphtheria toxin (DT). Hair cells were identified and "typed" using several markers, including antibodies to myosin VIIa, neurofilament, and tubulin. I compared the number of regenerated hair cells of Sox2 expressing supporting cells and Sox2 negative supporting cells. Sox2 deletion in supporting cells resulted in a significantly reduced number of type ll regenerated hair cells. This result provides evidence that Sox2 is required for transdifferentiation of supporting cells. Understanding the function of Sox2 will give insight into potential downstream molecules that can become prospective targets for future research in understanding cellular regeneration in adult mice.