ONAEDO ANAKWENZE

**Application of Immunofluorescence Microscopy to Locate OXPAT Proteins Within Cells**

Lipid droplets are organelles used by cells to store neutral lipids for use as an energy source in the future and OXPAT is one of the proteins that stabilizes the lipid droplets. OXPAT plays a role in metabolism of fat and is localized on lipid droplets as well as a cytosolic pool. OXPAT is primarily found in oxidative tissues. Lipoproteins are necessary for the movements of lipids in an extracellular environment and OXPAT is believed to parallel these plasma lipoproteins in structure and function. The primary use of this research was to further the understanding of the localization of OXPAT molecules in the cell and by doing so, it will provide more data towards the study of lipids and how they are utilized in the body. Obesity and diabetes are two major health issues associated with lipid movement and storage, so understanding the role of OXPAT will help break some ground for treatment. The main focus of the research was to use immunofluorescence microscopy to locate where OXPAT is found within the cell. Cultured cells were grown on coverslips and fixed with paraformaldehyde. The cells were permeabilized and stained with an antibody against OXPAT. A second antibody containing a fluorescent tag was used to stain the first antibody to visualize the antibodies, which would allow one to determine the location of the OXPAT protein in the cell. Using immunofluorescence we were able to determine that OXPAT is found primarily in the cytosol rather than on lipid droplets in c2c12 cells.

KRISTIN L. BRAUN

**The Effects of Past Industrial Contamination on Local Soil and Groundwater**

Urban sprawl continues to migrate into undeveloped land around urban centers as urban areas with existing utility infrastructure decline. Furthermore, this new suburban development requires additional infrastructure which is increasingly expensive due to the new lower density development. As communities continue to sprawl, many areas that could be redeveloped into productive real estate are overlooked due to real or perceived contamination from industrialization. The goal of this study is to use this assessment as a tool to stimulate redevelopment of urban areas.

The main objectives of this study were to research properties located in Westerville, Ohio and then identify properties that have the potential to have impacts from chemicals from historic or current industrial activities that could prevent redevelopment. Once the areas of interest were identified they were
then evaluated using Ohio EPA Voluntary Action Program criteria. Research conducted in this study consisted of reviewing records of the properties located in the industrial areas of Westerville, Ohio and developing a historical context to assess the potential for impact from chemicals of concern. This area of research included zoning and title search, historic maps, identification of types of industrial activities (past and present) and types of chemicals associated with these industries. Additional research included local geology including soil profiles, groundwater, well logs, and topographic features to identify local surface water runoff potential. Once this data was collected each area of interest was evaluated to determine risk of environmental contamination from the identified industrial activities. Results demonstrated that it is possible that chemicals exist today within the identified areas. However, these chemicals are limited in concentration and movement due to local geology, and therefore pose minimal risk within the industrial zone and beyond. These results indicate that the risks that hinder redevelopment of these properties is more likely perceived concentration and mobility rather than actual.

BRITTANY L. CLAWSON

The Use and Outcomes of Laparoscopic Versus Open Colectomy for Cancer in a Tertiary Community Setting

Laparoscopic colectomy has been gaining acceptance for the treatment of colon cancer over the last decade and a half. However, a study examining the use and effectiveness of laparoscopic colectomy versus traditional open colectomy has not been performed at a tertiary community hospital. Therefore the objective of this study was to compare the outcomes and rate of use for laparoscopic colectomy over a ten year interval. This study also aimed to explore the relative advantages and disadvantages of laparoscopic colectomy compared to open colectomy based on a variety of demographic and surgical factors including sex, age, stage of cancer, surgery type, number of lymph nodes removed, length of hospital stay, 30-day readmittance, and surgeon’s degree of specialization. A retrospective review of colon cancer cases was performed by examining medical records from a tertiary community hospital in Central Ohio for a total of 266 patients, 152 of whom underwent a colectomy for colon cancer in 1997 and the remaining 114 of whom underwent the same procedure in 2006. Statistical analysis, including chi-squared and MANOVA tests, assessed the correlation among variables and the statistical significance. The study showed that the number of laparoscopic cases increased from zero in 1997 to 18 in 2006. Furthermore, this study demonstrated that laparoscopic colectomy for cancer is as effective as open colectomy for many outcomes, and has advantages associated with decreased length of post operative hospital stay. The results suggest that laparoscopic colectomies represent an advance in treatment for the early stages of colon cancer. However, these results only apply to patients with early stages of colon cancer and to less complicated colectomy procedures.
Evidence-Based Science of Physical Therapy in a Clinical Setting with Particular Interest to Anterior Cruciate Ligament Surgical Reconstruction

The practice of physical therapy aids in recovery from injury or illness of the musculoskeletal system, and can also play a preventative role. It is an evidence-based clinical practice with its own disciplinary literature, but also draws on the literature of Orthopedics, research science, and medical science. During an internship with Orthoneuro in Westerville, Ohio, the application of science by clinicians was examined, particularly with respect to techniques and their effect during recovery from surgical reconstruction of the anterior cruciate ligament. Through specialized stretching, agility work and the DAPRE program the patient recovered adequately enough to leave therapy and resume activity with caution. Without physical therapy intervention the recovery time would be drastically expanded, with the tendons in the knee joint possibly never reaching full potential due to the deficiency of motion, stretching and maintained muscle work. This case study displays the effectiveness of a physical therapy regimen.

Feasibility Analysis: Cistern Rainwater Collection System for the Patrick & Jill McCuan Center for Equine Science, Otterbein College, Westerville, OH

As a part of Otterbein College’s sustainability assessments, an evaluation of a proposed rainwater collection and distribution system for the newly constructed Patrick & Jill McCuan Center for Equine Studies was completed as an effort to reduce municipal water consumption. This research evaluated the feasibility and economic benefit of employing rainwater as a non-potable source for the center's use, by assessing the volume available for capture, and the cost and operation of such a system. Potable water uses were not considered in this study since rainwater use for this purpose requires Ohio Environmental Protection Agency permits and routine disinfection treatments/chemical monitoring. Increased areas of impermeable surfaces from land development, related to the construction of an equestrian facility, negatively affect the structure and ecology of streams receiving the runoff volume. Therefore, stormwater management plans incorporating environmentally friendly features such as rainwater collection systems, are potentially beneficial for both the environment and the facility. In order to account for seasonal variations, the maximum, minimum and averages for regional precipitation, rainwater collection volume, and municipal water fees were calculated. A collection of four scenarios with varying assumptions were analyzed to provide a probable range for determining the feasibility of such a project. This range is projected to be a required time for economic return of 22-30 years. Cost projections suggest the return on investment to occur the 22nd year of operation with the selected parameters of Average Scenario A held constant. Conclusively, the replacement of municipal water by rainwater would be a cost effective alternative for this facility when allowing for the long term accumulation of savings.
LISA M. FABINY

Speciation of Arsenic and Quantification of Elemental Arsenic, Calcium, Phosphorus, and Sulfur within Gametophytes of the Chinese Brake Fern, *Pteris vittata*

The Chinese Brake Fern, *Pteris vittata*, has been identified as a hyperaccumulator of arsenic from contaminated soil. While considerable research on the sporophyte generation has been completed, the gametophyte generation has yet to be fully studied for its potential in bioremediation. Our current research examines the gametophyte over the span of 21 days, assessing arsenic speciation and a select group of elemental totals in relation to arsenic uptake. The plants were harvested at regular intervals for analysis through inductively coupled plasma mass spectrometry (ICP-MS) coupled with high performance liquid chromatography to measure the uptake and reduction of arsenate (AsV) to arsenite (AsIII) over the course of the gametophytes' growth. ICP-MS also allowed us to test for the presence and concentrations of elements within the gametophytes, including calcium, phosphorus, sulfur, and arsenic. In arsenic treated medium, the levels of arsenic increased, showing conclusively the ability of the gametophyte to act as a hyperaccumulator, with the point of hyperaccumulation beginning between days 7 and 9. Phosphorus uptake in the arsenic treated gametophytes has a direct relationship to arsenic being taken up, tending towards a 1:1 ratio within the gametophytes. Sulfur has a similar relationship to both arsenic and phosphorus, indicating that the three elements are interconnected. Calcium appears to have little connection with arsenic uptake in the gametophyte. Past research has indicated that phosphorus is a necessary component to arsenic detoxification and sulfur containing polypeptides are thought to complex with the arsenic to aid in transport across membranes in the sporophyte. Our data could be interpreted to support such conclusions in regards to the gametophyte.

SHANNON R. FLAHERTY

Medical Protocols: The Scientific and Clinical Evidence Base for the Small Baby Guidelines Derived by Staff of Nationwide Children’s Hospital Neonatal Intensive Care Unit

Medical treatment is the intervention in the course of a disease through the application of knowledge of physiology, pathology, biochemistry and pharmacology. This knowledge stems from basic science studies and research performed by scientists and clinicians around the world. When medicine is practiced in a clinical setting there are certain protocols, or standards of treatment that are followed. These protocols are guidelines for what are considered best practices compiled by national or international bodies or by local medical staff, using the whole body of published information from current research and clinical studies. The use of these protocols allows clinicians to quickly and accurately formulate treatment plans for patients without sparing the time for their own detailed research on current findings. During a three month internship at the Nationwide Children’s Hospital Neonatal Intensive Care Unit (NICU) in the ‘Small baby pod,’ I closely followed several case studies from
diagnosis through the treatment process. During this time, I focused mainly on the treatment plan given by the physician and on the evidence base from which the treatment was derived. The Small Baby Guidelines, the protocol in use in the Small baby pod, was revised in April of 2008 using information from current research and clinical trials. After reading about the diseases and conditions suffered by the patients I saw, I was able to correlate the disease process and evidence-based procedures in the Small Baby Guidelines. This internship therefore allowed me to see where and how research in basic science is applied in a clinical setting in order to achieve the optimal outcome.

JONATHAN H. HERR

The Effects of Selected Conditions on Growth of the Alga, Dunaliella, from the Baltic Sea by Chlorophyll a and Absorbency Analysis

Current research on the alga, Dunaliella, suggests that with favorable environmental conditions Dunaliella can be cultivated to create alternative energy sources. The growth of Dunaliella requires key environmental conditions such as light, nitrogen, phosphorus, trace elements, carbon, salinity, temperature, and turbidity. It is hypothesized that removing any one of these selected environmental conditions will cause a reduction in the absorbency and chlorophyll a concentrations which can be used as indications of overall growth. Different environmental conditions were set up to analyze their affects on Dunaliella growth: no nutrients, no O₂, no light, heat, and control. All environmental groups started with initial absorbency at 1.28±0.02 ‰ and Chlorophyll a concentration of 2105.97±893.19 µg L⁻¹. The control had final values of 1.43±0.09 ‰ and 2590.17±359.80 µg L⁻¹. No light had final values of 1.85±0.37 ‰ and 3020.93±208.18 µg L⁻¹. No O₂ had final values of 1.04±0.05 ‰ and 2287.33±50.14 µg L⁻¹. No nutrients had final values of 1.11±0.00 ‰ and 2360±117.73 µg L⁻¹. The samples grown in the 30° Celsius water bath had final values of 0.68±0.03 ‰ and 1428.5±71.88 µg L⁻¹. A one-way ANOVA test was conducted between each environmental change to the control at a confidence of p=0.05. This study suggests that there are no growth differences between the control group and the experiment groups no nutrients, no O₂, and no light. Furthermore, this study suggests that there is a difference in growth between the control and the experimental group grown in a 30° Celsius water bath.

MICHELLE L. HOBBS

Expression of Lipid Droplet Proteins in Macrophages

The molecular mechanisms underlying cholesterol storage in cells central to atherosclerosis remain unclear. The PAT proteins are a family of five related proteins involved in the shepherding and regulation of cellular lipid stores. Preliminary findings in the literature have identified several PAT proteins in atheroma or cultured macrophage-like cell lines. It has been hypothesized that these proteins and related family members are involved in the cholesterol storage in macrophage-derived foam cells, a central component in the progression of atherosclerosis. Primary cultures of human macrophages were
treated at varying stages of differentiation with oxidized LDL to induce cholesterol storage. Cholesterol and protein assays were conducted to monitor lipid accumulation. Western blots revealed the increased presence of OXPAT upon incubation with oxLDL, but significant differences could not be determined in the concentrations of adipophilin, TIP47, and Perilipin A upon incubation with LDL. S3-12, another PAT protein, was not found. These results reveal a correlational relationship for the PAT proteins in the pathogenesis of atherosclerosis. With this knowledge, more about the biochemical mechanisms in the progression of atherosclerosis can be determined, and treatments can be developed to better combat the growing epidemic that is heart disease.

HEATHER M. HOLL

Genetics Basis of Inherited Brindle Coat Color in Horses

Brindle coat color in horses is defined as dark vertical stripes of pigment on a lighter background. It was determined that two brindled horses found in the USA displayed their unique phenotype due to chimerism, but others have inherited their brindling from their parents. The goal of this project was to examine twenty brindle horses, believed to be non-chimeric, from Washington, Missouri, California, and Texas, to determine a genetic cause, to understand the molecular basis of brindling, and potentially create a test for the presence of a brindle allele. The agouti gene was selected as a candidate gene due to changes found in agouti alleles of Normande brindle cattle and mottled agouti mice. The specific objectives of this study were to test the agouti locus in brindle (N=20) and control (N=18) horses for insertion or deletion mutations in three exons and three previously identified single nucleotide polymorphisms. DNA was extracted from equine mane hair root samples, amplified using the polymerase chain reaction, and analyzed using gel electrophoresis and DNA sequencing. There was no evidence of large insertions or deletions in the three loci of the twenty brindle horses tested. Limited sequence data show a possible single base deletion immediately following exon one, and an association of an adenine in the SNP with three brindle horses, and guanine in one control. In the future, additional samples should be sequenced and other segments of the agouti gene examined.

KATHERINE A. HOWARD

The Role of Clinical Experience and Scientific Research in Medicine: A Study of Two Practices

Medicine leans heavily on research done in scientific labs across the world, but exactly how this research ends up influencing our day-to-day experiences with medicine is a complex process. Over the past year I studied two approaches to modern medicine: A traditional osteopathic physician who relies heavily on his past personal clinical experience; and a recently graduated allopathic physician who very closely follows current research and findings. Both practices have drastically different approaches towards following protocol. Protocols are determined by experts that analyze research and use this information to help outline the best course of action for physicians in varying situations. They help
doctors to quickly assess situations, assign the proper treatments and help to significantly improve the expected prognosis of the patients. During this experience, I was able to further understand how scientific research is applied in modern medicine, and the influence it has over standard protocols.

JENNIFER K. JOHNSON

Genetic Counseling Internship at The Ohio State University Division of Human Genetics

The importance of genetics for human health has been of growing interest over the last several decades, however genetic counseling has existed as a profession only for the past 20 years. The first graduate genetic counseling program and certification was established in 1996. The role of genetic counselors is to estimate the risk of a patient’s susceptibility to a genetic disorder based on their own and their family’s medical history. After evaluating medical histories, a genetic counselor can assess the risk of the individual carrying a gene or multiple genes that would increase their own, their relatives’ or their children’s risk of a genetic disorder, and if high enough can recommend genetic testing. In addition, genetic counselors provide an important link between physicians and patients, providing information about genetics and aiding them both in making often difficult decisions. For my internship I spent a year working as a personal intern to Amy Sturm, MS, CGC at the Ohio State University Division of Human Genetics. One of the main studies I worked on seeks to find the genetic components that are responsible for vitamin B-12 deficiency in juveniles. I also worked on two banking studies, one control study and the other banking the DNA of non-cancer patients. My personal goals for the internship were to learn as much as I possibly could about the profession of genetic counseling, to get first hand experience in the world of genetics and medicine and to establish solid contacts and references in the professional world of genetics. I feel that my internship has left me with a very clear understanding of what genetic counseling is about and has clarified my personal feelings about the profession. I have made very valuable contacts and gained significant professional experience for my future beyond my studies here at Otterbein College.

JOSEPH M. KREMER

Application of Scientific Methodology Exemplified in the Diagnostic Process in Neurological Surgery

The scientific method is a series of steps that aid in answering a specific question. Steps involved in this process are: identification of a problem, research known information concerning the topic, formulate a hypothesis, test the hypothesis, make observations, record data and arrive at a conclusion. This same process of information gathering to answer specific questions is used in surgical diagnosis. Literature such as medical journals, medical textbooks and established case studies aid physicians in determining appropriate diagnosis based on known evidence. Established case studies are a chief source of information that provide documentation of both successes and failures of surgical
intervention. Each aspect mentioned above was investigated and applied throughout the course of my internship. After shadowing Dr. Gregory Balturshot M.D. during clinic, I was able to compare the physical examination methods used to the conventional protocol accepted by the American Board of Neurological Surgery. These examination methods are: review of CT, MRI or X-ray film, sensory testing, reflex testing, flexion and extension testing and strength tests. I then researched the examination methods used while shadowing in clinic and compared them to a specific patient [patient X] of Dr. Balturshot’s who recovered exceptionally well from the removal of a bullet from the cervical spine. The chart review of patient X provided a step by step analysis of the patient’s condition to illustrate importance of the processes mentioned above, and allowed me to further explore the importance of evidence based medicine.

JONATHAN P. LUCHSINGER

Medical Equipment Sales

Ganim Medical, Inc. provides pre-owned and new medical equipment to outfit the needs of hospitals and surgery centers predominantly in the Midwest. Ganim Medical markets a broad range of equipment including Adoscopes, blood pressure cuffs, mayo stands, wheelchairs, I.V. poles, scrub sinks, case carts, surgical tables, light sources, laparoscopic equipment, autoclaves, and X-ray machines. I was able to learn about all the different equipment because my position and responsibilities were constantly changing. Time was spent working and observing every position available at Ganim Medical to help my understanding. My academic goals were to gain scientific understanding of the medical equipment. I learned the science behind how the sterilizers, patient monitors, and anesthesia machines work. In addition I wanted to know how these instruments were developed. My internship at Ganim medical was valuable in two ways: not only did I gain an understanding of both the science behind medical equipment and sales techniques, but I also have earned a job opportunity following Otterbein College graduation this spring.

MINA S. MAKARY

Isolation, Diversity Analysis, and Metabolic Characterization of Hydrocarbon-Degrading Bacteria from a Microbial Bioremediation Perspective

Increased global consumption of petroleum products has meant increased hydrocarbon pollution of the environment. Due to the hazardous influences of petroleum hydrocarbons on natural habitat and human health, research on microbial bioremediation has been undertaken to attenuate these contaminants from ecosystems. The purpose of this work was to investigate the effects of hydrocarbon-contamination in local soils by assessing the diversity of bacterial populations as well as by isolating and characterizing hydrocarbonoclastic degraders capable of bioremediation. Samples (N=7) from areas visually-contaminated with oil and from uncontaminated soils on Otterbein College campus were inoculated onto hydrocarbon-selective as well as rich media. Viable
counts for hydrocarbon-utilizing microbes and overall bacterial populations were performed. Diversity statistics (species richness, relative abundance, and Simpson’s, Shannon-Wiener’s, and Evenness’ diversity indices) of the soil microbial populations revealed increased degrader diversity in contaminated soils. Biochemical testing of sixteen different hydrocarbon-degrading isolates elucidated distinct metabolism. A subset of thirteen strains were identified to genus using 16S rRNA gene sequencing, which suggests the discovery of novel degrading isolates that were submitted to GenBank® database. These include novel strains of *Cellulomonas* and *Arthrobacter* as well as several organisms that may represent new species with closest relatives *Chryseobacterium* and *Flavobacteria*. Through characterization of the isolates’ bioremediation potentials by growth curve analysis, the degraders demonstrated ability to degrade hexane, cyclohexane, toluene, *iso*-amyl alcohol, *n*-amyl alcohol, and *tert*-amyl alcohol. Degraders grew fastest on cyclohexane and hexane, slowest on *tert*-amyl alcohol followed by toluene, and did not grow or grew weakly on *n*- and *iso*-amyl alcohols. Degraders from oil-contaminated sites generally better-degraded aromatics such as toluene than degraders from control sites, reflecting a possible effect of long-term contamination on degrader selection. This study contributes to the field by evaluating the environmental impact of long-term, low-grade contamination and by identifying strains that have potential for bioremediation of sites contaminated with hydrocarbons.

TIFFANY H. MCCLELLAN

**Response to Interferon-λ in Fibroblasts Previously Treated with Interferon-α**

Interferons (IFN) are cytokines produced by the immune system in response to invading viruses and infections. Interferons of the type 1 category attach to specific cell receptors on target cells and use the JAK/STAT signaling pathway to invade the cell and modify gene expression. Two interferons that behave this way are IFN-α and IFN-λ. While all cell types express the receptor for IFN-α, the IFN-λ receptor is only expressed on some, making those without indifferent to IFN-λ. We sought to identify if cells that do not possess IFN-λ receptors, such as fibroblasts, can become responsive to IFN-λ if first exposed to IFN-α, seemingly by upregulating expression of IFN-λ receptors. Two types of cells were tested—F114 mouse fibroblast cells, and primary 129 wild type mouse embryonic fibroblasts (MEFs). One group of cells was treated with only IFN-α, another with IFN-λ, another with both IFN-α followed by IFN-λ, and a last group left untreated. Human epithelial cells (A549) were treated with IFN-λ and used as a control. Cells were lysed and a protein assay was performed prior to performing a Western blot to measure activated STAT1. It was discovered that although cells were first treated with IFN-α, expression of IFN-λ receptors were not observed. This discovery suggests that fibroblasts that are unresponsive to IFN-λ are unable to upregulate expression of IFN-λ receptors when first exposed with IFN-α.
NATALIE L. MIKITA

**Immunohistochemistry Analysis of Enzymes Involved in Chronic Proliferative Dermatitis**

Vitamin A is used in many areas of the body, especially the hair and skin. The positive effect of vitamin A depends on its synthesis to retinoic acid. Vitamin A enters the body as a provitamin, and its subsequent metabolism to retinoic acid is facilitated by many enzymes. Chronic proliferative dermatitis in mice (cpdm) is one of many hair and skin diseases related to vitamin A. This disease is closely related to cicatricial alopecia and psoriasis in humans. It has a wide variety of symptoms including hair loss, weight loss and skin lesions. It has been linked to the *Sharpin* gene in mice. In this study, we looked to support initial gene microarray data that suggests the enzymes involved in vitamin A metabolism are altered in cpdm. It was also our hope to connect *sharpin* to vitamin A metabolism. Immunohistochemistry was performed on paraffin blocks of dorsal skin from C57B/KaLW Sharpin^{cpdm}/Sharpin^{cpdm} mutant mice and wild-type controls. The tissues all had hair follicles that were either in the anagen stage of the hair cycle (growth) or the telogen stage (rest). Tissues were pretreated with hydrogen peroxide, bovine serum albumin and normal goat serum and incubated with three separate antibodies. Afterwards, these tissues were stained and counterstained and mounted on slides. Analysis of these slides supported the microarray data as the enzymes were all altered in the disease. We were not, however, able to make a connection between vitamin A metabolism and *sharpin*.

KACIE E. MILLER

**Application of Digoxigen Probe Labeling and Southern Blotting to Human Major Histocompatibility Complex Gene Copy Number Variation in Systemic Lupus Erythematosus**

Systematic lupus erythematosus (SLE) is a complex autoimmune disease. SLE is thought to be caused by a combination of genetic and environmental factors. IgG autoantibodies that are specific for common cellular constituents (e.g. chromatin, membrane phospholipids, etc.) are the crucial diagnostic characteristic of SLE. These IgG autoantibodies are believed to cause systematic destruction of vital organs which can lead to potentially fatal disease. One genetic factor that is suspected to play a role in SLE is the major histocompatibility complex (MHC), a polymorphic gene family that is responsible for the presentation of both self and nonself antigens to T cells within the immune system. Recently, MHC gene copy number variation (CNV) in the complement subregion has been shown to present susceptibility of SLE. The goal of the present study is to extend this analysis to the DRB subregion of the MHC. One technique that can be used in measuring copy number variations is Southern blotting. The specific objective of this study was to prepare a nonradioactive digoxigenin (DIG) labeled MHC-DRB probe for the use in Southern blotting. The probe was successfully prepared and used to detect polymerase chain reaction (PCR) amplified MHC DNA by Southern blotting. Genomic Southern blotting was also attempted but did not produce results. Future research efforts should focus
on the improvement of the probe labeling efficiency and restriction endonuclease digestion of the genomic DNA.

DAVID J. POWERS

The Influence of Personal Cognition on Learning and Growth

My internship at OWjL camp in Delaware, Ohio proved to be both educational and affirmative. I served for 3 weeks as a full time camp counselor. As a counselor I was in charge of 8-10 new campers every week, as I lead them through educational, athletic and entertainment activities. I was tested in both my content knowledge and pedagogical practices. Middle school students are walking dichotomies so my training from the education department in cognitive psychology was very useful. They are also inquisitive individuals so I relied on my training from the science department for logical thought processing and free-thinking exploration, which prepared me for a number of learning situations, both formal and non-formal.

MOLLY A. ROUSH

Review of the Scientific Evidence behind Therapy used in Aphasia: Report on a Three Month Internship in Speech-Language Pathology

Speech-language pathology is a hospital/office based discipline which treats all forms of human communication disorders. Its focus lies in evaluating speech, language, and cognitive communication among all ages from infants to the elderly. The practice of speech-language pathology dates back to the early 1900’s when self proclaimed speech pathologists began to form groups, one of which developed into the American Academy of Speech Correction (AASC). The AASC established the scientific basis of the practice of speech-language pathology, and eventually evolved into the organization known as the American Speech-Language-Hearing Association (ASHA). My interest in discovering the scientific evidence behind the clinical practice of speech language therapy led to performing a 3 month internship with the Delaware Speech and Hearing Center. During my internship I assisted in planning activities to target specific speech needs, observed and assisted in speech support for groups and individual clients, and developed a particular interest in aphasia that resulted in the publication of an article on aphasia communication strategies published in the Council Communicator in May, 2009. Other outcomes of the internship include an understanding of the nature of the field of speech-language pathology and the likely direction of its future course, knowledge of the professional peer-reviewed literature of the discipline, and an ability to access the evidence on which a speech-language pathologist bases practice. Additionally, I realized during my internship that the field of speech-language pathology is a career that I feel very passionate about, and I have gained multiple contacts who will be helpful to me with references for graduate school as well as aiding my future career in the field.
TYLER A. RUDMAN

Analyzing Reasons for Use of Ceramic vs. Metal in Restorative Dentistry

Dental technology and the use of materials in dental restoration have evolved over time. In restorative dentistry, material such as gold alloys and base metal alloys were used in the past and are still used today. These alloys are made of gold, copper and other metals. As dentistry has changed, the materials used in restorations have changed also. Ceramic is being used now in restorative dentistry in place of metal alloys. Metal alloys are very durable and wear resistant but lack an esthetic quality due to the color of the metal. Ceramic on the other hand is more pleasing esthetically and provides a similar wear and strength factor in comparison to metal alloys. Metal alloys also have problems in patients who have sensitivity to hot/cold and with patients who may have metal allergies. The use of ceramics on restorative dentistry is a viable material to use over metal alloys. Ceramics provide the strength and durability of metal and also the esthetic quality of a natural looking tooth. During my internship, at Merion Village Dental in Columbus, I interviewed dentists who use ceramic restorations and found that patients are happier with these restorations. The internship lasted throughout a period of three months and I was able to see first hand the benefits of ceramic over metal alloys. Not only is it cost effective and convenient to mill the restoration on site, but ceramic provides the strength of metal alloys while not having the drawbacks of metal. I conclude ceramics provide a quality restoration that is more pleasing to patients in a shorter period of time.

GRETCHEN R. RUHE

Major Histocompatibility Complex (MHC) Genotyping Using the Polymerase Chain Reaction Restriction Fragment Length Polymorphism (PCR-RFLP) Method

The evolution of sexual reproduction is perplexing to biologists because the advantage of sexual reproduction over asexual reproduction is unclear. Several costs and benefits have been discovered over the years as the subject has been researched. One potential benefit of sexual reproduction is the option of mate choice. This has led scientists to explore the basis of mate choice. One particular point of interest is the possibility of mate choice based on variation in the major histocompatibility complex (MHC). The MHC, a highly polymorphic gene complex, contains genes that present foreign antigens to T cells and has also been linked to the expression of body scent. Therefore, the attractiveness of scent may enable an individual to select a mate to enhance the immune system of its offspring. The goal of this project was to apply a simple method of MHC genotyping to explore the roles of MHC and body scent in human mate selection. DNA samples were taken from several human subjects and amplified by two different methods of PCR, one to detect MHC associated single nucleotide polymorphisms (SNP-PCR) and another to detect the MHC DRB exon 2 (DRB-PCR). These PCR samples were then digested with restriction enzymes and examined by gel electrophoresis to detect restriction fragment length polymorphisms (RFLP). The DRB-PCR-RFLP method showed variation in the human samples, where the SNP-PCR-RFLP method did not. This demonstrated
that the DRB-PCR-RFLP method can be used as a simple method to view alleles for application in further mate choice studies.

SARAH E. STARR

Trace Element Content of Alum Creek Detected in Zebra Mussels (*Dreissena polymorpha*)

Elevated trace element concentrations from wastewater discharges to streams can be harmful to the aquatic populations. Trace element contamination can also travel up the food chain, bioaccumulate, and harm larger animals and humans that feed on organisms from the aquatic environment. This study examines differences in trace element concentrations in zebra mussel populations above the Delaware County sanitary sewer outfall versus those below to assess if the discharge into Alum Creek effects trace element concentrations of the *D. polymorpha* populations. These bivalves were good to use because they are filter feeders and they are essentially immobile. Zebra mussels were collected from three locations above the outfall and three locations below the outfall. The shells and tissue were separated, dried, and ground into shell powder and tissue powder. Each powder sample was put into its own plastic container and properly labeled. The powders were analyzed by using a handheld X-ray fluorescence analyzer. This device was used to detect and measure the amount of trace elements present in the shell and tissue samples. There were no statistically significant differences in trace element concentration between populations of zebra mussels collected from the upstream and downstream locations. There were significant differences in trace element concentrations between shells and soft tissue. Depending on the element of interest, shell or tissue may be used for analysis because different trace elements appear to concentrate more in either the shell or tissue. Since there is minimal published data regarding the concentrations of trace elements in zebra mussels, these results provide a meaningful database that would be beneficial for other locations. According to this study, it appears that no trace elements are being discharged from the outfall at an elevated level.

BARRY J. WANNINGER

Science Behind Sports Medicine: Use of the Literature of Synovial Fluid Replacement in Management of Osteoarthritis of the Knee in Orthopedic Practice

The academic goal of an internship performed at Wellington Orthopedic and Sports Medicine Center was to learn how medical doctors incorporate basic science research findings into their clinical practice in order to provide their patients with the best possible treatment in the current state of knowledge. Ethical responsibilities to their patients oblige physicians to replace present treatments if new information indicates that other treatment methods offer significant advantages, and therefore judging new information for its potential to favorably modify existing treatment is an ongoing process. In the state of Ohio, medical doctors must complete 100 credits (hours) of Continuing Medical
Education (CME) each year in order to keep up with developments of their field of specialization. This paper will examine the nature of the evidence base from scientific and clinical research that physicians use in deciding on or adopting best practices in patient management, (diagnosis, treatment, adjunct therapy and education). The specific example of synovial fluid replacement (viscosupplementation) with different molecular weights of intra-articular injected hyaluronans for the purpose of pain reduction, increased joint mobility, and improved function in osteoarthritis (OA) of the knee will be used to illustrate the nature of the scientific evidence and the considerations that affect its adoption into clinical practice.

REBECCA N. WILLIAMS
Analysis of Hydrophobic Residues in Helix VI and Helix IX of Lactose Permease in Escherichia coli

Lactose permease is a membrane protein that transports lactose and protons using a symport mechanism. This protein has been studied extensively for over 40 years establishing it as a model system for investigating transport. The protein is composed of twelve membrane spanning alpha helices. Eight of these helices are known to be amphipathic, based on amino acid prediction and crystal structure, creating a channel that binds both lactose and protons during symport. The remaining four helices, III, VI, IX and XII are known to be hydrophobic, and are predicted to stabilize the protein within the membrane. This study set out to analyze the roles of hydrophobic helices VI and IX. Site directed mutagenesis was utilized to create a unique restriction enzyme site to allow insertion of a charged residue into helix IX. Attempts to clone this mutation using T-vector and TA cloning systems were unsuccessful, as demonstrated by transformation and Blue-White screening. However, a similar mutation, L180R, was created in helix VI by Hranilovich in 2004. This mutation was shown to significantly impact function of the protein, resulting in 21.9% level of transport as compared to the wild type. Since hydrophobic helices are not implicated in direct substrate binding, the role of hydrophobic helices in transport is indirect. It is possible the loss of transport is due to loss of the protein in the membrane, or transport activity may be suppressed if the helix impacts conformational change. To test this hypothesis, immunoblot analysis on mutant, L180R, was completed to determine the effect on protein stability in the membrane. It was determined that lactose permease is present in the membrane at levels similar to wild type expression. This suggests that a charged point mutation within a hydrophobic helix interferes with conformational change, suggesting the importance of hydrophobic helices in protein movement.

JAMIE C. WILSON
The Effects of Plant and Animal Diets on Basking Behavior in the Slider Turtle Trachemys scripta

Yellow-bellied slider turtles, Trachemys scripta, go through an ontogenetic dietary shift from a carnivorous to herbivorous diet. This shift is driven by
changes in the relative costs and benefits of these diets as turtles grow. Turtles are ectotherms that rely on thermoregulatory behavior, such as basking, to maintain body temperature. I examined the basking behavior of juveniles fed plant and animal diets to determine if diet influences the amount of time spent basking. Twenty-two turtles were used in a repeated measure experiment. The turtles were separated into two tanks; eleven turtles in each tank. One tank of turtles was fed duckweed (Lemna minor) for one week while the other set of turtles was fed crickets (Acheta domesticus) for one week. The turtles were then fasted for a week and then the diets were switched so all of the turtles ate both diets. The turtles were videotaped for 12 hours on each treatment from approximately 0800h to 2000h; this included the two hours the turtles ate followed by ten hours of post meal basking time. Turtles basked significantly more when fed crickets than when fed duckweed. When fasted, they basked as much as when fed crickets, but significantly less than when fed duckweed. On both diets, basking behavior increased throughout the day with the most turtles basking between 1400h and 1500h. The high protein content and greater consumption of crickets probably resulted in the increased basking behavior on this diet.

KATHRYNE S. WORKMAN

Neuromuscular Electrical Stimulation as a Treatment Modality in Physical Therapy: The Evidence Base for Practice

Physical Therapy is a growing health profession that focuses on developing, preventing, maintaining, and restoring bodily movements, strength, and function in order to enhance the quality of life. In order for intervention to take place, physical therapists must encompass a vast knowledge of the body and the integrated systems that support normal functioning. Treatment modalities and rehabilitation programs are centered on the scientific research that evaluates the efficacy of treatment of specific congenital and acquired conditions. Neuromuscular Electrical Stimulation is a commonly used treatment modality that uses electrical current to recruit muscle fibers and stimulate muscle contraction between intervals of relaxation. During a five month long period, successive observations were completed at Nationwide Children’s Hospital Inpatient and Outpatient Rehabilitation and Freeman Athletic Training Center under physical therapist Shelley Payne. Several case studies were followed from initial assessment through implementation of treatment to successive evaluations of the response to treatment. NMES was used as a modality in a specific case study of child spastic diplegic cerebral palsy observed at Nationwide Children’s Hospital. A systematic and critical examination of the evidence in the literature supports the use of NMES in the above clinical case. Critical evaluations of the evidence by professionals as well as governing bodies of the profession, play an important role in clinical decision making, intervention, and implementation of treatment regimens. Evidence based practice is then an essential component of an autonomous health field, such as that of Physical Therapy.
Beaching and Reproductive Effects of the Lampricide TFM (3-trifluoromethyl-4-nitrophenol) on Freshwater Mussels in the Grand River and Conneaut Creek, Ohio

The objective of the current study was to determine the effect of TFM (3-trifluoromethyl-4-nitrophenol) on freshwater mussels (family Unionidae) in the Grand River and Conneaut Creek in Ohio. Historic and recent mussel data for the two streams were used to determine possible candidates for TFM sensitivity analysis. Sub-lethal effects of TFM were also assessed. Increased susceptibility to beaching and predation may occur when mussels are narcotized following TFM treatment. Beaching rate was determined pre-treatment and post-treatment for the Grand River and Conneaut Creek. Even though we found no significant difference between acute toxicity (in this case survivability before and after treatment with TFM), we did find an increased likelihood of beaching in Conneaut Creek following TFM treatment. This same effect was not evident in the Grand River, but beaching following treatment in this river was greater following treatment than prior to TFM treatment. In this case, however, so was the differential discharge between the high and low flow periods examined during this study. More data on mussels being beached by floods in the Grand River may clarify this effect. Annular ring data was also used to determine if mussel age class distribution has been eliminated or affected following lampricide treatment years. Measures of the affects on fertility and fecundity were determined by classifying mussels as either long term or short term breeders. Comparing age class means using a t-test determined that there was no significant difference in fertility or fecundity before and after treatment. This study had mixed results. The lampricide TFM had sub-lethal impacts on the mussels in Conneaut Creek where we found increased beaching after the treatment. The same impact was not demonstrated in the Grand River. Both streams may have lost mussels that were most sensitive to the lampricide during the initial treatments in the 1960’s and 1970’s.