WILLIAM PATERSON UNIVERSITY OF NEW JERSEY

COLLEGE OF SCIENCE AND HEALTH

RESEARCH

INTERNSHIPS AND EXTERNSHIPS

GARDEN STATE—LOUIS STOKES ALLIANCE FOR MINORITY PARTICIPATION

CELEBRATING STUDENT RESEARCH ACTIVITIES
2012

THIRD EDITION

RESEARCH
INTERNSHIPS, EXTERNSHIPS

WILLIAM PATERSON UNIVERSITY

COLLEGE OF SCIENCE AND HEALTH
BIOLOGY DEPARTMENT
GS-LSAMP & MAPS

Celebrating Student Research Activities
2011-12
Third Annual Edition

Introduction

This is the third year the Garden State Louis Stokes Alliance for Minority Participation (GS-LSAMP) program, formerly called Pathways for Academic Success in the Sciences or PASS, has put together such publication in order to recognize the research efforts and successes by William Paterson University science majors.

As previously noted, Summer Research Internships and Externships have provided students with the opportunity to work on or off campus, in a laboratory or in their field of interest , under the supervision of a faculty. Such opportunity has allowed them to experience firsthand "how scientists work" and how to conduct scientific research. Many actively participated in specific projects, learn new techniques including the use of elaborate laboratory equipments, computer -assisted analyses, animal husbandry and handling, to name a few. Others have spent their summers volunteering or shadowing physicians in Hospitals and Health Clinics. Such internship has proven to be a valuable asset for students applying to Graduate or Professional school, or in job placement or career selection following graduation.

Many of the students included in this publication are ISSBB (Increasing Student Success in Biology and Biotechnology) scholars. All the summer interns have presented their summer experience at one our monthly meetings in the Fall 2011 semester. Additionally, several GS-LSAMP students presented their work at the Undergraduate Research Symposium which took place at WPU in April 2012. Most of these abstracts or summaries are in their own words and represent an honest and candid account of their work. Other abstracts are more formal and were presented at a national scientific meeting.

These summer internships would not have been possible without the support of the Biology , Chemistry and Environmental Sciences faculty who have volunteered to mentor our students. Others have provided contacts for off campus opportunities.

This past summer, GS-LSAMP was able to provide stipends to 23 students. This support as well as this publication would not be possible without the support of Dr. Jean Fuller-Stanley, Associate Dean of CSH, LSAMP project director at WPU. Two more students were able to go off campus and work in a clinical or corporation setting . Many thanks Dr. Nina Jemmott from the Provost's office for providing the additional funding which was needed. A big thank you as well to Rita Levine for assisting in all matters related to GS-LSAMP and to Andres Salazar of the Science Enrichment Center for his technical and graphic support with this manuscript.

We hope that next's year publication will include many more interns and mentors.

Dr. Danielle Desroches
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Minority Association of Pre Medical Students (MAPS) Coordinator
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RESEARCH INTERNSHIPS

Ama Berko, an ISSBB scholar
Mentor: Dr. Jamie Weiss, Biology

I am a senior majoring in Biology. I intend to engage in pharmaceutical research after my undergraduate coursework. Over the summer I worked with Dr. Jamie Weiss on Calcium Signaling Pathways in Neuroprotection.

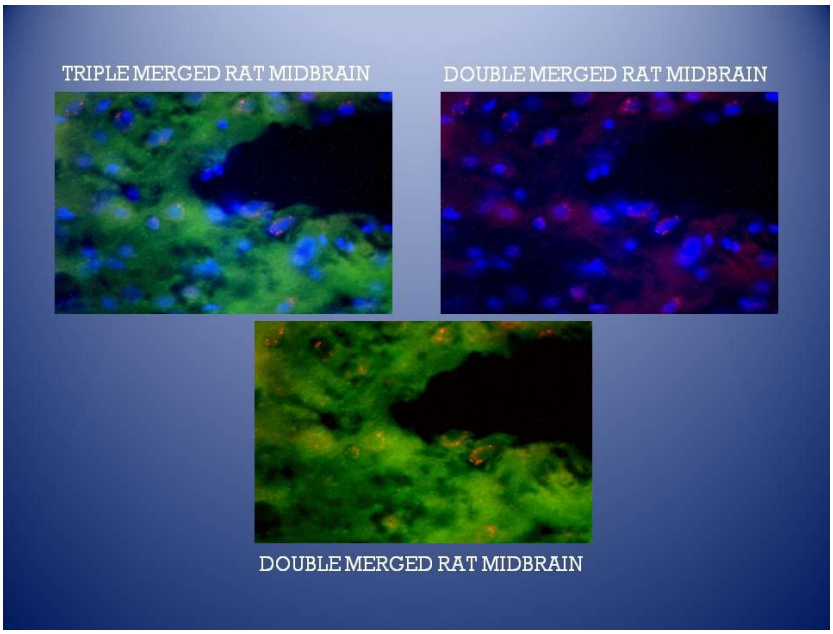
CALCIUM SIGNALING PATHWAYS IN NEUROPROTECTION

Abstract

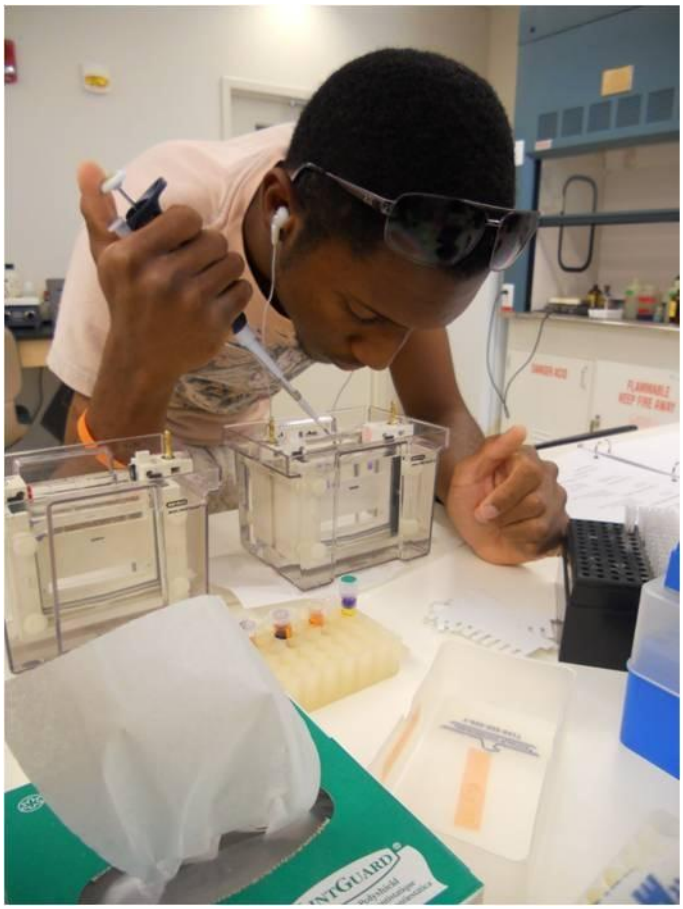
Neuronal survival is important for proper brain functioning. Protection of neurons (neuroprotection) is crucial in the nervous system while imbalanced levels cause toxicity to neurons (neurotoxicity). Proteins involved in neuroprotection are key elements in the nervous system. Balanced levels of interacting proteins such as calcium and nitric oxide are necessary to prevent cell death. In studying the importance of neuronal signaling pathways in the nervous system, defects in brain disorders such as Parkinson's disease, Schizophrenia, autism and Alzheimer's can be prevented and can help in finding novel drug targets. Nitric oxide (NO) is one important water-soluble molecule which plays significant roles in neuronal physiology and neuronal survival. High concentrations of NO have been shown to be neurotoxic while balanced concentrations are neuroprotective. NO is linked to the calcium signaling pathway in a way that is effected by calcium influx in the cells caused by depolarization.

We set our goals to confirm that high potassium levels depolarize cells and can create a good environment for an increase in intracellular calcium levels which affect NO production. Using PC12 (Pheochromocytoma) cells isolated from rat adrenal glands, we can examine this effect. PC12 cells can be stimulated to form neurites similar to brain neurons when treated with growth factors and serve as a great model for studying neuronal growth and differentiation in neuronal signaling pathways. We successfully used high K+ depolarization of PC12 cells to test NO production under timely conditions in the presence of DAF-2DA, a dye which fluoresces in the presence of NO. One study has reported that NCS-1 (Neuron Calcium Sensor) can potentiate Nitric oxide synthase (an enzyme that produces NO). This protein is therefore of interest because it has been shown to play significant roles in neuronal survival as well. Using immunohistochemistry and staining techniques, we expressed NCS-1 in PC12 cells as well as in rat brain slices, while setting up for our main goal of determining how NCS-1 may affect NO levels. Figure below shows staining of NCS-1, mitochondria stained with Rhodamine 123 and the nucleus, stained with Hoechst 33342.

NCS-1, NUCLEAR AND MITOCHONDRIAL STAINING OF RAT BRAIN SLICES



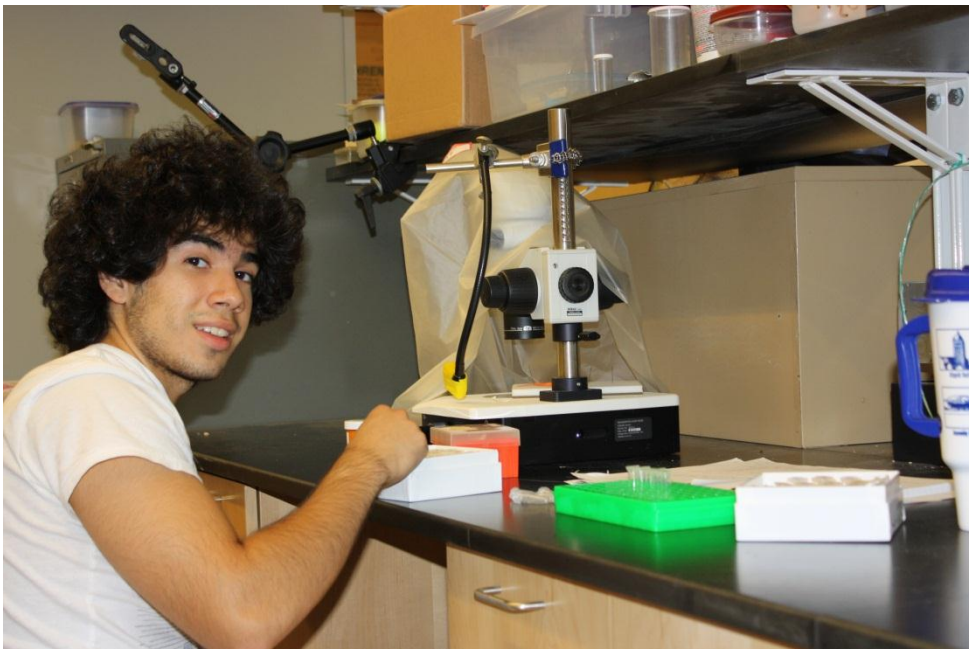
Tail Regenerative capacity in *Xenopus laevis* tadpoles



Obinna Onyekwere
Dept. of Biology, WPUNJ
Mentors: Drs. Gardner & Menon

Amphibians are very proficient in regenerating their appendages when amputated such as limbs and tail. *Xenopus* tadpole is a well characterized vertebrate model with high regenerative ability of tail and limbs. My preliminary results have shown that younger tadpoles regenerate their tail faster than older ones. If tail is amputated at a stage just before the regression begins, instead of regenerating these tadpoles regress their tail. Among the factors involved in intercellular communication to restore the lost part id nitric oxide (NO). This diffusible gas molecule acts on various cell types at the wound site and participated in healing process. A decline in the efficiency of *Xenopus* tail regeneration might be due to excess production of nitric oxide as evidenced by increased activity of inducible nitric oxide synthase enzyme (responsible for production of NO) in tail of older tadpoles.

Student Researcher: Edgar Valdivia
Advisor: Dr. Joseph Spagna



Project: MOLECULAR PHYLOGENY OF TRAP-JAW ANTS USING THE HISTONE H3 GENE

Trap-jaw ants are ants that use 'click mechanisms' to power extremely rapid, forceful jaw-closures, which can both devastate prey, and allow the ants to 'jaw jump' when the strikes are directed at hard surfaces. In the ant subfamily Ponerinae, there are two genera of trap-jaw ants: *Anochetus* and *Odontomachus*. The relationships between these two groups are not well-understood, and the ants that make up their nearest-non-trap-jaw relatives also remain unclear. In order to determine whether trap-jaw morphology evolved once or twice, and to understand what types of precursors trap-jaws evolved from, I developed a molecular phylogeny of *Anochetus, Odontomachus,* and representatives of genera most likely to form the sister groups for these ants. I amplified and sequenced the Histone H3 locus from 16 species of ponerine ants, including 10 species of *Odontomachus*, 2 species of *Anochetus*, and 4 outgroups. The tree showed that Ponerine trap jaw ants are monophyletic, and this means trap-jaw morphology has probably only evolved once in this group. The nearest outgroup was *Leptogenys*, a group with long, narrow jaws that are not especially powerful. Understanding the evolutionary pattern in the Histone H3 gene will be most useful when this data is combined with data from other genes to make a comprehensive phylogenetic tree for this group.

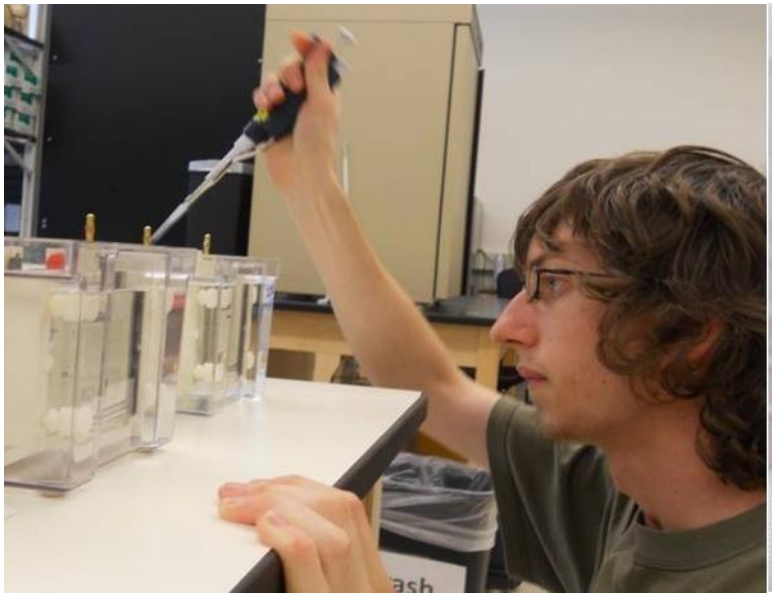
"Formalin Tested Nociceptive Pain in BTBR Mice"

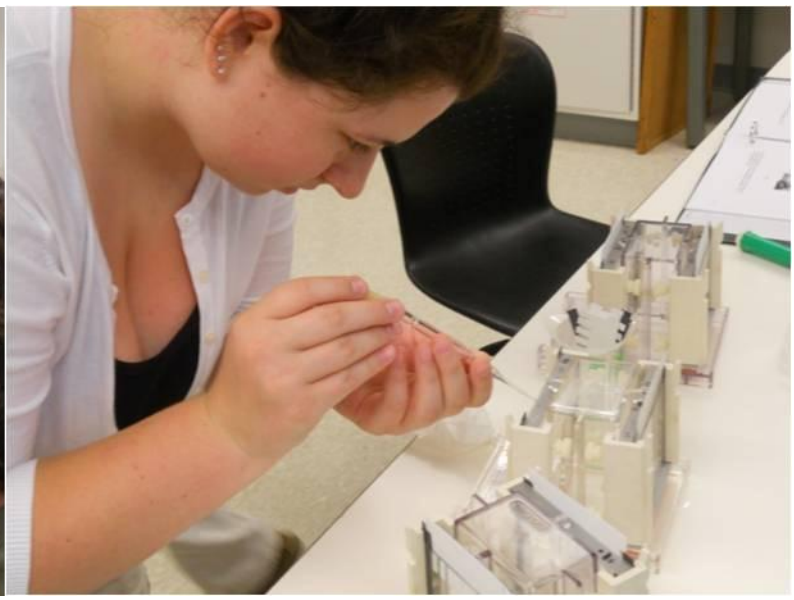
Ashley Miranda & Babajide Joshua Oderinde

Abstract:

Many studies have been done to find out the reasons underlying the JAX BTBR mice's high tolerance for pain. Studies have included testing whether pain responses are reduced due to high amounts of calluses on the paws or possible circuitry disconnects in terms of perceiving pain. The goal in this study was to determine whether the amounts of opiod receptors were a factor in this high pain tolerance. The hypothesis in this study was that high amounts of these opiod receptors were present , which would then cause for fast pain relief (or no pain felt) because pain relieving agents(opiods) have a larger amount of possible binding sites. In order to test this hypothesis naloxone, a common opiod blocker and formalin, a pain inducing agent, were injected in mice specimen. The predicted outcome of naloxone/formalin injection was that BTBR mice would show a higher response to pain (because most the opiod receptors would be blocked disallowing opiod binding and pain relief). Male BTBR mice were subjected to a series of tests using formalin (the pain inducer) for a series of two week trials (4-5 mice tested per day), with different BTBR subjects tested by both research assistants. The data collected from this portion of the study would serve as the both the baseline and control (because only formalin was applied and no pain receptor blockers were used during this period). After these baseline trials were completed, another set of BTBR mice were subjected to a modified formalin test. This test involved injection of naloxone prior to the formalin injection. Lastly, data collected were than compared to known C57/6J mice (JAX mouse relative) formalin study results. When comparing, the data from the formalin/naloxone mice and that of the C57/6J similarities were found based on the high frequency of pain response and the pain curve produced during the trials.

Apoptosis during tail regression in tadpoles, *Xenopus laevis*





Manzo William and Paige Appleton
Dept. of Biology, WPUNJ.
Mentors: Drs. Gardner and Menon

Amphibian metamorphosis, a model for post embryonic development is characterized by rapid and drastic changes in the body form and function under the influence of thyroid hormones Most obvious changes are: de novo formation of limbs, remodeling of intestine to suite to the carnivorous diet of a frog and regression of the tail. All these processes involve proliferation, differentiation, and apoptosis occurring simultaneously in several organs.

Apoptosis can occur in a variety of ways: the two most common methods for apoptosis are caspase mediated cell death (via calcium upregulation) as well as autophagy, or caspase independent mediated via reactive oxygen species (ROS). Previous results from our lab have shown that ROS such as superoxide (O_2^{-2}) and hydrogen peroxide (H_2O_2) play an important role in cell death during intestinal remodeling. The objectives of the present study were to investigate role of nitric oxide (NO) which is also considered as one of the ROS during tail regression of *Xenopus* tadpoles. There are three isoforms of nitric oxide synthase (NOS) enzymes: neuronal (nNOS), inducible (iNOS) and endothelial (eNOS), which are responsible for production of NO. We performed western blots for caspase enzyme as well as NOS isoforms during different stages of metamorphosis. The results of our study showed that cell death in tail during regression is mediated via both pathways, such as caspase mediated as well as caspase independent pathway via NO.

Exponential Fitting with Multiple Data Sets

Christopher Reyes with mentor Linda Kaufman, Computer Science

Fitting data to exponentials or Gaussians is a common problem in spectroscopy and microscopy, especially in Fluorescent Lifetime Imaging Microscopy (FLIM), which is used to detect interactions between various fluorescently labeled molecules such as protein, lipids, DNA and RNA. Sometimes the data represents the decay rates of different materials in combination as in *Figure 1* and we wish to determine which components of the materials contributed to the data.

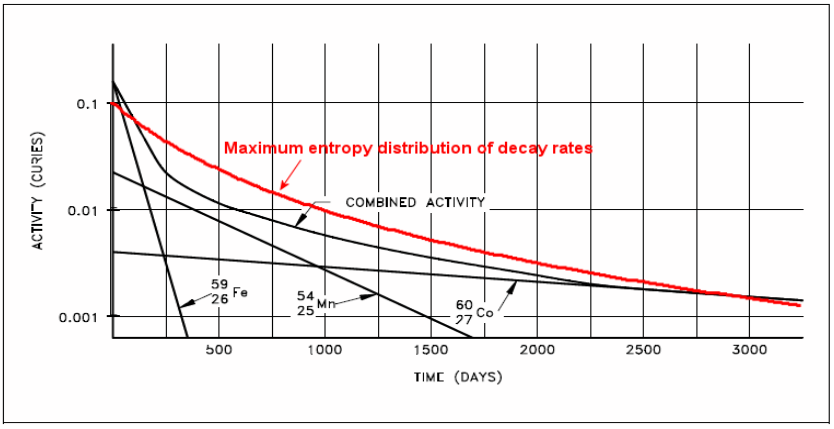


Figure1: Data for radioactive material

To recover the fact that the combined materials made up of Iron-59, Manganese-54, and Cobalt 60, we would fit our data to a model of the form $y \approx a_1 e^{\alpha_1 t} + a_2 e^{\alpha_2 t} + a_3 e^{\alpha_3 t}$ where the α's would correspond to the decay rates of the contributing materials and we would want to recover the a's and α's using m data points (t_i , y_i), where i = {1, 2,…, m}, by solving a nonlinear least squares problem of minimizing $(\sum_{i=1}^{m} a_1 e^{-\alpha_1 t_i} + a_2 e^{-\alpha_2 t_i} + a_3 e^{-\alpha_3 t_i} - y_i)^{1/2}$. The a's are linear parameters and once the α's have been computed, they can be determined by solving the linear least squares problem $\|G(\boldsymbol{\alpha})\mathbf{a}-\mathbf{y}\|_2$ .In 1973 Golub and Pereyra used this concept to reduce the problem of 6 variables, consisting of the a's and α's, to a problem of the 3 nonlinear α's.

Assume we were analyzing spectroscopic properties of the substance bacteriorhodopsin taken not only at different times during the chemical reaction but also at these times at different wavelengths. If we had s different wave lengths, we might get a problem of minimizing

$$(\sum_{k=1}^{s}\sum_{i=1}^{m} a_{1,k} e^{-\alpha_1 t_i} + a_{2,k} e^{-\alpha_2 t_i} + a_{3,k} e^{-\alpha_3 t_i} - y_{i,k})^{1/2}. \qquad (1)$$

This problem has 3*s linear variables and 3 nonlinear variables. In 1978, Golub and LeVeque showed how to transform the problem to one involving only the nonlinear variables.

For perspective, the idea of multiple data sets with the nonlinear variables common to all data sets also occurs in studying the retina where many data sets occur when taking angiograms of several fundus sites at various times; and also in the study of proton pumping in the membrane of Halobacterium salinarium when trying to find the number of chemical intermediates in the photocycle.

Most good nonlinear least squares solvers for minimizing $\mathbf{r}(\boldsymbol{\alpha}) = \|\mathbf{f}(\boldsymbol{\alpha})\|_2$, require the Jacobian J given of $j_{i,k} = \frac{\partial f_i}{\partial \alpha_k}$ by which for the multiple data set problem will have m^*s rows. In the summer of 2009 while working with students at WPU, Dr. Kaufman noticed that one could reduce this to only 3*m rows for a problem with 3 exponential terms. During the summer of 2011, the first author downloaded from netlib.org the program NSG (designed for problems of one data set) and modified it to handle the multiple data set problem (renamed NSGM in the table below). Kaufman's idea was then implemented to decrease the number of rows in the Jacobian (named *Q4* in the table below).

Both NSGM and Q4 were run on a series of problems involving a model with 3 exponentials as in equation (1) above. A typical problem would look like *Figure 2* where the top surface would be the data and one wished to recover the 3 underlying surfaces.

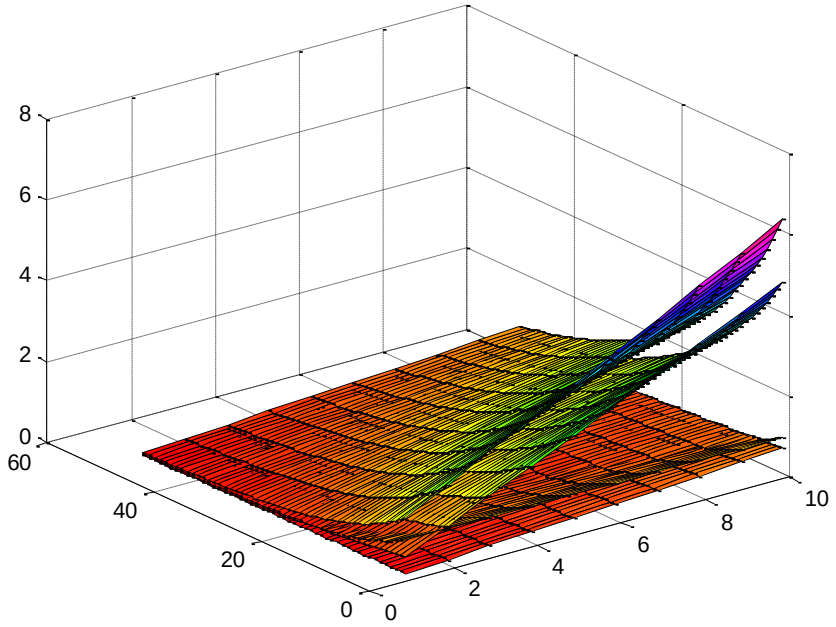


Figure 2: Typical sample problem

The tests were constructed so that the final α's and a's were known and the objective was to recover these values when starting elsewhere (an initial guess). The targeted α's were set to {0.02, 0.05, 0.09} and the starting values were set to {0.01, 0.04, 0.08}. The set of t's were set to t_i=i, where i = {1, 2, …, m}. The $y_{i,k}$'s were defined so that the linear parameters were $a_{1,k}$ =k/30, $a_{2,k}$=k/2, and $a_{3,k}$ =1, where k = {1, 2, …, s} (There was no need to specify the starting values for the linear parameters). The problems were run on the UNIX machine in the Computer Science Department at William Paterson University in the programming language FORTRAN with optimization set at level 2.

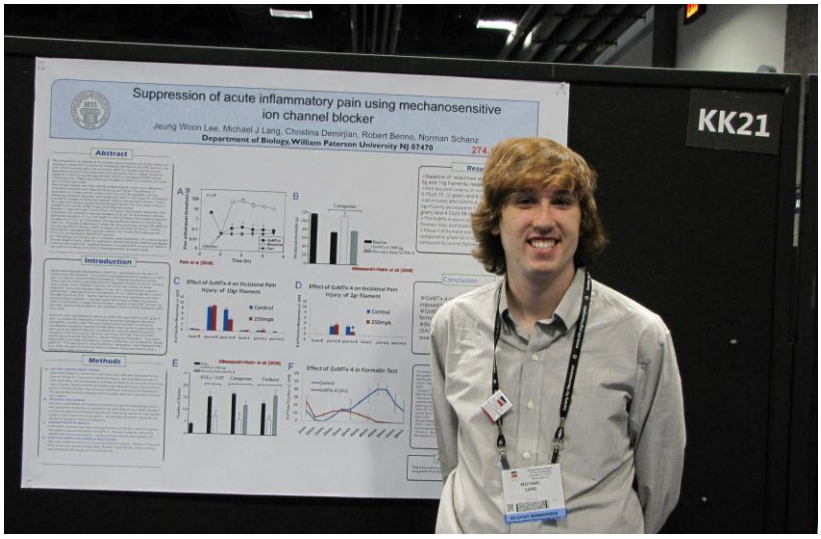
m - the number of data points per data set	*s* - the number of data sets	time for NSGM (sec)	Number of iterations for NSGM	time for Q4 (sec)	Number of iterations for Q4	Ratio of times
15	200	.462	40	.132	40	3.5
30	200	.557	22	.182	25	3.06
30	250	1.946	65	.405	61	4.8

Because of round-off error the number of iterations was not the same for both methods. Obviously, reducing the number of rows in the Jacobian had an impact on not only the linear algebra overhead associated with the Jacobian but the total cost of solving the nonlinear least squares problem.

The next part of this research would consider how one can reduce the number of rows in the Jacobian if there were many observations per data set.

Topic: Use of Real Time PCR & Melting Curves on Bacterial 16S Targets
Authors: Kiran Herapara, Jennifer Parente and Dr. Martin
Summary: We used Real Time Polymerase Chain Reaction (RT-PCR) to amplify and determine the number of copies of a ribosomal region of bacterial genomic DNA. We used three bacterial species: *Clostridium perfringens, Escherichia coli* and *Micrococcus luteus*. We began with optimizing conditions in order to produce enough DNA to be efficiently detected by SYBR-green fluorescence. RT-PCR enables measurement of the amount of product generated during each cycle. The accumulation of the PCR product with each cycle of amplification is used to track when each sample reaches a threshold fluorescence. A standard curve can then be constructed using a range of known starting amounts of DNA and plotting those amounts against the cycle the PCR reaches the threshold. We ran successful RT-PCR reactions using a PCR recipe mixed from individual reagents rather than a commercial mix of reagents. We also used inexpensive PCR vessels instead of the vessels branded to go with the machine. RT-PCR performed this way costs a fraction of what the prepackaged approach would cost.

Topic: Restriction analysis of bacterial DNA
Authors: Jennifer Parente, Kiran Herapara and Dr. Martin
Summary: We attempted to track down the source of contamination in our PCR amplifications. There had been PCR product produced in the negative controls that had no template DNA to amplify. This product was found, by agarose gel electrophoresis, to be similar in size to the ribosomal target sequence we amplified from our positive controls, *Clostridium perfringens, Escherichia coli* and *Micrococcus luteus*. After working to ensure that we were not contaminating the samples during set-up we developed the hypothesis that the contaminant was present in one or more of the reagents. To help determine the source, we performed restriction analysis of the PCR product to fingerprint the DNA sequences. We found that the restriction pattern matched that of the *E. coli* positive control. Careful step by step replacement of the less expensive reagents left only the Stratagene Paq5000 Hot-Start Polymerase as the unconfirmed source of contamination. Technicians at that company stated that they did use transgenic *E. coli* to produce the enzyme and that they tested for DNA contamination only with a simple 30-cycle PCR. Our protocol is much more sensitive and may be the reason that we see amplification of DNA from the polymerase product that they do not.



My name is **Michael Lang** and I'm currently a junior majoring in Biology at William Paterson University. I would like to pursue a PhD in some form of neurobiology, and ultimately pursuing a career in research and possibly teaching. Over the summer in 2011 I was able to do research with Dr. Lee in the field of pain/neuropathy. I am currently still doing the same research and working in the mouse lab, taking care of an entire colony of rats which includes breeding, changing cages, and making sure they have enough food/water. Research is an ever-changing process, and I've had to change experimental design and procedures multiple times. The experience of working with these professors and animals is absolutely amazing, and I've learned incredibly valuable research techniques while working with them.

Abstract: **Suppression of Acute Inflammatory Pain Using Mechanosensitive Ion Channel Blocker**

Mechanosensitive ion channels at the periphery play an important role on the initiation and subsequent transduction of mechanical nociceptive information by the DRG neurons to the CNS. Stretch-activated cation channel blocker, GsMTx-4, has been reported to dose-dependently reverse chronic inflammatory and neuropathic pain in rodents. Subdermal injections of GsMTx-4 reversed approximately 30-45% of carrageenan/PGE2-induced inflammatory pain. Present study examined the effect of GsMTx-4 in incisional pain model and in formalin pain model.

Male Sprague Dawley rats (180g) received unilateral plantar incision injury. Mechanical nociceptive thresholds were measured using a 2g and 10g von Frey filaments (10 applications on hindpaw plantar surface) at pre-injury and 24hr post-lesion. Animals displaying nociceptive responses were injected with GsMTx-4 (250 ug/kg; IP), and tested 40 min later for changes in mechanical threshold. Controls received saline injection. Three or 48 hr after toxin injection, animals received formalin injection (5%, 50ul; dorsal surface) in ipsilateral paw, and the number of paw lick/flinches was counted.

Baseline vF responses were 0.0 and 0.29$\pm$0.1 for 2g and 10g filaments, respectively. With 10g filament, the nociceptive response increased to 9.81$\pm$0.1 at 1D post-lesion, and was significantly reduced to 5.71$\pm$0.5 with GsMTx-4. With 2g filament, the nociceptive response increased to 4.71$\pm$0.7 at 1D post-lesion, and was significantly reduced to 1.29$\pm$0.6 with GsMTx-4. The phase 2 responses in formalin test were significantly reduced with GsMTx-4. Controls had 208$\pm$4.6 flinches, GsMTx-4 injected rats (3hr-post) had 58.5$\pm$2.1 flinches. When animals were tested 48hr post toxin injection, their formalin flinch response was 173.5$\pm$3.5, not significantly different from controls.

Ion channels play an important role on nociceptive signal transduction. The stretch-activated channel receptor blocker, GsMTx-4, significantly reduced mechanical allodynia/hyperalgesia in

animals with incision pain. Selective blockade of nociceptive DRG neurons with GsMTx-4 may improve the efficacy of the toxin in blocking peripheral nociceptive signal.

TOMIKO RENDON, AN ISSBB SCHOLAR-

During the summer I was involved in a research project involving the social behavior of mice and how Vasopressin is involved in their social responses. Autism is a disorder that affects the development of the brain resulting in changes the areas of communication, social interactions, and repetitive behaviors. One of the common characteristics is when exposed to strange or overwhelming environments, an increase in stress levels occurs which could also lead to displays of negative social behavior. In this project, I examined how the social interactions would be affected by the hormone vasopressin. Arginine Vasopressin (AVP) is a neuropepetide that is correlated with social interactions. High levels of AVP have been found to be correlated with anxiety responses and increased stress levels. Due to this association we believe there could be a possible association between the hormone vasopressin and the amount of social interaction that occurs.

In this study we used the BTBR T+tf/J inbred mouse strain (herein referred to as BTBR). Aside from being used as the animal model for Autism, the BTBR displays increased stress hormones, exhibits low social interactions, and also displays a high occurrence of repetitive behaviors. Putting all this information together we wanted to see if there is an association present between Autistic mice, vasopressin, and social interactions. To alter/reduce the amount of vasopressin present, we used a

vasopressin receptor antagonist. This antagonist was the drug, SSR149415, the first selective, orally active vasopressin V_{1b} receptor antagonist. It acts as a competitive antagonist and exhibits a high affinity with the V_{1B} receptor which stops the effects that occur when vasopressin is activated.

In order to test our hypothesis, we ran adult male mouse in the three-chambered social interaction box. The animals were broken up into different group that received different amounts of the drug SSR149415 through a gavage administration. During these tests the amount of time spent interacting as well as other behaviors were recorded. Preliminary results demonstrated that the C57 mouse showed greater amounts of social interaction when compared to the BTBR mouse. There were no significant differences found according to the treatment, or treatment by strain. Even though there were no significant differences, there were some interesting findings. A trend emerged suggesting that a higher dosage could possibly worsen the situation rather than improving it. At the present time there is still a lot of investigation and research that has to be done with this data. Thanks to the funding and support provided, I was able to research new facets of this drug, which could possibly help with ASD in the future.

Amber Koney and Andrew O'Brien

During the summer of 2011 we work with Dr. Becker recovering and identifying Devonian marine fossils found on High Mountain, Passaic County, NJ. These fossiliferous glacial erratics were transported to the Jurassic aged basalt of High Mountain nearly 12,000 years ago, during the last ice age. The majority of the erratics we recovered were determined to be from the Schoharie Formation of New York State. We worked with Dr. Alex Bartholomew, a geology professor at SUNY New Paltz, to identify the source region, which occurs in the southern Helderberg Mountains, near Albany, New York.
This past October, we presented our research with Dr. Becker at the 2011 Geological Society of America national meeting in Minneapolis, Minnesota.

SCHOHARIE FORMATION (LOWER DEVONIAN) GLACIAL ERRATICS FROM THE PREAKNESS FORMATION (LOWER JURASSIC) OF HIGH MOUNTAIN, PASSAIC COUNTY, NEW JERSEY

Abstract

Large fossiliferous glacial erratics occur scattered across the basalt of the Preakness Formation (Lower Jurassic) on High Mountain, Passaic County, New Jersey. These erratics are comprised of light tan to yellow, sandy limestone and contain fossiliferous beds with casts and molds of invertebrates. Analysis of these fossils including: rostroconchs, brachiopods, pelecypods, corals, bryozoans, nautiloid cephalopods and trilobites as well as the distinct lithology indicate that these erratics belong to the Lower Devonian Tristates Group and Schoharie Formation. The outcrop belt of the Schoharie Formation occurs throughout the Lower Hudson Valley Region of New York and due north of the High Mountain recovery location. Reconstruction of the glacial history across the Lower Hudson Valley and New Jersey Piedmont indicates that the Schoharie Formation erratics have been transported tens of kilometers from their original source region during the Wisconsinian glaciation. The Schoharie Formation erratics provide a unique opportunity to reconstruct the complex surficial geology of the New Jersey Piedmont and High Mountain. Palynology of glacial kettle ponds adjacent to High Mountain indicate that the final deposition of the Schoharie Formation erratics occurred 12, 000 to 11,000 YBP.

Brandon Schwartz

Mentor: Dr. Carey Waldburger, Biology

As a post-bac pre-medical student with an interest in infectious disease I was naturally drawn to Dr. Waldburger's research which involved the study of *E. coli* mutants. Despite having little lab experience and a limited knowledge of microbiology Dr. Waldburger was kind enough to allow me to work alongside him. The resulting research project I collaborated in quickly became one of the most educational endeavors I had ever undertaken.

Although the lab work I did does not directly translate to my desired career I consider the knowledge I gained about the scientific process absolutely invaluable. Despite the many frustration and setbacks along the way, I will always remember the excitement I experienced as I read over the data of the first assay I conducted; realizing that I was among several people in the world who knew how a specific mutation would affect the microorganism. The lesson learned in this moment was clear: The opportunity to conduct research is the opportunity to manufacture new knowledge. It is with this understanding that I now intended to make research opportunities an integral part of my scientific career.

As I apply to medical schools this coming fall my personal statement will certainly include how grateful I am to GS-LSAMP and Dr. Waldburger for allowing me to participate in this research which has made me a more curious and confident student. It is with these sentiments that I would recommend the experience to any student interested in science.

The following is the abstract presented for William Paterson's Undergraduate Research Symposium 2011:

CHARACTERIZATION OF B1500-BLIND MUTANTS OF THE PHOQ SENSOR KINASE OF ESHERICHIA COLI.

Jennifer Fiorelli, Brandon Schwartz, and *Carey Waldburger*
Biology, William Paterson University of New Jersey, Wayne, N.J.

PhoP-PhoQ is a two-component signaling system that controls many cellular activities and virulence in *Escherichia coli* and *Salmonella enteric*. PhoQ is a transmembrane sensor that monitors the environment for various signals and transmits this information to PhoP, a cytoplasmic transcriptional regulator that then modulates bacterial gene expression in response to the extracellular conditions. PhoQ has been shown to directly interact with and transmit information regarding extracellular signals that include divalent cation concentrations and pH. Additionally, the system can be regulated by two small membrane peptides (B1500 and MgrB) that are encoded in the *E.* coli genome. Expression of B1500 is controlled by a second two-component system (EvgS-EvgA) whose primary function is in responding to low external pH. Expression of B1500 leads to activation of the PhoQ-PhoP signaling system. Expression of MgrB is controlled by the PhoQ-PhoP system itself and its presence represses PhoQ-PhoP signaling. Thus, MgrB likely serves a modulating role via a feedback loop. In both cases, the peptide is thought to act via a direct interaction with the PhoQ sensor domain.

In previous work, we described the isolation of two mutants of PhoQ that respond normally to extracellular Mg^{2+} but are defective in activation by B1500, indicating amino acids with specific roles in B1500-mediated signaling. Once of these is a leucine to proline substitution at residue 87 (LP87), which lies in the extracellular sensor domain. The second is a leucine to proline substitution at residue 224 (LP224), which lies in the intracellular linker that connects the sensor domain and the intracellular transmitter domain (domain that transmits information to PhoP via a phosphorylation mechanism). The most likely roles for Leucine-87 and Leucine-224 are in peptide recognition and transduction of the signal, respectively. Here we show, using a bacterial two-hybrid system, that the LP87 mutation disrupts the B1500-PhoQ interaction while the LP224 mutation does not; results that are both consistent with the proposed roles. We also show that the LP09 mutation renders PhoQ blind to MgrB in addition to B1500, suggesting that there is an overlap in the docking site used by these two peptides, and surprisingly that the LP224 mutation causes MgrB to *activate* PhoQ-PhoP signaling rather than *repress* it.

The Search for a Cause of Soil Chlorite Weathering Under Post-Fire Conditions

John Dorval
Mentor: Jennifer Callanan

William Paterson University

Chlorite is the dominant mineral in the soils of Double N Farm in Warren County, New Jersey, an area where prescribed burning is utilized in forest management. Soil collected 3 months following the burning of a brush pile indicated weathering of chlorite in soils located directly under the burn pile. X-ray diffraction data showed decreasing relative intensity in the 004 chlorite peak in soil at depths of 30+cm from the surface, just above a lithic restrictive layer. It was hypothesized that this result was due to ash influenced rain water pooling at the restrictive layer, thereby increasing the weathering rate of chlorite. In order to validate this hypothesis a laboratory model was designed to observe pure chlorite weathering when influenced by post-fire factors, particularly ash addition. Chlorite was exposed to solutions of rain water and rain water filtered through soil (from the field location), ash (of similar vegetation as the field site), and soil + ash for periods of 1 week, and 1, 2, and 3 months. Preliminary data for samples collected after 1 week's treatment do not show significant variation in 004 relative peak intensity. We expect to observe significant decreases in chlorite 004 relative peak intensity as treatments approach 3 months time.

Methods

Sample Preparation

Chlorite [$(Mg,Fe^{2+})_5Al(Si_3Al)O_{10}(OH)_8$] from Calaveras County, California was crushed in a ball mill for about 10 minutes. Chlorite was run through a sieve to a grain size of 250µm. After the Chlorite was crushed, 4 solutions were created to simulate chemical changes associated with post-fire conditions:

- Rain Water
- Rain Water and Ash
- Rain Water and Soil
- Rain Water and Soil and Ash.

Solutions were created using the vacuum filtration method. Using 20 µm filter paper, a layer of soil was placed on the filter paper and rain water poured through the filter to simulate the leeching effect of rain water. This process was also done with a layer of ash, and also with a layer of ash on top of a layer of soil. After solutions were created approximately 5 grams of Chlorite were placed in 50 ml tube with 40 ml of water. Two samples were prepared for each solution and shaken in a vortex mixer periodically for 10 minutes to prevent settling of Chlorite at the bottom of the tube. Samples were stored at room temperature. Reaction to chlorite for the solutions was analyzed for four different time periods: 1 week, 1 month, 2 months, and 3 months.

pH Measurement and XRD Analysis

pH measurements were recorded for all time periods when the solution was created and before was extracted from the solution. Slides were created from the Chlorite mixed with solutions for XRD analysis, using the vacuum filtration method after a trial of other methods (dropper, smear mount) because of adhesion problems to the glass substrate. Chlorite mixed with solution was run through the

vacuum filtration using 0.45 µm filter paper. Two slides were created from each tube. The Shimadzu XRD-6000 was used for X-Ray Diffraction Five control samples of Chlorite were prepared in DI water to analyze peak position and relative intensity (measured in H% in MDI Jade 9) and later run through statistical analysis. Samples were run on the set parameters of 2-30°, with a step of 0.004°, and a scan speed of 0.5°/min. The wattage and amplitude were set to 30kV and 30mA using Cuk radiation. A Muscovite standard was also used under the same parameters and logged in a Microsoft Excel spreadsheet. Each slide was run three times under these parameters and MDI Jade 9 was used for peak determination.

At this time, data is still being collected and analyzed at this time. Dr. Callanan plans on expanding the project to do a chemical analysis on the weathering of chlorite. These findings will be presented at the American Association of Geographers on February 24, 2012 and University Research and Scholarship Day in April. A special thanks to Dr. Callanan for all of her help in this project as well as GS-LSAMP for providing a scholarship for this work.

Alban Biba
Summer Internship
Henkel Corp

My name is Alban Biba, I am a Senior Biology student. I was trying so hard to find a science internship for this summer 2011. My hard work and patience paid off in the end when I was elected as an intern for a fortune 500 company located in Bridgewater, NJ. The name of the company was called Henkel Corp. Henkel is a chemical company known for its adhesive and conductive materials found in your everyday televisions and cellular phones. I worked along side specialized research scientists and chemist on a project called "Low cost conductance". Essentially, the goal of the experiment was to substitute expensive material with low cost material to maximize profits.

I performed the wet chemistry and formulated conclusions for the scientists. In the experiment graphite was used as the cheap material and was covered with a conductive material such as silver at various loadings. Reagents such as silver nitrate, APTMS (aminopropyl trimethoxysilane) and ammonium nitrate were used to yield the end product. Working in the industry I gained exceptional experience in the business aspect as well as the scientific aspect. I would highly recommend undergrads to start applying to different scientific industries. As you know NJ contains a large number of pharmaceutical, chemical and engineering companies. It would not hurt to try. Work extra hard! Thanks

JON SEO- DR. LEE

The BTBR T^{+}ft/J mice have been suggested to display social and physiological abnormalities characteristic of Autism Spectrum Disorder. Autistic children display abnormally high tolerance to physical injury, and their incidence of developing diabetes is much higher compared to age-matched control. Previously, our group showed that BTBR mice also have a significantly high tolerance to pain compared to C57 6J to mechanical and chemical stimulations. In this experiment, we examined the effects of different concentrations of morphine antagonist in response to thermal pain in BTBR T^{+}ft/J mice.

Twenty BTBR T^{+}ft/J mice were divided into two groups: a) those that received vehicle (5mg/kg saline, IP) and b) those who received the morphine antagonist, Naloxone (5mg/kg and 10mg/kg IP). The mice were tested for hotplate (50^{o}C) behaviors at pre-injection and 20 minutes post-injection. Individual mice were placed on the hot plate until flicking or licking of the hind paw behaviors were observed. The cut off time was 50 seconds for BTBR T^{+}ft/J and 40 seconds for C57 BL/6J to prevent injuries to the mice.

As expected, at pre-injection, BTBR T^{+}ft/J (n=20) showed significantly higher pain tolerance compared to the C57BL/6J (n=20), as they averaged 25 second latency and C57BL/6J averaged 15 second latency in the hot plate test. At post-injection of 5mg/kg Naloxone, no statistical difference in pain behaviors was observed as those BTBR mice that received Naloxone (n=10) averaged 24 second latency, whereas those mice that received saline (n=10) averaged 25 second latency. At post-injection of 10mg/kg Naloxone, statistical difference in pain behaviors was observed as those BTBR mice that received Naloxone (n=4) averaged 15 second latency and those mice that received saline (n=5) averaged 21 second latency.

Our data suggest that naloxone decreased pain tolerance of the BTBR T^{+}ft/J mice at 10mg/kg concentration, and that 5mg/kg naloxone did not induce pain. Therefore, 10mg/kg naloxone is statistically more effective than 5mg/kg naloxone, and that BTBR T^{+}ft/J's high tolerance to pain can be mediated by morphine antagonist.

Gabriella Tosto- Internship
Kessler Research Foundation
West Orange, NJ

The Kessler Research Foundation is the leader of research and rehabilitation for those with physical and cognitive disabilities such as stroke, traumatic brain injury, multiple sclerosis and other neurodegenerative and musculoskeletal conditions. As an intern, I worked in the Neuropsychology & Neuroscience Research Lab (NNL) where participants suffering from these various ailments were assessed for their cognitive and motor functioning. Neuropsychology studies the structure and function of the brain related to specific psychological processes and behaviors. It has been applied to lesion studies in both animals and humans. Clinical neuropsychology is the application of neuroscience and psychology to the assessment, management and rehab of individuals who have suffered illness (MS) or injury (TBI) which has caused neurocognitive problems. At Kessler, I learned how to give neuropsychological tests, to score them according to the various study being conducted, and to work with patients who had various levels of a certain disease. Subjects are tested via neuropsychological assessment tests which challenge a particular function of the brain and reveal any deficits. fMRIs are done to accompany neuropsychological results. These results are then compared to standardized data for education, age, and type of injury. Because Kessler does much of its research at UMDNJ, I was able to sit in on many fMRI and MRIs and learned how the researchers conducted cognitive tasks while imaging was being carried out. This was a great way to expose me to both ends of neuropsychology and neuroscience in a real life setting.

Teaching internship

Veronica Cadavid
Implementing Technology in the Classroom
GS-LSAMP Summer Internship 2011

I am a senior, double majoring in Biology (General Concentration) and Education (K-12). My goal is to become a high school Biology teacher in a high-needs school district. In the summer of 2011 I had the opportunity to receive funding via the GS-LSAMP program to participate in an internship in which I worked alongside Dr. Desroches and Andres Salazar (a math. major) doing a variety of teacher like duties such as editing lab manuals and creating visuals for the classroom (such as GS-LSAMP poster). In addition, I had the opportunity to participate in the Summer Youth Program (’11) for the week of biomedical field which allowed me to take on the perspective of how a high school lab might be conducted as referring to the set ups, the technology used in the high-school laboratories (which greatly enhances students’ learning) and the overall student-teacher dynamics that occurs especially within a lab because it is a more informal environment than the classroom. Through this summer internship I confirmed my desire of wanting to work with and teach high school students when I graduate.

BIOMEDICAL RESEARCH INTERNSHIPS

Brian Nelson
Mentor: Dr. Eric Wasserman, Dr. Patrick Hinfey, & Dr. Mark Merlin
Newark Beth Israel Medical Center; Newark, NJ

I am currently a post-bachelors pre-med major and am preparing to enter into medical school in August of 2012. During the summer of 2011 I had the opportunity to not only shadow residents and attending physicians in the emergency department at Newark Beth Israel Medical Center but I also was given the opportunity to work on clinical research, studying methods of delivery for naloxone in the emergency department. The time I spent shadowing gave me invaluable experiences in patient care and evaluation, and my clinical research opportunity allowed me to understand the kinds of clinical research taking place in many hospitals and health care facilities.

Naloxone, commonly called narcan, acts as a competitive antagonist of opiates on μ-opiate receptors in the central nervous system. A competitive antagonist competes for the receptors but does not activate them. Naloxone is used for suspected overdoses and can be delivered through a variety of methods including intravenous (IV), nebulizer, and subcutaneous to name a few. One problem with naloxone delivery is that, although it stops the symptoms and life threatening problems associated with opiate overdose, it also causes the patient to lose their high, a consequence that commonly makes patients angry and violent. Without knowing the amount of opiate that the patient took it is sometimes difficult to determine the correct IV dose to administer to slowly bring a patient out of an overdose state. By delivering naloxone via a nebulizer the drug can be administered slower over a longer period of time. Unfortunately, there is not much research done on whether one method is better than the other. This study aimed to determine what, if any, differences there are in patient's outcomes between naloxone delivery via IV and naloxone delivery via nebulizer. The information was obtained through examination of physician and RN written patient charts for three years prior to the study. The study determined that the mean length of stay and time to return to a baseline mental status was approximately 2 hours longer for IV administration compared with patients who received naloxone via nebulizer treatment. Also, the nebulizer treated patients showed a greater decrease in both systolic and diastolic blood pressure. Although the results of this study appear to support the claim that the delivery of naloxone via nebulizer is a better treatment method, the study does have some limitations. IV delivery of naloxone is the most common delivery method in the emergency department so there was a significantly smaller pool of nebulizer patients than IV patients. Also, the study was conducted by examining previous patient records so it was difficult to determine specifics about the patient's condition upon arrival which could have affected the results. As a result, further research and examination is needed to determine the validity of the claims from the study. If they are upheld it could change the primary way in which physicians deliver naloxone in the emergency department.

Courtney Dorber
I am a senior majoring in Biology with a Physiology and Behavior concentration. I am graduating in May 2012 and I plan on applying to Physician Assistant schools this summer.

Abstract:

During the summer of 2011 I shadowed Ronda White, PA-C at High Mountain Health in Wayne, New Jersey. During my time there, I observed the kind of patient care a physician assistant provides while being under the supervision of a licensed physician. While observing Ronda, I learned the proper protocol to follow when diagnosing a patient, checking patient's medical histories, and learning how to listen to the patient before providing input. I learned about different conditions such as sinus infections, strep throat, fifth disease, and even conditions as serious as a stroke.

Overall this was a great experience in which I learned a lot about what a physician assistant does on a daily basis when practicing family medicine. It further encouraged me to stick to my goal of eventually becoming a physician assistant.

PRESENTATIONS PHOTOGRAPHS

WILLIAM PATERSON UNIVERSITY OF NEW JERSEY

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GS-LSAMP IS FUNDED BY A GRANT FROM THE NATIONAL SCIENCE FOUNDATION TO RUTGERS, THE STATE UNIVERSITY FOR THE ALLIANCE