

**MONMOUTH UNIVERSITY**  
**SCHOOL OF SCIENCE, TECHNOLOGY AND ENGINEERING**  
**EIGHTH ANNUAL STUDENT RESEARCH CONFERENCE**  
**Wednesday, April 8, 2009**  
**Wilson Hall**

**Presentations by Department**

**Biology**

**Caffeine and Adenosine Receptor Expression as Modifiers of Adolescent Alcohol Dependency**

*Darsi Pitchon and Michelle Zook*

*Faculty Mentor: Dr. Dennis E. Rhoads*

**Contact Inhibition Alters the JNK-1 Stress Response**

*Michael Slisz, Mary Grace Baker, Marian Gaballah*

*Faculty Mentor: Dr. Dorothy Lobo*

**Distribution, Diversity and Abundance of Marine Sponges in Cape Eleuthera, The Bahamas**

*Jillian Stokley*

*Faculty Mentor: Dr. Ursula Howson*

**E-cadherin Expression in Subconfluent and Confluent Fibroblast Cells**

*Ruth Adekunle and Julia Arpino*

*Faculty Mentor: Dr. Dorothy Lobo*

**Effects of Sub-Lethal Concentrations of Methylmercury on Morphology in Larval Mummichog *Fundulus heteroclitus***

*Meghan Shaw*

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**Identifying Target Genes for Hypoxia-Inducible Factor-1 in the Testis**

*Anoop Shah and Rebecca Tyson*

*Faculty Mentor: Dr. Michael A. Palladino*

**Optimizing the Potential for Sponge Harvest in Eleuthera, The Bahamas: Growth and Regeneration Studies on Commercially Valuable Sponge Species**

*Heather Tyrell*

*Faculty Mentor: John A. Tiedemann*

## **Chemistry, Medical Technology and Physics**

**Electrochemical Analysis of Roxarsone, 3-nitro-4-hydroxyphenylarsonic, using Palladium, Gold and Platinum Electrodes**

*Andrea Grafton*

*Faculty Mentor: Dr. Tsanangurayi Tongesayi*

**Euler Method for Solving Differential Equations in Maple**

*Kristina Dineko*

*Faculty Mentor: Dr. Louis Kijewski*

## **Mathematics**

**A Comparative Analysis of Complementary and Alternative Medicine (CAM) Usage in U.S. Oncology Patients Undergoing Treatment**

*Puja Sharma*

*Faculty Mentor: Dr. Wai Kong Pang*

**The Investigation into the Secret World of Steganography**

*Erin M. Humphries*

*Faculty Mentor: Dr. Joseph Coyle*

## **Software Engineering**

**BDIC- A Workflow-Based Artificial Intelligence System for Relational Data (Resources)**

*Larry Brewer, Walter Seme and Michael Sergio- Monmouth University*

*Glenn Crystal and Timothy Higgins -Point Pleasant Borough High School*

*Faculty Mentor: Dr. William Tepfenhart*

**Remote Learning and Testing Tool**

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# **Caffeine and Adenosine Receptor Expression as Modifiers of Adolescent Alcohol Dependency**

**Darsi Pitchon and Michelle Zook**

**Monmouth University  
Department: Biology**

**Faculty Mentor: Dr. Dennis E. Rhoads**

Alcohol and caffeine are commonly used (and co-used) drugs that target the inhibitory neuromodulator adenosine in the brain. While caffeine blocks adenosine activity in the brain, alcohol promotes it. Previous work in our lab has shown adolescent Long-Evans (LE) rats develop signs of dependence to either caffeine or alcohol and do so more rapidly and severely than adults of this strain. We hypothesize that baseline differences in the adenosine A1 and A2a receptors in LE rats could set the stage for rapid onset of alcohol dependency and how it is affected by caffeine. The present study has explored adolescent codependence on the two drugs. Alcohol was presented as part of a liquid diet (Lieber/DeCarli formulation). Caffeine was presented alone in the drinking water (1 mg caffeine/ml) or along with alcohol in the liquid diet (0.25mg caffeine/ml). Established conditions ascertained similar levels of alcohol and caffeine consumption among test groups. Pre-exposure to caffeine alone for 10 days decreased subsequent alcohol withdrawal seizure frequencies from 60% to 14% whereas caffeine administered with alcohol but without pre-exposure had no significant effect on the signs of alcohol dependency. We conclude that caffeine can alter the chronic effects of alcohol on the adolescent brain in a manner dependent on the pattern of caffeine consumption. However, what is it in the adolescent brain that causes these behavioral alterations by caffeine and alcohol? Using Western blotting and chemiluminescent detection, expression of adenosine A1 and A2a receptors was detectable in membrane preparations isolated from rat forebrain. Comparing adolescent and adult LE rats, expression of adenosine A2a was lower in adolescents and, in preliminary trials, expression of adenosine A1 was higher in adolescents. Ongoing work is providing further characterization of the expression of these receptors and of changes in receptor expression during chronic alcohol consumption with and without caffeine.

## **Contact Inhibition Alters the JNK-1 Stress Response**

**Mary Grace Baker, Marian Gaballah, and Michael Slisz**

**Monmouth University**

**Department: Biology**

**Faculty Mentor: Dr. Dorothy Lobo**

Cells in different stages of proliferation demonstrate changing levels of mitogen-activated protein (MAP) kinase pathway proteins, which may affect the response of cells in culture to oxidative stress. Previous results indicate increased MAP kinase phosphatase (MKP) levels upon contact inhibition in healthy fibroblasts, corresponding with decreased levels of phosphorylated extracellular signal-regulated kinase (ERK) and p38. Cancerous fibrosarcoma cells do not exhibit contact inhibition, and no change in active kinase or MKP levels was seen. Western blot analysis and chemiluminescence were used to obtain relative MKP-1, JNK, p-JNK, and cleaved PARP levels in subconfluent and confluent fibroblast and fibrosarcoma cell cultures following oxidative stress by H<sub>2</sub>O<sub>2</sub>. A relationship between culture density and a response to stress as indicated by MAP kinase and phosphatase activity was seen. JNK-1, a MAP kinase, remained inactive in cells during all stages of proliferation. However, following induced oxidative stress by, cleaved PARP as well as higher phosphorylated JNK (p-JNK) levels were detected in subconfluent cells in relation to confluent cells, indicating the early stages of apoptosis. Based on these results, a correlation can be established between confluency of the cell culture and the response to oxidative stress, as determined by varying levels of protein expression and activity within the cells.

# **Distribution, Diversity and Abundance of Marine Sponges in Cape Eleuthera, The Bahamas**

**Jillian Stokley**

**Monmouth University  
Department: Biology**

**Faculty Mentor: Dr. Ursula Howson**

With the increasing pressure on local fish stocks to sustain their economy, there is an unambiguous need for alternative and sustainable sources of income for the local communities of the Bahamas. The modern Bahamian sponge industry is currently underdeveloped despite the growing global demand in the cosmetic, medical, pharmaceutical, and chemical markets ([cei.bahamas.org](http://cei.bahamas.org)). The goal of this research is to categorize the species diversity and abundance in the surrounding marine areas of Cape Eleuthera. The information recorded will then be used to determine the location and abundance of commercially viable species. The sponges in this particular study are located in the semi-tropical waters of Cape Eleuthera, the Bahamas. Observers counted and identified sponge species located within one meter of a 10 meter transect line. Five transects were conducted at five different locations in Cape Eleuthera. The locations represented different habitats including those with wave energy and without. The data were then analyzed using the Shannon Diversity Index as an indicator of biodiversity. Diversity indices were statistically compared across locations to determine site effect.

# **E-cadherin Expression in Subconfluent and Confluent Fibroblast Cells**

**Ruth Adekunle and Julia Arpino**

**Monmouth University**

**Department: Biology**

**Faculty Mentor: Dr. Dorothy Lobo**

E-cadherin, found mostly in epithelial tissue, is an integral protein that plays an important role in cellular adhesion. Loss of E-cadherin through down regulation decreases the ability of the cell to adhere, which results in an increase of cellular motility. Deficient E-cadherin function has been associated with cancer progression. Since the cell's ability to adhere has been reduced, the cancer cells are able to metastasize. E-cadherin has an 80 kDa unit that is located in the extracellular space. It has been confirmed that if the 80 kDa is cleaved, E-cadherin is no longer active. It has been observed that as the level of MMP-9 increases, a peptidase enzyme that plays a role in the degradation of the extracellular matrix, the level of E-cadherin expressed decreases. It has also been observed that E-cadherin stimulates the mitogen-activated protein kinase (MAPK) pathway, specifically the ERK MAP kinase. Therefore, as the expression of E-cadherin increases, so does the expression of ERK. Since previous results in our laboratory have shown that ERK expression is decreased in confluent cells, it was hypothesized that upstream signaling pathways may inactivate this expression, including cadherin-regulated signaling. Fibroblast cells (BJ) were used to determine whether E-cadherin was expressed differently in confluent and subconfluent cells, and also if E-cadherin expression was correlated to MMP-9 and ERK expression. Our results demonstrate that the inactive form of E-cadherin (80 kDa) is definitely expressed in normal fibroblasts (BJ cells), and is expressed at a slightly higher level in subconfluent cells than confluent cells. MMP-9, is also expressed in subconfluent BJ cells. These results suggest a possible regulation of E-cadherin-dependent signaling upon confluence. Expression of these proteins will also be compared in fibrosarcoma cells, which lack contact inhibition.

# **Effects of Sub-Lethal Concentrations of Methylmercury on Morphology in Larval Mummichog *Fundulus heteroclitus***

**Meghan Shaw**

**Monmouth University  
Department: Biology**

**Faculty Mentor: Dr. Ursula Howson**

Mummichog *Fundulus heteroclitus* is an estuary-dependent fish and an important component of mid-Atlantic estuarine food webs. Estuarine sediment in the urban northeast US often contains anthropogenic methylmercury, which can bioaccumulate in fish tissue, causing neurological effects, morphological damage, and ultimately mortality. Other researchers have found that sub-lethal concentrations of methylmercury may affect behavior without gross morphological change. However, analyses of subtle morphological changes at sub-lethal concentrations have not been conducted previously. This research compared the effects of sublethal concentrations of methylmercury on larval mummichog morphology. Mummichog larvae were reared in control and 5, 10, 20, and 40 ppb methylmercury-contaminated water. Larvae were sampled every three days post-hatch for 40 days for image analysis. Photography was performed using a Zeiss image analysis system with stereoscope and AxioCam HS. Morphometric analyses were conducted with Zeiss AxioVision software.

# **Identifying Target Genes for Hypoxia-Inducible Factor-1 in the Testis**

**Anoop Shah and Rebecca Tyson**

**Monmouth University**

**Department: Biology**

**Faculty Mentor: Dr. Michael A. Palladino**

Testicular torsion occurs from a twisting of the spermatic cord, resulting in diminished blood flow (ischemia) to the testis. The ischemic testis then reaches a state of hypoxia, where there is a severe deficiency in the amount of oxygen reaching tissues of the testis. Testis hypoxia and ischemia result in germ cell apoptosis and decreased spermatogenesis, yet other cells in the testis such as Leydig and Sertoli cells appear to be protected from apoptosis. Previously, we have shown that the transcription factor hypoxia-inducible factor-1 (HIF-1), a key regulator of oxygen homeostasis, is abundantly expressed in both the normoxic and hypoxic testis. Results from an enzyme-linked immunosorbent assay (ELISA) demonstrated the binding of testicular HIF-1 to a hypoxia-response element promoter sequence, indicating HIF-1 is active in both normoxic and ischemic testis. However, target genes for HIF-1 in the testis have not been identified yet. We hypothesize that HIF-1 may activate Mcl-1, an antiapoptotic gene expressed in Leydig cells, to protect Leydig cells from torsion-induced apoptosis. Our prior studies using a model of experimentally induced torsion in male, retired-breeder Sprague-Dawley rats, demonstrated the presence of Mcl-1 protein in Leydig cells of the normoxic and ischemic rat testis. Chromatin Immunoprecipitation (ChIP) analysis is currently underway to determine if Mcl-1 is a HIF-1 target gene.



# **Optimizing the Potential for Sponge Harvest in Eleuthera, The Bahamas: Growth and Regeneration Studies on Commercially Valuable Sponge Species**

**Heather Tyrell**

**Monmouth University  
Department: Biology**

**Faculty Mentor: John A. Tiedemann**

Global demands for natural sponge products are beginning to grow. This increase has been fueled by a variety of markets including traditional domestic products and more recently, cosmetic, medical, pharmaceutical and chemical industries. With increasing pressures on commercial fish stocks in The Bahamas, there is a clear need for alternative and sustainable sources of income for small local communities. Sponge aquaculture has the potential to become one such alternative. Although the sponge fishery has encountered setbacks with disease, overfishing, and the introduction of synthetic sponges, commercial sponge farming continues to be a valuable industry that small island communities can potentially develop into a productive sustainable source of income. The Grass sponge (*Spongia tuberlifera*) and Hard Hat sponge (*Spongia pertusa*) are considered to be commercially marketable native sponges with a spongin fibrous skeletal framework. This study examines the growth rates of parent sponges after they have been cut to supply a donor sponge while also exploring the potential for a future sustainable sponge fishery in small island communities. This is an important step to understanding the stability of the sponge industry and the impact it will have on local wild sponge populations.

**Electrochemical Analysis of Roxarsone, 3-nitro-4-hydroxyphenylarsonic,  
using Palladium, Gold and Platinum Electrodes**

**Andrea Grafton**

**Monmouth University**

**Department: Chemistry, Medical Technology and Physics**

**Faculty Mentor: Dr. Tsanangurayi Tongesayyi**

Roxarsone, an arsenic-containing poultry-feed additive, is stable in fresh poultry litter but degrades to inorganic arsenic among other products when the litter is composted. Inorganic arsenic is probably formed via the cleavage of the C-As bond but the mechanism still remains obscure. We used cyclic voltammetry to study the redox behavior of roxarsone on palladium, gold and platinum electrodes. On the gold and platinum electrodes, there were oxidation peaks which could not be attributed to redox activities at the nitro or the arsonic acid groups. These peaks could be due to oxidative aromatic fission which is expected to release inorganic arsenic.

# **Euler Method for Solving Differential Equations in Maple**

**Kristina Dineko**

**Monmouth University**

**Department: Chemistry, Medical Technology and Physics**

**Faculty Mentor: Dr. Louis Kijewski**

The Euler method for solving differential equations is easily understood by undergraduate students in chemistry. This method has an error proportional to  $h$  (which is the step size) and therefore is less accurate for a given  $h$  than Runge-Kutta or other methods. But with the improvements in technology now and in the future, undergraduate chemistry majors can go far with the method because of the increase in memory and speed of today's and tomorrow's computers.

As  $h$  gets smaller, the truncation error gets smaller, but at the same time the number of calculations goes up. Increased number of calculations will increase the round-off error. Maple software has the advantage that you can set the number of significant digits by simply writing `Digits = # significant digits`.

A study was performed to see the effects of the round-off error and truncation error. Some interesting results are presented.

# **A Comparative Analysis of Complementary and Alternative Medicine (CAM) Usage in U.S. Oncology Patients Undergoing Treatment**

**Puja Sharma**

**Monmouth University  
Department: Mathematics**

**Faculty Mentor: Dr. Wai Kong Pang**

The objective of this experiment was to evaluate the use of Complementary and Alternative Medicine (CAM) in a community hospital setting and compare the results with national U.S. published studies on CAM usage. A survey was performed on oncology patients currently undergoing therapy at the Jersey Shore University Medical Center, a large community hospital in Neptune, NJ. Patients were accrued through hematology and radiation oncology clinics. Results were then compared with two other representative U.S. studies with a similar definition of CAM usage and methodologies. Results showed the majority of cancer patients (62.6%) from our community study and the national studies (88.1%) use some form of CAM. The community patients in this study were less likely to use CAM and experiment with different types of therapies when compared with nationally studied patients. Female gender, age under 55, and education of at least high school or some college were found in the majority of CAM users in two studies. In all three studies, close to half of the total number of CAM users did not disclose CAM information with their physician. In essence, cancer patients from community settings may be less likely to use CAM or try different therapies as compared to patients studied in a national population. Proper communication between physicians and patients is important. Further studies that compares whole states is needed to estimate a more exact percentage of CAM users in oncology patients in the United States.

# **The Investigation into the Secret World of Steganography**

**Erin M. Humphries**

**Monmouth University  
Department: Mathematics**

**Faculty Mentor: Dr. Joseph Coyle**

Imagine doing a Goggle Image search on the internet and having various hidden messages floating across the screen that are impossible to detect by the human eye. Which images contain a hidden message? How do you figure it out? The answer to these questions begins with understanding steganography. Steganography is often referred to as the concealing of digital information within computer images or files. The expansion of internet utilization has caused many investigators to develop methods to ensure security across computer systems. In this thesis we go on an investigation into the secret world of steganography using a method called LSB (Least-Significant Bit) Embedding. The results are appealing for one wanting to know more about the fast growing computer world and the ways to transfer data secretly.

## **BDIC- A Workflow-Based Artificial Intelligence System for Relational Data (Resources)**

**Larry Brewer, Walter Seme and Michael Sergio  
Monmouth University  
Department: Software Engineering**

**Glenn Crystal and Timothy Higgins  
Point Pleasant Borough High School**

**Faculty Mentor: Dr. William Tepfenhart**

BDIC is based on a model of practical reasoning that uses three abstractions of cognizance: Beliefs, Desires, and Intentions. A BDI implementation collects beliefs about the world (what it thinks is true), checks its desires (what it wants to do), and creates an intention to act based on those desires (what it will do). Our implementation, BDIC, adds a fourth process called Controller which carries out the intention (actually doing the work). The integration of the Controller into the thought process that is the BDI model leads to very dynamic and rich applications based on the data it holds. These applications will range anywhere from managing emergency responder resources (fire trucks, ambulances, etc...) to managing events on a calendar and scheduling meetings based on those times.

# **Remote Learning and Testing Tool**

**Anthony Dimaria, Angelo Scribellito, and Arthur Sullivan**

**Monmouth University  
Department: Software Engineering**

**Faculty Mentor: Dr. Daniela Rosca**

The Remote Learning and Testing Tool (v0.75) is a web-based system that allows users to take classes online by studying material that is uploaded by an instructor. The RLTT system will allow users to take online classes on a particular topic, at their own desired pace. After going through a section (chapter) of the material, or through the entire material of the class, the system will allow users to be tested on what they have learned. The system will provide immediate feedback on the test results along with links to the class material covered by each question, so that the users can go back and revisit the section where they did not score too well. Motivation was aimed toward, but not limited to the Rapid Response Unit at Monmouth University to facilitate training.

Development of this project began in September 2008 as a continuation of a previous team's efforts. The first step was to create a project plan to outline the process we would take to complete the RLTT. As outlined first, the Software Requirements Specifications (SRS) document was created to form the specifications needed to complete the project. The SRS document contains the user's functional and nonfunctional requirements as well as all the use cases that would be implemented in the program. Then the Software Architecture and Design (SAD) and System/Subsystem Design Description (SSDD) documents were completed to specifically detail the high and the low level design that would be needed to complete the RLTT.

From the requirements and design documentation, the project team was able to produce the code required. Future testing amongst the team and department staff with formal documentation will verify and validate the team's efforts before it is launched in the next few months.

## **SEER: Forecasting Disaster**

**Alexander S. Karpodinis**

**Monmouth University**

**Department: Software Engineering/Rapid Response Institute**

**Faculty Mentor: Dr. William Tepfenhart**

The Simulation Engine for Emergency Response (SEER) is one of the core components of the Rapid Response Institute's All Hazards Exercise Training Tool (AHETT) prototype, developed in the Java programming language.

SEER models a number of events including changing water tables, burning and spreading fire, blowing wind and panicking populations with parameters that can be configured by a user at run-time. All of these events can be spread over multiple environments like urban, suburban and rural to more specific settings like a floor in an office building, a forest, a crashed airplane or the Atlantic Seaboard. SEER was designed from the ground up to allow for maximum user configuration and extensibility in a training environment, attempting to encapsulate any disaster in real time for the purposes of training emergency responders.

SEER includes a basic visualization component to display information in an easy to comprehend way and an intelligent interpreter for rapid, mutable customization. Visualization of the activity within SEER can be customized with simple queries to the state of the engine, allowing a user to filter and display as needed. The included method of visualization is an implementation of a two-dimensional Heat Map, showing patterns in relevant data. SEER's interpreter extends the Java language using Reflection to act on available components in a safe and controlled way which simplifies interaction with the SEER engine, allowing for on-the-fly customization from multiple sources and ensures adaptability to changes in the engine with no overhead. SEER is a working prototype component and is continuing to be enhanced in conjunction with other AHETT components, including the developing AI client, to more accurately emulate realistic scenarios.