Student Research Poster Display

Caputo Hall Lobby

October 21–28, 2015

- Applied Engineering, Safety and Technology
- Biology
- Chemistry
- Computer Science
- Earth Sciences
- Physics

College of Science and Technology

Welcome Message from the Dean

On behalf of everyone in the College of Science and Technology, welcome to the Student Research Poster Display held annually during the Fall semester. In your program, you will find over 20 abstracts of student/faculty research that are representative of the excellent and innovative work being done within the College.

Although this will be the inaugural year for the College to have a poster display, student/faculty research has a rich history at Millersville University and has been in place for well over a decade. The goals of this event are to

- celebrate the breadth of research inquiry and scholarly activity within the College,
- promote and create a sense of excitement about the research students and faculty are collaboratively engaging in, and
- recognize the hard work and dedication of our students and faculty.

Engaging undergraduates in research is critical to a student's development as a scholar and a key feature in Millersville University's strategic plan, *Our Bold Path*. Identified as a high-impact practice, research experiences place the content knowledge students learn in the classroom into the context for how it is used within the discipline and by practitioners in the field. I would like to thank Dr. Aaron Haines, Ms. Marianne Frantz, and Ms. Susan Thomas for organizing the event and Ms. Amanda Kopil for creating the brochure.

I hope you enjoy perusing the posters displays and the fine work performed by our students and faculty.

Sincerely,

Michael Jackson
Dean, College of Science and Technology

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Applied Engineering, Safety & Technology

1. Mechanical Alloying as a Catalyst Preparation Method for the Synthesis of Carbon Nanofibers Applied in the Creation of Bulk Components

Guevara, Laura; Wanner, Crystal; Welsh, Roger; Atwater, Mark*
Department of Applied Engineering, Safety & Technology and Department of Chemistry, Millersville University, Millersville, PA 17551

Carbon nanofibers were synthesized using bimetallic catalysts in an atmospheric pressure chemical vapor deposition (APCVD) reactor. Catalyst compositions of Fe 30 at% Cu and Ni 30at% Cu were mechanically alloyed using high-energy ball milling over durations of 4, 8, 12, 16 and 20 h. The catalyst powders were then used to produce carbon nanofibers in an ethylene-hydrogen mixture (4:1) at temperatures of 500, 550 and 600 °C. The microstructures of the catalysts were characterized as a function of milling time as well as at deposition temperature, using X-ray diffraction (XRD), scanning electron microscopy (SEM) and particle size analysis. The corresponding carbon deposition rates were assessed and are correlated to the microstructural features of each catalyst. The milling process directly determines the performance of each catalyst toward carbon deposition, and both catalysts performed comparably to those made by traditional co-precipitation methods, but with a significantly reduced processing time. Considerations in miscible and immiscible nanostructured alloy systems are presented. The Ni-Cu system was then applied to create bulk carbon components made entirely of nanofibers using a custom-fabricated stainless steel mold under the optimal conditions identified in the kinetic study. Applications of such materials include advanced filtration of gases and liquids, composite reinforcement, high-temperature insulation, catalyst support and other applications benefitting from high surface area and/or carbonaceous materials.

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Applied Engineering, Safety & Technology

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2. A Survey of Safety Apps for Use in Job Sites

Muhl, Andrew. and Ogutu, Jack*
Department of Applied Engineering, Safety & Technology, Millersville University, Millersville, PA 17551

In the past few years, over 1 million smartphone apps have been developed, some of these to help safety professionals. Some apps are not much more than an advertisement, but we have selected a few that if used properly, can make the workplace safer and more efficient. For a progressive safety professional, we believe smartphone apps can help them and their company on the way to success. These apps help include important information that might be missed if an employee was conducting an incident report by hand. Some employees are involved in a number of potentially dangerous jobs and with these apps; employees can take photos/videos of the scene and send them electronically for review and approval instead of waiting hours. Work can begin quicker and employees will be able to act more safely and efficiently. All of the apps that are presented are free of charge. Many of these new apps can be used to replace standard industry equipment and for a much more appealing price. Several current professionals (mainly those in the field of safety) were surveyed for their input on the effectiveness of apps. Using their input as well as feedback/reviews from the App Store, it was our objective to determine commonly used apps, there effectiveness, and how they can change the workplace. This topic is worth consideration due to the fact that it is likely that alternate methods will soon become obsolete as the modern workplace continues to evolve.

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An asterisk (*) denotes the SCTE faculty mentor for the student research

Biology

3. Isolation and Analysis of Twitchin Gene Sequences in Muscles of the Squid, *D. pealeii*

Geating, Katherine; Coutts, Victoria; Fansler, Mervin; Hepfer, Carol Ely*
Department of Biology, Millersville University, Millersville, PA 17551

Identifying genes of interest remains a challenge, particularly in non-model organisms lacking rigorously sequenced genomes such as the longfin inshore squid *Doryteuthis pealeii*. Muscles in this species have an abnormally wide range of physiological properties. To identify possible genetic bases for these differences, DNA sequences of proteins that may be involved in regulation of invertebrate muscle function are being investigated. Twitchin is a protein proposed to be involved in the regulation of several properties of invertebrate muscle including contraction, relaxation, and extension length. The gene for twitchin has been well characterized in the nematode *C. elegans* and also sequenced in catch muscles of the clam *M. galloprovincialis*. Our goal is to investigate if differential expression of twitchin is responsible for distinct activities observed in squid muscles. A BLAST query using *M. galloprovincialis* and *C. elegans* twitchin cDNA sequences to search an early draft genome of *D. pealeii* revealed alignments that were used to design twitchin-specific PCR primers. Previously developed primers targeting highly conserved domains within clam twitchin were also used. Messenger (m)RNA was isolated from three distinct squid muscles (head retractor, funnel retractor, mantle) and used to make complementary (c)DNAs that served as PCR templates. Certain combinations of primers produced PCR products (amplicons) consistent with lengths expected for twitchin. Amplicons for each muscle type were cloned, sequenced, and compared with *M. galloprovincialis* twitchin sequences, homologous sequences in NCBI databases, and each other. Results indicate that twitchin is expressed in these squid muscles and this protein could play a role in muscle activity.

Biology

4. Do Estrogen and Progesterone Act Synergistically to Accentuate the Cognitive Effects of a Serotonergic Antagonist in Female Rats?

Hassell, Joel and Maswood, Sharmin*
Department of Biology, Millersville University, Millersville, PA 17551

The neurotransmitter serotonin (5-HT) is involved in the modulation of cognitive functions. Although the precise mechanism of action of the 5-HT system in the facilitation of cognitive functions has not been clearly identified, compounds such as tropisetron that act as a 5-HT3 receptor antagonist enhance cognition. Similar to the cognitive enhancing effects of tropisetron, female gonadal hormones such as estrogen and or progesterone also improve cognitive behavior in rodents. Interestingly, both estrogen and progesterone also act as antagonist at the 5-HT3 receptors. The objective of our study is to evaluate the cognitive effects of tropisetron in rats primed with both estrogen + progesterone. Since tropisetron, estrogen and progesterone all act as antagonists at the 5-HT3 receptors, we are expecting to see an accentuation of tropisetron's effect on cognition in rats primed with both estrogen + progesterone. We are evaluating the effects of these compounds in ovariectomized (ovaries removed) Sprague-Dawley female rats using the object recognition task. The object recognition task is a model of cognition in rodents in which the natural tendency of rats to explore novel aspects of the environment is utilized. Rats spend more time exploring the novel object, suggesting that rats recognize previously explored objects. Ongoing studies evaluating the combined effects of both estrogen (25 μg) + progesterone (250 μg) priming in rats are expected to show the greatest increase in cognition in response to 2.5 mg/Kg tropisetron than any of these compounds alone.

Physics

22. Dark Matter in the Galaxy Cluster PKS 0745-19

Panzarella, Alicia and Hendrick, Sean P.*
Department of Physics, Millersville University, Millersville, PA 17551

Galaxy clusters are fundamental building blocks of our universe. They contain a massive amount of matter, but much of it cannot be detected with conventional approaches. Dark matter has been detected in a number of various ways including gravitational lensing and X-ray emission. Hydrogen gas in the inter-cluster medium (ICM) emits a large amount of X-ray emission that can be observed by X-ray satellites. Archival data from the *Chandra* X-ray Observatory is used in this project. The specific target being observed in this paper is the galaxy cluster PKS 0745-19. Using archival data from the *Chandra* Observatory, the amount of dark matter present in the galaxy cluster PKS 0745-19 will be determined using its X-ray emission. Data from the satellite is processed, cleaned and filtered to allow extraction of spectra for various regions. The X-ray analysis of the whole target will allow us to determine the kinetic energy. From the Virial Theorem, we have used the kinetic energy to determine the gravitational potential energy required to hold the cluster. The virial mass of PKS 0745-19 is 1.66×10^{14} solar masses. Mass of the X-ray emitting plasma will be determined by the spectral analysis of ten concentric annular regions around our target. The difference between the mass of the X-ray plasma and the virial mass is the amount of dark matter present in PKS 0745-19.

Earth Sciences

21. The Effects of Environmental Factors on the Surface Microphytoplankton Community in the Summertime Western North Atlantic Ocean During the Western Atlantic Climate Study II
Stone, Jeremiah T. and Vaillancourt, Robert D.*
Department of Earth Sciences, Millersville University of Pennsylvania, Millersville, PA

Microphytoplankton community composition was determined along a section in the western North Atlantic Ocean between waters near Bermuda and the New England continental shelf during the Western Atlantic Climate Study II (WACS II) from May 18, 2014 to June 6, 2014. Seawater samples were collected from the underway line (z = 5 meters) of the *RV Knorr* and preserved in both Lugol's and formalin preservatives. The concentrations of centric diatoms, pennate diatoms, dinoflagellates and dictyophytes were determined using light microscopy of preserved samples settled in Utermöhl chambers. Cell abundance data were compared with the temperature and salinity of the surface seawater to determine statistical relationships between environmental factors and phytoplankton community composition. The microphytoplankton concentrations were lowest around the Sargasso Sea. Diatom concentrations varied along the transect from the Sargasso Sea. Dinoflagellates were most numerous in the northern-most waters and were absent in the southern-most point of the study, in the Sargasso Sea. The most abundant species of diatoms observed were in the genera *Pseudo-Nitzschia* and *Leptocylindrus*. The most abundant species of dinoflagellates were in the genus *Protoperidinium*. Highest species richness was observed closer to the coast, however the Simpson's diversity indices varied amongst regions. While many of the samples had a large species diversity, there was no clear pattern of species diversity with respect to ocean region. Dinoflagellates, centric diatoms, pennate diatoms, dictyophytes and diversity indices were significantly weakly correlated with temperature, while dinoflagellates were significantly strongly correlated with salinity.

Biology

5. Behavioral Analysis of *Spodoptera frugiperda* in relation to Volatile Chemicals of *Ailanthus altissima*
Kato, Amanda and Wagner, Ryan L.*
Department of Biology, Millersville University, Millersville, PA 17551

Ailanthus altissima, commonly known as "Tree of Heaven" is an invasive tree species that was introduced to America from China in the late 1700s (Flyer., 2010). Preliminary studies in our lab have demonstrated that certain insects, such as *Hyphantria cunea* (Fall Webworm), avoid feeding on the leaflets of *A.altissima* when given the feeding choice (Ritz, 2008). Other studies demonstrated that *A.altissima* has alleopathic characteristics, making it toxic and unpalatable to certain insects, rodents, and plants (*Ding et al,.* 2006). However, the chemical mechanism that is at work remains to be determined. This tree species is of interest because its secondary chemicals may be a potential deterrent for many insect, mammal, and plant species, therefore, our research is geared toward investigating what chemicals are released by *A. altissima* and how these chemicals influence the behavior of herbivorous insects. For this study we used 2nd and 4th larval instar *Spodoptera frugiperda* (Fall Armyworm). This study will investigate the feeding behaviors of *Spodoptera frugiperda* following exposure to secondary chemicals from *A.altissima*. Force-feeding and choice-feeding experiments will be performed to determine if the extract from *A.altissima* acts as a potential growth inhibitor and/or feeding deterrent. Modification of feeding behavior will be assessed using the instantaneous sampling method and a Chi-Squared Test. In addition to behavioral modification, *Spodoptera frugiperda's* growth rate, mortality, pupation, and emergence from pupation will be observed and analyzed for any significant difference between the regular diet and the diet containing the secondary chemical extract. Understanding the behavior of *Spodoptera frugiperda* in relation to the secondary chemicals from the Tree of Heaven leaflets may facilitate the development of a potential natural biocide.

Biology

6. A study of Discipline-Based Education Research in creating an interactive learning environment.

Kessler, Anthony.; Isabella, Amanda.; Haines, Aaron H.*
Department of Biology, Millersville University, Millersville, PA 17551

Research allows students to apply traditional course content into applied problem solving. The implementation of research projects as a teaching model for STEM courses may increase student retention in STEM academic programs. I propose to analyze a model STEM course structured around a field research project involving radio tracking of ring-necked pheasants. In this course, students will gather data on pheasant movement patterns and survival. Students will also design their own experimental research project to compare ecological differences (e.g., soil types, vegetative cover, insect diversity, etc.) between areas that pheasants use compared to areas they avoid. Students will then produce a research paper and present their results as part of a Biology Colloquium. Pre- and post-surveys will be issued to biology students enrolled in this course, and those who were not, to determine the effectiveness of using an applied research project as a teaching model to improve student interest and retention in STEM curricula.

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Earth Sciences

20. Airborne Lidar Data Assessment of Wallops Island, Virginia

Murry, Nathan and Kumar, Ajoy*
Department of Earth Sciences, Millersville University, Millersville, PA 17551

The Virginia eastern shore & Delmarva Peninsula are ideal test locations for developing adaptive conservation approaches & strategies for analyzing the effect of sea level rise on coastal ecology & municipal establishment. This work will use remote sensing LiDAR data collected by the NASA Wallops Flight Facility to develop various digital models of the elevation & terrain (surface & bare-earth) of Wallops and the surrounding areas. The digital model developed are used to map current distributions of important coastal habitats, create beach profiles, & detail areas likely to experience the greatest impact from sea level rise. The goal of this study is to understand the effects of sea level rise particularly for migratory birds & their habitats.

Earth Sciences

19. Coastal Bays and Sea Level Rise: a long term analysis of Chincoteague Bay Barrier Island System.

Murry, Nathan and Kumar, Ajoy*
Department of Earth Sciences, Millersville University, Millersville, PA 17551

The physical setting and dynamic processes of Coastal Bays provide the foundation for a complex and productive ecosystem. Stresses to the Coastal Bays system, and management challenges for the coming century, are related largely to the increasing pace of development in the coastal zone, and the prospect of accelerated sea level rise driven by global warming. The Chincoteague Bay, ideally located behind barrier islands support a critical habitat for migratory shorebirds and waterfowl, many important commercial and recreational fishing and numerous rare and threatened plant and animal species. Against this background, a 50-100 year storm can exert a powerful influence by reshaping and restructuring the barrier islands and Coastal Bays. In this study, we plan to illustrate how Hurricane Sandy exerted such an influence on the Chincoteague Bay. Using long-term tidal data, we will show how storm surges from Hurricane Sandy inundated and altered low lying areas of the region.

Biology

7. Evaluating the Effectiveness of Pre-baiting Traps for Small Mammal Capture Success.

Lopez, Kelsey and Haines, Aaron H.*
Department of Biology, Millersville University of Pennsylvania, Millersville, PA 17551

Baiting is conducted by many researchers in order to manipulate wildlife for research purposes such as observation and mark/recapture. In order to increase capture success amongst small mammals, we believe pre-baiting of live-traps allows small mammals to become accustomed to the trapping area and the traps themselves. The objective of our study is to capture small mammals using live Sherman traps in order to determine if pre-baiting improves small mammal capture success as well as recapture success. Using this information we would be able to tell how many days in advance a trap may be pre-baited in order to improve capture success. We hypothesized that pre-baiting will increase trapping and recapture success rates, and that the longer baits are placed in the field, the greater the capture and recapture rate for small mammals. We will set-up a six transects of Sherman live-traps, each with its own pre-bait schedule for one week. Once pre-baiting is done, traps will be set to determine capture and recapture rates. The trapping season will conclude once all transects have been exposed to each pre-bait schedule. The next trapping season will begin in the spring and follow the same protocol as outlined above. Data will be analyzed using a Two-Way ANOVA design to compare capture success between baiting schedules using transects as blocks.

Biology

8. Impacts of *Ailanthus altissima* leaf pack leachate on Radish (*Raphanus sativus*) and Wheat (*Triticum aestivum*) Seed Germination and Seedling Growth

Mohn, Charissa N. (MU 2015) and Wagner, Ryan L.*
Department of Biology, Millersville University, Millersville, PA 17551

Sustainable agricultural practices promote the use of natural biocides that are less harmful to the environment. In recent years, the Tree of Heaven (*Ailanthus altissima*) has become a popular choice of biocide study due to the allelopathic secondary metabolites that the plant produces. *Ailanthus altissima* contains ailanthone, which is known to have broad-spectrum herbicidal effects (Heisey 2003). The allelopathic effects of *Ailanthus altissima* have been previously tested with cellular extracts prepared from macerated plant tissue. This study uniquely focuses on the effects of *A. altissima* leaf pack leachate on radish and wheat seedlings in an effort to mimic a more natural, environmental situation. The specific objectives for this study were to (1) investigate the impact of *A. altissima* leaf pack leachate dose and preparation method on the germination of radish (*Raphanus sativus*) and wheat (*Triticum aestivum*) seeds, (2) evaluate the effects of abscised versus non-abscised leaf pack leachate on seed germination, (3) determine the impact of soil containing *A. altissima* mulch (from non-abscised and abscised leaves) on seed germination, and (4) determine the impacts of non-abscised *A. altissima* leaf packs on seedling biomass in a hydroponic system. *Ailanthus altissima* leachate was prepared by soaking 10, 20, and 30gram leaf packs in water for pre-determined lengths of time. For soil studies, shredded *A. altissima* leaf material was mixed into the top layer of the soil medium to simulate seasonal leaf drop. Mean percent seed germination and dry seedling biomass data was collected and analyzed. This study found that increasing both the size of the leaf pack and the duration of leaching negatively impacted seed germination in both radish and wheat. The mean percent of radish seeds that germinated decreased from 100% to 44% when increasing the leaf pack mass from 10 to 30 grams. Wheat seed germination decreased from 100% to 88% when increasing the leaf pack mass from 10 to 30 grams. This experiment could lead to identifying a more effective, economical, and ecologically safer biocide for landowners to use.

Earth Sciences

18. Examining the Nocturnal Stable Boundary Layer and Low-Level Jet During PECAN

McAuliffe, Megan; Midzak, Natalie; Bludis, David.; Dearth, Connor; Fisher, K.alen; Green, Matthew; Hane, Jennifer; Hower, Vanessa; Morganti, Kyle; Ntonados, Evan; Orehek, Ashley; Piarulli, Kara; Pozsonyi, Kristen; Prestine, Christina; Strickland, Nicholas; Clark, Richard.*; and Sikora, Todd*
Department of Earth Sciences, Millersville University, Millersville, PA 17551

PECAN aims to advance the understanding of continental nocturnal warm-season precipitation with a focus on conditions with a nocturnal low-level jet (LLJ) and stable boundary layer (NSBL). A unique aspect of the experimental design was the integration of a wide variety of profiling systems into a fixed and mobile PECAN Integrated Sounding Array (PISA) across northern Oklahoma, central Kansas, and south-central Nebraska. This paper reports the preliminary findings obtained at Fixed-PISA 3 (FP3). Measurements were obtained by the Millersville University Atmospheric Research and Aerostat Facility, which consists of the Vaisala MW41 rawinsonde system, acoustic SODAR with RASS extension, MPL-111 micropulse LIDAR, and 10 m flux tower. Data from FP3, supported by those from other fixed and mobile PISAs, allow for a detailed characterization of the structure and evolution of the boundary layer from late afternoon through early morning, including the development of the LLJ. Three case studies of the Great Plains LLJ will be presented that highlights differences between weak (13 m/s), moderate (23 m/s), and strong (31 m/s) LLJs, and the underlying structure and evolution of the nocturnal boundary layer. Preliminary results suggest that LLJs formed solely by differential heating over sloped terrain are relatively weak and allow for the initiation and growth of a substantial NSBL because momentum transfer to the surface is proportionally weaker. Conversely, relatively strong LLJs are synoptically-forced and occur in the absence of a robust NSBL.

Earth Sciences

17. Validation and Analysis of MW_IR OI SST product over the Indian Ocean

Ditri, Angela; Murry, Nathan; Geiger, Cara; Morganti, Kyle; Kumar, Ajoy*
Department of Earth Sciences, Millersville University, Millersville, PA 17551

One of the novel SST product that is available to the scientific community is the 9 km microwave plus infrared (MW_IR) OI SST product that combines the through-cloud capabilities of the microwave data (MW) with the high spatial resolution of the IR SST data. All OI SST values are corrected using a diurnal model to create a foundation SST that represents a 12 noon temperature. The constant cloud cover, strong stratification and variable wind fields experienced in the Indian Ocean makes such a SST product attractive for a range of scientific issues including improving short and long term forecast of the Indian Monsoons, and biogeochemical studies. In this study, we have compiled and quality controlled a huge dataset of in situ and satellite collocated SST fields and ancillary data from the Indian Ocean. In this poster, we show the results of our validation of satellite with in situ SST fields, relate the errors to the foundation SST and with other parameters like the wind speed, air temperature and radiation fields. We demonstrate how this SST product can immensely benefit the various scientific studies in the Indian Ocean region.

Chemistry

9. Fluorescence of Dye Molecules

Ashberry, Hannah, and Elioff, Michael S.*
Department of Chemistry, Millersville University, Millersville, PA 17551

Dye molecules are known to be important in various applications, which include bioanalytical chemistry, photometrics, health care, and ecological preservation, and forensics. In particular Alexa Fluor® Carboxylic Acid dye can be used for cellular labeling and detection. The dye molecules can be attached to proteins at high molar ratio without significant self-quenching, leading to brighter conjugates, and more sensitive detection. Experiments to investigate the effects of solvent polarity and solvent pH on the absorbance and fluorescence spectra of Alexa Fluor® Carboxylic Acid 488 and Alexa Fluor® Carboxylic Acid 647 are currently underway.

10. Studies Toward the Total Synthesis of Hunanamycin A

Dreer, James W.; Carta, Matthew; Kennedy, Steven M. *
Department of Chemistry, Millersville University, Millersville, PA 17551

Studies toward the synthesis of Hunanamycin A (HA) have recently been initiated in our laboratory. HA is a natural product isolated in small quantities (< 1 mg) from *Bacillus hunanensis*. It exhibits antibacterial activity for various pathogens such as *Salmonella* and *E. coli.* Conceivable synthetic routes to HA have been designed based on literature precedent. Test reactions (*e.g.* reductive amination, amine acylation, and cyclization) are being optimized on model systems to explore multiple pathways of producing the target product. Once an efficient route is elucidated, further biological testing of HA and related derivatives could allow for a calculated modification of the antibacterial properties displayed by this class of molecules. Currently, two methods, reductive amination and amine acylation, have achieved formation of a prenylated aromatic amine intermediate. Our most progressive route employs an intramolecular electrophilic cyclization of the prenylated aromatic amine to provide a tetrahydroquinoline intermediate.

Chemistry

11. Alkene Migration Studies En Route to Altersolanol P

Salim, Jevica B.; Smaligo, Andrew J.; Kennedy, Steven M.*
Department of Chemistry, Millersville University, Millersville, PA
17551

Studies toward the total synthesis of altersolanol P (AP), a new member of the altersolanol family of compounds, have been conducted in our laboratory. AP was recently isolated from an unknown Hypocreales fungus collected at a forest in Puerto Rico. AP exhibited broad-spectrum activity against Gram-positive bacteria and inhibited the growth of Gram-negative *Haemophilus influenzae*. Currently, a synthetic intermediate containing the complete carbon framework of AP has been synthesized via Lewis acid-mediated Diels-Alder cycloaddition on multi-gram scale (in 80% yield and 8:1 regioselectivity). An oxidization reaction of the cycloadduct provided efficient access to a 1,4-diene intermediate. From the 1,4-diene, a sequence of alkene isomerization followed by dihydroxylation should give rise to AP. Our efforts are focused on a methods study to isomerize the 1,4-diene to the 1,3-diene. The long-term goal of this project is to find an efficient route to synthesize Altersolanol P and related derivatives so that their biological activities can be further studied.

Earth Sciences

16. A Study on the Effects of Beach Replenishment at Wallops Island, VA

Alberto, Orlando; Murry, Nathan; Kumar, Ajoy*
Department of Earth Sciences and Brazil Scientific Mobility Program (BSMP)[1]
Millersville University, Millersville, PA 17551

The Wallops Island beach and surrounding area was recently replenished with sand dredged from offshore locations to reduce the impacts of erosion from longshore currents and storms that frequent the region during fall and winter. This sand has been observed to accumulate and fill the Chincoteague Inlet channel, reducing the navigable depth. This requires frequent and COSTLY de-silting of the channel and the Accomack County requests a study to quantify the source and direction of sediment flow to the Inlet channel. In this proposal, we plan to use our existing collaboration between NASA and the Chincoteague Bay Field Station (CBFS) to design, implement and produce a 3D bathymetric cross-section of the area mentioned above for the purpose of assessing the present location and height of sand that has been distributed by the longshore current and storms. This initial study will help us locate and identify regions where sand is accumulating and eroding. We propose employing a vessel-mounted multi-beam sonar system to survey the area for the purpose of developing digital elevation models of its bathymetry. This will provide a baseline model for future surveys to help determine the extent and rate of silt deposits about the channel.

Computer Science

15. Independent Game Design in the Unity Engine, Part I: Procedural Generation

Zelek, Steven and Zoppetti, Gary M.*
Department of Computer Science, Millersville University, Millersville, PA 17551

The working title of the game in development is Dungeon Rush. Dungeon Rush is a based on a 2-dimensional, top-down perspective, roguelike archetype. Roguelike games share some common characteristics: single-player, procedural level generation, and permanent death of the player. In Dungeon Rush, the player's goal will be to complete several consecutive levels of a treacherous, underground dungeon. On each level, the player will appear at one end of a maze-like cave system and must find the exit in order to progress to the next floor. Along the way, the player will explore the maze's twists and turns, collect items, fight enemies, and avoid traps. In addition, there will be a thematic time constraint (e.g., the dungeon is collapsing) to keep the player on edge and force them to take risks to save time. Programming this particular game will require mastery of the following concepts: Procedural level generation, artificial enemy intelligence, user input/control, GUI, simple physics, 2D graphics, camera perspective, and lighting simulation. So far, research has successfully produced an efficient algorithm for generating seemingly natural cave-like mazes in a 2D grid. This algorithm was written in C#, an object-oriented language with syntax similar to Java. By using simple squares to display wall tiles and floor tiles, these randomly generated mazes can be easily inspected for quality. The Unity Engine's inspector also allows run-time adjustment of public variables so that constants of the algorithm can be tweaked in order to find the desired effects. By the conclusion of the Fall semester, the game should allow for full gameplay.

Chemistry

12. Incorporation of Natural Product Extraction into an Undergraduate Organic Synthesis Laboratory: Efficient Isolation and Derivatization of Shikimic Acid

To, Gina G. and Kennedy, Steven M.*
Department of Chemistry, Millersville University, Millersville, PA 17551

A new, user-friendly, method for the rapid extraction of Shikimic acid (SA) from star anise, based on the work of Just and coworkers, has been optimized for an upper-level organic laboratory. Currently, our studies are focused on the development of a modified procedure that can be adapted into an undergraduate laboratory. The synthesis of SA derivatives is also being explored. To date, approximately 2.0 g of SA can be isolated and purified within an average of a 120 min time period, starting from 20 g of star anise. The ease and efficiency of this method allows SA, which is commercially available, but cost prohibitive (2.0 g = $206), to be used as the starting material for a six-week multi-step synthesis laboratory. SA derivatives have been shown to exhibit useful biological activities. Particularly, they act as viral neuraminidase inhibitors, display anticancer, antiviral and antibiotic behavior, or exhibit anticoagulant and antithrombotic activity. During the first half of a sixteen-week semester, students will use SciFinder Scholar to help them plan a step-wise organic synthesis that employs functional group protected SA derivatives as intermediates. After isolating SA with our modified extraction protocol, students will implement their multi-step synthesis.

Chemistry

13. Solid Phase Heats of Formation of Energetic Compounds Using Computational Methods

White, David L. (B.S. 2015) and Elioff, Michael S.*
Department of Chemistry, Millersville University, Millersville, PA 17551

Computational investigations of HEDMs are being conducted to discover solid phase heats of formations. HEDMs are compounds that detonate to evolve large volumes of gas rapidly, and have a wide range of uses including mining, airbags, and military applications. These compounds have different structural considerations and encompass a large range of future potential materials. The research is primarily aimed at finding appropriate and time-efficient methods for determining accurate gas phase heats of formation for a set of twenty compounds. Experimental heats of sublimation are subtracted to yield solid phase heats of formation. The current methods being evaluated are Hartree Fock calculations and density functional theory (DFT) calculations using the B3LYP functional with at least 6-31G as the basis set. Previous studies into this subject have typically included factors for ring strain and steric interactions. Current examination is focused on the relationship between the connectivity of the atoms and the accuracy of the calculated energetic parameters.

Computer Science

14. Design of a 2D Arena Boss Game using the Unreal Engine

Peterson, Ryan and Zoppetti, Gary*
Department of Computer Science, Millersville University, Millersville, PA 17551

With the use of the Unreal Engine and additional programming in C++, it is possible for an independent designer to implement a complete game. To accomplish this, we are researching game design, developing code, and using assistive functionality built into the Unreal Engine to execute a unique game of our own design. This research includes an equal emphasis on the study of game design, as well as on the programming techniques necessary to create a game. We will achieve familiarity with both the Unreal Engine and the intricacies of the C++ language, and experience all stages of the software development life cycle. Currently we have implemented a player character with actions and respective animations for walking, rolling and swinging a sword. A roaming enemy, player/enemy damage systems, tile sets and tile maps have also been implemented. The pixel art has been incorporated from sprite sheets based on Nintendo's classic game, The Legend of Zelda. The final goal is to allow for more player actions, such as the use of a bow and arrow, boomerang and magic, and to create intelligent, boss-level enemies capable of path following and smart decision making. Lastly, menu screens, in-game GUIs, and lighting simulations will be added to round out the game for a polished look.