Seventh Annual
American Chemical Society Illinois-Iowa
Undergraduate Research Conference

November 14, 2015
Rogalski Center
St. Ambrose University

Schedule of Events

9:30-10:30	Registration and breakfast in Gottlieb Conference Center Poster setup in Rogalski Center Ballroom
10:30-12:00	Research Talks (15 min/talk with 5 min for questions) in McCarthy Hall *Schedule and abstracts found beginning on pg. 2*
12:00-1:00	Buffet lunch in Gottlieb Conference Center
1:00-2:30	Poster presentations in Rogalski Center Ballroom 1:00-1:45 – poster presentations with an odd numbered abstract 1:45-2:30 – poster presentations with an even numbered abstract *Abstracts found beginning on pg. 6*
2:30-3:30	Keynote address in Gottlieb Conference Center **A Study on the Actin Binding Protein, Palladin, and its Possible Role in Cancer Metastasis** Dr. Ritu Gurung, St. Ambrose University *Abstract and biography found on pg. 16*
3:30	Recognition of students in Gottlieb Conference Center

Research Talks

Session A (McCarthy 002):

10:30 A1 **Essential Oils: Is it all hype or do they work as antibacterial agents?**
Antonetta Axup, Monmouth College

10:50 A2 **Langmuir Monolayer Analysis of a Collagen/Phospholipid Model Membrane Systems for the Investigation of Osteoblast Affinity to Titanium Rods**
Morgan L. Gulley, Monmouth College

11:10 A3 **Reduction of Ketones and Aldehydes using 1-Hydrosilatrane**
Paolo Suating and Joseph J. Hurley, Northern Illinois University

11:30 A4 **Utilizing a Manganese Catalyst for Intramolecular C(sp3)—H Amination**
Shannon M. Miller, University of Illinois at Urbana-Champaign

Session B (McCarthy 102):

10:30 B1 **A Survey of Personal Hair Care Products for the Presence of 1,4-Dioxane**
Allison Westra, University of Dubuque

10:50 B2 **A Survey for the Presence of Antibiotics in the Waters and Soils of Streams Surrounding Guttenberg, Dubuque, and Bellevue, Iowa**
Kayla Neff and Michael Kennedy, University of Dubuque

11:10 B3 **Isomerization of Humulus Lupulus α-Acids**
Chris J. Knutson, Monmouth College

Research Talk Abstracts

Abstract #A1

Essential Oils: Is it all hype or do they work as antibacterial agents?

Antonetta Axup and Audra Sostarecz
Chemistry Department, Monmouth College

Langmuir Monolayers of sweet orange essential oil, the phospholipid dipalmitoylphosphatidylcholine (DPPC), and E.coli lipid extract were used to investigate the antibiotic properties of essential oils. The Langmuir Monolayer technique is a useful one for the formation of model cell membranes by allowing analysis of the interactions between the molecules and their organization capabilities. Monolayers using the sweet orange oil as a subphase with DPPC added were found to be more fluid, and to be less stable, as indicated by a low surface pressure at low molecular areas when compared to monolayers with ultra pure water as the subphase. Similarly, monolayers using the sweet orange oil as a subphase with the E. coli lipid extract added were found to be more fluid, and to be less stable, as indicated by a low surface pressure at low molecular areas when compared to monolayers with ultra pure water as the subphase. Further investigations will involve using a gram-positive phospholipid, since DPPC is neutral and E. coli is gram-negative, and observing those results in the orange oil, and also using different essential oils as the subphase.

Abstract #A2

Langmuir Monolayer Analysis of a Collagen/Phospholipid Model Membrane Systems for the Investigation of Osteoblast Affinity to Titanium Rods

Morgan L. Gulley, Dr. Audra Sostarecz, Khader Eskandar, and Laura J. Moore
Department of Chemistry, Monmouth College

Langmuir-Blodgett Monolayers of collagen and phospholipids are being used as a model system for the affinity of osteoblasts to titanium rods. The Langmuir Monolayer technique allows for the analysis of the organization of amphiphilic molecules at an air-water interface and is, therefore, a useful technique for the formation of model cell membranes. Collagen, Type I from calf skin, was used as a substitute for human bone and titanium nitride foil was used as the substrate due to its increased biocompatibility. Langmuir monolayers of collagen are found to have a higher degree of order (less fluidity) and to be more stable indicated by a higher surface pressure at low molecular areas when incorporated into a film with phospholipids such as dipalmitoylphosphatidylcholine (DPPC) and dipalmitoylphosphatidylethanolamine (DPPE). Similarly, transfer ratio data of collagen monolayers to silicon (SiO_2) substrates increased in the presence of DPPC or DPPE indicating that this may be a good model system for this investigation. In preparation for current experiments involving Atomic Force Microscopy analysis of collagen/phospholipid monolayers transferred to titanium nitride foil using dipalmitolyphosphatidylglycerol (DPPG) as the lipid because of its impact on bacterial resistance in the bone cell model membrane, we have determined that we can use the ezAFM for analysis of transferred multilayers of arachidic acid.

Abstract #A3

Reduction of Ketones and Aldehydes using 1-Hydrosilatrane

Paolo Suating, Joseph J. Hurley, Vladislav Skrypai, Sami Ensio Varjosaari, and Marc J. Adler
Department of Chemistry and Biochemistry, Northern Illinois University

Modern techniques utilised in the reduction of aldehydes and ketones to alcohols involves transition metals, dissolving alkali metals, harsh reaction conditions, and very reactive reagents. In this presentation we demonstrate the utility of 1-hydrosilatrane – a mild, air-stable silicon-based reducing agent. Both aromatic and non-aromatic aldehydes and ketones have been reduced at high yields using 1-hydrosilatrane and an appropriate Lewis-basic activator.

Abstract #A4

Utilizing a Manganese Catalyst for Intramolecular C(sp3)—H Amination

Shannon M. Miller, Shauna M. Paradine, Jennifer R. Griffin, Jinpeng Zhao,
Aaron L. Petronico, and M. Christina White
Department of Chemistry, University of Illinois at Urbana-Champaign

Maintaining reactivity while displaying chemoselectivity remains a problem in the oxidation of aliphatic C–H bonds. The recently discovered catalyst, manganese tert-butylphthalocyanine [Mn(tBuPc)] , challenges the discrepancy between reactivity and selectivity. [Mn(tBuPc)] catalyzes intramolecular amination of all types of C(sp3)–H bonds while maintaining high chemoselectivity in the presence of sensitive functionality. This method has shown useful for the late-stage diversification of natural product and drug molecules.

Abstract #B1

A Survey of Personal Hair Care Products for the Presence of 1,4-Dioxane

Allison Westra and Mark Sinton
Department of Natural and Applied Sciences, University of Dubuque

Samples for ten personal hair care products were surveyed by means of a gas chromatography/mass spectral analysis for the presence of 1,4-dioxane, a known toxic substance that is a byproduct of how hair care products are manufactured. Of the products surveyed, none contained a detectable level of 1,4-dioxane, which suggests that manufacturers are doing a good job of removing this substance from their products before shipment. Surprisingly, however, the presence of lilial, 3-(4-tert-butylphenyl)-2-methylpropanal, was detected in two of the ten products tested. Lilial is banned in the European Union, but not in the United States.

Abstract #B2

A Survey for the Presence of Antibiotics in the Waters and Soils of Streams Surrounding Guttenberg, Dubuque, and Bellevue, Iowa

Kayla Neff, Michael Kennedy, and Mark Sinton
Department of Natural and Applied Sciences, University of Dubuque

Water and soil samples from twelve streams encompassing an area from the north of Guttenberg, Iowa, to the south of Bellevue, Iowa, and that empty into the Mississippi River were surveyed for the presence of five antibiotics commonly used in agriculture: ampicillin, ciprofloxacin, sulfadiazine, sulfamethazine, and tetracycline. Only three out of twenty-four water samples had a detectable amount of antibiotic, while all of the soil samples (forty-eight, in total) contained one or more of these compounds. These data suggest that, while there may be little antibiotic content in water in this area of the country, stream soils are a sink for these five antibiotics.

Abstract #B3

Isomerization of Humulus Lupulus α-Acids

Chris J. Knutson and Bradley E. Sturgeon
Department of Chemistry, Monmouth College

Hops are added to the brew kettle at different times in order to add specific character to the beer. “Early addition” of hops primarily add bitterness; “late addition” of hops contribute flavor and aroma. Hop bitterness comes from the isomerization of α-acids with effective utilization of not more than 30%. The reason for low utilization is most likely a combination of factors related to both the volatility of the α-acids as well as degradation of the isomerized α-acids. The contribution of “late addition” hops to the final beer is a result of essential oils and is not fully understood. Recipe formulations which have a strong hop component add hops throughout the brewing process as well as after primary fermentation (dry hopping). This talk will present a collection of data that suggest alternative methods of hop processing to both increase the utilization of hop α-acids and better preserve the essential oils in the final product.

Poster Abstracts

Abstract #1

Isolation of CRP protein for the attachment to an AFM surface

Mohanad Ahmad and Laura Moore
Department of Chemistry, Monmouth College

This research aims to determine the characteristics of transcription factor binding to DNA using Atomic Force Microscopy. The transcription factor that is being used for this experiment is CRP. CRP is a transcription factor found in E.coli that plays an important role in DNA to RNA transcription. Working towards this goal, the CRP protein was isolated and attached to an AFM surface using a linker protein, or His tag. Alternatively, Mutagenesis of CRP protein can be performed in order to attach the protein to the surface without the use of linker proteins. Therefore, His Tag was removed from CRP protein and set ready for the Mutagenesis reaction.

Abstract #2

Aspartame Found in Diet Sierra Mist Using UV-Visible Spectroscopy

Ashley Becker, Mackenzie Clawson, Morgan Pavlich, Grace Sieverding,
Andrew Axup, and Kelly Giddens
Chemistry Department, St. Ambrose University

Aspartame is a low-calorie sweetener currently found in diet sodas. This aspartic acid and phenylalanine compound has been linked to many chronic diseases such as chronic joint pain, the worsening of Alzheimer's, depression, and fatigue. The FDA does not require producers to list the aspartame content on nutrition labels, so most consumers are unaware of how much aspartame they are consuming. The goal of this research was to devise a method to accurately measure the amount of aspartame found in diet beverages. Ultraviolet-visible spectroscopy was used to measure the aspartame absorbance at 629 nm. It was concluded that aspartame is indeed present in Diet Sierra Mist. The average concentration was found to be 0.5±0.3 mg/mL at the 95% confidence level. A large source of error was attributed to the observation that other ingredients in the soda were contributing to the absorbance readings at 629 nm. As an approximation, this was corrected for by subtracting the absorbance of regular Sierra Mist at 629 nm. The result was an estimated aspartame concentrations of 0.15 and 0.17 mg/mL. In the future a technique which separates aspartame from its pop matrix would provide more direct results.

Abstract #3

The Effects of Late Transition Metal Nanoparticles on the Formation of Carbonic Acid

Alex Cardascio, Paris W. Barnes, and Timothy J. Guasco
Chemistry Department, Millikin University

Carbon dioxide is a greenhouse gas that is largely produced through human activities. Scientists have explored multiple methods to reduce the amount of carbon dioxide in the atmosphere including its sequestration in water, forming carbonic acid. Bhaduri and Siller (Catal. Sci. Tech. 2013, 3, 1234-1239) reported a significant increase in water's ability to dissolve carbon dioxide using nickel nanoparticles as a catalyst. This work focused on the effects of nickel, copper, or zinc nanoparticles on the hydration of carbon dioxide. The pH and conductivity of carbon dioxide-treated deionized ultra-filtered (DIUF) water and 30-ppm metal nanoparticle suspensions were monitored for 450-second periods. The DIUF water, nickel, and copper nanoparticle suspensions produced nearly identical results with respect to carbonic acid production. However, the zinc nanoparticle suspension showed a much higher uptake of carbon dioxide. Factors such as particle surface area, shape, and acidity of the metals used are being considered as possible explanations for our findings.

Abstract #4

The Use of Dimethyl Carbonate as a Suzuki Reaction Solvent

Jason Davidson, Carlos Montero, and Mark Sinton
Department of Natural and Applied Sciences, University of Dubuque

The Suzuki reaction, a widely used method for synthesizing biphenyl compounds, traditionally involves the use of environmentally toxic solvents such as benzene and benzotrifluoride. Here, we have endeavored to replicate the work of Satterlee, in which she found that dimethyl carbonate could be used in place of the traditional Suzuki solvents as a way to make the Suzuki reaction more "green" (Satterlee, 2012). This work demonstrates that dimethyl carbonate is indeed an effective solvent for the Suzuki reaction.

Abstract #5

Correlation between Avobenzone and Oxybenzone Concentrations and Sunscreen SPF Determined by Gas Chromatography-Mass

Kaylea Davis, Mustafa Saffaf, Ashlyn Rulis, Kelly Giddens, and Andrew Axup
Chemistry Department, St. Ambrose University

Chemical sunscreens provide protection form harmful UVA and UVB rays from the sun through UV filters, such as avobenzone and oxybenzone. These filters absorb the energy from the sun's rays, rather than allowing the electrons within the skin to become excited and cause damage to the surrounding tissue. Sunscreen SPF's are determined through outcome-based procedures, rather than through analytical measurements. To determine if there was a correlation between the amount of UV filter, specifically avobenzone and oxybenzone, and the SPF, approximately 0.25 g samples of 12, 30, and 50 SPF Hawaiian Tropic Silk Hydration Lotion Sunscreen were dissolved in hexane. These samples were then analyzed using gas chromatography-mass spectrometry. The percent composition of avobenzone for the samples ranged from 9.4% to 20.6%, while these values for oxybenzone ranged from 26% to 7.8%. It was found that SPF 50 contained the highest concentration of oxybenzone and, possibly, avobenzone. More research must be conducted to determine if the difference was significant. Future studies should make use of a larger sample size and a more efficient avobenzone extraction method. These studies could also expand to other brands of sunscreen.

Abstract #6

Biogeochemical Evolution of The Atmosphere: The BETA Project

Brittnie Dotson, Steven Gomez, Carissa Herkelman, Jose Lopez, Bobbi Minard, Kathryn Patrick, Jessica Wayson, Joshua Sebree, Alexa Sedlacek, and Xinhua Shen
Department of Chemistry and Biochemistry and Department of Earth Science, University of Northern Iowa

The interactions between the atmosphere and biosphere throughout Earth's history play an important role in the dynamic climate system. The BETA Project involves undergraduate students in a multidisciplinary study of the biogeochemical evolution of Earth's atmosphere at three key intervals of Earth's history. (1) The anoxic atmosphere that supported Earth's first life, (2) the Devonian, a period when forest ecosystems radiated onto the land surface and caused major CO2 drawdown from the atmosphere and (3) the modern agricultural sources of atmospheric NH3. Our interdisciplinary team includes undergraduate Earth Science, Environmental Science, Biology, Biochemistry, and All Science Teaching majors from the University of Northern Iowa. The team is led by faculty from the Earth Science Department and Chemistry and Biochemistry Department at UNI in collaboration with scientists from NASA Goddard Space Flight Center. The team will use a combination of laboratory simulations, field work and analysis, and weather and climate modeling to study atmospheric changes at these intervals of Earth's history.

Abstract #7

Oxidation of α-Crystallin in the Presence of Xanthurenic Acid Radical

Carley Folluo, Chris Knutson, and Bradley E. Sturgeon
Department of Chemistry, Monmouth College

The photo-excitation of xan in the presence of the α-crystallin lens protein has been shown to result in the polymerization of the α-crystallin, hence a possible mechanism for the formation of cataracts. An alternative mechanism for the role of xan, in the formation of cataracts, is the 1-electron oxidation leading to the xan radical. This poster will present ESR data showing the detection of xan radical formed from peroxidase/H2O2. Additionally the detection of peroxidase-associated polymerization of a-crystallin will be presented.

Abstract #8

Langmuir Monolayer Analysis of a Collagen/Phospholipid Model Membrane Systems for the Investigation of Osteoblast Affinity to Titanium Rods

Morgan L. Gulley, Audra Sostarecz, Khader Eskandar, and Laura J. Moore
Department of Chemistry, Monmouth College

Langmuir-Blodgett Monolayers of collagen and phospholipids are being used as a model system for the affinity of osteoblasts to titanium rods. The Langmuir Monolayer technique allows for the analysis of the organization of amphiphilic molecules at an air-water interface and is, therefore, a useful technique for the formation of model cell membranes. Collagen, Type I from calf skin, was used as a substitute for human bone and titanium nitride foil was used as the substrate due to its increased biocompatibility. Langmuir monolayers of collagen are found to have a higher degree of order (less fluidity) and to be more stable indicated by a higher surface pressure at low molecular areas when incorporated into a film with phospholipids such as dipalmitoylphosphatidylcholine (DPPC) and dipalmitoylphosphatidylethanolamine (DPPE). Similarly, transfer ratio data of collagen monolayers to silicon (SiO2) substrates increased in the presence of DPPC or DPPE indicating that this may be a good model system for this investigation. In preparation for current experiments involving Atomic Force Microscopy analysis of collagen/phospholipid monolayers transferred to titanium nitride foil using dipalmitolyphosphatidylglycerol (DPPG) as the lipid because of its impact on bacterial resistance in the bone cell model membrane, we have determined that we can use the ezAFM for analysis of transferred multilayers of arachidic acid.

Abstract #9

Chemical Potential Gradients for Surface-Directed Molecular Transport

Mary Grace Haugen, Amanda E. Cowfer, Kali A. Miller, Alexandria L. D. Stanton, Paul V. Braun
Department of Chemistry, University of Illinois at Urbana-Champaign

Biased diffusion has classically been thought of as the predictable migration of molecules from high to low concentration. However, in recent years, systems that exploit molecular interactions to move molecules against these conventional gradients have gained much interest. For example, it has been well established that surface gradients can create a difference in attraction that will cause molecules to diffuse preferentially in one direction, even against concentration and gravity gradients. Initial publications from our lab show promising results for directed transport along a patterned 1D pathway, across a 2D surface, and concentration by a radial gradient. However, these systems demonstrate only specific ionic and polar polymer/analyte systems. Thus, we are in the process of developing new methods for gradients in hydrogel materials and molecularly imprinted hydrogels. This will greatly broaden the scope of target molecules and the versatility of the polymer surface.

Abstract #10

Gas Chromatography Mass Spectrometry Analysis of Levels of Capsaicin in Varying Brands of Hot Sauce

Clare Huettner, Elizabeth Lange, Rachel Lemek, Kathryn Maher, Kelly Giddens, and Andrew Axup
Department of Chemistry, St. Ambrose University

Capsaicin/dihydrocapsaicin (cap/dicap) is an organic compound with a long hydrocarbon tail found in various hot peppers used in hot sauce. Cap/dicap is responsible for the burning sensation felt when eating hot sauce or hot peppers. The purpose of this study was to determine the levels of cap/dicap in various brands of original hot sauce. The three brands of sauces used in this experiment were Red Hot, Great Value, and Sriracha. Each of the sauces were placed in a liquid-liquid extraction to separate the cap/dicap from the sauces. Acetonitrile (AcCN) was used as the extraction solvent. The separated cap/dicap was analyzed using gas chromatography-mass spectrometry. Tetracosane was used as the internal standard. The results showed different levels of cap/dicap in each of the sauces ranging from 4.14 μg/mL to 98.4 μg/mL. This was compared to the results of a qualitative taste test that was conducted. It was found that Sriracha tasted the hottest (31.2 μg/mL), but Red Hot had the highest levels of cap/dicap (98.4 μg/mL). Additional studies must be done to further test the levels of cap/dicap in other types of hot sauce. Future studies should work to refine the extraction process.

Abstract #11

Isomerization of Humulus Lupulus α-Acids

Chris J. Knutson and Bradley E. Sturgeon
Department of Chemistry, Monmouth College

Hops are added to the brew kettle at different times in order to add specific character to the beer. “Early addition” of hops primarily add bitterness; “late addition” of hops contribute flavor and aroma. Hop bitterness comes from the isomerization of α-acids with effective utilization of not more than 30%. The reason for low utilization is most likely a combination of factors related to both the volatility of the α-acids as well as degradation of the isomerized α-acids. The contribution of “late addition” hops to the final beer is a result of essential oils and is not fully understood. Recipe formulations which have a strong hop component add hops throughout the brewing process as well as after primary fermentation (dry hopping). This poster will present a collection of data that suggest alternative methods of hop processing to both increase the utilization of hop α-acids and better preserve the essential oils in the final product.

Abstract #12

Reducing Greenhouse Gas Emissions with Advanced Nano-engineered Materials

Riley Mullins, Xinhua Shen, Hongbo Du, Ziaul Huque, and Raghava R. Kommalapati
Department of Earth Science, University of Northern Iowa

This research involves undergraduate students in a study of reducing greenhouse gas emissions with advanced nano-engineered materials. Carbon dioxide is the primary anthropogenic greenhouse gas. In order to mitigate global climate change, it is imperative that we reduce carbon dioxide emissions. One of the most effective ways to control carbon dioxide emissions is carbon capture and sequestration (CCS). However, today it is still a big challenge to produce effective and economic materials for carbon capture. There have been numerous studies with varying degrees of success to capture carbon dioxide. The recent focus has been directed towards the use of nanomaterial due to their very porous structure and high surface area. This research aims at conducting a through literature review to establish the knowledge of developing a novel nanomaterial to efficiently capture carbon dioxide from the flue gas in fossil energy power generation. This novel nanomaterial will have the advantages of the unique porous properties of nanotubes and the adsorption features of impregnated materials. This project will provide an opportunity to enhance research as well as educational training capabilities into air pollution control technologies. The research will ensure that the students involved in the project gain experiences in several STEM disciplines including: air pollution control technologies, laboratory measurement, and data analysis.

Abstract #13

A Survey for the Presence of Antibiotics in the Waters and Soils of Streams Surrounding Guttenberg, Dubuque, and Bellevue, IA

Kayla Neff, Michael Kennedy, and Mark Sinton
Department of Natural and Applied Sciences, University of Dubuque

Water and soil samples from twelve streams encompassing an area from the north of Guttenberg, Iowa, to the south of Bellevue, Iowa, and that empty into the Mississippi River were surveyed for the presence of five antibiotics commonly used in agriculture: ampicillin, ciprofloxacin, sulfadiazine, sulfamethazine, and tetracycline. Only three out of twenty-four water samples had a detectable amount of antibiotic, while all of the soil samples (forty-eight, in total) contained one or more of these compounds. These data suggest that, while there may be little antibiotic content in water in this area of the country, stream soils are a sink for these five antibiotics.

Abstract #14

A Model System to Investigate if Furfural Affects Bacterial agents

YeJun Park, Audra Sostarecz and Laura Moore
Department of Chemistry, Monmouth College

In biofuels production, treated biomass is used to produce biofuel. In addition, Furfural is a breakdown product of hemicellulose that is present in the treated biomass from pretreatment process. E.coli is one of the fermentative microorganism that is used as a biocatalyst for biofuels production. Furfural is the one that inhibits E.coli growth. However, nothing has figured out about the mechanism of the inhibition. To figure the mechanism out, Langmuir monolayer technique is used. E.coli monolayers were tested on HEPES buffer having different concentration of furfural. As a result, as the concentration of the furfural increased the E.coli monolayer got more fluid.

Abstract #15

Chemical Oxidation of Biophenols

Ahmad Pauzi and Bradley E. Sturgeon
Department of Chemistry, Monmouth College

In this project, we are interested in detecting free radical intermediates formed during the oxidation of biophenol. The idea of the project is to understand the mechanism behind the chemical oxidation of the biophenol. The biophenol compound of interest is the Butylated Hydroxyanisole (BHA). BHA is a synthetic phenolic type of food preservative that prohibits oils, fast and shortenings from rancidity. The reason is because BHA is a free radical scavenger that terminates oxidation to give stability to the system. A number of studies have shown that BHA displays an extensive span of biological activities. Studies have shown animals were protected against radiation and impeded carcinogenesis in various tissues after a dietary administration of this compound. The protective effect of BHA is due to its capacity to induce phase II detoxifying enzymes such as epoxide hydrolases, quinone reductases, glutathione S-transferases and UDP-glucuronosyl transferases, in addition to suppressing the cytochrome P-450 monooxygenase. However, other studies has also shown that BHA to be carcinogenic after long term dietary administration in animals at high doses. Despite the fact that BHA possesses both carcinogenic and anticarcinogenic effects, the detailed mechanisms of BHA effects still remain uncertain. The mechanism behind the chemical oxidation of BHA is that it gives a one electron oxidation to form a BHA radical and the radical will recombine together in a couple of different ways to form polymers. In this study, we show that BHA undergoes chemical oxidation to form free radicals. We analyzed the different radical products using the High Performance Liquid Chromatography (HPLC).

Abstract #16

A Study of Amino Acid Modifications in Phragmatopoma lapidosa and Pectinaria gouldii Biocement

Ashley Rackow, Marissa Franke, Amalia Leveille, and Maria Dean
Department of Chemistry, Coe College

Previously constructed cDNA libraries from two sea worms, P. lapidosa and P. gouldii, were sequenced in search of biocement proteins. Thirty-four sequences were published, including a new cement protein containing an “RRRS” repeated amino acid motif. Repetitive amino acid sequences were found in all of the discovered biocement proteins, such as “SSS”, “GYG”, and “SR”, where serine (S) is phosphorylated and tyrosine (Y) is converted to DOPA. Extracted biocement proteins were separated by SDS-PAGE (Polyacrylamide gel electrophoresis) and stained to confirm the presence of DOPA and phosphoserine. Analysis by Energy Dispersive Spectroscopy (EDS) showed high levels of phosphorous and oxygen to support the premise that biocement proteins are highly phosphorylated.

Abstract #17

Psychosocial Influences on Heart Rate Variability

Ashley Rackow, Alexandria Muldew, and Benjamin Tallman
Department of Psychology, Coe College

The current research study examined several respiration rates among undergraduate students to enhance their peak respiratory sinus arrhythmia (RSA) amplitude. The increase in RSA is due to physiological equilibration which is commonly referred to as resonant frequency. While there is strong evidence supporting the relationship between specific respiratory rates and resonant frequency, less is known about differences among psychosocial variables and their impact on heart rate variability. The current study examined mean differences between psychosocial variables (e.g., anxiety, internal/external locus on control, self-efficacy, and personality characteristics) and heart rate variability. Participants consisted of 24 undergraduate students who participated in focused breathing exercises with electrocardiogram (ECG) monitoring. Results of repeated measures ANOVA revealed significant main effects for breathing rate. While the interaction between psychosocial variables and HRV was non-significant, trends in the data suggest promising future research. Results have implications for HRV biofeedback training and will enhance understanding regarding how psychosocial variables may impact cardiovascular activity.

Abstract #18

Reduction of Ketones and Aldehydes using 1-Hydrosilatrane

Paolo Suating, Joseph J. Hurley, Vladislav Skrypai, Sami Ensio Varjosaari, and Marc J. Adler
Department of Chemistry and Biochemistry, Northern Illinois University

Modern techniques utilized in the reduction of aldehydes and ketones to alcohols involves transition metals, dissolving alkali metals, harsh reaction conditions, and very reactive reagents. In this presentation we demonstrate the utility of 1-hydrosilatrane – a mild, air-stable silicon-based reducing agent. Both aromatic and non-aromatic aldehydes and ketones have been reduced at high yields using 1-hydrosilatrane and an appropriate Lewis-basic activator.

Abstract #19

A Survey of Personal Hair C care Products for the Presence of 1,4-Dioxane

Allison Westra and Mark Sinton
Department of Natural and Applied Sciences, University of Dubuque

Samples for ten personal hair care products were surveyed by means of a gas chromatography/mass spectral analysis for the presence of 1,4-dioxane, a known toxic substance that is a byproduct of how hair care products are manufactured. Of the products surveyed, none contained a detectable level of 1,4-dioxane, which suggests that manufacturers are doing a good job of removing this substance from their products before shipment. Surprisingly, however, the presence of lilial, 3-(4-tert-butylphenyl)-2-methylpropanal, was detected in two of the ten products tested. Lilial is banned in the European Union, but not in the United States.

Abstract #20

Enzymatic Oxidation of Triclosan

Tyler Wilson and Bradley Sturgeon
Department of Chemistry, Monmouth College

Triclosan is used in many products that range from soaps to toys to mouthwashes because of its antimicrobial properties. Triclosan is believed to have a radical intermediate that allows triclosan to react and form different products. Different products that are formed through radical reactions are hazardous materials. Our research will detect the radical in triclosan and analyze the different products that are formed to characterize if they are hazardous. This will be done by performing trials of triclosan products through HPLC to distinguish and determine the products, followed by NMR and flash chromatography to characterize the samples.

Keynote Address

A Study on the Actin Binding Protein, Palladin, and its Possible Role in Cancer Metastasis

Dr. Ritu Gurung, St. Ambrose University

Biography

Dr. Ritu Gurung is a Visiting Assistant Professor of Chemistry at St. Ambrose University, Davenport Iowa. She received a M.Sc. degree in Chemistry from Tribhuvan University, Nepal, and M.S. and Ph.D. degrees in Chemistry from Wichita State University, Kansas. Chemistry has always fascinated her by explaining the complexity of the world in a logical manner. Her passion towards chemistry was sparked by seeing and learning about the periodic table and she watered her passion by coming all the way from Nepal to the USA to pursue a Ph.D. degree in polymer chemistry. Sometimes unexpected things happen in life which totally shift your interest as well as research pursuits, and the death of her graduate advisor from pancreatic cancer in 2011 led her to change from polymer chemistry to biochemistry. Many questions arose in her mind after his sudden death such as: what happens chemically and physically when you have cancer? What changes may occur in a body? What triggers it to spread all over the body? Is there any way to stop the spreading of cancer? She found herself dedicated to finding the answers to her questions and she sought out the guidance of a biochemistry professor in her department, Dr. Moriah Beck, whose research is focused on understanding the involvement of several critical proteins in cancer metastasis. Currently, Dr. Gurung teaches introductory chemistry and will be teaching biochemistry in the future. In her experience, theoretical concepts are best learned when coupled with hands-on research. She will be adopting an innovative approach of teaching biochemistry lab, which emphasizes research, inquiry and problem-solving experiences rather than the repetition of previously executed experiments.

Abstract

According to American Cancer Society, cancer is the second leading cause of death in the United States. In most cases, cancer survival is directly linked to the ability of cancerous cells to spread cancer, or metastasize, however; there are currently no therapeutic agents that can target directly to the migratory cancer progression. Therefore, it is important to identify proteins that are specifically associated with the migration of cancer to develop preventive care. Actin is one of the most abundant proteins in cells and actin cytoskeleton remodeling is critical for nearly all biological processes inside the cell, and any abnormality in actin-dependent processes may affect cell division, adhesion, as well as motile and invasive properties of the cell. These activities require the coordinated action of a large number of actin-binding proteins (ABPs) that modify the organization of actin by promoting polymerization, stabilizing filaments, causing branching, or crosslinking filaments. Palladin is one of the latest proteins to join the diverse group of ABPs that play an essential role in remodeling of the actin cytoskeleton. Previous experiments have shown that palladin plays an essential role in embryonic development and that overexpression of palladin has been correlated with invasive motility, yet the precise role of palladin in cell motility has yet to be determined. Given the number and diversity of ABPs that are involved in cell motility, these processes must be studied at the level of individual protein-protein interactions. We have employed novel imaging techniques, alongside biochemical and structural approaches to gain insight into the effect of palladin on the morphology of the F-actin network. We conclude that palladin directly controls actin polymerization kinetics and the resulting morphology of crosslinked F-actin networks. This alteration may result in invasive cell motility when palladin expression is enhanced.