Posters at the Capitol:
Undergraduate Research in Northwest Ohio

Statehouse Atrium
Columbus, Ohio
April 17, 2008
POSTERS AT THE CAPITOL:
Undergraduate Research in Northwest Ohio
April 17, 2008
Welcome!

We sincerely welcome you to the 1st Annual Posters at the Capitol: Undergraduate Research in Northwest Ohio event, April 17, 2008. Undergraduate students from all disciplines were invited to submit abstracts for their research posters to be presented at the atrium of the state capitol. This event in Ohio is modeled after the highly successful national Council on Undergraduate Research “Posters on the Hill” display that is held annually in the Capitol of the United States in Washington, D.C.

Conference Organizers:
Christopher S. Dunn, Associate Professor and Associate Dean, College of Health and Human Services
Bowling Green State University
Chair, Networking Committee, UT/BGSU Office of Research Collaboration
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Thomas Kvale, Professor of Physics and Director,
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Paul Moore, Professor of Biological Sciences and Director,
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Invited Institutions:
Bluffton University Bowling Green State University
Defiance College Heidelberg College
Lourdes College Mercy College of Northwest Ohio
Northwest Ohio State Community College Ohio Northern University
Owens Community College Rhodes State College
Terra Community College Tiffin University
University of Findlay University of Toledo
Posters at the Capitol: Undergraduate Research in Northwest Ohio

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Schedule of Events  Statehouse Atrium  April 17, 2008

• 8:00am - 10:00am  Set-up posters
• 10:00am - 11:30am  morning session - present research
• 11:30am - 12:00n  tour Capitol

• 12:00n - 1:30pm  lunch

• 1:30pm - 3:00pm  afternoon session - present research
• 3:00pm - 4:00pm  reception

• 4:00pm -  ending session & remove posters

We gratefully acknowledge support from:

• Bowling Green State University
• The University of Toledo
• UT and BGSU chapters of Sigma Xi (ΣΞ): The Scientific Research Society
• the UT/BGSU Office of Research Collaboration.
Students, Research Presentation Titles

**Bluffton University**

Lindsey K. Pritchett, *Measurement and Mitigation of Radon in Homes*

**Bowling Green State University**

Heather Emch, *Pseudomonas aeruginosa: A Dangerous Bug*

Lauren Fraley, *Citizen Artist*

Michael G. Lambert, *Hospital Acquired or Nosocomial Infection*


Abby Maag, *Factors affecting job satisfaction of school-based speech-language pathologists*

Sarah J. Murrey, *Hormonal Biological Amines Detoxify Acetaldehyde Effects Upon APTT*

Sarah J. Murrey, *Anticoagulant Activity of Captopril*

Amanda L. Stewart, *Why two hands are better than one: The bimanual advantage*

Kyle C. Swank and Julie A. Chaya, *Effects of Speed and Fin Use on Swimming Arm Coordination*

Marta F. Zaleha, *Increasing Pitch Velocity Increases the Magnitude of the Auditory Tau Effect*
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Students, Research Presentation Titles

University of Findlay

Christine D. Bentley, The Financial Knowledge of Students at The University of Findlay and It’s Implications on Credit Card Use and Level of Debt, Personal Health and Relationships, and Financial Pressures: Investigating Whether The University of Findlay Should Require All Students To Enroll in a Personal Finance Course

Jade A. Braman, Epigenetic Events in DNA Repair and Cancer: Promoter Hypermethylation of the hPMS2 Gene in Cancer

Brittany Erbe and Ashley Taylor, Antibiotic Resistance in Rodent Populations Associated with Commercial Farming

Jenna Lemle and Caitlyn Yoder, Can Dispersal Routes of an Introduced Species Be Determined from DNA Analysis?

Kimberly L. Lust, Adaptability Defects Due to Decreased Robustness in an RNA Virus

Laura E. Waite, Epigenetic Events in DNA Repair and Cancer: Promoter Hypermethylation of the hMLH1 DNA Mismatch Repair Gene

Emory S Winship VIII, Construction of a site-specific DNA lesion and measuring the efficiency of DNA repair

The University of Toledo

Lindsey E. Aschbacher, Spermidine/Spermine N\(^2\)-Acetyltransferase 2 (SSAT2): Coactivator for NF-κB and Enhancer of NF-κB Transcription

Katherine Barcelo, Effects of various lubricants on the angle of repose exhibited by several pharmaceutical solids
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Students, Research Presentation Titles

The University of Toledo (continued)

Evan M. DiSanto and Matt Longfield, Retrofit of Henry County ODOT Maintenance Garage

Andrew J Friedmann, Molecular Genetic Analysis of GABA<sub>A</sub> Receptor Trafficking in Caenorhabditis elegans

Mark J Gase, Study on the Bond Strength Between Fiber Reinforced Polymers and Concrete for Use in Retrofit of Aging Infrastructure

Adam M. Gray, Analysis of Protostellar Properties in the Serpens Cluster

Jessica J. Jennings, Development of M<sub>5</sub> muscarinic acetylcholine receptor antagonists

Matthew P. Longfield Jr., Nondestructive Examination of Deteriorated Strand in Prestressed Concrete Box Beams

Nicholas J. Maurer, Synthesis of open-chain epothilone analogues for enhanced selectivity and potency

Nick D Roth and Selena M Grodek, Business Waste Reduction Assistance Program

Emily A. Sopkovich, Temporal and Spatial Population Genetic Structure of the Eurasian Round Goby: Invasion Patterns in the Great Lakes

Adam R. Szabo, Rain Gardens

Ryan M Zeller, Optical Thickness Monitoring System for a High Vacuum Deposition Chamber for Photovoltaic Solar Cells
April 4, 2008

To Undergraduate Researchers, Faculty Mentors, and all Ohioans:

At the core of the higher education enterprise is the desire to advance the state of knowledge for the good of all. While this is an assumed requirement for graduate-level studies, increasingly the academic community understands this to also be an important element of a quality undergraduate student experience.

Bluffton University is committed to the principle of undergraduate research and seeks opportunities to make it available to our students. The one-on-one mentoring and collaboration between faculty and student--which is a defining characteristic of this sort of experience--creates learning and encourages initiative in the best possible ways.

Students and their faculty mentors who participate in undergraduate research projects distinguish themselves in many ways. Often an undergraduate research project helps set a trajectory for a student leading to advanced degrees and fruitful careers in the natural and social sciences. Future employers, local communities, and the state as a whole will benefit from the intellectual capital and economic development which is created in this process.

I am pleased that Bluffton University is a participant in this first Posters at the Capitol: Undergraduate Research in Northwest Ohio event. It is an excellent opportunity for our student and faculty representatives to showcase their projects and to interact with others who value the undergraduate research enterprise. Congratulations to all who participate in the day.

All the best,

James M. Harder, Ph.D.
President
Bluffton University
March 6, 2008

To all Undergraduate Researchers, Mentors, and all Ohioans:

I am very proud of Bowling Green State University’s participation in Posters at the Capitol: Undergraduate Research in Northwest Ohio. As the first such event of its kind, Posters at the Capitol enables our students to showcase the depths of their passion and talent for learning to the lawmakers and citizens of the state of Ohio. Additionally, this event speaks volumes to all Ohioans about our students and the achievements that are possible as the result of higher education.

Students receive numerous benefits through participation in research and creative projects. Their determination and perseverance allows them to demonstrate to future employers that they have the ability to begin a project, nurture it, and follow it through to completion. Additionally, research helps immensely in linking students’ classroom learning to the larger concerns of the world, and aids them in understanding the challenges and rewards of scholarship.

Student research serves a major function of all institutions of higher learning, that of generating greater knowledge. Northwest Ohio can also profit, as a number of our students’ projects have involved significant service-learning work, which helps to hone civic engagement and provides a conduit for students to give back to the communities in which they learn.

Given our current statewide budgetary challenges, the fruits of student research may prove to be an avenue for new economic development in Ohio. The research process and contact with faculty mentors will help prepare students to contribute meaningful, inventive possibilities to the statewide marketplace. I wish all students participating in Posters at the Capitol continued success in their efforts, and look forward to hearing of their future accomplishments.

Warmest regards,

Sidney A. Ribeau, President
Bowling Green State University
March 8, 2008

It is a pleasure to endorse and support POSTERS AT THE CAPITOL: UNDERGRADUATE RESEARCH IN NORTHWEST OHIO.

The purposes of "Posters at the Capitol" are compatible with teaching, learning, initiating research, independent thought, and advancement of knowledge.

Undergraduate research and creative activity certainly benefit students in developing the habit of inquiry, systematic way of considering relative issues, and arriving at logical conclusions.

Undergraduate research also benefits the institution in that it helps to elevate the nature and specifics of programs and brings new ideas and a new focus on matters being studied.

Undergraduate research benefits Northwest Ohio which has a long history of innovation. Numerous individuals from the area have brought benefits to society through their research and have advanced human welfare on a worldwide basis.

Research in Northwest Ohio builds upon that which has occurred previously and that which continues today, such as glass-based solar panels.

Undergraduate research is consistent with recent statewide educational economic initiatives in that it opens opportunities which are not being fully explored now and can lead to effective use of resources of a technical and support nature which are plentiful in Northwest Ohio.

We enthusiastically endorse the approach and look forward to the successful showcasing of undergraduate research in Northwest Ohio at the state capital.

It is a pleasure to thank those responsible for the initiatives which have led to the status and prospects of this program.

DeBow Freed
President
April 10, 2008

To the Organizing Committee of the "Posters at the Capitol: Undergraduate Research in Northwest Ohio":

The University of Toledo's strategic plan, *Directions*, defines "Discovery, Learning and Communication" as one of our core values. Such a value illuminates our respect for purposeful academic research and our desire to encourage students to "vigorously pursue and widely share knowledge." It is in the spirit of this value that I recognize the hard-work of the students, faculty, and staff who joined forces to initiate the first annual Posters at the Capitol: Undergraduate Research in Northwest Ohio, on April 17th in the State House Capitol Atrium in Columbus Ohio.

This event, which is a product of collaboration between The University of Toledo and Bowling Green State University, features students from a variety of schools in Northwest Ohio. Thus, it not only provides students the opportunity to present and improve their research, but it also embodies our commitment to growing and maintaining partnerships among emergent young scholars. Unquestionably, these qualities make Posters at the Capitol a source of pride for our institution.

Ultimately, this event is about engaging students in innovative research and helping them shape their futures. The 38 students participating in this event aspire to a variety of careers: they expect to be the next generation of scientists, engineers, business leaders, medical professionals, educators, artists, and humanists. Posters at the Capitol provides them an opportunity to shape their futures while making an impact on the world with their research. So, again, I thank each of the students, faculty, and staff members from both The University of Toledo and Bowling Green State University for initiating this effort that captures the mission of The University of Toledo and realizes the values of our institution.

Sincerely,

Lloyd A. Jacobs, M.D.  
President

LAJ:dlh
Posters at the Capitol:

Undergraduate Research in Northwest Ohio

Abstracts of Research
Measurement and Mitigation of Radon in Homes
Lindsey K. Pritchett*
Bluffton University
Faculty Mentor: Michael D. Edmiston
Air within a home is sampled with specially designed pumps that draw air through cans that contain activated charcoal. Sampling takes about 12 hours, usually overnight. The cans are returned to Bluffton University and gamma emissions are measured with a NaI scintillation system. If a radon problem is detected, more measurements are performed to pinpoint the source. Often the source is a sump-pump pit or un-trapped floor drain. If the source can be identified, a mitigation plan is developed. Mitigation usually involves a small fan to remove the radon at the source and blow it back outdoors. After the mitigation plan is developed and implemented the home is retested to see if the problem has been solved. Many homes have been tested within a 20-mile radius of Bluffton, Ohio. Patterns of radon have been detected in various geographic locations and patterns of entry into the home have been observed. All detection and mitigation work is done as a public service and as a scientific research program. This is done at no cost to the homeowner. The homeowner is informed in writing that this research is performed by students who are not licensed to do radon testing in Ohio, and therefore the results do not serve any legal purpose and the results could be wrong and mitigation techniques might not work. The data show that almost all homes in this area of Ohio have some radon, and some have significant radon. Many homes with significant radon have been corrected with very simple mitigation techniques.

Importance to Ohio:
Radon in homes is suspected as the 2nd leading cause of lung cancer after tobacco smoke. Radon is a problem in northwest Ohio even though it was not initially thought this would be a radon prone area. This work is making people aware of the problem, and is detecting and correcting the radon problem for residents in the Bluffton area. It is not unreasonable to assume that the life expectancy of some Ohio residents has been increased by this work.

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Infections caused by Pseudomonas aeruginosa can be acquired in many health care facilities, including out-patient clinics, hospitals and nursing homes. The most common type of infections caused by P. aeruginosa are urinary-tract, respiratory-tract, and wound infections. Immunocompromised, elderly, young patients, and individuals suffering from cystic fibrosis or cancers are more susceptible to P. aeruginosa infections than other individuals. Infections caused by P. aeruginosa are difficult to treat due to the prevalence of multidrug resistance strains worldwide. P. aeruginosa strains exhibit a high degree of phenotypic and genotypic diversity. In this study, the phenotypic and genotypic characteristics of clinical isolates of P. aeruginosa obtained from a northwest Ohio hospital were analyzed to determine the similarities and differences among these strains. Phenotypic characteristics analyzed included: serotyping, biotyping, and antibiotic susceptibility testing. Genotyping was determined by the analysis of DNA of selected strains, using polymerase-chain reaction (PCR). Serotyping was conducted by enzyme-linked immunosorbent assay (ELISA) using serotype specific antibodies. Antibiotic susceptibility was performed by the disk-diffusion technique. The pigment production was determined for each strain grown on different media. Growth characteristics and hemolytic properties were also recorded. Although the results showed some noticeable similarities among the strains, the majority of isolates showed unique characteristics. In conclusion, analysis of phenotypic and genotypic characteristics of P. aeruginosa would allow more accurate strain differentiation and detection of epidemic clone(s), for this dangerous organism.

Importance to Ohio:
The health of Ohioans is always an important subject. The Phenotypic and genotypic characteristics studied in this research could allow for more accurate strain differentiation of P. aeruginosa. This means in the future when a hospital encounters a P. aeruginosa infection the strain can be quickly determined and matched to the best treatment.

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This semester, 9 BGSU students have teamed up with 2 social studies classes at Libbey High School in Toledo with the goal of creating a theatre piece with and for Libbey, in order to stimulate thought and ultimately encourage dialogue about an issue within their community. After presenting 4 potential topics to the high school students in the form of short theatrical scenes, Libbey students voted for the topic they felt resonated most with their experiences: bullying in relation to hate crime legislation. With our over-arching theme of what it means to be a citizen, we began to delve into our topic. Through a qualitative study in their school environment (observation, story circles, group discussion), we first only seemed to hear opinions of denial from some students and reluctant admittance from others, despite the fact that they had chosen this topic for exploration. However, many days as we exit the high school, the security guard tells us of the multiple assaults and other deviant behavior, often related to bullying at Libbey. As rapport has been built with the Libbey students, they have become more open about their own bullying experiences, which have ultimately served as inspiration for our material in our upcoming final theatre performance. These students are just approaching age 18, and will carry these experiences with them as they vote on related laws, whether equipped to do so responsibly or not. Our primary project goal was not a policy change, but rather reaching a point of understanding of the complexities of citizenship and the responsibility of being informed on public issues as we present the multiple perspectives in our theatrical piece. While researching this topic in a data-centered manner, we also found out that the honest answers of the students generally matched the numbers: 30% of high school students do in fact experience bullying. We have been exposed to different perspectives through a partnership with guest speakers from UT such as Dr. Jenkins (former attorney) and (Lisa Kovach who specializes in bullying research). Both the BG and Libbey students have had a mutual learning experience, giving an artistic opportunity and outlet for expression/communication in a Humanities/Arts School while encouraging the idea of the active citizen.

Importance to Ohio:
Our topic of hate crime legislation/bullying is one that has become a hot topic of discussion in view of school shootings, even Cleveland’s shooting last October. While one of our discoveries is how difficult bullying is to legislate or even recognize, we do see that it is an ever-growing problem, and specifically Ohio is even considered the 7th worst state involving bullying according to the Census of “Bully Police USA”. Further, as mentioned above, because of the tendency to deny that this bullying exists, the issue is even more of a pressing one. Though we have acknowledged the complexity of legislating these occurrences, we know that for change to occur in a Democracy, action must be taken by the citizens.

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During the past decade, there has been a national increase in the number of hospital-acquired infections. Although gram-positive organisms account for the majority of nosocomial infections, there has been a significant increase in multi-drug resistant gram-negative bacteria, such as Pseudomonas aeruginosa. P. aeruginosa is the focus of the present investigation. Infection caused by P. aeruginosa is of great concern for immunocompromised patients, burn patients, and patients suffering from cystic fibrosis or cancer. The aim of the present study was to determine similarities and differences between our two hundred and eleven clinical isolates of P. aeruginosa. These isolates were obtained from a regional hospital in Northwest Ohio. The phenotypic characteristics studied included serotyping, antibiotic susceptibility, pigment production, and hemolytic properties. In addition to the above characteristics, selected strains (isolated from respiratory or urinary tract infections) were examined for their ability to attach to two human cell lines. These lines were A431 and SK-C7, developed from a lung and bladder respectively. Serotyping was conducted by Enzyme-linked immunosorbent assay (ELISA) using serotype specific antibodies, to determine differential expression of the O-antigen. The antibiotic susceptibility was measured by disk diffusion method. Pigment production was investigated by color production on different media and hemolytic activity was measured by the lyses of sheep red blood and human red blood cells. The attachment of the strains to the human cells was demonstrated by light and electron microscopy. Our results demonstrated high degree of phenotypic diversity among strains tested. We concluded that determination of phenotypic diversity of P. aeruginosa is very useful for differentiation of the clinical isolates and might help us design a more appropriate treatment for individual patients. We also believe a proper infection control protocol is necessary to prevent spreading this dangerous organism in hospitals.

Importance to Ohio:
This research is looking at biological diversity among one of the most prevalent hospital acquired infections. This research will hopefully lead to the development of a treatment program that will be focused on treating each individual infection.

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As a result of the terrorists’ attack on the World Trade Center and the Pentagon on September 11, 2001, the use of aircraft as a threat to national security is no longer an inconceivable peril; it has become reality. To guard against further risk from terrorists, the Transportation Security Administration (TSA) currently mandates security procedures for airports with airline and charter operations. TSA has indicated they would also begin mandating similar security policies at General Aviation (GA) non-towered airports. Because such mandates would require significant funding that is not currently available to these airports, the GA Industry appealed to TSA to permit the GA industry to police itself with regards to heightened security measures. The purpose of this study was to determine what policies and procedures public-use, non-towered airports in Ohio have implemented on their own and what concerns and financial constraints the managers feel are hindrance to implementing tighter security.

There are 176 public-use airports in the State of Ohio. The population used for this study involved the 110 GA airports in Ohio with paved runways, but no ATC control tower. The methodology for this study included sending a letter to the airport managers to explain the study to request their participation in a follow-up telephone interview. The interview was guided by the following questions which framed the study: (1) What are the current security practices at selected GA airports in Ohio? (2) What obstacles were encountered in implementing the security measures? (3) What are the future plans of airport managers to incorporate security measures at those selected airports?

The report findings have not yet been completed because the study has not yet been concluded but the entire report will be finished in time for the April 8th, 2008 Ohio Airports Conference at which this study will be presented.

Importance to Ohio:
This study should benefit BGSU because of the rapport we will establish with airport managers all over Ohio in making these calls. The need for this rapport is especially true since our students are required to complete 3 co-ops with aviation airports or companies in order to graduate. Another reason why this study is vital is that there has not been any research published on the security measures being used at GA Airports throughout Ohio. Finally, this research has been recognized as being important to the Aviation Office of the Ohio Department of Transportation as demonstrated in their request for the students to present their findings on April 8th at the 2008 Ohio Airports Conference in Columbus, Ohio.

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Factors affecting job satisfaction of school-based speech-language pathologists

Abby Maag*
Bowling Green State University
Faculty mentor: Lauren A. Katz

Currently, there are great challenges facing speech-language pathologists (SLPs) who work in public school settings. One of the most widely discussed challenges is the growing number of students that a given SLP is required to provide services to -- this number of students is referred to as a caseload. The increases in incidence of speech-language impairments as well as increases in the number of different disability categories served on a given caseload are at least two factors contributing to larger caseloads for school-based SLPs. These large caseloads mean more demanding workloads, which impact the quality of services that SLPs can provide as well as their personal levels of job satisfaction. To examine this pressing issue, school-based SLPs from across the country were asked to complete a survey that included questions related to caseload and job satisfaction. A total of 1,877 surveys were sent out, and 717 SLPs completed the surveys. The research questions were 1) Has a school-based SLP’s average caseload size changed since recommendations published in 2002 were made? 2) What is the extent to which caseload size relates to perceived manageability of caseload, and does there seem to be a “magic number” of students wherein caseload size is perceived as manageable? 3) To what extent are other factors (e.g., age, experience, working in multiple schools, etc.) related to perceived manageability of caseload size? To examine these questions, descriptive and inferential statistical analyses were conducted. It was found that in order to avoid the likelihood of a school-based SLP feeling a lack of manageability, caseload sizes should not exceed 50 students. Additionally, a logistic regression revealed specific factors that increase the odds of an SLP being “happy” (i.e., perceiving his/her caseload as unmanageable). Identifying those factors that affect happiness of school-based SLPs is an important step towards recruiting and maintaining well-qualified personnel to serve students with speech-language impairments.

Importance to Ohio:
Currently, Ohio is experiencing a shortage of well-qualified school-based SLPs. By identifying the factors affecting job satisfaction among school-based SLPs, steps can be taken to alleviate the issues preventing the retention of well-qualified personnel.

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Serotonin (5-HT), norepinephrine (NE), epinephrine (EP), dopamine (DA), and histamine (H) are each hormonal in nature, derived from amino acids and contain primary amine functional groups (EP contains a secondary amine). These are involved in treating alcoholism, stroke, and abnormal blood pressure. Acetaldehyde (AcH) is the primary metabolite in the metabolism of ethanol. AcH prolongs blood clotting time as followed by prothrombin time (PT) and activated partial thromboplastin time (APTT). Since amines readily react with aldehydic functions to form Schiff bases, the effect of each of these compounds, at pharmacological levels, was tested for their potential to detoxify acetaldehyde. It was observed that the prolongation of APTT by 20.3 (in plasma) was statistically significantly reduced by 0.91 mM 5-HT, 0.91 mM NE, 0.91 mM DA or by 0.91 mM H (concentrations in plasma) when these solutions were pre-mixed with AcH for five minutes at RT prior to addition to the level I plasma. Upon addition of plasma there was an additional five minute incubation period at RT prior to consummation of the APTT reaction. When AcH and the amines were added sequentially to plasma with AcH first, a greater prolongation of APTT was noted as compared to the addition of amines first. This pattern suggests an interaction of the amines with AcH in plasma. Interaction of the AcH with the phenolic hydroxyl to form hemiacetals may also contribute to chemistry of the reaction. While these pharmacological concentrations of the biogenic amines are not found in plasma, their capacity to the influence clotting times in the presence of AcH suggest that the AcH may also react with the amines at the latters’ low concentration, thereby affecting hormonal function.

Importance to Ohio:
This research I did is very important to the State of Ohio because we were able to demonstrate consequences of alcohol on medications. The research, and resulting invitation to the Central Society for Clinical Research meeting to represent BGSU and Ohio, is evidence that the work at BGSU results in contributing to the world of science and medicine. Driven undergraduates, such as myself, have doors open to them upon performing research in which would not have been so if the initial opportunity were not present and supported by the State of Ohio.

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Anticoagulant Activity of Captopril
Sarah J. Murrey*
Bowling Green State University
Faculty Member: Arthur S. Brecher

The antihypertensive drug, captopril, exerted an anticoagulant effect upon clotting time as followed by prothrombin time (PT) and activated partial thromboplastin time (APTT), with prolongation of clotting observed at 4.25 x 10^{-3} Molar and 4 x 10^{-3} Molar captopril for PT and APTT, respectively, using commercial Level I plasma. Utilizing Level III plasmas, PT and APTT values were both prolonged by 4.25 x 10^{-3} Molar captopril. Captopril (6 x 10^{-3} Molar) also directly prolonged the clotting of thrombin in a thrombin-Factor II Deficient Plasma assay, whereas 5 x 10^{-3} Molar captopril inhibited FIIDP in a thrombin-FIIDP assay. In thrombin-fibrinogen assays, pre-incubation of 2.5 x 10^{-3} Molar captopril with fibrinogen also prolonged clotting time, while 3 x 10^{-3} Molar captopril prolonged thrombin activity. These data suggest that thiol-disulfide exchange permits reduction of disulfide groups in thrombin and fibrinogen altering their tertiary structure and physiological function. Lisinopril at a pharmacological 10^{-2} Molar also prolonged APTT although it lacks a thiol group. Polylisin (1k-4k) affected a prolongation of APTT at 6.7 x 10^{-6} Molar suggesting inhibition of clotting by a different mechanism.

Importance to Ohio:
The work I did with captopril is very important to the State of Ohio because we were able to demonstrate why the medicine reacts the way it does when in contact with coagulation factors. The research, and resulting publication, is evidence that the work at BGSU results in contributing to the world of science and medicine. Driven undergraduates, such as myself, have doors open to them upon performing research which would not have been so if the initial opportunity were not present and supported by the State of Ohio which allows us to always recognize Ohio in our professional, future work.

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**Why two hands are better than one:** The bimanual advantage

Amanda L. Stewart*
Bowling Green State University
Faculty Mentor: J. Devin McAuley

When tapping in synchrony to a regularly-paced beat with both hands (bimanual tapping) compared to one hand (unimanual tapping), a reduction in timing variability occurs. This bimanual advantage (BA) is a heavily established phenomenon and is cited as support for the multiple-clock hypothesis. This study synthesizes previous literature on BA, and more importantly, proposes an explanation of BA alternative to the multiple-clock hypothesis. In two experiments, we propose that BA is an artifact of drift from the target tapping rate and is in part a consequence of Weber’s law. This law predicts a decrease in variability if the tapping rate increases, as well as a change in variability magnitude in proportion to the tapping rate. The first experiment replicated BA through a synchronize-continue task, similar to Helmuth and Ivry, Experiment I (1996). Although target rate was identical across conditions, participants tapped at a faster rate during bimanual tapping relative to unimanual tapping. Treating this difference as a covariate erased the statistical significance of BA. The second experiment was similar to Experiment I, with the addition of four conditions that differed in tapping rate. For both unimanual and bimanual conditions, timing variability between taps varied in proportion to the manipulated tapping rate. These results are consistent with Weber’s law and significantly weaken the multiple-clock hypothesis when considered in conjunction the difference in reported tap rates for unimanual and bimanual conditions consistently observed in previous studies.

**Importance to Ohio:**
Not only is basic research important for developing students and research institutions in Ohio, it is important to generate novel ideas that lead to innovative thinking about current problems. For example, Parkinson disease is characterized by substantial motor impairments, but also by less-known impairments in time perception and tasks involving the coordination of homologous limbs. Understanding the neurobiological mechanisms behind these impairments provides new applications for the prevention and treatment of Parkinson disease and other diseases marked by timing deficiencies, which will in turn substantially impact the community, state, and globe.

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Effects of Speed and Fin Use on Swimming Arm Coordination
Kyle C. Swank and Julie A. Chaya*
Bowling Green State University
Faculty mentor: Stephen J. Langedorfer
The purpose of our study was to determine whether the proposed front crawl arm coordination patterns of catch-up, opposition, and superposition (Chollet, et al., 2000, Siefert, et al., 2006) represents a valid and reliable developmental sequence. We also sought to identify whether task constraints associated with swimming speed and fin use alter the participant’s arm coordination pattern. Knowledge gained from the results of this study has implications for basic research in developmental motor control as well as provides very practical information for swimming instructors and coaches that may improve the instruction of swimming. We propose that improved swimming skill leads to a reduction in the risk of drowning, an important public health concern. After completing informed consent, two groups of participants (i.e., N=16 experienced Masters swimmers; N=40 college-aged students enrolled in swim class) swam 4 trials of swimming with and without swim fins at preferred and sprint speeds for a total of 20 trials. During each swim, we videotaped the swimmer with an underwater periscope and with an above-water camera. Subsequently, we reduced the underwater videotape as the coordination patterns and determined each swimmer’s arm stroke index (ASI) from the above water camera. In order to test validity of the proposed developmental sequence, we used each participant’s ASI as the ‘marker variable’ against which to compare the arm coordination pattern. The Masters swimmers never used the catch-up arm pattern, although several of the beginning swimmers did. There appears to be limited evidence that swimmers may change their arm coordination patterns in predicted order as they alter efficiency and effectiveness with speed or fins. We recommend that research be conducted examining other factors such as effort or energy expenditure on a broader sample of swimmers.

Importance to Ohio:
Knowledge gained from the results of this study has implications for understanding how the human body organizes itself, especially in buoyant environments such as water. More importantly, the results provide practical information for swimming instructors and coaches who are interested in reducing the rate of drowning in Ohio and the U.S. as a whole. Several estimates suggest that fatal and non-fatal drowning may have an economic cost exceeding a billion dollars annually. We propose that our results may improve the instruction of swimming which in turn should be linked to the reduction of drowning, an important public health concern.

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Increasing Pitch Velocity Increases the Magnitude of the Auditory Tau Effect
Marta F. Zaleha*
Bowling Green State University
Faculty mentors: John D. McAuley and Molly J. Henry

This experiment sought to examine the effects of pitch velocity on the magnitude of the auditory tau effect in order to test contrasting predictions made by the difficulty and auditory motion hypotheses. The auditory tau effect is a perceptual distortion that occurs when judgments of pitch are systematically influenced by changes in the timing of tones (Helson and King, 1931). Two opposing theories that attempt to explain why these perceptual distortions occur are the difficulty hypothesis and the auditory motion hypothesis. The difficulty hypothesis posits that tau effects occur when judgments of the to-be-judged dimension (pitch) become increasingly difficult, increasing reliance on the to-be-ignored dimension (time). The auditory motion hypothesis assumes that regularly spaced and timed auditory sequences induce a “feeling of motion” in the listener, and thus generate an expectancy of where and when a tone should occur. This experiment was a 2 x 5 x 8 mixed factorial design. Two base inter-onset intervals (IOIs; 364ms and 800ms) were crossed with five time levels (±0, 33, and 66% of the base IOI, relative to the temporal bisection point) and eight pitch levels (±100, 75, 50, and 25 cents relative to the pitch bisection point). The listener would hear a three tone sequence and judges whether they thought the middle tone sounded closer in pitch to the first tone (A) or last tone (B), while ignoring the timing manipulations. A two (velocity) by five (time levels) by eight (pitch levels) mixed measures ANOVA on the proportion of B responses revealed a main effect of pitch, $F(7,70)=3.926$, $MSE=0.018$, $p<0.001$, meaning that when the target tone was closer in pitch to A, participants responded A more often and when the target was closer in pitch to B, B responses were greater. There was also a main effect of time, $F(4,40)=12.967$, $MSE=0.230$, $p<0.001$, thus the participants responses were biased by timing manipulations. An interaction of time and velocity occurred, $F(4,40)=4.222$, $MSE=0.230$, $p<0.01$, indicating that the tau effect was stronger in the fast condition than in the slow condition. This result was predicted by the auditory motion hypothesis, thus, the results of this study support the auditory motion hypothesis. As pitch velocity increased, the magnitude of the tau effect increased. Therefore, larger velocities resulted in larger tau effects.

Importance to Ohio:
Conducting good basic research, such as this study, is an important skill to learn for any student of a scientific discipline aspiring to become a professional in their field. Fostering the growth of scientific expertise within the state of Ohio lends to a richer and more robust academic atmosphere.

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The Financial Knowledge of Students at The University of Findlay and It’s Implications on Credit Card Use and Level of Debt, Personal Health and Relationships, and Financial Pressures: Investigating Whether The University of Findlay Should Require All Students To Enroll in a Personal Finance Course.

Christine D. Bentley*
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Faculty Mentor: John A. Malacos

Credit card use among college students continues to increase leading to financial pressures and hardships not only during the time spent in college, but also, after graduation. Students are often times ill-prepared for the adult responsibilities of balancing a checkbook, buying a new car, or signing a mortgage for a house. At The University of Findlay, about 250 students were randomly surveyed regarding their personal financial knowledge and behaviors including questions pertaining to the Fair and Accurate Credit Transactions Act, credit cards and their use, and personal behaviors such as the number of credit cards in their name, personal financial concerns, and their perception of their spending. From the data collected, analysis shows that college students who attend The University of Findlay do not have a sufficient level of knowledge regarding personal finances. Also, students showed a general interest in learning more about how to create a budget/spending plan, setting attainable financial goals, and preparing for retirement. Therefore, the argument can be made that The University of Findlay implements a required personal finance course for all undergraduate students that allows them to leave college with a smaller debt load of along with feeling financially competent with today’s unpredictable economy.

Importance of the research for Ohio:
While this research study is aimed towards The University of Findlay and its students, individuals including college students throughout the state of Ohio and the nation are struggling with their personal finances. With the growing number of adults facing bankruptcy and housing foreclosures, states that offer/mandate personal finance courses to students in high school and college can decrease the number of individuals affected by financial troubles later in life. Therefore, this study provides the initial evidence as to why the state of Ohio should complete additional research regarding the personal financial knowledge and behaviors of high school and college students in order to eventually mandate that high schools and colleges/universities in the state of Ohio provide a personal finance course to their students.

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Epigenetic Events in DNA Repair and Cancer: Promoter Hypermethylation of the hPMS2 Gene in Cancer

Jade A. Braman*
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The epigenetic regulation of human genes and their association with disease are not well understood. The hPMS2 protein is a DNA repair protein associated with correcting mispaired DNA bases immediately after replication. Currently there is little evidence in literature which suggests that the hPMS2 DNA repair protein can be epigenetically regulated by methylation of its promoter areas. However, the hPMS2 protein is stable only when in its dimer form with hMLH1 and literature does suggest epigenetic regulation of hMLH1. Our working hypothesis is that hPMS2 gene is regulated in a concurrent manner with hMLH1. This may involve similar transcription factor binding elements and promoter methylation sites. Furthermore, the epigenetic silencing of hPMS2 may be involved indirectly in the cancer process. A bioinformatics approach was used to determine potential sites of transcriptional regulation extending from exon 1 to -3000 nucleotides upstream of the hPMS2 gene. Putative transcription factor binding sites and CpG promoter regions have been identified and mapped using this approach. Over 30 potential transcription factor binding locations have been predicted in this area and a 316 nucleotide CpG island is located at position -160 to -473 upstream (5') of the transcriptional start site. Using this information optimal primer sequences for PCR amplification of the identified CpG island were constructed for further investigation. Currently, the genomic DNA from cancer cells grown in culture has been isolated for bisulfite treatment followed by PCR amplification. This process will be used to identify cytosine methylation sites in the amplified promotor region. In the future, different cancer cell lines originating from different tissues will be tested to determine if methylation patterns in CpG island areas can be used as predictors for tumorigenesis. These results will be compared to hMLH1 results from the same cancer cell types. If hPMS2 regulation is concomitant with that of hMLH1, and this regulation is coordinated we expect to see similar methylation patterns in the promoter areas. This research is significant in providing a potential approach to measure the epigenetic contribution to the cancer process, and as a potential biomarker for cancer progression.

Importance to Ohio:
There is a significant rate of people in Ohio that are diagnosed with colorectal cancer each year and many of those people die. The incidence rate of colorectal cancer in Ohio as of 2004 was 47.8-52.9 people per 100,000 people and the mortality rate was 19.7-22.1 per 100,000 people. This basic mechanistic research will help researchers to be able to understand and predict cancer more efficiently, resulting in better ways to design more effective treatment strategies.

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Antibiotic resistance in animals raised on commercial farms has been well documented in recent literature; however, little has been documented on the impact of wildlife in the vicinity of these farms. Our study focused on comparing antibiotic resistant bacteria in rodent populations from a variety of farming practices in NW Ohio to determine if the prevalence of antibiotic resistance was higher in rodents associated with commercial farms. Bacterial isolates resistant to bacitracin, streptomycin, erythromycin, and tetracycline were isolated in all populations. Tetracycline resistant strains were tested to determine growth rate constants in varying tetracycline concentrations to determine if the Eagle Effect was demonstrated. Isolates were additionally screened for the presence of tetA, tetB, tetC, tetD, tetE, tetF, and tetM genes.

Importance to Ohio:
This research emphasizes how antibiotic use for growth promotion on commercial farms impacts the spread of resistant bacterial strains to surrounding wildlife. Testing was completed on samples collected on commercial farms in NW Ohio.

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DNA analysis is routinely used to determine parentage of individuals, population genetic structure, and phylogenetic relationships of populations and species. The Mediterranean gecko, *Hemidactylus turcicus* (Gekkonidae), introduced into the southeastern United States in the early 1900’s, experiences founder effects that decrease the number of genetically variable geckos by rapid dispersal of a few individuals to localities well away from their initial point of entry in the Gulf Coast region. Evidence suggests trucks carrying contaminated cargo as the mode of dispersal. If initially introduced populations of *H. turcicus* represented a limited number of unique sequence types, then founder effects may determine that distant populations have only one or a few of these unique types, possibly revealing the point of origin and the dispersal routes of founding individuals. We isolated gDNA from gecko tissue collected across the southern United States, from Florida to Nevada, and studied the sequence variation of the mitochondrial 16SrRNA gene using PCR, RFLP patterns on gels and DNA sequencing. Currently, the investigation is too preliminary to report results. However, we anticipate genetic uniformity within samples from distant locations relative to more genetically diverse Gulf Coast samples, and genetic diversity among samples from distant locations – each location with a limited number of identifying sequences.

**Importance to Ohio:**
Little is known about the genetics of populations of invasive species of vertebrates. In the United States, the Mediterranean gecko poses no threat to native wildlife and only one introduced population is known from Ohio. However, *H. turcicus* can serve as a model species for the genetic consequences of rapid dispersal.

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Adaptability Defects Due to Decreased Robustness in an RNA Virus

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Vesicular stomatitis virus (VSV) subjected to repeated genetic bottleneck in hamster cells have a defect in their adaptability (defined as their capacity to adapt to a given environment) compared to control, non-bottlenecked strains. Adaptability was measured as the rate of fitness increase averaged from multiple replicas. However, occasionally individual replicas of some viral strains with overall adaptability defects undergo fitness increases comparable to those of the controls. Virus survival depends not only by its degree of adaptation (fitness), but also by their ability to incorporate mutations with minimal fitness cost (robustness). We hypothesized that strains with adaptability defect have lower robustness than controls strains. The hypothesis was tested using four VSV viral strains: two strains derived from MARM U (a control strain) and two strains derived from MRb (a strain that is neutral compared to MARM U, but has an adaptability defect.) Each test strain was subjected to six replicas of a regime of plaque-to-plaque passages, which allows the fixation of any non-lethal mutation. After 20 passages fitness was determined in triplicate for each population by direct competition against wild type reference, for a total of 72 determinations. The two controls strains lost fitness from 7.8±0.98 to 4.57 and from 6.2±1.11 to 3.98. The test strains decreased their fitness from 6.2±0.67 and 7.2±0.41 to 2.54 and 1.26, respectively. Thus, the overall fitness loss was more marked in viruses with adaptability defects (p≤0.005), demonstrating a larger average negative effect of mutations in strains with adaptability defects, and, therefore, a lower robustness.

Importance to Ohio:
Research on viruses is significant because they are the cause of many diseases and illnesses found throughout not only Ohio but the whole world. Studying viruses allows researchers to gain a better understanding of viral behavior and evolutionary processes. This in turn will help to develop better vaccination methods for treating people affected by specific viruses.

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Epigenetic Events in DNA Repair and Cancer: Promoter Hypermethylation of the hMLH1 DNA Mismatch Repair Gene
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The epigenetic regulation of human genes and their association with disease are not well understood. The hMLH1 protein is a DNA repair protein associated with correcting mispaired DNA bases immediately after replication. There is currently evidence in literature which suggests that the hMLH1 DNA repair protein can be epigenetically regulated by methylation of its promoter areas. Our working hypothesis is that promoter methylation is involved in the regulation of the hMLH1 protein in normal cells and that epigenetic silencing may induce the cancer process, specifically in relation to a subset of sporadic colon cancers. A bioinformatics approach was used to determine potential sites of transcriptional regulation extending from exon 1 to -3000 nucleotides upstream of the hMLH1 gene. Putative transcription factor binding sites and CpG promoter regions have been identified and mapped using this approach. More than 50 potential transcription factor binding locations have been predicted in this area. Additionally a 324 nucleotide CpG island is located 5’ of the predicted transcriptional start site at position -190 to -514. Using this information optimal primer sequences for PCR amplification of the identified CpG island were constructed for further investigation. Currently, the genomic DNA from cancer cells grown in culture has been isolated for bisulfite treatment followed by PCR amplification. This process will be used to identify cytosine methylation sites in this region. In the future, different cancer cell lines originating from different tissues will be tested to determine if methylation patterns in CpG island areas can be used as predictors for tumorigenesis. This research is significant in providing a potential approach to measure the epigenetic contribution to the cancer process, and as a potential biomarker for cancer progression.

Importance to Ohio:
Currently the exact cause of most colorectal cancers is not known, and it is the third most common cancer in men and women. According to the American Cancer Society and the Ohio Department of Health, in Ohio alone there has been an incidence of colorectal cancer in 3,271 Males and 3,288 Females from 2000-2004, with a mortality rate of 1,266 Males and 1,311 Females. It is statistics like these that make our research to understand and predict cancer important to Ohio. The basic mechanistic research we perform is hoped to one day provide the basic research information needed to help other researchers design strategies in the early diagnosis of cancer, which will then allow for better treatment strategies.

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Construction of a site-specific DNA lesion and measuring the efficiency of DNA repair

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Oxidative damage of DNA is a frequent event which the cell corrects using specialized DNA repair proteins. The inability of cellular DNA repair proteins to efficiently correct DNA damage leads to the accumulation of genetic mutations which drives the cancer process. This project is investigating the ability of these specialized proteins to repair specific DNA damage. We hypothesize that different cancer cell types have varying capacity to affect repair of DNA, and that the inability to repair specific DNA lesions may predict the progression of cancer. To experimentally address this hypothesis, we have designed and constructed defective DNA substrates using a known hotspot of mutation. In this design, 8-hydroxyguanine, a well defined lesion resulting from oxidative damage of DNA, is mispaired to adenine. This lesion occurs in replicating cells subjected to oxidative damage. We have constructed a plasmid containing this specific 8oxoG:A lesion. This plasmid was introduced into two strains of bacteria and repair efficiency was measured. Repair efficiency can be measured using restriction enzymes to determine if the substrate DNA molecule has been repaired. The results indicate that the mutant bacteria was unable to efficiently repair this DNA substrate (<50%) while the wild type bacteria showed robust repair (>90%). Having successfully shown that bacterial DNA repair rates differ in this model system, repair by nuclear proteins collected from human cancer cell lines can now be measured. Currently, we are measuring the repair profile of colon derived cancer cells. We anticipate that the various cancer cell types will differ in their ability to repair the 8oxoG:A lesion.

Importance to Ohio:

Between 2000 and 2004, 3,271 men and 3,288 women were diagnosed with colorectal cancer, while 1,266 men and 1,311 women died from the disease (ACS 2007). These studies will help our understanding of the mechanisms driving the proliferation of cancer and should allow for better diagnoses and treatments. This will allow the many Ohioans afflicted with colorectal cancer to fight and survive this devastating disease.

www.cancer.org/docroot/COM/content/div_OH/COM_12x_OhioFactsFigures.asp

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Spermidine/Spermine N⁰-Acetyltransferase 2 (SSAT2): Coactivator for NF-κB and Enhancer of NF-κB Transcription

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The NF-κB pathway is associated with several cellular processes, which include immune and inflammatory responses, development and differentiation, cellular growth, and apoptosis. Dysregulation of such processes is associated with cancer, arthritis, chronic inflammation, asthma, neurodegenerative diseases, and heart disease. Recent studies indicate that continuous nuclear NF-κB activity protects cancer cells from apoptosis and may stimulate growth. Therefore, many current anti-tumor therapies seek to block NF-κB activity as a means to inhibit tumor growth or to sensitize the tumor cells to more conventional therapies, such as chemotherapy. To identify new proteins that interact with NF-κB to regulate its ability to activate transcription, we carried out a yeast two-hybrid screen using the C-terminal transactivation domain of the p65 subunit of NF-κB as the bait. Through this screen we identified the spermidine/spermine N⁰-acetyltransferase 2 (SSAT2) protein. SSAT2 was originally identified based on its homology to SSAT1, an enzyme involved in polyamine metabolism. SSAT2 is 46% identical and 64% similar to SSAT1. Despite this homology SSAT2 seems to have functions distinct from SSAT1. Our findings indicate that SSAT2 functions as a transcriptional coactivator to enhance NF-κB activity. SSAT2 transiently associates with the promoters of NF-κB-regulated genes in an inducible manner and cooperates with the CBP and P/CAF coactivators to further enhance TNFα-induced NF-κB activity. Recent evidence indicates that SSAT2 may also function in the regulation of NF-κB nuclear translocation since knockdown of SSAT2 expression using siRNA inhibits the TNFα-induced degradation of the IκBα protein, the inhibitor of NF-κB activity. Future experiments will establish SSAT2 as an effective means of manipulating the NF-κB pathway thereby inhibiting the development of NF-κB-related diseases such as cancer.

Importance to Ohio:
The Ohio Department of Health has reported an average of 56,000 cancer diagnoses each year in the state of Ohio; understanding the link between chronic inflammatory diseases and cancer and the role that NF-κB plays in this will help in the development of new therapies and improve the quality of life for afflicted individuals. Additional benefits of scientific research in Ohio include job generation, which stimulates the economy, and scholastic advancement amongst academic researchers and students in higher education.

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Effects of various lubricants on the angle of repose exhibited by several pharmaceutical solids
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This research is designed to observe the effects of various lubricants on the angle of repose exhibited by several pharmaceutical solids. The pharmaceutical solids included Calcium Phosphate, Magnesium Oxide, Calcium Carbonate, Magnesium Carbonate, and Lactose. The Lubricants employed in various percentages included Corn Starch, Stearic Acid, Microcrystalline cellulose, Starax 1500, and Magnesium Stearate. The angle of repose is referred to as the maximum angle of a stable slope determined by many properties such as friction, cohesion, and the shapes of the particles. Pharmaceutical solids containing various amounts of lubricant were placed in a funnel and allowed to flow from a height of 5.5 inches onto a clean glass horizontal plate, forming a conical pile. The internal angle that lies between the surface of the pile and the horizontal surface is referred to as the angle of repose. Certain changes may alter the flowability of a powder including variation in the processing conditions such as humidity or temperature of the air. Changes in the powder itself may also affect the flowability of the powder including particle size distribution, mean particles size, and particle shape. Powder flow is important in the pharmaceutical industry in early tablet and capsule formulation development as to optimize the formulation and its flow characteristics. The effects of the various lubricants on the angle of repose were compiled and their effects were compared. The results revealed that lubricants typically altered the angle of repose between 3-6 degrees, while the percentages of lubricant required to alter the angle ranged from .01% to 20%.

Importance to Ohio:
There are several pharmaceutical companies in Ohio that rely on research for tablet and capsule formulation development. By observing the effects of various lubricants on the angle of repose of pharmaceutical solids, Ohio companies can optimize a formulation and its flow characteristics.

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Retrofit of Henry County ODOT Maintenance Garage
Evan M. DiSanto and Matt Longfield*
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Faculty Mentor: Cyndee L. Gruden

ODOT’s Henry County Highway Garage is in need of renovations in the areas of the building, site layout, and water management. The goal is to provide the garage workers with an adequate and efficient retrofit to their facility to bring it up to present standards. In the development of the proposal, innovative methods were investigated to address the current problems within the facility while considering the given constraints. During this process, the budget was understood and all possible efforts were made to maintain an engineer’s social responsibility. Our research group has worked together to come up with ideas to improve each area of the site that needs it. The primary objectives of the project included the redesign of the site layout and pavement, maximization of the space in the garage, improving water management, and providing ways to reduce energy to meet the required mandate of the state. After much hard work and research, our group has come up with a new site layout that includes prefabricated buildings, better traffic flow, and new pavement. We have also researched ways to deal with the water runoff on the site to comply with the Ohio EPA. A new building plan has been designed to provide the workers with maximum space and comfort. Also, we are making recommendations to help decrease the energy consumption on site. Our design group developed many valuable skills during this project and learned that communication with each other and the client is critical. We all demonstrated great leadership qualities and are proud to provide ODOT with the new design. These ideas are significant because they will not only provide the workers with a better and safer working environment, but also a base for future research in similar areas.

Importance to Ohio:
This research is significant to Ohio because it is providing Ohio employees with a better working environment. Not only will it increase the morale of the workers, but the proposed design will increase efficiency and productivity of the work being performed. The proposed ideas can also stimulate others to come up with innovative ways to improve other facilities.

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Molecular Genetic Analysis of GABA_A Receptor Trafficking in 
*Caenorhabditis elegans*

Andrew J Friedmann*

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Faculty Mentor: Bruce A Bamber

Synapses are the sites of communication between neurons in the brain. Neurotransmitters are released by the presynaptic terminal, and detected by neurotransmitter receptors on the postsynaptic cell. The abundance of neurotransmitter receptors on the postsynaptic cell surface determines the strength of the synapse, and in turn influences the function of neural circuits. We study the aminobutric type A (GABA_A) receptor, which is the principal inhibitory neurotransmitter receptor in the brain. We use the nematode *Caenorhabditis elegans* as an experimental system because its GABA receptor is simple and well defined compared to the structurally more complex and heterogeneous mammalian GABA_A receptor, and *C. elegans* can be manipulated much more easily using genetic techniques.

Trafficking through the endocytic system controls the abundance and surface expression of GABA_A receptors at synapses. Exposure of *C. elegans* to an activator of the GABA_A receptor appears to switch GABA_A receptor trafficking from a predominately recycling pathway to a predominantly degradative pathway. This switch leads to a sharp reduction of GABA_A receptor abundance and reduced synapse strength. To better understand these pathways and how they are controlled, I have constructed a series of nine proteins tagged with green fluorescent protein (GFP) that localize to different parts of the endocytic machinery: chc-1, rab-5, rme-6, and apt-4 (endocytic vesicles), eea-1 (early endosome), rab-7 (late endosomes), rab-11, rab-10, and rme-1 (recycling endosomes). I am currently constructing transgenic worms that express these proteins, to chart the itinerary of GABA_A receptors as they recycle or traffic to degradative organelles.

**Importance to Ohio:**
GABA_A receptors are essential proteins in the nervous system that inhibit cellular excitability. Anti-epileptic and anti-anxiety therapies target the GABA_A receptor, however, there is a need for improved therapies. We are trying to understand the basic biology that controls regulating the receptor which could lead to improved drugs for these diseases.

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Study on the Bond Strength Between Fiber Reinforced Polymers and Concrete for Use in Retrofit of Aging Infrastructure

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Fiber reinforced polymers (FRP) have been found to be an excellent material for use in strengthening of reinforced concrete structures such as buildings and bridges. Many advantages, including their light weight and resistance to weathering, have made FRP sheets a desirable alternative to steel plates in such applications. FRP sheets used for strengthening concrete structures have been shown to typically fail by either FRP rupture or debonding from the concrete surface. Through a review of existing literature, a number of parameters have been identified to affect the strength of the FRP-concrete interface. These parameters have been categorized as relating to either the fiber composite material, adhesive, or concrete. Key parameters involving the fiber composite material include the stiffness and bond length. Adhesive stiffness, concrete compressive strength, and surface preparation have also been shown to influence the bond strength. Lastly, different test setups have been analyzed to determine the best method to test the FRP-concrete interface. Although many tests have already been performed, it has been determined that further investigations are necessary in order to assure the safety, enhance the performance, and optimize the design of FRP-retrofitted concrete structures. In particular, it is important to explore the parameters that influence the rupture of FRP sheets, as well as the effects of using multiple layers with various stacking orientations.

Importance to Ohio:
Fiber composite sheets have several advantages over steel plates in repair and rehabilitation of aging concrete structures. The advantages of using fiber composite materials include high strength to weight ratio, resistance to corrosion, and fast and easy installation. The application of fiber composite materials as an alternate retrofit technique has gained popularity throughout the world. The present study offers state of the art review on the best practices and knowledge gained through various investigations related to the utilization of an innovative material such as composites to enhance the performance of deteriorating structures.

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Analysis of Protostellar Properties in the Serpens Cluster

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We present an infrared and submillimeter wavelength study of the properties of protostars, young stars that have not yet begun the process of fusion and are still accreting mass, in the Serpens cluster located approximately 260 parsecs away. We use infrared photometry from the Spitzer Space Telescope’s MIPS and IRAC instruments to examine protostars detected in previous submillimeter surveys of the Serpens cluster. The protostars have measured photometry ranging from between the 3.6 μm and 850 μm bands. The data was inputted into an online fitter program to compare to a grid of models of protostars; by identifying which models show the best fit we can constrain the physical properties of the protostars. Out of 14 sources, we concentrate on seven protostars that have photometric measurements from 3.6 to 70 microns. We find that the 450 and 850 micron fluxes are not well fit by the models. These fits constrain the luminosities of the protostars to 0.656 to 61.2 Lsun and mass infall rates to 8.49x10^{-7} to 8.19x10^{-4} Msun per year. We also discuss the constraints placed on the disk properties of the protostars.

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Development of $M_5$ muscarinic acetylcholine receptor antagonists
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Faculty mentor: William S. Messer Jr.

The $M_5$ muscarinic acetylcholine receptor has been implicated in the rewarding properties of opiate-based analgesic drugs such as morphine. It has been hypothesized that an antagonist of the $M_5$ receptor would reduce the pleasurable feelings associated with opiate drugs without diminishing their analgesic medicinal effects. The discovery of a compound able to inhibit the $M_5$ receptor thus could be of great value in the treatment and prevention of drug abuse. Muscarinic receptors are membrane-bound acetylcholine receptors found in the central and parasympathetic nervous systems. Acetylcholine activation of $M_5$ receptors may control the expression of opiate reward by promoting release of dopamine in certain brain regions as well as mediating withdrawal symptoms. The purpose of this study is to test the affinity of several new compounds for the $M_5$ receptor in comparison with other muscarinic receptor subtypes ($M_1$-$M_4$). The identification of a selective $M_5$ antagonist is the ultimate objective of this research. This experiment includes receptor binding assays on each of the five muscarinic receptor subtypes to determine the affinity of the compounds for each muscarinic receptor in vitro. The compounds tested include known muscarinic antagonists, which do not exhibit any selectivity for muscarinic receptor subtypes. These compounds serve as suitable controls. Other compounds tested include a series of novel compounds. All compounds are tested for their ability to inhibit the binding of a nonselective muscarinic antagonist ($[^3H]-(R)$-quinuclidinyl benzilate) to each of the five muscarinic receptors. The studies should help identify novel compounds with improved affinity and selectivity for $M_5$ muscarinic receptors as the first step toward the development of a new treatment for drug abuse.

Importance to Ohio:
Drug abuse is a problem in all states. The entire United States could benefit from this research, including but not specifically Ohio.

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Nondestructive Examination of Deteriorated Strand in Prestressed Concrete Box Beams
Matthew P. Longfield Jr.*
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Faculty Mentor: Douglas K. Nims

There is an immediate need for a nondestructive inspection technique to assess the condition of the high strength steel tendons encased in prestressed concrete. These tendons are essential to the structural integrity of prestressed concrete bridges. In the typical annual visual bridge inspection, conditions conducive to strand corrosion may be observed, but no direct visual indicators of strand corrosion are known. Thus, the tendons may deteriorate to the point where the bridge is unsafe without being detected.

An approach which is able to detect corrosion products or changes in the concrete-prestressing steel interface boundary conditions caused by corrosion is required. The technique must be capable of “seeing” through concrete. The magnetic properties of rust are orders of magnitude different from those of uncorroded steel. The detection of this variation could lead to determining the amount of strand deterioration and, coupled with additional analysis, the load carrying capacity of a bridge. An initial review of the literature has established both the potential of using magnetic imaging and the paucity of work in using magnetic techniques to assess corroded strand. In the present work the available literature is being examined and a proof of concept experiment is being designed. This research could be the foundation of work that saves lives as well as reduces the life cycle cost of this type of bridge.

Importance to Ohio:
Many Ohio bridges susceptible to this failure mechanism exist. Some were built as long ago as the 1960s and some Ohio bridges have failed. The Ohio Department of Transportation (ODOT) has estimated that this type of bridge represents approximately 10% of the bridge square footage in the Ohio bridge inventory. ODOT is participating in a National Cooperative Highway Research Program pooled fund study to survey the problem and has funded the dissection of a failed Ohio bridge.

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Synthesis of open-chain epothilone analogues for enhanced selectivity and potency.

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Faculty Mentor: L. M. Viranga Tillekeratne

Recently, our laboratory reported the synthesis of a new class of open-chain analogues of the important microtubule-stabilizing anticancer agent epothilone. These compounds showed selective activity in tested cancer cell lines. We have designed a library of structurally diverse analogues of these open-chain epothilones to further enhance their selectivity and potency. The structure-activity relationship studies of epothilones have shown that the southern half of the molecule is critical for biological activity. However, the northern half of the molecule, including the aromatic side chain, has successfully been modified with retention of activity and efficacy. Therefore, a synthetic plan was designed and executed to develop a variety of aromatic moieties for coupling to the southern region of the compound to generate the open-chain analogues, which also included a cyclopropene moiety which acted as a molecular scaffold holding the two parts together. The synthesis of selected members of this library of open-chain analogues is described. The compounds synthesized were characterized by spectroscopic techniques including nuclear magnetic resonance spectroscopy. Stereochemical assignments were made based on Mosher ester analysis.

Importance to Ohio:
The American Cancer Society estimated that in Ohio in 2007, 59,400 new cases of invasive cancer will be diagnosed, including approximately 8,500 cases of lung and bronchus cancer; 6,700 cases of colorectal cancer; 9,000 cases of female breast cancer; and 8,800 cases of prostate cancer. The mortality rates of cancer in Ohio have also been found to be 7% higher than that of the United States average. This research may lead to new anticancer agents that may help decrease the risks of mortality and improve treatment for cancer patients, thus improving quality of life for not only patients, but also family and friends, many of whom are Ohio residents.

Sources:

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Business Waste Reduction Assistance Program
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In the Environmentally Conscious Design and Manufacturing Laboratory, students and faculty are working with local government and businesses to protect the environment by preventing solid waste from entering local landfills. This is accomplished with a grant from the Lucas County Solid Waste Management District to aid in making local manufacturers and businesses determine the amounts of their waste streams are recyclable material. During the audit stage, a site is visited and their waste streams determined by a series of measurements and cataloging; from there, the components are broken down and it is researched as to whether or not the waste materials produced can be utilized for other purposes. Then in the final report composition stage, the yearly landfill impact that the company has on the environment is calculated and broken down into what components can be recycled, and therefore kept out of the landfill. These studies also extend into the realms of energy conservation and proper utilization. The tasks of a research assistant in this lab also may include conducting container audits for the county, optimizing truck routes to determine the most efficient use of time and resources, conducting used oil surveys, landfill audits, as well as the ongoing work to make The University of Toledo a far greener campus through recycling initiatives.

Importance to Ohio:
This research lab is very important to Lucas County as a part of Ohio in that it is a continuous program to make the county a more environmentally conscious community.

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Temporal and Spatial Population Genetic Structure of the Eurasian Round Goby: Invasion Patterns in the Great Lakes

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The Ponto-Caspian round goby Apollonia melanostoma (formerly known as Neogobius melanostomus) invaded the Lake St. Clair region of the North American Great Lakes in 1990 via ballast water. It quickly spread throughout the Great Lakes and is now one of the most abundant benthic fishes in the lower Great Lakes. The genetic composition of an exotic introduction is believed to be linked to its success in new habitats. The objective of this investigation is to test whether the population genetic composition of the exotic round goby at given locations has changed over the invasion’s time course. We sequenced the mitochondrial cytochrome b gene and analyzed eight newly developed nuclear microsatellite loci to test for temporal and spatial patterns among 397 individuals from 2-3 time periods (1993-2007) at 5 locations in Lakes St. Clair, Erie, and Michigan. Results using the cytochrome b gene showed little temporal population change with some spatial divergences among sampling sites ($\theta_{ST}=0.000-0.172$). Higher-resolution microsatellite analyses revealed significant temporal change in the genetic composition of the Lake Michigan and Lake Erie populations ($\theta_{ST}=0.106; 0.021–0.048$), whereas those at and near the original introduction site in Lake St. Clair did not change ($\theta_{ST}=0.009-0.017$). Therefore, whereas peripheral population sites changed over the time course of the invasion, the central sites for the founding population remained genetically consistent.

Across the Great Lakes, the overall exotic round goby population is significantly genetically structured, with considerable divergence among some locations. Genetic data thus significantly enhance our understanding of the ecological adaptations underlying the round goby’s invasion success.

Importance to Ohio:
Great Lakes research, especially concerning Lake Erie, is immensely valuable to the state of Ohio; economically, recreationally and aesthetically. Exotic species, like the Round Goby, have become a great issue in the Great Lakes over the past few decades and studies involving population introductions and changes are vital in maintaining the success of the natural ecosystem.

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Rain Gardens
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The University of Toledo was looking into creating a rain garden on campus as a pilot project, to treat a portion of its storm water before it reaches the Ottawa River. A rain garden, or bio-retention area, is a landscaped area designed to treat the runoff from any weather event. This best management practice (BMP) is also going to be set up as a demonstration on campus, with informational signage. The design process for this rain garden included taking soil samples, performing test such as a soil infiltration test, taking measurements of the proposed area and running calculations. Research was done into other rain garden projects undertaken throughout the United States and they were used as examples to base this design on.

Importance to Ohio
This research is important for Ohio because it provides an example on how to solve our states storm water problems in an effective and environmentally conscious way. It also brings the issue to the public’s attention by having the project located in a heavily traveled area complimented by informational signage. It shows that state institutions such as the University of Toledo are concerned about environmental issues and that they want to keep Ohio beautiful in the process.

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Optical Thickness Monitoring System for a High Vacuum Deposition Chamber for Photovoltaic Solar Cells
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Faculty mentors: Alvin Compaan and James Walker
Groups at the University of Toledo studying CdTe/CdS based thin film photovoltaic solar cells require precise measurement and variation of film parameters to produce the most efficient cells possible. Controlling film thickness of the CdTe and CdS layers is essential to optimizing cell efficiency and desired cell characteristics. A non-destructive film thickness monitoring system was constructed for in-situ, real time chamber depositions in a high vacuum RF magnetron sputtering deposition chamber. The monitoring system visualizes interference fringes of reflected laser light from front and back surfaces of the deposited film. Sample thickness is determined from known optical properties of the film material. Complications due to sample rotation during growth, background noise, and limitations from chamber geometry were overcome to achieve clear signal detection.

Importance to Ohio:
Support for the advancement of solar technology will allow it to become viable both environmentally and economically in the near future. Research of this type is essential to maintaining the state of Ohio as a progressive entity in the field of sustainable energies.

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