The 7th Annual
Undergraduate Research & Scholarship Symposium

Power Center Ballroom
Thursday, April 9, 2015

PROCEEDINGS

Sponsored by:
Academic Affairs
Office of the Provost
Office of Research

Images and design concept by Jeffrey Stockman
The 7th Annual

Undergraduate Research & Scholarship Symposium

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Proceedings
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ACKNOWLEDGEMENTS

The organizers would like to thank all of the faculty mentors for their service and support of our undergraduate scholars.

A special thank you to the Bayer School of Natural and Environmental Sciences for their generous donation of the corkboards.

We would also like to thank the following organizations and individuals for their generous support of this important event:

Academic Affairs
Bayer School of Natural and Environmental Sciences
Center for African Studies
Center for the Catholic Intellectual Tradition
Center for Community Engaged Teaching and Research
Center for Spiritan Studies
Committee of Student Jurors
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Office of the Provost
Office of Multicultural Affairs
Phi Kappa Phi
Rangos School of Health Sciences
School of Nursing
University Academic Sustainability Committee
DU Undergraduate Jeffrey Stockman for the cover design
Office of Research, Christine Pollock, & Mary McConnell
Welcome

Students, Faculty, and Guests:

I would like to welcome you to the 7th Undergraduate Research and Scholarship Symposium. The URSS recognizes the achievements of our undergraduate scholars and their faculty advisors while highlighting the research and scholarship which is so much a part of a Duquesne education. It has become a celebration of undergraduate research and the diversity of scholarship at our university. This year’s event is our largest gathering of undergraduate scholars to date with 150 entries and over 220 participants. I would like to thank all of our participating undergraduates for the hard work and their excellent posters and presentations.

I especially want to thank our faculty who train and encourage young scholars and without whom this event would not be possible.

The URSS has been dependent on our sponsors who provide the recognition for exceptional scholarship and our judges who give their time to make this an outstanding experience for our students. Their continued support has been essential to the success of the symposium. Finally I must thank the organizing committee and the Office of Research staff who devote their time to ensuring the success of this event.

Enjoy the day and celebrate your scholarship and share that of your fellow undergraduate students across the diverse disciplines which are part of Duquesne University.

Sincerely,

Alan W. Seadler, Ph.D.
Associate Provost for Research and Technology
### Wednesday, April 8, 2015 | Power Center Ballroom:

<table>
<thead>
<tr>
<th>Event</th>
<th>Time</th>
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<tr>
<td><strong>Student Participant Set-up</strong></td>
<td>9:30 to 2:00</td>
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<tr>
<td>Participants are required to stop by, sign in, and set up posters between 9:30 and 2:00.</td>
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<tr>
<td><strong>Welcome Reception for Participants and Sponsors (Shepperson Suite)</strong></td>
<td>2:00 to 4:00</td>
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<tr>
<td>DU faculty, student participants and URSS sponsors are invited to attend. Light appetizers will be served.</td>
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<tr>
<td><strong>Judges-only “Sneak Peak” of posters</strong></td>
<td>4:00 to 7:00</td>
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<td>Judges are invited to view posters during this time.</td>
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<td>Event</td>
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<tr>
<td><strong>Student Participant Check In</strong></td>
<td>8:00 to 8:30</td>
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<td>Continental breakfast provided for participants</td>
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<tr>
<td><strong>Open Poster Session &amp; Judging</strong></td>
<td>8:30 to 9:30</td>
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<td>Guests are invited to walk around, peruse student projects, and engage w/ students.</td>
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<tr>
<td><strong>Keynote Speaker:</strong> Dr. Timothy Austin</td>
<td>9:30 to 10:00</td>
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<tr>
<td>“Roads Not Taken: On ramps and off ramps on the research highway”</td>
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<td>Poster Session is closed at this time</td>
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<tr>
<td><strong>Open Poster Session &amp; Judging</strong></td>
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<td>Guests are invited to walk around, peruse student projects, and engage w/ students.</td>
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<tr>
<td><strong>Formal Presentations Session 1</strong></td>
<td>10:45 to 12:00</td>
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<td>Poster Session is closed at this time</td>
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<tr>
<td><strong>Open Poster Session &amp; Judging</strong></td>
<td>12:00 to 12:30</td>
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<tr>
<td>Boxed lunches provided for participants. We encourage you to eat your lunches while viewing Posters</td>
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<tr>
<td><strong>Formal Presentations Session 2</strong></td>
<td>12:30 to 1:45</td>
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<td>Poster Session is closed at this time</td>
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<tr>
<td><strong>Open Poster Session &amp; Judging</strong></td>
<td>1:45 to 3:00</td>
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<tr>
<td>Guests are invited to walk around, peruse student projects, and engage w/ students.</td>
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<tr>
<td><strong>Awards &amp; Closing Remarks</strong></td>
<td>3:00</td>
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PRESENTATIONS: SESSION 1

*Click the student names below to view their papers.

10:45  Katherine Hilton, Laura Guarinoni
"Understanding the Signaling Mechanisms Underlying Melatonin and Estrogen/Progesterone’s Actions on HER2+ Breast Cancer”
Mylan School of Pharmacy | Faculty Advisor: Paula Witt-Enderby, Ph.D.
Abstract Number: 77

11:00  Julian Donado
“An Examination of The Durability of Batman as a Pop-Culture Icon and his Progression to a Modern Gothic Icon”
A.J. Palumbo School of Business Administration | Faculty Advisor: Emad Mirmotahari, Ph.D.
Abstract Number: 122

11:15  Katherine Sulkowski
“Effectiveness of Pharmacist Use of the Electronic Medical Record to Identify Adults at Risk for Anaphylaxis Without Access to Epinephrine for Self-Administration (EPI Rph)”
Mylan School of Pharmacy | Faculty Advisor: Autumn Stewart, PharmD, BCACP
Abstract Number: 92

11:30  Julia Lamar, Sam Colaizzi and Brian Liston
“Immigration or Extremism: Which Came First?”
McAnulty College and Graduate School of Liberal Arts | Faculty Advisor: Jennie Schulze, Ph.D.
Abstract Number: 17

11:45  Ashley Kershaw, Kahli Hale
“Association Among The Use Of Hand-Held Devices and Upper Quadrant Posture, Pain, and Dysfunction”
Rangos School of Health Sciences | Faculty Advisor: Kimberly A. Szucs PhD, OTR/L
Abstract Number: 143
12:30  *Benjamin Jagger  
“15N vibrational frequency shifts of the Rieske iron-sulfur cluster distinguish the protonation states of histidine ligands from cytochromes bc1 and b6f.”
Bayer School of Natural and Environmental Sciences | Faculty Advisor: Ralph Wheeler, Ph.D.
Abstract Number: 85

12:45  *Nicole Wozniak, Rachel Johnson  
“Make Sure You Get My Good Side: Perceptual-Motor Bias in Film Stills”
Rangos School of Health Sciences | McAnulty College and Graduate School of Liberal Arts | Faculty Advisor: Alexander Kranjec, Ph.D.
Abstract Number: 13

1:00  *Sarah Kochanek  
“Intramolecular Charge-Assisted Hydrogen Bond Strength in Pseudo-Chair Carboxyphosphate”
Bayer School of Natural and Environmental Sciences | Faculty Advisor: Jeffrey D. Evanseck, Ph.D.
Abstract Number: 62

1:15  Amanda Buchheit  
“Sexual Fluidity in Prison”
McAnulty College and Graduate School of Liberal Arts | Faculty Advisor: John Lane, M.A.
Abstract Number: 63

1:30  *Alec Chapman  
“Improvisation and the Death of the Performer's Voice”
Mary Pappert School of Music | Faculty Advisor: Benjamin Binder, Ph.D.
Abstract Number: 20
Bayer School of Natural and Environmental Sciences

2 for Excellence in the Basic Sciences: $300
Sarah Sweger | Sophomore | Bayer School of Natural and Environmental Sciences
Effects of Viscosity and Macromolecular Crowding on the Diffusion-Controlled Rate Constant of Ferredoxin NADP+ Reductase
Faculty Advisor: Jeffry Madura, Ph.D. | Abstract Number: 76

Youstina Seliman | Sophomore | Bayer School of Natural and Environmental Sciences
A Comparison of Planktonic Communities at the Murphy’s Bottom Ecological Site
Faculty Advisor: Brady Porter, Ph.D. | Abstract Number: 129

Center for African Studies
Award for Undergraduate Research: $250
Ian Ferguson | Senior | McAnulty College and Graduate School of Liberal Arts
The Tripartite Battle for East Africa: An Examination of the Crown Lands Ordinance of 1915
Faculty Advisor: Charles Steinmetz, Ph.D. and Holly Mayer, Ph.D. | Abstract Number: 135

Center for the Catholic Intellectual Tradition and Center for Spiritan Studies
Catholic Intellectual Tradition and Spiritan Studies Award for Undergraduate Research: $250
Edward Lippl | Junior | Rangos School of Health Sciences
The Effect of Sexual Orientation on Religious Beliefs
Faculty Advisor: Kathleen Glenister Roberts, Ph.D | Abstract Number: 32

Center for Community Engaged Teaching and Research
Outstanding Community-Engaged Scholarship Project: $250
Jennifer Estevez and Chuan Phongphothichitkun | Junior | Bayer School of Natural and Environmental Sciences
The mathematical framework for understanding effective TNR policies for feral cat control
Faculty Advisor: Rachael Neilan, Ph.D. | Abstract Number: 50

Gumberg Library
Gumberg Library Award for Undergraduate Research: $250
Lindsey Sosnowski | Senior | Mylan School of Pharmacy
Impact of Young-Onset Parkinson’s Disease on Quality of Life
Faculty Advisor: Khalid M. Kamal, M.Pharm, Ph.D. | Abstract Number: 108

Honors College
Outstanding Poster: $250
Natalie Campbell, Andrew Lendacky, and Tamir Turpin | Freshmen | Bayer School of Natural and
Environmental Sciences

*Environmental Knowledge and Attitudes of Students from Three Pittsburgh Universities*

Faculty Advisor: Michael Irwin, Ph.D. | Abstract Number: 46

**Mary Pappert School of Music**

*Mary Pappert School of Music Undergraduate Award: $250*

Victoria Visceglia | Senior | Mary Pappert School of Music

*On the Transmigration of Souls: The Construction and Impact of a Memory Space*

Faculty Advisor: Benjamin Binder, Ph.D. | Abstract Number: 58

**Mylan School of Pharmacy**

*Award for Undergraduate Research: $250*

Luke Gormley, Alicia Sacco, Bobby Gwin, and Caitlin Mitchell | Senior | Mylan School of Pharmacy

*Comparison of two different formulas for body surface area in adults at extremes of body size*

Faculty Advisor: Karen Fancher, PharmD | Abstract Number: 106

**Office of the Provost**

*Outstanding Scholarship Award: $250*

Benjamin Jagger | Senior | Bayer School of Natural and Environmental Sciences

*15N vibrational frequency shifts of the Rieske iron-sulfur cluster distinguish the protonation states of histidine ligands from cytochromes bc1 and b6f.*

Faculty Advisor: Ralph Wheeler, Ph.D. | Abstract Number: 85

*2 for Honorable Mention: $125*

Nichole Hirt | Senior | Behavioral Health

*Relationship between Body Image and View about Abuse*

Abstract Number 38

Justin Goodwill | Sophomore | Bayer School of Natural and Environmental Sciences

*Image Fusion Using SURE Guided Piecewise Linear Estimation*

Faculty Advisor: Stacey Levine, Ph.D. | Abstract Number: 147

**Office of Multicultural Affairs**

*Outstanding Undergraduate Research: $250*

Rhiannon Lewis | Sophomore | Rangos School of Health Sciences

*How Socioeconomic Factors Influence Healthcare in Tanzania*

Faculty Advisor: Bridget Calhoun, Dr.P.H., PA-C | Abstract Number: 29

**Phi Kappa Phi, National Honors Society**

*Outstanding Scholarship Award: $500*

Jessica Glas | Senior | Mylan School of Pharmacy

*Understanding the Signaling Mechanisms Underlying Melatonin and Estrogen/Progesterone’s Actions on Bone Density*

Faculty Advisor: Paula A. Witt-Enderby, Ph.D. | Abstract Number: 100
Brandon Hoenig | Junior | Bayer School of Natural and Environmental Sciences
DNA Barcoding of Stomach Contents Reveals Trophic Competition Among Three Species of Trout
Faculty Advisor: Brady Porter, Ph.D. | Abstract Number: 3

Michael Romero Moore | Junior | McAnulty College and Graduate School of Liberal Arts
In the Shadows of Berlin: The role of covert operations in Berlin during the Cold War
Faculty Advisor: Andrew Simpson, Ph.D. | Abstract Number: 60

Rangos School of Health Sciences
Undergraduate Award: $250
Elizabeth Mueller | Senior | Rangos School of Health Sciences
TeleWellness Support Systems for Spinal Cord Injury
Faculty Advisor: Andrea Fairman, PhD, MOT, OTR/L, CPRP | Abstract Number: 72

School of Nursing
School of Nursing Undergraduate Award: $250
Kayla Witkowski | Senior | School of Nursing
Utilizing African Traditional Dance as a Facilitator of HIV/AIDS Information
Faculty Advisor: Mary Guimond, Ph.D. | Abstract Number: 136

University Academic Sustainability Committee
Excellence in Sustainability and the Environment: $250
Natalie Campbell | Freshman | Bayer School of Natural and Environmental Sciences
Environmental Knowledge and Attitudes of Students from Three Pittsburgh Universities
Faculty Advisor: Michael Irwin, Ph.D. | Abstract Number: 46
Dr. Timothy R. Austin joined Duquesne University as provost and vice president for academic affairs on July 15, 2013.

For seven years immediately preceding his appointment at Duquesne, Dr. Austin served as vice president for academic affairs and dean of the College at the College of the Holy Cross in Worcester, Massachusetts. Prior to that, he had held positions as dean of the College of Arts and Sciences at Creighton University and as a faculty member, department chair, and research administrator at Loyola University Chicago.

A specialist in linguistic stylistics, Dr. Austin has authored two books on the language of poetry and scholarly articles in publications such as the Journal of Literary Semantics and the Princeton Encyclopedia of Poetry and Poetics. He has also published essays growing out of his work as an academic administrator in journals such as the Journal of College and Character.

Dr. Austin has reviewed programs at various schools as a member of accreditation teams for the Commission of Institutions of Higher Education for the New England Association of Schools and Colleges. He also served a term on the Board of Trustees for Saint Anselm College in Manchester, New Hampshire, for which he chaired the Academic Affairs Committee.

A native of Tonbridge, England, Dr. Austin earned his master's degree in English language and literature from Oxford University, where he was a member of Lincoln College, and his Ph.D. in linguistics from the University of Massachusetts, Amherst.
Formal presenters at the Undergraduate Research and Scholarship Symposium are carefully selected by a committee of student jurors from the Honors College through a “blind” selection process.

Papers have been reviewed for grammar and basic content by our undergraduate editorial board: Emily Keith, Jennifer Sens, and Brianna Brown
Improvisation and the Death of the Performer’s Voice
Alec Chapman | Mary Pappert School of Music | Faculty Advisor: Benjamin Binder, Ph.D.

There has been a great deal of debate and research in the musicological world about the performer’s status in the study and creation of music. A performer’s agency and authority is very often deemed less valid than that of the composer or music theorist. Performers have been devalued in the Classical Music realm. This phenomenon has been discussed extensively by scholars in musicological writings. In this essay, I will look more closely at the devaluation of the performer by examining one specific phenomenon: the disappearance of improvisation from conventional classical music performance. By looking at the many causes of this decline, I will offer a suggestion of what this implies about the current classical music tradition. The turn away from improvisation reflects a larger phenomenon of the devaluation of the performer in classical music and a mode of thought that strips the performer of his agency and individual creative freedom.

Improvisation’s Role in Classical Music Historically

Improvisation once played a significant role in western classical music culture and practice. The influential scholar Ernest T. Ferand writes, “The whole history of the development of [Western art] music is accompanied by manifestations of the drive to improvise”.¹ Anna G. Pietrowska writes, “Still in the very early 19th century improvisation was one of the most typical form of music performing”,² and cites a number of contemporary written texts concerning improvisation. Great classical composers such as Bach,³ Mozart, and

¹ Ferand, Ernst T., Improvisation in Nine Centuries of Western Music: An Anthology With an Historical Introduction. (Köln: Arno Volk Verlag), 4.


³ Gould, 143.
Beethoven were able and expected to improvise. Many compositions utilized or imitated improvisational qualities as well. Musical forms that were popular in the 19th century such as preludes, impromptus, fantasias, and rhapsodies were associated with improvisation.

Improvisation was expressly part of certain musical practices. Improvisations during concert settings were a common feature in a performance. Instrumentalist virtuosos were admired for their improvisational prowess. Opera singers would also embellish and improvise during their performances, sometimes taking great liberties with the music. One of the most important opportunities for a performer to improvise was the concerto cadenza. At the end of a movement of a concerto, usually the first movement, the orchestra would come to a halt and the soloist would improvise a cadenza. This cadenza could include thematic development from the material that was just played, but it was expected to be improvised by the composer. Once the performer was finished, they would cue the orchestra, who would then play the coda to end the movement. Many concertos do have optional cadenzas written for them, either by the composer or by others, but improvisation was frequently and generally a part of this tradition.

One of the most prominent composers of concertos and one of the most famous improvisers was Mozart. As a keyboard virtuoso, Mozart had a successful and exciting career in Vienna. His equal skills in composition and performance put him in the position of a composer-performer. Improvising was an especially important part of this experience. Simon P. Keefe writes, “Mozart’s improvisations at the keyboard occupied a special place, demonstrating in equal measure fertility of compositional imagination and supreme performance dexterity and expression”. He quotes a contemporary account of an audience member who witnessed Mozart

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4 Piotrowska, 336.
5 Ibid, 334.
6 Piotrowska.
7 Gould, 144.
8 Ibid.
improvising: “And actually this improvising exceeded everything that we could imagine from piano playing, the highest degree of compositional art united with the most perfect skill in playing”.

Mozart’s improvisations gave him the opportunity as a performer to create and present his abundance of musical ideas; he was, as Keefe says, “author and performer at the same time”.

Mozart is an excellent demonstration of the power that improvisation gives to performers: simultaneously creator and executor, free to express one’s own ideas through the act of performance. It is the pure expression of the performer’s voice. During Mozart’s time, this is how the musical world perceived musical improvisation: an important skill for performers to have with the potential for a highly valued musical experience where the composition and conception of musical ideas are tied directly in with their performance. This attitude would change, however, and the way in which improvisation would be viewed would change until improvisation became nearly irrelevant to classical music.

The Disappearance of Improvisation

Today, improvisation is associated more with styles such as jazz, bluegrass, or Indian ragas. Improvisation is rarely, if ever, seen in the performance of classical music. Considering how common improvisation was in the past, why is it almost extinct in the performance of the music today? To understand this, we must look at a period of time in musical history when many of our modern ideas that govern musical study and performance first started to emerge.

It is generally agreed that improvisation began to decrease in classical music practice in the mid-19th century. There have been many theories about how and why this happened, and there are undoubtedly many factors. Perhaps the most important change, though, had to do with the shift in the way that musical

\[1\] Ibid.

\[11\] Ibid, 188.

composition and performance were perceived. This change devalued the performer and, in doing so, made improvisation as the expression of the performer pointless and undesirable. This drastic and impactful shift in attitude toward musical performance began a debate between types of performers.

_Virtuosos and Authenticity_

In the mid-19th century, this debate was shown in the battle against the virtuoso. Virtuosos were a “cult object”\(^\text{13}\) of the time, exciting and dazzling audiences: “Many instrumentalists, especially pianists and violinists boasting uncommon, prestigious skills regarded as outstanding virtuoso... responded to the demands of frivolous public that would - in return - take delight in feats of their agility.”\(^\text{14}\) One of the skills most associated with virtuosos was improvisation. Piotrowski writes, “...virtuosity - with its preferred brilliant style - offered an abundance of possibilities for improvisations with trills, ornaments, as well as lyrical fragments”. Piotrowski argues that virtuosic improvisation was closely associated with Gypsy music, which was gaining popularity and attention at the time.\(^\text{15}\) Franz Liszt was a key figure in this view of the virtuoso. Already an accomplished virtuoso, Liszt was introduced to Gypsy music when he visited his native Hungary in 1839 and was “enchanted with music performed by Gypsies... Liszt especially admired Gypsy instrumentalists and was deeply affected by the virtuosity of their performances, technical possibilities, as well as improvisational skills”.\(^\text{16}\) The improvisations of Liszt and other virtuosos were thrilling to the audience, who loved to see someone spontaneously perform such incredible, seemingly impossible technique.

However, the worship of virtuosos was not universal. As theoretical discourse started to favor the concept of the work,\(^\text{17}\) a battle against virtuosos began. According to Piotrowski, “...the dexterity of the improvising virtuoso became to be questioned as a threat to the artistic nature of music making, and treated as

\(^{13}\) Piotrowski, 329.

\(^{14}\) Ibid.

\(^{15}\) Ibid, 327.

\(^{16}\) Ibid.

\(^{17}\) Ibid, 326.
a demonstration of purely mechanical abilities... The accusations were connected with the superficiality of many virtuosic practices”. These “virtuosic practices” were theatrical factors used in performance, such as physical appearance and effects of timing that would excite the audience. This theatrical performance style was detested by many of the leading musicians and critics of the day. This debate is most famously exhibited in the dichotomy between two very important ideals of 19th-century performance: theatricality and authenticity.

This binary is written about extensively by Karen Leistra Jones. Jones outlines the debate between two opposing schools whom embraced these practices. The first school, which valued theatricality, was headed by Liszt, who was “the ultimate theatrical actor”. Jones quotes a contemporary account of Liszt’s performance, which describes the virtuoso’s powerful influence and close relationship with the audience “…Liszt is a complete actor who intends to carry away the public, who never forgets that he is before it, and who behaves accordingly”. This description of Liszt aligns with Piotrowski’s description of the virtuoso, the almost supernatural performer who improvises and shows off to an astounded audience.

The other school valued the concept of “authenticity”. This school was headed by Johannes Brahms and the violinist Joseph Joachim. Jones defines the authentic self as being “true to oneself”, focused on the inner self and not concerned with outward displays of emotion or personality. Unlike Liszt, for whom the audience’s perception of his theatrical persona was essential, Brahms and Joachim believed that any emotion should be purely internal and that the performer should be totally absorbed in the music he is playing, unaware of an audience and everything other than the music itself. The performer should ultimately be bound by the music,

18 Ibid, 329.
19 Ibid, 330.
21 Ibid, 398.
22 Ibid, 397.
23 Ibid, 398.
24 Ibid, 403.
and anything he does in performance should reflect this. According to Jones, this was directly related to a principle called *Werktreue*.

*Werktreue, the Authority of the Score, and the Ownership of the Composer*

*Werktreue* is a concept that has become central to the study and performance of classical music. In her article “Being True to the Work”, Lydia Goehr outlines the history and principles of this idea. Originating from the Romantic author and music critic E.T.A. Hoffman, this notion implies “being true to the work”. Hoffman suggested that performance of music should be guided and derived from “the work themselves”.

“Works”, as thought of in the way Hoffman intended, are “a composer’s unique, objectified expression, a public and permanently existing artifact made up of musical elements”. In other words, works are actual objects in themselves, created and completed by the composer. A Beethoven Symphony can be considered a work. This work was created by Beethoven and has existed ever since its creation, even without being performed. Goehr goes on to say, “A work is fixed with respect, at least, to the properties indicated in the score and it is repeatable in performances”. The score, then, is a physical representation of the work and it is through the score that performers can understand and execute the work through performance.

Along with the concept of *Werktreue* comes certain principles of authority and authorship. The work ultimately belongs to the composer. Central to the principle of *Werktreue* is the perfection and completeness of the work itself, which the composer created and still possesses. Nicholas Cook writes about the values that music theorists have established and how these ideas are “of a quite general antipathy towards the idea of art being a communal production”. In other words, there is a sole author of the work, leaving out any decision or contribution of the performer, which Cook would describe as “multiple authorship”, a collaboration between

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26 Ibid.

composer and performer.\textsuperscript{28} Being the sole author would then give authority only to the composer, therefore taking it from performers.

\textit{The Devaluation of the Performer}

As Brahms and Joachim’s values of authenticity went against Liszt’s theatrical, affective performances, the \textit{Werktreue} principle developed and affected the entire culture of musical performance. Jones argues:

“...authenticity was an animating concept behind one of the most important developments in nineteenth-century performance culture: the shift away from flamboyant, popular, and spectacular forms of virtuosity toward what is often called the \textit{Werktreue} ideal... a ‘museum’ culture based on the faithful presentation of musical works gradually supplanted popular concerts based on improvisation, audience interaction, and the star personalities of virtuosos.”\textsuperscript{29}

By performing in a way that does not draw attention to oneself and one’s own technique and virtuosity, Brahms and Joachim believed that they were remaining “true to the work”, and more fully in line with the true spirit of the composer.

The concept of \textit{Werktreue} developed and eventually became an essential part of the classical music culture and practice. Public performances ceased being opportunities for performers to express their own voice and showcase their musical skills. They became purely about realizing the works, dictated by the ideals of \textit{Werktreue}. “performances themselves are transitory sound events intended to present a work by complying as closely as possible with the given notational specifications”.\textsuperscript{30}

With this mandate of compliance to the score, the performance must highlight the work and not the performer in order to be “authentic”. The performer loses his own agency and authority. Cook says about this ideology: “We categorize the music of the past in terms of \textit{works}, which essentially mean authoritative texts

\textsuperscript{28} Cook, 35.

\textsuperscript{29} Jones, 399.

\textsuperscript{30} Goehr, 55.
coupled with an established (or at least accepted) provenance... we talk about the performance of works...

Language, in short, leads us to the marginalisation of performance”. With so much emphasis placed on the composer and his intentions, represented by the text and idealized in the idea of the “work”, the artistry and accomplishment of the performer is overlooked, blotted out by the perfection and completeness of the work itself. Cook says, “performers, in other words, serve the same kind of function as printers - they have to be there, but we don’t have to talk about them”.

For Mozart, improvisation was one of the supreme forms of musical expression: his virtuosity of the piano together with his mastery of composition were used together to create ideas that were spontaneous, unique, and ultimately of him as a performer. But at the end of the 19th-century, improvisation was associated with flashy, self-centric virtuosos. Unlike Mozart’s, these improvisations were not seen as legitimate musical expression; they were inauthentic and self-serving, being done to impress a “frivolous audience” and giving the performer an opportunity to show off his mechanical abilities. As this kind of thinking developed, performance as a whole began to be seen like this. The true mastery came from the works, which were found in scores and only repeated in performance.

Now in the 21st century, there has been a turn of “performative studies” in music. Nicholas Cook, Lydia Goehr, and many other scholars have taken another look at the Werktreue ideal and how it has impacted our musical culture. There is a new emphasis on and search for the performer’s voice, whatever that entails. Perhaps now, then, it is worth looking again at improvisation and what we are missing without it. I would like to suggest that improvisation, far from being a performance technique that merely died out in the past, can be a worthwhile and meaningful part of classical music and help to redevelop an emphasis on performance and the performer.

A Case for Improvisation

31 Ibid, 33..
32 Ibid, 31..
Improvisation is not often seen in the modern classical music world. Cadenzas are more often written by a composer than improvised by the performer.\textsuperscript{33} The “museum” culture that Leistra-Jones describes exclusively emphasizes the works of the past. These works, I’d like to note, are absolutely worth study and performance. Does it have to be, though, at the expense of the performer’s creativity and agency? Does it have to exclude spontaneous musical expression, the kind of expression that has allowed jazz and other musical idioms to flourish? As Robin Moore suggests, “Why should unvarying restatement be desirable? [...] how much more might an aesthetic which allowed for spontaneity and creative musical reinterpretation satisfy both performers and audience?”\textsuperscript{34}

Perhaps jazz music can be a feasible model to look to for inspiration. In an essay from his liner notes for his album \textit{Art of the Trio, Vol. 4}, the jazz pianist Brad Mehldau discusses the spontaneity of improvisation and its merit in jazz music. He writes,

“Jazz improvisation isn’t born out of any previous text, which differentiates it from the interpretive art of classical performance... Part of the brazen quality of a music that puts improvisation at its center is that it simply did not care enough to write a text, and that not caring became its strength. I locate my personal aesthetic for jazz in that strength: It basks in the human capability to grab at the transcendental with immediacy, free of the usual trial and error of art.” \textsuperscript{35}

\textit{Conclusion}

In a culture where music has been put in an imaginary museum, works are to be admired and repeated; creation is absent. \textit{Werktreue}, while giving us an abundance of repertoire and musical history, spells out the end of creativity in classical music. Denying performers their agency and their voice does not

\textsuperscript{33} Gould, 144.

\textsuperscript{34} Moore, 80.

foster any sort of individual or cultural reimagining. The spontaneity of improvisation, once the pure
expression of performers like Mozart, has vanished in this culture. Perhaps by giving the performer back his
voice, and allowing spontaneous and improvisational expression and creation of ideas which are both
unique and valid, classical music will move forward and become an individually creative and expressive art
again.
Understanding the Signaling Mechanisms Underlying Melatonin and Estrogen/Progesterone’s Actions on HER2+ Breast Cancer
Katherine Hilton and Laura Guarinoni | Mylan School of Pharmacy | Faculty Advisor: Paula Witt-Enderby, Ph.D.

Despite our ever-increasing knowledge of the inner workings of the human physiology, there are times when the particular mechanisms of signaling processes or drug therapies are yet unknown. After Dr. Witt-Enderby’s past doctoral student, Dr. Bala Dodda, uncovered the impact of a novel combination melatonin, estrogen and progesterone hormone therapy on decreasing a particular form of breast cancer growth and metastases, our lab set out to identify the exact signaling mechanism by which these physiological and pathological changes occurred. As such, the focus of our research was to identify the signaling pathways impacted by more traditional hormone therapy and this new hormone therapy-melatonin combination. All of the information depicted in this presentation was completed in the lab of our faculty advisor, Dr. Paula Witt-Enderby with her graduate assistant, Sifat Maria. The information here expands on and features the work of Dr. Bala Dodda presented in his dissertation entitled: “An evaluation of the effects of a novel hormone therapy on mammary cancer development, progression, and uterine protection in the MMTV-neu mouse model 2012.”

Melatonin became the focus of this ongoing study for its demonstrated ability to decrease cancer risk. Melatonin is an endogenous hormone released in the body in response to darkness. As a result, melatonin is high at night, but low during the day. Several studies looking at situations such as light at night for shift workers, pinealectomy, and aging have found a correlation between low melatonin levels and increased cancer risk.

It is important to understand that hormone therapy (HT) typically features two parts: an estrogen component and a progesterone component. The estrogen component has been associated with increased risk of endometrial hyperproliferation and thus increased risk of uterine cancer. As such, estrogen-only therapies are restricted clinically to patients who have had a hysterectomy. However, in women with intact uteri, hormone replacement must also include a progestin component to help keep the proliferative effects of
estrogen in check. Some hormone therapies are even progestin-only, however they are not as frequently used in practice due to their androgen-related side effects such as bloating, acne, and weight gain, etc. In a recent study completed by the Women’s Health Initiative, it was discovered that a certain type of hormone therapy containing conjugated equine estrogens (CEEs) and medroxy progesterone acetate (MPA), also called PremPro™, while good for alleviating vasomotor symptoms in menopausal women and decreasing endometrial hyperproliferation, may increase the risk of breast cancer. As a result, our study involved a novel hormone therapy (EPMT) that featured an equivalent human-to-mouse dose of estrogen (E), but a lower equivalent progesterone dose (P); the difference was supplemented by the inclusion of melatonin (M) to decrease the endometrial hyperproliferation. As seen in Dr. Dodda’s dissertation, the uterine weights of the mice treated with HT were highest because of lack of protective coverage by this lower progesterone dose. However, the EPMT combination displayed a decreased uterine weight relative to the HT treatment; this emphasized melatonin’s uterine protective actions. Therefore, this new therapy served to decrease the negative side effects associated with higher progesterone doses while maintaining the uterine-protective effect. The ultimate goal of this research was to provide menopausal women an alternative therapy to alleviate the vasomotor symptoms that sometimes accompany women transitioning through menopause without increasing their risk of breast cancer. Also, the additional benefit of melatonin’s effects on sleep may improve overall quality of life in these women.

This tumor study conducted by Dr. Dodda had two main focuses: 1) identify if EPMT could alter protein levels to prevent and decrease tumor development and metastasis, and 2) identify if EPMT was uterine protective. The results from his research found that mice given EPMT demonstrated a decrease in HER2+ mammary cancer growth and metastases without harming the uterus. What was not determined in Dr. Dodda’s research were the signaling mechanisms underlying EPMT’s cancer-protective actions. The focus of our substudy was to identify those signaling pathways modulated in response to EPMT by looking at the EPMT’s impact on ERK1/2, ERK5, and Runx2 levels in both healthy mammary tissues and also tumor tissues.
In this study, an MMTV-neu mouse model was utilized since it mimics HER2+ breast cancer in humans. This type of breast cancer is ER+/PR+ early on, but later becomes ER- and PR-. With a high incidence of primary tumors and lung metastases, this cancer is associated with poor prognosis.

Before any experimental treatments were given, the mice we used for this study were fed a semi-purified isoflavone-free control diet and control vehicle water. This diet was chosen because isoflavones contain estrogens, which could interfere with our hormone therapy. This combination of control water and control diet was given to all mice for the first two months of their lives; this is how long it takes for the maturation of mammary glands in mice. Once the mice were fully mature, they were randomly divided into four treatment arms. The first group (control) was continued on water containing vehicle as well as control chow. The second group (HT) was given water containing vehicle and hormone therapy added to their chow; the HT consisted of 0.5 mg of E₂ (estrogen) and 50 mg of P₄ (progesterone)/1800 kcal of control diet ad libitum. The third group (melatonin) was given melatonin in the drinking water at a dose of 15 mg/L, which is equivalent to a 5mg daily dose every night along with control chow. Lastly, the fourth group (HT + melatonin) was given melatonin (15mg/L) in the drinking water every night and the hormone therapy diet described above; this group will be referred to as the Estrogen Progestin Melatonin Therapy group, or EPMT. The mice were given their respective treatments for months 2-14 of the study, equating to one year of therapy. Every week, the mice were palpated for presence of tumors. At the end of 12 months, the mice were necropsied, gross lung lesions were recorded, and excised tumors were weighed and measured. Additionally, lung lesions were confirmed as metastatic lesions by a veterinary pathologist (J.M.C.).

The results of this tumor and metastases analysis displayed a statistically significant increase in time of tumor formation and also a decrease in the incidence of tumors among nearly 250 mice included in the study. In addition to this increase in tumor latency and decrease in tumor incidence, it was also shown that the EPMT decreased the number of gross lung metastases seen in the mice by the end of the study. Considering this trend, our particular focus of study was to identify the relationships among different proteins in the signaling pathway that may be involved in mammary gland differentiation or in tumor growth and metastases. In particular we
looked at the amounts of pERK1/2, pERK5, and Runx2 expressed in mammary and tumor tissues of the study mice exposed to the four treatments described above.

Since pERK1/2 has been shown to induce mammary tissue differentiation, and pERK5 mammary tissue proliferation, we sought to understand the impact of these therapies on pERK1/2 and 5 in both healthy and transformed/tumor mammary tissue. Additional, Pratap et al. and Tandon, et al. demonstrated that Runx2, a critical protein involved in bone development may also be involved in mammary tissue differentiation and patients’ responses to small cell lung carcinoma treatments.

In previous studies performed by Dr. Witt-Enderby’s past graduate students, Drs. Radio, Sethi and Bondi, it was found that activation of melatonin receptors by melatonin triggers a signaling cascade resulting in a G-protein-mediated coupling to proteins, Grb, Sos, Ras, and Raf. These proteins then activate MEK1/2 leading to ERK1/2 phosphorylation. In our study, we looked at the impact of these therapies on ERK1/2 as well as on ERK5 and Runx2; literally nothing is known about the role of these kinases and proteins on melatonin-mediated cancer protection. As such, our theory was that the EPMT, the therapy demonstrated to decrease breast cancer development and metastases, would be correlated with increases in pERK1/2 and decreases in pERK5; pERK1/2 is involved in cellular differentiation, which would be protective against cancer and pERK5 is associated with cellular proliferation, which would be cancer-inducing.

In our investigation, we prepared protein lysates from normal mammary tissue or from tumor samples exposed to the treatments described previously and stored them in sample buffer at -20°C until we were ready to analyze them. Specifically, the tissues were individually homogenized using a TissueTearerTM in 2 mL of 50mM Tris buffer (pH 7.4). The samples were then centrifuged in order to isolate the desired proteins from the other cellular components. Initially, SDS-polyacrylamide gel electrophoresis (SDS-PAGE) was performed using 10% acrylamide gels to separate out the proteins on the basis of their size. Following SDS-PAGE, proteins were transferred to nitrocellulose membranes and then blocked in blocking medium to reduce background. Next, the membrane was soaked in antibody solution containing mouse monoclonal beta-actin and goat-anti-rabbit/goat-anti-mouse antibodies designed to specifically bind to pERK1/2, pERK5, and Runx2. The gels were then analyzed using the Odyssey® Infrared Imaging System run on two different wavelength channels. Beta-actin was
detected using the 700 channel producing a red band while pERK1/2, pERK 5, and Runx2 were detected using
the 800 channel producing green bands. The bands corresponding to pERK1/2 (40-42kDa), pERK5 (100kDa) and
Runx2 (50kDa) were quantified using LiCor Imaging software. Because sample tissue sizes may vary, all protein
data were normalized against beta actin (red band 37kDa) and then analyzed using GraphPad Prism software.

Following the quantification and analysis, we noted a statistically significant decrease in pERK5 in the
mammary EPMT samples while the tumor treatment group presented no statistically significant correlation,
indicating that normal healthy mammary tissue displayed reduced proliferative capacity. Meanwhile, pERK1/2
expression displayed a statistically significant increase in the EPMT group, while the same kinase was
significantly decreased in the tumor tissues, indicating that healthy mammary tissue displays enhanced
differentiation while tumor tissue lack differentiation. Interestingly, Runx2 expression in the healthy mammary
tissue was also increased but decreased in the tumor tissue, indicating increased differentiation in the healthy
mammary tissue treated with EPMT compared to transformed (tumor) tissue. As a result, it would appear that
the EPMT treatment encouraged a healthy balance of increased differentiation (↑pERK1/2, ↑Runx2) and
decreased proliferation (↓pERK5). As a result, EPMT may make healthy mammary tissue less prone to
proliferation and transformation into cancer. In addition, the tissue’s transformation may be due to imbalances
in ERK1/2, ERK5 and Runx2, resulting in tumors with high metastatic potential. Furthermore, this trend may
indicate that the pERK1/2 in the tumor tissue is trying to drive down Runx2 expression, decreasing metastasis in
transformed tissue.

From our results, we are able to conclude 3 possible mechanisms to explain Dr. Dodda’s cancer data.
First of all, in normal healthy mammary tissue, EPMT seems to be cancer-protective. This signaling balance
(↑pERK1/2; ↑Runx2; ↓pERK5) may make the gland less prone to transformation, that is, increased levels of
pERK1/2 and Runx2 are causing mammary gland differentiation and decreased levels of pERK5 are causing less
mammary gland proliferation. It is known that increases in mammary gland differentiation makes the cells less
likely to potentiate a mutation. Another thought is that transformation of the mammary gland into tumors
may be the result of imbalances in pERK1/2, pERK5 and Runx2 expression levels, resulting in tumors with high
metastatic potential. Lastly, since high Runx2 expression has been correlated with tumor metastases, it could
also be that EPMT in tumor tissue may be decreasing levels of pERK1/2 and RUNX2, making the tumors less metastatic.8,9

So what do all of these letters and numbers mean to us in the real world? This research is mostly applicable to post-menopausal women who take or are considering hormone therapy. Use of HT in this population is quite common in practice because post-menopausal women have diminished levels of estrogen and progestin, leading to the unpleasant symptoms of menopause like hot flashes and night sweats. Use of HT, while helpful in symptom relief, has been questioned because some forms of HT, for example, PremPro™ have been linked to cancer4. Because melatonin is cancer-protective and lowering of melatonin levels either by aging, light exposure at night or use of HT,1,2,3,6 then it is our thought that supplementing HT with melatonin may be protective against cancers caused by these variables.

Our research is a continuation of many years of study, and we are still only at the tip of the iceberg. Further research with larger sample sizes is required to solidify this trend. Our research here has uncovered a potential link to protein expression variances between healthy mammary tissue and tumor tissues both among and between treatment groups (control, melatonin, HT, and EPMT) that could establish not only the signaling mechanisms that could aid future drug development but also evidence the benefit of this novel therapy in reducing cancer risk. Additionally, we identified relationships between pERK1/2, pERK5 and Runx2 expression in normal mammary tissue; pERK1/2 was proportional to Runx2 expression while pERK5 was inversely proportional to Runx2 expression. In the tumor tissue, pERK1/2 was proportional to Runx2 suggesting a direct regulation of Runx2 by MEK/ERK1/2 in both the mammary and tumor tissue. Further research using inhibitors directed against pERK1/2, pERKS and/or Runx2 in the mammary gland will be able to prove or disprove a link between the proteins, opening up novel research areas and potential anti-cancer drug targets.


Updated March 19, 2015.


Accessed May 1, 2015
15N vibrational frequency shifts of the Rieske iron-sulfur cluster distinguish the protonation states of histidine ligands from cytochromes bc1 and b6f

Benjamin Jagger | Bayer School of Natural & Environmental Sciences | Faculty Advisor: Ralph Wheeler, Ph.D.

Cytochrome bc1 is a mitochondrial integral membrane protein essential for cellular respiration. The bc1 complex is a component of the electron transport chain and functions by transporting electrons through the oxidation of ubiquinol to ubiquinone, while simultaneously translocating protons across the cellular membrane. The chloroplast homologue of cytochrome bc1 is cytochrome b6f, which mediates the electron transfer between Photosystems I and II. In both complexes, a series of oxidations and reductions create an electrochemical gradient that is later used to facilitate the production of ATP by the enzyme ATP synthase. Both complexes operate via a modified Q cycle, in which a Rieske-type [2Fe-2S] cluster acts as the first electron acceptor. The energy produced from these reactions is critical for sustaining the cell. The protonation states of the His ligands (His141 and His161) of the [2Fe-2S] cluster are critical for understanding the mechanism of electron transfer, as the [2Fe2S] cluster is proposed to act as both an electron and proton acceptor via a hydrogen bond from ubiquinol. Experimental determination of the His protonation states via NMR spectroscopy is extremely difficult due to the close proximity of the two paramagnetic iron atoms of the [2Fe-2S] cluster. This work therefore proposes an alternative approach based on density functional calculations of a model Rieske [2Fe-2S] system. Qualitatively different 15N isotopic vibrational frequency shifts for different protonation states of the His ligands implies that difference vibrational spectroscopy with 15N substitution can distinguish doubly protonated from singly protonated His. Similar experiments may also tell whether His161 and/or His141 is protonated in the oxidized Rieske [2Fe-2S] cluster of cytochromes bc1 and b6f.

While the general mechanism of electron transfer through the complex is successfully described by a modified Q-cycle, the specifics of ubiquinol (QH2) oxidation has been under extensive debate. Multiple hypotheses attempt to describe the order of electron and proton transfer at ubiquinol’s Qo binding site. X-ray crystallographic studies resulted in structures of cytochrome bc1 with various inhibitors in the binding site. Protein-inhibitor hydrogen bonding in the binding pocket at the Qo site is widely accepted to stabilize the bound QH2 substrate. Amino
acids Glu271 and His161 both are potential hydrogen bond acceptors from the substrate. These residues are therefore potential proton acceptors for the oxidation of QH2.\textsuperscript{11–13} The order of the electron and proton transfer in this oxidation event is also of great interest. One hypothesis proposes a sequential mechanism where an electron is transferred to the iron-sulfur complex and then a proton is transferred to His161.\textsuperscript{11,12,19} In order for His161 to accept this proton, it must be deprotonated. A second hypothesis proposes a concerted mechanism in which His161 need not be deprotonated before the initial oxidation of QH2.\textsuperscript{13} In this hypothesis, QH2 forms a complex with His161 by replacing the proton on the imidazole nitrogen, in concert with electron transfer.\textsuperscript{13} An alternative hypothesis proposes that the protonation state of His161 has no effect on the oxidation of QH2, but that Glu271 is the proton acceptor.\textsuperscript{15,16} These proposed mechanisms are all highly dependent on the Rieske [2Fe-2S] cluster and, especially, on the protonation state(s) of its His ligands.

In its oxidized form, the two iron atoms of the [2Fe-2S] cluster each have a formal 3+ oxidation state and the cluster has an overall neutral charge. The cluster is coordinated by two cysteine ligands and two His ligands; His141 and His161 in bovine cytochrome bc\textsubscript{1}\textsuperscript{18} and His110 and His129 in cytochrome b\textsubscript{6f}.\textsuperscript{5,7,10} The role of the His in the electron transfer process is dependent on their protonation state within the protein environment, as previously described. Therefore, it is critical to know the pKa values for these two His ligands in the protein environment. The experiment observes the pKa values of the two His to be $7.63 \pm 0.15$ and $9.16 \pm 0.28$ in bovine cytochrome bc\textsubscript{1}\textsuperscript{20} and $7.85 \pm 0.15$ and $9.6 \pm 0.12$ for a bacterial cluster.\textsuperscript{21} Additionally, density functional calculations report pKa values of 6.9 and 8.8.\textsuperscript{22} These values suggest that only one His should be deprotonated near physiological pH. Due to the symmetrical nature of the iron-sulfur cluster and challenges the iron atoms present for NMR spectroscopy, the pKa values are unable to be assigned to a specific His residue. Therefore it is unknown which His, if either, is deprotonated in the oxidized [2Fe-2S] cluster.

Density functional calculations were performed on a model Rieske [2Fe-2S] system as well as on a model ferredoxin system (Figure 1).
Figure 1. Model structures of the oxidized Rieske [2Fe-2S] cluster and the Ferredoxin [2Fe-2S] cluster used in calculations.

Thiolate ligands represent cysteine side chains and methyl-imidazole ligands represent His side chains. For illustrative purposes, the Rieske cluster is shown with both imidazoles protonated, so the cluster is neutral when both iron atoms are present as Fe $^{3+}$. Nitrogens in the rings are numbered for use in tables 3 and 4.

The ferredoxin system has been more widely studied both computationally and experimentally and was used to determine the appropriate level of theory and size of basis set to model the Rieske cluster. The two iron atoms within ferredoxin and the Rieske clusters are antiferromagnetically coupled as a result of the five unpaired d electrons on each iron atom. The extent of this coupling is represented by the Heisenberg Coupling Constant, $J$, which may be calculated from the energies and $S^2$ values of the high spin and broken symmetry states.$^{23-25}$

For the ferredoxin model, structures were optimized with both Truhlar et al.’s M06-L functional$^{26}$ as well as the more popular B3LYP functional,$^{27}$ using Dunning’s correlation-consistent double, triple, and quadruple zeta basis sets.$^{28-31}$ Gaussian 09 software was used to perform the calculations and the procedure recommended for modeling antiferromagnetic coupling was followed to generate optimized high spin and broken symmetry structures.$^{32}$

Calculations of the model ferredoxin structure (Table 1) show that M06-L reproduces the experimental $J$ value$^{33}$ of $-182 \pm 20 \text{ cm}^{-1}$ within experimental error and more accurately than the B3LYP functional for this model system. Therefore, the M06-L functional was also used for the calculations of the Rieske model. The Rieske model geometry was optimized using the same procedure as the ferredoxin model. Calculated $J$ values (M06-L/cc-pVTZ) for the doubly protonated and singly protonated Rieske model geometry are $-223 \text{ cm}^{-1}$ and $-220 \text{ cm}^{-1}$ respectively. Note that calculated $J$ values for different protonation states of the Rieske cluster differ from each other by less than the 20 cm$^{-1}$ experimental error for ferredoxin.
The broken symmetry singlet that results from this optimization procedure is not a pure eigenstate of $<S^z>$, but is instead a linear combination of higher spin states. The pure singlet ground state geometry was optimized through an extended broken symmetry calculation,\textsuperscript{24} using the external optimizer feature of Gaussian 09 and a Fortran 77 program. The program weighted the energies, forces and hessians of the high spin and broken symmetry states to produce low spin singlet geometries and vibrational frequencies.

Calculated low spin vibrational frequencies for modes concentrated on the iron sulfur core have an rmsd of 10.6 cm$^{-1}$ from available experimental frequencies of Rotsaert et. al.\textsuperscript{34} and an rmsd of 9.7 cm$^{-1}$ from the available experimental frequencies of Khoury et. al.\textsuperscript{35} This is slightly smaller than the rmsds of 12.5 cm$^{-1}$ and 27.0 cm$^{-1}$ for published results obtained by using the BLYP/DZP method.\textsuperscript{36} Vibrational frequencies were also calculated for $^{15}$N isotopic substitutions within the imidazole rings. Three sets of isotopic substitutions were performed: (1) both nitrogens within both imidazole ligands were substituted, (2) both nitrogens within a deprotonated imidazole were substituted when the second imidazole remained protonated, or (3) both nitrogens within the protonated imidazole were substituted, while the second imidazole was deprotonated. The vibrational frequencies for double and triple zeta low spin calculations as well as the double, triple, and quadruple zeta high spin and broken symmetry calculations produce qualitatively consistent results. Therefore, we present only the values from the triple zeta low spin calculations.

A range of frequencies from 1483-1634 cm$^{-1}$ was examined for large isotopic shifts in the doubly protonated model (table 2). Two isotopic frequency shifts of -10 cm$^{-1}$ were identified, which correspond to carbon-nitrogen stretching modes on the imidazole rings. For the singly protonated model, a comparable frequency range from 1477-1622 cm$^{-1}$ was examined (Table 3). For this model, only one isotopic shift of approximately 10 cm$^{-1}$ (9cm$^{-1}$) was observed, corresponding to the carbon-nitrogen stretching mode on the imidazole ligand that remained protonated.
Table 2. Calculated vibrational frequencies and isotopic shifts upon $^{15}$N substitution of the doubly protonated Rieske cluster model. Two frequency shifts greater than -4 cm$^{-1}$ (-10 cm$^{-1}$) are observed for the C-N stretching modes of each imidazole ring when all N atoms are substituted.

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Table 3. Calculated vibrational frequencies and isotopic shifts upon $^{15}$N substitution of the singly protonated Rieske cluster model. One frequency shift larger than 4 cm$^{-1}$ (-9 cm$^{-1}$) is observed for the C-N stretching mode of the protonated imidazole ring when all N are substituted.

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Although experiments would be challenging, with current technologies the qualitative differences in the number of isotopic shifts calculated for the doubly protonated and singly deprotonated model Rieske clusters may be used to distinguish the protonation states of the cluster experimentally by using difference vibrational spectroscopy. If all nitrogen atoms are substituted and two shifts of approximately -10 cm$^{-1}$ are seen in the region from 1480-1600 cm$^{-1}$, then both His ligands are protonated. However if only one shift of approximately -10 cm$^{-1}$ is seen in this region, one of the His ligands must be deprotonated. Furthermore, if the nitrogen atoms on only one His ligand are substituted in the doubly protonated cluster, one isotopic shift near -10 cm$^{-1}$ is expected in the region from 1480-1600 cm$^{-1}$. However if the nitrogen atoms on only one His ligand are substituted in a singly deprotonated cluster, there is
again a qualitative difference in the number of isotopic shifts. If only one shift of approximately -10 cm\(^{-1}\) is seen in this region, the protonated His ligand has been substituted. If no shifts larger than approximately -4 cm\(^{-1}\) are seen in this region, the deprotonated His ligand has been substituted. Therefore, using this approach, not only is it possible to determine the protonation state of the Rieske cluster, but it is also possible to determine which of the two His ligands is protonated and thus to infer which of the His ligands has the higher pKa value. Assignment of pKa values to specific His ligands of the Rieske clusters in cytochromes bc1 and b6f would thus provide valuable insight into the mechanism of proton coupled electron transfer in these protein complexes.

REFERENCES

INTRODUCTION

The use of hand-held mobile devices, such as tablets and smartphones, has increased significantly in recent years [1]. A common observation of people using such hand-held devices reveals that they frequently adopt postures of the upper limb and neck (upper quarter) that when done repetitively could result in musculoskeletal pathology [2]. In order to understand the risk of developing upper quadrant musculoskeletal pathology from hand-held device and technology use, it is necessary to first determine the pattern of use of different devices. Previous research has examined the effects of isolated use of technology devices, such as a laptop or tablet [1, 2]. We seek to determine the number of devices students use in a typical day and for how many hours each device is used. This will give a more complete picture of the impact of multi-device use on the development of faulty postures and potential musculoskeletal pathology and cumulative trauma disorders. This study is a two-part, mixed methods design. The purpose of Aim 1 is two-fold: 1.) to determine the patterns of hand-held device and technology use among college-aged persons and, 2.) determine associated upper quadrant discomfort or fatigue with hand-held device use. Aim 2 is focused on describing the postures assumed by persons using different electronic technology and hand-held devices. Data collection for Aim 2 will begin once the response rate for the survey increases. The overall hypothesis is that college students will use a
variety of technology and hand-held devices during a typical day and will assume faulty postures while doing so.

BACKGROUND INFORMATION

The study is focused on college-aged children using a variety of devices to see if the use of the technology has affected their bodies at all. Previously, there was research done on children [2]. Since technology is implemented into students’ lives early on, it was applicable to conduct research on these young kids. This technology is also often used throughout the student’s day, at home and during the school day. A review of the literature found that these children did not show any musculoskeletal problems and there were scarce results that showed musculoskeletal issues in kids from technology [2]. Even though these kids have been using the devices daily and for significant a time period, they may be too young to see any postural differences. While children have not shown any significant musculoskeletal issues, this study’s population was geared toward any issues that arise from older students in college who use technology.

Other studies have been done to see if there are any faulty postures from adolescents using technology. For example, Straker, O’Sullivan, Smith & Perry (2007) have looked at computer use effect of posture in adolescents. They found that in adolescents there were negative effects depending on the gender of the child [3]. They found that males had increased head flexion and neck flexion, while females had increased lumbar lordosis [3]. While children may not see the effects of the technology yet, musculoskeletal issues have been starting to show in adolescents. The adolescents have used the devices longer than the children, which is why they are starting to see the effects of cumulative trauma. With adolescents experiencing the postural issues without any change in their positioning of the device, the posture will only continue to get worse as they age, with the continued use of the devices.
This article [3] and others have only looked into one specific device and its effect on the users posture. Some articles look specifically at either cell phones, tablets, desktop computers, or laptop computer. This study wanted to look at a variety of devices, because students typically use more than one device throughout the day. It is also difficult to determine what device musculoskeletal problems derived from.

This issue has become prevalent because of the recent change in not only the time spent using technology but also the change in the devices themselves. People previously used desktop computers while seated at a desk. This way, the device could be supported and only used when the user was at a table or desk [3]. Now, devices are smaller and lighter making them more transportable. This allows people to use hold the devices, take them anywhere, and use them whenever. The consistent, daily use of devices throughout most of the day, while the device is unsupported could lead to musculoskeletal issues and cumulative trauma disorders of the neck, back, and shoulders. The fact that young children are also starting to use these devices early and often is a big concern. These children could adapt poor posture from the unsupported device use, which will eventually lead to cumulative trauma disorders and musculoskeletal issues. This study will look to see if college students use multiple devices every day and if their posture is affected by this constant use.

METHODS

To address Aim 1, an online survey has been sent to all undergraduate and graduate students at Duquesne University via their university email address. This 5-section survey is designed to assess patterns of use for various technology and hand-held devices. The devices included in the survey include cell phones, tablets, laptops, and desktop computers. The use of these devices is then related to symptoms of upper quarter (UQ) (neck, shoulders, and back) discomfort. Section 1 is on demographic information, including the survey respondents age, gender, and grade level. Section 2 explores
participants’ experience with technology, including what type of devices and technology are used throughout the day, how many hours each device is used and general location of device use (i.e., School, Home, Work, etc). Positioning during device use is obtained in Section 3. The answer options for Section 3 include while sitting at a table/desk, lying in bed, walking, sitting on a couch, sitting on a bench, or riding on a bus or train (Table 1). The participant can then comment on how often they use the device while in this position by checking either almost always, often, sometimes, rarely or never. A Likert scale is used in Section 4 to assess how often the participant uses various devices to complete different tasks, including gaming, writing papers or school assignments, work, texting, phone calls, listening to music, and taking pictures (Table 1). The final part of the survey addresses discomfort in the hands/fingers, arms, and neck/upper back while using the devices. The participant is asked to select the frequency with which they experience discomfort in these body regions while using the devices listed in the survey. There are diagrams provided which map off different parts of the hands and neck, back, and shoulders where the participant can specifically pinpoint where they feel the discomfort or pain during device use (Table 2). Completion of the survey takes approximately ten minutes.

At the end of the survey, participants are asked if they are interested in completing Aim 2 of this study. Those who choose to participate in Aim 2 will be photographed from the front and from the side while using the previously identified hand-held devices and technology. Participants will complete a series of set tasks with each device in order to simulate actual use. Such tasks will include holding the phone up to the ear to talk, or hold the phone in front of oneself to text. Another task will be sitting at a desk or on a couch to use a laptop. This will help to get a better visual image of the postures that people adopt while using the devices in various positions. The pictures will be analyzed using a grid overlay to measure positioning of the subject’s head, shoulders and trunk. Specifically, we will be measuring for forward head position, rounded shoulders, and shoulder elevation.
RESULTS AND DISCUSSION

Currently, 363 out of 9,984 Duquesne University students have completed the survey (3.6% response rate). Due to this low percentage, the survey will be re-distributed at least twice more to all Duquesne students to increase the response rate. A preliminary descriptive analysis has been completed from the data collected thus far. 80.1% of respondents are female and the median age is 21 years old. 39.5% of the respondents were graduate students with the remaining participants divided among the four undergraduate years. Participants report using an average of 3 devices in a typical day. The most frequently used devices were cell phones (98.5% of respondents) and laptops (91.8%). The majority of respondents use their phone between 1-3 hours per day (30.2%) or 4-6 hours per day (29.9%). 22.3% report using their phone for 10 or more hours. Similarly, the majority of respondents use their laptop between 1-3 hours per day (40.8%) or 4-6 hours per day (29.2%). Most respondents rarely or never experience discomfort in their hands/fingers (computer 80.9%; laptop 71.1%; tablet/e-reader 90.5%; cell phone 70.0%) or arms (computer 72.9%; laptop 57.8%; tablet/e-reader 89.0%; cell phone 80.6%). Discomfort was more common in the neck and upper back, occurring sometimes to almost always in 40.0% of computer users and 58.8% of laptop users.

CONCLUSIONS

College students report using an average of three technology devices within a typical day. Cell phones and laptops are used up to 6 hours each per day in a third of the sample. Extensive daily use of these devices will likely continue throughout their schooling and beyond with work responsibilities. Despite the young age of the respondents, students are already experiencing discomfort in the neck and upper back with computer and laptop use. We suspect that this device use will continue to persist throughout the remainder of the respondents lives, whether it be for social or work related use. The persistent use of poor posture while using these devices will only continue to feed into the pain and discomfort that
these people are experiencing. Additional analysis will examine the relationship between hours of daily use and discomfort. While faulty postures in isolated device use has been previously explored, in Aim 2, we will explore the combination of postures used across these various devices to provide a more complete picture of how multi-device use can potentially lead to musculoskeletal disorders in this population.

REFERENCES


*Figure 1*: Example pictures for posture analysis
Table 1: Sample questions regarding positioning during device use and the different tasks devices are used for.

<table>
<thead>
<tr>
<th>Section 3</th>
<th>Question</th>
<th>Condition</th>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I use _____ (cell phone, tablet, etc) while...</td>
<td>Sitting at a table/ desk</td>
<td>Almost Always</td>
</tr>
<tr>
<td></td>
<td>Lying in bed</td>
<td></td>
<td>Almost Always</td>
</tr>
</tbody>
</table>

| Section 4 | How often do you use _____ (cell phone, tablet, etc) to complete the following tasks? | School Assignments | Almost Always | Often | Sometimes | Rarely | Never |
|           | Texting/Messaging | | Almost Always | Often | Sometimes | Rarely | Never |

Table 2: Sample questions regarding frequency of discomfort in body regions with device use.

<table>
<thead>
<tr>
<th>Question</th>
<th>Condition</th>
<th>Devices</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Over the past 7 days, have you experienced discomfort or pain in your:</td>
<td>fingers/hands when using the following devices:</td>
<td>Computer</td>
<td>Almost Always</td>
</tr>
<tr>
<td></td>
<td>Laptop</td>
<td>Almost Always</td>
<td>Often</td>
</tr>
<tr>
<td></td>
<td>Arms (wrist/elbow/shoulder) when using the following devices:</td>
<td>Computer</td>
<td>Almost Always</td>
</tr>
<tr>
<td></td>
<td>Laptop</td>
<td>Almost Always</td>
<td>Often</td>
</tr>
<tr>
<td></td>
<td>Neck or upper back when using the following devices:</td>
<td>Computer</td>
<td>Almost Always</td>
</tr>
<tr>
<td></td>
<td>Laptop</td>
<td>Almost Always</td>
<td>Often</td>
</tr>
</tbody>
</table>
**Intramolecular Charge-Assisted Hydrogen Bond Strength in Pseudo-Chair Carboxyphosphate**

Sarah E. Kochanek, Traci M. Clymer, Venkata S. Pakkala, Sebastien P. Hebert, Kyle Reeping, Steven M. Firestine, and Jeffrey D. Evanseck | Bayer School of Natural & Environmental Sciences | Faculty Advisor: Jeffrey D. Evanseck, Ph.D.

**Introduction**

Carboxyphosphate is an elusive intermediate in the ATP-dependent carboxylase superfamily of enzymes, which is involved in critical pathways related to obesity, diabetes, and microbial infections.¹–⁵ Recently, we found that carboxyphosphate exists in a unique “closed” or “pseudo-chair” conformation (Figure 1) stabilized by more than 14 kcal/mol as the monoanion and 12 kcal/mol as the dianion over the corresponding lowest energy “open” conformation.⁶ Key to understanding the novel pseudo-chair stability resides in the balance between the stabilizing intramolecular charge-assisted hydrogen bond (CAHB), which is a special case of the intramolecular hydrogen bond (IMHB),⁷ and associated destabilizing interactions. In addition, it is important to delineate carboxyphosphate’s CAHB strength to understand its stability in nonpolar environments compared to its reactivity in aqueous solution.

![Figure 1. M06-2X/aug-cc-pVTZ key distances (Å) and angles of pseudo-chair carboxyphosphate.](image-url)
The CAHB is suspected to be the key element of stabilization for the pseudo-chair conformation of carboxyphosphate, where the energy minimized pseudo-chair conformation reveals a hydrogen bond oxygen-oxygen distance of ca. 2.5 Å that is less than its van der Waals sum of 3.04 Å ($r_{O}^{vdW} = 1.52 \text{ Å}$)\(^8\) and significant angle expansion across the bridging oxygen (ca. 127\(^\circ\)) in both charged states. The geometric changes suggest that Pauli repulsion and ring strain could be contributing factors to the overall destabilization of the pseudo-chair conformation. Such destabilizing interactions need to be addressed to determine the CAHB strength accurately.

Unlike the intermolecular hydrogen bond that has a convenient reference state, where infinite separation defines its absolute strength, measurement of IMHB strength must be determined relative to a non-zero reference system that makes its value ambiguous. Determining the strength of an IMHB is a non-trivial task due to the reference state selection; thus, many methods have been proposed and explored with varying degrees of success.\(^9\)–16 The challenge is to isolate an open structure (no IMHB), which may not necessarily be stationary,\(^9\) without introducing new or removing essential geometric elements found in the closed conformation. To date, there is no one widely accepted method for identifying a reference structure or for estimating IMHB strength.

Despite its controversial nature, the most common IMHB estimation scheme involves the energy difference between the geometry optimized open and closed conformations,\(^17\) otherwise known as the open-closed method. However, geometry optimization has the potential to remove essential energetic contributions in defining an accurate open reference state.\(^18\)–23 Subsequently, there has been effort in determining the effects of partially constrained versus full optimization of the open reference system, where significant differences have been reported.\(^22,24\) Nevertheless, it is possible to take an alternative approach, where the energetic terms crucial to the IMHB configuration are estimated then reinserted into the open-closed energy. The process of correcting the open and closed energy difference to estimate CAHB strength is referred to here as the additive scheme.
Many estimation schemes beyond the open-closed method\textsuperscript{17} have been developed and implemented for their ability to estimate the strength of the IMHB. Specifically, isodesmic reactions have been used in order to determine the strength of the IMHB.\textsuperscript{25} More recent schemes include the investigation of rotation barriers, as well as the relationship between rotamers.\textsuperscript{12,22} The relationship between $^1$H NMR shifts and hydrogen bond strength is well known, and a direct correlation between the two has been discovered.\textsuperscript{14,15} NBO analysis has been implemented to study the interactions of orbitals involved in the IMHB.\textsuperscript{16,26} Topological analysis by QTAIM can be used to monitor changes in the electron density as the reference system is developed.\textsuperscript{16,17,27,28}

Given the physiological importance and controversial understanding of carboxyphosphate’s structure, stability and role in ATP-dependent carboxylase superfamily of enzymes, it is both appropriate and timely to investigate the intramolecular forces responsible for the novel pseudo-chair conformation of carboxyphosphate. The CAHB is estimated through additive corrections for Pauli repulsions to the open-closed method using CHARMM force field nonbond parameters,\textsuperscript{29,30} and compared to a subtractive variant of the open-closed method. An improved understanding of the CAHB strength in relation to the overall stability of the pseudo-chair conformation in vacuum is a starting point in dissecting the origin of instability in the aqueous phase and possible existence and meaningful contribution to the mechanism of ATP-dependent carboxylases. The importance of Pauli repulsion is demonstrated for the accurate prediction of the CAHB strength in carboxyphosphate.

**Computational Details**

Resources at the Center for Computational Sciences at Duquesne University,\textsuperscript{31} the Gaussian 09 program,\textsuperscript{32} and the CHARMM force field\textsuperscript{29,30} have been used for all calculations. All electronic structure computations utilized Truhlar’s Minnesota M06-2X functional\textsuperscript{33} with Dunning’s augmented correlation consistent polarized valence triple zeta basis set (aug-cc-pVTZ).\textsuperscript{34} This level of theory has been shown to capture the majority of energetic convergence giving the most consistent agreement with reference MP2
and CCSD(T) calculations, as shown in Figure S1. Frequency calculations were carried out to confirm all stationary points as minima on the potential energy surface. The atom types with epsilon and $r_{\text{min}}$ values from the CHARMM force field$^{29,30}$ were used to compute the $r^{-12}$ Pauli repulsion. All energy differences are reported as $\text{closed} - \text{open}, \Delta E_{\text{c-o}} = E_{\text{closed}} - E_{\text{open}}$, which delivers negative values for stabilized closed structures.

Results and Discussion

Open-Closed Method. The open-closed method is one of the most widely used approaches for estimating CAHB strength, where the energy of the hydrogen-bonded (closed) form is compared to that of an open structure in which the CAHB is not present.$^{9,17,24,35-39}$ As previously discussed, the open-closed method typically involves rotation about one or more bonds starting from the closed form in order to disengage the hydrogen bond to produce an open structure. There are many variations to the open-closed method; however, the most basic procedure involves geometry optimization of the closed and opened forms with subsequent energetic comparison. Structural relaxation of the open form can either add or remove important interactions indigenous to the closed CAHB structure, thereby distorting the accuracy of the CAHB estimate, which has been recognized and criticized before.$^{18-23}$

In the open-closed method, the open configuration of carboxyphosphate is selected to be the geometry optimized, lowest energy conformation without the intramolecular hydrogen bond. The M06-2X/aug-cc-pVTZ geometry optimized structures are shown in Figure 3. Stabilization of pseudo-chair is defined to be the energy difference between the closed and open conformations in both the monoanionic and dianion states. CAHB strength is commonly estimated from the open-closed method and defined by the computed stabilization energies of -14.5 kcal/mol for the monoanion and -12.0 kcal/mol for the dianion.
Figure 3. M06-2X/aug-cc-pVTZ open (bottom) and closed (top) monoanionic (left) and dianionic conformations (right).

The open structures defined in Figure 2 are slightly different than the geometry optimized open structures using M06-2X/aug-cc-pVTZ shown in Figure 3. The differences are a consequence of how the two techniques generate the open structure to estimate independently the same CAHB strength. In this fashion, a more practical comparison is undertaken to represent approaches reported in the literature. Change in the lowest energy geometry optimized open structures affirm that essential geometric elements can differ from the closed conformation in the standard implementation of the open-closed method.

Additive Scheme. The geometry minimized pseudo-chair conformations, in comparison to the open structures, reveal that in addition to the CAHB, Pauli repulsion interactions and ring strain are possible contributors to differences in energetics between the two forms, as shown in Figure 3. To gauge the effect of each type of contribution to the overall stability of pseudo-chair, a series of model systems were developed and applied.

Ring Strain. In order to study the differential ring strain \( \Delta E_{c-o}^{rs} = E_{closed}^{rs} - E_{open}^{rs} \) between the closed and open forms of carboxyphosphate, dihydrogen phosphate was used as a model system for its ability to resemble the phosphate side and bridging oxygen of carboxyphosphate. Geometry optimized
dihydrogen phosphate has an ∠HOP angle of 105.9° (M06-2X/aug-cc-pVTZ) and was used as the strain free reference, as shown in Figure 4.

![Figure 4. Angle representing ring-strain in dihydrogen phosphate model of carboxyphosphate.](image)

To model the ring strain in the closed and open forms, the ∠HOP angle of 105.9° in dihydrogen phosphate was adjusted and fixed to that of the bridging oxygen in the different states and conformations of carboxyphosphate. The dihydrogen phosphate model systems were allowed to optimize constrained to the bridging oxygen angle. The relative energies (Δ𝐸𝑐−𝑜𝑟) of the different constrained geometries are given in Table 1.

<table>
<thead>
<tr>
<th></th>
<th>Open</th>
<th>Closed</th>
<th>Δ𝐸𝑐−𝑜𝑟</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monoanion</td>
<td>125.3°</td>
<td>127.7°</td>
<td>0.8</td>
</tr>
<tr>
<td>Dianion</td>
<td>129.3°</td>
<td>127.3°</td>
<td>0.7</td>
</tr>
</tbody>
</table>

Even though ring strain from a ca. 20° expansion across the bridging oxygen is computed to be significant at ca. 4.0 kcal/mol, the angle and subsequent energy difference between the open and closed forms is found to be small. In fact, the computed energy difference is less than 1 kcal/mol. The angles between the open and closed structures are too small to generate an appreciable ring strain differences,
making model selection irrelevant. Consequently, ring strain is determined to play only a minor role in the accurate prediction of the CAHB from the open-closed method.

**Pauli Repulsion.** Comparison of the geometry optimized open and closed conformations using M06-2X/aug-cc-pVTZ reveals a significant shortening of the distance between the oxygen atoms \( r_{OO} \) and between the hydrogen bonded oxygen and hydrogen \( r_{HO} \) involved in the CAHB, as highlighted in Figure 5.

![Figure 5](image)

**Figure 5.** Specific nonbond interactions (red) computed to determine the Pauli repulsion in carboxyphosphate. CHARMM atoms types included.

In the geometry optimized closed conformations of both charge states, the \( r_{OO} \) distance of ca. 2.5 Å is less than its van der Waals sum of 3.04 Å \( (r_{OVdW} = 1.52 \text{ Å}) \). In addition, the hydrogen bond \( r_{HO} \) distances are 1.49 and 1.61 Å for the monoanion and dianion, respectively, which are shorter than the idealized van der Waals sum of 2.61 Å \( (r_{HVdW} = 1.09 \text{ Å}) \), as given in Table 2.

In the geometry optimized open conformations, the hydrogen bond is broken, and the distances between atoms change to relieve intramolecular nonbond interactions. The distances are computed to
become greater than the van der Waals sum, as shown in Figure 5. However, two \( r_{OO} \) distances in the open structures are close to the van der Waals sum, as given in Table 2. Thus, two interactions for each conformation were computed to determine the difference in Pauli repulsion between the closed and open conformations, as defined in Figure 5.

### Table 2. The \( r_{OO} \) and \( r_{HO} \) distances (Å) in the open and closed forms of the monoanion and the dianion and the difference \( \Delta r_{OO} \).

<table>
<thead>
<tr>
<th></th>
<th>Open</th>
<th>Closed</th>
<th>( r_{OO} )</th>
<th>( r_{HO} )</th>
<th>( \Delta r_{OO} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monoanion</td>
<td>3.105</td>
<td>3.243</td>
<td>2.481</td>
<td>1.489</td>
<td>0.624</td>
</tr>
<tr>
<td>Dianion</td>
<td>3.087</td>
<td>3.299</td>
<td>2.556</td>
<td>1.610</td>
<td>0.531</td>
</tr>
</tbody>
</table>

Difference in the Pauli repulsion between the closed and open conformations of carboxyphosphate was estimated by using the sum of repulsive \( r^{-12} \) part of the Lennard-Jones approximation, as given in Equation 1.

\[
E_{Pauli} = \epsilon_{ij} \left( \frac{r_{ij}^{\text{min}}}{r_{ij}} \right)^{12}
\]  
(Eq. 1)

The atomic Lennard-Jones parameters \( \epsilon, r^{\text{min}} \) are combined with the appropriate mixing rules for a pair of atoms i and j. In the current CHARMM force field, the parameters are \( \epsilon_{ij} = \sqrt{\epsilon_i \epsilon_j} \) (geometric mean) and \( r_{ij}^{\text{min}} = r_i^{\text{min}} + r_j^{\text{min}} / 2 \) (arithmetic mean), as listed in Table 3.

### Table 3. CHARMM force field Lennard-Jones parameters (\( \epsilon, r^{\text{min}} \)).

<table>
<thead>
<tr>
<th>Atom Type</th>
<th>Description</th>
<th>( \epsilon )</th>
<th>( r^{\text{min}} / 2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>OG311</td>
<td>Hydroxyl oxygen</td>
<td>-0.1921</td>
<td>1.7650</td>
</tr>
</tbody>
</table>
The CHARMM atom types defining the parameters used in Equation 1 for the computation of the Pauli repulsion \( \Delta E_{c-o}^{Pauli} = E_{c}^{Pauli} - E_{o}^{Pauli} \) are shown in Figure 5 and Table 3. The computed Pauli repulsion for the closed and open forms of the dianion are 6.48 and 0.78 kcal/mol, respectively. Therefore, the difference in the Pauli energies for the dianion is 5.70 kcal/mol. Likewise, the computed Pauli repulsion for the closed and open forms of the monoanion are 9.96 and 0.78 kcal/mol, respectively. Thus, the difference in the Pauli energies for the monoanion is 9.18 kcal/mol.

**Intramolecular Charge-Assisted Hydrogen Bond.** Analyses of the differential ring strain and Pauli repulsions in the open and closed forms uncover contributions that impact the estimated CAHB strength of the open-closed method, as described in Equation 2.

\[
\Delta E_{c-o} = \Delta E_{CAHB} + \Delta E_{c-o}^{Pauli} + \Delta E_{c-o}^{TS}
\]

\[
\Delta E_{CAHB} = \Delta E_{c-o} - \Delta E_{c-o}^{Pauli} - \Delta E_{c-o}^{TS}
\]

(Eq. 2)

The results of Equation 2 are given in Table 4 in order to estimate the range of CAHB strength. According to the additive correction for the Pauli repulsion to the open-closed method, the CAHB strength is -24.5 kcal/mol for the monoanion, whereas the CAHB strength is -18.4 kcal/mol for the dianion. The additive corrective terms for Pauli repulsion significantly increase the predicted CAHB strength compared to that predicted by the standard implementation of the open-closed method.

**Table 4. Components of the CAHB energy (kcal/mol) of dianionic and monanionic carboxyphosphate.**

<table>
<thead>
<tr>
<th></th>
<th>( \Delta E_{c-o}^{TS} )</th>
<th>( \Delta E_{c-o}^{Pauli} )</th>
<th>( \Delta E_{c-o} )</th>
<th>( \Delta E_{CAHB} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>OG2P1</td>
<td>=O in phosphate</td>
<td>-0.1200</td>
<td>1.7000</td>
<td></td>
</tr>
<tr>
<td>OG2D1</td>
<td>Carbonyl oxygen</td>
<td>-0.1200</td>
<td>1.7000</td>
<td></td>
</tr>
<tr>
<td>OG2D2</td>
<td>Carboxylate oxygen</td>
<td>-0.1200</td>
<td>1.7000</td>
<td></td>
</tr>
<tr>
<td>HGP1</td>
<td>Polar hydrogen</td>
<td>-0.0460</td>
<td>0.2245</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Monoanion</td>
<td>Dianion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------</td>
<td>-----------</td>
<td>---------</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.8</td>
<td>9.2</td>
<td>-14.5</td>
<td>-24.5</td>
</tr>
<tr>
<td></td>
<td>0.7</td>
<td>5.7</td>
<td>-12.0</td>
<td>-18.4</td>
</tr>
</tbody>
</table>

Based on the above estimation scheme, the CAHB can be classified as strong (greater than 12 kcal/mol). The class of hydrogen bonds known as short-strong hydrogen bonds (SSHBs) is often associated with those that are also low barrier (LBHBs). Although hydrogen bonds may be both short-strong and low barrier, these classifications are made based on separate criteria. Classification as an SSHB is based on the distance between the heteroatoms (less than 2.5 Å for an OHO hydrogen bond). However, classification as an LBHB is based on the equivalence of the pKₐ's of the two donor atoms, resulting in a low barrier to proton transfer between the two.

The estimated CAHB strengths from each of the three independent estimation schemes result in a bond strength greater than 12 kcal/mol used to classify a short-strong hydrogen bond. The heteroatom distance is 2.48 Å in the monoanion and 2.56 Å in the dianion. Thus, considering the sources of error, carboxyphosphate meets the geometric and energetic criteria for short-strong hydrogen bonding. The pKₐ values of the donor and acceptor are similar, dependent on the charge state; however, the proton does not readily transfer between the phosphate and carboxylic acid functionalities; thus, there is no double-well potential found, and the bond cannot be considered low-barrier. In summary, the bond is considered to be short-strong, but not low-barrier in both charge states of pseudo-chair carboxyphosphate.

**Conclusion**

The CAHB strength of the pseudo-chair conformation of monoanionic and dianionic carboxyphosphate in vacuum has been estimated by additive corrections to the open-closed method. Our additive correction scheme shows differential Pauli repulsion contributions between the pseudo-chair (closed)
and open conformations of carboxyphosphate that are significant in estimating the CAHB strength. Our CAHB estimate is -24.5 kcal/mol for the monoanion and -18.4 kcal/mol for the dianion. Ultimately, we find the CAHB in carboxyphosphate meets the criteria for short-strong hydrogen bonds. However, carboxyphosphate has a unique energy profile that does not result in the symmetric double-well behavior of low-barrier hydrogen bonds. The CAHB in carboxyphosphate is short-strong, but cannot be considered to be low barrier as the proton is not shared equally between the donor and acceptor groups. The strong hydrogen bond coupled with the fact that the hydrogen prefers to be on the phosphate group provides a previously unrecognized mechanism by which protons can be shuttled from the carboxylic acid side of carboxyphosphate to the phosphate. Such a proton shuttling mechanism has previously unconsidered implications for catalytic mechanism of the carboxylase enzymes. The present analysis delivers a fundamental report on the strength of the CAHB in the ionized forms of carboxyphosphate, which has the potential to realign and improve the mechanistic understanding of this intermediate in ATP-dependent carboxylases.
Effectiveness of Pharmacist Use of the Electronic Medical Record to Identify Adults at Risk for Anaphylaxis Without Access to Epinephrine for Self-Administration (EPI Rph)

Autumn Stewart, PharmD, BCACP and Katherine A. Sulkowski, PharmD Candidate 2015 | Bayer School of Natural & Environmental Sciences

Background

Anaphylaxis is an acute, life-threatening systemic allergic reaction associated with different mechanisms, triggers, clinical presentations, and severity. The diagnosis for anaphylaxis is based on clinical findings and criteria developed by the World Allergy Organization (WAO), a world-wide federation of national and regional allergy and clinical immunology societies and organizations that is dedicated to raising awareness and advancing excellence in the field of allergy and clinical immunology and has helped to define, prevent, and manage anaphylaxis. The WAO defines anaphylaxis as highly likely when any one of the following three criteria is fulfilled: (1) sudden onset of an illness with involvement of the skin, mucosal tissue, or both and at least one of the following—sudden respiratory symptoms and signs and/or sudden reduced blood pressure or symptoms of end-organ dysfunction; (2) two or more of the following that occur suddenly after exposure to a likely allergen or other trigger for that patient—sudden skin or mucosal symptoms and signs, sudden respiratory symptoms and signs, sudden reduced blood pressure or symptoms of end-organ dysfunction, and/or sudden gastrointestinal symptoms; or (3) reduced blood pressure after exposure to a known allergen for that patient. The symptoms vary from patient to patient and from case to case, creating difficulty in the diagnosis of anaphylaxis. However, symptoms usually occur in two or more body systems. Common presentations of
anaphylaxis include upper or lower airway obstruction, cardiovascular symptoms, and gastrointestinal symptoms.3

Anaphylaxis typically occurs suddenly; fatality can occur within minutes if untreated.2 Studies estimate that up to 16% of people in the United States may be at risk of anaphylaxis. The more rapidly the symptoms of anaphylaxis develop, the more likely the reaction is going to be severe.4 In outpatient settings, food is the most common trigger, accounting for 30% of fatal cases of anaphylaxis.5 The most common foods to cause anaphylaxis are peanuts, tree nuts, fish, and shellfish; but other foods such as milk, soy, and egg can also be triggers.3 Medications, insect stings, and latex are potential allergens that can cause anaphylaxis.

To date, epinephrine remains the first-line treatment of choice for anaphylaxis.6 Epinephrine should be administered at the onset of symptoms and administered every 5 to 10 minutes as necessary.4 Epinephrine works to maintain blood pressure by enhancing coronary blood flow and output, to open airways through bronchodilation, and to reduce edema in skin and mucosal tissues.4,7 Because symptoms can occur suddenly and progress rapidly, delays in administration are associated with an increased risk of fatality.6 Studies show that 54% of anaphylactic reactions occur in the home and only 13% occur in a hospital or health care clinic.1 To expedite access to treatment regardless of the setting, epinephrine is available for self-administration by patients in the form of epinephrine auto-injectors (EAI).6 Three different EAls are available in the U.S. market, Auvi-Q®, EpiPen®, and EpiPen Jr®. All three EAls are to be administered into the middle of the outer thigh by a patient experiencing symptoms of anaphylaxis.8,9 The use of epinephrine may result in mild adverse side effects such as heart palpitations, sweating, nausea and vomiting, dizziness, and anxiety; however, these symptoms indicate that a therapeutic dose has been given.10,2 Evidence-based guidelines from the Joint Council of Allergy, Asthma and Immunology recommend the following patient groups are at risk for anaphylaxis and are indicated
to be prescribed EAI: (1) all patients with a history of anaphylaxis with possible exposure to the allergen; (2) all patients with a history of a systemic allergic reaction; (3) patients with IgE-mediated food allergy and a history of asthma; or (4) patients with IgE mediated food allergy to specific food triggers known to be associated with severe fatal reactions. Despite these guidelines however, studies show that 52% of patients with a confirmed history of anaphylaxis never receive a prescription for EAI and 60% do not have EAI available.¹

In 2009, the Health Information and Technology for Economic and Clinical Health Act (HITECH) agreed to provide federal funding through Medicare and Medicaid to support the creation of electronic medical records (EMRs) in health systems over the next ten years. In addition to core objectives requiring EMRs to improve the safety, quality, and efficiency of care, the HITECH Act also emphasizes the “meaningful use” of data within the electronic medical record (EMR) to administer optimal care and improve health outcomes.¹¹ Allergy history and related information is routinely gathered by health care professionals in a variety of settings. When entered into specific fields within the EMR, this data becomes easily searchable, making the identification of individual patients with specific risk factors possible.

Pharmacists are uniquely trained as experts in the recognition and resolution of drug therapy related problems and work to ensure the appropriate and timely use of medications in the treatment of disease. Considering the gap in timely access to EAs as a drug therapy related problem and potential access to allergy history fields in the EMR, pharmacists may be able to improve the long-term management of anaphylaxis in patients at risk. The objective of this project is to determine the feasibility of using data from the EMR to address a gap in care through the identification of patients at risk for anaphylaxis in need of EAI.
Methods

A prospective, observational research study was conducted utilizing an EMR and patient interview at an urban, ambulatory care center serving uninsured, low-income adults. Approval from Duquesne University’s institutional review board was obtained prior to conduction of this study. The center’s EMR vendor created a report to identify patients who met inclusion criteria: documentation of “bee”, “nut”, or “anaphylaxis” in the allergy history fields of the EMR. A clinical pharmacist reviewed the report and excluded patients with a history of anaphylaxis to a medication—EAI therapy is not recommended in these patients as allergen avoidance is an effective means of prevention. The pharmacist then contacted patients via telephone; patients unable to be reached by phone were also excluded from the study. During the interviews, the pharmacist conducted an assessment of the patient’s reported history to determine patient need and access to EAI. Patients were encouraged to follow up with their primary care provider to further discuss obtaining a prescription for EAI if indicated. During the call, potential subjects were invited to participate in the research study; those providing consent to participate were enrolled and a data collection form listing age, gender, nature of allergy, nature of reaction, and epinephrine availability was completed. Data was entered into a Microsoft Excel Spreadsheet for analysis. Descriptive statistics were utilized to analyze the data to assess self-reported demographic and clinical characteristics of patients, along with access to EAI.
Results

Enrollment

Sixty-seven patients were identified as potential subjects in the report provided by the EMR vendor. Thirty-two patients were excluded due to medication allergies and 20 were excluded as they could not be reached via telephone. Of the 15 potential subjects able to be contacted via telephone, 12 provided informed consent. Figure 1 depicts subject enrollment in the study.

Figure 1: Study Enrollment

Demographics

Fifty percent of the subjects were female and the mean age was 49 years old (range 33-63).

Allergy History

Nine of the 12 subjects reported an allergy to bees; two subjects reported food allergies; and one subject had a latex allergy.

Seven of the participants (58.3%) reported a history of anaphylaxis and are definite candidates for EAI. Of the remaining five subjects without a history of anaphylaxis, two reported a reaction that
included both rash and facial swelling (i.e. systemic reaction) and one subject reported full body swelling. One subject reported mouth swelling from exposure to peanuts. These four subjects are also likely candidates for EAI due to the systemic nature of the reaction and the specific food trigger, respectively.

Access to EAI

None of the participants in the study had viable EAI in possession. Three subjects reported access to EAI; however, in each case the EAI was expired. Of the 12 participants, a treatment gap existed for seven subjects due to history of anaphylaxis and a treatment gap likely existed for four subjects due to history of a systemic reaction or specific food triggers.

An overall summary of study findings is depicted in Table 1.

Table 1. Demographic and clinical characteristics of subjects (n= 12)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Frequencies (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex</strong></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>6 (50%)</td>
</tr>
<tr>
<td>Female</td>
<td>6 (50%)</td>
</tr>
<tr>
<td><strong>Allergy†</strong></td>
<td></td>
</tr>
<tr>
<td>Insect (bee)</td>
<td>10 (83.3%)</td>
</tr>
<tr>
<td>Food (egg)</td>
<td>1 (8.3%)</td>
</tr>
<tr>
<td>Food (nut)</td>
<td>1 (8.3%)</td>
</tr>
<tr>
<td>Other (latex)</td>
<td>1 (8.3%)</td>
</tr>
<tr>
<td><strong>Nature of Reaction†</strong></td>
<td></td>
</tr>
<tr>
<td>Anaphylaxis</td>
<td>7 (58.3%)</td>
</tr>
<tr>
<td>Rash</td>
<td>2 (16%)</td>
</tr>
<tr>
<td>Other (facial swelling)</td>
<td>3 (25%)</td>
</tr>
<tr>
<td>Other (full body swelling)</td>
<td>1 (8.3%)</td>
</tr>
<tr>
<td>Other (local swelling)</td>
<td>1 (8.3%)</td>
</tr>
<tr>
<td>Other (breathing difficulty)</td>
<td>1 (8.3%)</td>
</tr>
<tr>
<td><strong>Epinephrine Auto-Injection (EAI) Access</strong></td>
<td></td>
</tr>
<tr>
<td>No EAI</td>
<td>9 (75%)</td>
</tr>
<tr>
<td>Expired EAI</td>
<td>3 (25%)</td>
</tr>
</tbody>
</table>

† % do not equal 100 as some patients reported more than one allergy or reaction
Discussion

This study demonstrates that information from the EMR can be used to gather valuable information regarding patient allergy history to prescreen patients at risk for anaphylaxis. These findings further demonstrate that pharmacist use of EMR data, coupled with patient-interview, may be an effective strategy in identifying patients who are at risk for anaphylaxis and who require EAI for self-administration. This information can be used to identify treatment gaps so that patients can be referred to their physicians for appropriate management of allergies and anaphylaxis. Implementation of practices similar to those used in this study may have the potential to improve management of anaphylaxis and allergies in patients within a variety of practice settings. This study also demonstrates the importance of pharmacist access to EMRs, specifically allergy history fields. In this study, an alarming number of patients with an indication to receive EAI were without treatment. This study further validates the need to identify patients as potential candidates for EAI, based on the most recent evidence-based guidelines for managing anaphylaxis, as a strategy for improving the long-term management of anaphylaxis. Improving access to EAI in these patients has the potential to reduce complications from anaphylaxis which could ultimately decrease hospitalization rates and fatalities associated with anaphylaxis.

Lastly, the results from this study may provide a more accurate estimate of EAI access among the uninsured. In the general population, less than half of patients receive a prescription for EAI after an anaphylactic reaction.¹ None of the patients in this study had viable epinephrine available. Therefore, it is important to realize that national estimates of EAI access may be overestimated in certain patient groups, including those who are uninsured or are low-income. More studies are needed to develop a better understanding of the management of anaphylaxis in low-income and uninsured adults.
Additionally, pharmacists and other health care providers should be aware of the different prescription assistance programs offered by various pharmaceutical manufacturers and available for uninsured patients with low incomes to help patients obtain access to epinephrine.

Limitations

Only patients with documentation of “anaphylaxis”, “nut”, or “bee” in the allergy history fields in the EMR were identified. Selection bias prevented any patient with other allergies or triggers to be included as potential subjects in the study. The population in this study was a low income, uninsured population and may not reflect the characteristics of the general population. The findings from this study may not be able to be generalized to patients with health insurance or prescription drug coverage. All information obtained via telephone interview on the data collection forms was patient-reported.

Conclusion

EMRs contain valuable information that can be coupled with patient interview by pharmacists to identify patients at risk for anaphylaxis without appropriate access to EAI. Access to EAI may be lower than national estimates among indigent patients.

References


This research is interested in first impressions. Individuals often make conclusions concerning a person’s character within seconds of their meeting. Many parameters of perception influence this initial judgment, and this project seeks to understand what judgments are made based on the concept of perceptual-motor bias. This concept suggests that individuals make judgments about stimuli, including people, depending on the direction in which the object is perceived to be moving. Previous studies suggest readers of left-to-right languages favor stimuli facing a direction that indicates left-to-right movement. Because of the constant movement of these readers’ eyes from left to right, the reader’s eyes become more comfortable with this motion, which transfers to a positive bias to left-to-right moving objects. Any movement that forced the individuals’ eyes to move right to left feels uncomfortable unnatural and awkward. It is hypothesized that this unfamiliar tracking of eyes from right-to-left and discomfort associated with it will then be projected on right-to-left moving object. Thusly the right-to-left moving object will be perceived as negative.

A previous study, A Sinister Bias for Calling Fouls in Soccer, sought to observe perceptual motor bias’s negative effects associated with right-to-left movement in left-to-right readers. This study used images of soccer fouls and surveyed referees to see the frequency of fouls associated with direction. It was concluded that referees of soccer matches tended to call fouls more often for images of left-moving events, a direction which for left-to-right readers would be considered atypical, than for right-moving event captures.
This concept of perceptual motor bias can be seen in our lives even if we do not actively know it. Film makers have been supposedly exploiting this bias for over a hundred years. Directors have used the right-to-left direction of the camera to make the audience feel awkward or foreboding. This can also be seen in some third person gaming. For example in Mario Brother’s the main character Mario moves in a left-to-right which is the usual tracking of the eyes. While Mario’s enemies move from right-to-left, which is atypical eye tracking for English readers.

The demonstration of a sinister use of direction, exploitation in film, and use in gaming design brought about the question: Can a low-level perceptual-motor bias associated with reading direction influence decisions about character? This question built the foundation of our study. Could positive and negative character traits be associated with characters in film stills due to perceptual-motor bias? We hypothesized that film goers will more often have a positive perception of characters who appear to be moving left-to-right than their left-moving counterparts.

Methods:

Given the nature of our study, it was determined that the simplest and most effective method of gathering and analyzing data was to develop an online survey wherein our participants could observe stimuli depicting a suggestion of horizontal movement, and then make judgments about those stimuli. The survey was distributed to a sample of undergraduate Duquesne University students. The primary interest lay in seeing how perceptual-motor bias would influence judgments about individual people. Film stills were chosen to be the desired stimuli. The film stills depicted two individuals facing each other directly, as if engaged in conversation. Given the direction each person in the still was facing, each image suggested that one character was moving leftward, while the other was moving the opposite direction.
The stimuli were limited to black-and-white film stills, selected primarily from 1930s movies. This was done to prevent biases. The first bias we tried to limit was fewer distracting elements mainly associated with color; including bright shirts, detailed backgrounds, or anything that could distract our participants’ focus from the characters in the pictures. A secondary bias was the familiarity with the stimuli collected. We wanted the stimuli to be film stills from movies never seen before by the participants. If participants recognized the characters in the film stills they would create a judgment based only on the characters traits or demeanor in the movie rather than their first impression. Since only college-aged undergraduates were tested their exposure to black and white films would be very limited.

Furthermore, the film stills had strict inclusion and exclusion factors. Inclusion factors were characters which were the same gender and race, similar hair color, height, facial hair, clothing, facial expression, and held the same body position (sitting, standing, or leaning). The exclusion factors we no characters with headwear, uniforms, eyewear, or facial deformities or scars. Our goal in this was to provide as little opportunity for bias as possible.

The stimuli that remained went through a photo shop program. Here film stills were cropped to remove hands (hand gestures of characters), other characters, and any items that were in between the two characters. After this process we had forty film stills. Each of the film stills were then flipped horizontally giving us forty mirror images. The total stimuli available were eighty black and white film stills. This was done to correct for any visible bias the filmmakers may have implemented when positioning their characters, and to provide twice as many stimuli for our surveys.

The next step after finding the film stills was imputing our stimuli into Qualtrics Online Survey Software & Insight Platform. The survey was designed so that, after answering demographic information, each participant would be randomly directed to one of nine possible surveys. Each survey
contained all forty stimuli, divided into two sets of twenty stimuli. Each set had three random variations, resulting in a total of nine possible surveys. No single survey had both an original and its mirror image; the originals and flipped images were distributed randomly amongst the nine versions of the survey.

Accompanying each stimulus was a question aimed at assessing either a positive or negative character trait. The participant would then be required to attribute that trait to either the character on the left (Character A) or on the right (Character B). The questions could be related to possible actions taken by the characters, their personality, or their moral standing. For example, one positive question (one that we hypothesized would be attributed to the left-to-right facing character) was “Which character is more likely to help an elderly woman cross the street?” while a negative question (hypothetically aimed at the right-to-left facing individual) resembled “Which character is more likely to cheat on their spouse?” In order to minimize bias, the questions only addressed attributes that could pertain to individuals of any race or gender.

This is an example question from the Qualtrics survey and example stimuli with their mirror counterpart.
Each possible survey contained the same stimuli and questions, for the purposes of randomization, in each possible survey, the film stills were paired with a different question. Based on our hypothesis, we surmised that our survey participants would consider Character A on the left, whose position on the screen suggested rightward movement, would be chosen in the positive oriented questions. While Character B (on the right) who suggested leftward movement would be chosen in negative oriented questions. This would occur whether the original or mirror image was used.

Results:

We initially compiled a total of 53 completed surveys. In order to correct for bias due to left or right-handedness, the left hand-dominant participants’ scores were discarded. Any participant who did not choose English as their first language was also eliminated from the survey. This produced a remaining number of 48 participants. All 48 participants answered never or rarely to watching black and white movies limiting the bias of character familiarization. Out of these participants, 54.12% selected a left-to-right facing stimulus when the question suggested a positive attribution. Similarly, when asked to attribute a negative characteristic to either the left or right-facing stimulus, 52.42% of participants
selected the stimulus on the right. This supported the expected hypothesis. A chi-squared test was used to determine statistical significance. The chi-square test produced a chi value of 7.58 and a P value of 0.005902. This means the results were statistically significant.

This graph shows the prevalence of results and its difference from chance.

**Conclusions:**

Based on the data collected and the subsequent analysis, it was determined that on a whole individuals tended to select the stimulus on the left more often when the question presented a positive attribution. When the question contained a negative attribution the stimuli on the right were more often selected. All of participants were readers of a left-to-right language, which supports the hypothesis for the perceptual motor bias of left-to-right readers. This also gives validity to the age old theatrical practice of having the villain enter from stage right and having the hero enter from stage left.
Subsequent experiments are required to continue to make conclusions concerning this phenomenon. Refinements to this experiment should be to have equal number of positive and negative questions and a larger more diverse participant group. It would be beneficial to have participants with a larger age range and more equivalent gender.

Future experiments should include the testing of perceptual-motor bias on left hand dominant individuals to determine the influence of handedness and perceptual motor bias. The next step to better understanding perceptual-motor bias would be to test readers from a right to left reading language and determine if the results would be reverse. If the bias holds true participants would consider Character A on the left, whose position on the screen suggested rightward movement, would be chosen in the negative oriented questions. While Character B (on the right) who suggested leftward movement would be chosen in positive oriented questions.
1 Healthy Start: Healthy Life
Emily Moreton, Elizabeth Mueller & Kate Bowers
Senior | Rangos School of Health Sciences
Faculty Advisor: Audrey E Kane, PhD, MS,OTR/L

ABSTRACT:
The purpose of the program, Healthy Start: Healthy Life is to promote health and wellness of women residing at Healthy Start House. Participants in the program include women who are homeless or transient and are also pregnant or have children. The three main outcomes of the program include increasing physical activity, increasing more nutritious eating habits, and increasing knowledge of relaxation techniques. Goals to meet these outcomes include weight loss, stress relief, and increasing self-esteem. Research shows that women who have a low-income or are homeless typically need assistance in maintaining a healthy lifestyle, goal setting and positive parent-child interactions. During planned activities, we will encourage positive interactions by incorporating children as possible and begin to assist in realistic goal setting. Healthy Start: Healthy Life will be implemented once per week for nine weeks. Progress will be tracked through pre and post program surveys, as well as interviewing throughout the program. The women will need to make positive choices, including making decisions on nutrition, stress management and exercise to promote their health and wellness and ensure balance mentally and physically. This program is designed in hopes that it will help to facilitate a healthier lifestyle.

2 A Comparative Analysis of Mexican Immigration in Texas
Ember Holmes, Saul Berrios-Thomas, Nicholas Dodd
Senior | McAnulty College and Graduate School of Liberal Arts
Faculty Advisor: Jennie Schulze, PhD.

ABSTRACT:
This research focuses on the factors that influence the assimilation of Mexican immigrants in Texas, comparing outcomes among first, second, and third generation Mexican immigrants in urban and rural regions of Austin, Brownsville, El Paso, Dallas-Ft. Worth, Houston, Kingsville, Laredo, McAllen, San Antonio and Sugar Land. We measure immigrant assimilation along various dimensions that include: political (voting, party membership, participation in civil society and organizations, and alternative political activism via protests and petitions); education (level of educational attainment, grades, standardized test scores, and college admittance rates); labor market (employment rates and sector of employment); cultural (English language fluency and use, patterns of consumerism, religious activity); and social (patterns of social identity). The discussion of these elements of structural and cultural assimilation helps explain why Mexican immigrants choose to live in certain regions of Texas and
provides the necessary context to understand how successfully immigrants are able to assimilate into society. These findings are used to formulate policy recommendations that will improve the assimilation process for the Mexican population in Texas.

3 DNA Barcoding of Stomach Contents Reveals Trophic Competition Among Three Species of Trout
Brandon Hoenig
Junior | Bayer School of Natural and Environmental Sciences
Faculty Advisor: Brady Porter, Ph.D.

A B S T R A C T:
The competitive exclusion principle states that different species cannot utilize the same resources at the same place and time. When two species compete for the same niche, the less fit species will either occupy a new niche or face extirpation. As a result, species typically adapt by differentiating their niches to avoid intraspecific competition. In this study we investigate trophic competition and niche differentiation between two non-native trout species, Brown Trout (Salmo trutta) and Rainbow Trout (Oncorhynchus mykiss), and native Brook Trout (Salvelinus fontinalis) in Powdermill Run near Rector, PA. This stream supports naturally reproducing population of all three trout species and their insect diets may be a key factor to understanding how these fish coexist. To elucidate the diet composition, we developed and employed a gastric lavage technique to collect stomach contents from the fish. The insect remains contained within the diet samples were identified using DNA mini-barcode approach. DNA was extracted from the diet samples and an arthropod-specific fragment of the mitochondrial cytochrome c oxidase I (COI) gene was amplified by PCR and sequenced using an Illumina MiSeq Next-Generation platform. Preliminary findings suggest that Mayflies (Ephemoroptera) are a primary component in the diets of all three trout species, and that differing size classes do not exhibit different dietary needs. Understanding the diets of these trout is important for the conservation of the native Brook Trout and can model the impact of stocking invasive species. To better comprehend dietary changes throughout time, future directions include sampling throughout the entire year.

4 A Non-local Approach to Denoising Image Curvature Data
James Matuk
Junior | McAnulty College and Graduate School of Liberal Arts
Faculty Advisor: Stacey Levine, Ph.D.

A B S T R A C T:
Image denoising by the non-local means algorithm is a relatively new technique that takes advantage of self-similarity in natural images in order to attenuate image noise. Although the process works well for natural images, applying the algorithm to non-natural images, specifically image curvature data, is not as well investigated. The goal of this research project is to apply the non-local means algorithm to non-natural images. This poster will give a brief explanation of the problem: image noise. Then the steps of the non-local means algorithm will be presented. Finally, initial experiments with image curvature data will be shown.
5 Exploring the Adaptations of Bobcats to Diverse Ecosystems by Identifying Genomic Regions under Selection
Sarah Sprauer
Junior | Bayer School of Natural and Environmental Sciences
Faculty Advisor: Jan Janecka, Ph.D.

ABSTRACT:
The bobcat (Lynx rufus) and Canadian lynx (Lynx canadensis) both inhabit North America. Bobcats and lynx share similar ecological niches, however they differ substantially in their habitat and prey use. While the bobcat is a generalist, thriving in diverse environments and prey use; the Canadian lynx is a specialist whose population depends on the snowshoe hare and primarily uses boreal forests. The objective of the proposed project is to examine localized adaptation of bobcats in diverse regions of the US through genomic analysis and contrast it with the specialist, Canadian lynx. This will be done through DNA extractions from tissue and double digest restriction site associated DNA sequencing libraries prepared for Illumina sequencing on a MiSeq. Loci will be genotyped and tested to determine if any are under selection using modified methods of Elshire et al. (2011) and Peterson et al. (2012). Currently, 79 tissue samples have been received from four museums as well as various state agencies. This is becoming increasingly important as development, human activity, and climate change cause changes in the home ranges of bobcats and lynx. Understanding the genomics behind phenotypic plasticity and local adaptations of bobcats and lynx will give us a better understanding of how these animals may adapt to shifts in their distribution through their movement to northern latitudes. Our data will contribute to conservation and management of wild and captive populations of bobcats and Canadian lynx, and provide insight into molecular mechanisms that enable them to thrive under different environmental conditions.

6 The Effects of Child Abuse on Future Mental Illness
Meghan Young
Sophomore | Rangos School of Health Sciences
Faculty Advisor: Bridget Calhoun Dr.P.H., PA-C

ABSTRACT:
Previous research shows that child abuse has long-lasting physical and emotional consequences, including mental illness. This project explores and presents case studies of children from broken or disrupted homes that have become victims of child abuse and are expected to one day face personal and relational issues. The four types of abuse - physical, neglectful, emotional, and sexual - are analyzed in this data. The study demonstrates how abuse can lead to increased rates of self-hate, suicidal behavior, low self esteem, and other life-altering mental illnesses. By understanding these statistics from a qualitative point of view through case studies, healthcare professionals can advocate for stronger supervision and more effective action against suspected child abusers.
7 Transitioning is hard, life afterwards does not have to be
Grace Monroe, Ashley Kershaw, Kristen Sypa, Jordan Stricko
Senior | Rangos School of Health Sciences
Faculty Advisor: Audrey E Kane, PhD, MS, OTR/L

A B S T R A C T:
For Duquesne University’s Occupational Therapy Master’s Degree Program fieldwork 1B, students must pick a psychosocial facility to create a plan to address their client’s needs and then to implement the plan. Our group chose to work with the veterans at the Veteran Leadership Program (VLP). For a semester we met with veterans and learned that these individuals have difficulty forming and maintaining social relationships, especially with non-veteran citizens, often resulting in isolation. Additionally, due to the various mental conditions, these veterans need to be able to cope with their anxiety in order to function in the civilian world. Moreover, these coping mechanisms are necessary so that these individuals are able to be productive in the workforce in a professional manner. Furthermore, the veterans who attend VLP have difficulty engaging in leisure activities, which results in the absence of relationships, novel social roles, and the ability to establish personal preferences. We decided that these perspectives will be incorporated into every aspect of our service learning program. Education of effective coping strategies will be dispersed throughout every session, while activities involving professional communication and workforce development will target productivity. Each session will additionally incorporate education of appropriate leisure activities and ways of affordably accessing these opportunities in the Pittsburgh area. Overall, we came up with three, three-week sessions due to the availability of these veterans to implement our plan.

8 Occlusion Training Increases Strength and Hypertrophy in Collegiate Male Collision Sport Athletes: A Critically Appraised Topic
Anthony Alimenti, Elliot Fisher
Junior | Rangos School of Health Sciences
Faculty Advisor: Jason Scibek, Ph.D, LAT, ATC

A B S T R A C T:
Context: Resistance training increases athletic performance, reduces injury, and promotes hypertrophy. Blood flow restricted (BFR) training is hypothesized to increase strength and hypertrophy. When implemented into an athlete’s workout program, BFR training may be beneficial in optimizing muscle strength and hypertrophy. Objective: To determine the effect of BFR exercises to increase strength and hypertrophy in collegiate male collision sport athletes compared to unrestricted exercises. Design: We utilized a Critically Appraised Topic design with PICO questions as our framework. The following search parameters were used: Population: college AND athlete; Intervention: vascular occlusion OR blood flow restricted training; Comparison: no intervention AND control; Outcomes: increased muscle strength AND hypertrophy. The resources searched included Pubmed, Medline, PEDro Database, CINAHL, Sport Discus, and additional resources obtained via hand search. Inclusion criteria included English-only articles with level 3 evidence or higher, utilizing human, male collegiate collision sport athletes.
Patients or Other Participants: American collegiate football and semi-professional rugby athletes. Interventions: The use of cuffs or wraps that prevented venous return in the upper and lower extremities during resistance training programs. Main Outcome Measures: Changes in strength or hypertrophy in collegiate athletes. Results: All five studies showed an increase in maximal resistance lifted with BFR mechanisms. Two studies achieved these results using BFR training at considerably reduced training intensities. Conclusion: There is robust supportive evidence that the use of BFR training increases muscle strength and hypertrophy. Therefore, it is recommended that clinicians may implement this style of training into their athletes' workout programs.

9 Man Spreading
Gabrielle Smith, Jessica Mckown
Junior | McAnulty College and Graduate School of Liberal Arts
Faculty Advisor: Alexander Kranjec, Ph.D.

ABSTRACT:
The Psychology of Man-Spreading “Man-spreading,” a phenomenon that can be described as excessive leg-spreading in public places, especially public transportation, where a man’s legs cover more than a single seat, is a subject of some debate in US urban centers. However, little is known about the psychological causes and effects of this behavior. Using both field and experimental methods, the current study aims at exploring the relationship between leg spreading and a number of psychological variables. A field study measured the distance of men’s leg-spread and compared this distance to scores on a masculinity survey. An experimental study manipulated leg-spread distance in male and female participants to investigate the effect that leg-spreading has on survey scores related to gender identification, extroversion, and political affiliation.

10 Examination of Cross Contamination by Fingerprint Brushes: Fiberglass and Squirrel Hair Brushes
Bridget McGinty, Samantha Proctor and Marissa Felinczak
Senior | Bayer School of Natural and Environmental Sciences
Faculty Advisor: Lisa Ludvico, Ph.D.

ABSTRACT:
Fingerprint collection is a routine procedure at crime scenes. Fingerprinting is performed using several types of brushes: squirrel hair, fiber glass, or magnetic. In recent years, analysts have questioned whether these brushes may serve as a source of DNA contamination between crime scenes. If DNA contamination does exist, serious issues, such as unreliable evidence, could be introduced into the court of law. This research focuses on the ability of fiberglass and squirrel hair fingerprint brushes to pick up DNA from one crime scene with the possibility that it is transferred to another. Initially, commercially obtained DNA at a concentration of 200 ng/μL was pipetted onto six glass microscope slides. Brushes were assigned to each glass slide – yielding a total of three squirrel hair brushes and three fiberglass brushes. The brushes were swirled over the slides, using a common dusting technique. Pieces of the brushes were cut off and DNA IQ was performed along with qPCR to determine if the brush picked up...
the DNA that was put on the slide. This was done to compare the known concentration of DNA to the concentration the brush picked up after the DNA was deposited on the slides. Future studies will involve extracting DNA from blood in varying concentrations, in addition to developing decontamination protocols.

11 The Infamous Purple Gang; Detroit's Most Prominent Gang

Adam Tatar
Junior | School of Education
Faculty Advisor: Andrew Simpson, Ph.D.

ABSTRACT:
While the blood stained floors and bullet-ridden corpses are real, the popular story of the St. Valentine’s Day Massacre is a hoax. This infamous murder has traditionally been ascribed to Al Capone, however it is more than likely the actual person behind the murders was noted Detroit Gangster Abe Bernstein. During the early 1920s Bernstein and his three brothers founded the now infamous Purple Gang, which rose from petty thieves as teenagers to the leading suppliers of bootlegged alcohol across the country. Traditional narratives held that the St. Valentine’s Day Massacre was over the struggle between Al Capone and Bugs Moran for control of the booming bootlegging business in Chicago. Drawing from recent scholarship, I argue the cause of the massacre was not over territory but retribution for Bugs Moran stealing from the Purple Gang. The St. Valentine’s Day Massacre is emblematic of the excessive violence used by the Purple Gang. Though, the St. Valentine’s Day Massacre was one of the most polarizing events of the 19th century, the influence of the Purple Gang is much larger than one gruesome execution. Without the Purple Gang, the nationwide distribution of alcohol would not have been as renowned as it became during the late 1920s. This group of infamous men deserves the acknowledgement the rightly earned and warrant.

12 Optimization of the Extraction of Nuclear DNA from Human Hair Shafts

Justin Shaffer
Senior | Bayer School of Natural and Environmental Sciences
Faculty Advisor: Lisa, Ludvico, Ph.D.

ABSTRACT:
Hair has never been a desirable source of nuclear DNA. Mitochondria DNA which varies greatly in copy number can easily be obtained from the hair shaft. The initial component of this research study was done to determine what part of the human hair shaft contains the highest concentration of Nuclear DNA. Each hair was cut into sections; the bulb was used as a positive control because of the epithelial cells that it most likely possesses. The section of hair that is cut closest to the bulb was called the proximal piece, while the section of hair farthest from the bulb was called the distal piece. A middle section of the hair was collected and was labeled middle. All three of these samples were cut in 1 cm increments. It is widely believed that the melanin in the hair has inhibitory effects on DNA amplification therefore a fourth sample was collected. The fourth sample consisted of three 1 cm sections of the middle section of a hair. In this preliminary study a volunteer was used that will not participate in the
final study. Two more volunteers were used to determine if an elution volume of 100 µL or 25 µL in the Promega Tissue and Hair Kit was optimal for nuclear DNA extraction.

*13 Make Sure You Get My Good Side: Perceptual-Motor Bias in Film Stills
Nicole Wozniak, Rachel Johnson
Senior | Rangos School of Health Sciences
Faculty Advisor: Alexander Kranjec, Ph.D.

A B S T R A C T:
Rachel Johnson & Nicole Wozniak Adviser: A. Kranjec 9 April 2015 Make Sure You Get My Good Side: Perceptual-Motor Bias in Film Stills First impressions matter, and we often make judgments about a person’s character hastily. We questioned if such judgments could be modulated by a well-documented perceptual-motor bias. Previous studies suggest readers of left-to-right languages favor stimuli facing a direction that indicates left-to-right movement. Films and play directors supposedly exploit this phenomenon. Protagonists are depicted entering from screen left—moving right, and the inverted idea applies to antagonists, having them enter from screen right—moving left: discomfort with leftward motion therefore transfers onto the villain. The current study uses a collection of black and white film stills (and their mirror opposites) as stimuli. Experiment One asks participants to rate the likelihood that right-or-left facing characters possess positive or negative traits. Experiment Two requires participants to attribute positive or negative traits to either a left or right facing character. The study aims to empirically assess the validity of a longstanding theatrical technique.

14 Purification of vitellogenin from nesting loggerhead sea turtles, Caretta caretta.
Adam Uraco
Junior | Bayer School of Natural and Environmental Sciences
Faculty Advisor: Kyle W. Selcer, Ph.D.

A B S T R A C T:
The loggerhead sea turtle (Caretta caretta) is an endangered species that exists in ocean waters throughout the world. Although they nest in a variety of localities, the southeastern coast of the United States has one of the largest concentrations of loggerhead nests. Little is known about the physiology of this species, due to the fact that they spend most of their lives at sea. Knowledge of their reproductive physiology is needed to help determine how best to protect these turtles. Vitellogenin is the precursor protein to egg yolk, which provides nutrition for the developing young. Vitellogenin is produced prior to egg-laying, under the influence of estrogen. Information is sparse regarding vitellogenin levels of female loggerhead turtles. Such data can provide important insight into maternal resources, energy levels, nesting frequency, and offspring quality. We sought to purify vitellogenin from nesting female C. caretta for use in developing assays for this protein. Blood was collected by syringe from turtles nesting on the Atlantic coast. Plasma from the blood was subjected to protein assays and gel electrophoresis prior to vitellogenin purification. Purification involved multiple rounds of DEAE chromatography, with subsequent verification of vitellogenin’s identity by gel electrophoresis and immunoassays. Presumptive purified loggerhead vitellogenin was revealed to have a molecular weight of approximately 200 kDa. It
crossreacted with antibodies against vitellogenin in immunoassays, revealing that is was authentic vitellogenin. There were obvious differences in vitellogenin concentration among nesting females, indicating that assays for vitellogenin will be useful for studies of sea turtle reproductive physiology.

15 Use of a Journal Club for Professional Development: Outcomes in a School-based Occupational Therapy Practice

Amanda Corturillo
Senior | Rangos School of Health Sciences
Faculty Advisor: Jeryl D. Benson, Ed.D., OTR/L & Kimberly Szucs, Ph.D., MS, OTR/L

ABSTRACT:
Occupational Therapists at The Children’s Institute in Pittsburgh, PA are participating in a guided Journal club that meets 6 times over the course of the academic year. Through the guided journal clubs, the occupational therapists will read evidence-based practice (EBP) articles in order to increase their knowledge of the chosen topics as well as improve their critical appraisal skills. The purpose of this current study is to explore clinicians’ perception of this guided journal club including their overall satisfaction, knowledge base skills, and presentation skills. It is hypothesized that the clinicians will perceive the participation in the Guided Journal Club as beneficial in learning key EBP skills. In this study, clinician perception of the benefits of a guided Journal Club on learning EBP skills will be assessed via an anonymous survey provided before and after the journal club experience. The initial survey was given in October, 2014 and was completed online by 9 clinicians. On average, 8-9 clinicians have attended and actively participated in the guided journal club in their workplace which take place during their scheduled staff meetings. The follow up survey assessing the clinicians’ perceptions will be given in April, 2015 after the 6 monthly journal clubs have taken place. These surveys will be used to compare their initial perceptions of a guided journal club, initial knowledge regarding EBP and critical appraisal skills to the clinicians’ perceptions in all three areas after attending a guided journal club in their workplace.

16 Dual hits of cellular stress elicit synergistic toxic effects in the exquisitely vulnerable hippocampus

Scott Heinemann, Jessica Posimo, Daniel Mason
Senior | Mylan School of Pharmacy
Faculty Advisor: Rehana Leak, Ph.D.

ABSTRACT:
The major hallmarks of neurodegeneration are proteotoxic stress from misfolded proteins and oxidative stress from free radicals. One of the main brain regions to develop proteotoxic and oxidative stress in Alzheimer’s and Parkinson’s disease is the hippocampus, an area involved in memory. Here we modeled that stress in primary hippocampal neurons by administering sequential hits of 1) the proteasome inhibitor MG132 to increase misfolded proteins and 2) the oxidative toxin paraquat, an herbicide associated with a higher risk of Parkinson’s disease. We discovered that previous exposure to MG132 exacerbated cell loss in response to subsequent secondary exposures to paraquat or more MG132. Thus, dual hits were synergistic in their toxic effects on neurons from this vulnerable brain region, consistent
with the two-hit hypothesis of neurodegeneration. In our model, MG132 raised levels of heat shock protein 70 (Hsp70), which helps refold misfolded proteins. Inhibition of Hsp70 activity greatly exacerbated MG132 toxicity. Thus, dual hits of proteasome and Hsp70 inhibitors are also synergistic in neurons from this brain region. Finally, the thiol N-acetylcysteine was found to protect hippocampal neurons against MG132. This finding is relevant to neurological disorders because patients with Alzheimer’s disease and traumatic brain injury have been shown to reap benefits from N-acetylcysteine supplements. Further studies are underway to examine the mechanism underlying the protective effects of N-acetylcysteine. In conclusion, hippocampal neurons are exquisitely vulnerable to dual hits of cellular stress, perhaps explaining their sensitivity to multiple neurological disorders.

*17 Immigration or Extremism: Which Came First?
Julia Lamar, Sam Colaizzi and Brian Liston
Senior | McAnulty College and Graduate School of Liberal Arts
Faculty Advisor: Jennie Schulze, Ph.D.

A B S T R A C T:
September 11, 2001 triggered a shift in the global landscape. The attacks on the World Trade Center, The Madrid transit system, and The London Underground, have triggered a concern with violent Islamic extremism and a response from the international community. Part of this response involves the immigration and integration policies in many Western European countries, such as the United Kingdom, Germany, and France. Recently, there has been a resurgence of radical Islamist groups. These groups are comprised not only of immigrants from the Middle East but also expatriates of the UK, Germany, and France. There are many factors that have led to the radicalization of individuals residing in European countries such as host-country policies, the development of community organizations, and discrimination from the native community. How do immigration policies, theories, practices, and politics in the United Kingdom, Germany, and France help us understand the radicalization of the Muslim minorities in these countries? We find that factors such as the receiving context, national immigration policies, and religious sensitivity of these countries are hugely influential in how Muslim immigrant groups have integrated into society.

18 QUALITY OF LIFE IN ADULT PATIENTS WITH CYSTIC FIBROSIS - A Systematic Review
Anastasia Ipatova, Mousam Parekh, Ankur Dashputre
Senior | Mylan School of Pharmacy
Faculty Advisor: Khalid M. Kamal, M.Pharm, Ph.D.

A B S T R A C T:
Objectives: Cystic Fibrosis (CF) is a life-limiting, genetic disorder that has a tremendous impact on patient’s quality of life (QoL). The goal of this review is to summarize QoL literature in CF and identify instruments utilized to capture QoL data in adult patients. Methods: A comprehensive literature search using PRISMA guidelines was conducted from January 2010 to October 2014 using electronic databases such as PubMed, Scopus, CINAHL, and Cochrane Reviews. Studies assessing physical, psychological, social and spiritual impact on adult patients with CF were identified. The QoL instruments from the
studies were identified and a review of their psychometric properties in CF was conducted. Results: A total of 14 QoL studies in CF, which utilized 3 disease-specific instruments (CFQ-R, CF-QOL, a single item measure) and 3 generic instruments, were identified. Some important factors that influenced QoL in CF were pain, lung function, self-esteem, and ethnicity. Psychometric validation included validity (discriminant, convergent, and concurrent validity) and reliability testing. Reliability of the instruments was found to be within appropriate ranges (CFQ-R: Cronbach’s alpha ≥ 0.70; CF-QOL: test-retest >0.8; and Generic instruments: Internal Consistency >0.8). Conclusion: Clinical outcomes, patient perception, and demographic variables were found to influence QoL in adult CF patients. CFQ-R is the most commonly reported QoL instrument in CF. Also, the time constraint physicians face in using QoL assessment in clinical practice can be addressed by the recently developed single-item, CF-specific QoL questionnaire. Overall, CF has a negative impact on the physical, mental, and social aspects of patient’s life.

19 Thermoregulatory characteristics of patients with Prader-Willi syndrome

Derek Michalski, Rachael Carr, Ashley Johnson
Senior | Mylan School of Pharmacy
Faculty Advisor: Jennifer Elliott, PharmD

ABSTRACT:
Prader-Willi Syndrome (PWS) is a rare, genetic disorder of the 15th chromosome and is characterized by morbid obesity, behavioral issues, and a multitude of other metabolic dysfunctions. Thermoregulatory dysfunction has also been implicated, and is believed to be caused by an abnormality in the hypothalamic regulation of temperature. The purpose of our study was to evaluate the thermoregulatory characteristics of patients with PWS, and determine if certain factors predisposed PWS patients to hypothermia. A retrospective cohort study was conducted, and the electronic medical records of all patients who were admitted to an inpatient PWS program from March 2002-March 2014 were reviewed. The following data was collected at admission, throughout the patient’s stay, and at discharge: age, gender, race, PWS genetic subtype, IQ, length of stay (LOS), body temperature, antipsychotic use history, and diabetes, hypertension and hyperlipidemia diagnosis. Daily mean temperatures were recorded over mean LOS and patients were divided into three groups: hypothermia (any temperature <95° F), hyperthermia (any temperature >101° F), or euthermia (all temperatures 95°-101° F). Associations with patient characteristics and antipsychotic medication use were evaluated. A total of 663 patients were evaluated, and 21 were excluded due to missing data. The mean body temperature during mean LOS was 97.7° F. 91 (13.7%) patients were classified as hypothermic, 10 (1.5%) patients as hyperthermic, and 541 (81.6%) patients as euthermic. There were no significant differences between the groups in demographic and clinical characteristics, although PWS patients had a mean daily temperature less than the commonly accepted average of 98.6°.
20 Improvisation and the Death of the Performer’s Voice
Alec Chapman
Senior | Mary Pappert School of Music
Faculty Advisor: Benjamin Binder, Ph.D.

ABSTRACT:
Improvisation was considered to be an important skill for classical music performers and remained a vital part of classical music until the mid-18th century. Today, improvisation has all but vanished from mainstream classical music performance practice. In this paper, I analyze the various factors that contributed to the decline of improvisation. I draw from previous musicological research of issues surrounding performance and music’s relationship to the written score. Specifically, I look at the aesthetic values and musical ideals that developed in the Romantic Era, such as Werktreue (fidelity to the composer’s intentions in performing the “work”) and the concept of authenticity (an ideal that sought to draw attention away from the performer and towards the music itself) and show what impact these concepts had on improvisation. I argue that the present lack of improvisation came about from a general devaluation of the role of the performer in classical music vis a vis the composer. This devaluation limits the performer’s authority, creativity, and personal voice, which has led to a “museum” culture, where the works are admired at the expense of the performer. I conclude by suggesting that reintegrating improvisation to classical music and allowing the performer to create ideas which are both unique and valid will reintroduce creativity and individual expressiveness to the music.

21 Distorted British Identity behind Pink Floyd’s "The Wall"
Jessica Kendall
Junior | Mary Pappert School of Music
Faculty Advisor: Benjamin Binder, Ph.D.

ABSTRACT:
During the 1977 “Animals” tour, Roger Waters of Pink Floyd had finally had enough. After the release of their album “Dark Side of the Moon” in 1973, Floyd rocketed to stardom. Despite Art Rock’s intention of being a complex, intellectual experience, the atmosphere of these concerts was often chaotic at best. The behavior of the masses ultimately led to a climactic incident that forced Waters to acknowledge the barrier that had been erected between him and those with which he was trying to connect. He took this idea of a physical barrier and developed it further, creating the concept album “The Wall.” In “The Wall”, Waters tells an autobiographical story of a troubled and insulated rock star, Pink. Throughout the album, Pink builds a wall out of events and memories that close him off from society, his loved ones, and the art that he created. However, what on the surface seems to be merely a statement about the rock culture of the time proves to be a larger commentary on the state of Postwar Britain. Waters, being a direct product of the devastation of World War II, expresses distaste for his lifestyle in the past and present socio-cultural situation through the work. By way of the lyrics, music, and imagery in the album, show, and film, “The Wall” creates a caricature of the effects of postwar Britain. This caricature, similar to the
way that Pink depicts Waters, shows Postwar Britain as a repressive, abusive distortion of its pre-war glory.

**22 Mathematical framework for evaluation of short-term and long-term aid programs for human trafficking victims**
Alfred (AJ) Vogt  
Junior | McAnulty College and Graduate School of Liberal Arts  
Faculty Advisor: Rachael Miller Neilan, Ph.D.

**ABSTRACT:**  
Human trafficking is a modern-day form of slavery. Human trafficking occurs on a daily basis throughout the United States with the majority of victims being women and children. The victims of human trafficking offenses and the unique care they need to return to a self-sufficient lifestyle are often overlooked in current government aid programs. Our study proposes a specialized long-term rehabilitation program for underage female victims of human trafficking and a mathematical framework for determining whether the program can be a cost-effective solution to providing long-term victim recovery. Our mathematical model consists of five coupled differential equations describing the movement of underage females between susceptible, victimized, and aided classes within an at-risk population. Variables in our mathematical model include the entrance and exit rates of susceptible females within the population, the recruitment rate of victims, the rate at which victims leave their captors, the rescue rate of victims, and the rates at which victims enter and exit short-term and long-term aid programs, respectively. Model equations are numerically solved using Maple 17 and the output shows the number of trafficking victims (both first-time and repeat victims) and the number of victims receiving aid through time. We use the mathematical framework to compare the costs of a long-term rehabilitation program with the benefit of the program in reducing the number of repeat victims for various parameter values.

**23 Quantitative Polymerase Chain Reaction Variability**
David Orbin  
Senior | Bayer School of Natural and Environmental Sciences  
Faculty Advisor: Lisa Ludvico, Ph.D.

**ABSTRACT:**  
The variability of qPCR DNA may have a substantial impact on the loss of finite forensically valuable sample. Variables like the pipetting skill of the analyst, effect of available light during the plate set-up, the efficiency of plate centrifuge, pipette tip retention of the sample and the use of a master-mix were analyzed to determine their effect on qPCR data. By extracting a large quantity of DNA from whole blood and using it as a stock, a reference plate was produced and analyzed with qPCR. The resulting values served as a comparison control to be referenced when examining the effect of the aforementioned variables. Quanitifiler®, the quantitation kit used in this experiment, specifically instructs for the plate to be centrifuged prior to qPCR analysis, but many smaller laboratories do not have the necessary instrumentation. Additionally, the kit’s product literature warns to store the
reagents in minimum light, but does not specify the lighting conditions during the plating process. For these reasons, these variables in particular are extremely intriguing. qPCR is a widely used technique, especially in the forensic community, and the effect of these variables on the resulting data could have a significant impact. Most crime laboratories rely on quantity data to determine if downstream applications, such as genotyping, are worthwhile. Therefore, if a particular sample yields a qPCR value lower than the threshold for downstream applications and the true value is misrepresented due to the presence or absence of these variables, valuable evidence could be abandoned.

**24 Application of Total Variation Minimization**

Kinardi Isnata  
Senior | McAnulty College and Graduate School of Liberal Arts  
Faculty Advisor: Stacey Levine Ph.D.

**ABSTRACT:**  
Total variation, a way to measure oscillation of a signal, yields various important applications in digital image processing. In 1992, Rudin, Osher and Fatemi proposed solving a minimization problem using an objective function involving total variation with a set of constraints containing the noise statistics to reduce the noise of an image. In this research, we are studying another application of total variation in fusing exposure bracketed image pairs, which also involves perceptual color correction through variational techniques. Here we present the algorithm and it’s extension to other applications in image fusion, such as colorization, video, and HDR.

**25 Nucleation mechanisms of γD-crystallin protein aggregates found in cataracts**

Sarah Richards  
Senior | Bayer School of Natural and Environmental Sciences  
Faculty Advisor: Ralph Wheeler, Ph.D.

**ABSTRACT:**  
Many diseases are a result of protein aggregation, which occurs when the protein is damaged and subsequently misfolds and aggregates. Cataracts are formed by damage to the proteins that compose the lens of the eye, specifically γD-crystallin. Molecular dynamics simulations were performed to determine if one of the hydrophobic cores, a contiguous section of five or more hydrophobic residues, within γD-crystallin is critical for aggregation. Determining the propensity for aggregation of this hydrophobic core might be used to design a drug that can prevent or treat cataracts. The aggregation methods exhibited with these small peptides were also examined and mechanism(s) for aggregation between γD-crystallin peptides containing a hydrophobic core will be described.
26 **The Messenger RNA p250GAP G-quadruplex Secondary Structure Biophysical Classification and RGG Box Domain/ISO 1 Interactions**

Allison Williams, Snezana Stefanovic  
Junior | Bayer School of Natural and Environmental Sciences  
Faculty Advisor: Rita Mihailescu, Ph.D.

**A B S T R A C T:**  
The gene that encodes for p250GAP, is found on chromosome 11 and encodes a protein belonging to the RhoGAP family which affects the plasticity of neurons, specifically in the brain. It is hypothesized that mRNA p250GAP interacts with the Fragile X Mental Retardation Protein (FMRP), a protein linked to Fragile X Syndrome, the most common form of inherited mental impairment. FMRP uses its arginine-glycine-glycine (RGG) box to interact within its mRNA targets, named a G-quadruplex. To confirm first the presence of a G-quadruplex in p250GAP mRNA, a series of biophysical techniques were employed including 1H NMR spectroscopy, CD spectroscopy, UV spectroscopy, and native PAGE gels. Following these experiments, fluorescence spectroscopy and native PAGE were used to quantify the interactions of p250GAP mRNA G-quadruplex with the RGG box domain and full length FMRP.

27 **Upper Extremity Plyometric Training Increases Throwing Velocity in Baseball Players**

Michael Powell  
Senior | Rangos School of Health Sciences  
Faculty Advisor: Jason Scibek, Ph.D, LAT, ATC

**A B S T R A C T:**  
Context: Improvements in throwing velocity have been linked to success in baseball. Restoring throwing velocity following a shoulder or elbow injury is crucial in the rehabilitation process. Objective: The purpose of the study was to evaluate the effect of a plyometric or ballistic resistance-training program on throwing velocity. Design: The design of the study was a critically appraised topic. The PICO-based search defined the following parameters: Population: baseball; Intervention: (plyometric OR ballistic resistance) AND shoulder; Comparison: plyometric training protocol AND control; Outcomes: baseball-throwing velocity OR (baseball AND velocity). The databases searched were PubMed, ProQuest, Sport Discus, PEDro database, and Google Scholar. Participant: A total of 126 male baseball players participated in the selected three articles. All players were within a range of 11-21 years of age and participated on baseball teams. Intervention: The intervention was a plyometric or ballistic resistance training protocol that utilized the stretch shortening cycle for the upper extremity. Main Outcome Measures: Pre and post testing measures of throwing velocity served as the outcome variable. Additionally, questionnaires speaking to overall satisfaction with the program were recorded during two of the investigations. Results: All three studies found showed a statistically significant increase in throwing velocity after the intervention (P< .05). The increase in throwing velocity after the intervention ranged from 1.5-2.2 mph compared to the control groups. For all participants across the studies, only one of the subjects expressed displeasure with the training program. Conclusion: A plyometric training protocol can significantly increase throwing velocity in a baseball player.
28 Genetic variation at the relaxin 2 (RLN2) promoter in humans, and its effect on gene expression
Rachel Zapf, Taylor Pollock
Junior | Bayer School of Natural and Environmental Sciences
Faculty Advisor: Michael Jensen-Seaman, Ph.D.

ABSTRACT:
Relaxin is a peptide hormone primarily released by the ovaries that is involved mainly with childbirth. Increased levels of relaxin have been found to increase the risk of preterm labor, which can compromise the health of newborns. Genetic association studies have recently linked a single nucleotide polymorphism (SNP rs3758239) located on chromosome 9 in the putative RLN2 promoter with an increased risk of preterm birth. Additionally, a nearby microsatellite repeat is highly variable in humans. Our project aims to discover the range of genetic diversity of this relaxin promoter in humans and quantify the differences in the level of relaxin transcription among these human haplotypes. We plan to do this by, first, characterizing the haplotype variation in a sample of 44 humans via PCR, sequencing, and fluorescent fragment size analysis. With the variations characterized in the SNP and microsatellite repeat, we will test the hypothesis that these allelic variations modulate expression differences of RLN2. To do this, we will clone up to ten common human haplotypes into a vector which promotes luciferase production, to measure levels of transcription. Then, these constructs will be transfected into a human trophoblast cell line, luciferase activity measured, and differences analyzed via ANOVA. Overall, analyzing the genetic basis for differences in RLN2 regulation can help determine how relaxin is controlled during pregnancy, which has been shown to have an impact on the likelihood of preterm birth.

29 How Socioeconomic Factors Influence Healthcare in Tanzania
Rhiannon Lewis
Sophomore | Rangos School of Health Sciences
Faculty Advisor: Bridget Calhoun Dr.P.H., PA-C

ABSTRACT:
Through research, interviews and firsthand experience, this project examines the healthcare system of Tanzania. There are many preconceived notions about what healthcare is like in African countries: that it is extremely rudimentary, lacking in supplies and skilled professionals and a general underdevelopment of health knowledge that prevents good quality of health. To determine if any of these notions are in fact true, the structure of the healthcare system was examined alongside various lifestyles of the people of Northern Tanzania. In reality, the quality of healthcare people receive depends on many socioeconomic factors, such as geographic location, social status and poverty, factors that also affect access to healthcare in the United States.
30 "An Exploration of Simone de Beauvoir's Reaction to the Case of Robert Brasillach"
Christina McElwee
Freshman | School of Education
Faculty Advisor: Paul Zipfel

ABSTRACT:
The purpose of this project is to examine a question Simone de Beauvoir puts forth in her essay “An Eye for an Eye” and to defend her answer to it: can one condemn an individual person based on one moment of one’s life? Beauvoir takes this theoretical question and relates it to the case study of Robert Brasillach, a public intellectual during WWII who advocated collaborationism and anti-Semitism in his writings. Consequentially, he was executed during the postwar trials. I conclude along with Beauvoir that you can condemn an individual based on what is not just a moment in one’s life, but an instance in a series of repeated choices. I defend Beauvoir’s essay by arguing that it does not advocate murder; rather, is an explanation of her reasoning as to why she could not pardon Brasillach from a clearly argued philosophical standpoint.

31 Good Vibrations: A Survey of Current Literature Surrounding the Use of Vibroacoustic Music Therapy on the Hearing Impaired
Elizabeth Harris, Elizabeth Harris
Sophomore | Mary Pappert School of Music
Faculty Advisor: Elaine Abbott, Ph.D., MT-BC, FAMI

ABSTRACT:
The human body experiences vibrational properties beginning with the sensations experienced by the human fetus inside the uterus. After birth, humans experience these same vibrational properties through music and sound. While hearing loss affects about 360 million people worldwide even the profoundly deaf can experience low frequencies by way of vibration reception elsewhere on the body. These are enhanced with the use of vibrational furniture and amplifiers. In this project I review the current literature on vibroacoustic music therapy. I illustrate the importance of using vibroacoustic therapy as a musical intervention with the deaf population, and suggest that this technique has the potential to increase and enhance the deaf’s perception, understanding, and interpretation of speech or environmental sounds.

32 The Effect of Sexual Orientation on Religious Beliefs
Edward Lippl
Junior | Rangos School of Health Sciences
Faculty Advisor: Kathleen Glenister Roberts, Ph.D

ABSTRACT:
Does a clearly defined relationship exist between a person’s religious beliefs and their sexual orientation? Do people who identify as homosexual or bisexual continue their family’s religious beliefs
at a rate different than people who identify as heterosexual? Additionally, if a discrepancy does exist, what steps can religious and psychological leaders take to correct and address these deviations? To investigate these questions, a survey will be compiled to survey a significant population of college-aged students to compare the replies of respondents who identify as homosexual or bisexual with the control group of students who identify as heterosexual. The deviations between the two groups will be studied to determine if the hypothesis that sexual orientation impacts the rate of having religious beliefs and continuing the faith of a person’s family is statistically supported. A selection of peer-reviewed articles will be reviewed after studying the deviations to observe if the conclusions reached in my study are supported in literature. After studying the results of the survey and the journal articles, thorough interviews will be conducted with religious leaders and psychological leaders specializing in sexuality issues within and external to Duquesne to determine which steps can be taken to correct deviations, if applicable.

33 The British Roma: The Modern Neglected Minority
Lara Konefal-Shaer, Madison Maxon, Michael Pendal, Merrill Dill
Senior | McAnulty College and Graduate School of Liberal Arts
Faculty Advisor: Jennie Schulze, Ph.D.

ABSTRACT:
Historically the Roma, a traditionally nomadic loosely incorporated ethnic group that have permeated the European continent since the eleventh century, have rejected or resisted integration while also being vehemently repressed by native populations or host societies. Britain, in recent decades, has been a bastion of minority acceptance and multicultural policies that allow minorities a political voice. However, the Roma in Britain are nearly alone in their continued lack of integration into British society. This is manifest through a variety of economic and social problems including an increased crime rate, homelessness, low graduation rates, and remarkably low political involvement. Our research seeks to discover what aspects of Romani culture and outlook prevent them from incorporating. Does the difficulty lie in the Roma’s reluctance to give up their own idiosyncratic cultural traditions and to assimilate somewhat into mainstream British society, or is it the refusal of the British to accept this victimized group? In this study we seek to determine this answer as we examine various aspects of Roma integration to determine their overall integration levels, including structural, cultural, social and identificational integration. There is no immediate solution to this problem, however, with reliable methods to gather and structure accurate information about the situation of the Roma people, more useful policies can be enacted. We argue that simply increasing contact and communication between the Roma and the British mainstream will do most to resolve this problem.
34 The Use of Organic Base to Restore Catalytic Activity of [Cu(Me6TREN)Cl][Cl] in Atom Transfer Radical Addition (ATRA) in the Presence of Ascorbic Acid as a Reducing Agent
Megan Wasson, Gabrielle Pros
Sophomore | Bayer School of Natural and Environmental Sciences
Faculty Advisor: Tomislav Pintauer, Ph.D.

A B S T R A C T:
Copper-catalyzed atom transfer radical addition (ATRA) is used for C-C bond formation through the addition of alkyl halides across various alkenes. According to electrochemical and mechanistic studies, copper complexes with Me6TREN (tris(2-dimethylaminoethyl)amine ligand should be theoretically ~10 times more active than with TPMA (tris(2-pyridylmethyl)amine). However, catalytic studies in ATRA with different alkenes and alkyl halides showed the opposite trend. Catalyst regeneration is necessary for ATRA due to unavoidable diffusion controlled radical-radical terminations. The side product of the oxidation of ascorbic acid is the generation of H-X which protonates the Me6TREN ligand, rendering it unable to coordinate to the copper. In this ATRA study, several weak bases were employed to inhibit the degradation of the ligand and restore the catalytic activity. These bases were used in different stoichiometric ratios relative to ascorbic acid with the addition of CCl4 across various alkenes catalyzed by [Cu(Me6TREN)Cl][Cl]. In this study, it was found that the 5:1 ratio of base to ascorbic acid was the most effective and increased the catalytic activity of [Cu(Me6TREN)Cl][Cl] to nearly quantitative yields. In addition, kinetic studies demonstrated faster reaction completion with the ligand reducing the reaction time of methyl acrylate, methyl methacrylate, and octene from 24 hours to 4 hours and decreased the reaction temperature from 60 °C to room temperature.

35 The Art of Art
Sean-Michael Nypaver, Ken Klabnik
Junior | Mary Pappert School of Music
Faculty Advisor: Jessica Wiskus, Ph.D.

A B S T R A C T:
Thesis: The art and music of the Baroque era compliment each other in their collaborative depiction of the power of artistic expression. In Claudio Monteverdi’s opera, "L'Orfeo", Orpheus’ story is about the power of music. Likewise, Jan Vermeer’s painting, "The Art of Painting" depicts the power of art.
Analysis: Both the opera by Monteverdi and the painting by Vermeer are expressing the power of the respective art forms by commenting on the medium of the work itself. There are similarities between both works that correspond on a macro and micro scale. Conclusion: The Baroque era ushered in the concept of bringing both the ideal and the human aspects of art together.
Development of Spore Associated Protein Fusions in Streptomyces coelicolor Spores
Matthew Kocher, Daniel Fucich, Zach Resko
Senior | Bayer School of Natural and Environmental Sciences
Faculty Advisor: Joseph McCormick, Ph.D.

Abstract:
Endospores from unicellular bacteria have been used for vaccine production, probiotics, and as biosensors while exospores from filamentous bacteria have not been thoroughly investigated. SapC is a spore-associated protein of the filamentous sporulating soil bacterium Streptomyces coelicolor. Although it is associated with the S. coelicolor spore, SapC is not predicted to be a secreted protein. A goal of this project was to fuse the gene encoding SapC to the gene encoding the B subunit of the heat labile toxin of Escherichia coli (LTB) to determine if this fusion protein can be expressed and incorporated on the spore surface. Another goal was to make C-terminal truncations of SapC fused to LTB to locate the secretion signal of SapC. SapC-LTB expression and localization was characterized by SDS-PAGE and Western Blot analyses. This could lead to a viable method for oral vaccine production.

Mobile Technology Strategies to Support Vocational Skills, Health & Wellness in Young Adults with Intellectual Disabilities
Kathleen Boyle, Erin Wynne
Senior | Rangos School of Health Sciences
Faculty Advisor: Andrea Fairman, PhD, MOT, OTR/L, CPRP

Abstract:
Objective: The purpose of this study is to understand the usefulness of available smartphone applications (“apps”) in facilitating health and wellness or vocational skills in young adults with developmental and intellectual disabilities. Rationale: Young adults with developmental and intellectual disabilities often experience difficulty in adopting and sustaining healthy behaviors and often need extra support to secure and maintain employment. The use of apps may help support the needs of persons with developmental and intellectual disabilities to improve outcomes in these areas. Methods: Participants & Setting: The participants of this study include students of St. Anthony’s Secondary Education Program, located at Duquesne University. This program contains young adults (18-21) with developmental and/or intellectual disabilities. All participants must be able to use a smartphone. Design: Participants were randomly assigned to one of two groups. One group used apps to improve self-management skills, while the other group used apps to develop vocational skills. Future research will employ a cross-over design to determine if skills are sustained after a wash-out period. Measures: Qualitative observation occurred and surveys have been administered at baseline and following the intervention period. Participants’ progress was measured through Goal Attainment Scaling. Intervention: Each participant identified goals through baseline interviews, and apps were chosen to assist each participant in reaching a goal. The participant received training on the app, and utilized this app throughout a two month intervention period. Researchers collaborated with St. Anthony’s staff and participants’ caregivers to gain insight on subjects’ progress in school, home and community settings.
38 Relationship between Body Image and Views about Abuse
Nichole Hirt
Senior | Behavioral Science
Faculty Advisor: Coralyn McCauley, PhD

ABSTRACT:
In this study our goal is to discover what, if any, association there is between a higher level of self-objectification and the ability to identify psychologically and physically dangerous behaviors of others. Beginning at a young age, objectifying messages in the media and society teach girls that their highest worth lies in their physical bodies. As girls become women, the objectification by others can turn to self-objectification; we hypothesize that the more a woman views herself as an object the less able she might be to recognize the behavior of others as victimizing. In order to gain a deeper understanding of the effects of objectified body consciousness on perceptions of abusive behavior, we have asked participants to complete a two part questionnaire; section one relates to objectified body consciousness and section two is comprised of questions designed to measure the participant’s identification and ranking of others’ behaviors as abusive. In this way, we hope to gain a better understanding of the role self-objectification might play in continuing a cycle of abuse. It is our hope that this research and other studies like this can be of assistance in the development of programming and education for young girls, as well as in the therapeutic communication with women of all ages.

39 Comparison of Differential Extraction Techniques based on Quantification of Male DNA
Kiersten Erlanson
Senior | Bayer School of Natural and Environmental Sciences
Faculty Advisor: Lisa Ludvico, Ph.D.

ABSTRACT:
Currently the United States is facing a backlog of untested rape kits sitting in laboratories or evidence facilities. Forensic laboratories recognize the importance of processing these rape kits effectively and efficiently. However, given the variety of extraction techniques developed to analyze the kits no standardized procedure exists. The most common technique is the organic differential extraction, a non-commercial procedure, with several variations existing to improve efficiency. This study focused on comparing variations of the organic differential extraction to determine the most effective process. Once the most effective organic differential procedure was determined, a comparison was made between the commercially available kit Erase™. All extraction techniques were tested with control samples containing a mixture of male and female DNA. The study was divided into three sections to identify the extraction procedure that yielded the highest concentration of male DNA. The first test aimed to ascertain which concentration column, Microcon, Amicon or Vivacon columns, would yield the highest concentration of male DNA. The second test compared two and twelve hour incubation times. Based on the initial results from tests one and two, test three compared the organic differential with the Vivacon and twelve hour incubation to the Erase™ kit. This study confirmed the use of an organic differential extraction with Vivacon concentration columns and a twelve-hour incubation period yielded
the highest DNA concentration. Further research aims to use this optimal extraction to process untested rape kits.

40 **Optimization of an extraction method to analyze neural gene expression in the context of urinary-bladder pain**

Bharaniabirami Rajaram, Katelyn Sadler
Senior | Bayer School of Natural and Environmental Sciences
Faculty Advisor: Benedict Kolber, Ph. D.

**Abstract:**
The central nucleus of the amygdala (CeA) is a brain region involved in modulating pain and emotion. Regardless of the side of injury in an organism, activation of the right CeA over the left, is detected, showing evidence for hemispheric lateralization. Changes in gene activation can be detected by measuring levels of pain markers, which are genes that are activated upon induction of pain, such as noxious urinary bladder distension. Previous Western blot and immunohistochemical evidence from our lab has shown lateralization of phosphorylation, and therefore activation, of extracellular signal-regulated kinase (ERK) in the right CeA. We are interested in identifying downstream expression changes from pERK at both the protein and transcript level. Western blot and quantitative real-time polymerase chain reaction (qRT-PCR) can be performed in order to quantify changes in gene expression and activation at not only the protein, but also the mRNA level. Moreover, using two methods simultaneously on one sample allows us to evaluate all levels of expression changes in the context of pain, as well as correlate transcript and protein changes. Here, we describe our optimization of this procedure. Future analyses will use this method to inform us about the molecular mechanisms of the observed lateralization associated with bladder pain.

41 **Team Dynamics Survey Study**

Elise Carter
Senior | A.J. Palumbo School of Business Administration
Faculty Advisor: Aimee Kane, Ph.D.

**Abstract:**
In today’s dynamic work environment, teams experience changes in membership as employees come and go. Newcomers can be excellent sources of unique knowledge, bringing new perspectives to the team. Nonetheless, decades of research reveals that teams are reluctant to utilize newcomer knowledge, even knowledge that would have contributed to group effectiveness (for a review see Rink, Kane, Ellemers & Van Der Vegt, 2013). The current research examines factors likely to increase newcomer acceptance and knowledge utilization: team control over the newcomer entry process and the identity strategy used by newcomers. The study is a 2 (newcomer entry process: management imposed, team selected) X 3 (newcomer identity strategy: control, integrating, differentiating) factorial design conducted using a newcomer teamwork scenario and questionnaire paradigm. The 10-20 minute study asks participants to imagine they are part of a project team and immerses them in a description of a workplace situation. First, a member of their team has departed and is replaced with a newcomer who
is either (a) imposed by management or (b) selected by their team. Second, the newcomer contributes unique knowledge using either an integrating identity strategy (e.g., we, our), or a differentiating identity strategy (e.g., I, you). The control condition has no mention of how the idea is suggested. Lastly, participants respond to questions regarding their willingness to accept the newcomer and utilize the newcomer’s knowledge. We expect that, compared to teams who select their newcomers, teams with imposed newcomers will be more sensitive to the way newcomers contribute their knowledge.

42 A BIOPHYSICAL ANALYSIS OF THE CDK5R2 mRNA G-QUADRUPLEX SECONDARY STRUCTURE AND ITS ROLE IN THE PATHOGENESIS OF FRAGILE X SYNDROME

Christian Gaetano
Junior | Bayer School of Natural and Environmental Sciences
Faculty Advisor: Rita Mihailescu, Ph.D.

A B S T R A C T:
In silico energy modeling has shown that guanine-rich regions of certain nucleic acids are capable of forming secondary structures known as G-quadruplexes. These structures are subject to unique protein binding and therefore partake in gene regulation by mediating translation of messenger RNA (mRNA). Such regulation suggests that G-quadruplex-containing mRNAs may play a role in the development of certain genetic diseases. We have selected a guanine-rich portion of the mouse cyclin-dependent kinase 5 regulatory subunit 2 (CDK5R2) mRNA 3’ untranslated region for the study of these regulatory G-quadruplexes, as this gene has been implicated in the pathogenesis of a particular inherited disorder, fragile X syndrome (FXS). Circular dichroism spectroscopy, 1H-nuclear magnetic resonance spectroscopy, UV spectroscopy, thermal denaturation experiments, and polyacrylamide gel electrophoresis (PAGE) were utilized to confirm the presence of and characterize G-quadruplex structures in the selected sequence. Electromobility shift assays and fluorescence spectroscopy experiments were performed to demonstrate the binding of CDK5R2 mRNA and the fragile X mental retardation protein (FMRP) arginine-glycine-glycine box domain, which is known to have high binding affinity for G-quadruplex structures.

43 Determining the Mechanism for the conformational change of PNIPAM

Madeline Galbraith
Freshman | Bayer School of Natural and Environmental Sciences
Faculty Advisor: Jeffry Madura, Ph.D.

A B S T R A C T:
The stimuli responsive polymer, or smart polymer, poly(n-isopropylacrylamide) undergoes a conformational change above the lower critical solution temperature (LCST). At low temperatures the extended polymer is dominated by enthalpic contributions while at higher temperatures the collapsed polymer is dominated by entropic contributions. The molecular-level interactions responsible for the behavior of PNIPAM above and below the LCST were studied using molecular dynamics simulations. Different analysis methods were implemented to determine if the simulation data agrees with the experimental data as well as determining how this collapse occurs. Knowing the specific mechanism for
this process can be used to target specific substitutions of the functional groups on the polymer to designing novel polymers for specific applications.

**44 St. Anthony Apartment Service Learning Program**
Michelle Morris, Anna Olexsovich and Brooke Willis
Senior | Rangos School of Health Sciences
Faculty Advisor: Audrey E Kane, PhD, MS,OTR/L

**A B S T R A C T:**
Our 9-week program was designed for the students enrolled in the Post-Secondary St. Anthony’s Program, specifically attending the Squirrel Hill Apartment on Thursday mornings. Our program addresses various independent living skills, socialization, and community participation. This program is unique by incorporating various community involvement opportunities, not only teaching concepts to the students, but also providing the opportunity for our lessons to be practiced in real-life community scenarios, and therefore, problem solving through any unexpected events that may occur while on a community outing. Each week we build on everyday living skills, including, but not limited to, cooking, house grooming, social interpersonal skills, and computer skills. All of our carefully chosen activities ultimately lead up to planning and carrying out an end of the program party, which provides the students motivation to engage in the activities. Teaching independent living skills in the form of planning a party will also provide the members with a sense of achievement by being able to physically visualize the progress they have made throughout the program through the opportunity to enjoy the party they worked together to plan.

**45 Understanding Chronic Pain In Context: Intervention and Outcomes Using the KAWA Model With Youth and Their Families**
Brooke Willis
Senior | Rangos School of Health Sciences
Faculty Advisor: Jaime Munoz, PhD, OTR/L, FAOTA

**A B S T R A C T:**
There is a wide array of diagnoses where pediatric chronic pain is a primary symptom such as complex regional pain syndrome, chronic migraines, fibromyalgia, and reflex neurovascular dystrophy. Parents and their children may differ in their reports of the impact of pain on function. Using an approach combining the KAWA Model and the Canadian Occupational Performance Measure (COPM), this study aimed to compare and contrast the relationships between context, participation in occupation, and the experience of chronic pain as described by youth with chronic pain and their families. This process sought to understand the impact of chronic pain from a person in family context perspective. We define and examine the effectiveness of an evaluation process that encouraged co-assessment of the impact of chronic pain on family functioning to inform family-centered care. This retrospective study employs a qualitative case study approach with all data derived from chart records. In this case study approach each youth and their families will represent individual cases. Using qualitative analysis we intend to
describe and understand factors influencing each family’s co-management of chronic pediatric pain and to using cross case analysis to examine the range of experiences defined in these family narratives.

46 Environmental Knowledge and Attitudes of Students from Three Pittsburgh Universities
Natalie Campbell, Andrew Lendacky, Tamir Turpin
Freshman | Bayer School of Natural and Environmental Sciences
Faculty Advisor: Michael Irwin, Ph.D.

ABSTRACT:
Research Question: How do students at three different schools in Pittsburgh (Carnegie Mellon University, University of Pittsburgh, and Duquesne University), view sustainability, the environment, and their individual impact on and involvement in both? Background: We think it is important to observe how different schools treat the environment and how it might relate to a larger environmental issue. Individuals who might have a possible interest in the results include states officials, school boards, and even city sanitation workers. Data: The major method of information gathering will be a survey. Every participant will take the survey anonymously. We will send the randomly selected participants from the three different schools an email and a link to survey monkey. The sample size from each school will be about 300 to ensure a response number of at least 30. The survey questions will be mostly ordinal level variables. Method: We will analyze the data based on statistical analysis, since the samples will be simple and random. The data will be organized into categories for each school. We will use descriptive statistics such as bar graphs and pie charts to compare the three schools. Expected Results/Products/Impacts: We predict that Carnegie Mellon will be the most environmentally conscious because it is a very science oriented school. We expect Duquesne to be second because it is more of a community, and a “park setting.” University of Pittsburgh would come last because its campus is so widespread, that its environmental consciousness is diluted due to the diversity of beliefs.

47 A Comparison of Hispanic Migrants in Pittsburgh, Pennsylvania and Tucson, Arizona
Ben Smith, Catherine Darden, Pat McCune
Senior | McAnulty College and Graduate School of Liberal Arts
Faculty Advisor: Jennie Schulze, Ph.D.

ABSTRACT:
For our research project, we are doing a comparative study on Latin American migrants between U.S. Cities Pittsburgh, Pennsylvania, and Tucson, Arizona. The research will investigate the immigration policies in place, migrant’s integration in society as a whole, and will compare the two cities differences on how Hispanics live in the U.S. We will argue the policies that are in place in Tucson are geared more toward “assimilating” the migrants compared to Pittsburgh, and are significantly different than the federal policies. Throughout the study, we will research the receiving context of the migrants in the cities, and discuss the different forms of integration the migrants experience in their transition into the United States. This will be done through researching specific policies put in place at the state and local levels; examining statistics regarding voting patterns, membership in political parties and civic organizations, levels of educational attainment, and other markers of integration. Through examining
all these factors regarding immigration policies in both Tucson and Pittsburgh, we hope to prove that the policies in place in Tucson are much more geared towards “assimilating” the immigrant population, whereas the policies in Pittsburgh allow for a certain degree of multiculturalism in the immigrant community. We will compare the states and cities to each other, to provide a better understanding of the current state of immigrants living in America. We will discuss what has been done, what could be done, and what should be done regarding future immigration policies in the United States.

48 The Effect of Dynamic Furniture in the Classroom on Student Behavior

Marissa Vaul
Freshman | School of Education
Faculty Advisor: David Carbonara, Ph.D.

A B S T R A C T:
Portraiture is a qualitative research methodology that seeks to reveal the researcher’s perspective on the unique experiences they have come across during their time in their field. My portraiture focuses on my perspective on the research study I am currently involved in, in which I observe a fourth grade class in western Pennsylvania use different types of dynamic furniture. Prior to the students trying new seats, I observed the students in a controlled environment, using the traditional classroom desks and saw behavior such as fidgeting, leg-swinging, and slouching. The goal of this research is to see if changing the seating will change student behavior. As a future teacher, the time I spent observing students in the classroom made me feel excited about my future career. As a hopeful future researcher, the time in the classroom helped me increase my skills in the research process. My project for the symposium discusses my experience as a future researcher and my experience in becoming a teacher.

49 THE EFFECTS OF REDD FUNDING ON DEFORESTATION

Adam Shipley,
Senior | McAnulty College and Graduate School of Liberal Arts
Faculty Advisor: Risa Kumazawa, Ph.D.

A B S T R A C T:
The main objective of this paper is to see how funding from the Reduced Emission from Deforestation and forest Degradation program (REDD) effects deforestation in tropical countries. This paper focuses on determinants of deforestation such as GDP, population, agricultural land expansion, agricultural production, and debt. These determinants of deforestation are used in a modified Environmental Kuznets Curve that measures the degree of forestation, as opposed to the degree of deforestation/degredation. This model is then applied to an unbalanced panel data set of 181 countries from 2006 to 2012. The paper also examines property rights as a time-invariant country-specific effect. The main findings of this paper is that REDD funding does have a positive relationship with forestation in tropical countries. It also supports the Environmental Kuznets Curve theory that an increase in the GDP per capita leads to decreased per capita forestation.
The mathematical framework for understanding effective TNR policies for feral cat control
Jennifer Estevez, Chuan Phongphothichitkun, Kareen Ayuk, Timothy Ireland, Caitlin Templin, Kaitlyn White, Benjamin Plakidas, Margot Gagen
Junior | Bayer School of Natural and Environmental Sciences and McAnulty College and Graduate School of Liberal Arts
Faculty Advisor: Rachael Neilan, Ph.D.

ABSTRACT:
In recent years, the feral cat population within the United States has been steadily increasing and contributing to a serious overpopulation problem. Feral cats are considered a nuisance species due to their occupation of public areas, predation on local bird populations, and potential to spread disease to domesticated cats. Multiple strategies for the control of feral cats exist with Trap, Neuter, and Release (TNR) considered the most humane. The goal of the project was to create and implement a mathematical framework for assessing which TNR policies effectively limit the long-term growth of the feral cat population. Using differential equations, a mathematical model was constructed to describe the growth of a feral cat colony under different TNR scenarios that vary in the timing and intensity of spay events. Data from Frankie’s Friends, a local feral cat clinic, was utilized to parameterize the model. Mathematical software, Maple 17, was used to simulate model equations under different TNR scenarios including spaying 99% once per year, 50% twice per year, 30% three times per year, and 10% monthly. For each scenario, the total birth, deaths, number of spays, and proportion of un-spayed cats over a three-year period. Results show that a one-time spaying of 99% of a cat colony in January before the birth season is most effective in decreasing total colony size. Other scenarios were not as effective in decreasing colony size but did provide a more economical approach with regards to mitigating population growth with limited resources.

The Detection of Organic Components Found in Gunshot Residue by Use of LC-QQQ-MS to Assess Home Reloaded Ammunition
Kyle Brown, Leah Ali, B.S. and Holly Castellano, M.S.
Senior | Bayer School of Natural and Environmental Sciences
Faculty Advisor: Stephanie Wetzel, Ph.D.

ABSTRACT:
In addition to the rise of gun violence in the past decade, gun sales broke records and ammunition shortages have plagued the United States. Because these recent ammunition shortages have driven sportsman and shooting enthusiasts alike to reload their own ammunition, gunshot residue (GSR) resulting from home-reloaded ammunition may become prominent physical evidence in firearm related crimes. After a firearm is discharged, the emitted GSR particles from the muzzle and ejection port of the gun are organic and inorganic. However, both components do not share the same origin. The organic components found in GSR are a result of the propellant powders, while the heavy-metal components originate from the primers. Because the uniqueness of inorganic GSR has been brought into question, the analysis of organic components is mandated. Thus, an optimized method was developed for liquid
chromatography with triple quadrupole mass spectrometry (LC-QQQ-MS) to examine the common organic components of GSR, which results from both home-reloaded and factory-manufactured ammunition. Through the optimization of LC-QQQ-MS parameters, the seven most common organic components of GSR were successfully separated and detected. The developed method provided R2 values of (> .999 for the seven organic components’ calibration curves as well as the limits of detection and quantitation. After GSR from both factory-manufactured and home-reloaded ammunition was extracted, differentiation between the two types of ammunition was achieved. Because this distinction between the two ammunitions is plausible, it is hypothesized that differentiation between the seven most commonly used reload-powders for 9mm can be attained as well.

52 Vertical Transmission of Paenibacillus lautus and Pseudomonas taiwanensis, A Possible Source of Malarial Control
Akaash Sheth
Junior | Bayer School of Natural and Environmental Sciences
Faculty Advisor: David Lampe, Ph.D.

A B S T R A C T:
Anopheles stephensi, the main transmission source of Plasmodium sp. that causes malaria in Africa, plays host to a microbiome teeming with bacteria of many species. The bacteria inhabiting the mosquito microbiome presents a unique opportunity for the regulation and control of Plasmodium sp. due to their shared micro-environment, rapid proliferation, and ease of genetic manipulation. The ease of genetic modification of the bacteria allows for the transformation and expression of a vector carrying a gene that codes for an anti-malarial protein in to the bacteria. Transforming bacteria of the mosquito microbiota with an anti-malarial gene vector presents a novel way of managing, controlling, and preventing the transmission of Plasmodium from mosquitos to humans; however, there has not been large amounts of research of the bacteria and how they colonize the mosquito. In this study, bacteria from the mosquito microbiome were transformed with a Glowing Fluorescent Protein (GFP) vector, and fed to mosquitos in order to investigate the colonization of A. stephensi. Pseudomonas taiwanensis and Paenibacillus lautus were found to inhabit the midgut and ovaries of A. stephensi and were found to be vertically transmitted from mother to offspring. The vertical transmission of P. taiwanensis and P. lautus is significant because an anti-malarial gene vector should only have to be introduced at one point in time to a population of mosquitos and vertical transmission would allow the bacteria containing the vector to pass from generation to generation which could prove to control malaria transmission effectively.

53 The Effects of Fungal Cellulase Digestion of Cotton Swabs on Touch DNA Concentrations
Brendan Shanahan
Senior | Bayer School of Natural and Environmental Sciences
Faculty Advisor: Lisa Ludvico, Ph.D.

A B S T R A C T:
In this experiment, cellulase from the Trichoderma viride fungus was utilized to digest the cotton swabs
for possible touch DNA using the double swab technique. Previous studies have applied this cellulase digestion to sperm and blood samples on cotton swabs, however this method has not been utilized with touch DNA (tDNA) samples, which are small DNA samples transferred to objects upon handling. It is imperative that as much of the sample is eluted from the cotton swab as possible when collecting tDNA. It is expected that the enzymatic digestion of the cotton swabs will lead to a higher yield of tDNA from the swabs, increasing the likelihood of obtaining a useful DNA profile. To conduct this study, volunteers rubbed their hands on a glass slide after a controlled period of time. Half of the slide was swabbed, and the samples from those swabs were extracted using the Qiagen QIAamp DNA Mini Kit. The other half of the object was also swabbed, however, those swabs were subject to an enzymatic digestion by the Trichoderma viride cellulase, prior to being used as the substrate in the Qiagen kit. The products of these extractions were then analyzed using qPCR to quantify the samples. Thus, a direct comparison of the concentrations of DNA extracted using the two methods was conducted, and it is expected that the samples extracted using the Qiagen protocol combined with the fungal enzyme digestion will have a higher concentration on average, than those samples extracted using just the Qiagen protocol.

**54 Endocrinology Meets the Economy: Analysis of Bisphenol-A Physiology and Consumption**

Joseph Hornak  
Senior | Bayer School of Natural and Environmental Sciences  
Faculty Advisor: Kathleen Roberts, Ph.D

**A B S T R A C T:**  
Bisphenol-A (BPA) is an estrogenic, endocrine-disrupting compound used to manufacture many products, particularly plastics. Recent research provides insight to the consequences of prenatal exposure to the chemical, many of which are dosage-dependent. Standard circulating levels of BPA in maternal serum is shown to alter follicle formation in developing mammalian embryos. Other exposure studies with similar concentrations found a BPA-induced decrease of fetal dopamine receptors and spine synapses in the midbrain and hippocampus, respectively. Some studies, however, conclude that BPA concentrations above the standard exposure level were required to induce significant embryonic changes. Because BPA exposure poses physiological risks, especially in cases of pregnancy, it is therefore important to assess these implications in a commercial context. An economic model of a plastics market thus depicts the decisions of a representative consumer of BPA and BPA-free plastics. The consumer’s objective is to maximize her expected future utility, which is a function of her health and consuming plastics. The consumer can purchase BPA and BPA-free plastics from a representative plastics firm. The representative plastics firm’s objective is to maximize its expected future profit, which the firm generates from sales of its products. The model suggests that the consumption of BPA-free plastics is income-dependent. According to the model, there is a utility-maximizing BPA health risk for a low-income consumer. The model also shows that while reduced BPA consumption causes an increase in consumer health, consumers and firms experience overall decreased utility and profit, respectively.
Comparing genetic diversity between two geographically isolated populations of the Bluebreast Darter, *Etheostoma camurum*
Emily Shemanski, Anthony S. Honick
Sophomore | McAnulty College and Graduate School of Liberal Arts
Faculty Advisor: Brady Porter, Ph.D.

**ABSTRACT:**
Bluebreast darters are small-bodied benthic fish (~30 to 70mm) that mainly eat aquatic insects, and prefer cobble substrates with moderate to high flow in riffle/run habitats of streams and rivers. They are of conservation interest because the U.S. Environmental Protection Agency has determined they are indicator species; sensitive to the effects of urbanization and bioaccumulation of chemicals that are harmful to humans and biota. Bluebreast darter populations in the upper Ohio River system of western Pennsylvania are disjunct because of previous water quality degradation, and the navigational lock and dam system. With previous surveys documenting that they exist as many small and spatially isolated populations, the bluebreast darter is listed as a Pennsylvania State threatened species. Therefore, it is important to understand their genetic population structure to make informed conservation management decisions. We used microsatellite DNA (small, nuclear DNA repeat motifs) analysis to determine the genetic population structure between two geographically isolated bluebreast darter populations: 1) a population from Big Darby Creek, OH, and 2) the upper Allegheny River, PA. Fin clips were collected from individuals at both locations, and DNA was extracted using phenol-chloroform isolation. Microsatellite DNA primers that were previously adapted for use on other darter species were used in conjunction with polymerase chain reaction (PCR) for fragment analysis on an ABI 3130 genetic analyzer. The goal is to compare the genetic diversity both within and between these populations, and use allelic differences to track the geographic source of new populations established from range expansions.

Computational Methods for Extracting Curvature
Claire Saunders
Senior | McAnulty College and Graduate School of Liberal Arts
Faculty Advisor: Stacey Levine, Ph.D.

**ABSTRACT:**
In human visual perception, most of the information the brain receives contains redundant information. For example in an image, the majority of the information is concentrated along the contours. Specifically, the areas containing the most content are the boundaries where the direction changes rapidly, like a corner. Theoretically, humans can make an inference with limited contour information of what an image contains. Therefore, much of image processing research involves perfecting contour imperfections in an image. In this research project, computational methods for extracting the curvature are obtained through the smoothing of level lines. Using modified code from the C library, MegaWave2, we will look at improving methods for extracting this curvature and developing alternative methods to process curvature for better denoising. This research can be applied to fields including materials science...
or medical physics, where scientists need to analyze grain boundary in scanning electron microscopy to
discern properties of materials or looking at elements of an X-ray.

57 Quantitative Method Development for Acetaminophen Tablet using Small Set Calibration in Near Infrared Spectroscopy
Kiana Motto
Senior | Mylan School of Pharmacy
Faculty Advisor: Carl Anderson, Ph.D.

ABSTRACT:
Tablet quality is an important feature in designing drug dosage forms to ensure efficacy and patient
safety. Analytical methods are used to determine the Active Pharmaceutical Ingredient (API)
concentration of a tablet to ensure quality. HPLC, an adaptation of chromatography, is the current
analytical method used by most manufactures to test tablet assay and content uniformity. However,
HPLC is slow and destructive; an alternative method to HPLC can be helpful in terms of reducing time
and cost of method development and routine testing. Near Infrared Spectroscopy (NIRS) is a well-
established analytical tool and can serve as an alternative method to HPLC for quantitative analysis. It is
fast, non-destructive and requires little or no sample preparation. Small set calibration can provide
additional benefits to near infrared spectroscopy in terms of development time and cost. In this project,
a quantitative near infrared method was developed to predict acetaminophen concentration in a model
drug containing acetaminophen, MCC, lactose, HPLC, and magnesium stearate. The design of the
calibration samples included 11 tablets, each with a different composition of components. The model
was tested against a separate set of 11 tablets. Partial Least Square algorithm was employed to develop
a model to predict concentration from the NIR data. The quantitative ability of the small set calibration
was demonstrated for prediction of acetaminophen in pharmaceutical compacts using near infrared
spectroscopy.

58 On the Transmigration of Souls: The Construction and Impact of a Memory Space
Victoria Visceglia
Senior | Mary Pappert School of Music
Faculty Advisor: Benjamin Binder, Ph.D.

ABSTRACT:
For the start of the New York Philharmonic’s 2002-2003 season, the orchestra and Lincoln Center’s
Great Performers series commissioned John Adams to compose a piece of music as a memorial for the
terrorist attacks on September 11th, 2001. Disappointed by the media’s response to the monumental
tragedy, Adams felt disinclined to provide more of the same heart-wrenching assaults on the senses that
the public had experienced for months. Aware of the importance of his commission and the nonmusical
audience it would draw, Adams hoped to create a “memory space” to provide a period of time in which
they could reflect on the events of that day and learn to feel again. Through several ensembles and a
unique electronic track, On the Transmigration of Souls avoids suggesting appropriate emotions to the
public and allows the audience to remember how they truly felt about the events of the day. It conveys
loss without commenting on it, and is therefore more reflective of real life than what politicians and the media portrayed at the time.

59 Disappearing Money: Agricultural Adjustment Act and the Tenant Farmer
Jake Roba
Sophomore | McAnulty College and Graduate School of Liberal Arts
Faculty Advisor: Andrew Simpson Ph.D.

Abstract:
The turn of the twentieth century marked a period of expansive growth for the agricultural industry. The demand for farm products grew rapidly as these goods were exported to Europe due to an increased need during World War I. This was a time of prosperity for both owners and tenant farmers. However, after World War I Europe began to reestablish its agriculture industry and the demand for U.S crops diminished, crippling the farm sector. Large and small American farms now had an excess of crops and no market to sell to, causing farmers to accumulate large debts. This became a vicious cycle of growing a surplus of crops and grossing less than the cost, leading to what is known as the “farm problem.” While steps were taken throughout the twenties, the depression called for new ideas like the Agricultural Adjustment Act of 1933 (AAA). This program involved extensive federal intervention in the agricultural marketplace, which was intended to help farmers achieve a fair market price and stabilize farm production. However, policies of the AAA would disadvantage tenant farmers, which happened because this legislation inadequately defined key terms regarding who would receive monetary benefits. The failure of the Adjustment Committee, created in 1934, to adequately protect the rights of tenant farmers allowed landlords to horde AAA funds, thus increasing the financial burden for tenant farmers. This story elucidates the beginning of a pattern that disadvantages small farmers at the federal level.

60 In the Shadows of Berlin: The role of covert operations in Berlin during the Cold War
Michael Romero Moore
Junior | McAnulty College and Graduate School of Liberal Arts
Faculty Advisor: Andrew Simpson, Ph.D.

Abstract:
Immediately after World War II, Germany was carved up and divided amongst the Allies, leaving the western half of the country to the capitalist forces –the United States, England and France -- and the eastern half to the USSR. Within the heart of Soviet Germany, Berlin, which was also divided in half, became a small-scale model of the struggle between capitalism and socialism as two ways of life and government during the Cold War. This project will aim to show how both the CIA and the KGB used covert operations, tactics and assets to collect information about their adversary and weaken the opposition, using Berlin as an example that can be extrapolated to the rest of Cold War battlegrounds around the world. The evidence provided comes mostly from primary source documents from the CIA, the State Department, U.S. Army Counterintelligence, first hand accounts from CIA and KGB operatives who were in Berlin during the Cold War -collected in the book Battleground Berlin by David E. Murphy et al, and secondary source articles to provide context and further analysis. Covert operations and
intelligence gathering were key for both factions during the Cold War and still are to present day, Berlin being the hub of what we understand today as modern intelligence gathering.

61 Transitions of Eu Ions in GaN: The Puzzle of the 634 nm Peak
Courtney Au-Yeung
Senior | Bayer School of Natural and Environmental Sciences
Faculty Advisor: Volkmar Dierolf, Ph.D.

ABSTRACT:
GaN doped with Eu is an important material for future use as the active layer of red LEDs. After excitation, the major emission, in the spectra takes the form of 3 peaks centered on 621 nm. These peaks are assigned to the 5D0 to 7F2 transitions of the majority defect center, Eu1. However, the spectra also shows a much smaller peak at 634 nm. This peak is roughly 20 times smaller than the ones at 621nm, but becomes comparable in strength in the emission of the most efficient LEDs. While this observation underscores the relevance of this emission peak for application, its origin remains unclear. To address this question, temperature dependent measurements using confocal spectroscopy were performed. Data recently collected, as well as old data, was further analyzed to determine if the strength of the 634nm peak is dependent on sample growth conditions and annealing. We also looked at if phonon coupling affected the peak. At this point, the origin of the 634 nm peak is still unknown, but we speculate that it might be related to a different Eu sites and/or a center reconfiguration during the optical excitation process. Further investigation needs to be done to determine what affects the 634 nm peak and what causes the high intensity found in the most efficient red LEDs.

*62 Intramolecular Charge-Assisted Hydrogen Bond Strength in Pseudo-Chair Carboxyphosphate
Sarah Kochanek, Traci M. Clymer
Senior | Bayer School of Natural and Environmental Sciences
Faculty Advisor: Jeffrey D. Evanseck, Ph.D.

ABSTRACT:
Dianionic and monoanionic carboxyphosphate is predicted to exist in a novel conformation known as pseudo-chair, stabilized by an intramolecular charge-assisted hydrogen bond (CAHB). Separate additive and subtractive correction schemes to the open-closed method are used to estimate the strength of the CAHB. Truhlar’s Minnesota M06-2X functional with Dunning’s aug-cc-pVTZ basis set is utilized for all computations. The CHARMM force field has been used to approximate the Pauli repulsive terms in the closed and open forms of carboxyphosphate. From our additive correction scheme, differential Pauli repulsion contributions between the pseudo-chair and open conformations of carboxyphosphate are found to be significant in determining the CAHB strength. Knowledge of an accurate CAHB strength provides deeper insight into the pseudo-chair conformation of carboxyphosphate, offers a partial explanation of its instability in the aq. phase, and leads to an improved mechanistic understanding regarding how carboxyphosphate is stabilized and used in ATP-dependent carboxylases.
**Sexual Fluidity in Prison**  
Amanda Buchheit  
Junior | McAnulty College and Graduate School of Liberal Arts  
Faculty Advisor: John Lane, M.A.

**ABSTRACT:**  
Although the society isolated within the walls of a prison is radically different from the outside world, it is often forgotten that it is populated by human beings who are trying to preserve their identities under the restrictions of incarceration. In the same way that general society creates roles and social structures, inmates in a prison maintain their own culture and roles. In a systematic, depersonalizing institution such as a prison, inmates must create and occupy these roles to avoid losing themselves. Since gender and sexuality are major components of identity, it makes sense that some form of gendered sexual behavior might occur in prison. The isolated environment of prison somewhat necessitates sexual fluidity as an adaptive measure. Sexual relationships in prison are not only about sexual desire, but have undertones of dominance or submission between those involved, creating systems of power. This uneven dynamic is an expression of gender roles that transfer from the outside world into the prison environment. Although inmates are the same sex, they perform heteronormative gender behaviors, calling into question the homosexual nature of these acts. This paper will explore prison sexuality as a phenomenon occurring in the isolated society of a prison, and in the context of the larger society in which prisons exist. The goal is to analyze the various behaviors that inmates display in an environment where sexual fluidity is commonplace, and to discover how sexual fluidity manifests itself as both an adaptive measure and as a reflection of societal standards.

**Eccentric Exercises Prevent Hamstring Strains In Adult Male Soccer Players: A Critically Appraised Topic**  
Ian Shadle  
Senior | Rangos School of Health Sciences  
Faculty Advisor: Jason Scibek, Ph.D, LAT, ATC

**ABSTRACT:**  
Context: Hamstring strains are a common soccer injury. Determining a prevention strategy to minimize risk is crucial. Improved eccentric muscle control has been shown to decrease contractile tissue injury.  
Objective: To perform a critical appraisal of literature addressing the question: What is the effect of eccentric exercises on hamstring strain prevention in adult male soccer players?  
Design: Using the PICO format, the following search parameters were utilized:Population: male AND professional OR amateur AND adult AND soccer; Intervention: eccentric exercises OR strengthening AND prevention; Comparison: no intervention AND control; Outcomes: hamstring strain OR hamstring injury.  
The resources searched included PubMed, Medline, Sport Discus, ProQuest Health Management, PEDro Database, and additional resources obtained via hand searches. Inclusion criteria included English-only articles with Level 2 evidence or higher, utilizing human, adult soccer athletes. Patients or Other Participants: In excess of one hundred teams’ worth of elite and professional northern European soccer players.
participated in the four selected studies. Interventions: The use of isolated eccentric exercise, particularly the Nordic Hamstring exercise, was used. Main Outcome Measures: A review of the data found in appropriate articles was examined to determine if eccentric exercise reduced hamstring strain frequencies. Results: Four relevant studies were located meeting the specific criteria. After reviewing the four articles, a Strength of Recommendation level A exists that supports using eccentric strengthening to prevent hamstring strains. Conclusion: There is robust supportive evidence that eccentric hamstring exercises can prevent a hamstring injury to an adult, male soccer player. Word Count 245

65 Arsenic metabolizing microbes from produced water from unconventional shale gas wells
Brittney Jackson
Senior | Bayer School of Natural and Environmental Sciences
Faculty Advisor: John F. Stolz, Ph.D.

ABSTRACT:
Arsenic occurs naturally and is a common constituent of natural gas shale deposits, including the Marcellus shale. The process of unconventional shale gas extraction produces wastewater that contains arsenic, an important water contaminant in drinking water. Unconventional natural gas extraction involves pumping millions of gallons of brine, water that contains hundreds of chemicals and known carcinogens, deep into the ground. This wastewater can potentially infiltrate drinking water sources. We hypothesize that there are microbes present in wastewater that can grow anaerobically using arsenate as an electron acceptor. This microbial activity could affect the oxidation state, mobility, and toxicity of the arsenic. A combination of media that mimics the typical composition of produced water and cultured aerobes as well as samples of produced water and impoundment water from different sources can be used as inocula to examine the potential for microbial arsenic transformation. The organisms in the enrichments will be identified by sequencing the 16s rRNA gene and isolated through standard methods such as serial dilution and streak plating. These organisms will be cultured further to understand their physiology. Arsenate reduction will be monitored using ion chromatography capable of detecting both inorganic and methylated arsenic species.

66 Formation of Mixed Monolayers on TiO2 and Ti-6Al-4V Using Phosphonic and Carboxylic Acids
Avani Dalal, Nina A. Reger
Senior | Bayer School of Natural and Environmental Sciences
Faculty Advisor: Ellen S. Gawalt, Ph.D.

ABSTRACT:
TiO2 and its alloys are commonly used aerospace, high performance sports equipment, medical devices, and electronic devices. Self-assembled monolayers are being used in these industries to control and alter interfacial properties of substrates. The aim of this study is to form monolayers using two different organic acid head groups. Self-assembled monolayers of, octadecylphosphonic acid, octadecanoic acid, and a mixture of both were covalently bound to the surface of TiO2 and Ti-6Al-4V metal oxide.
substrates. The results of this study indicate which acid head group preferably binds to which oxide surface. Diffuse reflectance infrared Fourier transform spectroscopy, matrix assisted laser desorption ionization time of flight spectrometry, and contact angle analysis were used to determine the presence, binding, and wettability of self-assembled monolayers on the metal surfaces. Octadecylphosphonic acids formed SAMs the easiest, followed by mixed and then octadecanoic acid on both of these metal oxide surfaces.

67 Java based reconstruction of the RICH detector’s main analysis package for Jefferson Labs
Richard Trotta, Andrew Lendacky, William Turke, Benjamin Torisky
Junior | Bayer School of Natural and Environmental Sciences
Faculty Advisor: Fatiha Benmokhtar, Ph.D.

A B S T R A C T:
Jefferson Lab (Jlab); in Newport News, Virginia, is performing a large-scale upgrade to its Continuous Electron Beam Accelerator Facility (CEBAF) up to 12GeV beam. The Large Acceptance Spectrometer (CLAS12) in Hall B is being upgraded and a new Ring Imaging CHERenkov (RICH) detector is being developed to provide better kaon – pion separation throughout the 3 to 80 GeV/c momentum range. With this addition, when the electron beam hits the target, the resulting pions, kaons, and other particles will pass through a wall of translucent aerogel tiles and create CHERenkov radiation. This light can then be accurately detected by a large array of Multi-Anode PhotoMultiplier Tubes (MA-PMT). We are presenting our work on the implementation of Java based reconstruction programs for the RICH in the CLAS12 main analysis package.

68 Structured Language Treatment for Primary Progressive Aphasia
Joanne Kinney, Alyssa Lanzi
Junior | Rangos School of Health Sciences
Faculty Advisor: Caterina Staltari, M.A., CCC-SLP

A B S T R A C T:
The purpose of this study is to investigate a treatment approach for Primary Progressive Aphasia, (PPA). PPA is considered a fairly rare language disorder. Broadly, it is described as a slowly worsening aphasia not due to stroke, trauma, tumor or infection (Mesulam, 2001, page 425). There are three primary progressive aphasia variants: nonfluent/agrammatic, logopenic and semantic. The semantic variant has degradation of the semantic system that results in loss of word knowledge; a logopenic variant presents with impairments in naming and repetition that are phonological in nature; and a nonfluent/agrammatic variant is characterized by syntactic impairments and motor speech deficits (Henry, Rising, DeMarco, Miller, Gorno-Tempini, & Beeson, 2013). Given the neurodegenerative nature of the disorder, a diagnosis of PPA, regardless of the variant, leaves individuals with many questions about the possibility of improving their skills. The literature is limited in demonstrating the effectiveness of treatment for PPA although it appears that steps can be taken to help manage an individual’s communication difficulty. This study will serve to review an approach that makes use of structured word retrieval treatment and
auditory attention treatment to help maintain language skills in persons with PPA. Results of this study will serve to add to the literature base on effective treatment of PPA.

69 Stress Relief is in the Air: Exploring the Regulatory Effects of Airborne Anions on Stress and Anxiety
Marisa Ross, Sara Kaminsky, Nicole St. Onge
Junior | McAnulty College and Graduate School of Liberal Arts
Faculty Advisor: Alexander Kranjec, Ph.D.

A B S T R A C T:
Negatively charged ions in the air have been thought by some to reduce stress and anxiety and modulate mood. We will examine these effects on two groups of college students by exposing the experiment group to negative ions and then administering a standardized self-report questionnaire on current anxiety levels before and after a standardized stress test (consisting of a public speaking task and a mental math task). If negatively charged ions have a stress reducing effect, we predict that upon completion of the stress test, participants in the experimental group will show a greater average decrease in state-anxiety scores as compared to a control group. If our predictions hold true, this would suggest that negative ion exposure plays a general role in reducing stress and anxiety.

70 Incidence and Frequency of Traumatic Brain Injuries Affect Sleep in Military Personnel: A Critically Appraised Topic
Dan O'Brien, Paul Cacolice
Senior | Rangos School of Health Sciences
Faculty Advisor: Jason Scibek, Ph.D, LAT, ATC

A B S T R A C T:
Context: Through the awareness of traumatic brain injuries (TBI) in athletics, we have begun to develop a greater appreciation of TBI in military personnel. Sleep has been designated as a treatment strategy for TBI, but less is understood about how TBI impacts sleep patterns in military personnel. Therefore, we elected to evaluate the question, “What effect do TBIs have on sleep in military personnel?” Objective: To better understand the effect of traumatic brain injuries (TBIs) on irregular sleep in military personnel. Design: PICO-based search using the following parameters: Population: military, Intervention: TBIs OR concussions OR head trauma, Comparison: military AND civilian, Outcome(s): sleep OR sleep disturbance using databases PubMed, SportsDiscus, CINAHL, PEDro, and Cochrane Library. Patients or other Participants: Military personnel and military contractors. Outcome Measures: Inclusion factors include insomnia, sleep disorders, TBI’s, and articles with a level of evidence 1 or 2. Exclusion factors include non-military and published earlier than 2011. Results: Those with TBIs reported significantly poorer sleep quality. Approximately four times as many patients with a single TBI (22.4%) and 10 times as many patients with multiple TBIs (47.6%) exceeded the threshold for clinical insomnia. Insomnia, PTSD, and pain co-occurred in 51.8% of military veterans. Conclusions: As with athletes, sleep patterns are altered in military personnel. Evidence shows that TBIs continue to be prevalent in the military while the ailing
effects are worsening. Without adequate sleep and treatment following TBI, military personnel will struggle to make full recoveries.

71 Moby Dick and the Bible Intertwined
Michael Sean Lawrence
Sophomore | McAnulty College and Graduate School of Liberal Arts
Faculty Advisor: n/a

ABSTRACT:
Herman Melville, author of Moby Dick, was heavily influenced by Christian theology. Many of the Bible's characters, stories, and themes are reflected in Moby Dick's literary devices. These thematic subjects include revenge, sin, the devil, and the wrath of God against the unjust. This presentation will explore just how deep the biblical reflections go in the "noble" quest of Ahab, Ishmael and their steadfast ship, the Pequod.

72 TeleWellness Support Systems for Spinal Cord Injury
Elizabeth Mueller, Meredith Karavolis
Senior | Rangos School of Health Sciences
Faculty Advisor: Andrea Fairman, PhD, MOT, OTR/L, CPRP

ABSTRACT:
OBJECTIVE: The purpose of this interdisciplinary study is to understand the usefulness of a mobile health (mHealth) system called iMHere (Interactive Mobile Health and Rehabilitation), in improving self-management skills in adults with spinal cord injury (SCI). RATIONALE: Individuals with SCI often utilize complex self-management routines to prevent possible complications resulting in hospitalization, death, and expensive medical care. iMHere may support the needs of persons with SCI, as well as increase early detection and treatment of complications. METHODS: PARTICIPANTS: Participants are adults with SCIs recruited from University of Pittsburgh Medical Center facilities and community organizations. All participants must be able to use a smartphone. DESIGN: Participants are randomly assigned to one of two groups. The intervention group receives a smartphone equipped with iMHere to help improve their self-management skills, while the control group receives standard care at an outpatient SCI clinic. MEASURES: Six assessments are being utilized to collect quantitative data on participant quality of life, level of independence, occupational performance, depression, and quality of care. Assessments are administered at baseline, three, six, and nine months to measure progress. INTERVENTION: Participants use iMHere to remind themselves of their self-care routines such as self-catheterization, bowel regimens, skin checks, and routine administration of medications. They report success with their activities or new problems and track symptoms of depression. A clinician views the participant’s data through a secure portal. This system alerts the clinician of reported problems through a secure communication system in real time, allowing quick triage and intervention. (Funding Source: Craig H. Neilsen Foundation)
73 Economical and Clinical Analysis of Yervoy Therapy
Elizabeth Travers, Kaysee Gruss, Fennil Patel, Sabina Vaichys
Senior | Mylan School of Pharmacy
Faculty Advisor: Khalid M. Kamal, M.Pharm, Ph.D.

ABSTRACT:
We evaluated the clinical and economic benefits of using Yervoy (ipilimumab) therapy versus other metastatic melanoma medications. Based on the Pitt Street Health Plan of 3.4 million members, a payer perspective was taken in order to determine where Yervoy therapy should be placed on the formulary for the treatment of metastatic melanoma. The research consisted of analyzing clinical trials data surrounding the Yervoy therapy to determine the efficacy and safety of Yervoy compared to other preferred treatments for metastatic melanoma. We analyzed economic models to determine the budget impact Yervoy would have on the Pitt Street Health Plan. The economic analysis consisted of utilizing budget impact models, cost utility analysis, and overall cost of providing the therapy when compared with other preferred formulary medications. The budget impact model involved analyzing the incremental cost/member/month for patients on Yervoy therapy and determining the market shares or comparators. The cost utility analysis consisted of analyzing incremental cost utility ratio (ICUR) and quality-adjusted life years (QALY). The overall cost of providing therapy was determined by analyzing different cost data such as medication costs, cost of administration, medical follow-up, and toxicity costs. The research analysis of efficacy, safety, and economic data was able to lead us to a formulary decision for Yervoy therapy. We decided to place Yervoy as a second tier due to its significantly higher costs and slightly lower efficacy rates. This process of analyzing data directly mimics what insurance companies and hospitals conduct when new drugs are approved by the FDA.

74 Dignity and Gender: A Community Engaged Study of Latino Immigrants and their Children in Pittsburgh
Ashley Reinhardt
Senior | McAnulty College and Graduate School of Liberal Arts
Faculty Advisor: Vanessa Fernandez

ABSTRACT:
This community-based service-learning project analyzes the challenges that Latino immigrants face when they migrate to the United States. Guided by my work with a Guatemalan family in Pittsburgh as a tutor for the non-profit Casa San José, I have concluded that Latino immigrants, especially women, suffer a loss of dignity in their new country. I have observed a language barrier is the most significant factor that deprives immigrants of their human dignity. For instance, when children are able to speak more English than their parents, parents loose their authority and are displaced from their sociocultural roles. However for both Latino children and their parents, the inability to communicate proficiently in school and in the community often marginalizes them as others assume that they are unintelligent and, therefore, less “human.” This language barrier inhibits women to greater degree because they must also conform to Latino cultural expectations. Women must stay home and care for the children, which
further diminishes their exposure to English and to their new community. As a result, Latino immigrant women are chastised as submissive and unintelligent, a stereotype consistently reinforced by media in the United States. Therefore, this project uncovers how language barriers are more than simply a separation of cultures. They also lead to a conflict of dignity.

75 Gorgons and Love: A Classical Perspective on Vision
Nicole Cordier
Sophomore | McAnulty College and Graduate School of Liberal Arts
Faculty Advisor: Sarah Miller, Ph.D.

A B S T R A C T:
This project is going to examine the complex, concrete view of vision held by those in the Greco-Roman world. Through the eyes, positive and negative things could enter, causing a wide variety of ailments and emotions. The role that vision played in love-sickness, the evil eye, and actual physical health, including human reproduction, was considered prominent. Their perception of vision is evident in Classical mythology, especially in the myths of Medusa, Andromeda, and Pan and Syrinx. In addition, Greek novels, such as An Ethiopian Tale, Daphnis and Chloe, Leucippe and Clitophon, and An Ephesian Tale, reflected this concept. This project is going to examine both vision itself and how vision was reflected in mythology and Greek novels.

76 Effects of Viscosity and Macromolecular Crowding on the Diffusion-Controlled Rate Constant of Ferredoxin NADP+ Reductase
Sarah Sweger
Sophomore | Bayer School of Natural and Environmental Sciences
Faculty Advisor: Jeffry Madura, Ph.D.

A B S T R A C T:
Experiments simulating the intracellular environment often neglect to include the high concentration of macromolecules within the cytosol of the cell. The influence of these macromolecules is a crowding effect, which impacts the rate at which reactions occur within the cell. Utilizing the methods of Brownian Dynamics, simulations were ran to calculate the protein-protein association rate of the Ferredoxin NADP+ Reductase (FNR) with the corresponding Ferredoxin (Fd) under standard conditions as well as those including macromolecular crowding. The resulting data indicated that the diffusion-controlled rate of the reaction was reduced when introduced to crowded conditions. This simulation and data indicates a greater understanding of the interactions occurring within a realistic model of the intracellular environment.
**Understanding the Signaling Mechanisms Underlying Melatonin and Estrogen/Progesterone’s Actions on HER2+ Breast Cancer**

Katherine Hilton, Laura Guarinoni, Sifat Maria, Paula Witt-Enderby  
Senior | Mylan School of Pharmacy  
Faculty Advisor: Paula Witt-Enderby, Ph.D.

**ABSTRACT:**  
A novel estrogen (E2)/progesterone (P4) and melatonin (M) hormone therapy (EPMRT) was developed to provide menopausal women relief from vasomotor symptoms without increasing their risk of breast cancer. Using a HER/neu mouse mammary cancer model, EPMRT protected these mice from HER2+ mammary cancer development. The mechanisms underlying these protective actions of EPMRT are not clear but proteins known to be involved in cellular proliferation and differentiation (i.e., ERK1/2, ERK5, RUNX2) may be involved. The goals of this study were to determine the effect of EPMRT on ERK1/2, ERK5 and RUNX2 activity and expression in normal mammary gland; in tumor tissue; and to correlate these protein changes with tumor outcomes. The results from this study demonstrate that EPMRT increased RUNX2 and pERK1/2 and decreased pERK5 expression in normal mammary gland. Interestingly, it was only the EPMRT-treated mice that were protected against HER2+ mammary cancer. For the tumor analysis, even though the results still demonstrated a correlation between pERK1/2 and RUNX2 expression, EPMRT decreased rather than increased their expression. Perhaps the cancer protective actions of EPMRT occur through an enhancement in mammary gland differentiation and a decrease in proliferation by increasing pERK1/2 and RUNX2 expression levels and by decreasing ERK5 activity, respectively, making the gland less prone to transformation. Transformation of the mammary gland into tumors may be the result of imbalances in pERK1/2, pERK5 and RUNX2 expression levels resulting in tumors with high metastatic potential. EPMRT may be decreasing pERK1/2 and RUNX2 levels making the tumors less metastatic.

**Species identification of an unknown cyanobacterium producing an antidepressant compound with 5-HT7 serotonin receptor activity**

Edward Hilton, Neil Lax  
Sophomore | Bayer School of Natural and Environmental Sciences  
Faculty Advisor: Benedict Kolber, Ph.D. and Kevin Tidgewell, Ph.D.

**ABSTRACT:**  
Cyanobacteria are photosynthetic prokaryotes found in diverse terrestrial and aquatic habitats. In previous studies, novel compounds produced by marine cyanobacteria have been shown to have pharmacological activity. Using the National Institute of Mental Health Psychoactive Drug Screening Program (PDSP), an unknown species of cyanobacteria (DUQ0002) was collected from Mogo Mogo in the Las Perlas Islands, Panama and the compounds produced were tested for activity at a panel of neuroactive receptors, including the serotonin receptors. One fraction from this sample, DUQ0002I, was found to have activity at the serotonin receptor subtype 7 (5-HT7), a known target for antidepressant and anxiolytic effects. The goal of the present study was to identify the cyanobacteria using
16S rRNA DNA sequencing for phylogenetic analysis. DNA from the cyanobacterium was isolated and the 16S rRNA gene was cloned into a TOPO vector. The gene was then sequenced using Sanger Sequencing. The sequences were compared to all identified cyanobacteria and, separately, cyanobacteria that produce pharmacologically active compounds to produce phylogenetic trees. The antidepressant activity of DUQ0002I was measured using the forced swim test in mice. Results to date will be presented.

79 The Impact of Libraries on Health Literacy
Samantha Sweeney
Sophomore | Rangos School of Health Sciences
Faculty Advisor: Bridget Calhoun, Dr. P.H., P.A.-C.

ABSTRACT:
The U.S. Department of Education reported in 2003 that 9 out of 10 adult Americans lack proficient health literacy skills, translating to 90% of the population having a diminished capacity to navigate and comprehend healthcare information, resources, and facilities. Proficient health literacy skills are imperative for an individual to effectively maintain and protect the health of both themselves and their family. My research explores the unique and accessible programs that libraries across Allegheny County have implemented through use of various media to improve this issue of low health literacy. The research revealed that successful programs are not only in place, but have improved the health literacy of thousands of Allegheny County residents thus far. With expansions of Allegheny County’s library programs already in motion, and over 100,000 other libraries in the United States today, these programs have great potential to expand and continue improving health literacy on both local and nationwide scales.

80 Investigation of Macromolecular Crowding on Ferredoxin and Ferredoxin-NADP+ Reductase Kinetics
Danielle Bautista, Marissa McGovern, Svea Owen, David Seybert
Sophomore | Bayer School of Natural and Environmental Sciences
Faculty Advisor: David W. Seybert, Ph.D.

ABSTRACT:
Macromolecular crowding is the phenomenon in which biomolecular properties are altered due to high concentrations of macromolecules in an environment. In order to test the effects of macromolecular crowding on biological redox reactions, the proteins ferredoxin (Fdx), and ferredoxin-NADP+ reductase (FNR), were purified from Spinacia oleracea. Extraction was implemented through tissue homogenization and sonication followed by a series of chromatographic steps. Utilizing NADPH as a reductant, FNR is capable of reducing cytochrome c through Fdx, or reducing dichlorophenolindophenol (DCIP) directly. Fdx-dependent cytochrome c reduction was measured using NADPH, cytochrome c, Fdx and FNR; whereas Fdx-independent DCIP reduction activity was measured with NADPH, FNR, and DCIP. To investigate the effects of macromolecular crowding on electron transfer, the polymers Ficoll, Dextran, and ovalbumin were utilized as model crowding species. Each polymer tested has shown
inhibitory kinetic effects and we are using steady-state kinetics to explore the specific nature of this inhibition.

81 Pain management of Neonatal Abstinence Syndrome in Neonates
Lauren Duffy, Amanda LeBreton
Junior | School of Nursing
Faculty Advisor: Alison Colbert, Ph.D., PHCNS-BC

Abstract:
It was estimated that in 2012 that there was about 23.9 million Americans aged 12 or older had used an illicit drug or abused a psychotherapeutic medication. Also, it was estimated that 1 in 20 women use street drugs while pregnant. There are many reasons women that use try to justify taking street drugs during pregnancy, but most of them do not completely understand what the effects can have on their future child. Babies that are born to moms who use street drugs during pregnancy suffer from potential complications such as: premature birth, low birth weight, heart defects, neonatal abstinence syndrome (nas), and etc. NAS is when the baby can have the same drug addiction as their mother. NAS can happen when a baby gets addicted to a drug before birth and then goes through drug withdrawal after birth. These babies that suffer from NAS are in a lot of pain, and are often diagnosed to late where they can have unmanaged pain up to weeks. Managing pain in these babies is crucial in helping them recover and help prevent or alleviate other complications that can occur from NAS. So the question arises is the pain management used for treating neonates suffering from NAS effective? A literature review using the database CINAHL and other resources will be used to critique whether or not this is true. We will describe the findings that we have in regards to the impact on effective pain management in these neonates.

82 Formation of Steel Workers Unions in Pittsburgh
Michael Howard
Freshman | McAnulty College and Graduate School of Liberal Arts
Faculty Advisor: Andrew Simpson Ph.D.

Abstract:
In 1892, Pittsburgh made national headlines as a battle ensued between steel workers and Pinkerton private security hired by Carnegie Steel. Twenty-seven years later, Pittsburgh steel workers went out on strike again as part of the strike wave of 1919. This project will compare the two major strikes and argue that while the strike of 1892 is better known, the strike of 1919 was more influential for the formation of modern labor unions. The steel strike of 1919 effected steel producers across America. 365,000 workers went on strike at its height. The strike in Homestead resulted in the defeat of unionized labor and a voice in the company. This set back was reflected in the strike of 1919. The American Federation of Labor would try to organize the workers on behalf of the Amalgamated Association. The strike would fought for less worker dependence on their employer, safer conditions for the steel workers, and the right to have unionized voice in the company. Anti Communism brought nationwide fear on the strike and kept the formation of a national committee of unionized steel workers. By looking
back at the progress made and failures of these great labor strikes to form labor unions we can witness how the labor unions of today were made.

83 Investigation of novel polymorphic Li2-II-IV-S4 diamond-like semiconductors utilizing synchrotron X-ray powder diffraction
Kasey Devlin, Kimberly Daley, Meghann Moreau, and Jacilynn Brant
Senior | Bayer School of Natural and Environmental Sciences
Faculty Advisor: Jennifer Aitken, Ph.D.

Abstract:
Diamond-like semiconductors (DLSs) have structures derived from the cubic or hexagonal form of diamond. The I2-II-IV-VI4 DLS systems are of particular interest due to their tunable nature and possible technological applications in photovoltaics, spintronics, and non-linear optics. Polymorphism may affect important physicochemical properties. Most commonly, polymorphic DLS materials arise from differing modes of closest packing. In quaternary DLSs, polymorphism may also be observed in structures that maintain the same anion packing, but differ in the cation ordering arrangement within the tetrahedral holes. In this work, high-temperature solid-state synthesis in a Li2-II-IV-VI4 system led to the discovery of two polymorphs, crystallizing in the Li2CoSiO4 (Pna21) and wurtz-kesterite (Pn) structures. The two polymorphs were analyzed using optical diffuse reflectance UV/Vis/NIR spectroscopy, single crystal X-ray diffraction, and synchrotron X-ray powder diffraction together with Rietveld refinement. The National Science Foundation supports this work under Grant No. DMR-1201729.

84 Forensic Evidence of Animal Cruelty: Atypical Infectious Disease
Krista Spear, Nikhil Patel
Senior | Bayer School of Natural and Environmental Sciences
Faculty Advisor: Becky Morrow, DVM

Abstract:
The proprietor of the Tiger Ranch Cat Sanctuary was charged with 593 accounts of animal abuse, yet denied all charges. Felines found at the location, many deceased, were riddled with atypical infectious diseases. The defendant claimed that the animals obtained their infections prior to arrival at the location, and that deceased cats found within freezers did not die on location. To prove that the animals were exposed to the infectious organisms that lead to suffering and death, assessment of the infections by molecular methods was necessary. DNA analysis was the optimal approach to assess the infectious organisms within the animals. Previous work determined that the atypical clinical signs in the living cats were due to highly pathogenic Streptococcal infection, with the predominance of Streptococcus canis, Streptococcus equi subsp. zooepidemicus and Streptococcus porcinus. This study evaluated tissue samples from the deceased cats to see if the same organisms were present, demonstrating that the cats acquired the atypical infections at the facility. The three Streptococcal species were grown in tryptic soy broth with 5% blood and plated on blood agar for use as positive controls during PCR. Streptococcal species-specific primers were developed to allow for identification and comparison between the tissue samples from the animals. Positive identification of Streptococcal organisms in the deceased and living
cats indicated that the same atypical infections affected the felines and that the deceased cats were
exposed to the organisms that caused their death. This molecular study substantiated the scientific link
necessary for abuse verification.

*85 15N vibrational frequency shifts of the Rieske iron-sulfur cluster distinguish the
protonation states of histidine ligands from cytochromes bc1 and b6f.
Benjamin Jagger, Ashlyn Koval
Senior | Bayer School of Natural and Environmental Sciences
Faculty Advisor: Ralph Wheeler, Ph.D.

A B S T R A C T:
An understanding of the protonation states of the histidine ligands of the Rieske iron-sulfur cluster is
essential for understanding the mechanism of electron transport within cytochrome bc1 and
cytochrome b6f. NMR spectroscopic studies of the cluster’s ligands are difficult due to proximity of the
two paramagnetic iron atoms of the cluster. Furthermore, attempts to assign available pKa values to
specific histidine ligands have been largely unsuccessful, due to the symmetrical nature of the cluster.
Therefore, an alternative approach to assign protonation states must be developed. Using broken
symmetry Density Functional Theory calculations and spin projection techniques in conjunction with
15N isotopic substitution, this work identifies a qualitative difference in the number of isotopic shifts for
the protonated state when compared to the deprotonated state. Therefore, we propose that difference
vibrational spectroscopy with 15N isotopic substitution can be used to assign the protonation states of
the histidine ligands of the Rieske iron-sulfur cluster and provide information about the mechanism of
electron transfer. A better understanding of the electron transfer mechanism can lead to the
development of inhibitory compounds for new antimalarial, antifungal, and antibacterial agents.

86 Biophysical Analysis of CDK5R2 DNA Secondary Structures
Kathryn Bandi, Brett DeMarco
Sophomore | Bayer School of Natural and Environmental Sciences
Faculty Advisor: Mihaela-Rita Mihailiescu, Ph.D.

A B S T R A C T:
BIOPHYSICAL ANALYSIS OF CDK5R2 DNA SECONDARY STRUCTURES Kathryn J. Bandi, Brett DeMarco,
Mihaela-Rita Mihailiescu Department of Chemistry and Biochemistry, Duquesne University, Pittsburgh,
PA In addition to the classic DNA double helix structure, certain guanine rich DNA sequences can form
secondary structures known as G-quadruplexes, and their complementary cytosine rich strand can form
i-motif structures. G-quadruplexes can be formed by the stacking of multiple G-quartets which are
formed by the Hoogsteen base pairing of several guanine residues. The i-motif structures are formed by
the stacking of cytosine- cytosine base pairs and are stabilized at low pH values. The CDK5R2 DNA
contains multiple guanine and cytosine base pairs and has the capability to form both a G-quadruplex
and an i-motif secondary structure. These secondary structures are important because being aware of
the structure of the DNA allows a person to understand the function of the protein within the cell. To
characterize the different secondary structures of these DNA strands, many biophysical techniques were
utilized including circular dichroism spectroscopy, 1H nuclear magnetic resonance spectroscopy, UV spectroscopy, and native polyacrylamide gel electrophoresis (PAGE).

87 Fiscal Decentralization and State-Level Tax Competition: A Leviathan Perspective
Joylynn Pruitt
Senior | A.J. Palumbo School of Business Administration
Faculty Advisor: Matt Ryan, Ph.D.

A B S T R A C T:
Analyses of interjurisdictional competition have extensively proved the presence of competition between local governments and the constraining effect of federalism or fiscal decentralization on government size. Few papers have applied local-level theories to the state level, despite the applicability of such theories to larger subnational governments. I apply several different local-level analyses from the literature on Leviathan governments and tax competition to a state-level analysis to examine the degree of inter-state and intra-state competition across the United States. Using state-level sales and income taxes, I compare average tax rates to revenue-maximizing rates and find that states set tax rates well below Leviathan revenue-maximizing rates. Using a spatial autoregressive model I also estimate the degree of interstate tax competition and find some evidence of strategic interaction among states. Lastly, I compare tax rates, the degree of competition between states, and a measure of fiscal decentralization using a panel model to tie the analysis back in to the underlying assumptions of the Leviathan hypothesis.

88 Intensive Drug and Alcohol Rehabilitation Program: Occupational Therapy
Cheryl Holzworth, Jennifer Polkabla, Jordan Steele
Senior | Rangos School of Health Sciences
Faculty Advisor: Audrey E Kane, PhD, MS, OTR/L

A B S T R A C T:
A ten week program is being implemented at an intensive outpatient drug and alcohol rehabilitation facility. The program was designed following a period of observation and interview to determine the specific needs of this population in Pittsburgh, PA. Stress management, identity, healthy communication, and healthy leisure activities were identified by group members as areas of importance to aid in their recovery. As such, the program uses journaling, group discussion, hands on activities, role playing, art, and relaxation techniques to address these areas. The program is implemented in a group of approximately 15 individuals for 90 minute weekly sessions over a ten-week period. The goal is to equip members with techniques and education in order to support their successful recovery.
Poverty is a disease: Developmental impairments due to poverty have lifelong consequences
Shelby Wasil, Naomi Anderson
Sophomore | Rangos School of Health Sciences
Faculty Advisor: Bridget Calhoun Dr.P.H., PA-C

ABSTRACT:
The purpose of the research was to explore the physical, social, and emotional effects of poverty on children from a public health perspective. According to the 2013 American Census, 22.6% of the population lives in poverty, many of whom are children who are unable to provide for themselves. Thoughtful review and analysis of archives, public records, and various studies regarding poverty and its impact on the health and well being of children has been completed. Existing data suggest that impoverished children are 1.3 times as likely to have cognitive impairments than non-poor kids. Further, young affluent children develop 12% more gray matter than their impoverished counterparts, and are less likely to develop psychiatric disorders as adults. Impoverished children who continue to live in poverty have more difficulty managing occupations and maintaining key social relationships. Individuals who live in poverty as children and continue to live in poverty as adults are likely to suffer negative consequences for the rest of their life.

Occupational Therapy in the U.S. Criminal Justice System
Audra Sitterly, Emily Moreton
Senior | Rangos School of Health Sciences
Faculty Advisor: Jaime Munoz, Ph.D., OTR/L, FAOTA

ABSTRACT:
The objective of this study was to share results of the most comprehensive survey to date of occupational therapy educators, researchers and practitioners in U.S. criminal justice settings. An online survey was designed to identify occupational therapy practitioners working in correctional settings in the U.S. and educators training using correctional environments for students training. A database of practitioners was generated based on a review of the literature of occupational therapy in corrections, solicitation of interested participants at the 2013 and 2014 AOTA conference, and a snowball sampling process that encouraged respondents to identify other potential participants.
91 Elevated Temperature Investigation of Copper Catalyzed Atom Transfer Radical Addition (ATRA) Utilizing Monohalogenated Alkyl Halides
Allison Jansto
Senior | Bayer School of Natural and Environmental Sciences
Faculty Advisor: Tomislav Pintauer, Ph.D.

Abstract:
Atom transfer radical addition (ATRA) has become a fundamental process producing monoadducts useful for further organic syntheses such as the production of natural products and pharmaceuticals. By the addition of a reducing agent, catalyst regeneration in ATRA and atom transfer cyclization (ATRC) has significantly reduced the amount of catalyst, thus creating a “greener” process. This method was first applied in the addition of polyhalogenated alkyl halides to various alkenes, and was extended to the utilization of monohalogenated substrates such as bromoacetonitrile (BrACN), 2-bromopropionitrile (BrPN), and 2-ethylbromophenylacetate (EBrP). The single carbon-halogen bond formed from the monohalogenated alkyl halides is more expedient for further organic transformations. After optimizing the reactions in NMR tubes, reactions performed in pressure tubes allowed for increase in reaction temperature regardless of solvent, resulting in significantly higher yields in shorter reaction times with BrACN, BrPN, and EBrP. The reactions were performed with BrACN, BrPN, and EBrP with alkenes such as 1-octene, styrene, methyl acrylate, and methyl methacrylate.

*92 Effectiveness of Pharmacist Use of the Electronic Medical Record to Identify Adults at Risk for Anaphylaxis Without Access to Epinephrine for Self-Administration (EPI Rph)
Katherine Sulkowski
Senior | Mylan School of Pharmacy
Faculty Advisor: Autumn Stewart, PharmD, BCACP

Abstract:
The objective of this pilot project was to determine the feasibility of using an electronic medical record (EMR) to address a gap in care through the identification of patients at risk of anaphylaxis in need of epinephrine auto-injector (EAI). The Asthma and Allergy Foundation of America estimates that 52% of adults with anaphylaxis never receive an EAI prescription and 60% do not have EAI currently available. The focus of this project was to use EMR data and pharmacist intervention to improve the long-term management of patients at risk for anaphylaxis. The study objective was evaluated using prospective, observational research methods via patient interview and data from the EMR at an urban care center serving uninsured, low-income adults. Patients with a history of anaphylaxis or allergies (insect or food) were interviewed by a pharmacist to determine their possession of non-expired EAI. Descriptive analyses were conducted to assess demographic and clinical characteristics of patients and self-reported access to EAI. Sixty-seven potential subjects were identified; 12 subjects met inclusion criteria and consented to participate. None of the participants in the study had viable EAI in possession. A treatment gap likely existed for 11 of the 12 participants (91.6%) due to history of anaphylaxis (58.3%) or due to history of systemic reaction (33.3%). The findings from this pilot project demonstrate that
pharmacist use of EMR data, coupled with patient-interview, may identify treatment gaps in the long-term management of anaphylaxis and has the potential to ultimately improve management of anaphylaxis in patients within the community.

**93 Music, Confidence, and Motor Skill Learning**

Jesse Jack, Victoria Farber, Corey Robinson, Allison Broaddrick  
Junior | McAnulty College and Graduate School of Liberal Arts  
Faculty Advisor: Alexander Kranjec, Ph.D.

**Abstract:**
Music, Confidence and Motor Skill Learning  
Music is known to effect thought and behavior. The current study investigates the effect of music on learning a complex motor task. Confidence inducing music influences many aspects of daily life (e.g. performance test scores, competitions, focus, etc.). However the effect of confidence-inducing music on learning a complex motor task has not been explored. Songs were selected by way of a norming study where participants rated a number of songs from several genres for the extent of their confidence-inducing properties. Confidence-inducing and non-confidence inducing songs are presented to subjects while attempting to learn a complex motor task. We are interested in whether confidence boosting musical stimuli will produce accelerated motor-skill related learning in contrast to non-confidence inducing musical stimuli.

**94 Exploring Water Pollution in Pittsburgh**

Anna Hansen, Emily Pollock, Catherine Porter, Alec Wilson, Dan Suriano  
Junior | McAnulty College and Graduate School of Liberal Arts  
Faculty Advisor: Michael Irwin, Ph.D.

**Abstract:**
From 1811 until about the 1970s, Pittsburgh led the nation in steel production, creating environmental issues within the rivers in Pittsburgh. In recent years, Pittsburgh has been moving forward in its efforts to become a sustainable city. Because of this, it is wise for us to understand and analyze our past experiences with the rivers and ask the question: How can we as a city find a balance between industrial use and community development while also sustaining the environmental well-being of our rivers? In order to support our research topic, we will gather data from various Pittsburgh-based resources. Many of Pittsburgh’s leading news websites and organizations provide quantitative and qualitative research looking into the impact of industrialization on the city’s rivers over time in addition to the current condition of the rivers today. For our project we plan to use mixed method qualitative/quantitative in order to conduct secondary analysis. We will be pulling statistics from qualitative websites such as EPA and Fish and Wildlife, but also be interviewing professionals of the water quality field. We plan to look at the pollutions, parts per million, and the effects this pollution has on the ecological layout. By analyzing data already collected about the condition of Pittsburgh rivers, interviewing key informants, and looking back on the history of the rivers, we will be able to create a list of policies for Pittsburgh water officials, and community members in order to most efficiently utilize our rivers and become one with the environment around us.
Differentiation of Sex Through Fingerprint Residues
Joseph Coiro
Senior | Bayer School of Natural and Environmental Sciences
Faculty Advisor: Stephanie Wetzel, Ph.D.

Abstract:
This project investigates the chemical nature of fingerprints to determine whether differences in chemical composition can be used to determine personal traits such as gender and race. The information gained through this research can help investigators to reduce the amount of suspects in criminal investigations when latent fingerprints are unable to be compared using traditional methods such as dusting. Fingertip residues are deposited on a small bead and extracted using chloroform. Each bead is washed in a small volume of chloroform prior to sample collection. This reduces contamination from both the manufacturer and handling during sample collection. Each sample is gathered from a sample that is asked to gather residues from face and hair and then place them on the bead by touch. After extraction, samples are concentrated and reconstituted in a small amount of chloroform suitable for Gas Chromatography/Mass Spectroscopy (GC/MS). The chemical components of proteins are then analyzed for their presence or absence and in the abundance they occur. Preliminary results have showed that composition between both male and female fingerprint residues differ in substantial ways. Further experimentation, will include standardizing these results and the use of Liquid Chromatography/Mass Spectrum. Additionally, the samples will be further analyzed using the statistical F-Test. However, it should be noted that this research would not provide perpetrator identification, but a means to narrow down the suspect pool. With this information, forensic investigators will be able to analyze latent fingerprints that are unsuitable for testing by traditional methods and cannot be run through national databases for fingerprint identification.

Predicting Polish Fortune through Wigilia and Christmas Celebration
Jennifer Hennel
Junior | Rangos School of Health Sciences
Faculty Advisor: Kathleen Roberts, Ph.D.

Abstract:
The purpose of this project was to conduct thorough research surrounding Christmas traditions in Poland in order to gain insight into their cultural norms. A wide variety of sources including historical books and informative websites were utilized while collecting and analyzing these cultural traditions. Upon review of the information gathered, food, luck, and superstition seemed among the most prominent themes of the Polish celebration. Upon examination, these themes symbolize deeper values such as religion, family, and good will. Much can be learned about the values of the Polish community through the analysis of their holiday traditions.
**97 Real-time Conceptual Scaffolding in Hands-on Information Systems**

Alexa Peduzzi  
Senior | A.J. Palumbo School of Business Administration  
Faculty Advisor: Jacqueline Pike, Ph.D.

**Abstract:**  
Information systems is a field that is ever-changing and evolving with the discovery of new technologies, system designs, and methodologies. Information systems professionals in academia are faced with the challenge of staying up to date on the latest trends and incorporating them into the classroom while also providing students with knowledge of foundational concepts. Further, the Internet and web 2.0 resources have become a repository of knowledge that can be accessed quickly and ubiquitously, and it is essential to educate students on how to incorporate this knowledge into their existing knowledge base so that they, too, can stay relevant. This study focuses on the process of taking new technical knowledge and incorporating it with existing conceptual, foundational knowledge as a student’s understanding of the information systems curriculum may be directly correlated with the method in which students are exposed to the technical instruction. Through this research project, the world of developing foundational concepts alongside technical knowledge was explored by working alongside an information systems faculty member to develop a new unit for an information systems course that incorporates both foundational knowledge and technical skills. In addition, the plans developed for data collection during the unit rollout, retrospectives were documented from a student perspective as the “behind the scenes” efforts that go into designing, developing, and delivering a university-level course are experienced. Themes are identified based on the retrospectives. Future work will involve the quantitative analysis of the data collected during the rollout.

**98 Cold cutaneous assay: A novel method to measure cold sensitivity in humans**

Melissa Wolz  
Senior | Bayer School of Natural and Environmental Sciences  
Faculty Advisor: Benedict Kolber, Ph.D.

**Abstract:**  
Chronic pain affects 100 million Americans and is often accompanied by problems including changes in cold sensitivity including increased cold pain. In humans, methods to study cold temperature sensitivity have been limited to the application of ice water (cold pressor test), alcohol, ether, or Peltier thermodes on to the skin of a subject. Unfortunately the cold pressor test does not allow for a threshold for sensation to be determined because pain is immediate; rather, it measures tolerance to cold pain. A Peltier cooling device allows for cold sensitivity measurements on specific locations of the skin, but these devices are cost prohibitive for wide adoption by researchers and clinicians alike. More recently, a novel method, the cold plantar assay, was designed to test cold response thresholds in animal models. In this design, mice are placed on a glass surface. A syringe filled with powdered dry ice is applied to the underside of the glass surface to gradually cool an animal’s paw. This assay is inexpensive and safe. We reasoned that a similar approach could be applied to study cold sensitivity and pain in human
participants. Here, we describe the basic design for this new assay, the cold cutaneous assay, including the necessary modifications as we adapted the animal assay to human testing. We have analyzed the progressive cooling of the stimulus surface and are currently designing an experiment to evaluate the efficacy of this new assay in healthy control participants.

99 The Changing Temple at Khirbet Omrit in Northern Israel
Timothy Anderson
Senior | McAnulty College and Graduate School of Liberal Arts
Faculty Advisor: Sarah Miller, Ph.D.

ABSTRACT:
For this project I intend to examine how the temple complex at the archaeological site of Khirbet Omrit in northern Israel changed with the political situation in Israel. To do this I will thoroughly examine the political history of Israel as well as the archaeological evidence at the site of Omrit. To accomplish this I will use a combination of primary sources, which I plan to read in the original languages, and modern scholarship; in addition to historical resources I will also use archaeological reports from the site as well as the research I did while I was at the site this summer. The purpose of this project will be to see what political changes can be seen in the archaeological record of a country. This project is valuable because it provides insight into how the archaeological evidence can be used to support or nullify the historical accounts of authors. The time period of the use of the temple complex at Khirbet Omrit is from 45/50 BCE through ca. 100 CE a time period that was very tumultuous for the specific region of northern Israel as well as the eastern section of the Roman Empire as a whole; being able to see how a changes in types of leadership as well as several individual affected the use and architecture of temples is very interesting because it gives a glimpse into how people reacted to the civic religion as well as how big of a part this played in building programs.

100 Understanding the Signaling Mechanisms Underlying Melatonin and Estrogen/Progesterone’s Actions on Bone Density
Jessica Glas, Sifat Maria
Senior | Mylan School of Pharmacy
Faculty Advisor: Paula A. Witt-Enderby, Ph.D.

ABSTRACT:
Recent studies are demonstrating a role for melatonin in protecting bone by inducing osteoblast differentiation. In mice, melatonin (5mg) given nightly for one year had equal efficacy to an estrogen (0.5mg)/progesterone (50mg) hormone therapy (HT), a drug therapy commonly used by menopausal women to relieve vasomotor symptoms and protect against bone loss. Interestingly, when melatonin was combined with this HT, all bone-enhancing effects were lost. The mechanisms underlying these actions are not clear. Melatonin-induced osteoblast differentiation is mediated, in part, by the formation of MT2 melatonin receptor/b-arrestin scaffolds with the mitogen activated protein kinases, MAPKs, ERK1/2 (Radio et al., 2006; Sethi et al. 2010). There is some evidence to suggest that ERK5 may be involved in bone physiology (Dong et al., 2012; Li et al., 2013), however, whether this MAPK mediates
melatonin’s effect in bone is not known. The goals of this study were (1) to determine the effect of melatonin, HT and combinations thereof on ERK1/2 and ERK5 activity and expression in mouse bone; (2) to determine the effect of these same treatments on RUNX2 expression in mouse bone; and (3) to correlate changes in ERK1/2, ERK5 and RUNX2 expression on bone density. The results from this study demonstrate that melatonin alone, induced pERK1/2, pERK5 and RUNX2 expression. HT alone or in combination with melatonin was without effect. These findings suggest that melatonin increases bone density by inducing ERK1/2, ERK5 and RUNX expression in osteoblasts while the bone-enhancing effects of HT most probably occur through E2-mediated osteoclast inhibition.

101 Cementing British Superiority through Human Displays in the High Victorian Era
Megan Rabenstein
Senior | McAnulty College and Graduate School of Liberal Arts
Faculty Advisor: Jotham Parsons, Ph.D.

ABSTRACT:
The “Colonial and Indian Exposition” of 1886 exemplified the Victorian presentation of humans as displays in ways that made apparent a message of British racial and moral superiority and fueled the cultural and moral arguments of pro-imperialists. Such displays dated back to the mid-nineteenth century and over the course of approximately forty years, human displays evolved from small itinerant shows into officially sanctioned events in the high Victorian era, both of which reflected and shaped the emergent colonial system. The displays purported to bring the wilds of Africa to Britain and included Africans scantily clad in inaccurate costumes, an introductory lecture by a white expert, painted scenery, and props. Proponents of ethnography, an early form of cultural anthropology, lamented the focus on entertainment and thought the exhibits could further the developing science by providing subjects for study. Human displays subtly and overtly defined colonial roles for broad, relatively uninformed audiences through the visible signs of skin color and clothing.

102 Exposure to stress hormones increase susceptibility to disease in an amphibian
Shelby Boord, Chris Fonner, Shreya Patel
Senior | Bayer School of Natural and Environmental Sciences
Faculty Advisor: Sarah Woodley, Ph.D.

ABSTRACT:
Amphibians across the world are experiencing extreme population declines that have been linked to infection by Bactrachochytrium dendrobatidis (Bd), a fungal pathogen that may develop into the deadly disease, chytridiomycosis. It is thought that environmental stressors influence amphibian susceptibility to infection. We hypothesized that chronic exposure to the stress hormone, corticosterone (CORT), would increase infection and disease after exposure to the fungal pathogen. Red-legged salamanders were treated with either CORT or oil for 9 days prior to exposure to fungal zoospores or vehicle. We measured infection at baseline, Day 10 and Day 17, using molecular techniques. Subjects were also monitored for 30 days after exposure to the fungal pathogen for symptoms of disease. All Bd-exposed animals became infected with Bd and showed symptoms of disease. Bd-exposed animals that were also
treated with CORT were more infected compared to control animals treated with oil vehicle (P = 0.001), supporting our hypothesis that exposure to stress hormones increases infection rates. Therefore, efforts should be made to minimize exposure to environmental stressors in order to increase amphibians’ disease resistance and allow them to persist in a rapidly changing world.

103 Evaluating the Clinical Use of Ipilimumab in Treating Unresectable Metastatic Melanoma
Kemper May, Timothy Porter, Nicholas McCloskey, Scott Borton
Senior | Mylan School of Pharmacy
Faculty Advisor: Khalid M. Kamal, M.Pharm, Ph.D.

Abstract:
The goal of our research is to evaluate the safety, efficacy, and cost-effectiveness of Ipilimumab in the treatment of unresectable metastatic melanoma patients. Unresectable metastatic melanoma is a deadly form of cancer that is difficult to treat. The disease significantly affects quality of life and is associated with a large financial burden for patients and health insurance payers. We compared ipilimumab with other standards of drug treatments as determined by the NCCN (National Cancer Comprehensive Network) including dabrafenib, vemurafenib, temozolomide, and interleukin-2. We evaluated clinical trials and safety profiles submitted by the manufacturer of ipilimumab as well as trials done by independent researchers. Furthermore, we evaluated the cost-effectiveness by analyzing manufacture submitted cost modeling and compared the data to the cost-effectiveness of other drugs that are considered standard in treatment as determined by NCCN. We used cost modeling data such as QALY’s (quality adjusted life years) and total course of treatment costs that included toxicity and administration costs, to determine the cost effectiveness and economic viability of using ipilimumab in treatment. Our analysis of clinical trials, safety data, efficacy data, and cost data will determine ipilimumab’s place in therapy for the treatment of unresectable metastatic melanoma.

104 Context Effects and the Risk-Averse Consumer
Erika Davies
Senior | McAnulty College and Graduate School of Liberal Arts
Faculty Advisor: Antony Davies, Ph.D.

Abstract:
Since the 1970s, market researchers have observed patterns in the consumer’s decision-making process. In 2005, Davies and Cline developed four hypothetical propositions based on these observations which, if tested, may provide empirical evidence for these observations. In 2008, Sciandra tested three of the hypotheses and provided empirical evidence for two. I test the validity of all four propositions to the decision-making process of a risk-averse consumer within a monopolistically competitive environment.
**105 Utilization review and cost analysis of N-acetylcysteine (NAC) for the prevention of contrast-induced nephropathy**
Alicia Sacco, Erica Gray
Senior | Mylan School of Pharmacy
Faculty Advisor: Branden Nemecek, PharmD, BCPS

**ABSTRACT:**
Views on the use of n-acetylcysteine (NAC) for the prevention of contrast-induced nephropathy (CIN) vary among medical institutions and even among clinicians within the same institution. The purpose of this retrospective study was to evaluate the current utilization of oral and intravenous NAC for the prevention of CIN, including a cost analysis of this therapy and associated outcomes, at a single medical center. The study population consisted of adults admitted to a single medical center receiving contrast as part of standard of care from January 1, 2011 to December 31, 2013 and pre-treated with either oral or IV NAC and an untreated comparator group. Pertinent data included: demographics (age, sex, BMI); risk factors for CIN (diabetes mellitus, hypertension, smoker, systolic blood pressure, diastolic blood pressure, left ventricular ejection fraction <40%, pulmonary artery disease, coronary artery disease); relevant concomitant drug utilization (non-steroidal anti-inflammatory drugs, metformin, diuretics, calcium channel blockers, beta-blockers, statins, angiotensin receptor blockers, angiotensin converting enzyme inhibitors); serum creatinine levels at baseline, 24, 48, 72, and 120 hours; the volume of contrast dye; route and dose of NAC; amount and type of IV fluids; and outcomes associated with CIN (dialysis, nephrology consult, length of hospitalization). The time required to prepare and administer NAC was documented and included in the cost-analysis. Outcomes of the study include utilization of dialysis, nephrology consult obtained, death, duration of hospitalization, and treatment of hyperkalemia. Results to date will be presented.

**106 Comparison of two different formulas for body surface area in adults at extremes of body size**
Luke Gormley, Alicia Sacco, Bobby Gwin, Caitlin Mitchell
Senior | Mylan School of Pharmacy
Faculty Advisor: Karen Fancher, PharmD

**ABSTRACT:**
Several different equations for predicting body surface area (BSA) from measurements of height and weight have been derived. The DuBois and Mosteller BSA equations are largely considered equivalent but the accuracy of either formula in adult patients at extremes of body size is unknown. Our study compared the variation in BSA and dosing calculations in patients at extremes of body size using both formulas. Anthropometric data was extracted from the 2012 Centers for Disease Control and Prevention Vital and Health Statistics. Weight and height for all races for both males and females over age 20 were examined. BSA was calculated using both the DuBois and Mosteller formulas and then used to calculate the dose of doxorubicin in the “ABVD” regimen, which is a chemotherapy regimen used for curative intent in patients with Hodkgins lymphoma. A difference of 4.5 percent or greater in the calculated
doses was considered significant. Dosing differences between the Mosteller and DuBois formulas were apparent in both male and female patients. The dosing differences were most apparent in patients in the fiftieth, seventy-fifth or ninety-fifth percentile for both weight and height. In each instance of significance, the Mosteller equation calculated a greater dose of chemotherapy. Current guidelines recommend administering full doses of chemotherapy to patients treated with curative intent, but the guidelines do not specify which formula should be used to calculate BSA for chemotherapy dosing. Our results suggest that the Mosteller equation should be used to avoid underdosing individuals at extremes of body size.

107 The Effects of Macromolecular Crowding on the Kinetics of Catalyzed Electron Transfer of Adrenodoxin and Adrenodoxin-NADP+ Reductase Reactions

Marissa McGovern, Danielle Bautista
Junior | Bayer School of Natural and Environmental Sciences
Faculty Advisor: David Seybert, Ph.D.

ABSTRACT:
Macromolecular crowding refers to the high total concentration of macromolecules such as proteins and nucleic acids, inside cells whose concentrations may reach 30-40%. Macromolecular crowding may affect many cellular functions including enzymatic reaction rates. In this study the effects of macromolecular crowding on the kinetics of biological redox reactions were studied. The model system used was the electron transfer catalyzed by ferredoxin NADP+ reductase (FNR) and ferredoxin. There are two types of FNR: Plant (P)-type and glutathione-reductase (GR)-type. The latter is found predominantly in animals. For this investigation adrenodoxin reductase (AR), a GR-type FNR was studied along with its redox partner adrenodoxin (Adx). Adx-dependent reduction of cytochrome c was studied by steady-states kinetics and cytochrome c reduction rates were monitored using UV-Vis spectroscopy. The protein ovalbumin was used as the model macromolecular crowding agent. Experiments to date have shown that ovalbumin at a concentration range of 0.5-1.5% does not show any inhibitory kinetic effects. This is surprising, since ovalbumin at the same concentration induces significant effects on the electron transfer rates of the P-type ferredoxin reductase system currently under investigation in our lab. These results could reflect fundamentally different mechanisms for these two different electron transfers and/or differences in rate-determining steps. Continuing studies will expand the range of model molecular crowding agents and will also include more detailed kinetic studies to better understand and describe the differing kinetic behaviors of these two systems.
**Impact of Young-Onset Parkinson's Disease on Quality of Life**

Lindsey Sosnowski  
Senior | Mylan School of Pharmacy  
Faculty Advisor: Khalid M. Kamal, M.Pharm, Ph.D.

**Abstract:**  
OBJECTIVES: About 5-10% of the total Parkinson's population are diagnosed from the ages of 21-45 and thus characterized as having Young-Onset Parkinson’s Disease (YOPD). Since YOPD is diagnosed during the most productive years of a patient’s life, the disease can potentially have a larger impact on quality of life (QoL), in part due to the unique psychosocial issues younger patients face. The goal of the review is to (i) identify QoL instruments utilized in YOPD and (ii) describe the studies that have utilized these instruments.  
METHODS: A systematic literature search based on PRISMA guidelines was conducted from 2004 to 2014 using electronic databases such as Pubmed, Medline, Cochrane, and Ovid. RESULTS: Ten QoL instruments were identified. Although frequently utilized in YOPD patients, all instruments were validated in either regular-onset PD patients (initial diagnosis greater than 45 years of age) or the general population. The literary search did not yield any YOPD-specific QoL instruments. CONCLUSIONS: QoL instruments validated in PD were commonly utilized in YOPD. Thus, there is a need to create YOPD-specific QoL instruments to capture the impact of this condition on young patients. In addition, the development of new YOPD-specific instruments may allow clinicians the opportunity to better understand the complexity of problems in YOPD patients to guide appropriate care of their unique condition.

**Optical and Thermal Properties of Lithium-Containing Thiostannate with Potential Nonlinear Optical Applications**

Ashley Weiland  
Sophomore | Bayer School of Natural and Environmental Sciences  
Faculty Advisor: Jennifer Aitken, Ph.D.

**Abstract:**  
Diamond-like semiconductors (DLSs) have applications in many areas such as photovoltaics and nonlinear optics. All diamond-like semiconductors possess a noncentrosymmetric structure and are potential candidates for second harmonic generation. Properties of these materials such as second-order nonlinearity in the IR can be tuned by employing a wide range of predictable compositions. The majority of benchmark IR nonlinear optical (NLO) materials are DLSs. Compounds of the formula Li2MSnS4 (where M = a divalent tetrahedrally coordinated metal) were prepared by high-temperature solid-state synthesis under vacuum. One of these compounds, Li2CdSnS4, was prepared as a phase-pure material as determined by synchrotron X-ray powder diffraction and Rietveld refinement. Diffuse reflectance spectroscopy shows that the compound exhibits a direct optical bandgap of 2.718(1) eV and an Urbach energy of 0.1994(6) eV. The compound is relatively transparent (75-80%) from approximately 0.6 to 25 μm. Differential thermal analysis shows that the compound melts at about 917 °C. The material
is a promising candidate for nonlinear optical applications due to the wide bandgap, broad range of optical transparency, relatively high thermal stability, and stability under ambient conditions.

110 **Microbial Iron Metabolism in Abandoned Mine Drainage Remediation**

Michael Petrides, Gabrielle Gallagher  
Senior | Bayer School of Natural and Environmental Sciences  
Faculty Advisor: Nancy Trun, Ph.D.

**ABSTRACT:**
Abandoned mine drainage (AMD) is a continuing problem across Western Pennsylvania. Passive remediation systems are the cost effective method to resolve environmental issues associated with AMD. Although passive remediation systems have been found to be effective, environmental changes are not always considered. Iron, a prevalent metal in AMD, is important to the metabolic functions of microorganism, including the electron transport system. Understanding how iron is tolerated and utilized by microorganisms at an AMD site could have many implications in bioremediation. The determination of microbial growth in high iron concentrations is crucial for understanding iron metabolism in these bioremediation systems. Microorganisms involving iron metabolism could be aiding in passive remediation. We are identifying the bacteria living in high iron concentrations to determine the effect on the bioremediation of AMD.

111 **Victim or Villain? : A Contemporary Analysis of the Historical Legacy of Marie Antoinette, Last Queen of France**

Joseph Mastaler  
Freshman | McAnulty College and Graduate School of Liberal Arts  
Faculty Advisor: Andrew Simpson Ph.D.

**ABSTRACT:**
Marie Antoinette was one of the most villainized monarchs to ever rule on the French throne. During her reign, slanderous and often pornographic material was circulated against her which contributed to the guilty verdict that was rendered at the quick trial, containing almost no evidence, which condemned her and led to her untimely death at the age of thirty-seven. Her reputation that was prevalent during the French Revolution has sustained itself to the present day. Many saw her as a spendthrift, someone who had many affairs with many French and foreign noblemen, unintelligent, and unfit to rule France. Although she was decadent and carefree during her first few years at Versailles, Marie Antoinette was actually a modest, quiet, and good natured person who was used by her mother to broker an alliance between France and Austria. Marie Antoinette’s letters show a devotion to the French State, her husband, and her people that has never been recognized after the abolishment of the monarchy in 1792. Marie Antoinette was not the villain that many have made her out to be. Rather, she was a scapegoat that took the blame for the shortcomings of an antiquated system. The nobility, angry at Marie for her dismissal of court etiquette and her selection of a few close friends on whom she spent extravagant sums and had her favor, also conspired against her. This research will help the public understand who Marie Antoinette really was and how distorted her image is outside of France.
112 Women’s Performative Perspective: The Impact Of Performance Interactivity On The Identity Of Female Sacred Musicians

Stephanie Sloan
Senior | Mary Pappert School of Music
Faculty Advisor: Benjamin Binder, Ph.D.

Abstract:
The realm of Western sacred music boasts some of the earliest documented musical works and performances. Many of these musicians, composers, and performers were men. Women possess a scant percentage of the total musical output of this genre. While this historical trend is not surprising, given the stereotypic repression of women throughout the centuries, what is surprising is that this trend has continued in sacred music up to the present day. As I am myself a female sacred musician, I am curious to know why there is still a lack of the female voice present in sacred music and what trends encourage that behavior today. This project will address this topic by examining the impact of performance interactivity on the identity of female sacred musicians. Certain key figures are examined based upon their background, accomplishments, and historical context. This project also connects with musicians and composers across the country and across the world by providing online pedagogical resources for feminine sacred music, including current compositions, recordings, and their modern reception in the twenty-first century.

113 Interferon gamma protects neural stem/progenitor cell populations and activates inflammatory signalling pathways during a measles virus infection

Erica Gray, Priya Ganesan, Apurva Kulkarni
Senior | Mylan School of Pharmacy
Faculty Advisor: Lauren O'Donnell, Ph.D.

Abstract:
Neural stem/precursor cells (NSPC) are a self-renewing population of cells that produce new neurons and glia in the developing brain. NSPC survival and differentiation can be influenced by neurotropic viruses and anti-viral immune responses. However, it is difficult to differentiate from the direct of viral infection on NSPCs and the effects of the antiviral immune response. To address this question, we use a mouse model of neuron-restricted measles virus (MV) infection, which spares NSPCs from direct infection. Therefore, we can evaluate the effects of the anti-viral immune on NSPC function and differentiation. Two-transgenic mouse lines were used: CD46+ mice express the human isoform of CD46, the MV entry receptor under the control of the neurospecific enolase promoter, and CD46+/IFNγ-KO mice lack IFNγ. Flow cytometric analysis revealed NSPCs were reduced in CD46+/IFNγ-KO mice at 3, 7, and 10 days post infection (dpi), but were unaltered in CD46+ mice. Newly-differentiated neurons showed the greatest cell loss at 7 dpi in both genotypes, but there was no effect on mature neurons and glial cells. Thus, IFNγ protected against NSPC loss, but did not protect young neurons. Western blot data revealed sustained signaling via the signal transducer and activator of transcription (STAT) pathway, with activation of STAT1-beta but not STAT1-alpha isoforms in infected brains. This study evaluates the
unique by-stander effects of neurotropic viral infection on NSPCs and suggests IFNγ protects against NSPC loss and sustains STAT1-beta activation during a neurotropic viral infection.

114 Developing an ESI-MS Method to Detect and Distinguish Xanthohumol and Isoxanthohumol in an Ethanol/Water Matrix
 Cortney Dumm
 Senior | Bayer School of Natural and Environmental Sciences
 Faculty Advisor: Michael Van Stipdonk, Ph.D.

A B S T R A C T:
Xanthohumol is a natural product and the most abundant prenylated flavonoid extracted from the female hop plant. Human are exposed to xanthohumol and related prenylflavonoids, such as 8-prenylnaringenin and isoxanthohumol, through the consumption of beer. Xanthohumol has been deemed a 'broad-spectrum' cancer chemopreventive agent, while 8-prenylnaringenin is one of the most potent phytoestrogens known. This makes accurate identification and quantification of concentrations in beer, and detection of exposure to the compounds, an important task. Craft beer makers have been interested in determining the ratio of xanthohumol to isoxanthohumol in their beers. Xanthohumol, when extracted from hops, contributes to the bitter taste. When heated, xanthohumol isomerizes isoxanthohumol, which does not lend any flavor to the beverage. Because these two compounds have the same mass, quantification using mass spectrometry can be a challenge. This project aims to develop a method for distinguishing xanthohumol from isoxanthohumol in ethanol/water solutions (mimicking a beer environment). This methodology, once perfected, can be applied to “real world” samples, as well as the detection and quantification of other components.

115 When Privacy Is Invaded on Social Media: An Ethical Analysis
 Stephanie Confer
 Senior | McAnulty College and Graduate School of Liberal Arts
 Faculty Advisor: Margaret Patterson

A B S T R A C T:
In today’s technology-focused world, individuals ask for and give information under the assumption that they have privacy in these exchanges. In reality, technology has advanced in proportion to a decrease in personal privacy. The use of social media to incriminate people is particularly troubling. These breaches of privacy diminish the public trust because people lose control of how their information is used. In this research project, the ethical theories of John Rawls, Immanuel Kant and Emmanuel Levinas are examined to explore whether the use of obtaining information that is posted online to incriminate invades privacy.
116 Quantum models of methylphosphonate adsorption onto the rutile (110) surface
Sadie Clifford, Matthew N. Srnec, Sebastien P. Hebert
Senior | Bayer School of Natural and Environmental Sciences
Faculty Advisor: Jeffrey D. Evanseck, Ph.D.; Ellen S. Gawalt, Ph.D.

A B S T R A C T:
Modification and functionalization of TiO2 surfaces by adsorption of phosphonic acids is of great interest in view of its applications in biomaterials and corrosion protection. Experimental studies indicate strong and stable P-O-Ti bond formation during adsorption of phosphonic acid on TiO2 surfaces. However, the mode and strength of adsorption continues to be debated. We have investigated the adsorption modes and bonding strength between the rutile (110) surface and methylphosphonate using quantum chemistry with periodic boundary conditions. The Crystal09 quantum software package was used with the Perdew-Wang ‘91 functional and the pob-TZVP basis set. The surface free energy, structure, ligand binding energy, and vibrational spectrum were computed. The computations indicate tridentate bonding between the rutile (110) surface and methylphosphonate, which is consistent with experimental data from FTIR spectroscopy. Understanding the mode and strength of adsorption can lead to a new generation of biomaterials that could withstand corrosion and prevent biological rejection.

117 Left and Right-Brain Approaches to the Ultimate Good: Reconciling Knowledge and Experience
Anna Kemper
Freshman | McAnulty College and Graduate School of Liberal Arts
Faculty Advisor: Therese Bonin, Ph.D.

A B S T R A C T:
This project assesses how the differing approaches of the two hemispheres of the brain can help us understand the question of ultimate goodness and the levels of being. I examined the distinct methods of philosopher Thomas Aquinas and essayist G. K. Chesterton. Both thinkers used the color white to demonstrate the essence of good as actual and positive rather than absent and theoretical. While Aquinas’ discourse is a rational argument, Chesterton’s is a metaphorical reflection. I have found that both logical and allegorical appeals to understanding allow for relatability and consistency in the midst of an apparent divide between knowledge and experience. Through these particular lenses the audience is invited to contemplate the degrees of being and confirm the existence of an ultimate good.
118 The anti-viral immune response in the central nervous system decreases proliferation of Neural Stem/Progenitor Cells
Taylor Scully, Apurva Kulkarni
Senior | Mylan School of Pharmacy
Faculty Advisor: Lauren O'Donnell, Ph.D.

ABSTRACT:
Viral infections in the central nervous system (CNS) are characterized by infiltration of lymphocytes into the brain parenchyma and release of pro-inflammatory cytokines. Both inflammatory and developmentally-regulated cytokines alter the activity of neural stem/progenitor cells (NSPCs), which are critical for CNS development and repair. Moreover, the proliferation and fate of NSPCs are affected during viral CNS infections. Interferon-gamma (IFNγ) is a cytokine that is released by T cells and NK cells in response to a viral infection in the brain and is required for clearance of certain viruses from the CNS. IFNγ signals via the Janus kinase/Signal transducer and activator of transcription (Jak/STAT) signaling pathway, which is also activated by developmental cytokines during cell fate decisions. The activation of JAK/STAT pathway also could lead to decreased protein levels of G1/S phase Cyclin-dependent kinase (CDK) complexes, leading to decreased phosphorylation Retinoblastoma (Rb) protein and decreased cell cycle progression. Therefore, we will test the hypothesis that IFNγ influences NSPC proliferation and differentiation through Jak/STAT signaling. In preliminary studies, we found that IFNγ activates STAT1 and STAT3 proteins in NSPCs and decreases cell cycle progression and proliferation. Through these studies, we will define the role of the inflammatory response in modulating NSPC activity during viral infections.

119 Obesity and Related Healthcare Problems in Pittsburgh
Jennifer Thomas
Sophomore | Rangos School of Health Sciences
Faculty Advisor: Bridget Calhoun Dr.P.H., PA-C

ABSTRACT:
The growing epidemic of obesity and its related complications have placed the United States in a healthcare crisis. Pittsburgh and its economically diverse populations reflect this alarming trend. This study details the rate at which obesity affects those from different socioeconomic classes and neighborhoods throughout Pittsburgh based on income and availability of nutritious food. To gain insight on this issue, information on the number of grocery stores and the availability of food in areas of different incomes was gathered. The quality of food available, whether it be from fast food restaurants or corner convenience stores, was beneficial when determining the disparities between economic classes. In light of this research it was discovered that lower income families and individuals cannot afford healthy meal options, therefore the neighborhoods they live in do not offer fresh and nutritious food. The limited availability and quality of food causes those with lower incomes to have poor diets and be at risk for obesity, a condition that may lead to numerous healthcare complications.
120 Dried Blood Spot Analysis by Laser Ablation–Mass Spectrometry for Assessment of Environmental Human Health
Sarah Sheffield
Sophomore | Bayer School of Natural and Environmental Sciences
Faculty Advisor: H.M. "Skip" Kingston, Ph.D.

ABSTRACT:
The need for a better method of blood drawing and analysis is increasing for the demands of the aging population in the US. By utilizing dried blood spot (DBS) cards and media, a smaller amount of blood is required and can be taken and shipped by the patient for analysis. This allows analytes in blood to be quantified with small amounts of sample. Sampling of blood for DBS analysis is also simple and can be completed by the patient at home by finger or heel pricks. Previously, the DBS cards had to undergo microwave digestion to analyze the inorganic analytes in blood using inductively coupled plasma–mass spectrometer (ICP-MS). However, using an excimer laser, the blood can be ablated from the card and analyzed directly, cutting out hours of the sample preparation work. Accuracy in laser ablation (LA)–ICP-MS can be achieved by utilizing isotope dilution mass spectrometry (IDMS), which eliminates the use of calibration curves and allows the standard to be on or in the matrix. This method has been standardized and is covered in EPA method 6800 update V, 2013. LA can also be used to quantify organic molecules and peptides in whole blood, such as glutathione (GSH) and oxidized glutathione (GSSG) that play important roles in maintaining human body functions by coupling it with a molecular mass spectrometer, such as Q-TOF-MS. The quantification of peptides allows a better understanding for doctors to more often follow their patients and improve treatment. IDMS is used for the quantification of both inorganic and organic ions.

121 Development of a statewide antibiogram to guide pharmacist recommendations for the treatment of antibiotic-resistant ESKAPE organisms
Laura Brickett, Timothy J. Porter, Nancy D. Lee
Senior | Mylan School of Pharmacy
Faculty Advisor: Anthony Guarascio, Ph.D.

ABSTRACT:
Bacterial resistance rates are on the rise, while antibiotic drug development has not been able to keep pace. Hospitals and other inpatient institutions utilize antibiograms as tools for both optimal antibiotic selection and to track and analyze resistance patterns, as these inpatient settings are breeding grounds for lethal, multidrug-resistant organisms. Currently, there are no regional antibiograms or tracking measures in place that compare these trends between institutions, even though there is a need for more comprehensive and widespread monitoring of this public health crisis. The objectives of this study are to collect, collate, and compare antibiograms that depict antimicrobial resistance patterns in institutions across the state of Pennsylvania. This project will be conducted using a prospective survey questionnaire to gather data from secondary care facilities across the state. Data collected includes baseline facility characteristics and microbiological data, as well as vital qualitative and quantitative data.
from institutional antibiograms depicting local antibiotic susceptibility patterns. Data will be utilized to build a regression model for prediction of resistance patterns due to organisms of interest. Collecting these data are critical to studying the evolution of drug resistance across the state of Pennsylvania. Benefits from this data include providing information necessary for clinicians to provide optimal antibiotic selection for patients, as well as depicting areas with high resistance rates for which to target antimicrobial stewardship efforts. Furthermore, it creates an interface for pharmacists, doctors, and clinical microbiologists to collaborate with the ultimate goal of enhancing current and future patient outcomes.

**An Examination of The Durability of Batman as a Pop-Culture Icon and his Progression to a Modern Gothic Icon**

Julian Donado  
Senior | A.J. Palumbo School of Business Administration  
Faculty Advisor: Emad Mirmotahari, Ph.D.

**Abstract:**  
Easily one of the most recognizable figures in modern day pop culture, Batman has become a prominent image in the mainstream. With an undeniable darker appeal, Batman gains salience amongst an innumerable crowd of superheroes as an atypical symbol of justice. However, Batman was not always the gritty “Dark Knight” many have come to know him as in modern day. In fact, the Christian Bale Batman the general movie-goers have come to adore is vastly different from the campy Adam West Batman older generations remember watching on television (“Same Bat-Time! Same Bat-place!”), an image that perfectly parallels the optimistic, cheerful image many shows of the 40s embodied during the historically-prosperous, post-WWII era. The purpose of this study is to discern where and when this shift occurred, as well as the sociocultural implications the time period had on such a shift. According to psychologist Malcolm Gladwell, shifts similar to the one exemplified in the polarized image of Batman are not as gradual as we may believe; rather, Gladwell suggests that trends begin gradually and then reach a certain point – a tipping point – that affects the trend all at once. Through analysis of landmark works of Batman in different mediums (including comic books, graphic novels, movies, and television series), as well as historical and sociological data relevant to the times in which such works were released, the precise location of the tipping point will be pinpointed, while also assessing the durability of Batman as a pop-culture icon, and his ability to retain popularity through such a drastic change.
123 A Sociohistorical Analysis of the Proclivities of Japanese and American Populations Towards Health Care Systems and Policies
Andrew Gaiser
Senior | Mylan School of Pharmacy
Faculty Advisor: Khalid M. Kamal, M.Pharm, Ph.D.

Abstract:
The ultimate goal of this project is to utilize the findings of the sociohistorical analysis to explain Japanese and American proclivities towards health care systems and policies. A sociohistorical approach will allow the examination of traditional American literature in genres such as Transcendentalism and Pragmatism, while still delving into the vital history that has shaped the nation. Also, the two systems have enough similarities, such as government run components, as well as differences, for example privatization, that an analysis of the two will yield insight into potential for transplantation of proven successful aspects of each system into the other to address existing health care disparities.

124 Drain Water Heat Recovery: A Plan to Prevent Energy from Pouring Down the Drain
Brian D’Orazio, Lauren Graessle, Rachel Zapf, Kayla Mood, Amy Carr
Junior | A.J. Palumbo School of Business Administration
Faculty Advisor: Pinar Geylani, Ph.D.

Abstract:
Studies have shown that approximately 17% of residential energy consumption and 7% of commercial energy consumption can be attributed to the energy needed for water heating. Research has also indicated that between 80% and 90% of the energy that the water possesses in the form of heat is lost when it goes down the drain. The purpose of this research is to determine the efficiency of drain water heat recovery systems if implemented in a city such as Pittsburgh. Duquesne is used as a representative model for the application of recovery systems within residential and commercial buildings. Data on the amounts of water and energy used for water heating in Brottier Hall (our residential model) and the Power Center (our commercial model) are obtained from Duquesne Facilities Management. We further utilize cost-benefit analysis to determine whether the implementation of drain water heat recovery systems in a city would be an economically viable and efficient way to reduce energy consumption and greenhouse gas emissions.
125 An Inquiry of the "Objective" Sciences and "Subjective" Humanities: Is there a Relationship Between Individual Attractiveness and Academic Productivity and Prestige?
Brooke Webster, Caitlin Reilly; Emily Emsurak
Senior | McAnulty College and Graduate School of Liberal Arts
Faculty Advisor: Alexander Kranjec, Ph.D.

ABSTRACT:
Is there a relationship between particular academic fields and the attractiveness of people who are successful in those disciplines? Are there differences in attractiveness when comparing faculty in more "subjective" fields from the humanities and more "objective" ones in the natural sciences? To investigate these questions, we randomly selected 150 assistant and associate professors from 10 state universities from five distinct geographic regions. To compare attractiveness in the "hard" sciences and the humanities we selected an equal number of faculty members from English, Philosophy, Psychology, Biology, and Physics departments. An equal number of male and female professor photographs were selected. Male and female students will rank all faces in terms of attractiveness. Using this data we hope to determine if certain fields are rated more attractive than others, and if individual attractiveness is predictive of academic productivity and prestige.

126 Renewal Service Learning
Kelsey Biernesserk, Mia Amatangelo, Rachel Barry
Senior | Rangos School of Health Sciences
Faculty Advisor: Audrey E Kane, PhD, MS,OTR/L

ABSTRACT:
We have partnered with Renewal, Inc. in Pittsburgh in order to work with the men who are enrolled in their work-release program. We developed distinct and separate learning modules which cover topics pertaining to job compatibility, computer skills, interview skills, resume building, and stress relief for the men to complete over an 11 week period.

127 Analyzing Equine Hindgut Microbial Communities in Relation to Laminitis
Klancie Martinez
Sophomore | Bayer School of Natural and Environmental Sciences
Faculty Advisor: Jan Janecka, Ph.D

ABSTRACT:
Laminitis is a disastrous disease to equine if not treated right away. It causes the epidermal laminae to be unable to attach properly to the hoof wall of the horse. The hoof falls away from the rest of the foot. It causes the horse great pain and can become infected very easily. Infection could eventually lead to horse death. In my research endeavor, I sought to find out what may be causing this horrible disease to plague all breeds of equine. It can be concluded that one possible factor is the amount of microflora bacteria found in a horse’s digestive system. A larger amount of microflora bacteria (or bacteria similar
to microflora) could create a greater chance of the horse becoming inflicted with the disease. The type of food a horse consumes may contribute to the amount of bacteria it has. It seems the more pasture a horse eats, the greater amount of a microbial community is found inside of it. Which could ultimately lead to laminitis. I have collected twenty horse samples, all from the same farm. A few whom were diagnosed with laminitis at least once. I extracted DNA from the samples and observed DNA abnormalities as well as microbial abnormalities among those ill compared to the healthy horses. My hypothesis for this experiment is that those horses who have laminitis will show a larger amount of microbial communities whereas those horses who are healthy will show a lesser amount of the bacteria.

128 Bust of Move
Alyssa Mancini, Allyson Strahler, Matt Liberatore
Senior | Rangos School of Health Sciences
Faculty Advisor: Audrey E Kane, PhD, MS, OTR/L

ABSTRACT:
Our program takes place at CLASS (Community Living and Supportive Services). The population is mainly people with Cerebral Palsy. We are working with a wheelchair dance class. Our program incorporates movement and exercise. The outcomes our programs will address are self-esteem, self-expression, and socialization. According to the OTPF (2014), there are two types of occupational performance outcomes: improvement and enhancement. We will aim to improve the participant’s socialization and social skills by working with partners. We will enhance their self-esteem and self-expression by having them lead the exercises and creating dance moves for the group to perform. Adaptations will be made if a participant is unable to perform the activity we have planned. By enhancing the participant’s self-esteem and self-expression, this will address the health and wellness and quality of life outcomes stated in the OTPF (2014).

129 A Comparison of Planktonic Communities at the Murphy’s Bottom Ecological Site
Youstina Seliman, Caroline Kirby
Sophomore | Bayer School of Natural and Environmental Sciences
Faculty Advisor: Brady Porter, Ph.D.

ABSTRACT:
Murphy’s Bottom is an ecological research site located along the Allegheny River in Armstrong County, PA. Due to mining activities in the mid-1980’s, a 25 acre lake and small annex were created adjacent to the Allegheny River. The goal of this project is to obtain baseline data on planktonic communities to predict the possible ecosystem changes that might result from connecting the lake to the river to form a backwater wetland. We hypothesized that the shallow and deep lake’s planktonic communities should be highly similar due to their current connection. The shallow lake and the annex are of similar depth and connect seasonally; possibly leading to similar planktonic communities. Furthermore, all three sites are predicted to be very different from the isolated river. To test these predictions, we analyzed the plankton composition of water samples taken in 2008 and preserved in Lugol’s solution. Aliquots were concentrated through a 0.45micron filter which was examined using light microscopy. Similarity indexes
compare species composition across all four sample sites and seasonal changes within sites. In mid June, the dinoflagellate Ceratium dominated the annex and the shallow lake while cyanobacteria and diatoms thrived in the deep lake and the river respectively. Our prediction of connectivity-based similarity was partially supported. As predicted, the lake sites and annex differed from the river in planktonic composition. The shallow lake was more similar to the annex than the deep lake, revealing the importance of water depth in shaping planktonic communities.

130 *Budgeting Bootcamp*

Erin Wynn, Audra Sitterly, Amanda Corturillo
Senior | Rangos School of Health Sciences
Faculty Advisor: Audrey E Kane, PhD, MS, OTR/L

**Abstract:**
We are conducting a service-learning project at Shepherd’s Heart Veteran’s Home, in which we create an 11-week program to address the needs of our population. Throughout the program we will teach the men how to create a budget for themselves based off their own, individual income. This will allow the men to develop money management skills that they can use to become financially independent. The second goal of our program will be introducing stress/anger management coping techniques to the veterans. They will be provided opportunities to learn and practice these skills in a variety of settings. This will allow the men to generalize these skills and incorporate them into their daily lives. By the end of our program, we hope to change many of the detrimental habits and patterns the men demonstrate in their daily lives, and replace them with more productive options.

131 *Rebirth of the Bald Eagle Population in Pennsylvania*

Katherine A. Miller, Makayla N. Dillingham; Ryan Willis; Becky Andrus; Mike Schlichtkrull
Junior | McAnulty College and Graduate School of Liberal Arts
Faculty Advisor: Michael Irwin, Ph.D.

**Abstract:**
In what ways have humans affected the population of Bald Eagles in Pennsylvania? Over the course of time in Pennsylvania humans have played a very integral role in the decline and rebirth of the eagle population. The Bald Eagles’ history has been strongly interconnected with the humans that also call these areas home. In the 1980’s there were only three nests in the state and now there are over 250 according to the Pennsylvania Game Commission. Methods to improve the environment have benefitted the eagle population over time, and through a combination of gathering existing research and fieldwork we will illustrate this accomplishment for the human and Bald Eagle relationship. Through qualitative and quantitative research pertaining to state DDT usage, pollution of the waters affecting the food chain, changes in the climate, and making eagles a social media and public interest, we plan on using descriptive statistics and content analysis to show the results of our study. We expect this study to demonstrate the nature to which humans affect the world around them and how we can fix problems we have caused through education, preservation, and hard work. We believe that our research will lead
more individuals to take an active role in conservation of the environment and also keep the current management efforts going strong.

**132 Duquesne Dining Ordering System - An Object-Oriented Approach to Information Systems**  
Cynthia Huang  
Senior | Rangos School of Health Sciences  
Faculty Advisor: Wenqi Zhou, Ph.D

**A B S T R A C T:**  
The purpose of this research project is to propose, analyze and design an online dining ordering system as a more efficient way for students and staff to dine on Duquesne University’s campus. This new system would allow students and staff to view selections at all available dining locations online and then subsequently order food. The system will deliver the order information to the kitchen and process payments. Once the order is ready, a confirmation e-mail will be sent to the customer. The objective of this project aligns well with Duquesne University’s mission. It will eradicate long lines, especially during busy hours, and provide an overall more enjoyable dining experience. Economically, this dining ordering system is anticipated to bring in more sales and start to generate net revenues by month 6. This project adopts an Object-Oriented Systems Analysis and Design methodology by using objects as opposed to data or processes. A careful examination of the Point-of-Sales system used in Duquesne’s current dining service was conducted and then followed by a context-level data flow diagram to show the project scope. In order to collect the system requirements, interviews and surveys were conducted. All the collected requirements were analyzed and documented by a series of Object-Oriented diagrams in university-purchased Microsoft Visio, including a use case diagram, an activity diagram, and a sequence diagram. Lastly, based on the diagrams in digital format, an interface design was created on a cloud based server, Mockflow, to show a prototype of the Duquesne Dining Online Ordering website.

**133 Turning the Corner: A Better Public Transportation System for a Sustainable City**  
Josef DiPietrantonio, Dj Landoll, Bharaniabirami Rajaram, Joseph Pavlick  
Junior | McAnulty College and Graduate School of Liberal Arts  
Faculty Advisor: Stan Kabala, Ph.D., Associate Director, CERE

**A B S T R A C T:**  
Currently, only approximately 8% of Pittsburghers ride public transportation on a consistent basis, and the national average is even lower at only 5%. The most visible service in Pittsburgh public transportation is the Port Authority, which currently operates with 875 buses and 80 light rail vehicles. While cleaner bio-diesel fuel has been mandatory since 2010, only 32 buses currently operate with a hybrid diesel/electric power source. This project will investigate increasing the availability and quality of public transportation, toward reducing traffic and harmful emission. Effectively cutting back on carbon emission, reducing the cost of daily commuting, and running clean energy vehicles are necessary toward ecological, environmental, and economic sustainability of any city, including the city of Pittsburgh. Shorter and smoother commutes both to and from work can also result in a decrease in overall stress.
and save time for people. Higher usage of public transportation will not only save people money, but also increase revenue for the city, stimulating the local economy. Reduction of traffic will decrease the amount of harmful emissions that result from traffic back up and too many vehicles on the roads, improving the air quality of the city. Overall, increasing the number of bus routes and T lines accessible to the public, expanding existing roads, and encouraging alternative forms of transportation are just a few ways by which a more environmentally, economically, and socially sustainable system can be achieved.

134 One Man’s Trash is Another Man’s Meal: A Sustainable Proposition for Food Waste at Duquesne University
Kaitlyn Caron, Anita Ghosh, Catherine Hull, Krista Spear
Sophomore | Mary Pappert School of Music
Faculty Advisor: Lisa Barreiro, M.S.

Abstract:
An estimated 34.7 million tons of food waste per year occurs in America, which is unnecessary because much food can be donated. On average, 150-200 pounds of food per week is wasted at college campuses, of which we believe Duquesne could donate at minimal 50 pounds per week. The food of interest in this study includes prepared whole, unbroken foods at Duquesne University that are viable for donation and within legal code. This includes pre-prepared sandwiches, salads, dairy products, fruits, and vegetables that are sold in individual ampules, allowing them to be considered sufficient for contribution, and specified with dates of freshness. Food will be collected from four specific dining locations on Duquesne University’s campus (The Incline, Options, Campus Market, and Coffee Tree Roasters). The purpose of this project is to feed the hungry by obtaining excess food from the dining locations, and redistributing this food to the Pittsburgh Area Food Bank to help hungry people (there are about 1,500 homeless in Allegheny County). The food is currently thrown away, but could be utilized to provide nutritional benefits for needy persons who participate in the program, as the donated foods will be fresh and of various food categories, and the people would otherwise not have access to this food. The food will be collected daily from the campus locations by several volunteer students, and will be transported to the Food Bank daily. Continued research will lead to optimized methods for the collection, preservation, and distribution of the foods of interest.

135 The Tripartite Battle for East Africa: An Examination of the Crown Lands Ordinance of 1915
Ian Ferguson
Senior | McAnulty College and Graduate School of Liberal Arts
Faculty Advisor: Charles Steinmetz, Ph.D. and Holly Mayer, Ph.D.

Abstract:
The East Africa Protectorate (EAP), which would eventually become Kenya Colony, was in a state of chaos from 1902 to 1915. After building the Uganda Railway through the EAP, the British found that they had built a railway to nowhere, and they needed to develop the EAP in order to justify the railway’s
construction. White settlement was encouraged to develop the land, but the competing interests of White settlers, native Africans, and Colonial Office officials in London ground development to a halt. I argue that the Crown Lands Ordinance of 1915 was an attempt to reconcile these three competing interests. The ordinance is significant in that it would cause land issues later in EAP and Kenyan colonial history, such as providing a legal framework for alienating native land, as well as being a flashpoint for the land question in early colonial Kenya. The white settlers are represented through newspapers such as the East African Standard that served as a settler mouthpiece for political interests, and Elspeth Huxley’s White Man’s Country. The lack of primary source material from native Africans forces me to rely upon the minutes of British Colonial Office officials attached to dispatches and telegrams who represented their interests through the theory of Trusteeship. The Colonial Office records will represent the officials from the period 1912-1915. There is little historiography about the Crown Lands Ordinance of 1915, at most a passing mention, which is astonishing considering how important the ordinance is to the history of Kenya.

136 Utilizing African Traditional Dance as a Facilitator of HIV/AIDS Information

Kayla Witkowski
Senior | School of Nursing
Faculty Advisor: Mary Guimond, Ph.D.

ABSTRACT:
HIV/AIDS is one of the leading causes of death in the world. Aiming to further prevent this disease, The Sankofa Center educates children by utilizing African traditional dance. This poster examines the impact of traditional dancing and its means as a facilitator of HIV educational material. The influence of dance was examined by volunteering with The Sankofa Center in Accra, Ghana. For five weeks, school outreaches were conducted using the following structure: an introduction to HIV, the difference between HIV/AIDS, African traditional dancing, basic HIV/AIDS education, group sessions, and trivia/group dancing. Traditional dancing was conducted in conjunction with dance dramas. Dance dramas were depicted based on the risks of the community and portrayed situations that expose individuals to HIV. To ensure retention of the information, trivia games were conducted at the conclusion of each session. Throughout the outreaches, three schools were educated including over 1,000 children.

137 Beauty Over Bounty: the Real Goal of the Gardner Heist

Stephanie Laux
Senior | McAnulty College and Graduate School of Liberal Arts
Faculty Advisor: Elaine Parson, Ph.D., Andrew Simpson, Ph.D.

ABSTRACT:
On the night of March 18, 1990, two policemen gained entrance to the Gardner Museum to investigate suspicious activity inside. As the security guards quickly realized, the men were thieves who then spent the next hour and a half in control of the helpless museum. Walking through the museum with a purpose, they cut and smashed priceless works out of their frames, leaving hauntingly empty spaces
behind. After carefully selecting thirteen works, they left the museum without a trace. For the past twenty-five years, this dramatic and unique robbery has continued to perplex investigators due to the lack of traceable evidence and the seemingly strange choices of works taken by the burglars. However, when examining the works that were stolen and comparing them to the ones left behind, it is clear that the robbers had a specifically planned shopping list with a distinct pattern. Rather than choosing pieces based on their monetary values, the thieves chose works for their personal aesthetic appeal, most likely for a personal private collection. Since most thieves are motivated by financial gain, the probability of a theft for personal gain is unlikely, and therefore disregarded by authorities. However, the fact that authorities have made no progress in locating the stolen works or the thieves themselves suggest that this motive has been under investigated and deserves further consideration.

138 Regulate. Reprimand. Repeal?
Peter Mysels
Junior | School of Education
Faculty Advisor: Andrew Simpson Ph.D.

A B S T R A C T:
“Regulate. Reprimand. Repeal?” examines the origins of divergent drug and alcohol enforcement policies in the United States over the course of the Progressive Era and beyond. This paper uses a social and cultural lens to examine how the fear of criminal or deviant behaviors has shaped the particular policies of American drug regulation. Three primary drugs are examined: cocaine, morphine, and heroin. Unregulated cocaine abuse raised the specter of social disorder and cross-racial violence, particularly between the white and African American communities in the South. Morphine abuse, by contrast, raised concerns about preserving the virtue of middle-class women and mothers and preventing the self-destructive behaviors that came with opiate addiction. Attempts to ban the importation of heroin were tied to a broader immigration policy that linked the drug to nativist campaigns to further restrict Asian immigration. Unlike drug regulation, alcohol use existed across all social groups making it more difficult for social activists to cast it as a truly disordering agent. Understanding the role of fear in past regulatory efforts based on social and cultural factors provides policy makers with a lesson on how to avoid pitfalls in legislating today.

139 St. Anthony’s Reps for Success
Kahli Hale, Kelsey Kinnare & Alex Watts
Senior | Rangos School of Health Sciences
Faculty Advisor: Audrey E Kane, PhD, MS,OTR/L

A B S T R A C T:
Over the course of the semester, we will be working with 5 students from the St. Anthony’s program at the Power Center located on Duquesne University’s campus. The overall goal of our program is to increase the health and well-being of each student by engaging them in physical activity and also educating them on nutrition. Each week, we will engage the students in various exercises and activities. Some of these will include basketball, kickball, soccer, using workout machines, and teaching them body
weight exercises. We will also incorporate nutrition education into these sessions so that the students make healthy food choices. We will be providing handouts for the students when applicable, so that they can take the information home with them to both show their parents and use as a reference for future exercise. It is our hope that the students will continue to use these exercises and nutrition information on their own, therefore improving their health and overall quality of life.

140 Cuban Immigration in the United States: A Comparative Study Across Various Waves
Alexandria Pappas, Ben Kelly, Heather Williams, Anthony Buzzelli
Senior | McAnulty College and Graduate School of Liberal Arts
Faculty Advisor: Jennie Schulze, Ph.D.

Abstract:
Since the communists took power following the Cuban Revolution in 1959, the United States has maintained a favorable policy toward Cuban immigrants and has welcomed the self-proclaimed exiles into its country. They are awarded this special privilege in part due to official United States policy towards the Cuban government, characterized by lack of diplomatic relations and a strict trade embargo. This paper will explore how the various waves, stretching from 1959 through the Soviet Union’s collapse in 1991, of Cuban exiles have become incorporated into mainstream society in Southern Florida. Many Cubans have settled here due to the close geographical proximity to their home country. It will also examine how each wave has integrated structurally, culturally, politically and with respect to identification into their host environment from generation to generation, as well as comparing their performance with the native population. This paper will pay specific attention to how political association, educational attainment, categorical identification, and social interactions vary across the waves. Cuban immigration into the United States presents a unique case to immigration research, because the migrants represent all levels of the socioeconomic stratosphere. Earlier waves were generally motivated for political reasons and later waves were often determined to escape dire economic circumstances. After careful examination of the past waves of Cuban immigrants, this paper will predict the future of Cuban migration to the United States as a result of the gradual restoration of the United States relationship with Cuba.

141 Parking Roof Gardens to Reduce City Pollution
Alexandra Santer, Kiersten Erlanson, Megan Hockman, Alexandra Matejczyk
Freshman | Rangos School of Health Sciences
Faculty Advisor: Lisa Barrerio, MS

Abstract:
In urban settings there is limited space with little left to implement sustainable advances. Cities have high levels of ozone, increased energy consumption, and potential health hazards as a result of pollution. To help combat some of these issues, we propose the addition of parking roof gardens. Roofs made of metal with coconut fiber overlay would be installed above existing open-air parking lots. Sedums would be planted in the coconut fiber overlay, as in the case of the California Academy of Sciences’ existing green roof. The metal grating would also be used for the installation of vines to further
reduce pollution. The addition of parking roof gardens to cities would decrease the heat of concrete by 35°F and parked cars by 45°F by creating organic shade. Reductions in car heat have been shown to reduce the need for air conditioning use, which under hot summer conditions lowers car fuel economy by as much as 25%. The reduction of temperatures in cars can reduce the formation of pollutants and will decrease gas emissions by 8% when canopy coverage is increased from 8% to 50%. Furthermore, creation and implementation of a continuous recycling water trough irrigation system would store excess rainwater, keep the plants healthy, and reduce surface water runoff. Implementation of these gardens throughout cities across the United States would decrease global warming effects, surface ozone, and car emissions resulting in a better quality of life for inhabitants and a healthier Earth.

142 Evaluation of immediate early gene expression following light-induced activation of the central amygdala and basolateral amygdala
Allison Trouten, Katelyn Sadler
Junior | Bayer School of Natural and Environmental Sciences
Faculty Advisor: Benedict Kolber, Ph. D.

ABSTRACT:
The central amygdala (CeA) and basolateral amygdala (BLA) are closely related in their physical orientation in the brain and in their roles in modulating stress. However, the distinct roles of these nuclei in the modulation of pain is unresolved. Using a unique light-based approach (optogenetics), cells in the left CeA, right CeA, left BLA, or right BLA were activated during bladder pain testing in mice. Interestingly, activation of the right CeA only elicits an increased physiological response to urinary bladder distention. To determine if this asymmetrical physiological trait was due to unequal activation of the left versus right amygdala, immunohistochemistry was performed for c-Fos, a well-known immediate early gene and marker of neuronal activation. Our results show that the lateralization of the CeA in the visceral pain response is not due to a difference in the number of activated c-Fos cells in the right and left amygdala. This same technique was also employed to investigate activation levels in other downstream brain regions known to play a role in pain processing. Currently, we are analyzing data from the BLA of mice stimulated in either the right or left BLA with the same optogenetic approach used in the CeA studies. Here we report the distribution of activated c-Fos cells in these brain loci.

*143 Association Among The Use Of Hand-Held Devices and Upper Quadrant Posture, Pain, and Dysfunction
Ashley Kershaw, Kahli Hale
Senior | Rangos School of Health Sciences
Faculty Advisor: Kimberly A. Szucs PhD, OTR/L

ABSTRACT:
Purpose: The use of hand held mobile devices, such as tablets and smartphones, has increased significantly in recent years. A common observation of people using such hand held devices reveals that they frequently adopt postures of the upper limb and neck (upper quarter) that when done repetitively could result in musculoskeletal pathology. In order to understand the risk of developing UQ
musculoskeletal pathology from hand held technology use, it is necessary to first determine the pattern of use of different hand held devices. Hypothesis: The frequency of UQ discomfort/fatigue will be directly associated with the duration and frequency of hand-held electronic device used. Data Collection: Data will be collected with distribution of an anonymous University-wide online survey. The collection of data is ongoing as participants respond to the survey. The survey is designed to assess patterns of use for various hand-held devices, including cell phones and tablet computers, and related symptoms of upper quarter (UQ) fatigue or discomfort. Aim 2: If students want to help complete Aim 2 of the study, they can enter their name and email address at the end of the survey. This will allow the investigator to contact them to schedule a data collection session. Student’s neck, back and UE will be photographed while using of the different hand-held devices. These pictures will serve as a guide and a gridded overlay will be used to measure the student’s posture.

144 Improving Work Behaviors at Blind Vision Rehabilitation Services
Alexa Schuck, Katie Boyle, Molly McElroy
Senior | Rangos School of Health Sciences
Faculty Advisor: Audrey E Kane, PhD, MS,OTR/L

A B S T R A C T:
Our service learning project is a weekly program in which we are working with 8 participants attending Blind Vision Rehabilitation Service’s Employment Transition Services. The purpose of our program is to improve work behaviors in our group through the use of strategies for emotional regulation, communication, and attentiveness.

Kelsey Kinnare, Jordan Steele
Senior | Rangos School of Health Sciences
Faculty Advisor: Kimberly Szucs, Ph.D.

A B S T R A C T:
Purpose. Approximately 116 million adults in the United States experience chronic pain 1. The study examines the effects of exercise dose on pain perception in healthy humans. It is hypothesized that low-dose exercise will produce the best cost-to-risk ratio for individuals with pain. Method. Participants will be randomized into a low-dose (3x/week) exercise, moderate-dose (5x/week) exercise, or no exercise control group. Exercise will consist of 30 minutes walking on a treadmill at a moderate pace. Walking speed will be calculated with a standard equation based on desired METS, age-adjusted maximal heart rate, and treadmill gradient 2. Baseline physiology measures include HR and BP. Cutaneous sensitivity threshold will be measured at intake and discharge. Pain measures include constant thermal, radiant thermal and mechanical pressure stimuli. For each stimulus, sensitivity thresholds, pain intensities, and pain quality ratings will be assessed. Pain measures will be taken at intake, post-exercise (days 1, 3, 5), and at discharge (Table 1). Participants will wear a pedometer for the duration of the study. Results. The study is ongoing. Descriptive analysis is expected to be available for 7-8 participants at the time of
the symposium. Results are anticipated to show that even low-dose exercise will be beneficial in reducing pain ratings.

Table 1. Method for intake through intervention.


146 The Effect of Integrated Healthcare Delivery Systems on Insurer Profits and Consumer Welfare
Hannah Doerr
Senior | McAnulty College and Graduate School of Liberal Arts
Faculty Advisor: Kevin Shaver, Ph.D.

Abstract:
Since the implementation of the Patient Protection and Affordable Care Act, pressure on the healthcare industry to reduce expenditures has increased. In an effort to control costs and provide care more efficiently, some health insurers and providers have merged to form integrated healthcare delivery systems. This paper theoretically models the effect of backwards vertical integration on insurers’ profits and consumer welfare when asymmetric transportation costs and administrative networking costs are introduced to the market. Multiple insurer-provider network configurations are considered in this analysis of a competitive healthcare market of two insurers and two providers. The solutions indicate that backwards vertical integration, in which a health insurer purchases a healthcare provider, is more profitable for the insurer under certain conditions; however consumer welfare is lowered.

147 Image Fusion Using SURE Guided Piecewise Linear Estimation
Justin Goodwill
Sophomore | Bayer School of Natural and Environmental Sciences
Faculty Advisor: Stacey Levine, Ph.D.

Abstract:
In recent years, a number of models for image processing have employed the Gaussian mixture model as a probabilistic patch-based paradigm for data classification and signal estimation in order to achieve near state-of-the art processing algorithms. Much of their success can be owed to the fact that image patches of an appropriate size can be represented sparsely as a linear combination of elements in a prefixed basis. Yu, Sapiro, and Mallat developed a general framework for solving inverse problems through the connection that estimating an image patch from a Gaussian mixture model is precisely equivalent to sparsely representing an image patch using an over-complete PCA dictionary. Wang and Morel expand upon this work by developing a method of piecewise linear estimation (S-PLE) using an alternative initialization based on samples from natural images, a Bayesian Gaussian factor model, and a SURE (Stein’s unbiased risk estimator) guided statistical filter selection. In light of Wang and Morel’s results, we show how the S-PLE formulation can be used as the basis for a model used to fuse multiple images that have been degraded by additive Gaussian noise.

148 Withdrawn from URSS
149 A Photo Ethnography of Place
Logen Fogal
Junior | McAnulty College and Graduate School of Liberal Arts
Faculty Advisor: Eva Simms, Ph.D.

Abstract:
How do we experience place in meaningful ways during the course of our everyday lives? This is what I shall address in this ethnographic work. I will attempt to find themes in photographs related to inner city youth and attempt to address my own experience related to place.

150 Saturated absorption laser spectroscopy of potassium-39 vapor
Julie Gillis, Robert W. A. Brooke, Christopher A. Zaccagnini, Theodore A. Corcovilos
Junior | Bayer School of Natural and Environmental Sciences
Faculty Advisor: Theodore Corcovilos, Ph.D.

Abstract:
Saturated absorption spectroscopy is an effective and reliable technique that is used frequently in atomic and optical physics in order to precisely measure the hyperfine energy structure of atoms, such as the alkali metals that are used in laser-cooling experiments. We present an effective optical design to measure the D2-line of potassium-39 at 766.700 921 nm (near infrared) that can be used to frequency-lock our laser diode with 6 MHz (~10 ppb) accuracy. Counter-propagating laser beams are passed through an atomic vapor cell of 39K to obtain sub-Doppler resolution peaks of the excited atoms. The design consists of several optical components including the introduction of an anamorphic prism pair to optimize the beam shape and a set of telescoping lenses for magnification and collimation of the beam.