

Spring 5-2-2014

## 11th Annual Symposium of the School of Science, Engineering and Health

Messiah College

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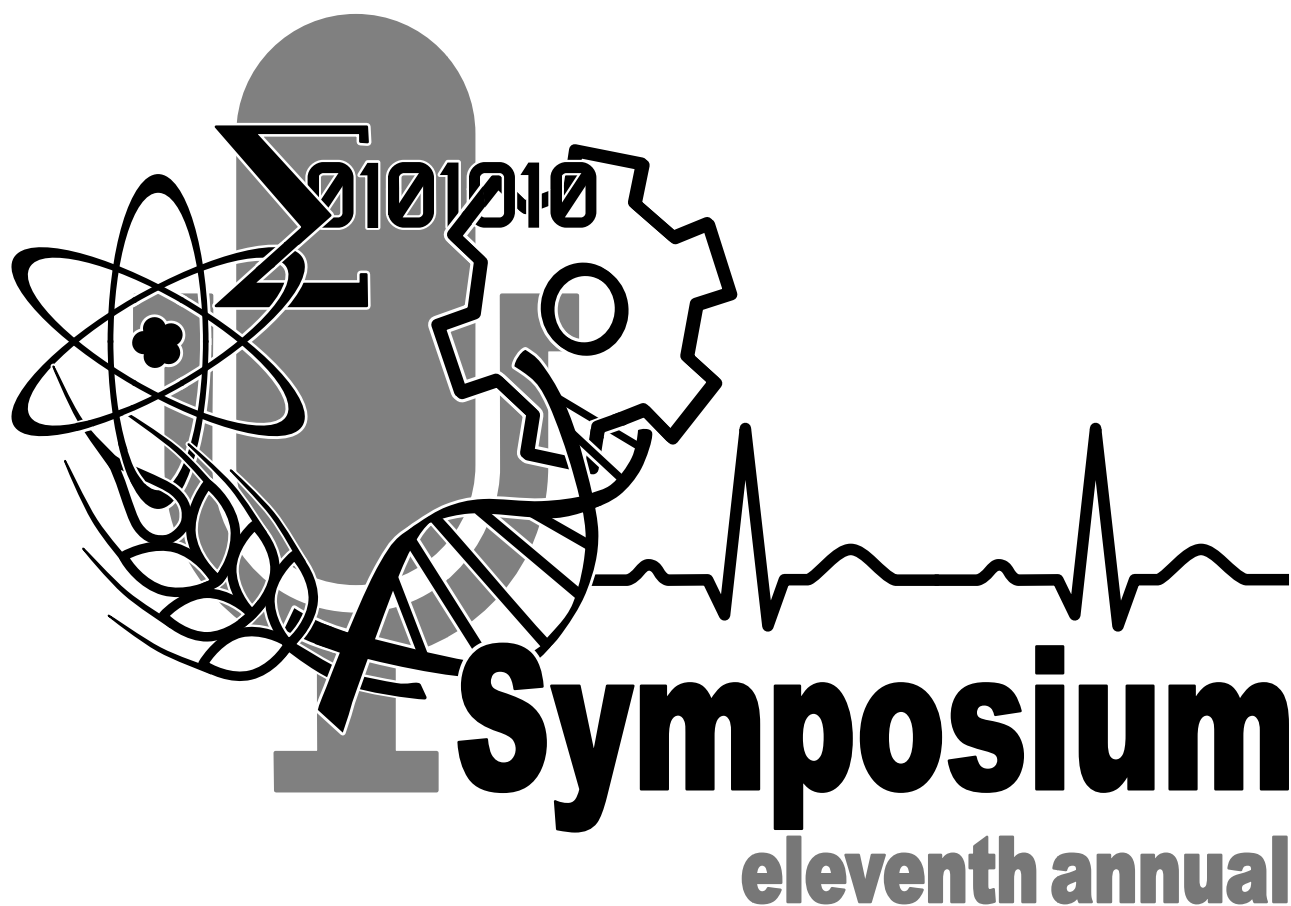
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Sharpening Intellect | Deepening Christian Faith | Inspiring Action

Messiah University is a Christian university of the liberal and applied arts and sciences. Our mission is to educate men and women toward maturity of intellect, character and Christian faith in preparation for lives of service, leadership and reconciliation in church and society.

# SCHOOL OF SCIENCE, ENGINEERING AND HEALTH



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## PROGRAM & ABSTRACTS




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**Frey Hall - Jordan Science Center - Kline Hall of Science**  
**Friday, May 2, 2014**



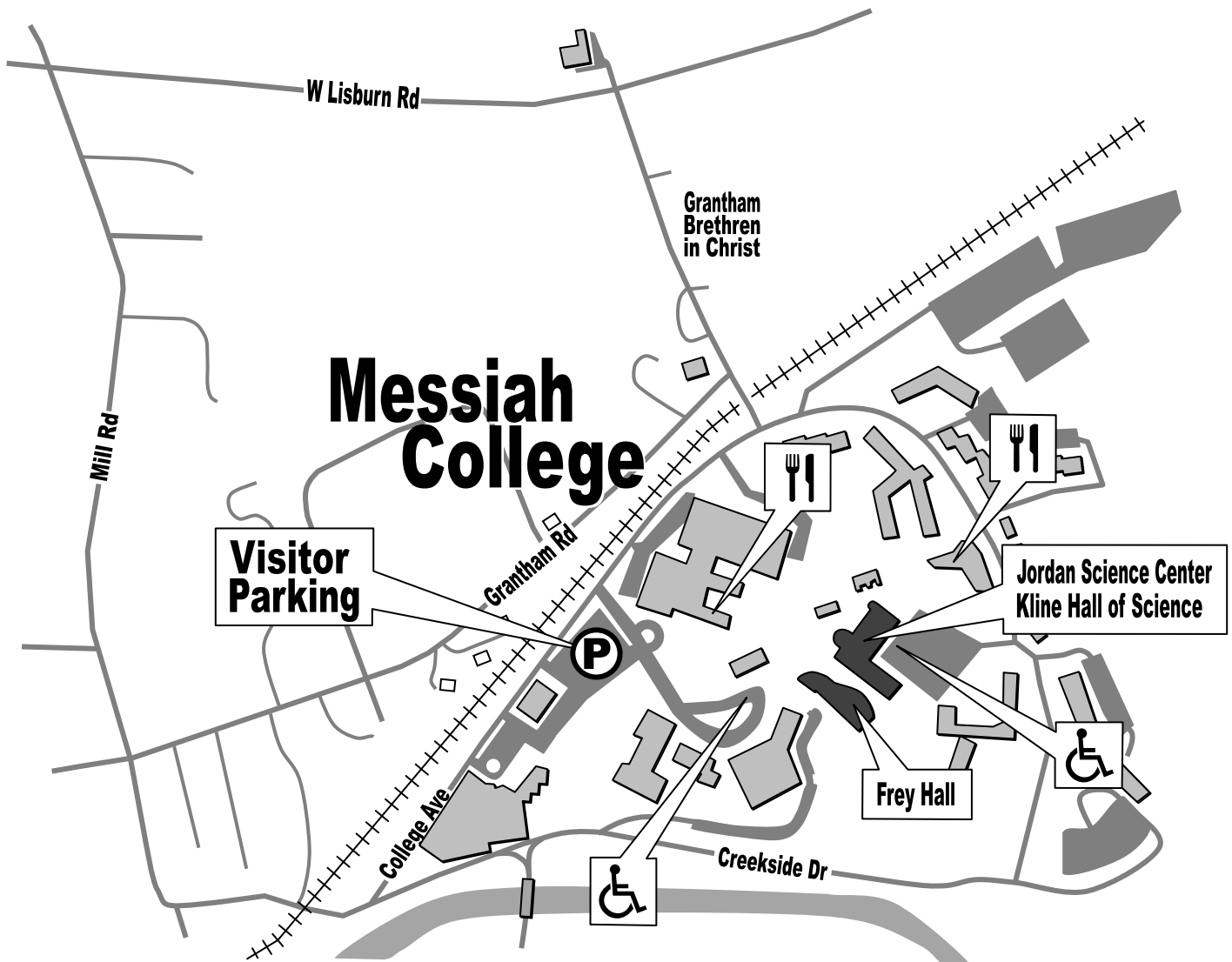


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# Messiah College

## Mechanicsburg Campus



### ***Welcome to Messiah College!***

**Visitor Parking:** Parking is provided in the main Visitor Parking lot (VV) accessed from College Avenue, between Old Main and the Eisenhower Campus Center. Parking tags are not required during the Symposium. While designated handicapped parking is distributed throughout campus, spots closest to Symposium venues are available in the employee parking lots behind the Jordan Science Center (WW) and in the circle at the heart of campus (YY).

**Dining facilities:** The Lottie Nelson Dining Hall (upper level) and The Falcon (lower level; soup, paninis, salads) are located in the Eisenhower Campus Center. The Union Café (pizza, grill, wraps, salads) is located in the Larson Student Union.

## The Symposium and How to Use This Booklet...


**W**elcome to the 11<sup>th</sup> Annual Symposium of the School of Science, Engineering and Health! This event continues a strong tradition of annual events designed to showcase student and faculty innovation, creativity and productivity in academic departments largely from within the School of Science, Engineering and Health. We look forward to incorporating new facets and improvements each year. For example, new this year: project posters will be presented by junior Engineering students during one large, multi-location, mid-afternoon poster session break that will include presentations by many other departments.


***The Program and Abstract booklet provides times, locations and topics for all of the presentations that will be given as part of the symposium.*** A consolidated “Schedule at a Glance” for Oral Presentations is found following the Table of Contents and provides a presentation number, the names of all student presenters, and the starting time and location for each oral presentation. ***Each presentation has been assigned a unique number based on the order in which it is scheduled within the symposium.*** Oral presentations are grouped into Oral Presentation Sessions I – XII, and locations of various poster groups are given for the single, mid-afternoon Poster Session. The title of each presentation and the names of all contributing co-authors and mentors are given in numbered lists on the pages that follow. **Bold font** indicates the names of **presenting authors**. An Abstract for each presentation (Oral or Poster) appears in the latter part of this booklet. Abstracts are arranged in alphabetical order by the last name of the first author (see “Schedule at a Glance”); the presentation number appears in bold in parentheses at the end of each abstract. Finally, the names of all co-authors (and mentors) are listed at the end of the booklet in a single alphabetized list with the number(s) of each presentation on which that individual is listed as a co-author. I apologize in advance for any errors in, or omissions from the program.


A variety of symbols are used throughout to designate the roles of authors or contributors:

The “\*” symbol indicates a research or project mentor.

The “^” symbol indicates an off-campus contributor.

The “” symbol indicates the project was affiliated with or supported by the Collaboratory for Strategic Partnerships and Applied Research (Messiah College).

The “” symbol indicates the project was supported by the Steinbrecher Undergraduate Summer Research Program (Messiah College).

The easel symbol (  ) indicates the oral presentation is accompanied by a poster that will be presented in the mid-afternoon Poster session.

We want to thank several individuals without whom we could not have organized the symposium or produced this booklet. Thanks to Scott Weaver (Information & Mathematical Sciences) and his students for providing improvements to and assistance with the on-line Symposium Project Registration and Management system (SymPRM). SymPRM was used to collect and organize Title, Abstract and Author information for each project, and then to organize much of that information into near Program-ready format. Thanks also to the “brave” faculty members and students who used the SymPRM (some for the first time!). Thanks to Lori Zimmerman for her wonderful support and helpful suggestions.

Sincerely,

Larry Mylin and John Harms, Symposium Coordinators (Biological Sciences)

## F110

## F243

## F349

## F343



### Engineering Oral Pres. I

### Information Science Oral Pres. II

### Mathematics Oral Pres. III

### Physics, Mathematics Oral Pres. IV

<b>9:00</b>	Welcome and instructions by Session Chairs			
<b>9:05</b>	1 Bergey	9 NejmeH	15 Bellino	22 Love
<b>9:25</b>	2 Steeves	10 deGruchy	16 Bigelow	23 Chrestay
<b>9:45</b>	3 Black, Murrill, Richter	11 Musselman, Olchewsky	17 Boyle	24 Sooy
<b>10:05</b>	4 Long, Nordstrom	12 Hoffman, Kennedy, Moyer, Newman	18 Jablonski	25 Beam
<b>10:25</b>	5 Galaska, Herwig	13 deGruchy, Hoffman, Eberwein, Moyer	19 Skovron	
<b>10:45</b>	6 Betteridge, Henry	14 Jones, Budd, Snyder, Eberwein	20 Tansey	
<b>11:05</b>	7 Love		21 Waidelich	
<b>11:25</b>	8 Clemens, Powers			



### Engineering Oral Pres. V

<b>12:55</b>	Welcome and instructions by Session Chairs	
<b>1:00</b>	26 Kulp	
<b>1:20</b>	27 Martin, Morris, Kratz	
<b>1:40</b>	28 Adomat, Upton, Wilson	
<b>2:00</b>	29 Horst	
<b>2:20</b>	30 Heindel, Schneider	
<b>2:40</b>	31 Albert, Madea	

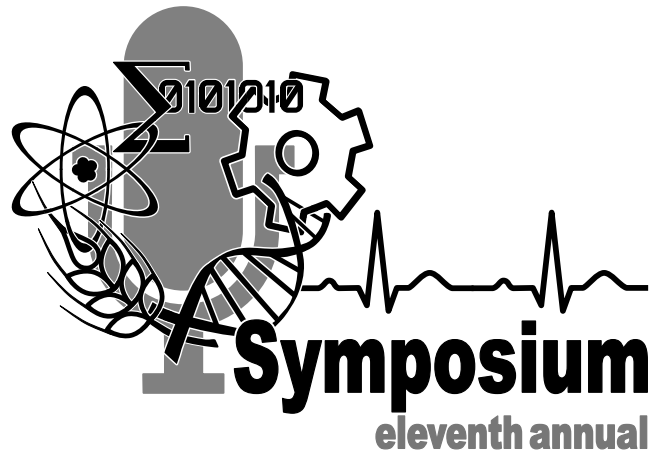
**Poster Session: Engineering**  
3:00 – 4:00 Frey 110, Frey Lobby



### Engineering Oral Pres. IX

<b>4:00</b>	49 Everett, King, Slater
<b>4:20</b>	50 Everett, King, Slater
<b>4:40</b>	51 Jacob
<b>5:00</b>	52 Satterberg
<b>5:20</b>	53 M. Miller
<b>5:40</b>	54 Carson, Nesbitt, Wagner

# Oral Presentations



## J161

## Hollinger Lounge

## K120



**Biology;  
Exercise Science;  
Nutrition & Dietetics**  
Oral Pres. VI

**Chemistry**  
Oral Pres. VII

**Biology**  
Oral Pres. VIII

**12:55** Welcome and instructions by Session Chairs

<b>1:00</b>	32 Kovach	38 Tay	44 Shirey
<b>1:20</b>	33 Veazey	39 Mellott	45 Tyrpak
<b>1:40</b>	34 N. Smith	40 Robertson	46 Stephan
<b>2:00</b>	35 Chrisfield	41 Sharber	47 J. Miller
<b>2:20</b>	36 Hogan, Hitesman, Gill	42 Martin	48 Wingert, Wilson
<b>2:40</b>	37 Taifayongvichit	43 Wehrmann	↓ Wingert, Wilson



**Poster Session: 3:00 – 4:20**  
Hollinger Atrium, J159, K104, K108, K113



**Biology**  
Oral Pres. X

**Chemistry,  
Biochemistry,  
Biology**  
Oral Pres. XI

**Biology**  
Oral Pres. XII

<b>4:20</b>	55 Neal	60 Fenton	65 Hiller
<b>4:40</b>	56 Sicher	61 Cannon	66 Spenceley
<b>5:00</b>	57 Bruce	62 Bender	67 McGee
<b>5:20</b>	58 Kim	63 Song	68 Mason
<b>5:40</b>	59 Tomlin, Vautour	64 Skolka	69 Grando

- Evidence-Based Nursing Care
- Exercise Science
- Nutrition & Dietetics
- Biopsychology
- Physics
- Biological Sciences
- Chemistry & Biochemistry

**Schedule at a Glance**





# Poster Presentations

## Hollinger Atrium

### Evidence-Based Nursing Care

Conducted with Collaborators at Holy Spirit Hospital

70 D'Amelio, Lacadie, Colligan, Crane

71 Barber, Beardsley, Colligan, Johnston

72 Mauger, Hackett, Kelly, McNeil

73 Hagerott, Moore, Praetsch, Schmidt

Conducted with Collaborators at PinnacleHealth

74 Sobolewski, Shade, Frederick, Hoover, Wade

75 Kueakomoldej, Weisel, Hertzler, Herwig

76 Matthews, Cummings, Roland, Weaver

77 Gafencu, Black, Brong, Chilcote, Corrin

78 Benson, Crawford, Thompson, Urmston, Stewart

79 Curtis, Ranck, Stallsmith, Davidhizar, Varish

80 Faber, Pedersen, McClure, Quesenberry, Petro-Roy

## Hollinger Atrium

### Nutrition & Dietetics; Exercise Science

35 Chrisfield

87 Horst, DeLew, Horton, Borders

88 T. Smith, Myer, Brady

89 Nissley, Visneski, Young

36 Hogan, Hitesman, Gill

## Hollinger Atrium

### Physics

23 Chrestay

## Hollinger Atrium, J159

### Chemistry & Biochemistry

85 Jahangir, Roth

86 Gibson

38 Tay

39 Mellott

41 Sharber

42 Martin

40 Robertson

43 Wehrmann

60 Fenton

61 Cannon

63 Song

62 Bender

## K113

### Biopsychology

90 Pusey

## K104, K108, K113

### Biological Sciences

81 McKeown

82 Maurer

83 Lage

84 Ritenour, Robitaille, Rossomme, Ross

33 Veazey

32 Kovach

46 Stephan

47 J. Miller

44 Shirey

45 Tyrpak

67 McGee

48 Wingert, Wilson

66 Spenceley

65 Hiller

69 Grando

64 Skolka

68 Mason

56 Sicher

55 Neal

57 Bruce

58 Kim

37 Taifayongvichit

## Frey 110, Frey Lobby

### Engineering

91 Bechard, Edgin, Gates, Good

92 Baker, Chaney, Evans, Gettemy, Sorrell

93 Albert, Daub, Kadar-Kallen, Stauffer

94 Kelley

95 Sagcal, Scholl, Yost

96 VanSickle

97 Loar, Myers, Oland, Schmuck

98 Dufrenne

99 Richter, Murrill, Black

100 Schutz

101 Castilow, Woleslagle

102 Deseno

103 Kulp

104 Barton, Brunk

105 Bashore, Foley, Price

106 Eberly

107 Angowski, Houck

108 Film

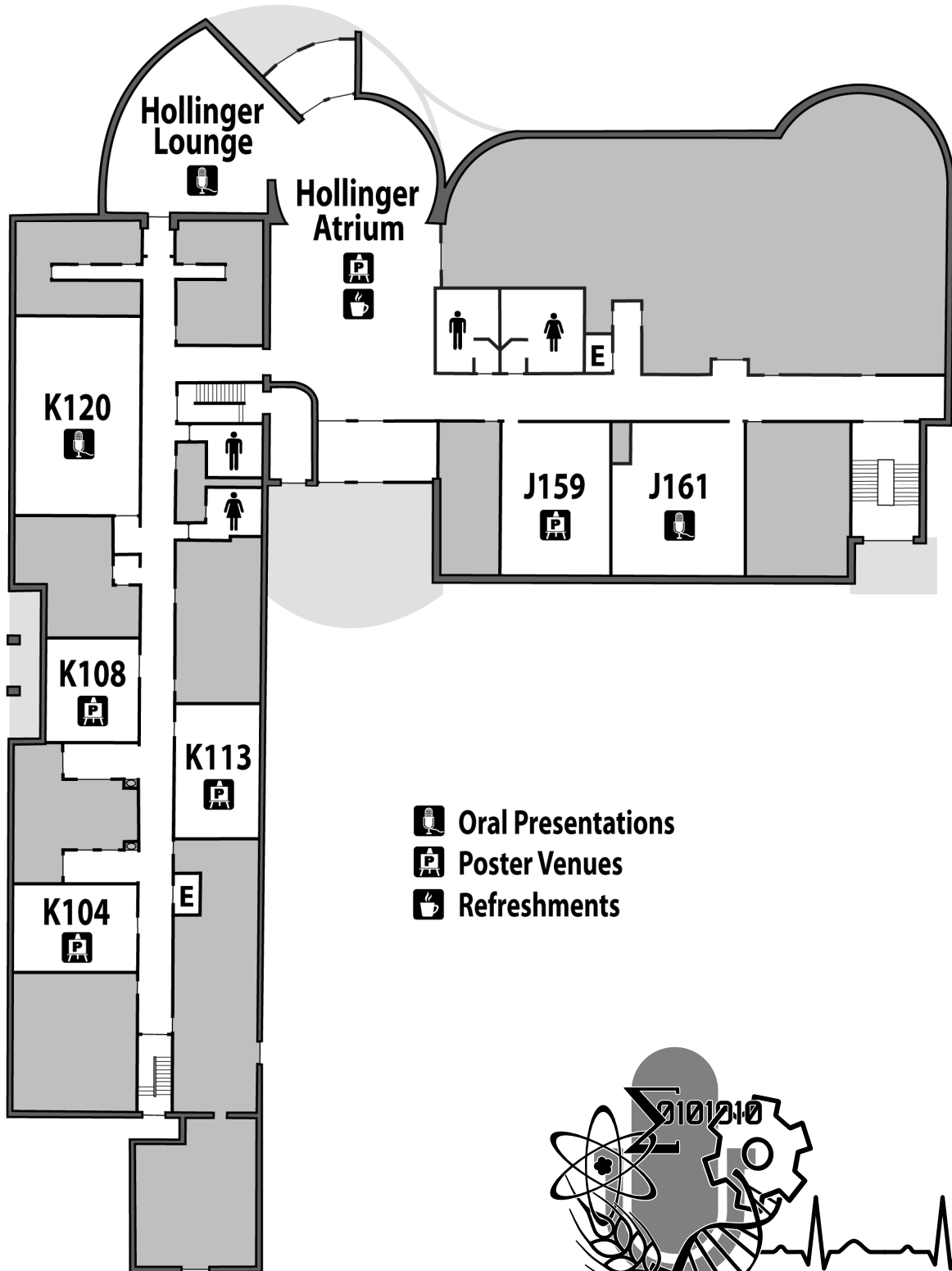
109 Howell, Penwell

110 Hepner, Ports

111 Kok

Schedule at a Glance

# Jordan Science Center - Kline Hall of Science



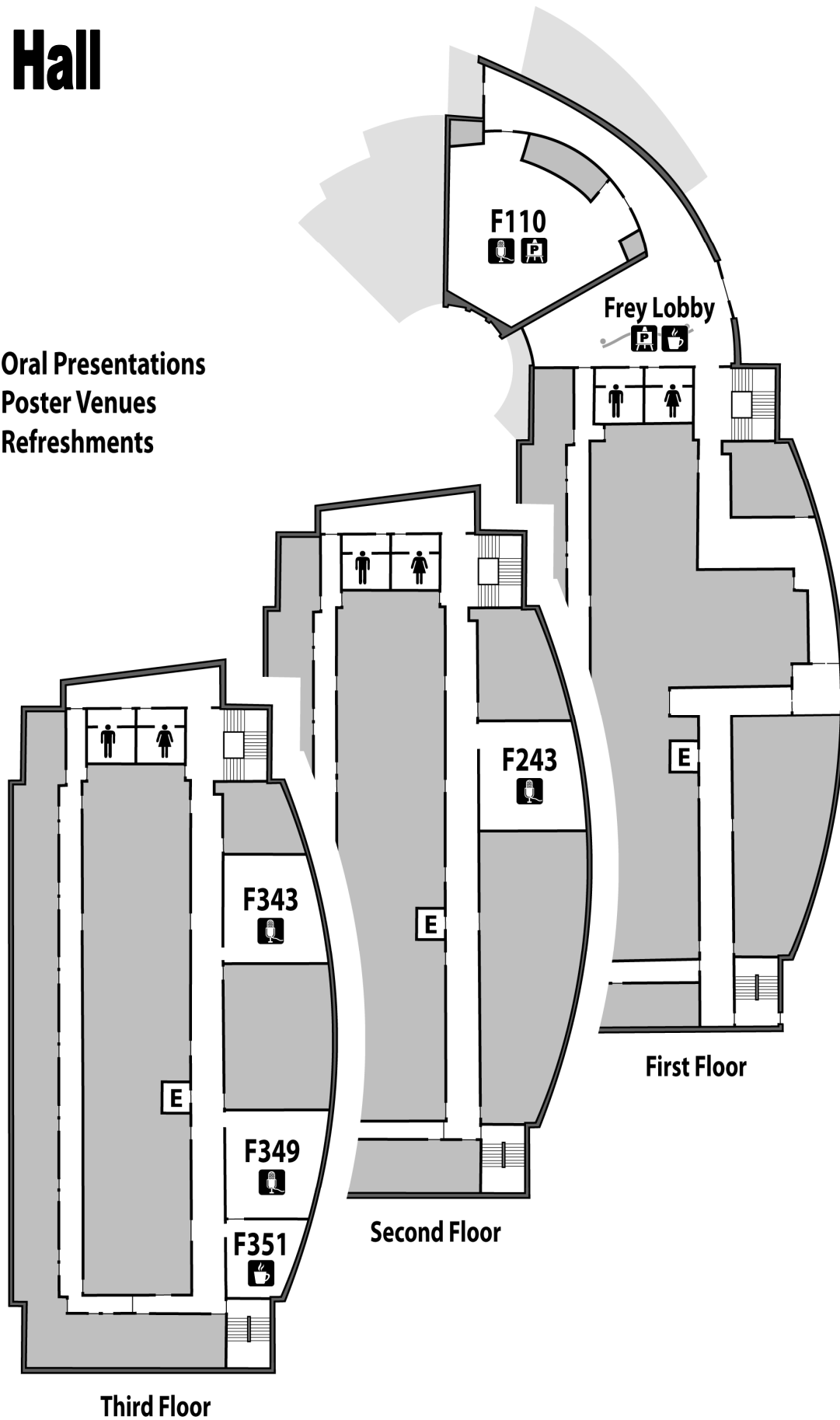
-  Oral Presentations
-  Poster Venues
-  Refreshments

Maps



# Frey Hall

-  Oral Presentations
-  Poster Venues
-  Refreshments



# Oral Presentations (Morning)

## Oral Presentations I: *Engineering* (Frey 110; 9:00 – 11:45)

- 1     **9:05**  
*Electrical Systems of the Solar Commuter Vehicle*  
**Matthew Bergey, Donald Pratt\*** 
- 2     **9:25**  
*Solar Commuter Vehicle Drive System Redesign*  
**Zachariah Steeves, Donald Pratt\*** 
- 3     **9:45**  
*Kenya Mobile Medical Clinic*  
**Aaron Black, Lukas Murrill, Benjamin Richter, Joel Zeigler, Donald Pratt\*** 
- 4     **10:05**  
*Mobility Electric Tricycle: Front End Redesign*  
Taylor Eberly, **Lauren Long, John Nordstrom, Tim Van Dyke\*, John Meyer\*** 
- 5     **10:25**  
*Mobility Electric Tricycle: Brake Redesign*  
**Austin Galaska, Luke Herwig, Tim Van Dyke\*, John Meyer\*** 
- 6     **10:45**  
*Mobility Electric Tricycle: Rear Axle Design Evaluation*  
**Seth Betteridge, Justin Henry, Tim Van Dyke\*, John Meyer\*** 
- 7     **11:05**  
*Flight Tracking and Messaging Systems (FTMS)*  
**Joel Love, Harold Underwood\*** 
- 8     **11:25**  
*Wireless Enabled Remote Co-presence (WERC)*  
**Chad Clemens, Stephen Powers, Harold Underwood\*** 

## Oral Presentations II: *Information Science* (Frey 243; 9:00 – 11:05)

- |    |   |   |
|----|---|---|
| 9  | <p><b>9:05</b><br/><i>Overview of the Intelligent Water Project (IWP) Program</i><br/><b>Brian Nejme<sup>*</sup></b>, D. Scott Weaver<sup>*</sup></p>   |    |
| 10 | <p><b>9:25</b><br/><i>Designing a Reliable SMS-based Data Transmission Engine for IWP</i><br/><b>Avery deGruchy</b>, William Eberwein, Kyle McGovern, Kyle Young, Brian Nejme<sup>*</sup></p>             |    |
| 11 | <p><b>9:45</b><br/><i>Designing a Reporting and Analysis Engine for IWP</i><br/>Andrew Yau, Ben Sheeler, <b>Matthew Musselman</b>, <b>Kevin Olchewsky</b>, Brian Nejme<sup>*</sup></p>                    |    |
| 12 | <p><b>10:05</b><br/><i>The Intelligent Water Project: Mobile First</i><br/><b>Michael Hoffman</b>, <b>Jonathan Kennedy</b>, <b>Greg Moyer</b>, <b>Christopher Newman</b>, Brian Nejme<sup>*</sup></p>     |    |
| 13 | <p><b>10:25</b><br/><i>Web Development for Intelligent Water Project</i><br/><b>Avery deGruchy</b>, <b>Michael Hoffman</b>, <b>William Eberwein</b>, <b>Greg Moyer</b>, D. Scott Weaver<sup>*</sup></p>   |  |
| 14 | <p><b>10:45</b><br/><i>Database Challenges for the Intelligent Water Project</i><br/><b>Peter Jones</b>, <b>Andrew Budd</b>, <b>John Snyder</b>, <b>William Eberwein</b>, D. Scott Weaver<sup>*</sup></p> |  |

## Oral Presentations III: *Mathematics* (Frey 349; 9:00 – 11:25)

- |    |  |
|----|--|
| 15 | <p><b>9:05</b><br/><i>Medieval Astronomy: The Birth of Modern Cosmology</i><br/><b>Camille Bellino</b></p> |
| 16 | <p><b>9:25</b><br/><i>The relationships between Mathematics and Music</i><br/><b>Andrew Bigelow</b></p>    |

- 17**    **9:45**  
*The Beautiful Mind of Game Theory*  
**Meghan Boyle**
- 18**    **10:05**  
*Women in Mathematics*  
**Kathryn Jablonski**
- 19**    **10:25**  
*A Triple Pendulum Model of the Golf Swing*  
**Logan Skovron, Niklas Hellgren\***
- 20**    **10:45**  
*iTunesU: A New Wave of Math Education*  
**Meaghan Tansey**
- 21**    **11:05**  
*Johannes Kepler, more than 3 laws*  
**Greg Waidelich**







## **Oral Presentations IV: *Physics & Mathematics* (Frey 343; 9:00 – 10:25)**

- 22**    **9:05**  
*Neutron Veto Scintillator Study for Cryogenic Dark Matter Search Experiment*  
**Joel Love, Jack Bluebaugh, Abaz Kryemadhi\***
- 23**    **9:25**  
*Gamma Ray Spectroscopy with a Silicon Photomultiplier and a LYSO crystal*  
**Kyler Chrestay, Abaz Kryemadhi\***
- 24**    **9:45**  
*My Philosophy of Mathematics*  
**Nicholas Sooy, Gene Chase\***
- 25**    **10:05**  
*The Mathematical Thought and Legacy of Alan Turing: Theory and Practice*  
**Christopher Beam, Gene Chase\***







# Oral Presentations (Afternoon)

## Oral Presentations V: *Engineering* (Frey 110; 1:00 – 3:00)





- 26    1:00  
*Handpump Sustainability Study*  
**Matthew Kulp, Tony Beers\*** 
  
- 27    1:20  
*Intelligent Water Management System (IWMS)*  
**Nicholas Martin, Rachel Morris, Tyler Kratz, Tony Beers\*** 
  
- 28    1:40  
*Garden Water Access Project*  
**Lindsey Adomat, Marcus Upton, David Wilson, Joseph Longenecker^\*, Timothy Whitmoyer\*** 
  
- 29    2:00  
*Hollow Fiber Membrane Filtration System*  
**Darin Horst, David Vader\*** 
  
- 30    2:20  
*Village Water Ozonation System (VWOS)*  
**Amy Heindel, Katy Howell, Laura Penwell, Amanda Schneider, David Vader\*** 
  
- 31    2:40  
*The Macha Oxygen Concentrator Project: Prolonging medical device lifespans in a rural care facility*  
**Wyatt Albert, Michael Madea, Brian Swartz\*** 

## Oral Presentations VI: *Biology; Exercise Science; Nutrition & Dietetics* (Jordan 161; 1:00 – 3:00)




- 32    1:00  
*Zinc tolerance and accumulation in Arabidopsis thaliana*  
**Kaitlin Kovach, Michael Shin\*, Richard Schaeffer\*** 

- 33**    **1:20**  
*Quantification of Histidine from Plant Extracts using High Performance Liquid Chromatography and Electrochemistry*      
**Janelle Veazey**, Richard Schaeffer\*, Michael Shin\*
- 34**    **1:40**  
*The Caffeine Dose Response in Habitual Caffeine Consumers Performing a Maximal Anaerobic Test*  
**Noah Smith**, Kevin Ogden, Drew Mininger, H. Scott Kieffer\*, Jodie Haak\*
- 35**    **2:00**  
*Beta-alanine supplementation has no effect on rowing performance in college age athletes*      
**Benjamin Chrisfield**, Trevor Stutzman, Zachary Schutte, Isaac Starr, Amy Porto\*, H. Scott Kieffer\*
- 36**    **2:20**  
*No Significant Differences Found in Food Group Intake of Messiah College Students Participating in the Dining Dollars Meal Plan and Those Not Participating in any Meal Plan*      
**Sarah Hogan**, Kelsie Hitesman, Kaitlin Gill, Amy Porto\*
- 37**    **2:40**  
*Correlation of Ki-67 labeling index and time to progression in brain tumors*      
**Varit Taifayongvichit**, Samuel Wilcock\*










## Oral Presentations VII: *Chemistry* (Hollinger Lounge; 1:00 – 3:00)

- 38**    **1:00**  
*Fabricating a Nanoscale Electrode Pattern on Zinc Selenide for Studies of Long-chain Alkanethiol Monolayer Influence on Liquid Crystal Orientation*      
**Nicholas Tay**, Alison Noble\*
- 39**    **1:20**  
*Analysis of Adsorbates on Polished Zinc Selenide*       
**Emily Mellott**, Alison Noble\*
- 40**    **1:40**  
*Investigating an alternate synthesis pathway for aspernigrin A*      
**Wesley Robertson**, Anne Reeve\*



- 41    2:00  
*Toward the Synthesis of Aspernigrin A Precursor 6-Benzyl-4-hydroxypyran-2-one: Optimization and Cross-Coupling Strategies*  
**Seth Sharber, Anne Reeve\*** 
- 42    2:20  
*Synthesis and Purification of Aspernigrin A Analog Intermediates*  
**Lauren Martin, Anne Reeve\*** 
- 43    2:40  
*Characterization of Barium Phosphates by XRD and Molecular Modeling*  
**Caleb Wehrmann, Julie Fenton, Richard Schaeffer\*** 

## Oral Presentations VIII: *Biology* (Kline 120; 1:00 – 3:00)

- 44    1:00  
*Development of a murine pancreatic cancer model for testing immunotherapy strategies against CCK-BR and characterization of monoclonal antibodies against the receptor*  
**Evan Shirey, John Harms\***  
- 45    1:20  
*Determining the Role of a Silent, Intronic Single Nucleotide Polymorphism (SNP) in Pancreatic Cancer*  
**Katlyn Tyrpak, John Harms\*** 
- 46    1:40  
*Quantification of CCK mRNA Down-Regulation in Pancreatic Cancer Cells and Cloning the Human Gastrin Gene*  
**Michael Stephan, John Harms\***  
- 47    2:00  
*Construction of pCAGEN.puro for Gene Expression Studies in Pancreatic Cancer Cells*  
**Jordan Miller, John Harms\***  
- 48    2:20 & 2:40 (Double length, shared presentation)  
*Culturing Plasmodium falciparum in the Laboratory*  
**Daniel Wingert, Lauren Wilson, Lawrence Mylin\***  

## Oral Presentations IX: *Engineering* (Frey 110; 4:00 – 6:00)


- 49 4:00  
*Solar Power Used To Reduce Dependence on Unreliable Electric Grid*  
Taylor Everett, Taran King, Ryan Slater, Randall Fish\*
- 50 4:20  
*Solar PV System for the Theological College of Zimbabwe*  
Taylor Everett, Taran King, Ryan Slater, Randall Fish\*
- 51 4:40  
*Reducing Indoor Cooking Smoke Hazards for Those without Electric Power*  
Abhishek Jacob, Randall Fish\*
- 52 5:00  
*Automating the Sharing of Limited Solar Power*  
Carl Satterberg, Matt Walsh<sup>^\*</sup>, Tom Austin<sup>^\*</sup>, Randall Fish\*, Brian Swartz\*
- 53 5:20  
*Seed Pressing and Biodiesel Production in Burkina Faso*  
Meagan Miller, Randall Fish\*
- 54 5:40  
*Seed Pressing Process Modifications*  
Thomas Carson, Daniel Nesbitt, Mark Wagner, Randall Fish\*




## Oral Presentations X: *Biology* (Jordan 161; 4:20 – 6:00)

- 55 4:20  
*Evaluating the Presence and Prevalence of Batrachochytrium dendrobatidis (Bd) in Anuran Populations in Central Pennsylvanian Vernal Pools and Creating a Bd standard for use in qPCR analysis*  
Brennan Neal, Kristin Sicher, Erik Lindquist\*, Michael Shin\*
- 56 4:40  
*Presence/Prevalence and Positive Controls: Assessment of the Presence and Prevalence of Batrachochytrium dendrobatidis among Caudatan Species in Central Pennsylvania Woodland Vernal Pools and Testing of Broad Amphibian Positive Control Primers for qPCR*  
Kristin Sicher, Brennan Neal, Erik Lindquist\*, Michael Shin\*





57    5:00  
*Prevalence of Batrachochytrium dendrobatidis (Bd) within a Local Marbled Salamander Population in Cumberland County, PA*  
**Zachary Bruce**, Erik Lindquist\*, Michael Shin\* 


58    5:20  
*Presence and prevalence of Bd (Batrachochytrium dendrobatidis) in Picado's Bromeliad Treefrog (Isthmohyla picadoi)*  
**Jessica Kim**, Erik Lindquist\*, Michael Shin\* 



59    5:40  
*Large-scale Rain Garden Design: A case study for standards and assessment*  
**Jessica Tomlin**, Emma Vautour, David Foster\*


**Oral Presentations XI: *Chemistry, Biochemistry, Biology***  
**(Hollinger Lounge; 4:20 – 6:00)**

60    4:20  
*Construction of a Glow-Discharge Plasma Microelectrode for the Synthesis of Inorganic Solids*  
**Julie Fenton**, Richard Schaeffer\* 







61    4:40  
*Isolation and Purification of Archaea HMfA histone Protein*  
**Stephen Cannon**, Hannah Tims\* 

62    5:00  
*Archeal Histone Binding Affinity in Methanothermus fervidus: DNA Purification and Amplification*  
**Bethany Bender**, Hannah Tims\* 

63    5:20  
*Expression, Purification, and Activity of sHSP 17.0 and 17.8 from Zea maize*  
**Michael Song**, Hannah Tims\*  

64    5:40  
*Intraductal Lidocaine Attenuates the Severity of Post ERCP Acute Pancreatitis*  
**Michael Skolka**, Tanja Babicâ^\*, R. Alberto Travagliâ^\* 

## Oral Presentations XII: *Biology* (Kline 120; 4:20 – 6:00)

- 65    4:20  
*Optimizing conditions for the use of alpha-amylase from Aspergillus oryzae in an introductory BIOL160 laboratory exercise*   
**Aaron Hiller**, Lawrence Mylin\*
- 66    4:40  
*Construction of a Bacterial Fusion Protein Expression System for Presentation of Simian Virus 40 Large Tumor Antigen MHC Class II-Restricted Epitopes to CD4+ T Lymphocytes*    
**Stephne Spenceley**, Lawrence Mylin\*
- 67    5:00  
*Characterization of the cellular immune responses to two immunodominant Simian Virus 40 Large Tumor Antigen (SV40 T ag) CD8+ T lymphocyte epitopes in the absence of three CD4+ epitopes*   
**Caitlin McGee**, Stephanie Schell<sup>^</sup>, Caroline Passmore, Lawrence Mylin\*
- 68    5:20  
*Generation and Detection of T Cell Responses to the Pancreatic Cancer-Associated CCK-B Receptor Splice-Variant (CCKCR) in C57Bl/6 Mice*   
**Caitlin Mason**, John Harms\*, Lawrence Mylin\*
- 69    5:40  
*Transfection of Primary Kidney Cells with Mutated SV40 T ag DNA Containing a CCKCR Intron Sequence*   
**Kaitlyn Grando**, Courtney Burkett, Lawrence Mylin\*

# Poster Presentations

## ***Evidence-Based Nursing Care*** **(Hollinger Atrium; 3:00 – 4:20)**

- 70** *Evidence-Based Interventions to Manage Critical Incident Stress*  
**Elizabeth D'Amelio, Hannah Lacadie, Sarah Colligan, Joseph Crane, Jennifer Hudson^, Jennifer Brewer^\*, Deborah Audette^\*, Tara Jankouskas\***
- 71** *Evidence-Based Interventions for Inpatient Discharge Outcomes*  
**Hannah Barber, Courtney Beardsley, Rebecca Colligan, Chelsea Johnston, Nicole Sheedy^, Tricia Kranz^, Jennifer Brewer^\*, Deborah Audette^\*, Tara Jankouskas\***
- 72** *Increasing Influenza Vaccination among Healthcare Personnel*  
**Daniel Mauger, Jamie Hackett, Shannon Kelly, Jacquelyn McNeil, Susan Shorb^, Jennifer Brewer^\*, Deborah Audette^\*, Tara Jankouskas\***
- 73** *Investigating the Use of Music Therapy in the NICU*  
**Enid Kreiner^, Jill Hagerott, Esther Moore, Trevor Praetsch, Julie Schmidt, Jennifer Brewer^\*, Deborah Audette^\*, Tara Jankouskas\***
- 74** *The Effects of Using a Screening Tool on Medication Adherence*  
**Babette Rudick^, Lydia Johnson^, Dawn Hippensteel^, Deb Heisey^, Jaleesa Andrade^, Cathy Druckenmiller^, Kimberly Fowler^, Kathryn Shradley^, Kate Sobolewski, Sara Shade, Joanna Frederick, Kaitlyn Hoover, Abigail Wade, Louann Zinsmeister\***
- 75** *One versus Many: Team vs. Primary Nursing: A look at nursing models*  
**Christina Johnson^, Wanda Hoyer^, Mark Book^, Tiffany Boyd^, Sarah Harne-Britner^, Denise Klahre^, Supakorn Kueakomoldej, Sarah Weisel, Katie Hertzler, Susie Herwig, Louann Zinsmeister\***
- 76** *Traditional vs. Rooming-In Care for Infants Experiencing Neonatal Abstinence Syndrome*  
**Angela Horne^, Chris Egresits^, Donna Roller^, Deb Schafer^, Shelly Kowalski^, Christa Matthews, Bethany Cummings, Kessiah Roland, Alyse Weaver, Louann Zinsmeister\***
- 77** *Immersion Bathing and Improved Thermoregulation in the Newborn*  
**Megan Gross^, Stacy Chubb^, Erin Anderson^, Jeffrey Stroup^, Mary Lou Mortimer^, Meredith Schorner^, Iulia Gafencu, Laura Black, Amanda Brong, Rebekah Chilcote, Rebecca Corrin, Louann Zinsmeister\***

- 78 *Deep Venous Thrombosis Prophylaxis in Adult ICU Patients*  
Cathy Phelan<sup>^</sup>, Karen Good<sup>^</sup>, Michelle Browning<sup>^</sup>, Amy Leshner<sup>^</sup>, Melanie Duffy<sup>^</sup>,  
Nicole Carran Young<sup>^</sup>, **Kimberly Benson, Katherine Crawford, Kelly Thompson,**  
**Kelly Urmston, Kathryn Stewart,** Louann Zinsmeister\*
- 79 *Improving Quality of Life in Cancer Patients Through Patient Education on Non-  
Pharmacological Interventions*  
Talisha Maxwell<sup>^</sup>, Sue Ann Bruce<sup>^</sup>, Cindy Hallman<sup>^</sup> , Maryalyce McCormick<sup>^</sup> ,  
Marianne Allen<sup>^</sup> , Jeannie Wirth<sup>^</sup> , **Sarah Curtis, Jennifer Ranck, Kurt Stallsmith,**  
**Kirsten Davidhizar, Alexandria Varish,** Louann Zinsmeister\*
- 80 *Traumatic Brain Injury: Recognition of Post-Concussion Symptoms*  
Yvonne Hoke<sup>^</sup> , Amanda Hammaker<sup>^</sup> , Teresa Biagio<sup>^</sup> , Joanne Konick-  
McMahan<sup>^</sup> , Stefanie Miller<sup>^</sup> , **Rachel Faber, Sarah Pedersen, Lauren McClure,**  
**Emily Quesenberry, Rachel Petro-Roy,** Louann Zinsmeister\*

## ***Nutrition & Dietetics; Exercise Science*** **(Hollinger Atrium; 3:00 – 4:20)**

- 35 *Beta-alanine supplementation has no effect on rowing performance in college  
age athletes*  
**Benjamin Chrisfield,** Trevor Stutzman, Zachary Schutte, Isaac Starr, Amy Porto\*,  
H. Scott Kieffer\*
- 87 *Project SHARE*  
**Brittany Horst, Kelly DeLew, Suzanne Horton, Liz Borders,** Amy Porto\*
- 88 *Sleep Duration has Little Effect on Caloric and Macronutrient Intake in Messiah  
College Students*  
**Tessa Smith, Jennifer Myer, Meghan Brady,** Amy Porto\*
- 89 *Messiah College students living on campus and taking a multivitamin need a  
multivitamin to achieve recommended intakes of calcium, magnesium, iron,  
vitamin D, folate, potassium, and zinc as evidenced by analysis of dietary intake*  
**Celina Nissley, Jessica Visneski, Lydia Young,** Amy Porto\*
- 36 *No Significant Differences Found in Food Group Intake of Messiah College  
Students Participating in the Dining Dollars Meal Plan and Those Not  
Participating in any Meal Plan*  
**Sarah Hogan, Kelsie Hitesman, Kaitlin Gill,** Amy Porto\*



## **Physics** **(Hollinger Atrium; 3:00 – 4:20)**

- 23 *Gamma Ray Spectroscopy with a Silicon Photomultiplier and a LYSO crystal*  
**Kyler Chrestay, Abaz Kryemadhi\***

## **Chemistry & Biochemistry** **(J159, Hollinger Atrium; 3:00 – 4:20)**

- 85 *Synthesis and Purification of Aspernigrin A Analog Intermediates*  
**Maha Jahangir, Philip Roth, Anne Reeve\***
- 86 *Quantification of sHSP 17.0 and 17.8 activity in dynamic light scattering assays*  
**Zachariah Gibson, Hannah Tims\***
- 38 *Fabricating a Nanoscale Electrode Pattern on Zinc Selenide for Studies of Long-chain Alkanethiol Monolayer Influence on Liquid Crystal Orientation*  
**Nicholas Tay, Alison Noble\***
- 39 *Analysis of Adsorbates on Polished Zinc Selenide*  
**Emily Mellott, Alison Noble\***
- 41 *Toward the Synthesis of Aspernigrin A Precursor 6-Benzyl-4-hydroxypyran-2-one: Optimization and Cross-Coupling Strategies*  
**Seth Sharber, Anne Reeve\***
- 42 *Synthesis and Purification of Aspernigrin A Analog Intermediates*  
**Lauren Martin, Anne Reeve\***
- 40 *Investigating an alternate synthesis pathway for aspernigrin A*  
**Wesley Robertson, Anne Reeve\***
- 43 *Apatite Project (Hope you have a good apatite when you go to dinner tonight!)*  
**Caleb Wehrmann, Richard Schaeffer\***
- 60 *Construction of a Glow-Discharge Plasma Microelectrode for the Synthesis of Inorganic Solids*  
**Julie Fenton, Richard Schaeffer\***
- 61 *Isolation and Purification of Archaea HMfA histone Protein*  
**Stephen Cannon, Hannah Tims\***
- 63 *Expression, Purification, and Activity of sHSP 17.0 and 17.8 from Zea maize*  
**Michael Song, Hannah Tims\***



- 62 *Archeal Histone Binding Affinity in Methanothermus fervidus: DNA Purification and Amplification*  
**Bethany Bender**, Hannah Tims\*

## ***Biopsychology*** **(K113; 3:00 – 4:20)**

- 90 *Pharmaceutical manipulation of fear learning in an animal model of Post-traumatic Stress Disorder*  
**Jacqueline Pusey**, Ciara Pigliacampi, Jennifer Thomson\*

## ***Biological Sciences*** **(K104, K108, K113; 3:00 – 4:20)**


- 81 *Antibiotic Resistance of Bacteria across Anthropoc Input*  
**Zach McKeown**, Jeff Erikson\*
- 82 *The Distribution and Population of *O. rusticus* in three South-Central Pennsylvania Streams*  
**Blake Maurer**, Jeff Erikson\*
- 83 *Testing If Wastewater Antibiotics Induce Bacterial Resistance in Streams*  
**Alyssa Lage**, Jeff Erikson\*
- 84 *Microbiological Testing of Sawyer Products Hollow Fiber Membrane Water Filters*  
Janelle Veazey, **Laura Ritenour**, **Sarah Robitaille**, **Elliot Rossomme**, **Holly Ross**, Shaun Egolf, Bethany Bender, Jeff Erikson\* 
- 33 *Quantification of Histidine from Plant Extracts using High Performance Liquid Chromatography and Electrochemistry*  
**Janelle Veazey**, Richard Schaeffer\*, Michael Shin\*
- 32 *Zinc tolerance and accumulation in Arabidopsis thaliana*  
**Kaitlin Kovach**, Michael Shin\*, Richard Schaeffer\*
- 46 *Quantification of CCK mRNA Down-Regulation in Pancreatic Cancer Cells and Cloning the Human Gastrin Gene*  
**Michael Stephan**, John Harms\* 
- 47 *Construction of pCAGEN.puro for Gene Expression Studies in Pancreatic Cancer Cells*  
**Jordan Miller**, John Harms\* 












- 44** *Development of a murine pancreatic cancer model for testing immunotherapy strategies against CCK-BR and characterization of monoclonal antibodies against the receptor*  
**Evan Shirey**, John Harms\*
- 45** *Determining the Role of a Silent, Intronic Single Nucleotide Polymorphism (SNP) in Pancreatic Cancer*  
**Katlyn Tyrpak**, John Harms\*
- 67** *Characterization of the cellular immune responses to two immunodominant Simian Virus 40 Large Tumor Antigen (SV40 T ag) CD8+ T lymphocyte epitopes in the absence of three CD4+ epitopes*  
**Caitlin McGee**, Stephanie Schell<sup>^</sup>, Caroline Passmore, Lawrence Mylin\*
- 48** *Culturing Plasmodium falciparum in the Laboratory*  
**Daniel Wingert**, **Lauren Wilson**, Lawrence Mylin\*
- 66** *Construction of a Bacterial Fusion Protein Expression System for Presentation of Simian Virus 40 Large Tumor Antigen MHC Class II-Restricted Epitopes to CD4+ T Lymphocytes*  
**Stephne Spenceley**, Lawrence Mylin\*
- 65** *Optimizing conditions for the use of alpha-amylase from Aspergillus oryzae in an introductory BIOL160 laboratory exercise*  
**Aaron Hiller**, Lawrence Mylin\*
- 69** *Transfection of Primary Kidney Cells with Mutated SV40 T ag DNA Containing a CCKCR Intron Sequence*  
**Kaitlyn Grando**, Courtney Burkett, Lawrence Mylin\*
- 64** *Intraductal Lidocaine Attenuates the Severity of Post ERCP Acute Pancreatitis*  
**Michael Skolka**, Tanja Babic<sup>^</sup>\*, R. Alberto Travagli<sup>^</sup>\*
- 68** *Generation and Detection of T Cell Responses to the Pancreatic Cancer-Associated CCK-B Receptor Splice-Variant (CCKCR) in C57Bl/6 Mice*  
**Caitlin Mason**, John Harms\*, Lawrence Mylin\*
- 56** *Presence/Prevalence and Positive Controls: Assessment of the Presence and Prevalence of Batrachochytrium dendrobatidis Among Caudatan Species in Central Pennsylvania Woodland Vernal Pools and Testing of Broad Amphibian Positive Control Primers for qPCR.*  
**Kristin Sicher**, Brennan Neal, Erik Lindquist\*, Michael Shin\*



- 55 *Evaluating the Presence and Prevalence of Batrachochytrium dendrobatidis (Bd) in Anuran Populations in Central Pennsylvanian Vernal Pools and Creating a Bd standard for use in qPCR analysis*  
**Brennan Neal**, Kristin Sicher, Erik Lindquist\*, Michael Shin\* 
- 57 *Prevalence of Batrachochytrium dendrobatidis (Bd) within a Local Marbled Salamander Population in Cumberland County, PA*  
**Zachary Bruce**, Erik Lindquist\*, Michael Shin\*
- 58 *Presence and prevalence of Batrachochytrium dendrobatidis (Bd) in Picado's Bromeliad Treefrog (Isthmohyla picadoi)*  
**Jessica Kim**, Erik Lindquist\*, Michael Shin\*
- 37 *Correlation of Ki-67 labeling index and time to progression in brain tumors*  
**Varit Taifayongvichit**, Samuel Wilcock\*

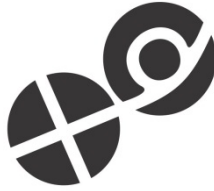
## **Engineering** **(Frey 110, Frey Lobby; 3:00 – 4:00)**

- 91 *Bio-fuels At Home and Abroad*  
**Casey Bechard, Aaron Edgin, Andrew Gates, Nathan Good**, Randall Fish\* 
- 92 *Automated Sharing of Solar Power*  
**Daniel Baker, Nathan Chaney, Ashley Evans, Aaron Gettemy, Zachary Sorrell**, Tom Austin^\*, Randall Fish\* 
- 93 *Solar Photovoltaic System Design Process for The Theological College of Zimbabwe*  
**Benjamin Albert, Steven Daub, Josiah Kadar-Kallen, Jillana Stauffer**, Randall Fish\* 
- 94 *The Briquettes Project: Realistic Alternatives to the Use of Charcoal and Wood in Malawi*  
**Josiah Kelley**, Thomas Soerens\* 
- 95 *Smoke Free Indoor Cooking*  
**Christian Sagcal, Joshua Scholl, Brenton Yost**, Randall Fish\* 
- 96 *Solar Commuter Vehicle Motor Integration Redesign*  
**Glenn VanSickle**, Donald Pratt\* 
- 97 *Basic Utility Vehicle (BUV)*  
**Wesley Loar, Garrett Myers, Nicholas Oland, Robert Schmuck**, Donald Pratt\* 



- 98** *Light Sport Aircraft (LSA)*  
**Richard Dufrenne**, Donald Pratt\*
- 99** *Kenya Mobile Medical Clinic*  
**Benjamin Richter, Lukas Murrill, Aaron Black**, Joel Zeigler
- 100** *The Macha Oxygen Concentrator Project: Prolonging medical device lifespans in a rural care facility*  
**Jilean Schutz**, Erik Listor, Chris Scheib, Brian Swartz\*
- 101** *A Pedestrian Bridge for Rio Missions (Panama)*  
**Laura Castilow, Russell Woleslagle**, Adam Pozun, Christian Rogerson, Brian Swartz\*
- 102** *Flight Tracking & Messaging Systems (FTMS)*  
**John Deseno**, Harold Underwood\*
- 103** *Wireless Enabled Remote Co-presence (WERC)*  
**Kelly Kulp**, Harold Underwood\*
- 104** *Mobility Electric Tricycle: Reducing Wear in Drive Shaft*  
**Luke Barton, Madison Brunk**, Tim Van Dyke\*, John Meyer\*
- 105** AWDS Project: Improving Access to Water, Sanitation and Hygiene Facilities for Persons with Disabilities in Africa  
**Elizabeth Bashore, Andrew Foley, Kaitlin Price**, Nate Kamban\*
- 106** *Mobility Electric Tricycle: Head Tube Angle Redesign*  
**Taylor Eberly**, Lauren Long, John Nordstrom, Tim Van Dyke\*, John Meyer\*
- 107** *Handpump Sustainability Studies*  
**Stephen Angowski, David Houck**, Tony Beers\*
- 108** *Garden Water Access Project*  
**Aaron Film**, Marcus Upton, David Wilson, Joseph Longenecker\*^, Timothy Whitmoyer\*, Tony Beers\*
- 109** *Village Water Ozonation System*  
**Katy Howell, Laura Penwell**, David Vader\*
- 110** *Hollow Fiber Membrane System*  
**Jonathan Hepner**, Darin Horst, **Rebecca Ports**, David Vader\*
- 111** *Intelligent Water Management System*  
**Ken Kok**, Tony Beers\*

## What is this?



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# The Collaboratory for Strategic Partnerships and Applied Research

## Service today... servant-leaders tomorrow.

The **Collaboratory** is a center for applied research and project-based learning in the School of Science, Engineering and Health at Messiah College. We add value to classroom learning by enabling participants to apply academic knowledge and live out their Christian faith through imaginative, hands-on problem solving that meets needs brought to us by Christian mission, relief and development organizations and businesses. The twofold mission of the Collaboratory is:

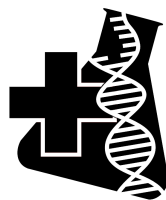
- To foster justice, empower the poor, promote peace, and care for the earth through applications of our academic and professional disciplines.
- To increase the academic and professional abilities of participants, their vocational vision for lifelong servant-leadership, and their courage to act on convictions.

Areas of engagement include science, engineering, health, information technology, business, and education. Our projects enable students to engage classroom fundamentals in an authentic client-provider environment. Student leaders run the Collaboratory organization in partnership with the educators who mentor them. As God enables us to serve others today, we seek to grow as disciples of Jesus, to serve as God's stewards over the resources of our academic and professional disciplines, and to bear witness to the good news of the Kingdom of God.

**To learn more about the Messiah College Collaboratory for Strategic Partnerships and Applied Research please visit our web site at [www.messiah.edu/collaboratory](http://www.messiah.edu/collaboratory).**



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## STEINBRECHER UNDERGRADUATE SUMMER RESEARCH PROGRAM

The Steinbrecher Endowment for Research in the Health and Life Sciences was established at Messiah College in 2003 by Dr. Leroy and Mrs. Eunice Steinbrecher to support collaborative experimental research between students and faculty. Dr. Steinbrecher (Class of 1955) was a physician and longtime supporter of Messiah College. Eunice (Class of 1958) has served on the Board of Trustees at Messiah College continuously since 1987 and as chairperson of the board for 10 years (2000 – 2010).

*The Steinbrecher Undergraduate Summer Research Program* provides “heads-on, hands-on” research experiences essential to our School’s efforts to offer premier undergraduate health and science programs. The research must be experimental and collaborative in nature. Awarded on a competitive basis, the Steinbrecher scholarships provide housing, meals and a stipend supporting full-time research employment – forty hours per week – for between five and ten weeks of the summer.

*We graciously acknowledge the oversight and training provided by Messiah College faculty and external collaborators!*



## Engineering Faculty and External Collaborators

### Biomedical Group

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#### *Clients/Partners*

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Macha Mission Hospital, Zambia

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JAARS  
SymBionx Corporation

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SIM (Serving in Mission)  
World Vision

### Energy Group

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Mr. Craig Dalen  
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#### *Clients/Partners*

Advanced Solar Industries LLC  
Dillsburg Brethren in Christ Church  
Partners in Development  
Forward Edge International  
SIM/Open Door Development  
Theological College of Zimbabwe

### Infrastructure Group

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#### *Clients/Partners*

Rio Missions  
World Vision

### Transportation Group

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#### *Clients/Partners*

SIM/ Open Door Development  
Stanley Black & Decker

### Water Group

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Mr. Bryan Hoover  
Mr. Joseph Longenecker  
Dr. Thomas Soerens  
Mr. Earl Swope  
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Dr. David Vader  
Dr. Tim Whitmoyer

#### *Clients/Partners*

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Elizabethtown Church of the Brethren  
Enterprise Works  
Forward Edge International  
SIM/Open Door Development  
World Vision

### Department-Wide Support

Mr. John Meyer  
Mr. Paul Myers

*We graciously acknowledge oversight and training provided by full time and adjunct Messiah College faculty of...*



***The School of Science, Engineering and Health  
and  
The School of Business, Education and Social Sciences\****

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**Psychology\***

Jennifer Thomson, Ph.D.

***We graciously acknowledge the oversight and training  
provided by the following  
Nursing Professionals***

**Holy Spirit Hospital**

		<i>Presentation</i>
Brewer, Jennifer	MSN, RN, ACNS-BC	70, 71, 72, 73
Hudson, Jennifer	RN, CEN	70
Kranz, Tricia	RN	71
Kreiner, Enid	MSN, RNC	73
Sheedy, Nicole	RN, BSN, BC	71
Shorb, Susan	BSN, RN, CRNI, CIC	72

**Pinnacle Health**

		<i>Presentation</i>
Anderson, Erin	BSN, RNC-OB	77
Andrade, Jaleesa	BSN, RN	74
Book, Mark	BS, RN, CEN, SDI	75
Browning, Michelle	RN, CCRN	78
Bruce, Sue Ann	BSN, RN, VA-BC	79
Carran Young, Nicole	BSN, RN	78
Chester, Kathy	RN	78
Chubb, Stacy	BSN, RNC-MNN	77
Egresits, Chris	RN, CPN	76
Good, Karen	BSN, RN, CCRN	78
Gross, Megan	MPH, BSN, RN	77
Hallman, Cindy	RN, BSN, CMSRN	79
Hammaker, Amanda	BSN, RN, CNRN	80
Heisey, Deb	BSN, RN, CNOR	74
Hippensteel, Dawn	MS, BSN, RN, CCRN, G	74
Hoke, Yvonne	BSN, RN, CMSRN	80
Horne, Angela	MSN/MHA, RNC-NIC	76
Hoyer, Wanda	RN	75
Johnson, Christina	RN	74
Johnson, Lydia	MS, RN, CCRN	74
Klahre, Denise	RN	75
Kowalski, Shelly	BSN, RN	76
Maxwell, Talisha	BSN, RN	79
Phelan, Cathy	BSN, RN, CCRN	78
Rudick, Babette	BSN, RN CBN, CCM	74
Schorner, Meredith	BSN	77
Shradley, Kathryn	BS, RN, CVRN-BC	74
Wirth, Jeannie	BSN, RN	79



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# Abstracts

*An abstract was provided for each oral and poster presentation in the Symposium. The abstracts are arranged here in alphabetic order by the last name of the first author. The names of authors who were scheduled to share in the presentation of the Project in the Symposium today are indicated in bold. To allow for cross-referencing, a number appears in bold within parentheses at the end of each abstract. The same number is used for that presentation when it appears in the "Schedule-at-a-Glance" and/or the lists of Oral Presentations and Poster Presentations.*

## **Example:**

**Author One, Author Two,** Author Three, Author or Project Mentor off campus<sup>^\*</sup>, Project Mentor on campus\* **(Names of presenting authors are in bold.)**

***Title for the presentation appears in bold italic***

The abstract is written in standard faced type font and is usually shorter than 250 words. **(55)**

**Lindsey Adomat, Marcus Upton, David Wilson,** Timothy Whitmoyer\*, Joseph Longenecker<sup>^\*</sup>

### ***Garden Water Access Project***

The Collaboratory Water group is partnering with Serving in Missions (SIM) and Open Door Development in Burkina Faso to design low cost well drilling and water lifting technologies to complement their Survival Garden program. This year we have completed construction of our well drilling equipment and begun testing. We have also worked on some revisions to our pump design. **(28)**

**Benjamin Albert, Steven Daub, Josiah Kadar-Kallen, Jillana Stauffer,** Randall Fish\*

### ***Solar Photovoltaic System Design Process for The Theological College of Zimbabwe***

As in many emerging countries, Zimbabwe has an unreliable power grid. Because of this, the students at the Theological College of Zimbabwe (TCZ) must deal with regular loss of electric power for hours or days. This poster describes our work designing a Solar Photovoltaic power plant to provide reliable power for TCZ's computer lab and library. This effort includes load analysis, component selection, system sizing, and installation layout design. We are currently planning to install this system in May of 2015. **(93)**

**Wyatt Albert, Michael Madea,** Brian Swartz\*

### ***The Macha Oxygen Concentrator Project: Prolonging medical device lifespans in a rural care facility***

The Macha Oxygen Concentrator project team works in conjunction with the Macha Mission Hospital in Zambia, Africa to provide engineering support for respiratory devices. They are currently engaged in troubleshooting early failures experienced with the hospital's oxygen

concentrators, devices which replace conventional tanked oxygen for patients with respiratory issues. These devices take ambient air in and separate the oxygen from the other gases in the air via a material called zeolite. The team has found that this material can become contaminated by high humidity and dust, both of which are prevalent in the environment at Macha. They have been focusing their efforts on designing an alternate intake filter for the concentrators that can adequately reduce the amount of humidity and dust the zeolite is exposed to. The team has also provided training to the maintenance staff at Macha enabling them to repair concentrators at the facility. The team has sent a team member to Macha in May of 2013 to evaluate an initial filter prototype and has plans to send another team in January of 2015. **(31)**

**Stephen Angowski, David Houck, Tony Beers\***

***Handpump Sustainability Studies***

Obtaining clean water access has been an ongoing struggle for villages across Africa. As a solution, many villages have implemented wells with handpumps to reach safe drinkable water. Unfortunately, mechanical failure leaves many of these pumps unusable often within a year of their installation. The Handpump Sustainability Studies project (HSS), is working to redesign and improve failure-prone components of the pump so to elongate their lifespan. HSS is currently in the process of providing two prototype designs: a machined poppet valve to replace the standard cast-iron valve, and an oil-impregnated iron bushing to replace the ball bearings at the pivot point of the handle. In addition to these prototypes, HSS has designed and built a testing apparatus to be able perform in-house testing of the India MK II pump. **(107)**

**Daniel Baker, Nathan Chaney, Ashley Evans, Aaron Gettemy, Zachary Sorrell, Randall Fish\*, Tom Austin^\***

***Automated Sharing of Solar Power***

Missionaries and NGOs in remote locations do not have the luxury of unlimited energy availability that we often take for granted in the United States. Even when they have solar electric systems, the energy is limited and has to be used wisely. This poster describes a solution to this problem: a electricity meter that allows communities to allocate and share the electricity available to them. **(92)**

**Hannah Barber, Courtney Beardsley, Rebecca Colligan, Chelsea Johnston, Nicole Sheedy^\*, Tricia Kranz^\*, Tara Jankouskas\*, Jennifer Brewer^\*, Deborah Audette^\***

***Evidence-Based Interventions for Inpatient Discharge Outcomes***

**Background and significance:** Advancements in medical interventions have increased the length of survival with chronic disease in an aging population. As a result, morbidity and cost are also increasing. Medicare is now denying payments to hospitals for readmission within 30 days of discharge. Readmission is thought to result from a combination of inadequate discharge instructions, non-adherence, and patient knowledge deficit. However, effective discharge instructions are essential for patient comprehension and adherence to therapies **PICO**  
**Question:** What is the effect of interactive [video, audio, pictograph] discharge instructions in addition to standard written and oral instructions compared to adult patients who receive solely verbal and written discharge instructions? **Literature Search:** A review of the literature

was conducted using PubMed and CINAHL. Five articles were found among 60 to address the problem and were the focus of the review. The articles included levels I, II, III, V, with an overall B quality. **Findings:** Evidence shows that video or interactive, take-home, discharge instructions increased patient knowledge and were just as effective, if not more effective as current patient education practices (Fox, 2009). Eighty-six percent of patients said that they preferred a combination of the computer based learning, verbal teaching, and written instructions. The researchers found no significant difference between groups on knowledge ( $p=0.65$ ) and self-care ( $p=0.65$ ) (Dilles, 2011). Research showed that Interactive or video discharge instructions decreased readmissions by 7%, increased patient knowledge by 58.8%, increased patient satisfaction to 100% and increased staff satisfaction by 96% (Bailey, 2012). **Recommendations:** Based on the literature review, further research is recommended. While readmission rates were positively affected by interactive discharge instructions in these preliminary studies, there is no clear consistency among interventions. In order to generalize the findings and institute a change in practice further research is needed. **(71)**

**Luke Barton, Madison Brunk, Tim Van Dyke\*, John Meyer\***

***Mobility Electric Tricycle: Reducing Wear in Drive Shaft***

Electric tricycles, which have been designed by the Disability Resources group for the clients of the Center for the Advancement of the Handicapped in Burkina Faso, use a planetary gear assembly to reduce the speed of the electric tricycle to an appropriate riding speed. In recent years the splines on the planetary gear assembly's socket have been wearing prematurely resulting in immobile tricycles. Our team's goal is to redesign the mate between the planetary gear assembly's splined socket output and the drive shaft in order to reduce the wear that is occurring at this mate. Previous teams have developed several design changes with some success. We have focused on replacing the planetary assembly made from sintered metal with one made from steel (a much harder metal). We are conducting both field and accelerated testing to compare the wear between these two options to see if there is sufficient decrease in wear with steel to justify the increased cost. At this time we have completed these tests with the planetary gear made of sintered metal and are in the beginning stages of testing the new planetary gear made of steel. **(104)**

**Elizabeth Bashore, Andrew Foley, Kaitlin Price, Nate Kamban\***

***AWDS Project: Improving Access to Water, Sanitation and Hygiene Facilities for Persons with Disabilities in Africa***

The Africa WASH and Disabilities Study (AWDS) seeks to accomplish its mission of improving access to water, sanitation and hygiene facilities for persons with disabilities by modifying WASH facilities (hand-pumps, latrines and washing stations) and developing low-cost assistive technologies such as latrine chairs and water pouring devices. The focus areas of the AWDS include disability-friendly adaptations for hand-pumps, technologies to aid in the transportation of water and modifications to sanitation and hygiene facilities. The AWDS has worked to improve the design of hand pump superstructures by rendering them accessible with the addition of gradually sloped ramps, modified pump handles, seats and lifting stations. In addition, low-cost assistive technologies such as bucket tippers have been developed to aid persons with the management of water within the home. Adaptations have also been made to

latrine facilities with the addition of hand supports and a disability-friendly latrine chair. Through a partnership with World Vision and a grant from the Conrad N. Hilton Foundation, the AWDS works with beneficiaries in East, West and Southern Africa. **(105)**

**Christopher Beam**, Gene Chase\*

***The Mathematical Thought and Legacy of Alan Turing: Theory and Practice***

The Enigma machine, Turing test, and Turing's theoretical computation machines all helped to develop the field of mathematics by forming a new branch of mathematical studies called computer science. **(25)**

**Casey Bechard, Aaron Edgin, Andrew Gates, Nathan Good, Randall Fish\***

***Bio-fuels At Home and Abroad***

The Bio-Fuels projects within the Energy Group exist to contribute to a more environmentally sustainable fuel option at Messiah and for our partners in other countries. Our work to produce Bio-Diesel fuel at home and abroad, in conjunction with our local community and partners around the world, serves to educate and promote environmental and economic sustainability. We do this to proclaim the biblical truth that we are all stewards of the Earth. Our **Seed Pressing** operation here on campus has reached the phase of certifying that our process meets USDA standards for oil production so that we can sell locally grown sunflower oil to Dining Services. The **Bio-Diesel Production** team has been working on making our production process reliable, efficient, and properly documented. The **Burkina Faso Production** team recently returned from a site team trip in January. Significant progress was made in developing a bio-diesel production process that is applicable to a developing world setting. **(91)**

**Camille Bellino**

***Medieval Astronomy: The Birth of Modern Cosmology***

This presentation will discuss several influential thinkers of mathematical astronomy. We will look at the development of astronomy across the Middle Ages from its initial foundation in the Ptolemaic System up to the birth of our current astronomical model. We also be identifying key contributions to the field by Copernicus, Galileo, and Kepler and how their mathematical approach shaped our study of the universe. **(15)**

**Bethany Bender**, Hannah Tims\*

***Archeal Histone Binding Affinity in Methanothermus fervidus: DNA Purification and Amplification***

Archaea are organisms similar in many ways to both single-celled Eukarya as well as Bacteria. However, many Archaea are able to survive in extremely hot or acidic environments, which may be due to their unique method of packaging DNA via histone proteins into nucleosomes. Because the exact mode of nucleosome packaging is unknown, research methods were conducted to better understand this mechanism. Cell culture, PCR, SDS-PAGE, and Native PAGE were used to obtain and purify Archaea DNA 80 base pair strand ks1344 from e. coli. The DNA originated from Archaea organism *Methanothermus fervidus*. Purified 80 bp ks1344 was not obtained with confidence through this process, although previous research had shown presence of this strand in samples from Kathleen Sandman (The Ohio State University). This

discrepancy may have been due to the instability of the strand or plasmids used during these processes. One method employed excision from the plasmid, and PCR was used in an attempt to bypass this instability. Other issues may have arisen from use of aging primers for PCR and variation in technique employed by the researchers. Once a sufficient amount of DNA has been obtained, electrophoretic mobility shift assay (EMSA) will be performed using both the DNA and purified histone to examine these fascinating protein-DNA interactions. **(62)**

**Matthew Bergey, Donald Pratt\***

***Electrical Systems of the Solar Commuter Vehicle***

The electric motorcycle project is now in its second and final phase, with only a few remaining electrical systems to be completed. The battery pack and motor controller have already been successfully integrated into the motorcycle. Electrical systems to be completed include accessory systems, which provide battery monitoring and protection. This presentation will explore the system designs and proposed implementation of battery balancing and battery monitoring systems on the electric motorcycle. **(1)**

**Seth Betteridge, Justin Henry, Tim Van Dyke\*, John Meyer\***

***Mobility Electric Tricycle: Rear Axle Design Evaluation***

The Mobility Tricycle Project designs electric and hand-powered tricycles for persons with disabilities in Burkina Faso, West Africa. In 2009, the tricycle frame was redesigned to include advancements in manufacturability, strength and ergonomics. This frame supported the rear axles only on one side similar to how traditional wheelchairs are supported; our previous frame designs supported the axles on both sides, similar to how standard bicycle axles are supported. Data collected from Burkina Faso and from extensive testing at Messiah College demonstrated that the axles used on the new frame design fail prematurely in the electric version of the tricycle. The goal of the current project is to increase the life of the axles while delivering a sustainable solution that utilizes locally available materials and manufacturing processes. Our team tested and evaluated different axle designs developed by previous teams. After evaluating several variations of the single-sided axle support, we ultimately decided to return to a double-sided axle support configuration. This configuration utilizes local materials, is easy to manufacture and is expected to provide improved part life. Computer simulations were used to show that this solution is viable, and we constructed prototypes for experimental testing. Currently the design is being evaluated through long-term testing to verify that the axle wear problem has been solved. In addition, we have compared two different variations of this double-sided axle support design and used computer simulation to determine which design is the best choice. The next step is to integrate this design into the rest of the frame in order to increase ease of manufacturing. **(6)**

**Andrew Bigelow**

***The relationships between Mathematics and Music***

Mathematics and music have had a deep relationship since the beginning. Several of these relationships and their importance will be discussed. **(16)**

**Aaron Black, Lukas Murrill, Benjamin Richter, Joel Zeigler, Donald Pratt\***

***Kenya Mobile Medical Clinic***

Proper medical care is not readily available to many people who live in remote areas of Kenya. The Mobile Medical Clinic project aims to equip a trailer as a mobile clinic to provide medical examinations and screenings to the people of Western Kenya where healthcare services are inaccessible. The project began in the Fall of 2013 and the team is currently developing a suspension system and finalizing the design parameters of the trailer to be able to efficiently use the space as a clinic and safely carry equipment on unimproved roads. **(3)**

**Meghan Boyle**

***The Beautiful Mind of Game Theory***

The story of mathematician John Forbes Nash Jr. has been made famous through Sylvia Nasar's book *A Beautiful Mind* and the 2002 Academy Award winning film by the same name. In the eyes of the general public, Nash's story is more popularly characterized by his descent into madness and miraculous recovery. However, Nash has produced brilliant, original, revolutionary work that deserves to be acknowledged far more than his fascinating illness. His work earned a Nobel Prize in economics and advanced a field that could one day become the language of all sciences. This presentation will discuss the incredible advancements John Nash made in the field of Game Theory. **(17)**

**Zachary Bruce, Erik Lindquist\*, Michael Shin\***

***Prevalence of *Batrachochytrium dendrobatidis* (Bd) within a Local Marbled Salamander Population in Cumberland County, PA***

The lethal chytrid fungus, *Batrachochytrium dendrobatidis*, which has been linked to the drastic decline or extirpation of over 350 amphibian species worldwide, has been detected sporadically throughout the eastern United States. Furthermore, with respect to the state of Pennsylvania, the vast majority of Bd detection work previously published has focused upon the northern and extreme eastern portions of the state. In order to establish a more complete picture of the prevalence of chytridiomycosis within the state of Pennsylvania and within the eastern United States as a whole, additional research must be conducted throughout the portions of the state not yet surveyed. Thus, the purpose of this study is to provide data concerning the prevalence of Bd within central Pennsylvania by sampling a local population of marbled salamanders (*Ambystoma opacum*) located in Cumberland County. Individuals were first located, collected from a single locality during the fall breeding season, and then swabbed using sterile, single-use Dryswabs™. Amphibian and chytrid DNA present on the swabs was then extracted using Qiagen QIAamp® DNA Mini Kits, and qPCR was performed in order to determine the approximate zoospore load present on each sample. **(57)**

**Stephen Cannon, Hannah Tims\***

***Isolation and Purification of Archaea HMfA histone Protein***

DNA packaging plays an important role in gene regulation and ultimately gene expression, thus it is important to understand the relationship between DNA and its packaging proteins to further learn how genes are expressed. Archaea are known to package their DNA by supercoiling their DNA with histone proteins, specifically HMfA and HMfB. This particular

experiment used *E. coli* to express the HMfA histone protein for further analysis of DNA and histone binding affinity. The *E. coli* were grown and lysed to release the recombinant histones into the solution. Excess DNA was removed by digestion, and histones were purified by centrifugation and heat precipitation. Unfortunately, as assessed by SDS page, the HMfA protein was not recovered and was most likely lost in the heat precipitation step of the experiment even after the pH had been lowered to 6.5, as opposed to 8. **(61)**

**Thomas Carson, Daniel Nesbitt, Mark Wagner, Randall Fish\***

***Seed Pressing Process Modifications***

The Bio-Fuels projects within the Energy Group exist to contribute to a more environmentally sustainable fuel option at Messiah and for our partners in other countries. In recent years we have been able to demonstrate that growing and pressing sunflower seeds on the Messiah College campus is a cost effective source of cooking oil for use in campus dining halls. The major focus of the Seed Pressing team this year has been to modify the seed pressing process to move from a Proof of Concept to a Production system. The intent is for clubs and organizations to be able to take over from Engineering once the process has been modified and documented so they are able to operate the machinery without difficulty. This talk will discuss the modification of the seed pressing equipment in the basement of the Women's Restoration House in order to streamline and simplify the seed pressing procedure. **(54)**

**Laura Castilow, Russell Woleslagle, Adam Pozun, Christian Rogerson, Brian Swartz\***

***A Pedestrian Bridge for Rio Missions (Panama)***

We are engineering a timber-type pedestrian footbridge that will help a community in Panama cross a ravine that is otherwise impassable during the rainy season. The bridge will provide year-round access to essential life resources, including water, food, and schooling. These resources are found in a community center that is led by a Panamanian pastor named Pastor Guerra. Rio Missions is supporting this pastor and his ministry by improving the community center, and now with us, bridging the literal and spiritual gap in Arraijan. **(101)**

**Kyler Chrestay, Abaz Kryemadhi\***

***Gamma Ray Spectroscopy with a Silicon Photomultiplier and a LYSO crystal***

Gamma Ray Spectroscopy has been traditionally expensive for physics labs due to needs for multichannel analyzers and/or NIM crates. We have been able to design a low cost gamma ray spectroscopy for physics labs using a silicon photomultiplier as a photodetector, a LYSO crystal for scintillation, and a typical digital oscilloscope with Labview. The method we use does not only provide low cost gamma ray spectra from different isotopes but also unlike the black box approach in multichannel analyzers, it provides opportunities for undergraduate students to be familiar with detection techniques in particle and nuclear physics. **(23)**



**Benjamin Chrisfield, Trevor Stutzman, Zachary Schutte, Isaac Starr, Amy Porto\*, H. Scott Kieffer\***

**Beta-alanine supplementation has no effect on rowing performance in college age athletes**

Supplementation is popular for individuals who exercise as many believe it will help them achieve higher levels of fitness. High intensity exercise causes an increase in hydrogen ions and metabolites that cause muscle fatigue.  $\beta$ -alanine is a component carnosine which is a peptide shown to act as a pH buffer in muscle tissue and combat muscle fatigue. Athletes turn to  $\beta$ -alanine to supplement workouts as it is thought to increase power output and endurance. The purpose of this study was to examine the effect of  $\beta$ -alanine supplementation on a 2000 meter rowing test followed by repeated 30 second Modified Wingate tests on a rowing machine in relation to power output and performance. Eleven men and twelve women participated in a six-week, double-blind, quasi-experimental study and were randomly assigned to one of two groups:  $\beta$ -alanine (n=11) (800 mg tablets, 4 times daily) or placebo (n=12) (800 mg maltodextrin tablets, 4 times daily). Subjects consisted of NCAA Division III track, swimming, wrestling, and soccer athletes as well as Messiah College club athletes. Prior to and immediately following supplementation, participants performed a 2000 meter row to exhaustion followed by two maximum exertion Wingate tests. Researchers measured total time, peak power, power per kilogram, and power decline for the mean value of pre and post-supplementation testing for each treatment. No significant treatment effects were observed for the 2000 meter row ( $p > 0.05$ ). Additionally, no significance was found in either Wingate test ( $p > 0.05$ ). This data suggests that  $\beta$ -alanine may not enhance athletic performance in individuals performing novel exercises. **(35)**

**Chad Clemens, Stephen Powers, Harold Underwood\***

***Wireless Enabled Remote Co-presence (WERC)***

The Wireless Enabled Remote Co-presence (WERC) team is working together with SymBionyx to develop a system that dispenses coaching services via a remote link. People with cognitive disabilities and traumatic brain injuries often need an assistant to help them learn or re-learn daily tasks. However, assistance by a life-coach or attendant-care provider in person can foster dependency, and limit the ability of social agencies to meet the need long term. WERCware aims to revolutionize this strategy, by enabling one attendant to serve multiple participants from a remote location, and fostering more independent development by the participant. WERCware 3.0 initiates and maintains contact between attendant and participant via a Skype call over an Android smartphone worn by the participant via a pendant-style adjustable holster. This presentation reports on development of the StressAlyrter (SA) as a component of the WERCware system. The SA system is intended to monitor the emotional status of the participant, so as to automatically initiate a call to the remote attendant when encountering a stressful situation. Specialized biometric sensors have been researched and tested. For example, the Q-sensor utilizes galvanic skin response (GSR) to gauge human stress. Such sensors require an Application Programming Interface (API) to feed data to the smartphone. Development of an API for this purpose has been initiated. Using voice with an artificial neural network to discriminate between positive and negative stressors has been explored. Future work will involve fully developing the biometric sensors with an API as an effective StressAlyrter for the WERCware system. **(8)**

Elizabeth D'Amelio, Hannah Lacadie, Sarah Colligan, Joseph Crane, Jennifer Hudson<sup>^\*</sup>, Tara Jankouskas<sup>\*</sup>, Jennifer Brewer<sup>^\*</sup>, Deborah Audette<sup>^\*</sup>

***Evidence-Based Interventions to Manage Critical Incident Stress***

**Background and significance of clinical problem/question:** Work-related stress in the hospital setting has been correlated with employee attrition, burnout, and increased medical errors. Some hospitals have implemented various stress management techniques, but many facilities lack concrete hospital policy to address this issue, especially related to the occurrence of a critical incident. It is important to identify measures to evaluate and improve such policies to prevent stress related complications in hospital employees. **PICO Question:** What is the effect of workplace stress management interventions on critical care and emergency department nurses? **Methods of Literature Search:** A review of the literature was conducted using PubMed, MedLine, and CINAHL from 2003-2013. A total of 303 articles were identified; 6 were found to address the problem and were the focus of the review. The majority of the articles were Level III and Level V with an overall B quality. **Findings from EBP project:** Evidence reveals a statistically significant correlation between the variables of: stress, incivility, burnout, and turnover intentions ( $p=0.001$ ) (Oyeleye, 2013). Clinical experience accounts and quality improvement evaluations suggest that critical incident stress management debrief sessions help evoke and manage the mental and emotional complications associated with such incidents in a hospital setting (Blacklock, 2012; Malone, 2012). Critical incident debriefing is regarded as important by emergency department clinicians and there is a high demand for a debriefing program and guidelines within the emergency setting (Mitchell, 2003). **Recommendations for practice:** Based on the literature review, there is some evidence indicating that critical incident stress management can have a positive effect on reducing work-related stress in the hospital setting. Further research, particularly quantitative research, should be conducted to explore issues that may impact the success of debriefing as well the structure of the debriefing session. **(70)**

Avery deGruchy, William Eberwein, Kyle McGovern, Kyle Young, Brian Nejme<sup>h\*</sup>

***Designing a Reliable SMS-based Data Transmission Engine for IWP***

At the core of the Intelligent Water Project (IWP) lies a reliable data transmission system. This system is responsible for receiving and interpreting data transmitted from pumps via SMS. Additionally, the system implements checks and balances to ensure reliable data transmission. A team of students has worked this semester to leverage, update, test, and implement existing code for this crucial system. **(10)**

Avery deGruchy, Michael Hoffman, William Eberwein, Greg Moyer, D. Scott Weaver<sup>\*</sup>

***Web Development for Intelligent Water Project***

As part of the Intelligent Water Project (IWP), a team of students has taken on the task of designing and programming a secure web application that is both browser and mobile friendly. This web application shall serve as the main resource for users who will be accessing and analyzing IWP's data. The web application has been thoughtfully designed to work on all display environments and will be a valuable resource to field workers, managers and donors of the IWP. **(13)**

**John Deseno, Harold Underwood\***

***Flight Tracking & Messaging Systems (FTMS)***

Outside radar range, small planes flying in remote locations must be tracked by alternative means. Organizations aimed at emergency relief, humanitarian development and missionary support follow such flights, to insure safety. The Automatic Flight Following System (AFFS) has been extensively tested by JAARS for this purpose, but its central microcontroller--a small single board computer (SBC) has become obsolete. The FTMS team has been upgrading AFFS to version 2.0 by replacing the SBC with a newer one on the market. This past year, the team has been testing functionality of the newly ported code for the system by interfacing the SBC with the PACTOR modem (which turns text messages into radiowaves) and sending data from this modem to AFFSWin - a computer program used by the ground-based flight monitor. For test purposes, the team has successfully sent data from the SBC to its Pactor modem (pilot-side), established a link between the pilot side modem and a second modem representing the ground-based monitor, and parsed the data into AFFSWin. The team has also begun interfacing the SBC with the GPS unit through a serial connection, and is trying to establish a working link between these two devices. Vision for future work includes interoperability with other communications modes including satellite links, so as to make AFFS 2.0 a more flexible system useful for a variety of organizations. **(102)**

**Richard Dufrenne, Donald Pratt\***

***Light Sport Aircraft (LSA)***

The goal of the LSA project is to create an affordable and rugged light aircraft which can serve in rural and isolated areas for medical missions and pilot training. Some features include folding wings and short takeoff and landing (STOL) capabilities. At this point in time, the fuselage has been largely completed and the engine has been tested. The wings are in the beginning stages of construction. The goal of this semester is to mount the engine completely to the fuselage and make significant progress on both the wing folding and construction. **(98)**

**Taylor Eberly, Lauren Long, John Nordstrom, Tim Van Dyke\*, John Meyer\***

***Mobility Electric Tricycle: Front End Redesign***

The Mobility Tricycle Project designs electric and hand-powered tricycles for people living with physical disabilities in Burkina Faso, West Africa. To date, a majority of the tricycle design has been carefully reviewed and optimized, however, one area in particular, the front-end of the tricycle, still can benefit from a systematic redesign. With the current tricycle design, the rider must constantly exert a force on the steering handle in order to maintain a straight path and as the tricycle reaches higher speeds, the steering begins to wobble left and right. These handling characteristics are undesirable and troublesome for many of our clients who have limited upper body strength. The first aspect of our project looks to evaluate the geometry of the front-end with an eye toward improving the handling and steering characteristics of the tricycle, particularly the electric tricycle. Head tube angle, an important quantity for defining the geometry of the front end, may play a significant role in tricycle handling. In order to test the relationship between head tube angle and handling characteristics, we designed and built an experimental test setup, which allows us to vary this angle and evaluate the resultant handling response. With this setup, we are able to conduct a number of different tests including a test

for wobble using accelerometers, a test for the force required to keep the tricycle going in a straight line, and a test for the force required to turn the tricycle. We have also developed a handling test to qualitatively analyze the handling and stability of the tricycle. We analyzed the data from these tests and were able to determine an optimal head tube angle. **(4)**

**Taylor Eberly, Lauren Long, John Nordstrom, Tim Van Dyke\*, John Meyer\***

***Mobility Electric Tricycle: Head Tube Angle Redesign***

The Mobility Tricycle Project designs electric and hand-powered tricycles for people living with physical disabilities in Burkina Faso, West Africa. While much of the tricycle design has been carefully considered and optimized, one area in particular, the front-end of the tricycle, still can benefit from a systematic redesign. Our project was based on examining how the tricycle head tube angle, an important geometric aspect of the front end, affects the handling of the tricycle. To do so, we designed a test apparatus to allow us to adjust the head tube angle and installed it on the electric tricycle. Using this angle adjuster, we conducted several tests to examine the effect of the head tube angle on handling factors such as wobble (shaking left to right of the front wheel fork at higher speeds), ease of turning, and stability. In each test, we incrementally changed the head tube angle in order to examine what effect the head tube angle has on each of these factors. Our aim was to find the optimal head tube angle that would best decrease wobble while also making the tricycle easier to turn and more stable. Using our test data, we determined what angle would provide the best handling performance for the tricycle and we plan to implement this angle into the existing electric tricycle design. **(106)**

**Taylor Everett, Taran King, Ryan Slater, Randall Fish\***

***Solar Power Used To Reduce Dependence on Unreliable Electric Grid***

The public electric power grid in many emerging countries is unreliable. Customers must deal with the unpredictable loss of electric power for hours or days. Solar Power (PV) systems can provide the bridge over these times of power loss. This presentation gives an overview of this type of PV system intended to supplement an unreliable power grid. We will explore the important factors that must be considered during system design with specific examples from our current work with the Theological College of Zimbabwe. **(49)**

**Taylor Everett, Taran King, Ryan Slater, Randall Fish\***

***Solar PV System for the Theological College of Zimbabwe***

As in many emerging countries, Zimbabwe has an unreliable power grid. Because of this, the students at the Theological College of Zimbabwe (TCZ) must deal with regular loss of electric power for hours or days. This talk provides a detailed overview of the components chosen for a Solar Photovoltaic (PV) system designed to provide power for TCZ's computer lab and library. One central component, the MATE, which is the user interface for these system components, is then described in detail along with current plans for the system installation in May 2015. **(50)**

**Julie Fenton, Richard Schaeffer\***

***Construction of a Glow-Discharge Plasma Microelectrode for the Synthesis of Inorganic Solids***

This study focuses on the construction of a glow-discharge plasma microelectrode and its potential for usage as a lower-energy synthetic alternative for nano-crystalline multinuclear inorganic solids. Several atmospheric pressure microelectrode designs were constructed and assessed, and two different systems showed positive proof of plasma generation. Parameters for plasma generation were optimized with the two microelectrode systems. Though a glow-discharge plasma could be generated via both systems, neither produced a reactive plasma plume that could be used as planned for the synthesis of inorganic solids. **(60)**

**Aaron Film, Marcus Upton, David Wilson, Timothy Whitmoyer\*, Tony Beers\*, Joseph Longenecker^\***

***Garden Water Access Project***

The Collaboratory Water group is partnering with Serving in Missions (SIM) and Open Door Development in Burkina Faso to design low cost well drilling and water lifting technologies to complement their Survival Garden program. This year we have completed construction of our well drilling equipment and begun testing. We have also worked on some revisions to our pump design. **(108)**

**Austin Galaska, Luke Herwig, Tim Van Dyke\*, John Meyer\***

***Mobility Electric Tricycle: Brake Redesign***

Since the caliper brakes used initially in the design of the electric tricycle developed by the Disability Resources group were unreliable and ineffective, a new band brake design was developed last year. Although this design proved to be far more reliable and effective than the caliper brakes, there were still some issues with the design which had to be resolved before this new design was finalized. This year the Brake Redesign group revised the design to make the braking and accelerating functions of the tricycle completely independent. The group also tested band materials which could reliably provide the necessary braking force to determine the wear on these materials under both clean and dirty conditions. The clean trials gave a good baseline for our testing, while the dirty samples were intended to replicate conditions in Burkina Faso. This testing gave important data regarding the durability and reliability of each of the band materials. Combining this data with information about availability and cost of these materials in Burkina Faso, we are able to recommend a band material to be used. **(5)**

**Zachariah Gibson, Hannah Tims\***

***Quantification of sHSP 17.0 and 17.8 activity in dynamic light scattering assays***

Small heat shock proteins (sHSPs) are ubiquitous proteins found across the three domains of life (Eukarya, Bacteria, and Archaea). Their role in the prevention of protein denaturation is crucial for survival of all organisms, and may provide insights into the possible prevention of Alzheimer's, Parkinson's, and multiple sclerosis. However, the mechanisms for many sHSPs are largely unknown. In order to further understand the mechanism of action within Class II sHSPs 17.0 and 17.8, the method of dynamic light scattering assays needed to be proven reproducible. Aggregation was detected as an increase in light scattering through use of a spectrophotometer and two different aggregation assays. The citrate synthase assay was

performed to reproduce heat denaturation, and the lysozyme assay was chosen to reproduce room temperature chemical denaturation involving the reoxidation of disulfide bonds. After various procedural alterations, including a more detailed protocol and various mechanical corrections, the final protocols of both aggregation assays produced consistent and reproducible results. In conclusion, the assays can be considered reproducible and now await the purification of sHSPs in order to test the effectiveness of light scattering assays to quantify sHSP activity. (86)

**Kaitlyn Grando**, Courtney Burkett, Lawrence Mylin\*

***Transfection of Primary Kidney Cells with Mutated SV40 T ag DNA Containing a CCKCR Intron Sequence***

Cholecystokinin-C receptor (CCKCR) is an alternatively spliced version of cholecystokinin-B receptor (CCKBR) found in pancreatic cells. CCKCR retains the 69 amino acids of intron 4 of CCKBR and is uniquely expressed by pancreatic cancer cells. Therefore, it is an important target for immune therapy. The Simian Virus 40 Large Tumor Antigen has proved to be a powerful model in the study of cell-mediated immune responses to tumors. Our goal has been to construct cells which express a derivative of the SV40 T ag that incorporates this intron sequence to use as a tool in the study of cell-mediated immunity targeting this unique sequence in pancreatic cancers. Plasmids containing mutated Simian Virus 40 (SV40) large tumor antigen (T ag) DNA with a 20 codon insertion/replacement from CCKCR intron 4 were transfected into primary kidney cells harvested from naïve mice. First, kidneys were harvested from 3 mice and individual kidney cells sloughed off using trypsin to break the cell-cell bonds. These cells were maintained in culture and propagated to sufficient numbers for transfection. Transfection was performed using five plasmids encoding T ag insertion mutants constructed previously using site directed mutagenesis; one encoding the wild-type SV40 T ag as a positive control for immortalization; or no added plasmid DNA as a negative control. After several weeks, significant numbers of dense foci were observed in cultures transfected with the wild-type SV40 T ag. Foci were observed in flasks transfected with the mutant T ags at frequencies intermediate to that observed in the wild type T ag and the no DNA control flasks. Transfection candidates were picked and plated in 12-well plates to allow for expansion and subsequent characterization. Cells which are confirmed to carry and express the SV40 T ag - CCKCR intron sequence insertion mutants will be maintained, propagated, and preserved for use in further immunological studies. (69)

Megan Gross<sup>^</sup>, Stacy Chubb<sup>^</sup>, Erin Anderson<sup>^</sup>, Jeffrey Stroup<sup>^</sup>, Mary Lou Mortimer<sup>^</sup>, Meredith Schorner<sup>^</sup>, **Iulia Gafencu**, **Laura Black**, **Amanda Brong**, **Rebekah Chilcote**, **Rebecca Corrin**, Louann Zinsmeister\*

***Immersion Bathing and Improved Thermoregulation in the Newborn***

The Association of Women's Health, Obstetric, and Neonatal Nurses (AWHONN) recommends immersion bathing as the best practice for normal newborns and stable preterm infants. Historically, immersion bathing was thought to increase the risk of infection and newborns were sponge-bathed as an infection control mechanism. PinnacleHealth System uses sponge bathing as the primary method for newborn baths. This issue was chosen for investigation to determine which method of bathing most improved thermoregulation, and to determine if a

practice change is necessary within the PinnacleHealth System. The purpose of this evidence-based practice project is to determine the best practice regarding newborn bathing methods and their effects on thermoregulation. **(77)**

**Amy Heindel**, Katy Howell, Laura Penwell, **Amanda Schneider**, David Vader\*

***Village Water Ozonation System (VWOS)***

The Village Water Ozonation System (VWOS) is a village scale water purification system that uses a combination of filters and ozone to disinfect water. This project strives to create a product that is both economically and culturally sustainable. With a moderate supply of electricity, a VWOS could be implemented in small communities to provide a source of potable water. Recently the VWOS team has partnered with Forward Edge International. In May of this year, some of the VWOS team members and other Collaboratory volunteers will be installing a prototype at Villa Esperanza Girls Orphanage in Managua, Nicaragua. This past year, the team has been running tests to ensure proper functionality of the system as well as preparing materials such as a user manual, detailed parts list, and logistics for installation in May. **(30)**

**Jonathan Hepner**, Darin Horst, **Rebecca Ports**, David Vader\*

***Hollow Fiber Membrane System***

The Hollow Fiber Membrane (HFM) Team works to design, build, innovate, and implement cutting-edge gravity-fed water filtration technology in collaboration with Sawyer Products. The HFM filter can be washed and reused for at least 10 years but requires clean pressurized water for backwashing. Currently the team is gathering feedback on the HFM 1.0 System which consists of backwashing tanks, a charcoal filter, and one large HFM filter, as well as prototyping the HFM 2.1 system which uses smaller filters in parallel without using backwashing tanks. **(110)**

**Aaron Hiller**, Lawrence Mylin\*

***Optimizing conditions for the use of alpha-amylase from *Aspergillus oryzae* in an introductory BIOL160 laboratory exercise***

Alpha-amylase is a protein capable of catalyzing the breakdown of starches into simple sugars. This enzyme is currently used to illustrate protein structure and function in a laboratory session of the introductory-level BIOL 160 Molecular and Cellular Biology course. Like any protein, alpha-amylase performs best under a limited set of environmental conditions. BIOL 160 students investigate conditions that should denature or degrade the alpha-amylase protein and thereby reduce its catalytic activity. Students heat the alpha amylase protein or treat it with a protease (Proteinase K) to attempt to alter the tertiary and/or primary structure and thereby inactivate the enzyme. Students currently monitor alpha-amylase activity by testing for the presence or absence of intact starch (by iodine staining) in solutions to which solutions containing control or "treated" alpha-amylase have been added following a suitable reaction period. Unfortunately, proteinase K treatment does not reliably inactivate enough of the alpha amylase to nicely demonstrate the intended effect. The goal of this project was to establish conditions in which the desired results may be achieved in the laboratory setting by the BIOL 160 students. Altered reaction conditions have been investigated to better control or reduce the catalytic rate of alpha amylase, enhance proteolysis, and reduce the intensity of

background color contributed by the IKI staining reagent. Variables altered included reaction pH, salt (buffer) concentrations, times of proteolysis and/or starch hydrolysis and reaction volumes and proportions. SDS-PAGE was used to readjust the starting concentration of alpha amylase and to confirm proteolysis. Our results confirm that the amylase works optimally at acidic pH (~4.5) and is dramatically slowed at neutral to moderately alkaline pH where proteolysis appears to be optimal. Additional work must be done to explore alternate proteases and to identify a detergent that can be used to prevent precipitation of heat-denatured amylase, but which can be included in all reactions. **(65)**

**Michael Hoffman**, Jonathan Kennedy, Greg Moyer, Christopher Newman, Brian Nejme<sup>\*</sup>

***The Intelligent Water Project: Mobile First***

As part of the Intelligent Water Project, a group of students has taken on the responsibility of making a mobile app driven towards field technicians in Africa. By having a mobile app to leverage in the field, World Vision staff will be able to take advantage of location based services, easily monitor statuses of pumps, and perform basic maintenance protocol to ensure continued reliability of pumps. **(12)**

**Sarah Hogan**, Kelsie Hitesman, Kaitlin Gill, Amy Porto<sup>\*</sup>

***No Significant Differences Found in Food Group Intake of Messiah College Students Participating in the Dining Dollars Meal Plan and Those Not Participating in any Meal Plan***

Past research has shown that college students do not typically meet dietary intake guidelines. The purpose of this cross sectional study was to determine if those who participate in the Messiah College campus meal plan have increased food group consumption compared to students not on the meal plan. Subjects included a convenience sample of 23 students (19 female, 4 male) participating in the meal plan and 13 students (all female) not on the meal plan. Participants completed a 3-day food record and anthropometrics were measured. Food Processor Software (version 10.12) was used to analyze the food records and compare food group intake to the MyPlate guidelines. Generally, participants did not meet MyPlate recommendations. Microsoft Excel was used to determine significance of data using unpaired t-tests. Results determined no significant differences between meal plan and non-meal participation across all food groups. Nutrition professionals should focus on education rather than solely providing students with a variety of food options to get students closer to recommended intake values. **(36)**

Yvonne Hoke<sup>^</sup>, Amanda Hammaker<sup>^</sup>, Teresa Biagio<sup>^</sup>, Joanne Konick-McMahan<sup>^</sup>, Stefanie Miller<sup>^</sup>, **Rachel Faber**, Sarah Pedersen, Lauren McClure, Emily Quesenberry, Rachel Petro-Roy, Louann Zinsmeister<sup>\*</sup>

***Traumatic Brain Injury: Recognition of Post-Concussion Symptoms***

**Background:** In recent years, traumatic head injury in school-aged children has become a predominant injury in society. Traumatic head injury is a major topic of interest due to the possible long-term effects that can occur post-injury. National media has addressed this topic and has raised concern in the healthcare industry that school-aged children and parents with traumatic brain injury symptoms have not been provided proper education regarding post-concussion symptoms. **Purpose:** The purpose of this evidence-based practice project was to



determine the effectiveness of child and parent education regarding recognition of post-concussion symptoms in school-aged children. **Methods:** Using CINAHL, PubMed, Medline, and The Cochrane Database, fifteen journal articles were chosen and then were narrowed down to four pertinent journal articles that were critically appraised. **Results:** It is evident that parents of school-aged children diagnosed with traumatic brain injury want both post-traumatic brain injury symptom information as well as traumatic brain injury preventive information. Discharge instructions provided to parents and children are evidently inadequate due to parents reporting children asymptomatic, when in reality, children were symptomatic or vice versa. Oftentimes, emergency department physicians and nurses provide only verbal instruction that may or may not be in agreement with post-concussion recommendations. **Limitations:** The limitations of our Evidence Based Practice Project included limited amounts of literature focusing on post-traumatic brain injury discharge instruction. **Implications for Practice:** There is a need for written and verbal instruction to both parents and school-aged children regarding post-traumatic brain injury symptomology. Follow-up care should be required to ensure that it is safe for the child to return to regular activity. **Areas for Future Research:** Future research should consider conducting both quantitative and qualitative studies assessing the effects of various discharge instruction techniques concerning post-traumatic brain injury symptomology. Qualitative studies should also be conducted in order to observe and evaluate discharge education as given by physicians and nurses. **(80)**

Angela Horne<sup>^</sup>, Chris Egresits<sup>^</sup>, Donna Roller<sup>^</sup>, Deb Schafer<sup>^</sup>, Shelly Kowalski<sup>^</sup>, **Christa Matthews, Bethany Cummings, Kessiah Roland, Alyse Weaver, Louann Zinsmeister\***

***Traditional vs. Rooming-In Care for Infants Experiencing Neonatal Abstinence Syndrome***

**Background:** Over the last decade, researchers have noticed an increasing incidence of maternal opioid dependence during pregnancy. Often NAS infants are in the Neonatal Intensive Care Unit (NICU) for extended periods of time and are separated from their mother. **Purpose:** To explore the benefits of rooming-in compared to traditional care for infants with Neonatal Abstinence Syndrome as it relates to their length of stay. **Methods:** Using multiple databases, four research articles were selected. **Findings:** Rooming-in care for infants with NAS was found to decrease the need and length of treatment, shorten the length of stay and increase the likelihood of positive breastfeeding outcomes. **Recommendations:** Evidence is compelling enough to suggest consideration of a practice change. However, commitment from both the patient and the provider has to be equal and education must begin early in the prenatal care and continue throughout infancy. **(76)**

**Brittany Horst, Kelly DeLew, Suzanne Horton, Liz Borders, Amy Porto\***

***Project SHARE***

Food banks primarily seek to relieve hunger but with an increase in obesity and nutritionally deficient diets observed among those who have a lower income, some have sought to assess the nutrient quality of food donations. When seeking to offer healthier alternatives, it is beneficial to food pantries to understand the food preferences of clients. A descriptive study was conducted to determine the food preferences of participants at Project SHARE (Survival Help and Recipient Education), a local food bank in Carlisle, PA. Subjects (n=200) were required to be Project SHARE participants, English-speaking, and eighteen years or older. Participants

were surveyed on site over a period of four days while food was being distributed. Surveys were conducted verbally and answers were recorded by researchers. Compared to MyPlate recommendations, more participants chose the less healthy options. A majority of the group favored regular soup to low-sodium soup (50.8%), higher fat milk (2% and whole) to lower fat milk (fat-free and 1%) (69%), and regular pasta to whole-wheat pasta (52.8%). However, more participants preferred whole wheat bread to white bread (45.2%) and lean ground beef to regular ground beef (57.4%). Men, women, and caretakers preferred less healthy options in every category except ground beef. Non-caretakers preferred less healthy options in every category except ground beef and white bread. Before food banks offer more nutrient dense foods, it would be beneficial to survey participants to see if these changes would be accepted. **(87)**

**Darin Horst, David Vader\***

#### ***Hollow Fiber Membrane Filtration System***

The Hollow Fiber Membrane (HFM) Team works to design, build, innovate, and implement cutting-edge water filtration technology in collaboration with Sawyer Products. The goal of the project is to provide underprivileged communities around the world with an inexpensive and self-sustaining water filtration system. The HFM filter is gravity-fed and can be backwashed and reused for at least 10 years. The team is currently gathering feedback on the larger and more expensive HFM 1.0 system, and providing support for systems like these that have been installed in Burkina Faso. The team is also prototyping the HFM 2.1 system which uses several smaller, less expensive filters in parallel and eliminates the need for backwashing tanks. Testing has been done on the new system to determine the flow rate with varying numbers of filters, minimum required pressure for the backwashing procedure to work, and maximum pressure allowed to avoid damaging the filters. Documentation of assembly and operation procedures for the new system has also been completed and will be used by our client in India to install several systems in locations where they are needed. **(29)**

**Katy Howell, Laura Penwell, David Vader\***

#### ***Village Water Ozonation System***

The Village Water Ozonation System (VWOS) is a small, community-sized water purification system. It uses two loops - a filtration loop and a purification loop. The purification loop uses a venturi to inject ozone into the system to purify the water. Our client is Forward Edge International and in May 2014, we are installing the system at a girls' orphanage in Nicaragua. **(109)**

**Kathryn Jablonski**

#### ***Women in Mathematics***

The recorded history of mathematics has long been dominated by men. However, this history doesn't tell the whole story of mathematical development. The women who were courageous and determined enough to involve themselves in the man's mathematical world have shaped not only our mathematics, but also the opportunities for women following them to have a place in the field. It is necessary to tell the stories of the matriarchs of mathematics like Hypatia,

Maria Agnesi, Sophie Germain, and Emmy Noether, in order to understand the great impact they have had as pioneers for mathematical education and involvement for women. (18)

**Abhishek Jacob**, Randall Fish\*

***Reducing Indoor Cooking Smoke Hazards for Those without Electric Power***

In a recent study, it was found that nearly 2 billion people worldwide use open cook fires in an indoor environment for cooking food and boiling water. Because these cook fires use biomass like wood and leaves for fuel, harmful byproducts are emitted that settle within the indoor environment causing disease and nearly 1.5 million deaths annually. To address this problem, we have been developing a ventilation system which can be affordably manufactured in our client communities. This system uses a fan that draws smoke from the fire through a filtered ventilation hood. The reusable filter eliminates most of the carbon particulate from the smoke. This smoke is then vented outside the home via a duct in the ceiling or wall. Since many clients in need of such a ventilation system do not have access to electric power, we are experimenting with an alternative energy source which uses a Thermo Electric module to convert waste heat from the cook stove to the electricity needed to power the fan. This talk will describe the experimental data used to identify our current design. This prototype will be implemented in Oaxaca, Mexico in partnership with Forward Edge International on August 2014. This project has provided us with an excellent opportunity to use our abilities and resources to externalize God's love for us through our service, sharing the hope of Christ. (51)

**Maha Jahangir, Philip Roth**, Anne Reeve\*

***Synthesis and Purification of Aspernigrin A Analog Intermediates***

Aspernigrin A is a potent secondary metabolite of marine endophytes found in the Mediterranean sea sponge *Axinella damicornis*. It was first isolated in 2004 from an *Aspergillus niger* strain of the sea sponge and again in 2005 from the endophyte *Cladosporidium herbarum* obtained from *Cynodon dactyl*. Aspernigrin has been found to moderate cytotoxicity towards multiple colon cancer cell lines, which stimulates the interest in synthesizing the lead compound and its analogs. Progress has been made towards the synthesis of 6-aryl structural analogs. The reaction of 4-methoxy acetophenone and floro acetophenone with trimethylsilyl chloride was completed first to yield trimethylsilylenoethers. These are reacted with malonyl dichloride to produce 4-methoxy pyrone and floro pyrone. The pyrone is reacted with dimethylformamide dimethyl acetal to form an enamine intermediate. These reactions have been optimized, affording intermediates in good yield, with significant progress made on synthesis of Aspernigrin A analogs. (85)

Christina Johnson<sup>^</sup>, Wanda Hoyer<sup>^</sup>, Mark Book<sup>^</sup>, Tiffany Boyd<sup>^</sup>, Sarah Harne-Britner<sup>^</sup>, Denise Klahre<sup>^</sup>, **Supakorn Kueakomoldej, Sarah Weisel, Katie Hertzler, Susie Herwig**, Louann Zinsmeister\*

***One versus Many: Team vs. Primary Nursing: A look at nursing models***

With changing healthcare policies and increasing rigor of healthcare standards, healthcare systems need to find ways to use resources most efficiently. Registered nurses (RN) play a vital role in the health care team and excellent nursing care promotes patients' wellbeing and satisfaction. Over the years, many nursing models have been developed to best use the RN

staffing in clinical settings, and to best promote patient and nurse satisfaction. The purpose of this project was to compare and analyze the two most common nursing models used in the current healthcare industry—primary and team nursing. By critiquing and evaluating evidence pertaining to both models, the findings may be able to be incorporated into an evidence-based practice change in clinical nursing settings to best use nursing personnel resources. (75)

**Peter Jones, Andrew Budd, John Snyder, William Eberwein, D. Scott Weaver\***

***Database Challenges for the Intelligent Water Project***

The database side of this project has been rather difficult. Not only did we have to work with a database that was created from previous years, but we also had to cater to the changing desires of the applications development teams as well. To begin we changed names and relations to make it standardized. After this we focused on the system for alerts, blogs and data security. (14)

**Josiah Kelley, Thomas Soerens\***

***The Briquettes Project: Realistic Alternatives to the Use of Charcoal and Wood in Malawi***

Malawi's forest resources are being harvested at alarming and unsustainable rates. Much of this deforestation is caused by the countries' demand for charcoal and wood to meet its daily energy requirements. It has been reported that 42% of Malawians use charcoal or wood as their primary source of energy for cooking, with over 85% of the population using charcoal or wood to some extent. In 2004, this amounted to a forest consumption rate of 15,000 hectares every year. Charcoal made from wood is often transported distances in excess of 40 miles on a bicycle for purchase by consumers. This raises the price of charcoal and creates the opportunity for alternative fuels to become more economically feasible. The goal of the Briquettes project is to significantly reduce charcoal and wood consumption in Malawi. We are developing a process using locally available equipment to convert abundant natural by-products into fuel briquettes which are an economically feasible alternative to charcoal. (94)

**Jessica Kim, Erik Lindquist\*, Michael Shin\***

***Presence and prevalence of Bd (*Batrachochytrium dendrobatidis*) in Picado's Bromeliad Treefrog (*Isthmohyla picadoi*)***

*Batrachochytrium dendrobatidis* (Bd) is a virulent amphibian pathogen that invades the keratinized skin cells of juvenile and mature amphibians and the mouthparts of tadpoles, and causes the disease chytridiomycosis. By causing regions of outer layers of the skin to unevenly thicken, osmoregulation and respiration are disrupted. Considering the important role of skin in amphibian respiration, chytridiomycosis has high mortality rates. And because Bd is an exotic pathogen, introduction to new sites- and naïve populations- quickly leads to epizootic outbreaks and high losses in susceptible populations. However, despite amphibian declines and extinctions in the Cerro Punta region of western Panama, anuran species *Isthmohyla picadoi* has persisted. It is known that some amphibians harbor epidermal bacterial flora that serve to protect from chytridiomycosis, and hypothesized that *I. picadoi* does as well. In this study, presence and prevalence of Bd in a sample of *I. picadoi* individuals (n=9) will be determined using genomic extraction and PCR. *I. picadoi* individuals were captured and swabbed near Guadalupe Arriba, Chiriquí Province, in the Republic of Panama. Eight individuals were captured

within Finca Dracula, owned by Andrés Maduro, and one was captured near a lodge owned by Los Quetzales Lodge and Spa on 26, 28 and 29 May 2012. Genomic extraction for *I. picadoi* DNA and Bd DNA was performed on the nine swabs 15 November 2013, and PCR has been performed on the extracted DNA to determine presence of Bd in this sample. (58)

**Ken Kok, Tony Beers\***

#### ***Intelligent Water Management System***

36% of handpumps in Africa are nonfunctional at any given time. Upon the completion of our project, the many rural users of the India Mark II pump will have a system set up that automatically and remotely informs pump technicians of current or ensuing problems and provides water resource planners with real-time hydrology data. Such a system, by wirelessly notifying the pump technician of a failure, would help avoid situations where villages are without water for days while people travel to get a pump technician to fix the problem. These advances would improve the reliability of rural water supply systems and promote the likelihood of acceptance among villages that have yet to receive a handpump. Minor failures, when not properly addressed, propagate more costly failures in the future. Rural community members often do not report problems until there is a critical failure. Catching problems early via IWMS would prevent more costly repairs. Water resource planners and hydrologists would benefit from daily water extraction data from well sites. They would be able to analyze aquifer extraction and recharge, the impact of weather events on aquifers, and – when networked among many sites – hydraulic trends throughout extensive regions. (111)

**Kaitlin Kovach, Michael Shin\*, Richard Schaeffer\***

#### ***Zinc tolerance and accumulation in *Arabidopsis thaliana****

Due to accumulation of heavy metals in contaminated topsoil, plants become vulnerable to taking up quantities of metal ions far in excess of the micronutrient levels required for health, as any additional ions quickly become toxic to growing organisms. *Arabidopsis thaliana*, as an ideal model organism for the lab, was utilized to observe the effects of zinc ( $ZnCl_2$ ) on plant growth. Multiple studies of *A. thaliana* were conducted to determine the plant's tolerance of  $ZnCl_2$  in situations of exposure to the ions, with the determination that  $ZnCl_2$  becomes toxic in exposure ranges of 0.25 mM – 0.60 mM  $ZnCl_2$ . Furthermore, studies were continued to quantify amounts of  $ZnCl_2$  accumulated within the plants. In an initial round of accumulation assays, *A. thaliana* seedlings were grown on concentrations of 0.25 mM – 2.00 mM  $ZnCl_2$ ; amounts of zinc taken up by the plants were analyzed via atomic absorption. To determine partitioning of accumulated  $ZnCl_2$  within *A. thaliana*, a second round of accumulation assays utilizing were performed utilizing concentrations of 0.25 mM – 1.00 mM  $ZnCl_2$  in which roots were separated from shoots prior to analysis via atomic absorption. (32)

**Enid Kreiner^\*, Jill Hagerott, Esther Moore, Trevor Praetsch, Julie Schmidt, Tara Jankouskas\*, Jennifer Brewer^\*, Deborah Audette^\***

#### ***Investigating the use of music therapy in the neonatal intensive care unit***

**Background and Significance of Clinical problem:** Music therapy provides physiological and emotional benefits across clinical settings. In the NICU, music therapy can help stabilize patient

vital signs and provide a non-pharmacological intervention to pain control. A review of articles will identify benefits of music therapy based on physiological and behavior responses of infants.

**PICO question:** What are the physiological effects of music therapy in the neonate intensive care population?

**Methods of Literature search:** A review of literature was conducted using PubMed, CINAHL, MedLine and the Cochrane database from 2008-2013. A total of 83 articles were identified, and the review concentrated on the 7 articles that applied to the clinical problem. The majority of the articles were Level I evidence plus additional articles at Levels II and III with quality ratings of A-, B and B-, respectively.

**Findings From EBP project:** Evidence supports the use of music therapy in the neonatal intensive care unit. Music therapy has been shown to increase oxygen saturation both during (p=0.001) and after intervention (p=0.019) (Standley, 2012). Farhat (2010) found music therapy decreases heart rate (p=0.00). Alipour (2013) found that respiratory rates decrease post intervention (p=0.03). Music therapy also improves the stabilization of vital signs after a painful or stressful procedure (p=0.02) (Tramo, 2010; Haslbeck, 2012).

**Recommendations for practice:** Based on the literature review, music therapy is recommended for stable infants in the NICU. Because of the possible risk of overstimulation, more research should be conducted to assess the level of stimulation appropriate to ensure a beneficial outcome. **(73)**

**Kelly Kulp, Harold Underwood\***

#### ***Wireless Enabled Remote Co-presence (WERC)***

The Wireless Enabled Remote Co-presence (WERC) team is working together with Symbionyx to develop a system that dispenses coaching services via a remote link. People with cognitive disabilities and traumatic brain injuries often need an assistant to help them learn or re-learn daily tasks. However, assistance by a life-coach or attendant-care provider in person can foster dependency, and limit the ability of social agencies to meet the need long term. WERCware aims to revolutionize this strategy, by enabling one attendant to serve multiple participants from a remote location, while fostering more independent development by the participant. WERCware 3.0 initiates and maintains contact between attendant and participant via Skype over an Android smartphone worn by the participant via a pendant-style adjustable holster. This presentation reports on the automatic cut-off solution, a component of the WERCware system that automatically turns off any video and sound feed for privacy in identified areas, whether for personal or work-related reasons. A successful solution will correctly recognize when the participant has entered a private area. To do this, some wireless technologies considered include radio frequency, ultrasonic, and infrared emitter-detector pairs. After evaluating the options, ultrasonic detection was selected. Circuits for transmitting and receiving signals in the ultrasonic range have been tested. The optimized detector circuit will eventually interface with the Arduino microcontroller to integrate the solution with the smartphone. Future work includes developing biometric sensors interfaced with the Arduino to monitor the participant, implementing a successful automatic privacy shutoff, and developing an internet connectivity monitor. **(103)**

**Matthew Kulp, Tony Beers\***

***Handpump Sustainability Study***

Obtaining clean water is an ongoing struggle for villages across Africa. Many villages have implemented wells with handpumps to reach potable groundwater. Unfortunately, mechanical failure in village handpumps such as the India MK II leaves many pumps unusable often within a year of their installation. The Handpump Sustainability Study project (HSS) is working to redesign and improve failure-prone components of the India MKII Handpump to improve reliability and access to water. HSS is currently in the process of providing two prototype designs: a machined steel poppet valve to replace the standard cast stainless steel valve, and an oil-impregnated iron bushing to replace the ball bearings at the pivot point of the pump handle. In addition to these prototypes, HSS has designed and built a testing apparatus to be able to perform in-house fatigue tests on the India MK II Handpump. **(26)**

**Alyssa Lage, Jeff Erikson\***

***Testing if Wastewater Antibiotics Induce Bacterial Resistance in Streams***

Many are aware of the increasing danger of antibiotic resistance in bacteria. However few realize how important their role is in the spread of this resistance. Antibiotics are expelled from the human body in the form of waste. Furthermore, people flush unused antibiotics down toilets as a method of disposal. The purpose of this experiment was to compare the influent from wastewater treatment centers to the effluent to see if the effluent had a higher antibiotic resistance. Samples were taken 20 meters upstream and downstream from the wastewater treatment facility at Dogwood Run. Plates were inoculated with stream water. After two days, Colony morphology was used to determine unique species of bacteria. These bacteria were then transferred to slants and the streak plate method was applied when necessary in order to ensure pure cultures. Each species underwent gram-staining for future identification. The bacteria were tested for antibiotic resistance using the Kirby-Bauer disc diffusion method. Each colony from the influent was matched to its identical species in the effluent based on colony morphology and gram stain results. The antibiotic resistance of the upstream microbes was then compared to that of the downstream bacteria. It was hypothesized that the microbes in the effluent would show greater signs of resistance due to exposure to the antibiotics in the wastewater. This research will be continued in the fall with the comparison of antibiotic resistance in microbes from the influent and effluent of multiple wastewater treatment centers around Mechanicsburg. **(83)**

**Wesley Loar, Garrett Myers, Nicholas Oland, Robert Schmuck, Donald Pratt\***

***Basic Utility Vehicle (BUV)***

The ability to move products and materials is crucial to the quality of life. In Africa, a Basic Utility Vehicle provides an affordable solution to faster transportation. BUVs are designed to withstand the rugged terrain while transporting large payloads. Our team hopes to integrate a power take-off system with a BUV; this will enable people to power other equipment using the BUV's motor. In time, we hope to apply similar technologies to small gas-powered scooters to improve their functionality. The BUV is a new project and has involved a great deal of communication with our consultant as we sought to define project objectives. This semester, we acquired a small diesel engine, mounted it to a test stand, and began testing to ensure that

it would work properly. We have designed a prototype BUV frame and begun its assembly. The engine will power our prototype and provide flexibility in designing and testing various methods of power take-off. (97)

**Joel Love, Jack Bluebaugh, Abaz Kryemadhi\***

***Neutron Veto Scintillator Study for Cryogenic Dark Matter Search Experiment***

We analyzed various scintillators, both plastic and liquid, to determine their relative and absolute light yields and determine their effectiveness for use in the Cryogenic Dark Matter Search (CDMS) neutron veto. The 2,5-diphenyloxazole (PPO), DPA, and Trimethyl borate (TMB) concentrations were varied in both plastic and liquid scintillators. They were then exposed to barium-133, cesium-137, californium and the light output was measured using a photomultiplier tube (PMT) and recorded using a data acquisition system. (22)

**Joel Love, Harold Underwood\***

***Flight Tracking and Messaging Systems (FTMS)***

Outside radar range, small planes flying in remote locations must be tracked by alternative means. Organizations aimed at emergency relief, humanitarian development and missionary support follow such flights, to insure safety. The Automatic Flight Following System (AFFS) has been extensively tested by JAARS for this purpose, but its central microcontroller--a small single board computer (SBC) has become obsolete. The FTMS team has been upgrading AFFS to version 2.0 by replacing the SBC with a newer one on the market. This past year, the team has been testing functionality of the newly ported code for the system by interfacing the SBC with the PACTOR modem (which turns text messages into radio waves) and sending data from this modem to AFFSWin - a computer program used by the ground-based flight monitor. For test purposes, the team has successfully sent data from the SBC to its Pactor modem (pilot-side), established a link between the pilot side modem and a second modem representing the ground-based monitor, and parsed the data into AFFSWin. The team has also begun interfacing the SBC with the GPS unit through a serial connection, and is trying to establish a working link between these two devices. Vision for future work includes interoperability with other communications modes including satellite links, so as to make AFFS 2.0 a more flexible system useful for a variety of organizations. (7)

**Lauren Martin, Anne Reeve\***

***Synthesis and Purification of Aspernigrin A Analog Intermediates***

Aspernigrin A is a natural product first isolated in 2004 from an *Aspergillus niger* strain in the Mediterranean sea sponge *Axinella damicornis*. It was isolated again in 2005 from the endophyte *Cladosporidium herbarum* obtained from *Cynodon dactylon*. Aspernigrin A was found to be cytotoxic towards multiple strains of colon cancer, which promotes the interest in synthesizing the lead compound and its analogs. Progress has been made of the synthesis of 6-aryl structural analogs beginning with the reaction of methyl acetophenone with trimethylsilyl chloride to yield a trimethylsilylenoether. This is reacted with malonyl dichloride to afford a methyl pyrone. An enamine intermediate is formed by reacting the pyrone with dimethylformamide dimethyl acetal. Optimization of these reactions has afforded



intermediates in good yield, with significant progress made on synthesis of aspernigrin A analogs. (42)

**Nicholas Martin, Rachel Morris, Tyler Kratz, Tony Beers\***

***Intelligent Water Management System (IWMS)***

36% of handpumps in Africa are nonfunctional at any given time. Upon the completion of our project, the many rural users of the India Mark II pump will have a system set up that automatically and remotely informs pump technicians of current or ensuing problems and provides water resource planners with real-time hydrology data. Such a system, by wirelessly notifying the pump technician of a failure, would help avoid situations where villages are without water for days while people travel to get a pump technician to fix the problem. These advances would improve the reliability of rural water supply systems and promote the likelihood of acceptance among villages that have yet to receive a handpump. Minor failures, when not properly addressed, propagate more costly failures in the future. Rural community members often do not report problems until there is a critical failure. Catching problems early via IWMS would prevent more costly repairs. Water resource planners and hydrologists would benefit from daily water extraction data from well sites. They would be able to analyze aquifer extraction and recharge, the impact of weather events on aquifers, and – when networked among many sites – hydraulic trends throughout extensive regions. (27)

**Caitlin Mason, John Harms\*, Lawrence Mylin\***

***Generation and Detection of T Cell Responses to the Pancreatic Cancer-Associated CCK-B Receptor Splice-Variant (CCKCR) in C57Bl/6 Mice***

The goal of this study was to investigate the potential for using T cell responses targeting intron-encoded amino acid sequences of the pancreatic-cancer-associated form of the cholecystokinin receptor (CCKR) to control tumor growth in mice. Linked to the presence of cancerous pancreatic cells, a splice variant of the CCKB receptor, known as CCKC or the cancer-associated CCK receptor contains a unique insertion of 69 amino acids encoded by an intron that is usually removed from the normal CCKB receptor mRNA. Previous studies have demonstrated that a synthetic 20mer peptide representing a conserved region within the 69mer intron-encoded sequence can induce a T cell response in mice, but the subset(s) of these peptide-induced T cells remains unknown. T cell responses in mice immunized with Panc02-C, Panc02-B, and B6/WT-19 cells were measured by ELISPOT using the 20mer synthetic intron peptide, an epitope I peptide from SV40 T ag, and an SV40 T ag 529 CD4+ epitope peptide. The ELISPOT analysis failed to detect Panc02-C-induced intron-20mer-specific T lymphocytes at levels comparable to those induced by either of the SV40 T ag control epitopes. Tumor growth was observed in the abdominal cavity of mice immunized with both Panc02 cell lines. Mice injected with Panc02-B cells exhibited the most extensive growth. Future investigations will continue to investigate T cell responses to one or more portions of the unique 69 amino acid intron-encoded sequence of CCKCR. (68)

Daniel Mauger, Jamie Hackett, Shannon Kelly, Jacquelyn McNeil, Susan Shorb<sup>^\*</sup>, Tara Jankouskas<sup>\*</sup>, Jennifer Brewer<sup>^\*</sup>, Deborah Audette<sup>^\*</sup>

### ***Increasing Influenza Vaccination among Healthcare Personnel***

**Background & Significance:** Despite rising vaccination rates among healthcare personnel, most U.S. hospitals have not achieved the target 90% influenza vaccination rate of Healthy People 2020. Extreme variation has caused institutions to research new methods to increase the vaccination rate among healthcare personnel. Methods include education, rewards, or punitive consequences such as facemask requirements, no patient contact, or employee termination (Fricke, 2013; Miller 2011). Many institutions are also instituting influenza vaccination mandates to increase vaccination compliance rates among healthcare workers (Miller 2011). **PICO Question:** Among healthcare personnel in the US, how do non-consequential interventions versus consequential interventions affect the rate of compliance with influenza vaccination? **Methods of Literature Search:** A collaborative review of current literature was conducted, using the following search terms to retrieve articles from CINAHL, Medline, PubMed, and the National Guideline Clearing House: healthcare personnel, influenza vaccine, guideline adherence, and United States. Fourteen articles directly addressed the PICO question and ranged from level I-V with an average B quality. **EBP Findings:** While ample research has been conducted on promotional tactics for the influenza vaccine, evidence was inconclusive on the efficacy of consequential over non-consequential interventions. Institutions frequently employ multiple tactics concurrently to increase voluntary vaccination, obscuring the individual efficacy of promotional tactics (Nowalk, 2013). Evidence demonstrated that multifaceted promotion strategies, which used both consequential and non-consequential methods, consistently yielded high institutional rates of influenza vaccination amongst healthcare workers (Doratotaj, 2008). **Recommendations for Practice:** Based on the evidence in the literature review, institutions should use multifaceted promotional strategies to enhance healthcare worker vaccination rates. Promotions should address common inhibitions such as cost, time, logistical inconvenience, and misunderstanding of the vaccine (Hollmeyer, 2009; Shefer, 2011). Further research should examine the individual effects of specific promotional interventions through randomized controlled trials and statistical regression. (72)

Blake Maurer, Jeff Erikson<sup>\*</sup>

### ***The Distribution and Population of *O. rusticus* in three South-Central Pennsylvania Streams***

*Orconectes rusticus* is an invasive crayfish species that displaces native stream macroinvertebrates and crayfish populations. The crayfish study was conducted in Trout Run, Stoney Run, and Dogwood Run in sites which held similar substrate habitat. Crayfish collection techniques included the use of minnow traps and kick nets. Mark and recapture techniques were performed with moderate success, whereas the use of kick nets provided instant population estimates of the crayfish. The results showed that *O. rusticus* prefers a substrate size of large cobble to small boulder (3-6"). Additionally, *O. rusticus* was not represented in any collections performed in Trout Run. In Stoney Run the *O. rusticus* population was 7/m<sup>2</sup> in slow water velocity (0.1 m/s) whereas the population was 0.5/m<sup>2</sup> in fast water velocity (0.8m/s). Where *O. rusticus* was found its population density was up to 6.5/m<sup>2</sup> higher than where other crayfish species were found in a similar habitat. Future studies could include a deeper investigation of why there is not an established *O. rusticus* population in Trout Run. (82)

Talisha Maxwell<sup>^</sup>, Sue Ann Bruce<sup>^</sup>, Cindy Hallman<sup>^</sup>, Maryalyce McCormick<sup>^</sup>, Marianne Allen<sup>^</sup>, Jeannie Wirth<sup>^</sup>, Sarah Curtis, Jennifer Ranck, Kurt Stallsmith, Kirsten Davidhizar, Alexandria Varish, Louann Zinsmeister\*

***Improving Quality of Life in Cancer Patients Through Patient Education on Non-Pharmacological Interventions***

**Background:** Pain is a primary symptom for patients undergoing cancer treatment. The goal of the nurse is to improve comfort level and quality of life, however medical means are often the source. Non-pharmacological interventions are many times dismissed by the patient due to lack of education on possible interventions that do not include medication. **Aims:** The intention of this project was to answer whether or not patient education on non-pharmacological interventions was more beneficial to increasing the quality of life when used concurrently with medical interventions. **Methods:** A review of literature was individually performed using CINAHL, EBSCO, and PubMed. Articles were used that ranged from the years 2008-2013. To find articles relevant the topic of choice, key terms were searched such as: *quality of life, patient education, cancer, complementary therapy, and symptoms*. Of the 29 articles originally found using the search criteria listed, four were critically appraised which included two systematic reviews, a qualitative study, and a randomized control trial. **Results:** The studies critiqued revealed that education on non-pharmacological interventions significantly improved management of adverse symptoms. Patients felt as if they had more control over their symptoms when educated on ways to decrease pain aside from their traditional medical interventions. Giving a patient more control over their symptoms through education increases their quality of life. **Conclusion:** Although positive outcomes of educating patients on non-pharmacological methods are seen throughout the study, there is still need for future research to be done. Future research is needed to evaluate what the best method of patient education is, and to specify the non-pharmacological interventions that improve patients' quality of life the most. (79)

Caitlin McGee, Stephanie Schell<sup>^</sup>, Caroline Passmore, Lawrence Mylin\*

***Characterization of the cellular immune responses to two immunodominant Simian Virus 40 Large Tumor Antigen (SV40 T ag) CD8+ T lymphocyte epitopes in the absence of three CD4+ epitopes***

T lymphocyte mediated tumor immunity is an important function of the adaptive immune system, and requires the participation of both CD4+ and CD8+ T lymphocytes. T lymphocytes are activated upon recognition of specific, short epitope peptides which are presented to their T cell receptors by Major Histocompatibility (MHC) molecules expressed on appropriate host antigen presenting cells. The goal of this study was to measure CD8+ T lymphocyte responses to two immunodominant Simian Virus40 large Tumor antigen (SV40 T ag) epitopes, I and IV, in the presence or absence of three newly-discovered CD4+ epitopes. Epitope I- and IV-specific CD8+ T lymphocyte frequencies were measured in suspensions of immune C57Bl/6 splenocytes by two flow cytometry-based methods: direct co-staining with MHC tetramers and an anti-CD8+ monoclonal antibody; and by staining for increased levels of interferon gamma in CD8+ T cells that had been transiently re-stimulated *in vitro* with either peptide (Intracellular Cytokine Staining; ICS). The results from both methods revealed that CD8+ T cell responses to epitopes I

and IV were markedly reduced at two weeks post-immunization for cells expressing an SV40 T ag derivative engineered to lack the three CD4+ epitope sequences compared to cells that expressed the wild type SV40 T ag. The pronounced difference was not evident at six weeks post-immunization when overall frequencies of SV40 T ag-specific CD8+ T lymphocytes had markedly diminished in both groups. A boosting immunization utilizing cells expressing the wild type SV40 T ag was given to both groups and naive individuals at nineteen weeks after the initial immunizations, and epitope I and IV-specific CD8+ T lymphocyte frequencies were measured seven days later. Epitope IV-specific CD8+ T cell responses appeared diminished in the recall response induced in mice originally immunized with the SV40 T ag derivative lacking the three CD4+ epitopes. Further research is needed to investigate the significance of procedural artifacts (e.g. bovine serum proteins) that may replace the need for helper epitopes within the SV40 T ag. **(67)**

**Zach McKeown, Jeff Erikson\***

***Antibiotic Resistance of Bacteria across Anthropic Input***

Antibiotics serve as key tools that help our bodies fight off pathogens, but the existence of antibiotics doesn't end with our consumption of the antibiotic product; the consumer of the antibiotic product will excrete the antibiotic partially metabolized. The wastewater treatment plant is the destination for human excretion of wastes, and studies have found that the water treatment methods fail to remove the pharmaceutical components of human waste from the water they discharge. Whether or not the presence of pharmaceuticals in the aquatic environment plays a role in fostering antibiotic resistance is an important topic to evaluate for the environment, and for human health. The hypothesis was there are higher levels of antibiotic resistant bacteria on fish living closer to the WWTP. This study examines antibiotic resistance in bacteria from Slimy Sculpin, Darter, and Dace fish, collected at 3 sites: Trout Run Mechanicsburg and Dogwood Run, Dillsburg (two sites within this source of water). These sites serve to give us samples that are from WWTP effluent, agricultural runoff and a mixture of anthropogenic inputs. The samples from these sites were collected through electrofishing and netting the fish, then followed by aseptic swabbing of the skin around the stomachs of the fish. The bacterial samples were then gram-stained to discover morphological characteristics. These samples were then introduced to nutrient-agar containing a variety of antibiotic discs (Novobiocin, Ampicillin, Tetracycline, Penicillin, Nitrofurantoin, Doxycycline), which were then observed to determine resistance. It was found that all bacterial samples were susceptible to Doxycycline, and most were susceptible to Tetracycline (32/36). The bacterial samples were also found to be most resistant to Penicillin (31/36) with Nitrofurantoin being the 2<sup>nd</sup> most resisted against (19/36). **(81)**

**Emily Mellott, Alison Noble\***

***Analysis of Adsorbates on Polished Zinc Selenide***

Zinc selenide (ZnSe) is an intrinsic semiconductor that is transparent over a wide range of the visible spectrum and has low absorption in the infrared region of the electromagnetic spectrum. For this reason, ZnSe is useful as an optics element in many spectral devices including CO<sub>2</sub> lasers and infrared spectrometers. In addition, ZnSe has been shown to be a suitable substrate for self-assembled monolayers (SAMs). These well-ordered monolayers of organic

molecules chemisorbed to a substrate can be prepared without special equipment, and they can provide functionality to the surface because the end group can be changed easily. Therefore, SAMs may be used as analytical sensors or to promote certain orientations of liquid crystals. Other applications of SAMs include lubrication, protection against corrosion, catalysis, optics, and medical devices. The goal of this research is to characterize the surface of a polished ZnSe substrate in order to understand the molecular level interactions between the surface and the monolayer adsorbate. The main technique used to analyze the ZnSe was X-ray Photoelectron Spectroscopy (XPS). Initial results indicate a formation of a complex zinc oxide and selenium oxide on the surface, which changes when SAMs with varied types of chemical functionality are adsorbed. In the last stage of my project, carboxylic acid adsorbates of varying chain length on ZnSe were characterized by infrared spectroscopy (IR) and XPS. **(39)**

**Jordan Miller**, John Harms\*

***Construction of pCAGEN.puro for Gene Expression Studies in Pancreatic Cancer Cells***

Pancreatic cancer is one of the most deadly cancers, with a 5-year survival rate of less than 1%. Integral to our studies of pancreatic cancer is the construction of a series of mammalian expression vectors, each with different antibiotic selectable markers and each capable of driving expression of genes of interest via a  $\beta$ -actin promoter. These vectors would support simultaneous expression of multiple genes in cancer cells, including tagging of cells with green fluorescent protein (GFP), an effective technique for tracking cells in living organisms. The aim of this study was to engineer the vector pCAGEN.puro, containing the puromycin resistance gene, an endeavor previously problematic. In prior experiments, excessive background was obtained during PCR assembly of the SV40 promoter and puromycin resistance gene, and incorporation of the resulting cassette into pCAGEN was unsuccessful. We hypothesized that more stringent PCR conditions followed by stepwise cloning of a puromycin cassette into pCR-Blunt-II-TOPO would allow effective subcloning into pCAGEN. During PCR assembly of the puromycin cassette, we demonstrated that raising annealing temperatures to  $\sim 2^\circ\text{C}$  below the primer melting temperatures reduced background. PCR-based detection of the cassette within pCR-Blunt-II-TOPO using *Taq* polymerase was deemed ineffective without adjustments to  $\text{Mg}^{2+}$  concentration. High-fidelity *Pfx* polymerase was used instead and successfully detected the cloned cassette. The puro cassette was subsequently restriction digested for sticky-end ligation into pCAGEN. Restriction analysis demonstrated forward orientation of the cassette and automated DNA sequencing successful confirmed construction of pCAGEN.puro. Efforts to subclone the GFP gene into pCAGEN.puro are ongoing. **(47)**

**Meagan Miller**, Randall Fish\*

***Seed Pressing and Biodiesel Production in Burkina Faso***

Biodiesel is a form of diesel fuel manufactured from vegetable oils, animal fats, or recycled restaurant greases. It is safe, biodegradable, and produces less air pollutants than petroleum-based diesel. Oils used in the biodiesel production process can be obtained through a seed pressing oil extraction process. The various Biofuels projects within the Energy Group work to produce biodiesel fuel at home and abroad in conjunction with our local community and partners around the world to educate and promote environmental and economic sustainability. The Burkina Faso Seed Pressing and Production team is focused on biodiesel

production in developing communities. The team recently returned from a site team trip in January to work with one of our partners in Burkina Faso. Significant progress was made in developing an oil extraction process that is applicable to a developing world setting. This presentation will give an overview of the team's progress in extracting oil from *Jatropha* seeds in order to produce biodiesel in Mahadaga, Burkina Faso. (53)

**Brennan Neal**, Kristin Sicher, Erik Lindquist\*, Michael Shin\*

***Evaluating the Presence and Prevalence of *Batrachochytrium dendrobatidis* (Bd) in Anuran Populations in Central Pennsylvanian Vernal Pools and Creating a Bd standard for use in qPCR analysis***

*Batrachochytrium dendrobatidis* (*Bd*) is a virulent chytrid fungus responsible for global amphibian decline. Little conclusive research has been conducted concerning the presence of *Bd* in the unique ecosystems of Central Pennsylvanian vernal pools. This study included sampling in five vernal pools over a period of two months during amphibian breeding periods. Two anuran species, *Lithobates sylvaticus* and *Pseudacris crucifer* were sampled over a range of water and air temperatures to detect *Bd* presence as well as any correlation with environmental factors, specifically air and water temperature. *Bd* was detected, although in low quantities, in some of the *P. crucifer* samples with no significant correlation between environmental trends and zoospore load. Despite confirmed *Bd* presence, positive control testing revealed a need for a more general positive control primer as well as a more thorough swabbing procedure to ensure amphibian and *Bd* DNA harvest. In addition, a need was identified for creating a standard for *Bd* DNA quantification in the qPCR analysis. Therefore, issues surrounding creating such a standard were resolved. (55)

**Brian Nejme**, D. Scott Weaver

***Overview of the Intelligent Water Project (IWP) Program***

An overview of the scope and goals of the Intelligent Water Project will be given to provide a context for subsequent presentations by students which summarize individual facets of the larger program. (9)

**Celina Nissley**, Jessica Visneski, Lydia Young, Amy Porto\*

***Messiah College students living on campus and taking a multivitamin need a multivitamin to achieve recommended intakes of calcium, magnesium, iron, vitamin D, folate, potassium, and zinc as evidenced by analysis of dietary intake***

Over the past decade, the use of dietary supplements among Americans has increased. The purpose of this study was to determine whether or not Messiah College students taking a multivitamin actually need a multivitamin. Twenty-two students [(n=3 males) (n=19) females] participated in this study (age=20+/-2). During an education session regarding how to properly complete a three-day food record, subjects reported multivitamin information, height, weight, and physical activity level. Using Food Processor, 10.11.0, researchers analyzed the nutrient intake of seven specified nutrients: calcium, magnesium, folate, vitamin D, iron, zinc and potassium. The percentage of participants (n=22) that met the recommended daily allowance (RDA) or adequate intake (AI) through diet alone was 27.3% for calcium, 4.5% for magnesium, 36.4% for iron, 4.5% for vitamin D, 13.6% for folate, 0% for potassium and 18.2% for zinc. The

percentage of RDA being met through diet and multivitamin combined was 50% (n=20) for calcium, 5.9% (n=17) for magnesium, 76.9% (n=13) for iron, 100% (n=21) for vitamin D, 93.8% (n=13) for folate, 0% (n=2) for potassium, and 95.2% (n=21) for zinc. The only nutrient group that exceeded the upper limit through diet and multivitamin combined was folate at 6.3% (n=16). As evidenced by our analysis, Messiah College students living on campus and taking a multivitamin need the multivitamin to meet the recommendations for calcium, vitamin D, iron, folate, magnesium, potassium and zinc. **(89)**

Cathy Phelan<sup>^</sup>, Karen Good<sup>^</sup>, Michelle Browning<sup>^</sup>, Amy Leshner<sup>^</sup>, Melanie Duffy<sup>^</sup>, Nicole Carran Young<sup>^</sup>, **Kimberly Benson, Katherine Crawford, Kelly Thompson, Kelly Urmston, Kathryn Stewart**, Louann Zinsmeister\*

#### ***Deep Venous Thrombosis Prophylaxis in Adult ICU Patients***

Currently, medical and surgical intensive care patients are receiving both mechanical prophylaxis, such as sequential compression devices (SCD's), and subcutaneous anticoagulation to prevent deep vein thrombosis (DVT). Surgical patients are known to be at a higher risk for developing a DVT. Medical intensive care patients may not need both methods in place to prevent DVT. There may be enough protection against DVT development by just using mechanical methods like SCD's. This treatment could prevent some of the negative side effects of subcutaneous anticoagulation. The purpose of this evidence based practice project was to determine if both SCD's and subcutaneous anticoagulation are needed or if just SCD's are enough to prevent DVT in medical intensive care patients. **(78)**

**Jacqueline Pusey**, Ciara Pigliacampi, Jennifer Thomson\*

#### ***Pharmaceutical manipulation of fear learning in an animal model of Post-traumatic Stress Disorder***

Post-traumatic stress disorder (PTSD) is a mental health condition that can develop after exposure to a severe traumatic event, such as war, a violent personal assault, a serious physical injury, or a natural disaster. PTSD is characterized by exaggerated feelings of fear, anxiety, danger, and helplessness, which can severely hinder daily functioning and consume a person's life. The current study investigates the pharmacotherapeutic use of opioid growth factor (OGF) as a preventative treatment for PTSD. In this experiment, a standard fear conditioning model a PTSD is used. Rats are exposed to a stressor (three foot shocks) and then reexposed to the shocking chamber without receiving any further shocks, where freezing behavior is measured. When presented with a stressful situation, rats exhibit freezing behavior. The amount of time spent freezing is correlated with the amount of stress the rat is under. Thus, freezing behavior in rats can be seen as a PTSD-like symptom, measuring their fear memory. The rats that were administered OGF showed an increase in freezing behavior 3-5 days after shocking, in comparison to the control group. This study suggests that OGF may actually increase adaptive fear in the standard fear conditioning model. Future studies will investigate the effect of OGF on maladaptive fear, the type of fear that is seen in patients with PTSD. **(90)**

**Benjamin Richter, Lukas Murrill, Aaron Black, Joel Zeigler**

***Kenya Mobile Medical Clinic***

Proper medical care is not readily available to many people who live in remote areas of Kenya. Working with Dala Development, the Mobile Medical Clinic project aims to equip a trailer as a mobile clinic to provide medical examinations and screenings to the people of Western Kenya where healthcare services are inaccessible. The project began in the Fall of 2013 and the team is currently developing a suspension system and finalizing the design parameters of the trailer to be able to efficiently use the space as a clinic and safely carry equipment on unimproved roads. (99)

**Wesley Robertson, Anne Reeve\***

***Investigating an alternate synthesis pathway for aspernigrin A***

Aspernigrin A is a secondary metabolite obtained from the fungus *Aspergillus niger* found on the Mediterranean sea sponge *Axinella damicornus*. This compound has been seen to exhibit inhibitory properties on the growth of the human colon cancer cell line SW1116, as well as xanthine oxidase, making it a potential drug candidate. Several synthetic schemes have been proposed for the synthesis of aspernigrin A involving the bromination of a methyl group to activate the position for a cross-coupling reaction to join a phenyl group to the more substituted ring of aspernigrin A. One such scheme involves the bromination of 6-methyl-1,4-dihydro-4-oxopyridine-3-carboxylic acid, which is synthesized in two steps from 4-hydroxy-6-methyl-2-pyrone. The first step of this scheme is the reaction of to form 3-(dimethylaminomethylene)-4-oxo-6-methyl-2-pyrone and has been successfully completed. The second step converts this product to 6-methyl-1,4-dihydro-4-oxopyridine-3-carboxylic acid, and has also been successful. Bromination conditions are currently being explored to prepare the intermediate for the cross-coupling reaction which may yield the desired compound, aspernigrin A. (40)

**Babette Rudick<sup>^</sup>, Lydia Johnson<sup>^</sup>, Dawn Hippensteel<sup>^</sup>, Deb Heisey<sup>^</sup>, Jaleesa Andrade<sup>^</sup>, Cathy Druckenmiller<sup>^</sup>, Kimberly Fowler<sup>^</sup>, Kathryn Shradley<sup>^</sup>, Kate Sobolewski, Sara Shade, Joanna Frederick, Kaitlyn Hoover, Abigail Wade, Louann Zinsmeister\***

***The Effects of Using A Screening Tool on Medication Adherence***

**Background:** Lack of adherence to medications within the patient population is very prevalent and is of concern to clinicians, healthcare systems, and other stakeholders. Medication adherence has been found to be associated with frequent readmissions, adverse outcomes, and higher costs of care. Patients with cardiovascular conditions often must adhere to a lifelong therapeutic medication regimen in order to obtain optimal outcomes therefore, constituting non-adherence to cardiac medications a major concern. In routine clinical practice, measurement of patient medication adherence and implementation of interventions to improve patient adherence to medication regimens is rare. **Aim:** The purpose of this evidence based practice project was to determine whether the use of a medication adherence screening tool prior to discharge affected the readmission rates of patients. Knowledge gained from the research could guide future medication adherence interventions and practice. **Findings:** A review of literature found specific barriers to medication adherence as well as patient reasons



for non-adherence to medications. Available medication adherence tools that were developed through psychometric studies were identified. (74)

**Christian Sagcal, Joshua Scholl, Brenton Yost, Randall Fish\***

***Smoke Free Indoor Cooking***

In a recent study, it was found that nearly 2 billion people worldwide use open cook fires in an indoor environment for cooking food and boiling water. The wood and leaves used to fuel these cook fires generate harmful byproducts which when unvented, cause disease and nearly 1.5 million deaths annually. This poster will present the work of the Thermoelectric Generator project within the Energy group whose mission is to develop a viable way for people in developing communities without access to electric power to reduce health risks by removing the smoke from their homes caused by indoor cooking. (95)

**Carl Satterberg, Randall Fish\*, Matt Walsh^\*, Brian Swartz\*, Tom Austin^\***

***Automating the Sharing of Limited Solar Power***

Missionaries, NGOs, and communities in remote locations do not have the luxury of unlimited energy availability that we often take for granted in the United States. Even when they have solar electric systems, the energy is limited and has to be used wisely. This talk is about a solution to this problem: an electricity meter that allows communities to allocate and share the electricity available to them while educating the users about better energy usage habits. (52)

**Jilean Schutz, Erik Listor, Chris Scheib, Brian Swartz\***

***The Macha Oxygen Concentrator Project: Prolonging medical device lifespans in a rural care facility***

The Macha Oxygen Concentrator project team works in conjunction with the Macha Mission Hospital in Zambia, Africa to provide engineering support for respiratory devices. They are currently engaged in troubleshooting early failures experienced with the hospital's oxygen concentrators, devices which replace conventional tanked oxygen for patients with respiratory issues. These devices take ambient air in and separate the oxygen from the other gases in the air via a material called zeolite. The team has determined that this material can become contaminated by high humidity and dust, both of which are prevalent in the environment at Macha. They have been focusing their efforts on designing an alternate intake filter for the concentrators that can adequately reduce the amount of humidity and dust the zeolite is exposed to. The team has also provided training to the maintenance staff at Macha in May of 2013 to evaluate an initial filter prototype and has plans to send another team in January of 2015. (100)

**Seth Sharber, Anne Reeve\***

***Toward the Synthesis of Aspernigrin A Precursor 6-Benzyl-4-hydroxypyran-2-one: Optimization and Cross-Coupling Strategies***

Aspernigrin A is a cytotoxic substituted pyridone natural product produced by an *Aspergillus niger* strain harbored in the Mediterranean sea sponge *Axinella damicornis* and by the endophyte *Cladosporidium herbarum* obtained from *Cynodon dactylon* (crabgrass) tissue. The synthesis of the natural product and structural analogs was undertaken in order to study the

structure-activity profile of aspernigrin A and a series of related compounds against human colon cancer cell lines. Conversion of the 6-methyl-4-hydroxy-2-pyrone analog to 6-methyl-3-carboxy-4-pyridone was previously accomplished in good overall yield using mild reaction conditions and safe reagents (dimethylformamide dimethylacetal followed by methanolic ammonia.) Several approaches to the 6-benzyl-4-hydroxy-2-pyrone needed for aspernigrin A synthesis were undertaken with a varying degree of success. For the target pyrone construction, bromination at the 6-methyl position provides a key opportunity for linking the benzyl group to the pyrone. The most promising approach involves oxidizing the 6-methyl group of 6-methyl-4-hydroxy-2-pyrone to the corresponding aldehyde, reducing to the alcohol, and conversion of the alcohol to a bromide, in preparation for by Pd-catalyzed Stille cross coupling with tributylphenyltin. **(41)**

**Evan Shirey, John Harms\***

***Development of a murine pancreatic cancer model for testing immunotherapy strategies against CCK-BR and characterization of monoclonal antibodies against the receptor***

Pancreatic cancer is one of the most devastating forms of cancer due to its unusual aggressiveness and lack of early warning symptoms. Survival rates remain very low. It has been established that both the cholecystokinin-B receptor (CCK-BR) and its cancer-associated splice variant, CCK-CR, play a major role in the growth and proliferation of pancreatic cancers. To develop immunotherapy strategies targeting these receptors, we have sought to (1) develop a model for studying the effects of CCK-BR and CCK-CR in immunocompetent mice and (2) develop a monoclonal antibody against CCK-BR. Our lab previously engineered PANC-02 murine pancreatic cancer cells expressing human CCK-BR or CCK-CR. In this study, receptor expression in 82% of the clonal lines was confirmed by real-time RT-PCR. The clonal lines with the highest expression were selected for protein level quantification by immunohistochemistry. This model is currently being utilized to study immune-based methods of targeting the receptor. Towards the development of a monoclonal antibody against the receptor, four hybridoma candidates were previously shown to have reactivity toward a CCK-BR epitope. Here we report that three are capable of detecting the full length receptor in intact cells overexpressing the receptor. Two were selected for high-titer production and further characterization. Production has been completed for one of the candidates and remains ongoing for the second. These antibodies could enhance our ability to effectively study CCK-BR and may be useful in targeting the receptor in clinical treatment. Studies using these antibodies to quantify receptor protein expression in the PANC-02 transfectants are ongoing. **(44)**

**Kristin Sicher, Brennan Neal, Erik Lindquist\*, Michael Shin\***

***Presence/Prevalence and Positive Controls: Assessment of the Presence and Prevalence of *Batrachochytrium dendrobatidis* Among Caudatan Species in Central Pennsylvania Woodland Vernal Pools and Testing of Broad Amphibian Positive Control Primers for qPCR.***

*Bd*, a virulent chytrid fungus responsible for dramatic amphibian decline, has been detected in the northwestern and southeastern regions of Pennsylvania. However, little environmental *Bd* testing has been performed in central Pennsylvania, particularly in the unique and specious environments of woodland vernal pools. My study included sampling in five vernal pools over a period of two months during salamander breeding periods. Three

caudatan species, were sampled over a range of water and air temperatures to detect *Bd* presence as well as any correlation with environmental factors, specifically air and water temperature. Two of the three species *Ambystoma maculatum* and *Ambystoma jeffersonianum*, reported measurable *Bd* zoospore loads, albeit at very low quantities. Despite confirmed *Bd* presence, positive control testing revealed a need for a more general positive control primer as well as a more thorough swabbing procedure to ensure amphibian and *Bd* DNA harvest. Furthermore, there were no significant trends between environmental data and zoospore load. My exploration of a broad-spectrum positive control stems from current lack of amphibian DNA control primers used in *Bd* environmental and organismal testing. Primers amplifying amphibian DNA are necessary components of experimental design to rule out the possibility of false positive and negative results. In the midst of the global *Bd* epidemic, accurate results in population sampling are imperative. Five previously published primer combinations were tested for broad amphibian DNA fragment amplification in PCR. DNA from five Pennsylvanian amphibian species were used to represent a diverse sampling of amphibian taxonomy. Reactions were conducted under standard, published conditions and run on EtBr electrophoresis gels to confirm DNA amplification. (56)

**Michael Skolka**, Tanja Babic<sup>^</sup>, R. Alberto Travaglini<sup>^\*</sup>

***Intraductal Lidocaine Attenuates the Severity of Post ERCP Acute Pancreatitis***

Endoscopic retrograde cholangiopancreatography (ERCP) is a procedure used to identify biliary duct obstruction. 5-10% of patients, however, develop acute pancreatitis (AP). AP is a severe disorder of the exocrine pancreas marked by acinar inflammation and a rise in plasma amylase levels. Pancreatic secretions, including exocrine secretions (PES) are modulated by the vagus nerve, and microinjections of group II mGluR agonist APDC in the dorsal motor nucleus of the vagus (DMV) increase PES. In AP, however, DMV neurons are less sensitive to APDC. The aim was to develop a rat model of post ERCP-pancreatitis to test the hypothesis that intraductal application of lidocaine prior to ERCP attenuates AP. The femoral vein and pancreatic duct of male SD rats were cannulated to collect whole blood samples and PES (at 10 minutes intervals: 30min baseline, treatment, and 90min post-treatment), respectively. Similar to what occurs in ERCP, mechanical stimulation of the papilla of Vater increased plasma amylase and reduced the PES response to DMV microinjections of APDC (100pmoles/60nl; N=6). Injections of 200µL of lidocaine (N=5) and/or contrast dye (N=3, 3) into the pancreatic duct prior to papilla stimulation prevented the rise in plasma amylase and restored the APDC-induced increase in PES. Intraductal lidocaine prior to ERCP may be a useful prophylactic treatment to lower the incidence of post-ERCP AP.

Group	Amylase (U/L)	Percent Change (%) PES to APDC
Sham (n=3)	52.9 ± 16.7	33.4 ± 7.7
Papilla stimulation (n=6)	1012.2 ± 353.5	8.6 ± 6.4
Lidocaine (n=3)	263.0 ± 124.4	38.8 ± 7.7
Papilla stim. + Lidocaine (n=5)	235.1 ± 33.2	38.9 ± 8.1
Contrast dye (n=3)	155.6 ± 65.4	33.9 ± 2.9
Contrast dye + Lidocaine (n=3)	148.2 ± 46.4	27.9 ± 3.0

(64)

**Logan Skovron, Niklas Hellgren\***

***A Triple Pendulum Model of the Golf Swing***

In our research we wanted to describe a golf swing using a triple-pendulum model. Once we had a system of differential equations of motion to accurately model a real golf swing, we set out to create a computer model to iteratively solve this system of equations to model the entire downswing. One goal was to tweak initial conditions such as the torques to find the optimum sequence to maximize club head speed at impact. **(19)**

**Noah Smith, Kevin Ogden, Drew Mininger, H. Scott Kieffer\*, Jodie Haak\***

***The Caffeine Dose Response in Habitual Caffeine Consumers Performing a Maximal Anaerobic Test***

Caffeine is the most popular legal substance used by athletes to enhance performance. The ideal dosage of caffeine that will maximize its ergogenic effects is presently unknown. The purpose of this study was to evaluate the dose response of caffeine in habitual users performing a maximal anaerobic exercise protocol using the 90-s Wingate Test (WAnT90). Nine (3 females, 6 males) anaerobically-conditioned subjects who were classified as habitual caffeine consumers (more than two servings of caffeine a day) volunteered for a randomized counterbalanced double-blind study. Subjects reported to the lab to ingest either caffeine (3, 5, or 7mg/kg<sup>-1</sup>) or placebo and one h later completed a WAnT90 using a resistance of 0.05g/kg<sup>-1</sup>. In addition to peak power (PP), total power (TP), and total power decline (PDT), power and power decline were calculated for each 30-s interval of the test (TP30, TP60, TP90, PD30, PD60, PD90). Rate of perceived (RPE) was recorded at the end of each test. One-way analysis of variance (ANOVA) was conducted to compare dosage of caffeine and placebo treatment for each variable. Significance was set at p<0.05. Results will be presented in presentation format at the symposium. **(34)**

**Tessa Smith, Jennifer Myer, Meghan Brady, Amy Porto\***

***Sleep Duration has Little Effect on Caloric and Macronutrient Intake in Messiah College Students***

Lack of sleep has been suggested to affect energy balance and result in weight gain due to the tendency for increased hunger following a shorter nights' sleep. Research has attempted to discover correlations between sleep duration and subsequent diet intake, yet none of these studies have addressed a college student population. The purpose of this study was to observe college sleep patterns and the subsequent effect on diet. Sixteen Messiah College students (n =3 men, n=13 women) age 19.56 ±1.75 recorded four consecutive days of food, sleep, and activity data. Diet records were analyzed for caloric and macronutrient content using Food Processor SQL (Version 14). After dividing data into short (sleep<7hrs/24 hours) and long (sleep≥7hrs/24 hours) sleep duration, researchers used Minitab Statistical Software to perform a multivariable 2-way ANOVA test. No significant associations were found between sleep duration and actual vs. recommended intake of calories, protein, and carbohydrate (p=0.110). Due to lack of statistical significance in these variables, sleep duration was not found to affect subsequent diet intake in the college population. Failure to find a relationship between sleep duration and diet may have been caused by the low number of subjects or an inaccurate

estimation of portion sizes/inaccurate food recording by subjects. Future studies exploring the relationship between sleep and diet intake in the college population should include a larger number of subjects. **(88)**

**Michael Song**, Hannah Tims\*

*Expression, Purification, and Activity of sHSP 17.0 and 17.8 from *Zea mays**

Small heat shock proteins (sHsps) are a type of protein that inhibit the denaturing of other proteins by slowing or stopping complete denaturation of a target protein. Further understanding of the abilities of sHsps could be useful in understanding degenerative diseases like Alzheimer's or Parkinson's which have been shown to have ineffective sHsps. Aggregation assays utilizing two different types of proteins were designed to analyze the effectiveness of sHsps in inhibiting protein aggregation under various stressful conditions. Citrate synthase was denatured using heat, while lysozyme was denatured reducing the stabilizing disulfide bond chemical with dithiothreitol (DTT). Reproducible assays were developed in order to test the functions of sHsps by inhibition of protein aggregation. Once the aggregation assays were fairly replicable, sHsps were expressed and purified. Expression and purification was analyzed using SDS PAGE analysis and UV/Vis spectrophotometry. Quantification of protein encountered difficulties as UV/Vis analysis revealed a high concentration of protein in the sample, yet Coomassie stained SDS showed no proteins present at all in the same samples. Further analysis is necessary in order to determine the cause of protein disappearance on the SDS. However, current investigation is in the filters used to concentrate the proteins, as problems have been associated with these tubes in multiple different experiments as well as this project. **(63)**

**Nicholas Sooy**, Gene Chase\*

*My Philosophy of Mathematics*

What do we desire from a theory of mathematics? Until our desire is satisfied we will continue to search for a theory. Most contemporary philosophies of mathematics assume that there is a consistent theory of mathematics to be found. But it is possible to desire impossible things. Thus I hope to suggest ways in which our desire for a consistent theory of mathematics might be impossible. **(24)**

**Stephne Spenceley**, Lawrence Mylin\*

***Construction of a Bacterial Fusion Protein Expression System for Presentation of Simian Virus 40 Large Tumor Antigen MHC Class II-Restricted Epitopes to CD4+ T Lymphocytes***

The power of the immune system to fight cancer has provided a great platform for the emerging field of immunotherapy research. The proper cell-mediated immune response to proteins from foreign microorganisms or tumors requires the participation of both CD8+ and CD4+ T cells. CD8+ cytotoxic T lymphocytes (CTL) kill infected host cells, while CD4+ helper T lymphocytes regulate immune responses. The processing and presentation of antigens and the successive efficiency of the T cell response have been the focal point in recent studies. In the past, the response of CD8+ T cells to simian virus 40 large tumor antigen (SV40 T ag) was investigated in our laboratory, but our focus has now shifted to include CD4+ T cells. Recently, three MHC Class II-restricted epitopes were identified within the SV40 T ag. The goal of this study was to construct a bacterial fusion protein expression system to allow for the

investigation of epitope structure and processing. Dendritic cells pulsed with bacterial cells expressing individual fusion proteins would be combined with epitope-specific CD4+ T lymphocyte hybridoma clones. Efficient hybridoma stimulation would indicate efficient processing of an appropriate epitope sequence. Screening of expression vectors for insertion of epitope coding sequences was performed through restriction analysis and confirmed by DNA sequence analysis. Epitope-GFP fusion proteins were produced for all three epitopes and tested in hybridoma assays. Only one, the "381-GFP" fusion, appeared to stimulate the corresponding hybridoma. Curiously, this fusion appeared to be the least abundant in induced bacterial cells. (66)

**Zachariah Steeves, Donald Pratt\***

### ***Solar Commuter Vehicle Drive System Redesign***

Last year, problems were discovered between the 1997 Solar Car motor and the 1999 Solar Car motor controller. The team decided to use the '99 motor to alleviate these interface problems. There are many advantages associated with the '99 motor, but first, obstacles had to be overcome. The entire rear axle of the Solar Commuter Vehicle (SCV) needed to be redesigned to accommodate the new motor. The '99 motor has different mounting requirements than its predecessor. This rear axle redesign has been the major focus of the SCV group this academic year. The entire process, including initial design, Finite Element Modeling (FEM) analysis, prototyping, and machining, has been performed in-house by the SCV group. (2)

**Michael Stephan, John Harms\***

### ***Quantification of CCK mRNA Down-Regulation in Pancreatic Cancer Cells and Cloning the Human Gastrin Gene***

Pancreatic Cancer is both aggressive and devastating with ineffective treatment methods. Previous research has implicated two sister hormones in the proliferation of pancreatic cancer: gastrin and cholecystokinin (CCK). To further understand the role of each hormone in tumor growth, we pursued two independent aims: down-regulation of CCK and up-regulation of gastrin. First, we hypothesized down-regulation of CCK in cancer cells with high CCK levels will inhibit their tumor growth. We previously transfected PANC-1 cells with shRNA, targeting CCK mRNA at two sites, -6 bp and 141 bp. Expression analysis by real-time RT-PCR revealed significant down-regulation in the shCCK 141 clones, while shCCK -6 did not significantly suppress expression compared to parental and control cells. Despite the success of shCCK 141, CCK mRNA levels were highly variable across all clones. We further demonstrated a significant variability – and at times very low CCK expression – in the parental PANC-1 line, compromising reproducibility of future work in this aim. In our second aim, we hypothesize that gastrin up-regulation in non-tumorigenic pancreatic ductal cells will confer tumorigenicity. To achieve this, it was essential to clone the full-length genomic sequence of gastrin. PCR primers, optimized using a cDNA gastrin sequence, were utilized to amplify the complete gene (including introns; ~3750 bp) from a human genomic DNA sample by high-fidelity PCR. The amplified gastrin gene was then purified and ligated into a cloning vector. Automated DNA sequencing and sub-cloning into a vector permitting human expression are ongoing. (46)

**Varit Taifayongvichit, Samuel Wilcock\***

***Correlation of Ki-67 labeling index and time to progression in brain tumors***

The Ki-67 index is a cellular marker for proliferation. It is an excellent marker in determining the growth fraction of a given cell population. Multiple studies have shown the Ki-67 index to be significantly correlated to the tumor's malignancy. However, there have not been many studies that examine the relationship between the Ki-67 index and time to progression or recurrence of brain tumors after surgery. This study aims to examine if a correlation exists between the Ki-67 index at surgery and time to progression of Grade II (Diffuse astrocytoma) to a more aggressive tumor (Grade III Anaplastic astrocytoma or Grade IV Glioblastoma multiforme). We will additionally examine time to recurrence of Grade IV Glioblastoma multiforme. We received access to a brain tumor database provided by the Lowy Cancer Centre in Sydney, Australia. Two cohorts were categorized – the first cohort consisted of patients who first presented with lower-grade lesions and progressed to higher-grade lesions, the second cohort only consisted of patients with high-grade lesion recurrences with no prior lower-grade tumor. We have examined 455 patient charts and have categorized them in their prospective cohorts. Our hypothesis is Ki-67 index will be negatively correlated with time to progression or recurrence. We expect lower proliferation rates to suggest longer time until the tumors come back. **(37)**

**Meaghan Tansey**

***iTunesU: A New Wave of Math Education***

In the past couple of years, online education has risen in popularity. This is evidenced by iTunesU which provides podcasts and videos of high school curricula posted by various college professors, including those at HACC. This presentation looks at the feedback from an online education as provided by these instructors and looks at the effect this resource and other online education tools can have in the high school math classroom. **(20)**

**Nicholas Tay, Alison Noble\***

***Fabricating a Nanoscale Electrode Pattern on Zinc Selenide for Studies of Long-chain Alkanethiol Monolayer Influence on Liquid Crystal Orientation***

A nanoscale interdigitated electrode array (IDEA) was successfully fabricated on a zinc selenide (ZnSe) substrate using a positive resist lithography process. A ZnSe surface cleaning method was developed in the process of establishing a reproducible technique for IDEA. A bilayer resist consisting of the lift-off-resist LOR5A and the photoactive resist SPR-3012 was utilized to establish an IDEA pattern with high structural integrity. The patterned ZnSe was used for electrooptical studies of 4-cyano-4'-pentylbiphenyl (5CB) reorientation. Polarized microscopy and transmission FT-IR studies were performed to confirm the efficacy of our electrodes and to elucidate the Fréedericksz transitions induced by the application of static voltages to the electrooptical cell. A new electrooptical cell set-up was established to enable polarized microscopy studies while maintaining compatibility with the previous set-up used for IR studies. The difference spectra obtained from FT-IR studies suggest that the initial equilibrium state of the 5CB molecules (bulk) has its optical axis tilted off the surface normal. When FT-IR and polarized microscopy studies are evaluated holistically, a maximal transmission range is observed with the bulk 5CB orientation aligned parallel to the electrical field. This study thus

shows an effective IDEA fabrication procedure and its useful application in the study of confined nanoscale liquid crystal orientation. (38)

**Jessica Tomlin, Emma Vautour, David Foster\***

***Large-scale Rain Garden Design: A case study for standards and assessment***

In recent years, there has been a growing concern about the how to manage increased volume of stormwater runoff and its potentially harmful effects in local waterways. Rain gardens have emerged as a noninvasive, inexpensive way of lowering the negative impacts of urban stormwater runoff and are considered a stormwater best management practice (BMP) by the U.S. Environmental Protection Agency. However, research on this topic is limited and current rain gardens are restricted to home-owner scales. The primary objective of this study was to implement a large-scale rain garden to serve as the primary means of stormwater management for all runoff generated within a small housing development located just off the Messiah College campus in Grantham, PA Cumberland Co. The initial design developed in this portion of the study is a proposed hypothesis for the best implementation standards based on site-specific conditions, which will then be evaluated and readjusted until a successful model is found. This rain garden, along with other local rain gardens, will be evaluated for effectiveness and used to formulate a set of design criteria including overall design specifications and vegetation selection for large-scale rain gardens. The results of this research will be used in a future study to create a comprehensive guide to large-scale rain garden design. (59)

**Katlyn Tyrpak, John Harms\***

***Determining the Role of a Silent, Intronic Single Nucleotide Polymorphism (SNP) in Pancreatic Cancer***

Pancreatic cancer is the fourth most common cancer and has a 5 year survival rate of only 6%. Towards the development of a genetic screen for pancreatic cancer risk, our lab researches the role a silent single nucleotide polymorphism (SNP) in pancreatic cancer. The SNP (C to A) occurs in intron 4 of the gastrin hormone receptor CCK-BR and is correlated with increased severity of pancreatic cancer. Gastrin and CCK-BR are normally involved in regulation of digestion. However, in pancreatic cancer, elevated gastrin levels have been linked to increased cell proliferation. A splice variant of CCK-BR (CCK-CR) novel to cancer retains the fourth intron. With a higher affinity for gastrin and increased signaling, we believe CCK-CR may be correlated with increased cancer aggressiveness. We hypothesize that the polymorphism causes the retention of intron 4 in CCK-CR and thereby contributes to increased cancer severity. In order to test this, both polymorphisms first must be genetically engineered into a plasmid. Second, these plasmids must be transfected into mammalian cells and tested for their ability to generate the splice variant (CCK-CR) and confer increased proliferation. In this study we report the successful mutation of CCK-CR SNP(C) to CCK-CR SNP(A). Using PCR-based mutagenesis and PCR fusion, the polymorphism was introduced and the resulting PCR product was sub-cloned into the wild-type plasmid. Successful mutagenesis was confirmed through automated DNA sequencing. In further research, each SNP-containing plasmid will be transfected into mammalian cells and screened for expression of CCK-BR and CCK-CR. (45)



Glenn VanSickle, Donald Pratt\*

***Solar Commuter Vehicle Motor Integration Redesign***

The Solar Commuter Vehicle (SCV) team discovered compatibility problems between the 1997 Solar Car motor and the 1999 Solar Car motor controller and therefore decided to substitute the 1999 motor for the presently applied 1997 motor. Due to geometric differences between the two motors, the motor mounts and axle required redesign. The older motor allowed the axle to pass completely through its center while the replacement motor was designed to have an axle on only one side. This difference mandated the design of a load-bearing motor mount and a single-sided axle system. The design, analysis, and fabrication of the motor and axle mounts were the group's major points of focus this academic year. (96)

Janelle Veazey, Richard Schaeffer\*, Michael Shin\*

***Quantification of Histidine from Plant Extracts using High Performance Liquid Chromatography and Electrochemistry***

Soil contamination by heavy metals, such as nickel, is a problem in many areas. However, some plants exhibit the ability to accumulate high levels of nickel into their biomass, which can be used to remove the metal from soil in a process known as phytoremediation. Current hyperaccumulating species grow too slowly for useful phytoremediation, leading to efforts to engineer rapidly growing transgenic phytoremediators. The common model organism *Arabidopsis thaliana* has proved useful for this work as it contains several of the accumulation-associated protein families present in natural hyperaccumulators. Previous studies have indicated a correlation between endogenous free histidine pools and hyperaccumulation. This study aims to investigate the relationship between histidine levels and *A. thaliana*'s ability to accumulate nickel, which necessitates the ability to accurately quantify levels of histidine within the plant. A protocol was developed to quantify histidine from plant extracts using high performance liquid chromatography (HPLC) and pre-column derivitization of amino acids with o-phthaldialdehyde/<sub>N</sub>-acetyl-L-cysteine (OPA-NAC). Initial histidine analysis proved linear over a wide concentration range (1 μM to 100 mM) and remained reliable in the presence of multiple amino acids with the use of standard addition. Initial efforts were also made to develop a protocol to quantify histidine using electrochemistry as this method offers the potential to very selectively quantify histidine, histidine complexed to nickel, and free nickel from the same plant extraction solution and so allow for a more informative analysis of the relationship between high histidine levels and nickel accumulation in plants. (33)

Janelle Veazey, Laura Ritenour, Sarah Robitaille, Elliot Rossomme, Holly Ross, Shaun Egolf, Bethany Bender, Jeff Erikson\*

***Microbiological Testing of Sawyer Products Hollow Fiber Membrane Water Filters***

Three Sawyer PointOne filters: *Mini Filter*, *Squeeze Bottle Filter* and a *Bucket Filter*, were tested in triplicate for their ability to remove three microorganisms: *Raoultella terrigena*, *Bacillus subtilis*, and *Micrococcus luteus* – using United States Environmental Protection Agency (USEPA) approved procedures. These three surrogate organisms for fecal coliform, *Cryptosporidium* and *Giardia* respectively, were added to test water to reach a 10<sup>7</sup> – 10<sup>8</sup> initial concentration. All of the three tested filters met the target reduction of 6 log units, or

99.9999% for all runs. All three Sawyer filters tested met the USEPA standard for bacteria filtration. **(84)**

**Greg Waidelich**

***Johannes Kepler, more than 3 laws***

This talk will focus on the work of Johannes Kepler and its influence on the thinking of his time and beyond. It will not only talk about his correct work and his three famous laws, but also of the flawed system that he originally imagined. **(21)**

**Caleb Wehrmann, Julie Fenton, Richard Schaeffer\***

***Characterization of Barium Phosphates by XRD and Molecular Modeling***

Compounds of Barium Chloroapatite, Hydroxylapatite, Iodoapatite, Bromoapatite, and Nabaphite were synthesized and characterized using a number of methods. Powder x-ray diffraction was used to determine the structure by matching the XRD patterns with ones in the ICDD database. Elemental analysis was performed with an anion exchange column and atomic absorption. In conjunction with elemental analysis, solubility studies were also performed to evaluate their physical properties for environmental applications. Molecular modeling was performed in Crystal Maker© to confirm the structure by generating theoretical XRD patterns. The presence of mixed phases was also explored in Crystal Maker©. Additional calculations were performed to find the unit cell parameters for the new phases created and to find their physical properties. **(43)**

**Daniel Wingert, Lauren Wilson, Lawrence Mylin\***

***Culturing Plasmodium falciparum in the Laboratory***

*P. falciparum* is one of the most dangerous and resilient parasites in the world today, accounting for thousands of deaths around the world. Despite its resilience *in vivo*, *P. falciparum* is challenging to grow in a laboratory setting, requiring human blood cells and very specific gas and temperature conditions. To facilitate research with *P. falciparum*, this study set up and maintained two cultures of laboratory strains of the parasite, and investigated the effectiveness of various culturing techniques. Differences between two known culturing techniques were investigated. The potential use of a candle jar apparatus to produce an atmosphere suitable for the culture of the parasite was shown to be inferior to equilibration with a compressed specialty gas mixture. In addition, differences in blood obtained from different donors were investigated, and the procedures for obtaining and separating serum and red blood cells were also tested. Finally, to prepare the project to be continued in a remote laboratory in rural Zambia, procedures for freezing and thawing red blood cells and serum from known donors were tested to demonstrate the feasibility of the research in rural areas where blood-borne diseases are prevalent. **(48)**

**Andrew Yau, Ben Sheeler, Matthew Musselman, Kevin Olchewsky, Brian Nejme\***

***Designing a Reporting and Analysis Engine for IWP***

As part of the IWP (Intelligent Water Project), our team was tasked with reporting, analytics and cloud infrastructure. In terms of reporting and analytics, we started by designing an event notifications management system to store data about various potential use cases — both

system generated and user generated about the status of a pump. With the backend setup, we began work on the end user layer (EUL). The EUL consisted of maps and charts which primarily revolved around Google Map and Chart API's. The map shows the status of the pumps based off our event notifications system and the graphs depict various measures and calculations to help identify patterns. In terms of the cloud, we researched available platforms, choose a provider, consulted with our provider on best practice setup design, and then implemented that design. **(11)**

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