

Spring 4-27-2012

9th Annual Symposium of School of Science, Engineering and Health

Messiah College

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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



PROGRAM & ABSTRACTS

Frey Hall - Jordan Science Center - Kline Hall of Science
Friday, April 27, 2012



(Rear of front cover)

Table of Contents

| | |
|---|----|
| The Symposium and How to Use This Booklet | 2 |
| Schedule at a Glance: Oral Presentations | 3 |
| Schedule at a Glance: Poster Presentations | 4 |
| Oral Presentations I: Engineering (Frey 110; 9:00 – 11:35 AM) | 5 |
| Oral Presentations II: Mathematics (Frey 343; 9:00 – 11:35 AM) | 5 |
| Oral Presentations III: Information Sciences (Frey 349; 9:00 – 11:35 AM) | 6 |
| Oral Presentations IV: Engineering (Frey 110; 1:10 – 6:00 PM) | 7 |
| Oral Presentations V: International Service; Exercise Science (Frey 150; 1:10 – 3:00 PM) | 8 |
| Oral Presentations VI: Nutrition & Dietetics; Biological Sciences (Kline 120; 1:10 – 3:00 PM) | 9 |
| Oral Presentations VII: Biological Sciences (Hollinger Lounge; 1:10 – 3:00 PM) | 10 |
| Oral Presentations VIII: Chemistry & Biochemistry (Jordan 170; 1:10 – 3:00 PM) | 10 |
| Oral Presentations IX: International Service; Exercise Science (Frey 150; 4:00 – 5:00 PM) | 11 |
| Oral Presentations X: Biological Sciences (Kline 120; 4:00 – 5:20 PM) | 12 |
| Oral Presentations XI: Biological Sciences (Hollinger Lounge; 4:00 – 5:20 PM) | 13 |
| Oral Presentations XII: Biological Sciences; Chemistry (Jordan 170; 4:00 – 5:20 PM) | 13 |
| Poster Session I: Information & Mathematical Sciences (Frey, 3 rd Floor Hall; 10:15 – 10:35 AM)  ... | 14 |
| Poster Session II: Biological Sciences; Chemistry & Biochemistry; Nursing; Nutrition & Dietetics (Jordan Lobby, Jordan 159, Jordan 163; 3:00 – 4:00 PM)  | 14 |
| Poster Session III: Biological Sciences; Chemistry & Biochemistry (Jordan Lobby, 5:20 - 5:40 PM)  | 14 |
| The Collaboratory for Strategic Partnerships and Applied Research  | 17 |
| Engineering Mentors: Messiah College Faculty and External | 18 |
| Messiah College Faculty Mentors (School of Science, Engineering and Health) | 19 |
| Mentors: Nursing Professionals from Holy Spirit Hospital and PinnacleHealth | 20 |
| Acknowledgements: Financial & Material Support; External Science Collaborators | 21 |
| Abstracts | 22 |
| Alphabetical Listing of Authors with Presentation Numbers | 58 |

The Symposium and How to Use This Booklet...

Welcome to the 9th Annual Symposium of the School of Science, Engineering and Health!

This symposium continues a strong tradition of annual events designed to showcase student and faculty innovation, creativity and productivity in academic departments that were formerly housed in two different schools within the college. This will be the second year in which we are holding the event as the School of Science, Engineering and Health. We have tried to maintain favorite customs while blending to establish new traditions. We look forward to incorporating improvements into future symposia.

This Program and Abstract booklet provides you with 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 on the next page 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 and Poster presentations are grouped into blocks designated Oral Presentations I – XII, and Poster Sessions I - III. 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 the Schedule at a Glance. **Bold font** indicates the names of **presenting authors**. An Abstract for each presentation (Oral or Poster) appears on the pages that follow the Oral Session and Poster Session schedules. Abstracts are arranged in alphabetical order by the last name of the first author (see “Schedule at a Glance”); the presentation number appears 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 to which that individual contributed. 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 research or project mentor.

The “^” symbol indicates an off campus contributor

The “” symbol indicates that a project was affiliated with or supported by the Collaboratory for Strategic Partnerships and Applied Research.

The easel symbols (e.g.   ) contain numbers indicating that an oral presentation is accompanied by a poster in the respective Poster session (I, II or III).

I want to thank several individuals without whom I could not have organized the symposium or produced this booklet. Thanks to Scott Weaver (Information & Mathematical Sciences) and his students Brian Douglass and Jeremy Stuter for designing and providing assistance with the on-line Symposium Project Registration and Management system (SymPRM) that was used to collect and organize Title, Abstract and Author information for each project. Thanks also to the “brave” faculty members and students who used the SymPRM (some for the first time!). A special thanks to John Harms (Biological Sciences) for the cover art and additional helpful suggestions. Thanks to Lori Zimmerman for her wonderful support and helpful suggestions.

Sincerely, Larry Mylin, Symposium Coordinator (Biological Sciences)

Schedule at a Glance: Oral Presentations

Locations, Numbers, Times & Student Names

9th Annual Symposium April 27, 2012

Frey Hall

Kline & Jordan Buildings

| | | | | | | |
|------|------|------|------|------|------------------|------|
| F110 | F343 | F349 | F150 | K120 | Hollinger Lounge | J170 |
|------|------|------|------|------|------------------|------|

| | | | | | | |
|--------------------|--------------------|----------------------------|--|--|--|--|
| Engineering | Mathematics | Information Science | Biological Sciences.; Chemistry & Biochemistry; Exercise Science; Nursing; Nutrition & Dietetics; International Service | | | |
|--------------------|--------------------|----------------------------|--|--|--|--|

| | | | | | | |
|--------------|---|--|---|-----------------------|--|--|
| 9:00 | Welcome by President Kim Phipps (Webcast to all presentation venues) | Oral Pres. I | Oral Pres. II | Oral Pres. III | | |
| 9:15 | 1 Gerhart, Houck | 8 Bigelow | 14 Sheeler, Moyer, Yau, Kennedy, Young | | | |
| 9:35 | 2 Hollenbach, Earl | 9 Ausel | 15 Douglass, Stuter, Strausbaugh, Johnson | | | |
| 9:55 | 3 Smith, Sizemore | 10 Woolford | 16 Hertfelder, Allen, Guscick, et al. ** | | | |
| 10:15 | 4 Kauffman, Yoder | Poster Session I: Information & Mathematical Sciences | | | | |
| 10:35 | 5 Adomat, Mino | 11 Martin | 17 Janczyk, Ribbens, Yoder | | | |
| 10:55 | 6 Mylin | 12 Hess | 18 Faus, Meckley, Phillips | | | |
| 11:15 | 7 Sletta, Jarvis | 13 Ehrenzeller | 19 Tajari | | | |
| 11:45 | Lunch | | | | | |

| | | | | | |
|-------------|---|--------------------------------------|-----------------------------------|-----------------------|------------------------|
| 1:10 | Welcome by President Kim Phipps (Webcast to all presentation venues) | Oral Pres. V | Oral Pres. VI | Oral Pres. VII | Oral Pres. VIII |
| 1:20 | 20 Basom, Breighner, Francis | 34 Beiler, Stuter, Silvis, Musselman | 39 Gray | 44 Lister | 49 Bowlin |
| 1:40 | 21 Hornberger, Wilker, Wolgemuth | 35 Kirkpatrick, Frey | 40 Myers | 45 McBeth | 50 Ferguson |
| 2:00 | 22 Finn | 36 Hare (Faculty) | 41 Abel, Gray, Neiswender, Sender | 46 Foster | 51 McCullum |
| 2:20 | 23 Sorrell, Watkins, Hunsburger, Fickett | 37 Veacock | 42 Perta | 47 Nickerson | 52 Steele |
| 2:40 | 24 Stevenson | 38 Lister, Miller, Phipps, Voran | 43 Sell | 48 Basch | 53 Fenton |

| | | | | | |
|-------------|------------------------------|----------------------|----------------------|----------------------|-----------------------|
| 3:00 | 25 Frederick, Kimpel, Patton | Oral Pres. IX | Oral Pres. X | Oral Pres. XI | Oral Pres. XII |
| 3:20 | 26 Schroeder, Hoaglin | 54 Marlowe, Flanick | 57 Hayes, Kreider | 61 Tay | 65 Bischof |
| 3:40 | 27 Sisson | 55 Larson, Steiner | 58 Miller, Hallowell | 62 Brantner | 66 Yang, Listor |
| 4:00 | 28 Finney | 56 Steiner, Larson | 59 Hallowell, Miller | 63 Koh | 67 Hepler |
| 4:20 | 29 Hahn | | 60 Himmelberger | 64 Okon | 68 Tagore |
| 4:40 | 30 Lee, Herndon | | | | |
| 5:00 | 31 Martinez | | | | |
| 5:20 | 32 Smith | | | | |
| 5:40 | 33 Manieri, Allen, Martin | | | | |

| | | | | | |
|--|--|--|--|--|--|
| Poster Session II (Jordan Lobby & J159, J163): Biological Sciences; Chemistry & Biochemistry; Evidence-Based Nursing Care; Exercise Science; Nutrition & Dietetics (3:00 - 4:00 PM) | | | | | |
| Poster Session III (Jordan Lobby & J159, 163): Biological Sciences; Chemistry & Biochemistry (5:20 - 5:40 PM) | | | | | |
| Reception for Student presenters, Parents, Mentors (Hors d'oeuvres; Oakes Museum) | | | | | |

16 ** ... Byler, Hoover, Groff, deGruchy, Beiler, Musselman, Silvis, Herman

Schedule at a Glance: Poster Presentations

Locations, Numbers, Times & Student Names

9th Annual Symposium April 27, 2012

Frey Building, 3rd Floor Hallway

Poster Session I (10:15 - 10:35 AM)

Information & Mathematical Sciences

- 34 Austin Beiler, Jeremy Stuter, Kara Silvis, Matthew Musselman
- 35 Pamela Kirkpatrick, Kimberly Frey
- 36 Angela Hare (Faculty)
- 69 (D. Scott Weaver), Michael Adams, Zachary Felix, Anthony Spargo

Jordan Lobby, Jordan 159 & Jordan 163

Poster Session II Only (3:00 - 4:00 PM)

Evidence-Based Nursing Care

Conducted with Holy Spirit Hospital Collaborators

- 81 Victoria Fulford, Brooke Airey, Kelly Thomas
- 82 Sara Foor, Erica Heisey, Sarah Jones, Naomi Sappe, Anna Zook
- 83 Jordan Trout, Jessica Brown, Casey Hetrick, Kara Miller, Brianna Reed
- 84 Hannah Dotts, Ashley Arnold, Larisa Bazhan
- 85 Jaclyn Merkel, Shalisa Brubaker, Megan Clapp, Megan Craley, Audrey Hanselman, Katie Blosenski

Conducted with PinnacleHealth Collaborators

- 86 Kayla Bechtei, Rachel Obenschain, Emily Dincher
- 87 Emily Gonder, Jenaë Griffith, Sophia Mavronis, Michael Whitner
- 88 Katie Lisa, Jessica Morris, Sierra Stephens, Cammie Wilcox
- 89 Laura Kieliszewski, Erin Horst, Elizabeth Smith
- 90 Nichole Carran, Alyssa Groff, Danielle Johnson, Meredith Schorner, Emily Wenger
- 91 Rachel Coyle, Hannah Kurtz, Chelsey Kauffman, Chelsey Herzig, Stephanie Rausch
- 92 Kristi Cook, Shannon Sensi, Brianna Wilbur
- 93 Ruthanne Hepkins, Rebecca Rotzeli, Sarah Wagoner

Nutrition & Dietetics

- 41 Kate Abel, Amanda Gray, Cierra Neiswender, Rachel Sender
- 74 Pymie Calloway, Holly Harper, Kara Shifler
- 75 Gina Catalano, Laurn Clark, Catherine Joseph
- 76 Andrea Dean, Courtney Long, Nathan Myers, Ashley Sites
- 77 Sarah Bova, Cody Heagy, Sarah Painter
- 78 Amy Krug, Cecilia Kjellman, Rebekah Sabo
- 79 Gabrielle Alderfer, Safoura Azeem, Andrea Gamber, Elizabeth Hackman
- 80 Christine Blanke, Brenda Flaherty, Hilary Gillette, Abby Reed

Poster Sessions II & III (3:00 - 4:00; 5:20 - 5:40)

Biological Sciences

- 42 Julie Petra
- 43 Shannon Sell
- 44 Kristen Listor
- 45 Charles McBeth
- 46 Danika Foster
- 47 Paul Nickerson
- 48 Bianca Basch
- 57 Lindsey Hayes, Daniel Kreider
- 58 Elizabeth Miller, Benjamin Hollowell
- 59 Benjamin Hollowell, Elizabeth Miller
- 60 Victoria Himmelberger
- 61 Nicholas Tay
- 62 Emily Brantner
- 63 Jacinth Koh
- 64 Aloysius Okon
- 67 Benjamin Hepler
- 68 Joshua Tagore
- 70 Daniel Kreider, Lindsey Hayes
- 71 Rachael Picard

Chemistry & Biochemistry

- 49 Leah Bowlin
- 50 Stephanie Ferguson
- 51 Keane McCullum
- 52 Andrew Steele
- 66 Cha Yang, Kristen Listor
- 72 Leben Tadesse
- 73 Kirsten Eldredge, Kyle Burch

Oral Presentations (Morning)

Oral Presentations I: Engineering (Frey 110; 9:00 – 11:35)

9:00 Welcome by President Kim Phipps

- 1 9:15
Oxygen Concentrator Modification: Intake Filter Testing and Analysis
Jaime Gerhart, Timothy Houck, Barbara Ressler* 
- 2 9:35
Village-Scale Water Filtration by Hollow Fiber Membrane (HFM)
Wesley Hollenbach, Daniel Earl, David Vader* 
- 3 9:55
India Mark II Deepwell Handpump Redesign
Derek Smith, Zachary Sizemore, Timothy Whitmoyer*, Tony Beers* 
- 4 10:15
Village-Scale Batch Water Treatment using Ozone
Eric Kauffman, Tim Yoder, David Vader* 
- 5 10:35
Garden Water Access Project
Lindsey Adomat, Zachary Mino, Tony Beers*, Matt Walsh^*, Brendon Earl^* 
- 6 10:55
LSA Nuts and Bolts (and a few rivets)
Alyssa Mylin, Donald Pratt* 
- 7 11:15
LSA Main Gear Suspension: Flexible Rods and Safe Landings
John Sletta, Benjamin Jarvis, Donald Pratt* 

Oral Presentations II: Mathematics (Frey 343; 9:00 – 11:35)

9:00 Welcome by President Kim Phipps

- 8 9:15
"Why Do I Need To Know This?"
David Bigelow

9 9:35
Going Beyond Euclid: Integrating Non-Euclidean Geometry into High School Mathematics
James Ausel

10 9:55
The Influence of Carl Friedrich Gauss
Scott Woolford

10:15 – 10:35 Poster Session I & Break

11 10:35
Muscle Polarization and Contraction with Andrew Huxley
Mary Martin

12 10:55
Google Search Engine and Page Rank
Hope Hess

13 11:15
Mathematics in Sub-Saharan Africa
Clarissa Ehrenzeller, Gene Chase*

Oral Presentations III: Information Sciences (Frey 349; 9:00 – 11:35)

9:00 Welcome by President Kim Phipps

14 9:15
Access Databases and a Local Church
Ben Sheeler, Greg Moyer, Andrew Yau, Jonathan Kennedy, Kyle Young

15 9:35
Photography Management with Open Source
Brian Douglass, Jeremy Stuter, Thomas Strausbaugh, Mark Johnson, D. Scott Weaver*

16 9:55
Building a Dynamically Dynamic Website
**Thomas Hertfelder, David Allen, Matthew Gusick, Joshua Byler, Matthew Hoover,
Randall Groff, Avery deGruchy, Austin Beiler, Matthew Musselman, Kara Silvis,
Gunnar Herman, D. Scott Weaver***

10:15 – 10:35 Poster Session I & Break

- 17 10:35
Church Software Analysis for Daybreak Church
David Janczyk, Philip Ribbens, Chad Yoder, D. Scott Weaver*
- 18 10:55
Grace House Ministries: Our contribution to help meet the immediate need
Corey Faus, Justin Meckley, Coryden Philips
- 19 11:15  
Investigation of the Sensitivity and Specificity of the Fluorescent Chemosensor, Newport Green DCF diacetate
Samuel Tajiri, Richard Schaeffer*, Michael Shin*

Oral Presentations (Afternoon)

Oral Presentations IV: Engineering (Frey 110; 1:10 – 6:00)

1:10 Welcome by President Kim Phipps

- 20 1:20
LSA Engine Integration Team
Andrew Basom, Andrew Breighner, Jacob Francis, Donald Pratt* 
- 21 1:40
Intelligent Battery Balancing with Multiplexers
Erik Hornberger, Jordan Wiker, John Wolgemuth, Donald Pratt* 
- 22 2:00
User Interface for the Electric Motorcycle
Sara Finn, Donald Pratt* 
- 23 2:20
Electric Motorcycle Final Assembly
Joshua Sorrell, Bryce Watkins, Jamison Hunsberger, Judah Fickett, Donald Pratt* 
- 24 2:40
Mobility Tricycle Project History and Electric Tricycle Control Box Redesign
Justin Stevenson, Timothy Van Dyke*, John Meyer* 
- 25 3:00
Disability Resources Tricycle Rear Axle Redesign Project
Ryan Frederick, Charles Kimpel, Andrew Patton, Jean Zipagan, Timothy Van Dyke*, John Meyer* 

- 26 3:20
Electric Tricycle Spline Shaft and Bearing Evaluation
Ryan Schroeder, Marc Hoaglin, Timothy Van Dyke*, John Meyer* 
- 27 3:40
Disability Resources Tricycle Durability Project
Luke Sisson, Timothy Van Dyke*, John Meyer* 
- 28 4:00
Improving Water Access For Persons With Disabilities in Africa
Sarah Finney, Barbara Ressler* 
- 29 4:20
Oil Pressing and the Sunflower Project
Anthony Hahn, Carl Erikson*, Mike Zummo* 
- 30 4:40
Biodiesel Centrifuging
Trevor Lee, Beau Herndon, Carl Erikson*, Mike Zummo* 
- 31 5:00
Automated Biodiesel Production System
Philip Martinez, Carl Erikson*, Mike Zummo* 
- 32 5:20
Powering Hope in Blanchard, Haiti
Trevor Smith, Carl Erikson* 
- 33 5:40
Kilowatt-Hour Meter Project
Kevin Manieri, David Allen, Jonathon Martin, Randall Fish* 

Oral Presentations V: Service in the Developing World; Exercise Science (Frey 150; 1:10 – 3:00)

1:10 Welcome by President Kim Phipps

- 34 1:20 
Technology in the Third World: A Reflection on Service
Austin Beiler, **Jeremy Stuter, Kara Silvis, Matthew Musselman, D. Scott Weaver*** 

- 35 1:40 
Academic enrichment in mathematics; a summer program in West Africa
Pamela Kirkpatrick, Kimberly Frey, Angela Hare*
- 36 2:00 
Teaching Mathematics to Children who are Blind or Visually impaired
Angela Hare
- 37 2:20
The Effects of Chocolate Milk Compared to a Carbohydrate Beverage on Performance in Female endurance runners
Danielle Veacock, Jodie Haak*, H. Scott Kieffer*
- 38 2:40
Comparison of Oxygen Consumption During Walking on a Woodway Curve Treadmill and a Woodway Standard Motorized Treadmill
Morgan Lister, Stephanie Miller, Jennifer Phipps, Sara Voran, H. Scott Kieffer*

Oral Presentations VI: Nutrition & Dietetics; Biological Sciences **(Kline 120; 1:10 – 3:00)**

1:10 Welcome by President Kim Phipps

- 39 1:20
Assessment of Malnutrition Among Albanian Elderly Participating in Home Meal Delivery Using the Mini Nutritional Assessment
Amanda Gray, Amy Porto, Mary Ann Mihok*
- 40 1:40
Comparison of Sedentary Time between College Competitive Distance Runners and Recreationally Active College Students
Nathan Myers, Kay Witt*
- 41 2:00 
Project SHARE Food Baskets Do Not Meet All Nutrient Recommendations for a Family of Four
Kate Abel, Amanda Gray, Cierra Neiswender, Rachel Sender, Amy Porto*
- 42 2:20  
Quantification of the Down-Regulation of Cholecystokinin (CCK) mRNA Expression in PANC-1 Human Pancreatic Cancer Cells
Julie Perta, John Harms*

- 43 2:40  
Exploring the Role of a Single Nucleotide Polymorphism in the Alternative Gene Splicing of the Gastrin Receptor in Pancreatic Cancer
Shannon Sell, Gail Matters^, John Harms*

Oral Presentations VII: Biological Sciences (Hollinger Lounge; 1:10 – 3:00)

1:10 Welcome by President Kim Phipps

- 44 1:20  
*The Construction of a Guide for Larval Identification of the Marbled Salamander (*Ambystoma opacum*).*
Kristen Listor, Erik Lindquist*
- 45 1:40  
*Stratification and Tissue Culture Propagation of *Mertensia virginica**
Charles McBeth, David Foster*
- 46 2:00  
Mechanisms of Increased Plant Growth Through Vermicompost
Danika Foster, David Foster*
- 47 2:20  
Aquaponics as a Viable Means of Processing Sunflower Seed Cake Waste
Paul Nickerson, David Foster*
- 48 2:40  
Evaluation of Vermicomposting for Disposal of Ground, De-watered Food Waste (SOMAT)
Bianca Basch, David Foster*

Oral Presentations VIII: Chemistry & Biochemistry (Jordan 170; 1:10 – 3:00)

1:10 Welcome by President Kim Phipps

- 49 1:20  
*Characterizing the stability of DNA and archaeal chromosome packaging proteins from the archaeon *Methanothermus fervidus**
Leah Bowlin, Hannah Tims*

- 50 1:40  
Packaging of Archaeal DNA: Methanothermus fervidus Histone Binding Affinity
Stephanie Ferguson, Hannah Tims*
- 51 2:00  
Small Heat Shock Proteins 17.0 and 17.8: Expression, Purification, and Temperature Dependent Activity.
Keane McCullum, Hannah Tims*
- 52 2:20  
Liquid Crystals and the study of Self-Assembled Monolayers on a Zinc Selenide Substrate
Andrew Steele, Alison Noble*
- 53 2:40
An Investigation into the Formation Mechanism of Copper Hydroxy Nitrates using a Double-Jet Reactor
Julie Fenton, Richard Schaeffer*

Oral Presentations IX: Service in the Developing World; Exercise Science (Frey 150; 4:00 – 5:00)

- 54 4:00
The Effects of Overspeed Training on Two Different Training Methods
Nathan Marlowe, Kyle Flanick, H. Scott Kieffer*
- 55 4:20
Community-Based Rehabilitation: an Effective Solution to Health-care Disparities and Social Rejection of Individuals with Disabilities in Sub-Saharan West Africa 
JoAnna Larson, **Dena Steiner**, Jodie Haak*
- 56 4:40
The Efficacy of Rehabilitation Programs in Sub-Saharan West Africa for Children with Cerebral Palsy: An Evaluative Study 
Dena Steiner, **JoAnna Larson**, Jodie Haak*

Oral Presentations X: Biological Sciences: Immunology & Virology (Frey Kline 120; 4:00 – 5:20)

- 57 4:00  
Generation of a Simian Virus 40 Large Tumor Antigen (SV40 Tag) 529-543-specific T cell Receptor Transgenic Mouse
Lindsey Hayes, Daniel Kreider, Lawrence Mylin*
- 58 4:20  
Comparing the immunological potencies of two viral epitopes: LT529-543 from the Simian Virus 40 Large Tumor Antigen vs. LT678-690 from the Large Tumor Antigen of murine Polyomavirus
Elizabeth Miller, Benjamin Hallowell, Lawrence Mylin*
- 59 4:40  
CD4+ T Lymphocyte Induction by a Mouse Polyomavirus Epitope inserted into the Simian Virus 40 Large Tumor Antigen
Benjamin Hallowell, Elizabeth Miller, Lawrence Mylin*
- 60 5:00  
A bacteriophage neutralization exercise for the Microbiology for Health Professions course
Victoria Himmelberger, Lawrence Mylin*

Oral Presentations XI: Biological Sciences (Hollinger Lounge; 4:00 – 5:20)

- 61 4:00  
The Selection and Optimization of PCR Amphibian Primers for Real Time (RT) PCR Probes
Nicholas Tay, Erik Lindquist*, Michael Shin*
- 62 4:20  
Twitching Toes and Genetic No's
Emily Brantner, Erik Lindquist*, Michael Shin*
- 63 4:40  
Histidine's Rescue Effect on Arabidopsis thaliana Amidst Nickel Toxicity.
Jacynth Koh, Michael Shin*, Richard Schaeffer*

64 5:00  
Developing & Optimizing a Functional Assay for Amylase Activity
Aloysius Okon, Michael Shin*

Oral Presentations XII: Chemistry & Biochemistry; Environmental Biology (Jordan 170; 4:00 – 5:20)

65 4:00
Barium Apatite Synthesis and Characterization
Jordan Bischof, Richard Schaeffer*

66 4:20  
Analysis of Surface Water for Contaminants from Hydraulic Fracturing Operations in the Upper Susquehanna River System
Cha Yang, Kristen Listor, Alison Noble*, Richard Schaeffer*

67 4:40  
Do Differences in Geologically Determined Physico-chemical Properties Influence the Community Structure of Aquatic Macroinvertebrates?
Benjamin Hepler, Jeff Erikson*

68 5:00  
Presence of Antibiotic Resistant Bacterial Strains in Three South Central Pennsylvanian Streams
Joshua Tagore, Jeff Erikson*

Poster Presentations

Poster Session I: Information & Mathematical Sciences

(3rd Floor Frey Hallway; 10:15 – 10:35)

69 10:15 – 10:35

Association of Computing Machinery (ACM) Programming Contest

D. Scott Weaver, Michael Adams, Zachary Felix, Anthony Spargo, Angela Hare*

NOTE: Many oral presentations will be accompanied by a poster presentation. A Poster that accompanies an Oral Presentations which will be presented in Poster Session I is indicated by the Poster Session I icon . The title and authors for such posters are not reprinted here.)

Poster Sessions II & III:

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

(Jordan Lobby, Jordan 159, Jordan 163; 3:00 – 4:00; 5:20 – 5:40)

NOTE: Many oral presentations will be accompanied by a poster presentation. A Poster that accompanies an Oral Presentation and which will be presented in Poster Session II and/or III are indicated by the Poster Session II  and/or III  icons. The titles and authors for those posters are listed with the Oral Presentations and are not reprinted here.)

70 3:00 – 4:00; 5:20 – 5:40

Generation of a T Cell Receptor Transgenic Mouse; Assembling the Full Sized Expression Cassette

Daniel Kreider, **Lindsey Hayes**, Lawrence Mylin*

71 3:00 – 4:00; 5:20 – 5:40

The use of herbal remedies in the treatment of human tinea

Rachael Picard, Gary Emberger*

72 3:00 – 4:00; 5:20 – 5:40

Development of a Lysozyme Aggregation Assay

Leben Tadesse, Hannah Tims*

73 3:00 – 4:00; 5:20 – 5:40

Oxidation of 4-Hydroxy-6-methyl-2-pyrone

Kirsten Eldredge, Kyle Burch, Anne Reeve*

74 3:00 – 4:00

No correlation found between body mass index and quantity of taste buds on the tip of the tongue in Messiah College adults

Pyrnie Calloway, Holly Harper, Kara Shifler, Amy Porto*

- 75** 3:00 – 4:00
Participation in the Grantham Community Garden results in a stronger sense of community but no change in dietary habits
Gina Catalano, Lauryn Clarke, Catherine Joseph, Amy Porto*
- 76** 3:00 – 4:00
Comparing Nutrition Knowledge among Non-Nutrition Majors in the Messiah College School of Science, Engineering, and Health
Andrea Dean, Courtney Long, Nathan Myers, Ashley Sites, Amy Porto*
- 77** 3:00 – 4:00
Messiah College Students Serve Themselves More Breakfast Cereal When Given Larger Bowls Compared to Smaller Bowls
Sarah Bova, Cody Heagy, Sarah Painter, Amy Porto*
- 78** 3:00 – 4:00
Evaluation of the Nutritional Adequacy of Meals Served at the Salvation Army in Carlisle, PA
Amy Krug, Cecilia Kjellman, Rebekah Sabo, Amy Porto*
- 79** 3:00 – 4:00
Residency has no significant effect on the dietary intake of female Messiah College students for any of the food groups except dairy.
Gabrielle Alderfer, Safoora Azeem, Andrea Gamber, Elizabeth Hackman, Amy Porto*
- 80** 3:00 – 4:00
Higher vitamin C content in organic vs. conventionally grown red bell peppers and decline with storage time
Christine Blanke, Brenda Flaherty, Hilary Gillette, Abby Reed, Amy Porto*
- 81** 3:00 – 4:00
Do Not Disturb: Clustering Care to Decrease Incidence of ICU Psychosis
Victoria Fulford, Brooke Airey, Kelly Thomas, Maryann Brogden[^], Lea Dailey[^], Nancy Woods*
- 82** 3:00 – 4:00
Pre-operative Insulin Drips: Are They Truly Necessary?
Sara Foor, **Erica Heisey, Sarah Jones, Naomi Sappe, Anna Zook, Stephanie Rehman[^], Jenna Verrechio[^], Nancy Woods***
- 83** 3:00 – 4:00
Hospital Acquired Infections Related to Reusable ECG Lead Wires
Jordan Trout, Jessica Brown, Casey Hetrick, Kara Miller, Brianna Reed, Tina Jackson[^], Lauren McNaughton[^], Nancy Woods*
- 84** 3:00 – 4:00
Evidence-Based Interventions to Decrease Readmissions Rates for Congestive Heart Failure

Patients

Hannah Dotts, Ashley Arnold, Larisa Bazhan, Jenny Brewer[^], Nancy Woods*

85 3:00 – 4:00

Nurse-to-Patient Ratio and Patient Satisfaction

Jaclyn Merkel, Shalisa Brubaker, Megan Clapp, Megan Craley, Audrey Hanselman, Katie Blosenski, Andrea Kopchik[^], Nancy Woods*

86 3:00 – 4:00

Career Development: A Pathway to Clinical Improvement

Kayla Bechtel, Rachel Obenschain, Emily Dincer, Sarah Harne-Britner[^], Donna Roller[^], Tina Willier[^], Kathleen Garcia[^], Jamie Shirey[^], Sheri Matter[^], Louann Zinsmeister*

87 3:00 – 4:00

Rounding at the Roundtable

Sophia Mavronis, Jenae Griffith, Emily Gonder, Michael Whitner, Kim Fowler[^], Cathy Druckenmiller[^], Sue Ann Bruce[^], Ann Savidge[^], Jeff Stroup[^], Louann Zinsmeister*

88 3:00 – 4:00

"Cold Hearted:" A Positive Thing

Kaitlyn Lisa, Jessica Morris, Sierra Stephens, Cammie Wilcox, Marianne Allen[^], Bonnie Clemence[^], Deb Heisey[^], Darlene Yeun[^], Cindy Zimmerman[^], Louann Zinsmeister*

89 3:00 – 4:00

Sleep in the Intensive Care Unit

Erin Horst, Elizabeth Smith, Laura Kieliszewski, Melanie Duffy[^], Amy Leshner[^], Michelle Browning[^], Durga Ayyala[^], Melinda Smith[^], Louann Zinsmeister*

90 3:00 – 4:00

Childbirth Education's Influence on Elective Induction Rates

Nicole Carran, Alyssa Groff, Meredith Schorner, Danielle Steele, Emily Wenger, Erin Anderson[^], Carol Engle[^], Nancy Frank[^], Yovanka Hoover[^], Leslie House[^], Karen Ilgenfritz[^], Michalena Levenduski[^], Louann Zinsmeister*

91 3:00 – 4:00

Head Positioning in the NICU: Why does it matter?

Stephanie Rausch, Chelsey Herzig, Chelsey Kauffman, Hannah Kurtz, Rachel Coyle, Crystallein Egresits[^], Donna Wicks[^], Tina Daniels[^], Tricia Falgoust[^], Louann Zinsmeister*

92 3:00 – 4:00

Patients Who Self-harm: They Did What?

Kristi Cook, Tiffany Egolf, Shannon Sensi, Brianna Wilbur, Teresa Biagio[^], Amanda Cresswell[^], Mary Mortimer[^], Avis Pulaski[^], Babette Rudick[^], Louann Zinsmeister*

93 3:00 – 4:00

Better Communication for Better Results

Ruthanne Hepkins, Rebecca Rotzell, Sarah Wagoner, Krista Witmar[^], Deb Schafer[^], Naisha Stoney[^], Louann Zinsmeister*

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.



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

Engineering Faculty and External Collaborators

Energy Group

Prof. Carl Erikson for Ride Solar and Powering Hope in Haiti
Mr. Brendon Earl for Solar Heating
Prof. Randy Fish for Kilowatt-Hour Meter Project
Mr. Mike Zummo for Biofuels - Methanol Recovery and Biofuels - Production & Processor Development

Water Group

Dr. David Vader for Village Water Ozonation System and Hollow Fiber Membrane System
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Mr. Tony Beers, Dr. David Vader and Dr. Timothy Whitmoyer for India Mark II Hand Pump Re-design

Disability Resources Group

Mr. John Meyer
Dr. Barbara Ressler
Dr. Tim Van Dyke

Transportation Group

Dr. Donald Pratt

Biomedical Engineering Group

Dr. Barbara Ressler
Dr. Phil Thuma (Macha Mission Hospital, Zambia)
Dr. John Spurrier (Macha Mission Hospital, Zambia)



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Gene Chase
Angela Hare
D. Scott Weaver
Lamarr Widmer

Biological Sciences

Gary Emberger
Jeff Erikson
David Foster
John Harms
Erik Lindquist
Lawrence Mylin
Michael Shin

Chemistry & Biochemistry

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Hannah Tims

Health & Human Performance

Jodie Haak
H. Scott Kieffer

Nursing

Nancy Woods
Louann Zinsmeister

Nutrition & Dietetics

Mary Ann Mihok
Amy Porto
Kay Witt

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

Holy Spirit Hospital

| | |
|--------------------|---------------|
| Brewer, Jenny | BSN, RN |
| Brogden, Maryann | RN, MSN, APNC |
| Dailey, Lea | RN |
| Jackson, Tina | MSN, RN, CCRN |
| Kopchik, Andrea | RN, BSN |
| McNaughton, Lauren | BSN, RN, CCRN |
| Rehman, Stephanie | RN, BSN |
| Verrechio, Jenna | RN, BSN |

PinnacleHealth

| | |
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| Clemence, Bonnie | MSN, RN, CRN |
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| Roller, Donna | RN, CPN |
| Rudick, Babette | RN, BSN, CCM |
| Savidge, Ann | BSN, RN |
| Schafer, Deb | MSN, RNC-OB |
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Gail Matters, Ph.D.
Mr. Chris McGovern

Abstracts

An Abstract is provided for each oral and poster presentation. Abstracts are arranged here in alphabetic order by the last name of the first author. The number of the presentation that appears in the "Schedule-at-a-Glance" and lists of Oral Presentations and/or Poster Presentations appears in bold and within parentheses at the end of each abstract. The same numbers are shown beside the name of each author in a unified alphabetical list at the end of this Program.

Kate Abel, Amanda Gray, Cierra Neiswender, Rachel Sender, Amy Porto*

Project SHARE Food Baskets Do Not Meet All Nutrient Recommendations for a Family of Four

Project SHARE, a food pantry in Carlisle, Pennsylvania, claims their monthly food distribution provides approximately one week's worth of groceries for a family of four. An observational research study was conducted to determine nutritional adequacy of Project SHARE's monthly food distribution. Four months of food distribution data was compared against Acceptable Macronutrient Distribution Ranges (AMDRs), Dietary Reference Intakes (DRIs), and USDA food group recommendations. Food baskets from Project SHARE provided 65% of recommended calories. They provided adequate vitamin C and sodium and less than 75% of recommended vitamin A (54%), vitamin D (14%), calcium (72%), potassium (27%), zinc (70%), and fiber (54%). Food baskets did not meet recommended servings for grains (57%), fruit (52%), vegetables (47%), dairy (30%), and protein (68%). To improve nutritional adequacy, Project SHARE should seek to increase caloric content of food baskets, specifically with dairy, fruits, and vegetables. **(41)**

Lindsey Adomat, Zachary Mino, Tony Beers*, Matt Walsh^*, Brendon Earl^*

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. We have focused our efforts in three main areas this year: a low cost hand pump, a bailer, and a set of hand augers. We plan to provide SIM with a complete well drilling and water lifting solution for small scale vegetable production by spring of 2013. **(5)**

Gabrielle Alderfer, Safoora Azeem, Andrea Gamber, Elizabeth Hackman, Amy Porto*

Residency has no significant effect on the dietary intake of female Messiah College students for any of the food groups except dairy.

Previous research has shown that college students do not typically meet their nutritional recommendations and various environmental factors affect the dietary intake of college students. The purpose of this quantitative study was to investigate the differences in the dietary habits of students based on residency. Female students from Messiah College participated in the study (n= 13 commuter students; n=15 dormitory students). Participants were mainly recruited through an on-campus nutrition class and personal networking. Subjects completed three 24-hour food intake records which included anthropometric data and an indication of residency. Food intake records were analyzed on choosemyplate.gov using SuperTracker. Microsoft Excel 2007 was

used to perform an unpaired T-test to determine the differences between commuter and dormitory student food group intakes. Average intake was similar between commuter and dormitory students for all food groups except dairy (p-value = 0.004). Commuter students consumed an average of 7.4 ± 2.0 oz. grain, 1.6 ± 0.7 cups vegetables, 1.4 ± 1.0 cups fruit, 1.8 ± 0.60 cups dairy and 4.8 ± 1.5 oz. protein. Dormitory students consumed an average of 6.2 ± 3.0 oz. grain, 1.5 ± 0.6 cups vegetables, 1.9 ± 1.0 cups fruit, 2.1 ± 2.0 cups dairy and 5.5 ± 3.0 oz. protein. Therefore, residency did not show a significant effect on the dietary habits of female college students. (79)

James Ausel

Going Beyond Euclid: Integrating Non-Euclidean Geometry into High School Mathematics

In high schools across Pennsylvania the education of geometry ends with Euclidean geometry. Curricula across the keystone state are primarily based off of the Pennsylvania State System of Assessments (PSSA) created by legislation. Historically, spherical and hyperbolic geometry have been viewed as topics usually covered in an undergraduate or graduate program and therefore have been excused from the secondary learning environment because of their complexity. Even though there have been major roadblocks in the past for including higher dimensional geometry in high schools, there are new found advantages and technologies to introduce non-Euclidean geometry to students in 9th through 12th grades. By following a simple threefold unit plan, including hands-on exploration, identifying the historical significance of geometry and comparisons of the similarities and differences among the three geometries, this unit will provide students the opportunity to gain a deeper understanding of geometry as a whole. (9)

Bianca Basch, David Foster*

Evaluation of Vermicomposting for Disposal of Ground, De-watered Food Waste (SOMAT)

Messiah College daily produces over 200lbs of food waste daily, in the form of ground up dewatered SOMAT from the Lottie Nelson cafeteria alone. The college pays over \$20,000 removing this waste per annum. This experiment seeks to determine if vermicomposting with red wigglers (*Eisenia foetida*) is a viable option for reducing the cost of food waste disposal at Messiah while creating a valuable fertilizer. We constructed four bins, two inside the greenhouse for temperature control, and two outside the greenhouse with straw insulation to prevent deep freezing but allow cooler temperatures. Each bin was stocked with 8.5 kilos of shredded waste office paper, a fourth of a bag of sphagnum peat and an initial 16 kilos of earthworms (approximately 10,000 worms). The conditions inside and outside were kept the same except for variations in temperature in order to determine if outdoor bins were viable, given an ideal temperature range of 20-30 C, and the C:N ratio of the was analyzed and shredded paper was added to bedding to reach a C:N ratio of 20:1. The rate of SOMAT consumption of the worms inside was much higher than the worms outside, and a threshold temperature of 8-9 °C was determined for feeding activity of the worms. The feeding rate the worms was determined to be 1.36 kilos/day of SOMAT under optimal conditions. (48)

Andrew Basom, Andrew Breighner, Jacob Francis, Donald Pratt*

LSA Engine Integration Team

The engine integration team, a vital component of the Light Sport Aircraft (LSA) project, began back in 2005. Originally, the team had chosen a rotary engine, but due to circumstances beyond their control, this engine was grounded in 2009, requiring much of the work they had

accomplished to be redone. After several semesters of research, the team selected the HKS 700E as a suitable replacement for the defunct rotary. Most of the redesign work has been completed, and it is now nearing the point where it can be integrated into the fuselage of the LSA. Over the past year, we have acquired all necessary engine components, constructed an exhaust system, designed a housing for the radiator, designed and fabricated a special thrust mount for our test stand, designed gas tanks for the fuselage, and created and analyzed models of the proposed base mount and thrust mount in SolidWorks. We accomplished all of this work while assembling our engine with all its components on our test stand. With the addition of our recently acquired Powerfin propeller, the LSA powerplant is complete. Once the test program has been completed, including measuring such things as thrust and fuel consumption, the engine and all its components will be ready for final installation in the fuselage. (20)

Kayla Bechtel, Rachel Obenschain, Emily Dincher

Career Development: A Pathway to Clinical Improvement

Background: Many hospital systems are using Career Development Pathways (CDP). Currently the PinnacleHealth system (PHS) is experiencing a low participation rate in the CDP. Guidance is needed on how to better utilize CDP nurses on each unit. There is currently no clear link between CDP nurses and patient outcomes. **Aims:** The purpose of this evidence-based practice research project was to determine if in staff nurses, does participation in a career development pathway affect nurse satisfaction and accountability compared to nurses who do not pursue advancement? **Methods:** We utilized CINAHL, Medline, and PubMed. We used these key terms: nurse satisfaction, career development pathways, career ladders, professional development, staff nurses, clinical ladder, job satisfaction, and accountability. We used only English, peer-reviewed, research articles that were published between 2004 and 2011. We found a total of eleven articles. We found six articles that were relevant enough to be critiqued. We decided on four of them to be used for this presentation. **Results:** It was found that nurse satisfaction inconsistently related to CDPs. CDP nurses tend to be more involved in clinical improvement and leadership activities. Advancement does not equate with nurse excellence. There is no clear way to measure the effect of CDP nurses on patient outcomes. Managers have an unclear expectation for CDP nurses. **Conclusions:** There is a need for PHS nurses to have more education on the CDP opportunities available to them. There needs to be collaboration with the nurse manager and CDP nurses. (86)

Austin Beiler, Jeremy Stuter, Kara Silvis, Matthew Musselman, D. Scott Weaver*

Technology in the Third World: A Reflection on Service

In 2008 Professor Weaver took an exploratory trip to Burkina Faso, West Africa with a cross-cultural/mathematics course to investigate opportunities for Computer and Information Science students to take part in projects of service to missionaries. It was found that missionaries, due to the very nature of their work, find ways of working around problems that arise including technology. When something isn't working correctly and the local technician cannot fix it, they find a way to accomplish their end goal. However, the original problem still exists. In January of 2012, four Computer and Information Science students joined eight other students and four faculty members on a trip to Burkina Faso. Their primary goal for this trip was to be of service to missionaries. That trip was very successful. The students worked on over 97 computers, fixed or established networks for five organizations, and taught local Burkinabè adults basic computer applications. Missionaries found themselves being able to use their technology (including a

video projector) in the way they were intended. Professor Weaver and the students will reflect on their experience in Africa. (34)

David Bigelow

"Why Do I Need To Know This?"

An exploration of the history and meaning behind the mathematics curriculum in public education. (8)

Jordan Bischof, Richard Schaeffer*

Barium Apatite Synthesis and Characterization

Currently, little is known about the formation, stability, and solubility of the hydroxyl barium apatite phase. Some methods of synthesis are known, but the results are not always uniform, so two primary known methods of synthesis were performed and built upon. First, barium nitrate was added to ammonium hydrogen phosphate with heat at different pH values under a flow of nitrogen gas. Small portions of product were taken at different times along the reaction's run and according to X-ray diffraction, barium phosphate was formed instead of barium apatite. Second, barium chloride dihydrate, sodium dihydrogen phosphate, and urea were heated in an acidic solution. X-ray diffraction indicated that in many cases barium apatite was successfully made. In the future, the formation of barium apatite will be studied more and the products will be further characterized. Also, the solubility of barium apatite will be studied to decide if the amount of barium in a saturated solution of this apatite is at, or below, the EPA limits for barium in water. In the commercial application, barium (and potentially radium) would be sequestered by the formation of the apatite by passage of water through a relative insoluble form of phosphate, thus providing a remediation method with a potential 100-fold improvement in barium removal over current methods. (65)

Christine Blanke, Brenda Flaherty, Hilary Gillette, Abby Reed, Amy Porto*

Higher vitamin C content in organic vs. conventionally grown red bell peppers and decline with storage time

The term "organic" has gained popularity in today's society. Besides the environmental benefits, some studies have demonstrated higher nutrient values in organic produce. Several researchers have investigated the nutrient content of organic fruits and vegetables in comparison to their conventional counterparts; although there has been no conclusive evidence. An experimental research study was conducted to determine if there was a significant difference in vitamin C (ascorbic acid) content between organic and conventionally grown red bell peppers, as well as if there was a significant decline in vitamin C content over a ten-day storage period. Juice from the peppers was titrated with an iodine indicator and ascorbic acid content was compared to a 0.5 mg/mL ascorbic acid standard. Results were evaluated using paired and unpaired t-tests to determine the significant differences in ascorbic acid concentrations. Analysis indicated organic red bell peppers contain a significantly higher amount of vitamin C compared to conventionally grown red bell peppers on both day one (44.69 ± 0.79 mg vs. 37.16 ± 0.60 mg, respectively; $p < 0.0001$) and day ten (42.39 ± 0.34 mg vs. 34.93 ± 0.72 mg, respectively; $p < 0.0001$). Vitamin C content of both conventional and organic red bell peppers decreased significantly over a ten-day storage period (2.30 ± 0.34 mg vs. 2.23 ± 0.54 mg respectively; $p < 0.0001$). Further research is needed to determine if the higher ascorbic acid content in organic produce is worth consumer attention. (80)

Sarah Bova, Cody Heagy, Sarah Painter, Amy Porto*

Messiah College Students Serve Themselves More Breakfast Cereal When Given Larger Bowls Compared to Smaller Bowls

Due to the prevalence of overweight and obesity in recent decades, increases in the portion size of foods and decreased activity levels have been researched in an attempt to establish possible correlations. Portion sizes in particular have undergone dramatic changes which may be related to overeating and increased perception of consumption norms. Due to varied results among the preexisting research, a randomized crossover study was conducted to analyze possible differences in the amount of breakfast cereal consumed by 18 college students (n=12 females; n=6 males) when given two differently sized bowls (10 oz. and 20 oz., respectively). Results indicated that subjects involved in the study served themselves significantly more of the breakfast cereal (p=0.03) when provided with the larger, 20 oz. bowl compared to the amount served when the subjects were provided with the 10 oz. bowl (65g ± 33g and 54g ± 26g, respectively). Only 4 of these subjects served themselves more cereal when they were given the smaller bowl. The application of these results is fairly limited and cannot be extrapolated to larger populations due to the limited, non-representative sample size and convenience method of recruiting subjects. As such, additional research should be conducted to further define the relationship between portion size and consumption, especially with regard to the incidence of overweight and obesity. (77)

Leah Bowlin, Hannah Tims*

Characterizing the stability of DNA and archaeal chromosome packaging proteins from the archaeon *Methanothermus fervidus*

The genomes of all three domains of life need to be packaged and protected as chromatin. Eukaryotes use proteins known as histones to package their DNA into nucleosomes and then chromosomes, while prokaryotes package their DNA primarily by supercoiling. The third domain, archaea bacteria, are prokaryotes; however, they are known to use histones that are homologous to their eukaryotic counterparts to package their DNA. Specifics about how archaea use histones to wrap and package their DNA, and the stability and equilibrium dynamics of these complexes are poorly understood. Thus, the purpose of this study was to use fluorescence resonance energy transfer (FRET) to characterize the stability of archaeal nucleosomes and to determine why, how, and where nucleosomes are formed in the archaeal genome. Electrophoretic mobility shift assays (EMSA) were performed to determine binding affinities of different histone-DNA complexes from the archaea *Methanothermus fervidus*. Future work will include performing FRET to measure equilibrium dynamics of the archaeal nucleosome. (49)

Emily Brantner, Erik Lindquist*, Michael Shin*

Twitching Toes and Genetic No's

American and Fowler's Toads (*Anaxyrus americanus* and *A. fowlerii*) both exhibit a toe-tapping behavior in the presence of prey. This behavior has been suggested as a mechanism for luring their prey towards them, and has been shown in some toad species to lure younger conspecifics to them for cannibalization. We hypothesized that it may have both visual and vibrational luring components, and began to set up an experimental protocols with and without both visual stimuli

and vibrational stimuli. Unfortunately, through a combination of *Aeromonas* and worms, the toads did not survive through the winter and a change in research project was undergone in January. This new project consists of working with amplification of mitochondrial frog DNA in order to create a negative control for tests detecting the Chytridiomycete fungus, *Batrachochytrium dendrobatidis*. Current tests have some questioned whether or not the DNA being tested is of amphibian origin, and therefore, these tests would provide a control to alleviate that ambiguity. (62)

Pyrnie Calloway, Holly Harper, Kara Shifler, Amy Porto*

No correlation found between body mass index and quantity of taste buds on the tip of the tongue in Messiah College adults

The purpose of this experiment was to determine the relationship between taste bud count and body mass index (BMI). We hypothesized subjects with lower amounts of taste buds on the tip of the tongue (sweet region) would have a higher BMI level. This descriptive, observational, and cross-sectional study was composed of a wide variety of subjects (n=22) including both genders between the ages of twenty and forty. Subjects were selected via a mass e-mail sent to Messiah College students, faculty, and staff and by word of mouth. BMI was calculated by measuring height with a stadiometer and weight with a scale. Researchers placed a notecard that was whole punched, on the tip of the subject's tongue and dyed the exposed area of the frontal region with food coloring. A photograph was taken of strictly the tongue region for further evaluation and counting of papillae. A paired t-test revealed no correlation between subject BMI and papillae count ($R^2=0.0043$). This lack of correlation may be due to a low number of subjects. (74)

Nicole Carran, Alyssa Groff, Meredith Schorner, Danielle Steele, Emily Wenger, Louann Zinsmeister*

Childbirth Education's Influence on Elective Induction Rates

The need for proper, professional childbirth education prenatally is one of priority and must be nationally recognized as such. To address our societies' general lack of knowledge in the birth process, medical interventions, and postnatal complications; concrete and descriptive childbirth education must be provided nationwide and attendance encouraged. The pertinent intervention of education by health care professionals is necessary for a mothers' ability to make informed decisions, thereby leading to improved outcomes and optimal maternal care. Furthermore, educational deficits in specific areas such as elective delivery and inductions may indeed increase the risks for maternal mortality, labor complications, and fetal and maternal harm. The purpose of this evidence-based practice research project was to ascertain if there was an effect on elective labor induction rates related to nulliparous women's attendance at childbirth education classes. The PICO question to guide the project was "In nulliparous women, how does attending childbirth education classes compared to not attending childbirth education classes affect the occurrence of elective deliveries?" Literature was reviewed via online databases such as PubMed, CINAHL, and Medline for scholarly articles and research studies published in the last five years. After compiling relevant articles, four were discussed and critiqued. A literature review matrix was completed concurrently so as to compile pertinent information from each article and to determine the findings' clinical significance and applicability. Concluding from the reviewed studies and articles, it is proposed that all areas of education necessary for nulliparous women, regarding their impending labor process and possible interventions, be included in standard prenatal care offered by health care professionals. This primary

preventative measure will further increase the success of the birthing process as thorough decision-making, based on evidence and assisted by health care professionals, is the most effective way to protect an individual. By reducing the pandemic of medical childbirth interventions, spontaneous births may increase as well as the rates of healthy and uncomplicated births. There is however, a need for future research to identify specific areas of education weakness and its overall clinical application for all health care professionals involved. (90)

Gina Catalano, Lauryn Clarke, Catherine Joseph, Amy Porto*

Participation in the Grantham Community Garden results in a stronger sense of community but no change in dietary habits

Nutrition intervention through community gardening has been established within urban settings to bring healthy, local, and fresh produce to residents of the area. Presence of community gardens is seen to be beneficial in regards to the nutrition-related health of individuals and the sense of community and aesthetics of the area. Using an observational, cross-sectional study design, a survey was distributed to assess the impact the Messiah College Community Garden has on its members in regards to nutrition intake and sense of community. Thirteen members of the community garden, 5 males and 8 females, between the ages of 19 and 23 were surveyed. Fifty-four percent of participants did not agree that the garden had any impact on their overall nutrition, including fruit and vegetable intake and organic food intake. Eighty-five percent of participants indicated that they felt closer to friends and their community because of working in the garden. This research suggests that participating in a local community garden has a positive impact on members' sense of community, regardless of social setting. It also suggests that within the college community participation in gardening does not significantly impact changes in nutritional intake. (75)

Kristi Cook, Tiffany Egolf, Shannon Sensi, Brianna Wilbur, Louann Zinsmeister*

Patients Who Self-harm: They Did What?

Nurses are responsible for the care of patients who deliberately self-harm in a variety of clinical settings. However, limited research has been conducted to explore the attitudes, experiences, and preparedness of nurses who work with this patient population. Self-harm encompasses a wide variety of actions and behaviors, and there is a wide discrepancy in the definition of deliberate self-harm in the literature. For the purpose of this evidence-based practice research project, the definition of deliberate self-harm coincides with that of authors Thompson, Powis and Carradice (2008), who claim that "deliberate self-harm could be described as a specific act whereby intentional destruction of body tissue occurs with the function of managing psychological distress without conscious suicidal intent". The purpose of our evidence-based practice research project was to explore the attitudes of nurses who care for patients who deliberately self-harm compared to the attitudes of nurses who care for the general population. A broad search was conducted using health related databases, including Cochrane Library (Health and Medical Journal), CINAHL, and PubMed. This search method was implemented in order to find existing evidence focused on the nurses' experience of working with patients who deliberately self-harm. After critiquing seven systematic reviews, four articles were chosen for further consideration. Both quantitative and qualitative designs were incorporated into the final analyses. While analyzing these reviews, common themes were identified. Predominant themes included findings of nurses' positive attitudes towards patients who self-harm despite the need

for more education, improved support in the workplace from peers and nurse managers, and emotional struggle with personal feelings. (92)

Andrea Dean, Courtney Long, Nathan Myers, Ashley Sites, Amy Porto*

Comparing Nutrition Knowledge among Non-Nutrition Majors in the Messiah College School of Science, Engineering, and Health

Previous research indicates that education for students seeking to enter health-, fitness-, or medical-related fields (HFM fields) provides insufficient nutrition knowledge to prepare them for nutrition-related care. The objective of this study was to compare the nutrition knowledge of Messiah College School of Science, Engineering, and Health (SSEH) students in majors requiring a nutrition course (RNC group) with nutrition knowledge of majors in the SSEH not requiring a nutrition course (NRNC group) with the goal of assessing whether current requirements for nutrition education increase nutrition knowledge. The study design was qualitative, observational, and cross-sectional. Participants were 135 SSEH students with intent to pursue a career in an HFM field. Data was obtained through use of an on-line questionnaire administered through Qualtrics survey software that assessed subjects' general nutrition knowledge. Statistical analysis involving a two-sample, unpaired t-test assuming unequal variances was used to determine differences in overall score. The mean scores for the RNC group and NRNC group were 74.03 +/- 8.36 % and 73.92 +/- 7.48%, respectively. No significant difference ($p=0.47$) existed between the mean scores of the RNC group and the NRNC groups. Findings from this study indicated that students planning to enter HFM fields in the RNC group and the NRNC group have similar nutrition knowledge, suggesting that nutrition knowledge in the RNC group was not increased by the required nutrition education. Nutrition education requirements beyond current levels are needed to adequately prepare students for HFM fields. (76)

Hannah Dotts, Ashley Arnold, Larisa Bazhan, Jenny Brewer[^], Nancy Woods*

Evidence-Based Interventions to Decrease Readmissions Rates for Congestive Heart Failure Patients

Background and significance of clinical problem/question: Implementation of community interventions for patients with congestive heart failure (CHF) patients are difficult due to patient factors, such as advanced age, co-morbidities, and polypharmacy. Following hospital discharge, it is common for these patients to be readmitted within a short period of time causing increased costs. Readmissions result from a combination of inadequate post discharge care, chronic disease progression, non-adherence, and patient knowledge deficit. It is important to identify measures to improve compliance and decrease 30 day readmission rates. **PICO Question:** Among CHF patients, do standard discharge instructions plus a discharge phone call as opposed to standard discharge instructions alone reduce readmission rates within thirty days? **Methods of Literature Search:** A review of the literature was conducted utilizing PubMed, MedLine, CINAHL and the Cochrane Database from 2004-2011. A total of 67 articles were identified; 8 were found to address the problem and were the focus of the review. The majority of the articles were Level III with a B quality. **Findings from EBP project:** Evidence supports follow-up phone calls in addition to standard discharge instructions for CHF patients. Telephone intervention delivered shortly after hospital discharge successfully reduced re-admissions because the approach can be effectively scaled and delivered (Harrison, 2011). Average cost per case was significantly reduced (Prior: \$11,993; After: \$6,553) after telephone program as seen in

Slater (2008). Additional findings include: reduced mortality, improved quality of life, and increased satisfaction with level of care. **Recommendations for practice:** Based on the literature review, a change in practice is recommended. A follow-up phone call from a nurse within 72 hours of discharge is supported in literature. Furthermore, a standardized scripted telephone call protocol should be utilized. (84)

Brian Douglass, Jeremy Stuter, Thomas Strausbaugh, Mark Johnson, D. Scott Weaver*

Photography Management with Open Source

The Collaboratory and other departments at Messiah College maintain a plethora of photos of students from different events. With so many photos, searching for the desired images becomes a time-intensive task. The goal of this project is to design and develop a photo management application to help tag, organize and search for photos on a personal computer. Rather than building the application from scratch, an open source project called Digikam was used as the foundation to the project and refined to manage photos and images more easily for organizations and individuals. (15)

Clarissa Ehrenzeller, Gene Chase*

Mathematics in Sub-Saharan Africa

Going beyond the well-known history of European, Asian, and Islamic mathematics to the lesser-known mathematics of sub-Saharan Africa. The role of geometry in African culture such as fractals, games, and symmetries is covered, but also the integration of African mathematics into today's classroom. (13)

Kirsten Eldredge, Kyle Burch, Anne Reeve*

Oxidation of 4-Hydroxy-6-methyl-2-pyrone

4-Hydroxy-6-phenylmethyl-2-pyrone is a key intermediate in the synthesis of the cytotoxic natural product aspernigrin A. Several approaches to this seemingly simple molecule have been designed and attempted, but none have been successful to date. The latest scheme involves oxidation of 4-hydroxy-6-methyl-2-pyrone to the corresponding alcohol or aldehyde as the initial step, followed by bromination, and palladium-mediated coupling of the phenyl ring. Oxidation of similar substrates has been accomplished with selenium dioxide, but our starting material has proven resistant to the standard reaction conditions. Results of our attempts with 4-hydroxy-6-methyl-2-pyrone and several test compounds will be described. (73)

Corey Faus, Justin Meckley, Coryden Philips

Grace House Ministries: Our contribution to help meet the immediate need

Since its beginnings in the 1990's, Grace House Ministries has poured out love and hope to its surrounding community. They serve over 250 families a month with programs such as a self-choice pantry, a clothing closet, and a summer program for children of the Hall Manor area of Harrisburg, a prison outreach, and various social services. They have also joined partnerships with the Central Pennsylvania Food Bank, United Way, and other agencies. When it came to the attention of the database students from Messiah, we knew this was an organization that we wanted to become a part of. The database team were shown firsthand the difficulty of using the present database system, which consisted of handwritten file cards to keep track of customers. In order to facilitate the customers through more efficiently, a Microsoft Access database was deemed to be the best solution. Join the Grace House Team on April 27th at 10:55, as we discuss

our successes and failures of accomplishing our task of helping Grace House meet the immediate need of their customers. (18)

Julie Fenton, Richard Schaeffer*

An Investigation into the Formation Mechanism of Copper Hydroxy Nitrates using a Double-Jet Reactor

A double jet reactor was utilized to synthesize copper hydroxy nitrate mineral phases. Data collected simultaneously by conductivity, temperature, and pH probes points to a gradual two-step mechanism to form the final double-anion salt. Trends in pH indicate that a copper-hydroxide phase forms in solution first, causing a rapid drop in the pH of the system. Over time, nitrate ions begin to replace hydroxide ions in the product crystals, releasing hydroxide back into the solution, causing a steady but significant increase in pH as the reaction is allowed to continue. Analysis of the final crystalline solid by powder x-ray diffraction identified rouaite as the phase of copper hydroxy nitrate present, providing further evidence of the hypothesized formation mechanism. (53)

Stephanie Ferguson, Hannah Tims*

Packaging of Archaeal DNA: Methanothermus fervidus Histone Binding Affinity

Organisms within each domain of life have unique ways to package, organize, and protect their genetic information. Eukaryotic organisms use nucleosomes as a basic repeating unit for DNA packaging, while Bacteria condense their genetic information through a process known as supercoiling. It is thought that Archaea combine these two systems, using both supercoiling and histone homologues for their DNA packaging. The genome of the Archaea, specifically those that are extremophiles, have unique demands which must allow rapid responses to environmental changes. The hyperthermophile *Methanothermus fervidus*, the Archaea of interest in this study, lives at 83°C, remarkably close to the melting temperature of DNA, 95°C. The histone system in Archaea is believed to have developed to stabilize the genome in order to protect against extreme conditions such as thermal denaturation. This study seeks to further understand Archaeal nucleosome structure and function by examining the flexibility of the Archaeal nucleosome. The two histone proteins from *Methanothermus fervidus* examined were, HMfA and HMfB. These histones share a common ancestry with the eukaryal nucleosome core histones. Mutations, M35C and L62C, were also of interest for their unique ability to be tagged with fluorescent dye. We were able to amplify and purify in significant amounts the DNA sequence KS1418, which has been shown to have high affinity for Archaeal histones. Using electromobility shift assays (EMSA), the binding affinity of the histones to KS1418 fragments were examined. Results showed nucleosome formation using HMfA, HMfB, and fluorescently tagged histones. This confirms that fluorescence resonance energy transfer (FRET) can be used to further study binding dynamics of Archaeal histones. (50)

Sara Finn, Donald Pratt*

User Interface for the Electric Motorcycle

The field of human computer interaction is concerned with designing technology in such a way that user interactions with the device feel natural. Creating a user friendly interface is especially important in situations where user safety is concerned, for example when operating machinery. Riding a motorcycle is an example of a complex and dangerous task, requiring the operator not only to monitor the machine, but also to be very aware of road hazards and other drivers who

may not notice him/her. Due to the inherent dangers of riding a motorcycle it is very important that motorcycle riders keep their eyes on the road as much as possible. The electric motorcycle that is being developed by the Collaboratory has several subsystems that produce a significant amount of data. Some of this data is relevant only during charge cycles, but several key parameters, such as the remaining level of charge, are important during operation and must be monitored by for the operator. If this data it is not displayed in an easily readable format then the rider's safety could be compromised. The onboard computer system must sort the information by level of necessity and then display the required information to the operator in a way that minimizes the amount of time required to view and comprehend that information. (22)

Sarah Finney, Barbara Ressler*

Improving Water Access for Persons with Disabilities in Africa

The Africa WASH and Disabilities Study focuses on designing appropriate technologies to make water and sanitation more accessible to persons with physical disabilities throughout West Africa. My work focuses on two of the three technologies the project has created: pump handle extensions and jerry can tippers. The pump handle extension makes it easier for persons with disabilities to obtain their own water from the India Mark II pump. A jerry can tipper serves to support the large water containers in the home and make it easier to pour the water. Our previous designs for the pump handle extension and the jerry can tippers were not optimized and created some difficulties for the end user. After collecting feedback from pump users on various extension designs and determining the correct weight distribution of the handle, I produced a new pump handle design that corrected our difficulties from previous designs. This design can be used by SOVEMA, the manufacturer of the India Mark II pump, to mass produce our modified handle. For the jerry can tipper, I performed a static analysis that determined the optimum location of the pivot point that minimizes the force required to tip the container while maintaining stability during pouring. A new jerry can tipper will be constructed for demonstration purposes so that African craftsmen can duplicate our design. All of our new designs will be adapted by World Vision International to be used throughout West Africa to serve the disabled community. (28)

Sara Foor, Erica Heisey, Sarah Jones, Naomi Sappe, Anna Zook, Stephanie Rehman[^], Jenna Verrechio[^], Nancy Woods*

Pre-operative Insulin Drips: Are They Truly Necessary?

Background and significance of clinical problem/question: Hyperglycemia is a common stress response noted in surgical patients who can complicate surgical procedures and healing. Currently, the practice at Holy Spirit Hospital is to begin an insulin drip in pre-operative patients whose blood glucose exceeds 110, regardless of diabetic status or glycosylated hemoglobin level. Staff RNs noted that this practice seems to be an inefficient use of resources, and may put patients at risk for hypoglycemia. **PICO question:** In adult non-diabetic preoperative surgical patients, what are the effects of tight glycemic control versus usual care on postoperative infections and length of hospital stay? **Methods of literature search:** A literature search was conducted utilizing PubMed, Medline, CINAHL, and the Cochrane Database from 2006 to 2011. Fourteen articles were retrieved. Nine of these were applicable to the problem and were evaluated in detail. Articles ranged from Level I to VII, with the majority of at least B quality. **Findings:** Evidence supports the importance of controlling hyperglycemia in reducing post-operative infections in adult surgical patients. However, there is conflicting evidence regarding

the optimum blood glucose target range and adverse effects of hypoglycemia related to aggressive glucose management. Additionally, most available research focuses on diabetic patients, with minimal research regarding glycemic control in non-diabetic patients. **Recommendations for practice:** Based on the literature review, there is not conclusive evidence supporting a practice change at this time. More research is needed regarding optimum target range for blood glucose and the related risk of hypoglycemia. Ideally, research would include large, randomized controlled trials focusing on glycemic control in non-diabetic surgical patients. We recommend that staff nurses consult unit protocols regarding glycemic control for pre-operative patients while continuing to follow up with evidence as further research is conducted. (82)

Danika Foster, David Foster*

Mechanisms of Increased Plant Growth through Vermicompost

Organic fertilizer from vermicomposting, the production of worm castings through the breakdown of organic material has been touted as the best way to produce vegetable crops over conventional compost and chemical fertilizers. We tested this hypothesis using Burpee Super Sweet 100 hybrid (TM) tomato plants (*Solanum lycopersicum*), Broccoli, and lettuce. Plants were split into two trial groups (growth to maturity for tomatoes and broccoli; growth to seedling stages lettuce, tomato). Organic fertilizer produced through vermicomposting in a ratio of 75% 3-B™ Potting Mix and 25% worm castings was the most effective at producing mature tomatoes fastest, more so than a 75% growing media of 3-B™ mix with 25% regular vegetable compost, and much more so than a control group of straight 3-B™ Potting Mix. Conversely, broccoli seedlings demonstrated moderate increase in growth rate when raised in a mixture of 75% 3-B™ Potting Mix and 25% vegetable compost. The plants and soil were also analyzed for nutrient content (N,P,K, Ca) and CO₂ fixation rate under saturating light conditions using a Li-Cor 6400xt Infrared Gas Analyzer. Results to be presented. A similar trial was conducted using lettuce and tomato seedlings in three experimental groups using weekly fertilization of Miracle Grow™ plant food, or one of two types of compost in the soil mix. For this trial, two replicates of 3-B™ potting soil were prepared as well as two replicates of 75% compost /25% 3-B™ for both types of compost. The Miracle Grow was applied at maximum recommended rate as aqueous solution to one of the replicates of 3-M™ Potting Mix and the other was left as a control group. Aqueous solutions of Miracle Grow™ mix and two different compost teas were prepared and applied to their respective soils. Each of the treatments and soil was then tested for three key foliage nutrients (P, K, Ca), and the soil was tested for cation availability. Results to be presented. (46)

Ryan Frederick, Charles Kimpel, Andrew Patton, Jean Zipagan, Timothy Van Dyke*, John Meyer*

Disability Resources Tricycle Rear Axle Redesign Project

Messiah College has partnered with the Center for the Advancement of the Handicapped in Mahadaga, Burkina Faso to design electric and hand-powered tricycles for persons with disabilities. In 2009 the tricycle frame was redesigned to include advancements in ergonomics, strength, and manufacturability. The new design called for a new axle design for the rear wheels. In this new design, the axle is supported on one side, similar to a wheelchair, rather than on two, as in the old axle design. When the new rear axle design was implemented in Burkina Faso, it was found that because of metal fatigue and wear, the axle failed. As a result, the current project was formed to modify the axle design to solve these problems. This project has had two

goals. First, design an axle using high quality parts from the United States, to replace the faulty design. Second, consider design changes which could be used for all future tricycles using locally available material. During the January 2012 trip, the first design was implemented. Simultaneously, the team worked on the axle design to be installed on all future tricycles. Data has been gathered concerning case-hardening the axles to decrease wear. Additionally, a new axle and hub assembly has been designed, prototyped, and tested as a proof of concept. Long term testing, to be carried out by next year's project, is needed to fully evaluate the new rear axle design as a viable option for the harsh conditions it will experience in Burkina Faso. (25)

Victoria Fulford, Brooke Airey, Kelly Thomas, Maryann Brogden[^], Lea Dailey[^], Nancy Woods*

Do Not Disturb: Clustering Care to Decrease Incidence of ICU Psychosis

Background and significance of clinical problem/ question: Patients in Intensive Care Units (ICU) often experience a range of adverse psychological reactions, such as ICU psychosis, that may delay the recovery process, increase length of stay, and have long-term psychological sequelae. Sleep deprivation that occurs among these patients has been linked to such psychological disturbances. The current practice at Holy Spirit Hospital is to provide care to the patient as it is indicated, disregarding the patient's sleep patterns. The Registered Nurse (RN) staff has observed these constant interruptions as detrimental to the patient's wellbeing. **PICO question:** Among adult Intensive Care Unit patients, what is the effect of clustering care compared to routine (unclustered) care on incidence of ICU psychosis? **Methods of literature search:** A review of literature was conducted utilizing PubMed, PsycINFO, CINAHL, MedLine and the Cochrane Database from 1996 to 2011. A total of 57 articles were identified and seven addressed the research question and became the focus of the study. The majority were Level III with a B quality. **Findings from EBP project:** Evidence clearly supports an inverse relationship between environmental stimuli in the ICU and the amount of sleep that patients receive. Olsen (2001) found that patients were 1.6 times more likely to be asleep during an established quiet time. Both systematic reviews recommended clustering care to further decrease the incidence of sleep deprivation. **Recommendation for practice:** Based on the literature review, there is insufficient evidence to conclude that clustering care will decrease the incidence of ICU psychosis, although it may decrease sleep deprivation. Our suggestion is that further research is needed to investigate the benefits of clustering care. Meanwhile, nurses should make an effort to reduce environmental stimuli and avoid unnecessary interruptions. (81)

Jaime Gerhart, Timothy Houck, Barbara Ressler*

Oxygen Concentrator Modification: Intake Filter Testing and Analysis

Oxygen concentrators provide respiratory support for patients in hospitals around the world. However, because of the harsh environmental conditions in rural hospitals in Africa, oxygen concentrators fail frequently. During a visit to Macha Mission Hospital in Zambia in the summer of 2011, we determined that the concentrators were failing because of the high concentration of dust in the air; the filters in place were insufficient to prevent the dust from damaging the device. In an attempt to fix this problem we selected various types of filters from other oxygen concentrator manufacturers and tested their capacity to remove dust from circulating air. We designed an apparatus for accelerated filter testing in which large quantities of dust were circulated in a closed chamber; air from this chamber was drawn through the different concentrator filters. Throughout the testing, we measured the quantity of dust retained by the

filters as well as the dust that passed through the filters. Filters that were able to retain large quantities of dust and/or prevent dust from passing through are candidates for further testing. Based on our results, the most durable filters will be selected for use in the concentrators at Macha Hospital. (1)

Amanda Gray, Amy Porto, Mary Ann Mihok*

Assessment of Malnutrition among Albanian Elderly Participating in Home Meal Delivery Using the Mini Nutritional Assessment

Malnutrition is of increasing concern among the elderly. Home meal delivery programs target individuals with decreased access to food and increased risk of malnutrition. The purpose of this study was to assess the nutritional status of elderly Albanian meal recipients using the Mini Nutritional Assessment (MNA). Elderly meal recipients (n=31) were assessed using the MNA during July and August, 2011. Fisher's exact test was used to compare the frequency of the malnutrition indicator score (MIS) categories to the frequency of individual responses to the MNA. The MIS revealed 65% of the elderly were at risk for malnutrition, 6% malnourished, and 29% with normal nutritional status. The malnourished and at risk MIS categories were significantly associated with MNA responses for food intake decrease, meat/fish/poultry consumption, and negative self-views of nutritional status and health status ($p < 0.05$). A trend was observed in association of MIS categories with responses to number of meals per day and overall protein intake ($p \leq 0.1$). Malnutrition was not prevalent among meal recipients although nearly two-thirds of the subjects were at risk of malnutrition. Future meal recipients who report a decrease in food intake or negative self-views of nutritional status or health status should be monitored for nutritional risk. The meal delivery program should work to provide meals containing adequate protein sources. (39)

Anthony Hahn, Carl Erikson*, Mike Zummo*

Oil Pressing and the Sunflower Project

In the summer of 2011, five acres of sunflowers were grown on the Messiah College campus in an effort to implement a sustainable solution to obtaining quality cooking oil and biodiesel. The goal was to harvest the five acres of sunflower seeds, mechanically press these seeds to obtain oil, deliver the pressed oil to Dining Services to be used for cooking oil, and produce biodiesel from the oil once it was no longer usable for cooking. The pressing project is a subset of this sunflower project and focuses specifically on the mechanical extrusion of the oil from the sunflower seeds. The objective of the pressing project is to obtain an efficient, reliable, and safe way to remove the oil from the seeds using a screw press and diesel engine and to optimize the press parameters so that the maximum oil yield is obtained while reducing the amount of gums present in the pressed oil. (29)

Ben Hallowell, Elizabeth Miller, Lawrence Mylin*

CD4+ T Lymphocyte Induction by a Mouse Polyomavirus Epitope inserted into the Simian Virus 40 Large Tumor Antigen

Our laboratory has used the SV40 T ag as a model tumor antigen to study CD8+ T cell-dependent control SV40 T ag-induced tumors in mice. We wish to explore the role of SV40 T ag-specific CD4+ T cells in establishing and maintaining tumor control and in regulating tumor-induced (CD8+) T cell tolerance. Residues 529-543 have been identified as a CD4+ epitope within the SV40 T ag which appears to be weakly immunogenic in C57Bl/6 mice immunized

with SV40 T ag-expressing cells. To explore factors which may limit the immunogenicity of LT529-543 within SV40 T ag, we have constructed SV40 T ag derivatives in which LT529-543 was replaced by amino acids corresponding the related murine Polyomavirus Large T antigen (mPyT) LT678-690 epitope. Immortalized cell lines were generated by transfection of primary C57Bl/6 kidney cells, and have been compared in immunization experiments to established cell lines which express the unaltered SV40 T ag. The results of these experiments combined with those of experiments in which the immunogenicities of synthetic peptides corresponding to the respective epitopes were compared will allow us to determine whether location within the SV40 T ag or intrinsic properties limit the immunogenicity of the SV40 T ag LT529-543 epitope. (59)

Angela Hare

Teaching Mathematics to Children who are Blind or Visually impaired

For students who are blind or have visual impairments, mathematics can be especially challenging to learn. Teachers of mathematics can incorporate learning tools that help these students and enhance the mathematical learning of all students in a class. This presentation will cover tactile representations, physical activities that build mathematical understanding and use of the Nemeth code for math notation. (36)

Lindsey Hayes, Daniel Kreider, Lawrence Mylin*

Generation of a Simian Virus 40 Large Tumor Antigen (SV40 Tag) 529-543-specific T cell Receptor Transgenic Mouse

To explore the role of tumor-specific CD4⁺ T cells in controlling growth of, and in regulation of tumor-induced (CD8⁺) T cell tolerance to SV40 T ag-induced murine tumors, we have identified residues 529-543 as a CD4⁺ T cell epitope within the SV40 T ag and have begun to characterize its immunogenicity in C57Bl/6 mice. We have undertaken to construct a T cell receptor (TCR) transgenic mouse in which all developing T cells will be programmed to express both the alpha and beta TCR subunits utilized by the LT529-543-specific CD4⁺ T cell hybridoma clone 4-15. LT529-543-specific CD4⁺ T cell frequency will be modulated in tumor-bearing animals by adoptive transfer of lymphocytes from the TCR transgenic mice. Nucleotide sequences corresponding to the unique combining regions of the clone 4-15 alpha and beta TCR subunits were obtained from partial cDNA clones generated by 5'RACE. Comparison to C57Bl/6 genomic sequences allowed for the construction of PCR primers needed to amplify the relevant recombined V-(D)-J sequences from clone 4-15 genomic DNA. Following sequence verification, the cloned V-(D)-J regions were ligated into alpha or beta TCR cassette expression vectors from which larger constant region and enhancer-bearing fragments could be excised for microinjection into day-old mouse embryos. (57)

Ruthanne Hepkins, Rebecca Rotzell, Sarah Wagoner, Louann Zinsmeister*

Better Communication for Better Results

Introduction: In a day, nurses make countless calls and spend a great deal of time trying to communicate with all the professions involved in each patient's care. Multidisciplinary Rounding (MDR) is a potential solution to cut down on adverse events, improve communications within the healthcare team, and improve nurse's job satisfaction on medical-surgical units.

Objective: The PICO question is, on a medical surgical unit, what are the effects of multidisciplinary rounding on patient outcomes? The focus of this evidence-based practice research project was to find the best practice for rounding. **Methods:** This evidence-based

practice research project was developed to determine if multidisciplinary rounding is a beneficial practice change. The data bases of Pub Med, Cochrane, Medline and CINAHL were searched using the terms multidisciplinary, patient safety, patient satisfaction, quality of care, nurse-physician communication, nurse-physician collaboration, joint rounding, intensivist, hospitalist, etc. A variety of studies were appraised by the research team and narrowed down to the research that was deemed to be valid. **Results:** The evidence-based practice research team found from the critically appraised studies that although evidence is lacking within the context of medical-surgical units, there is an overwhelming positive impact of multi-disciplinary rounding on critical care units. Communication was found to improve including a decrease in medication errors on the units where multi-disciplinary teams were established. **Conclusion:** It was found that although evidence lacks within medical-surgical units, the results could be generalized from the findings based on critical care units. A recommendation was made to conduct a pilot study within a medical-surgical setting to determine the effects of multi-disciplinary rounding within a medical-surgical unit context. (93)

Benjamin Hepler, Jeff Erikson*

Do Differences in Geologically Determined Physico-chemical Properties Influence the Community Structure of Aquatic Macroinvertebrates?

Abiotic factors like water chemistry and hydrology have a significant effect on the types of benthic macroinvertebrates that can survive within a given aquatic ecosystem because each taxonomic group has specific environmental preferences and tolerances. Streams whose principal substrate is limestone will invariably have different chemical properties than streams dominated by sandstone substrate. As a result, the make-up of the macroinvertebrate communities of these streams typically is significantly different. In this study, conducted at Dogwood Run in Dillsburg, Pennsylvania, a stream section below the convergence of a sandstone and a limestone stream was examined to gain insight into the effect of “mixed” abiotic properties on macroinvertebrate communities. The site was visited five times between the fall of 2011 and the spring of 2012. Macroinvertebrates and water samples were collected at four points below the convergence, as well as at two points in each stream above the convergence. In the lab, water chemistry values were determined for each sample, and macroinvertebrates were identified to the genus level. This study allowed us to conclude that water chemistry in the mixing zone was indeed influenced by each stream. Conclusions regarding which stream contributed the most to these properties, in addition to how the macroinvertebrate communities were influenced, will be discussed. (67)

Thomas Hertfelder, David Allen, Matthew Gusick, Joshua Byler, Matthew Hoover, Randall Groff, Avery deGruchy, Austin Beiler, Matthew Musselman, Kara Silvis, Gunnar Herman, D. Scott Weaver*

Building a Dynamically Dynamic Website

Several years ago a project was started in another Computer and Information Science course to develop a Project Management System for the Agape Center that allows Community Partners to propose service projects in a structured manner. The initial project was enhanced by students over the summer, then taken on by a consulting firm to further develop its functionality. The project has been in use by the Agape Center and the United Way is interested in implementing it for their project management. With discussions with the United Way and other organizations it was determined that the web-application needed to be able to be customized by the organization

to better fit their needs. Two Computer and Information Science courses were involved in the re-design of the application, making it a dynamically-dynamic web application. The concept of a dynamically-dynamic web application will be presented as well as the progress made by the students. (16)

Hope Hess

Google Search Engine and Page Rank

We are all familiar with the Google search engine. But how does it work? Like many search engines, Google uses page rank as an effective way to categorize search results. The idea behind it is to give a measure of importance to a particular web page, based on the number and quality of backlinks to this page. Google then uses this Page Rank along with a text-matching algorithm to generate the search results ordered by relevance to the search query. (12)

Victoria Himmelberger, Lawrence Mylin*

A bacteriophage neutralization exercise for the Microbiology for Health Professions course

Bacteriophages are viruses that infect bacteria. Infection can be inhibited by antibodies that bind to phage coat proteins. Two strains of bacteria--*E. coli* B and *E. coli* C--were infected with differing numbers of plaque forming units of the respective bacteriophage, T4 or PhiX174, to determine conditions that would result in comparable plaque coverage of bacterial lawns on agar plates. In parallel experiments, the strains were infected with phage suspensions which had been incubated with T4-specific goat IgG antibodies for varying lengths of time prior to addition to the bacterial cells. The resulting plates for both strains displayed plaques, denoting infection, while the plates for *E. coli* B/T4 displayed a dramatic reduction in plaque number with increasing concentration of antibody. The *E. coli* C/PhiX174 plates produced using PhiX174 phage incubated with the T4-specific antibody showed no reduction in plaque formation, indicating appropriate specificity of the antibody for the T4 phage. These results will be used to formulate appropriate conditions for a two hour microbiology course laboratory experience. (60)

Wesley Hollenbach, Daniel Earl, David Vader*

Village-Scale Water Filtration by Hollow Fiber Membrane (HFM)

The Collaboratory has partnered with Forward Edge International and rural communities in Eastern Nicaragua to develop culturally and fiscally sustainable water treatment strategies. Ultrafiltration of water using Hollow Fiber Membrane (HFM) technology for the removal of biological contaminants is widely used in larger scale and higher cost applications the developed world. More recently, the HFM filtration products of Sawyer Products, Inc. have achieved significant success in developing world applications. This project seeks an implementation of Sawyer's 10" HFM filter for village-scale water treatment in a design that can be replicated and maintained by local people in a developing world context, and facilitates backwashing where there is no access to pressurized potable water. The presentation will include the results of prototype testing in Nicaragua, an overview of design modifications made in response to prototype testing, and pressure-flow performance data through cyclic backwashing. Additional prototype systems will be installed in Nicaragua this May 2012. (2)

Erik Hornberger, Jordan Wiker, John Wolgemuth, Donald Pratt*

Intelligent Battery Balancing with Multiplexers

Providing energy to hybrid and electric vehicles presents a unique challenge. Unlike in most other applications, the load on an electric vehicle's battery pack is undetermined. The batteries that power electric vehicles experience large non-uniform loads while the vehicle is being driven and so tend to unbalance. Battery packs can only be used until their least charged cell is completely depleted, so correcting this imbalance is desirable for increasing the range of electric vehicles.

We have created a unique system for balancing charge in high capacity battery packs, with specific application in the Transportation Group's Solar Commuter Vehicle. In our system, a microprocessor monitors the charge on each string of batteries in the pack and uses an algorithm to intelligently route charge between the highest and lowest batteries using sets of multiplexers and a capacitor array. Two of the advantages our balancing scheme offers are expandability and efficiency. Unlike some other balancing systems which continually move charge to and from all batteries, our intelligent system achieves balancing faster by focusing on the batteries with the greatest imbalance. Most charge balancing systems have a set capacity - the balancing current cannot exceed a certain value without damaging the circuit. Our design uses parallel multiplexers controlled by a single multiplexer, so the maximum balancing current can be increased linearly simply by adding more multiplexers to the circuit board. **(21)**

Erin Horst, Elizabeth Smith, Laura Kieliszewski, Louann Zinsmeister*

Sleep in the Intensive Care Unit

Title: Sleep in the ICU: Patients Aren't Getting Quality Sleep or the Right Quantity **PICO**

Question: In adult ICU patient, does uninterrupted sleep of at least 4 hours on the night shift reduce length of ICU stay as compared to q2 hour interrupted sleep for nursing interventions, such as mouth care and turning? **Background:** Critical care nurses have always been aware that it is difficult for patients to sleep in the ICU, but few have thought of ways to help improve their patient's sleeping habits. Sleep is essential for critically ill patients, but it is hard for patients to get enough sleep in an environment filled with alarms and nursing interventions that are done every two hours. The purpose of this evidence-based practice research project was to see if decreased sleep leads to longer length of stay. **Methods:** A review of literature was conducted utilizing PubMed, CINAHL, and EBSCO for articles ranging from 2006-2011. Eight articles were chosen and it was narrowed down to four articles to critically appraise; the other four articles were used as supporting evidence. **Findings:** Both intrinsic factors such as the disease process and extrinsic factors like noise affect sleep. Even if patients appear to be getting the correct amount of hours of sleep, the quality of sleep is poor. Decreased sleep in ICUs leads to a decreased immune system, increased intubation time and longer length of stay. Direct nurse contact is one of the main reasons patients cannot sleep. **Recommendations:** More research is needed regarding if turning or mouth care can be skipped for one 2 hour interval. Nurses need to cluster care whenever possible in order to minimize direct patient contact, and be aware of the surrounding noise and lights. Mechanical ventilation should be synchronized with the patient's breathing in order to avoid discomfort and promote sleep. **(89)**

David Janczyk, Philip Ribbens, Chad Yoder, D. Scott Weaver*

Church Software Analysis for Daybreak Church

Churches today are beginning to recognize the role technology and software can play in the management within the church. This project, in collaboration with Daybreak Church and the

Messiah College Systems Analysis and Design CIS 412 course, examines the need for church software in a local church. Through the use of requirements gathering, end user needs, and software research, a church management software package was chosen and recommended to Daybreak Church. Further thought and planning has also been put into place for current technical requirements, group management within the software, and security roles. We will present the process we took in arriving at this software, as well as presenting the software we chose. (17)

Eric Kauffman, Tim Yoder, David Vader*

Village-Scale Batch Water Treatment using Ozone

The Village Water Ozonization System (VWOS) is a village-scale water purification system developed by the Collaboratory to produce potable water for communities that lack access to clean water. The design uses a combination of filtration and ozone to disinfect water. Unlike filtration alone, the presence of ozone in water delivered from the VWOS system provides residual disinfection capability to purify containers used to collect and transport water, but without the unpleasant taste of chlorine. A standard biological challenge to the system using non-pathogenic bacteria was developed to standardize measurement of the effects of design modifications. Baseline tests were performed as a benchmark for future results. Test results showed that the ozone contact time needed to increase, resulting in the addition of a series of flow turns through large diameter pipe chosen to decrease water velocity and thereby increase contact time. A new venturi was also installed to increase the mixing efficiency of the ozone. The location of a future prototype implementation will be explored with the client organization, Forward Edge International, in eastern Nicaragua this May 2012. (4)

Pamela Kirkpatrick, Kimberly Frey, Angela Hare*

Academic enrichment in mathematics; a summer program in West Africa

Five years ago, the Education Group of The Collaboratory for Strategic Partnerships and Applied Research began working with a school for students with disabilities in the rural village of Mahadaga, Burkina Faso. In conjunction with the school's administration, Messiah College students and faculty decided that the training Messiah College education students receive could be used to improve the education of the Burkinabè students. In response, the Burkina Summer Enrichment Program (BSEP) was created. Throughout this three year project, Education Group members spent the school years developing curriculum for summer programs. During the summer of 2011, the second year of the project, five Messiah College students as well as Dr. Angela Hare implemented a curriculum revised from the summer before with thirty upper elementary school students with varying levels of disability. The materials used included a mathematics curriculum created by Bethany Blackwood, a second less advanced mathematics curriculum, and music, handwriting, and photography activities designed to address literacy and mathematics needs. The team also took twelve netbook computers to leave with the school and performed teacher training workshops with the computers. The information gathered during this program will impact the future work on the Education Group in Burkina Faso. (35)

Jacynth Koh, Michael Shin*, Richard Schaeffer*

Histidine's Rescue Effect on Arabidopsis thaliana Amidst Nickel Toxicity

Past Messiah students have conducted studies on *Arabidopsis thaliana* regarding its response to nickel toxicity revealing that small amounts of nickel (>50 μM) have detrimental effects on the health of the plant. Most recently, the observation of histidine's rescue effect on the plant in toxic

nickel levels has invited further examination of nickel uptake into the plant in the presence of histidine and was sought to be assessed using High Liquid Performance Chromatography (HPLC) and electrochemical potentiometric methods. The goal of this study was to formulate and verify methods that could effectively provide an assessment of histidine content in *Arabidopsis thaliana*, providing insight into the possible interaction with nickel. Although workable HPLC and electrochemical potentiometric methods remains to be formed, numerous venues were explored and pitfalls weeded out. With regards to HPLC methodology, the main useful thing was the qualitative verification of literature claims for histidine's retention time being between 7-8 min with 0.1% formic acid and acetonitrile as the mobile phase. Given the limitations of instrumentation, it is fair to say that HPLC methods may not be very favorable unless there is a simple way of pre-functionalizing histidine with a fluorescence tag so that it does not interfere with separation through the column. Post-manual functionalization and separate fluorescence detection is, to say the least, very laborious. On the other hand, electrochemical potentiometric methods in their simple preparation, nondestructive detection, and easy use may remain a promising alternative for histidine content with additional testing and calibration. (63)

Daniel Kreider, Lindsey Hayes, Lawrence Mylin*

Generation of a T Cell Receptor Transgenic Mouse; Assembling the Full Sized Expression Cassette

The development of a T cell receptor transgenic mouse would be useful to research efforts designed to understand immune control of solid tumors. Availability of a line of mice which exclusively express CD4+ helper T cells specific for a single epitope within the Simian virus 40 large tumor antigen would allow the harvest of large numbers of clonal tumor-specific T cells. These T cells would prove useful for future adoptive transfer experiments which will investigate the roles of CD4+ and CD8+ T cells in the cellular immune response to and control of SV40 T antigen-induced tumors. cDNAs encoding the epitope-specific regions of both (alpha and beta) T cell receptor subunits from a CD4+ T cell hybridoma specific for the SV40 T ag epitope 529-543 were used to construct expression cassette vectors that will be used for microinjection of mouse embryos to produce a line of T cell receptor transgenic mice. (70)

Amy Krug, Cecilia Kjellman, Rebekah Sabo, Amy Porto*

Evaluation of the Nutritional Adequacy of Meals Served at the Salvation Army in Carlisle, PA

Private and small food assistance organizations have limited monetary resources and rely on foods that are energy dense but do not necessarily provide adequate nutrients. The Salvation Army of Carlisle, PA offers a few food assistance programs such as the Homeless Breakfast Program, which serves a hot breakfast to approximately forty homeless individuals, and My Brother's Table, a program that serves a meal to anyone in need of assistance every day of the year. The goal of this observational research was to evaluate the nutrient content of meals served by the Salvation Army's Homeless Breakfast program and My Brother's Table program. For four days, breakfast and dinner recipes were documented. At the beginning of each meal, digital pictures were recorded of a typical tray including all the foods for a meal. Digital pictures, tray measurements, and cookware measurements helped in determining the serving size of each portion of food served. Nutrient content was evaluated using Food Processor 10.8. Average nutrient values for the four days were compared to two-thirds of the Recommended Dietary Allowance (RDA) or Adequate Intake (AI) values for men and women ages 31 to 50 years.

Nutrients above the RDA or AI included cholesterol and sodium, and nutrients below were fiber, thiamin, riboflavin, vitamin B6, vitamin C, vitamin D, folate, calcium, magnesium, and potassium. Results from this study can inform the Salvation Army about the imbalance of crucial nutrients and assist the organization to create menus that are diverse, nutritious, and balanced. (78)

JoAnna Larson, Dena Steiner, Jodie Haak*

Community-Based Rehabilitation: an Effective Solution to Health-care Disparities and Social Rejection of Individuals with Disabilities in Sub-Saharan West Africa

Nearly 650 million people in the world live with disabilities, with eighty percent living in developing countries. Many of these individuals are denied their rights, including access to appropriate rehabilitative care. In response to this oppression, a movement within the global community to develop rehabilitation options was born. Community-based Rehabilitation (CBR), the current most widely-practiced theory, aims to empower families, communities, and individuals with disabilities. Through the decentralization of power and knowledge, CBR aims to enable individuals to be involved with, and eventually lead, their own rehabilitative care as a part of community development. Witnessing the devastating effects of neglect and healthcare disparity during our personal experiences in West Africa affirmed the need for CBR programs. However, the efficacy of the physical rehabilitation of individuals with disabilities within the CBR model had not been validated. After finding a seemingly successful and sustainable model program in Mahadaga, Burkina Faso, an empirical evaluative study was initiated. Additionally, a literature review was started to validate the therapies utilized in CBR-modeled clinics and analyze CBR as a theory of practice. Our research has affirmed that both the therapy methods utilized in these clinics and CBR as a theory are effective in some, but not all, situations. It was found that it is necessary to include environmental and cultural considerations when introducing CBR to a community in order to achieve effective practice. (55)

Trevor Lee, Beau Herndon, Carl Erikson*, Mike Zummo*

Biodiesel Centrifuging

A critical part of turning waste vegetable oil into usable biodiesel is cleaning the waste vegetable oil of dirt, water, and impurities. One of the ways to do that is through the use of a Raw Power Centrifuge to separate by density the pure oil from the impurities in the oil. This project determines if running a centrifuge was the most efficient way to obtain clean vegetable oil in our current system based on time and cost, and to determine the optimum settings to run the centrifuge. The results of testing have determined the best flow rate and rotational speed that the centrifuge should be run in order to receive the cleanest oil in the most efficient time. The project also determines other possible cleaning techniques that may be cheaper and more efficient options depending on the application. (30)

Kaitlyn Lisa, Jessica Morris, Sierra Stephens, Cammie Wilcox, Louann Zinsmeister*

"Cold Hearted:" A Positive Thing

Introduction: Out of hospital cardiac arrest is a leading cause of death in the United States. Occurring at approximately 300,000 per year, the survival rate stands only at 92 percent. Of those that do survive, many are left with neurological deficits. Furthermore, for many, the cause of death is the absence of any neurological independence. Therefore, we are presented with an issue of finding better treatment modalities to decrease neurological deficit in patients who

experience out of hospital cardiac arrest. This evidence-based research project investigated if therapeutic hypothermia would increase favorable neurological outcomes in patients who experience cardiac arrest. PICO Question: In patients who survive out of hospital cardiac arrest what is the effect of therapeutic hypothermia on neurological outcome compared with patients who receive traditional therapy? Methods: CINAHL, PubMed and Cochran database of systematic reviews were searched using the keywords therapeutic hypothermia, cardiac arrest, and neurological outcome. Nine research studies were selected and reviewed and four were chosen to be included in this review. Results: The reviewed articles provided critical appraisals of one or more research studies in which hypothermia therapy was performed on an individual who experienced cardiac arrest and the individual's neurological status after treatment. The articles chosen define "good neurological outcome" in different approaches, some used the Pittsburgh cerebral-performance scale while another defined it as going home or to a short term rehab center. Each article indicates that the use of therapeutic hypothermia improves neurological outcome in those who experience out of hospital cardiac arrest. Conclusion: Therapeutic hypothermia should be implemented into current practice. (88)

Morgan Lister, Stephanie Miller, Jennifer Phipps, Sara Voran, H. Scott Kieffer*

Comparison of Oxygen Consumption During Walking on a Woodway Curve Treadmill and a Woodway Standard Motorized Treadmill

Purpose: The purpose of this study was to compare the physiological responses (heart rate, VO_2 , respiratory exchange ratio (RER), and caloric expenditure) between exercise on a motorized (TM) treadmill and the Woodway Curve Treadmill (C) at similar Rating of Perceived Exertion (RPE). **Methods:** Twenty-one (10 males and 11 females, age = 20.28571 ± 1.0556 years) recreationally active subjects participated in a randomized and counterbalanced study. Following a familiarization protocol, subjects underwent one session on either TM or C treadmill that consisted of a 1-2-minute warm-up and completed a 15 minute exercise session at self-selected pace that corresponded to 13 (Somewhat Hard) on the Borg Scale.. Breath by breath analysis was collected for the entire protocol providing measurements of VO_2 , VE, and RER. Heart rate (HR) RPE and caloric expenditure were also collected at intervals during and following the protocol. The same protocol was repeated on the second modality after a minimum of 24 hours. A two-way ANOVA was performed on each variable, and a paired t-test was conducted, comparing total calories burned for each modality. **Results:** The main effect of condition was significantly higher for HR and VO_2 on C. The main effect of time was not significant for any variable. There were no interaction effects. Caloric expenditure was significantly higher for C for total work performed during the exercise session.

| | Heart Rate (bpm) | VO_2 (ml/kg/min) | Caloric Expenditure (kCal) |
|-----------------|---------------------|-----------------------|-------------------------------|
| Curve (C) | 150.8±18.0 | 27.4±5.1 | 143.0±33.3 |
| Motorized (TM) | 114.2±17.4 | 18.1±11.3 | 87.4±26.4 |

Conclusion: While working at similar RPE, the subjects elicited higher HRs, higher VO_2 s, and increased caloric expenditures on the Curve treadmill in comparison to the motorized treadmill. (38)

Kristen Listor*, Erik Lindquist*

The Construction of a Guide for Larval Identification of the Marbled Salamander (Ambystoma opacum)

Distinguishing between the three ambystomatid larvae that can be found in this region can be difficult. These include the marbled salamander (*Ambystoma opacum*), spotted salamander (*Ambystoma maculatum*), and Jefferson salamander (*Ambystoma jeffersonianum*). The goal of this research was ultimately to determine defining features in marbled salamander larvae in order to facilitate in identification of the species at this stage of development. Field surveys were conducted in the fall during breeding time in order to gauge the size of the population and the amount of males vs. females. Eggs and larvae were collected and raised in order to document development through photographs. Additional collections were taken weekly for the same purpose. Total length size comparisons can effectively be used when collecting during the spring to distinguish between species, as marbled salamanders are much larger. Additionally, some common features have been found between the specimens as markers for identification. Similar photographic documentation of the additional ambystomatid species is needed to solidify these results through interspecies comparisons. (44)

Kevin Manieri, David Allen, Jonathon Martin, Randall Fish*

Kilowatt-Hour Meter Project

The goal of this project is to design and implement a reliable, manufacturable device to measure, display, and limit kilowatt-hour usage of a home or other facility. This device was requested by our client, Matt Walsh, with the intent of facilitating the sharing of excess power from an existing solar power system in Mahadaga, Burkina Faso. In addition to allowing equitable sharing of power, this device also promotes energy awareness and conservation. Three such devices have been successfully installed in Mahadaga, Burkina Faso. (33)

Nathan Marlowe, Kyle Flanick, H. Scott Kieffer*

The Effects of Over Speed Training on Two Different Training Methods

PURPOSE: The purpose of this study was to compare the difference in over speed-training on a curved non-motorized treadmill compared to a traditional speed training program, specifically in the areas of sprint speed. **METHODS:** Thirty athletes (17 men and 13 women) were randomly assigned to a curved treadmill group or a traditional over speed training group. The each group participated in a pre-season conditioning regimen; however, 15 subjects were randomly assigned to undergo their speed training on a curved treadmill designed for over speed training and 15 were assigned to a traditional linear speed training group. All speed sessions were matched for volume and intensity. A 2 (time) x 2 (condition) ANOVA was utilized to determine the differences between the main effects and possible interaction effects.

RESULTS/CONCLUSION: There was a significant increase in speed in both training groups and a trend towards greater increases in the curved treadmill group. Data is still being analyzed and will be presented at the symposium. (54)

Mary Martin

Muscle Polarization and Contraction with Andrew Huxley

Andrew F. Huxley, along with others, won the Nobel Prize for Physiology or Medicine in 1963. His work included discoveries in the ionic mechanisms on the nerve cell membranes and creation of formulas for trends of muscle contractions. Huxley was able to combine his mathematical

passion and knowledge with his experience in exercise physiology, which was encouraged by professors that observed his talent. He was one who took well the influence of others and was in turn able to develop that in those who worked in his lab and under his instruction, making him an influential figure to many. Researching and observing the width of A bands in the sarcomere and the polarization of potassium and sodium on cell membranes are just scratching the surface of his work, which will be discussed. (11)

Philip Martinez, Carl Erikson*, Mike Zummo*

Automated Biodiesel Production System

Currently, the production of biodiesel for campus use is labor intensive because the main system is not automated. This slows down production because at the end of a process step if someone is not available, the production stops until someone is available. With student volunteers this may lead to multi-day delays especially during holidays and semester breaks. The automated biodiesel production project is to allow a batch to be produced without the requirement of a presence of a person at each stage to advance the production process. The project involves the design, construction, and testing of both the mechanical and electrical subsystems of the processor. This presentation covers the testing and lessons learned along with future potential areas of research. (31)

Sophia Mavronis, Jenae Griffith, Emily Gonder, Michael Whitner, Louann Zinsmeister*

Rounding at the Roundtable

This evidence-based practice research project examines the effect of bedside shift report on patient safety. The PICOT question is as follows: In adult medical/surgical patients how does bedside shift report, compared to other report methods, affect patient safety (such as falls, medication errors, accuracy of information) within a 30 day period? A literature search was conducted using CINAHL, PubMed, Medline, and Cochrane databases. Four articles were critiqued, including a descriptive study and three case studies with a level of evidence of VI. The studies were critiqued for their review of literature, major findings, and strengths and weaknesses. Correlations were made between bedside shift report and an increase in patient safety, as well as patient satisfaction. According to Moffitt and Butler (2009), there was a decrease in patient falls and pressure ulcers as a result of the implementation of bedside report. The descriptive study performed by McMurray, Chaboyer, Wallis, Johnson, and Gehrke (2010) concludes that bedside shift report is essential for implementing a partnership model of care. It was determined that there was a movement towards patient centered care and safety. Recommendations are to compile a fact sheet for nurses on bedside shift report, implement a practice change with a specific process, and to conduct a further study that focuses on the outcomes of bedside shift report. (87)

Charles McBeth, David Foster*

Stratification and Tissue Culture Propagation of *Mertensia virginica*

This study addresses the steps necessary to move *Mertensia virginica* towards tissue culture propagation. We explored the following tissues as possible sources for callus development: seeds, seedlings, fine roots, released and unreleased buds, and true leaves. We determined the seeds were contaminated with fungal and mold spores inside a small arch protecting the micropyle, rendering surface sterilization useless. Seeds can still germinate and grow with this fungus present, but embryos are immature when seeds are shed requiring a double cold

stratification period of 90 days each for seed germination, with the first stratification being at either 4°C or 10°C and the second at 4°C, interrupted by 15 days of 21°C. Only 2% of seeds germinated after one stratification cycle at 4°C (varying from 54 to 120 days). At 10°C stratification only 0.1% of seeds germinated and no seeds germinated after 21°C stratification. Natural leaf senescence of bluebells can be delayed by \approx 60 days via growth in a 4°C chamber with a 16hr light/8hr dark photoperiod. After leaf senescence, rootstocks need to be stratified a minimum of 37 days at 4°C to initiate bud release when brought to 21°C. At this temperature there is an inverse linear relationship between length of cold stratification of the rootstock and time until emergence of leaf material; the longer stratified, the sooner leaf material emerges. Rootstocks were stratified for an average of 112 days before foliar emergence at 4°C and a maximum of 156 days at 4°C. We determined true leaf material was the ideal source for callus development. A reliable method for true leaf sterilization was developed by agitating leaves in 10% bleach with Tween 20 for one minute. Media containing 1-Naphthaleneacetic acid (NAA) was ideal for callus formation from true leaves; 10 μ M NAA resulted in callus formation of 75% of the leaves after 37 days. Callus formation on indole-3-butyric acid (IBA) media is still being studied, but it is much slower and less vigorous than on NAA media. Media containing indole-3-acetic acid (IAA) has indicated a delayed and weak capability to develop calluses. (45)

Keane McCullum, Hannah Tims*

Small Heat Shock Proteins 17.0 and 17.8: Expression, Purification, and Temperature Dependent Activity

Small heat shock proteins (sHsp) are essential for life and help organisms survive under stressful conditions. Their function is to bind to cellular proteins that are denaturing or aggregating due to environmental stress, and “rescue” the cellular proteins, holding them in a neutral state until other chaperone proteins can properly refold them. Our research focused on expression of sHsp 17.0 and 17.8 from *Zea Maize* using E-coli ER2566, purification of our protein using affinity chromatography, and development of a separate protein substrate on which to test the activity and temperature dependence of aggregation inhibition by our sHsp. (51)

Jaclyn Merkel, Shalisa Brubaker, Megan Clapp, Megan Craley, Audrey Hanselman, Katie Blosenski, Andrea Kopchik[^], Nancy Woods*

Nurse-to-Patient Ratio and Patient Satisfaction

Background and Significance: Patient satisfaction is a critical element for hospitals to attain. Nurse-to-patient ratio is an important factor when looking to improve patient satisfaction. Assigning more nurses to fewer patients could potentially improve the satisfaction ratings provided by patients. Holy Spirit Hospital currently has an overall average of one nurse to six patients. The Registered Nurse (RN) staff stated this ratio was too high and believed, if lowered, they could deliver better focused and more holistic patient care; which would in turn improve patient satisfaction. **PICO question:** What is the effect of nurse to patient ratios on patient satisfaction in acute care settings? **Methods of literature search:** A review of literature was conducted utilizing CINAHL and PubMed from 2000 to 2011. A total of 121 articles were identified that addressed nurse staffing. Four articles focused on patient satisfaction related to nurse-patient ratios and were included in this project. The majority of the articles were Level IV with a B quality. **Findings from EBP project:** Evidence supports the increased number of licensed nurses to patients in the acute care setting to improve patient satisfaction. The majority of studies found that an increased, or adequate, number of registered nurse hours per patient day

was significantly associated with improved patient satisfaction and less complications. A study performed by Chapman et al (2009) defines an adequate nurse-to-patient ratio as one nurse to five patients. An indirect correlation is found when increasing the ratio of nurses to patients, therefore increasing the amount of nurses on a unit each shift is beneficial in improving the patient's satisfaction. **Recommendations for practice:** Based on the review of literature, there is substantial evidence supporting a change in practice and increasing the number of registered nurse hours to patient day, therefore decreasing nurse-to-patient ratios. We recommend performing a pilot study on a medical surgical unit at Holy Spirit Hospital with decreased nurse-to-patient ratios to determine the effect on patient satisfaction ratings. (85)

Elizabeth Miller, Ben Hallowell, Lawrence Mylin*

Comparing the immunological potencies of two viral epitopes: LT529-543 from the Simian Virus 40 Large Tumor Antigen vs. LT678-690 from the Large Tumor Antigen of murine Polyomavirus

The results of this study are part of our ongoing effort to understand factors which control the efficiency with which tumor epitope-specific CD8+ T lymphocytes can control the progression of SV40 T ag-induced tumors in murine models. We wish to explore the requirement and role of SV40 T ag-specific CD4+ T cells in establishing and maintaining tumor control and regulating tumor-induced (CD8+) T cell tolerance. We have recently identified residues 529-543 as a CD4+ epitope within the SV40 T ag. We are interested in understanding why this epitope appears to be weakly immunogenic within SV40 T ag. To address this question, the immunogenicities of synthetic peptides corresponding to SV40 T agLT529-543 and murine Polyomavirus Large T antigen(mPyT) LT678-690 were compared in C57Bl/6 mice using ELISPOT assays. While the mPyTLT678-690 peptide was shown to be strongly immunogenic within the context of mPy viral infections by others, synthetic mPyT LT678-690 and SV40 T ag LT529-543 peptides induced similar, but low levels of CD4+ T cells. These results suggest that the lack of virus-induced immunity may limit the immunological potency of the mPyT 678-690 epitope and that the two epitopes may possess similar intrinsic immunogenic properties. (58)

Nathan Myers, Kay Witt*

Comparison of Sedentary Time between College Competitive Distance Runners and Recreationally Active College Students

Sedentary behavior is associated with chronic health risks and mortality even in active individuals. Time spent at sedentary metabolic equivalent (MET) levels by Messiah College competitive distance runners and recreationally active students was documented and analyzed to determine whether competitive athletes accrue more sedentary time than recreationally active students. In this descriptive cross-sectional study, 22 competitive distance runners and 26 recreationally active students wore SenseWear™ Armbands (SWA; BodyMedia, Inc.) continuously for seven days while engaging in free-living activity. Male (n = 10) and female (n = 12) distance runners were Messiah College Track athletes in distance events (800m through 10000 m) and who reported running more than 30 miles weekly. The recreationally active group consisted of male (n = 14) and female (n = 12) full-time Messiah College students who reported running at least six but less than 30 miles weekly, or equivalent physical activity, and who were not competing on club or intercollegiate sports teams. The SWA recorded the subjects' total time at sedentary MET levels for seven days. The difference in the mean sedentary time between the

two groups will be analyzed using two-way ANOVA and results evaluated with regard to the study objective. (40)

Alyssa Mylin, Donald Pratt*

LSA Nuts and Bolts (and a few rivets)

Every major project is composed of a large number of small details. Some of these attract more attention than others, but all must be carefully considered, addressed, and completed before the project is finished. This presentation covers several aspects of the LSA project that may seem disconnected, but all of which contribute to making the LSA project unique. The construction of the wings for the LSA is a major undertaking, and unique in that most of the internal structure of the wings is made from material left over after the wing skins were cut out. Additionally, the attachments of two key components were designed, the pilot/passenger seating and the mounting of the medical evacuation backboard. The wing construction had been started a few years back by the Messiah College Flying Club; however this work has now been taken over by the Transportation Group. If construction of the LSA as a whole is to stay on schedule, then the construction of the wings must move forward as well. Also, as the design of the plane develops and changes are made, it is crucial that key elements such as the backboard mounting system be considered as other subsystems evolve. Finishing the design of the backboard and seat mounting systems will insure that these elements will not be left out when the other LSA components and subsystems are completed. (6)

Paul Nickerson, David Foster*

Aquaponics as a Viable Means of Processing Sunflower Seed Cake Waste

Aquaponics is the use of fish culture as a nutrient source for a hydroponic agricultural system. The purpose of this study was to look at aquaponics as a means of processing waste press cake from the Sunflower Power sunflower oil extraction project. The first phase of the project was to establish a stable aquaculture system using Tilapia (*Oreochromis* spp.). The second phase involved gradually supplementing press cake into the Tilapia's diet until it was the primary food source for the system. Nutrient removal capacity by lettuce plants (*Lactuca sativa*, Buttercrunch and Romaine varieties) was evaluated. (47)

Aloysius Okon, Michael Shin*

Developing & Optimizing a Functional Assay for Amylase Activity

The examination of proteins has most often been performed through denaturing gels, which reveal information about protein structure, and native gels, which reveal information about protein function. Denaturing gels break down tertiary structure to reveal the protein size, while native gels maintain folded protein structure to allow protein function. A protein analysis lab ran the enzyme amylase through both denaturing SDS-PAGE gels and native starch agarose gels. The non-denaturing starch agarose gels revealed problems concerning the ability to detect amylase activity in digesting starch in the gel. Therefore, a new solution based functional assay for amylase activity was developed and optimized. Soluble starch was incubated in the presence of amylase in solution and subjected to various treatments, including exposure to heat and protease to determine the effects of various factors on enzyme activity. Untreated amylase controls were found to readily digest starch in solution, but heat-treated amylase lost effectiveness, showing that heat negatively impacts enzyme activity. Results from protease

treated amylase samples were inconclusive because the protease seemed to precipitate out of solution. (64)

Julie Perta, John Harms*

Quantification of the Down-Regulation of Cholecystokinin (CCK) mRNA Expression in PANC-1 Human Pancreatic Cancer Cells

As the prognosis of pancreatic cancer remains poor and a cure elusive, we are investigating ways to improve treatment of pancreatic cancer. Previous research has shown that the peptide hormone gastrin stimulates growth of pancreatic cancer cells. Down-regulation of gastrin inhibits tumor growth, while down-regulation of cholecystokinin (CCK), a closely-related peptide hormone, has not displayed an inhibitory effect. However, these studies utilized cell lines that expressed high levels of gastrin and gastrin receptor (CCKBR) in comparison to levels of CCK and its preferred receptor (CCKAR). We hypothesize that down-regulation of CCK in a cell line more dependent on CCK (higher levels of CCK than gastrin), will inhibit their tumor growth. The human pancreatic cancer cell line, PANC-1, has high levels of CCK and CCKAR and relatively less gastrin and CCKBR. To down-regulate CCK, PANC-1 cells were transfected with pSUPER.hygro shRNA constructs targeting two sites (-6 bp, 141 bp) in the CCK mRNA. A non-specific control shRNA (NSC) was also transfected in parallel. Transfected clones were selected with hygromycin and RNA was isolated from each line. Real Time RT-PCR was performed to measure CCK mRNA. A pool of shRNA(141) cells was significantly down-regulated 65-70% relative to wild-type PANC-1 cells ($p = 0.0007$). Two pools of control cells (NSC) preliminarily exhibited a decrease in CCK that were significant in one case ($p = 0.15$; $p = 0.004$). mRNA analysis of individual clonal cell populations is ongoing. (42)

Rachael Picard, Gary Emberger*

The use of herbal remedies in the treatment of human tinea

Tinea pedis can be difficult to treat and people can have unwanted side effects such as anaphylaxis to modern antifungal medicines. Herbal remedies could provide an alternative method of treatment for those who have adverse side effects to current treatments. This study was conducted as a preliminary test to see if herbal extracts of *Melaleuca* spp., *Eucalyptus* spp., *Lavandula* spp., *Mentha* spp., *Juglans* spp., *Echinacea* spp. and *Usnea* spp. have any effect at all on the fungus *Trichophyton rubrum*. Diluted extracts were sterilized by passage through a 0.22 μ m pore size filter and 0.5ml portions were added to individual 60mmX15mm petri plates of 9.5ml autoclaved liquid DIFCO© Sabouraud's Dextrose Agar, SDA. The plates were inoculated with *T. rubrum* and monitored for seven days for fungal growth. (71)

Stephanie Rausch, Chelsey Herzig, Chelsey Kauffman, Hannah Kurtz, Rachel Coyle, Louann Zinsmeister*

Head Positioning in the NICU: Why does it matter?

Premature infants born at less than 32 weeks gestation are at risk of developing dolichocephaly, a posterior to anterior elongation of the head. A contributing factor to dolichocephaly is the prolonged side to side head positioning often utilized in the NICU for critically ill infants. Nurses in the NICU are concerned that head shape could affect long term brain growth and development. The PICO question used to guide this evidence-based research project was "In Premature infants less than 32 weeks gestation, what is the effect of midline versus side-to-side head positioning on long-term brain growth and development?" A variety of databases were used

to find current studies to guide this evidence-based research project. The literature review included a critical appraisal of studies focused on the problem of dolichocephaly, and indicated that side to side head positioning increases cerebral blood volume and intracranial pressure. One particular study indicated that although premature infants begin to develop dolichocephaly, with interventions, including midline head positioning, premature infants can approach a more normal head circumference, shape, and appearance by discharge. There was little information found on long-term sequelae of dolichocephaly in the preterm population. Our recommendations would include NICU staff and parent education on the importance of mid-line head positioning. Further research is needed on the long-term effects of dolichocephaly. (91)

Ryan Schroeder, Marc Hoaglin, Timothy Van Dyke*, John Meyer*

Electric Tricycle Spline Shaft and Bearing Evaluation

The drive train for the Disability Resources electric tricycle includes a planetary gear in order to reduce the speed of the motor. The output plate of the planetary gear contains a splined socket which transfers power to the remainder of the drive train via a splined shaft and bearing assembly. Field trials have indicated excessive wear in the splined socket leading to premature failures in many of the planetary gear assemblies. The purpose of this project is to investigate the causes of wear in the splined socket of the planetary gear and to propose design changes which may reduce this wear. Experimental work and research have shown there are two main factors contributing to spline wear: the overhanging nature of the load on the splined output shaft and bearing, and impact loading of the splined socket upon acceleration, deceleration or change of direction of the electric motor. Based on these two factors, we have redesigned the assembly to include a more robust splined shaft support bearing. This reduces the impact of the overhung load and therefore reduces stress on the splined socket. With less wear and less play, the effect of the impact loading is also reduced. We are in the process of testing this new design. (26)

Shannon Sell, Gail Matters^, John Harms*

Exploring the Role of a Single Nucleotide Polymorphism in the Alternative Gene Splicing of the Gastrin Receptor in Pancreatic Cancer

Pancreatic cancer is a devastating disease and the fourth leading cause of cancer mortality. The digestive hormone, gastrin, stimulates human pancreatic cancer growth via its receptor, CCKBR. Furthermore, a splice-variant of CCKBR (termed CCKCR), retains the fourth intron, exhibits greater signaling and has been detected only in cancer cells. Recently, a single nucleotide polymorphism (SNP; C>A) in the fourth intron was identified. Only patients with an A allele expressed the CCKCR variant. These patients also had decreased survival compared to those with two SNP(C) alleles. We hypothesize that the SNP(A) plays a role in the alternative gene splicing of the receptor. The aim of this study was to engineer cells to express the CCKCR receptor encoded by either the SNP(A) or SNP(C) allele. While a vector encoding the SNP(C) allele existed, a version mutated to form the SNP(A) required cloning into a vector capable of transfection and selection in pancreatic cells. The gene was excised and ligated into pCAGEN.neo. Resulting clones were screened by diagnostic restriction enzyme digest and gel electrophoresis to confirm insertion and correct orientation of the gene. DNA sequencing confirmed the presence of SNP(A). Next, CCKBR, CCKCR-SNP(A), CCKCR-SNP(C) and empty vector were transfected in parallel into PANC02 murine pancreatic cells. Antibiotic selection of stably transfected cells is ongoing and will be followed by analysis of mRNA expression and transcript splicing. (43)

Ben Sheeler, Greg Moyer, Andrew Yau, Jonathan Kennedy, Kyle Young

Access Databases and a Local Church

Local Daybreak Church received help from Messiah College Database Applications students in order to resolve unfinished work in two of their regularly used databases. By collaborating with church administrators and correspondent Scott Weaver, the students have devised solutions to the databases needs. Problems prior to the project start included many planned functions not working properly along other additions that were asked to be included to the final database product. The two databases include Short-Term Ministries which help church officials keep track of mission's trips and finances that commonly go along with such missions. The other is the Care Ministries Department that deals with church member interventions and record keeping with all events that that relate. By updating and creating full functionality, Daybreak Church now has both databases fully functioning and now is regularly utilized. (14)

Luke Sisson, Timothy Van Dyke*, John Meyer*

Disability Resources Tricycle Durability Project

In many areas of the developing world, adequate transportation is difficult to find, especially for those living with a physical disability. To help alleviate this situation, Messiah College's Collaboratory ministry has teamed up with The Center for the Advancement of the Handicapped (CAH) in Burkina Faso, Africa. The workers at CAH manufacture hand-powered and electric tricycles for the disabled in their local community. These tricycle designs are continuously being redesigned and improved each year by Messiah engineers in order to reduce costs and enhance tricycle performance. Nevertheless, new problems still arise for the end users when the tricycles are ridden. Batteries die out; wheels bend or puncture; and internal mechanisms can rust and render the tricycles unusable until fixed. For the past year, the Tricycle Durability Project team has worked to analyze potential problems and determine the life expectancy of different components of the tricycles. To this end, the team has developed an extensive testing procedure for the tricycles to be put through in future years to determine what tricycle parts fail and how often. With this information, future Durability team members will be able to track the problems that occur with these tricycles and determine the likelihood of the problems reoccurring. This will allow them to find innovative ways to reduce these problems in the future. This project allows the tricycle users to obtain a continuously improving personal transportation device that they can trust in and rely on for years. (27)

John Sletta, Benjamin Jarvis, Donald Pratt*

LSA Main Gear Suspension: Flexible Rods and Safe Landings

During the past year the LSA Suspension team has been focusing its efforts on finalizing the main gear suspension system for the Light Sport Aircraft. Since the LSA has a tricycle type landing gear, the plane will come in for landing nose up, leaving the back two wheels to touch down first. Consequently the suspension system supporting these wheels will take the full load of landing. The focus of the design is on a flexible pultruded fiberglass rod, which will deflect and take the load of the aircraft landing. This year's work has included selecting, mounting, and testing of the fiberglass "flex rod." The flex rod design of the main gear suspension is an innovative design offering many unique advantages along with some interesting design challenges. Analyzing the rod and the suspension system it supports has necessitated the use of tools and techniques beyond the scope of normal undergraduate classes. Despite unforeseen

roadblocks, goals were achieved using creative problem solving and timely decision making. With the design stage finished and the prototyping phase in full swing, the project is on pace for a 2012 completion date. Join the LSA Suspension Team for a talk on the nearly completed main gear suspension system covering topics such as nonlinear deflection theory, flexible rod testing, and various suspension design considerations. (7)

Derek Smith, Zachary Sizemore, Timothy Whitmoyer*, Tony Beers*

India Mark II Deepwell Handpump Redesign

The Collaboratory is partnering with World Vision to improve the reliability of India MK II pump installations in Mali, Niger, and Ghana. The hand pumps represent a large donor investment and are a critical part of the beneficiary communities' water and sanitation strategy. Our work focused on identification of critical failures based on field observations in Mali and Niger. Currently, we are working on finding Installation and design solutions to reduce or eliminate these failures. The Project will help World Vision to provide communities with a more dependable and cost effective water lifting solution. (3)

Trevor Smith, Carl Erikson*

Powering Hope in Blanchard, Haiti

Many communities in Haiti are still trying to recover after the destructive earthquake in 2010, and with a unreliable power grid, solar energy is one of the most viable options for power in the region. Therefore, using the funds produced by Ride Solar, a benefit bike ride, the Energy group has worked jointly with Advanced Solar Industries to design and install a 3.9kW photovoltaic system on a Medical Clinic in Blanchard, Haiti. This will help the community rebuild with an overall goal to help them become more self-sustaining. (32)

Joshua Sorrell, Bryce Watkins, Jamison Hunsberger, Judah Fickett, Donald Pratt*

Electric Motorcycle Final Assembly

Our project has been developed with the ever climbing gas prices and the growing push for more efficient vehicles that save the environment in mind. Many different companies have been working to make electric vehicles a viable option. The Transportation Group is currently working towards the same goal as major automotive companies: making a vehicle that uses absolutely no fossil fuels. The electric motorcycle brings together technology commonly seen in production vehicles including a brushless electric in-hub motor, a lithium ion battery pack, and a solar charging station. The goal is to prevent this motorcycle from being an “elsewhere emission” like many others in the field. Through work, experience, and real world testing the Transportation Group has proven that solar powered electric vehicles are becoming a classroom buildable method of transportation. This past year we have continued to progress in our prototyping of the vehicle. We have added a battery read out display and a motor shield. We have also completed our lithium ion battery packs and the circuitry to allow us to control the motor. We will continue to push to finish and improve our electric motorcycle while we search for the next step in bringing solar and electric vehicle technology to the world so that we can create a more eco-friendly sustainable vehicular pattern. (23)

Andrew Steele, Alison Noble*

Liquid Crystals and the study of Self-Assembled Monolayers on a Zinc Selenide Substrate

Polarized optical microscopy was used to investigate the alignment of liquid crystalline (LC) thin films on a zinc selenide (ZnSe) surface. When LC films are placed between crossed polarizers, light and dark features indicate regions of order within the thin film. Within the film, one way to introduce order in the liquid crystals is to chemically modify the substrate by forming a self-assembled monolayer (SAM) on its surface. Zinc selenide crystals were exposed to 0.1 mM solutions of hexadecanethiol and pentadecanethiol overnight to form SAMs on their surfaces. The quality of the SAMs was measured using static contact angles of water droplets. Bare ZnSe surfaces had a static contact angle of $74 (\pm 1)^\circ$ and samples exposed to pentadecanethiol solution had a contact angle of $88 (\pm 2)^\circ$. The contact angles confirmed the formation of organized SAMs, since they were matched well with literature values. Infrared spectroscopy also confirmed the presence of SAMs. Using a clean ZnSe plate as the background, a spectrum of the chemically modified surface showed three peaks corresponding to CH_3 asymmetric stretching, CH_2 symmetric stretching, and CH_2 symmetric stretching, which were at 2958 cm^{-1} , 2919 cm^{-1} , and 2851 cm^{-1} , respectively. These values corresponded to ones found in the literature. The surfaces were also imaged using atomic force microscopy (AFM). LC thin films were spread onto ZnSe surfaces (with SAMs chemisorbed on the ZnSe) and the pictures between crossed polars showed many dark areas. Pictures of LC thin films on bare ZnSe surfaces had no large dark areas. The dark areas indicate homeotropic (perpendicular to surface) alignment of the LC molecules, and the light areas indicate homogeneous (parallel to surface) alignment. Our results indicate that thiolate SAMs on ZnSe are a promising system for promoting specific alignment and order within liquid crystalline thin films. (52)

Dena Steiner, JoAnna Larson, Jodie Haak*

The Efficacy of Rehabilitation Programs in Sub-Saharan West Africa for Children with Cerebral Palsy: An Evaluative Study

In West Africa, disability is seen as a curse and hidden rather than treated. Despite this cultural context, several rehabilitation program models have emerged and been established in communities. The effectiveness of these programs has not yet been formally evaluated. In an evaluative research study, the Gross Motor Function Measure (GMFM) was used as a standardized test for 48 children with cerebral palsy associated with two rehabilitation facilities. To date GMFM testing has been administered twice, six months apart, for 22 children who participated in a rural community-based rehabilitation program based in Mahadaga, Burkina Faso. The evaluation for the 15 control subjects and 11 urban-based subjects from Bamako, Mali started in January 2012. The current progress of the study will be shared using the two sets of data available from the rural group. With only one set of data from the control and urban groups, there is not sufficient data to make a definitive comparison regarding the efficacy of the respective programs. To date, the only significant findings were a negative functional difference among children with moderate severity cerebral palsy (GMFCS level III) over the six month period. Although this difference shows a decline in gross motor function, the difference may be due to testing error or insufficient intervention time. In addition, without the comparison of the control group, no statements can yet be made. Final testing will be completed by March of 2013, after which we are hopeful that more definitive statements can be made. (56)

Justin Stevenson, Timothy Van Dyke*, John Meyer*

Mobility Tricycle Project History and Electric Tricycle Control Box Redesign

The Mobility Tricycle Project partners with the Center for the Advancement of the Handicapped in the village of Mahadaga, Burkina. The purpose of the mobility tricycle project is to design personal transportation technologies for those with limited mobility. Project goals include assisting the fabricators in designing sustainable, simple, and appropriate solutions to be built and maintained by the fabricators at the center. Past project work provided two different style tricycles: a hand-powered tricycle and an electric-powered tricycle for those with limited upper-body strength. Different iterations of the tricycle designs have reduced weight, cost and fabrication time. Currently the uniform frame design allows builders to use one frame design for both the electric and the hand-powered tricycles. The present project involves revising the design and manufacturing process for the control box for the electric tricycle and documenting this process. The existing assembly consists of many parts with a time-consuming manufacturing process requiring careful detail. To cut-down on assembly time and make the assembly process easier, a template has been developed to aid in manufacturing some of the prefabricated parts. Documentation of the final assembly for the control box has also been developed and includes engineering drawings of the individual parts and fabrication instructions for the prefabricated parts. A SolidWorks assembly drawing supplements the documentation and will aid in future project work. Future project work includes researching alternative designs to modify and improve upon the current design. Prototypes of this modified design and testing of this design will continue next year. (24)

Leben Tadesse, Hannah Tims*

Development of a Lysozyme Aggregation Assay

Small heat shock proteins (sHsps) represent a critical class of molecular chaperones that function to prevent the aggregation of its substrate proteins. To study the mechanism by which sHsps function an assay was generated to model conditions in which the sHsps would be active. Lysozyme can be used as a model protein to test for sHsp activity by designing an assay in which lysozyme is exposed to denaturing conditions inducing the aggregation of the protein. The aggregation of lysozyme was induced by the reduction of its disulfide bonds by the reducing agent Dithiothreitol (DTT). Dynamic light scattering was used to measure any changes in intensity, which would result from the accumulation of protein aggregates in the sample being analyzed. It was found that as the protein substrate lysozyme is introduced to a reducing environment the intensity measured increased as a function of time, indicating that the protein was aggregating out of solution. We were able to successfully develop a repeatable lysozyme aggregation assay. (72)

Joshua Tagore, Jeff Erikson*

Presence of Antibiotic Resistant Bacterial Strains in Three South Central Pennsylvanian Streams
Antibiotic resistance has been an issue plaguing medicine since the inception of antibiotics as a treatment option. With increased prescriptions for antibiotics, the potential for bacteria to gain resistance has been steadily increasing. One potential source for increasing resistance to antibiotics is sewage treatment plants. Treatment plants do not treat aqueous pharmaceuticals. As a result, these drugs are being released into various bodies of water, and are helping to increase drug resistance of the normal microbiota. The purpose of this study was to determine the antibiotic resistance of bacteria in the sections above and below sewage treatment plant effluent.

Individual effects of each drug on the microbes were also studied, using a 24 hour replication plate techniques. Three local streams in South Central Pennsylvania, each with sewage treatment plants, served as the sites for collection. The streams were assessed for the presence of bacteria, and all three streams demonstrated antibiotic resistance below sewage treatment plants, where resistance below the drainage pipe was greater for certain drugs. Increased resistance was observed for the following drugs: Erythromycin, Kanamycin, Novobiocin, and Nitrofurantoin. Individual responses demonstrated that microbiota from below the drainage pipe were more resistant to each of the drugs studied, when compared to bacteria above the pipes. Further studies are still needed to evaluate identities of the organisms. (68)

Samuel Tajiri, Richard Schaeffer*, Michael Shin*

Investigation of the Sensitivity and Specificity of the Fluorescent Chemosensor, Newport Green DCF diacetate

The growing recognition of phytoremediation as an advantageous method to reduce and remove high metal concentrations from contaminated sites has led to an increased interest in plant species that can uptake and tolerate high metal concentrations. Further investigation of the mechanism of these plants species is crucial to developing future phytoremediation applications. Localization of these metal ions at the molecular level, within the tissues and sub cellular compartments, will aid in understanding the mechanism of metal ion uptake and tolerance. A promising tool to help localize metal ions is fluorescent chemosensors. For this study, a series of three preliminary assays were performed. The first test assessed the sensitivity and specificity of three dilutions of the fluorescent chemosensor, Newport Green DCF, to a range of cobalt, nickel, and zinc ion concentrations ranging from 0.01 μ M-100 μ M. The results indicated that at metal concentrations between 1 μ M-100 μ M, Newport Green DCF was most sensitive and specific to nickel ions. The second test quantified the concentration levels of cobalt, nickel, and zinc present in the plant species, *Arabidopsis thaliana*, exposed to metal concentrations of either 0.5mM CoCl₂, 0.5mM NiCl₂, or 0.5mM ZnCl₂. As expected, the results of this test revealed that plants exposed to a higher concentration of a specific metal ion, took up a much greater amount of that metal ion concentration compared to the other metal ions tested. The third test involved a crude examination for fluorescence in the roots of living *Arabidopsis thaliana*. Surprisingly, fluorescence was observed in all the plants viewed. (19)

Nicholas Tay, Erik Lindquist*, Michael Shin*

The Selection and Optimization of PCR Amphibian Primers for Real Time (RT) PCR Probes

Polymerase Chain Reaction (PCR) Primers for the amphibian genes Rhodopsin and Tyrosinase were analyzed and optimized. PCR reactions were run with ten different amphibian samples, chytrid, and a distilled water control. Contamination was observed early on in the experiment as the control displayed DNA amplification at the same base pair length as the amphibian DNA samples with both Rhodopsin and Tyrosinase primer sets. Contamination checks narrowed down its source to the bottles in which the glass distilled water samples were stored. The experiment with RNase-free water using the primer set MS048S/MS049A (S – sense; A – antisense) showed that DNA amplification was absent for samples with RNase-free water. However, the test must be performed again as there was a lack of reagent (Taq polymerase enzyme) to perform the test for multiple samples. The Rhodopsin primer set MS073S/MS074A displayed strong DNA amplification around 100 – 200 base pairs (bp). This observation confirmed amphibian DNA amplification around the calculated 140 length for all amphibian samples. The Tyrosinase primer

set MS065S/MS068A displayed strong DNA amplification for all amphibian samples, except for the red spotted newt (*N. viridescens*), between 400-500 bp. This observation confirmed amphibian DNA amplification around the calculated 460 bp length. We attempted to design Real-Time PCR (RT-PCR) probes sequences for MS073S/MS074A and MS065S/MS068A sets using free bioinformatic software, but the final custom Taqman probes were designed by Applied Biosystems as secondary features of the amplified sequence increased the complexity of the probe structure. (61)

Jordan Trout, Jessica Brown, Casey Hetrick, Kara Miller, Brianna Reed, Tina Jackson[^], Lauren McNaughton[^], Nancy Woods*

Hospital Acquired Infections Related to Reusable ECG Lead Wires

Background and significance of clinical problem/questions: Hospital acquired infections have significance because of the prevalence, cost and the effect on patient outcomes. Historically reusable equipment has been replaced with disposable equipment in an effort to decrease the risk of hospital-acquired infections. In current practice hospitals still use reusable ECG wires, yet there is no consistent protocol for decontamination. However, some hospitals have started using disposable ECG lead wires and reported a reduction in hospital-acquired infections. **PICO question:** Among adult patients does using disposable ECG leads compared to reusable ECG leads reduce hospital-acquired infections. **Methods of literature search:** A review of the literature was conducted utilizing CINAHL, PubMed, Medline, and references from published articles from 2004 to 2011. A total of 50 articles were identified, however, nine were found to address the problem and were the focus of study. The majority of articles were a Level VI with a B- quality. **Findings from EBP project:** Evidence supports that ECG lead wires contain microorganisms and suggest a possible relationship between contamination and hospital-acquired infections; however, the research is lacking in the causal relationship. Research shows that hospital-acquired infections are costly and increase the risk morbidity and mortality. **Recommendations for practice:** Based on the literature review, a change in practice is recommended for the use of re-usable ECG lead wires. Our suggestion is to implement an evidence-based cleaning protocol for the re-usable leads while further research is done on the use of disposable leads. (83)

Danielle Veacock, Jodie Haak*, H. Scott Kieffer*

The Effects of Chocolate Milk Compared to a Carbohydrate Beverage on Performance in Female endurance runners

PURPOSE: The purpose of this study was to compare the effects of chocolate milk (CM) to a carbohydrate (CHO) beverage (4:1 CHO to protein) on performance and recovery in female endurance runners. **METHODS:** Seven trained female runners (age 33.71±9.91, VO₂max 47.2±4.90) completed a multistage protocol consisting of a glycogen-depletion run following a twelve hour fast, a two-hour recovery period, and a 5K time trial. Glycogen depletion was achieved by running on a treadmill to volitional exhaustion. Immediately following the glycogen depletion run, subjects consumed CM or CHO beverage, which were matched for CHO content (1g/kg body weight). Administration of the beverage was randomized and counterbalanced between trials. After the 2-hr recovery period, subjects completed a 5K time trial on a treadmill; during the time trial subjects were blinded to their heart rate (HR) and speed. The second trial was conducted 28 days after the initial trial to account for possible menstrual variation in metabolism. Paired t-tests were conducted between CM and CHO for HR, oxygen consumption

(VO₂), respiratory exchange ratio (RER), rate of perceived exertion (RPE), and 5K time. **RESULTS:** There was no significant difference in 5k performance following recovery when comparing CM or CHO beverage when matched for CHO.

5K Time Trial Data

| | <u>HR (bpm)</u> | <u>VO₂ (ml/kg/min)</u> | <u>RER</u> | <u>RPE</u> | <u>5K Time</u> |
|-----|-----------------|-----------------------------------|-------------|------------|----------------|
| CM | 168.57±14.37 | 39.80±4.33 | 0.8786±0.01 | 14.41±1.49 | 26.53±3.23 |
| CHO | 169.29±10.93 | 39.09±5.40 | 0.8693±0.04 | 13.85±1.25 | 26.66±3.59 |

CONCLUSION: The results of this study suggest that CM is an equal recovery drink to a CHO beverage as measured by performance times and physiological indicators in female endurance runners during a 5K Time Trial. (37)

D. Scott Weaver, Michael Adams, Zachary Felix, Anthony Spargo, Angela Hare*

Association of Computing Machinery (ACM) Programming Contest

Three Messiah College students in the Computer and Information Science major will be traveling this May to the University of Warsaw in Poland to compete in the International Collegiate Programming Contest, sponsored by IBM. Approximately 100 college and universities from Africa, Asia, Europe, Latin America, North America, and the Middle East have been invited to participate, based on their performance at regional competitions in Fall 2011. This poster describes the contest and the competitors and highlights the accomplishments of our Messiah College team, 'Falcons Blue'. (69)

Scott Woolford

The Influence of Carl Friedrich Gauss

Carl Friedrich Gauss contributed significantly to several areas of mathematics including number theory, non-Euclidean geometry, and statistics. This presentation explores his work and contributions as well as his personal beliefs. (10)

Cha Yang, Kristen Listor, Alison Noble*, Richard Schaeffer*

Analysis of Surface Water for Contaminants from Hydraulic Fracturing Operations in the Upper Susquehanna River System

Our work assessed the possible relationship between surface water contaminants and a natural gas drilling method called hydraulic fracturing, or hydrofracking. This study focused on five heavy metals that are often found in high levels due to drilling: lead, barium, strontium, sodium and calcium. At all sites studied ($n = 8$), barium levels were above EPA regulation of 2.0 mg/L. The average level of barium was 19.67 mg/L, with the lowest value at 7.380 mg/L. Levels of strontium, sodium, and calcium came out to safe levels compared to EPA regulations. Concentration of lead in all samples were below the instrumental detection limit of 0.05 mg/L. Conductivity, pH, and temperature measurements on water fell within EPA safety standards. Testing for gross alpha detected no significant levels of radiation present in our samples. In all, the streams of study were found healthy except in concentrations of barium, which differed from past literature. The data also revealed that higher amounts of contaminants existed in areas that previously accepted wastewater from hydrofracking drill sites before regulations prohibited the transfer. From our results, we could not determine a direct correlation between hydraulic fracturing and the contaminants. (66)

Alphabetical Listing of Authors with Presentation Number(s)

| <u>Author</u> | <u>Presentation No.</u> | <u>Author</u> | <u>Presentation No.</u> |
|---------------------|-------------------------|-----------------------|-------------------------|
| Abel, Kate | 41 | Clarke, Lauryn | 75 |
| Adams, Michael | 69 | Clemence, Bonnie | 88 |
| Adomat, Lindsey | 5 | Cook, Kristi | 92 |
| Airey, Brooke | 81 | Coyle, Rachel | 91 |
| Alderfer, Gabrielle | 79 | Craley, Megan | 85 |
| Allen, David | 16, 33 | Cresswell, Amanda | 92 |
| Allen, Marianne | 88 | Dailey, Lea | 81 |
| Anderson, Erin | 90 | Daniels, Tina | 91 |
| Arnold, Ashley | 84 | Dean, Andrea | 76 |
| Ausel, James | 9 | deGruchy, Avery | 16 |
| Ayyala, Durga | 89 | Dincher, Emily | 86 |
| Azeem, Safoora | 79 | Dotts, Hannah | 84 |
| Basch, Bianca | 48 | Douglass, Brian | 15 |
| Basom, Andrew | 20 | Druckenmiller, Cathy | 87 |
| Bazhan, Larisa | 84 | Duffy, Melanie | 89 |
| Bechtel, Kayla | 86 | Earl, Brendon | 5 |
| Beers, Tony | 3, 5 | Earl, Daniel | 2 |
| Beiler, Austin | 16, 34 | Egolf, Tiffany | 92 |
| Biagio, Teresa | 92 | Egresits, Crystallein | 91 |
| Bigelow, David | 8 | Ehrenzeller, Clarissa | 13 |
| Bischof, Jordan | 65 | Eldredge, Kirsten | 73 |
| Blanke, Christine | 80 | Emberger, Gary | 71 |
| Blosenski, Katie | 85 | Engle, Carol | 90 |
| Bova, Sarah | 77 | Erikson, Carl | 29, 30, 31, 32, 33 |
| Bowlin, Leah | 49 | Erikson, Jeff | 67, 68 |
| Brantner, Emily | 62 | Falgoust, Tricia | 91 |
| Breighner, Andrew | 20 | Faus, Corey | 18 |
| Brewer, Jenny | 84 | Felix, Zachary | 69 |
| Brogden, Maryann | 81 | Fenton, Julie | 53 |
| Brown, Jessica | 83 | Ferguson, Stephanie | 50 |
| Browning, Michelle | 89 | Fickett, Judah | 23 |
| Brubaker, Shalisa | 85 | Finn, Sara | 22 |
| Bruce, Sue Ann | 87 | Finney, Sarah | 28 |
| Burch, Kyle | 73 | Fish, Randall | 33 |
| Byler, Joshua | 16 | Flaherty, Brenda | 80 |
| Calloway, Pyrnne | 74 | Flanick, Kyle | 54 |
| Carran, Nicole | 90 | Foor, Sara | 82 |
| Catalano, Gina | 75 | Foster, Danika | 46 |
| Chase, Gene | 13 | Foster, David | 45, 46, 47, 48 |
| Clapp, Megan | 85 | Fowler, Kim | 87 |

Alphabetical Listing of Authors with Presentation Number(s) contd.

| <u>Author</u> | <u>Presentation No.</u> | <u>Author</u> | <u>Presentation No.</u> |
|---------------------------|-------------------------|--------------------------|-------------------------|
| Francis, Jacob | 20 | Hoover, Yovanka | 90 |
| Frank, Nancy | 90 | Hornberger, Erik | 21 |
| Frederick, Ryan | 25 | Horst, Erin | 89 |
| Frey, Kimberly | 35 | Houck, Timothy | 1 |
| Fulford, Victoria | 81 | House, Leslie | 90 |
| Gamber, Andrea | 79 | Hunsberger, Jamison | 23 |
| Garcia, Kathleen | 86 | Ilgenfritz, Karen | 90 |
| Gerhart, Jaime | 1 | Jackson, Tina | 83 |
| Gillette, Hilary | 80 | Janczyk, David | 17 |
| Gonder, Emily | 87 | Jarvis, Benjamin | 7 |
| Gray, Amanda | 39, 41 | Johnson, Mark | 15 |
| Griffith, Jenae | 87 | Jones, Sarah | 82 |
| Groff, Alyssa | 90 | Joseph, Catherine | 75 |
| Groff, Randall | 16 | Kauffman, Chelsey | 91 |
| Gusick, Matthew | 16 | Kauffman, Eric | 4 |
| Haak, Jodie | 37, 55, 56 | Kennedy, Jonathan | 14 |
| Hackman, Elizabeth | 79 | Kieffer, H. Scott | 37, 38, 54 |
| Hahn, Anthony | 29 | Kieliszewski, Laura | 89 |
| Hallowell, Benjamin | 58, 59 | Kimpel, Charles | 25 |
| Hanselman, Audrey | 85 | Kirkpatrick, Pamela | 35 |
| Hare, Angela | 34, 35, 36, 69 | Kjellman, Cecilia | 78 |
| Harms, John | 42, 43 | Koh, Jacinth | 63 |
| Harne-Britner, Sarah | 86 | Kopchik, Andrea | 85 |
| Harper, Holly | 74 | Kreider, Daniel | 57, 70 |
| Hayes, Lindsey | 57, 70 | Krug, Amy | 78 |
| Heagy, Cody | 77 | Kurtz, Hannah | 91 |
| Heisey, Deb | 88 | Larson, JoAnna | 55, 56 |
| Heisey, Erica | 82 | Lee, Trevor | 30 |
| Hepkins, Ruthanne | 93 | Leshner, Amy | 89 |
| Hepler, Benjamin | 67 | Levenduski, Michalena | 90 |
| Herman, Gunnar | 16 | Lindquist, Erik | 44, 61, 62 |
| Herndon, Beau | 30 | Lisa, Kaitlyn | 88 |
| Hertfelder, Thomas | 16 | Lister, Morgan | 38 |
| Herzig, Chelsey | 91 | Listor, Kristen | 44, 66 |
| Hess, Hope | 12 | Long, Courtney | 76 |
| Hetrick, Casey | 83 | Manieri, Kevin | 33 |
| Himmelberger, Victoria | 60 | Marlowe, Nathan | 54 |
| Hoaglin, Marc | 26 | Martin, Jonathon | 33 |
| Hollenbach, Wesley | 2 | Martin, Mary | 11 |
| Hoover, Matthew | 16 | Martinez, Philip | 31 |

Alphabetical Listing of Authors with Presentation Number(s) contd.

| <u>Author</u> | <u>Presentation No.</u> | <u>Author</u> | <u>Presentation No.</u> |
|--------------------|---------------------------------------|---------------------|-------------------------|
| Matter, Sheri | 86 | Ressler, Barbara | 1, 28 |
| Matters, Gail | 43 | Ribbens, Philip | 17 |
| Mavronis, Sophia | 87 | Roller, Donna | 86 |
| McBeth, Charles | 45 | Rotzell, Rebecca | 93 |
| McCullum, Keane | 51 | Rudick, Babette | 92 |
| McNaughton, Lauren | 83 | Sabo, Rebekah | 78 |
| Meckley, Justin | 18 | Sappe, Naomi | 82 |
| Merkel, Jaclyn | 85 | Savidge, Ann | 87 |
| Meyer, John | 24, 25, 26, 27 | Schaeffer, Richard | 19, 53, 63, 65, 66 |
| Mihok, Mary Ann | 39 | Schafer, Deb | 93 |
| Miller, Elizabeth | 58, 59 | Schorner, Meredith | 90 |
| Miller, Kara | 83 | Schroeder, Ryan | 26 |
| Miller, Stephanie | 38 | Sell, Shannon | 43 |
| Mino, Zachary | 5 | Sender, Rachel | 41 |
| Morris, Jessica | 88 | Sensi, Shannon | 92 |
| Mortimer, Mary | 92 | Sheeler, Ben | 14 |
| Moyer, Greg | 14 | Shifler, Kara | 74 |
| Musselman, Matthew | 16, 34 | Shin, Michael | 19, 61, 62, 63, 64 |
| Myers, Nathan | 40, 76 | Shirey, Jamie | 86 |
| Mylin, Alyssa | 6 | Silvis, Kara | 16, 34 |
| Mylin, Lawrence | 57, 58, 59, 60, 70 | Sisson, Luke | 27 |
| Neiswender, Cierra | 41 | Sites, Ashley | 76 |
| Nickerson, Paul | 47 | Sizemore, Zachary | 3 |
| Noble, Alison | 52, 66 | Sletta, John | 7 |
| Obenschain, Rachel | 86 | Smith, Derek | 3 |
| Okon, Aloysius | 64 | Smith, Elizabeth | 89 |
| Painter, Sarah | 77 | Smith, Melinda | 89 |
| Patton, Andrew | 25 | Smith, Trevor | 32 |
| Perta, Julie | 42 | Sorrell, Joshua | 23 |
| Philips, Coryden | 18 | Spargo, Anthony | 69 |
| Phipps, Jennifer | 38 | Steele, Andrew | 52 |
| Picard, Rachael | 71 | Steele, Danielle | 90 |
| Porto, Amy | 39, 41, 74, 75, 76, 77, 78, 79, 80 | Steiner, Dena | 55, 56 |
| Pratt, Donald | 6, 7, 20, 21, 22, 23 | Stephens, Sierra | 88 |
| Pulaski, Avis | 92 | Stevenson, Justin | 24 |
| Rausch, Stephanie | 91 | Stoney, Naisha | 93 |
| Reed, Abby | 80 | Strausbaugh, Thomas | 15 |
| Reed, Brianna | 83 | Stroup, Jeff | 87 |
| Reeve, Anne | 73 | Stuter, Jeremy | 15, 34 |
| Rehman, Stephanie | 82 | Tadesse, Leben | 72 |

Alphabetical Listing of Authors with Presentation Number(s) contd.

| <u>Author</u> | <u>Presentation No.</u> |
|----------------------|-----------------------------------|
| Tagore, Joshua | 68 |
| Tajiri, Samuel | 19 |
| Tay, Nicholas | 61 |
| Thomas, Kelly | 81 |
| Tims, Hannah | 49, 50, 51, 72 |
| Trout, Jordan | 83 |
| Vader, David | 2, 4 |
| Van Dyke, Timothy | 24, 25, 26, 27 |
| Veacock, Danielle | 37 |
| Verrechio, Jenna | 82 |
| Voran, Sara | 38 |
| Wagoner, Sarah | 93 |
| Walsh, Matt | 5 |
| Watkins, Bryce | 23 |
| Weaver, D. Scott | 14, 15, 16, 17, 18, 34, 69 |
| Wenger, Emily | 90 |
| Whitmoyer, Timothy | 2, 3, 4, 5 |
| Whitner, Michael | 87 |
| Wicks, Donna | 91 |
| Widmer, Lamarr | 8, 9, 10, 11, 12, 13 |
| Wiker, Jordan | 21 |
| Wilbur, Brianna | 92 |
| Wilcox, Cammie | 88 |
| Willier, Tina | 86 |
| Witmar, Krista | 93 |
| Witt, Kay | 40 |
| Wolgemuth, John | 21 |
| Woods, Nancy | 81, 82, 83, 84, 85 |
| Woolford, Scott | 10 |
| Yang, Cha | 66 |
| Yau, Andrew | 14 |
| Yeun, Darlene | 88 |
| Yoder, Chad | 17 |
| Yoder, Tim | 4 |
| Young, Kyle | 14 |
| Zimmerman, Cindy | 88 |
| Zinsmeister, Louann | 86, 87, 88, 89, 90, 91, 92, 93 |
| Zipagan, Jean | 25 |
| Zook, Anna | 82 |



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