



**Des Moines University  
December 6, 2012  
12 – 5 p.m.**

**Des Moines Universities Research Vision is to be...**

A cultivator of distinctive faculty and student researchers  
who discover and disseminate new knowledge.



**DMU Research Symposium  
December 6, 2012  
Des Moines University, Des Moines, IA**

**Welcome**

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Welcome to the Des Moines University third annual University Research Symposium. I would like to thank our organizing committee Dr. Feilmeier, Dr. Nguyen, Dr. Ronnebaum, Vanessa Ross and especially our student members Eric So, D.P.M.'15, Scott Roberts, D.O.'15 and Leah Koepp, D.P.T.'13 for their efforts in putting together such a high quality program. If you get a chance, please congratulate them.

This year our keynote address is considering how research and scholarship are synergistic with a career in clinical medicine. We are excited to have Dr. Mark Rupp from the University of Nebraska Medical Center who has very successfully integrated research into his infectious disease career. The broader discussion will be how research fits within academic careers as a whole and to that end we have a distinguished panel to discuss this topic which includes Dr. Rupp, Dr. Karen McLean, Dr. Tim Yoho, Dr. Kevin Carnevale and Dr. Shane McClinton. This years meeting has some excellent work that will be presented and while reviewing the presentations I hope you will reflect on how the discoveries we are making in our research today will impact society and our patients in the future.

Des Moines University is striving to become a leader with our research culture and environment and this symposium demonstrates the strong research that is occurring on campus and in our community. This symposium allows all of us a wonderful opportunity to further our scholarship goals and expand our collaborative research efforts. Please enjoy the symposium and thank you for attending.

Jeffrey T. Gray, Ph.D.  
*Vice President for Research, Des Moines University*

**Agenda**

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Time	Program	Location
12 p.m.	Lunch	SEC Auditorium
12:30 p.m.	When Opportunity Knocks... Conduct a Study: Clinical and Translational Research in Infection Prevention <i>Mark Rupp, M.D.</i> 1. Describe rigorous quasi-experimental study design features. 2. Recognize and consider opportunities to conduct clinical-translational research projects to answer clinically-relevant questions. 3. Identify gaps in our knowledge base in infection prevention and cite several well-accepted infection prevention practices that may not be as effective as commonly believed.	
1:30 p.m.	Panel Discussion	
2:15 p.m.	Break	
2:30 p.m.	Oral Abstract Presentations (Concurrent Sessions)	Academic Center Lecture Halls
3:30 p.m.	Break	
3:45 p.m.	Poster Abstract Presentations	SEC First Floor (Near the Bookstore)
4:50 p.m.	Abstract Awards	SEC Auditorium
5 p.m.	Adjourn	



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## Purpose

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The DMU Research Symposium aims to recognize the research efforts of those in the surrounding community; to provide a forum for the collaboration of ideas and the production of new hypotheses; and to impress upon the students of DMU the critical role that research plays in the advancement of health care.

## Keynote Speaker

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### Mark Rupp, M.D.

Dr. Rupp is a Professor and Chief of the Division of Infectious Diseases in the Department of Internal Medicine at the University of Nebraska Medical Center. He is the Medical Director of The Nebraska Medical Center Department of Infection Control & Epidemiology and Co-Director of the Antimicrobial Stewardship Program.

Dr. Rupp received his medical degree from Baylor College of Medicine, Houston, Texas and holds a B.S. degree in Chemical Engineering from the University of Texas, Austin, Texas. He underwent internship and residency training in Internal Medicine and completed Fellowship training in Infectious Diseases at Virginia Commonwealth University.

He is a Diplomate, American Board of Internal Medicine, and in the subspecialty area of Infectious Diseases. He is a Fellow of the American College of Physicians (ACP), the Infectious Diseases Society of America (IDSA), and the Society for Hospital Epidemiology of America (SHEA). He is a Past-President of SHEA and is a past-president of ASM Division L (Infection Control/Hospital Epidemiology). Dr Rupp has served as a consultant for the US Food and Drug Administration as well as the Centers for Disease Control and Prevention.

Dr. Rupp has published over 300 articles, chapters and abstracts. He frequently presents papers at national and international meetings, serves as a guest lecturer, and is an active teacher and researcher. Dr. Rupp's research interests are in the areas of staphylococcal disease, healthcare-associated infections, and antimicrobial resistance.

*Relative to the content of this CME activity, Dr. Rupp indicated he is a consultant for 3M, C. R. Bard, Inc., and Semprus BioSciences. He is also the principal investigator or working directly with 3M, Mölnlycke Health Care, and Sanofi.*

## Panel Discussion Members – Integrating Research in Clinical and Academic Careers

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Kevin Carnevale, M.D., Academic Pathologist - Microbiology and Immunology, Des Moines University

Shane McClinton, D.P.T., Physical therapist - Physical Therapy Clinic, Faculty - Post-Professional Doctor of Physical Therapy, Des Moines University

Karen McLean, Ph.D., Provost, Des Moines University

Mark Rupp, M.D., Professor and Chief of the Division of Infectious Diseases - Department of Internal Medicine, University of Nebraska Medical Center, Medical Director - The Nebraska Medical Center Department of Infection Control and Epidemiology

Robert Yoho, D.P.M., Dean - College of Podiatric Medicine, Clinician - Foot and Ankle, Des Moines University

*The panel members indicated they have no financial relationships to disclose relevant to the content of this CME activity.*

## Organizing Committee

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Jeffrey Gray, Ph.D., Vice President - Research (scientific chair), Director - Master of Science in Biomedical Sciences, Professor - Microbiology and Immunology, Des Moines University

Mindi Feilmeier, D.P.M., AACFAS, Assistant Professor, Doctor of Podiatric Medicine Program, Clinician, Foot and Ankle Clinic, Des Moines University

Leah Koepp, D.P.T.'13, Des Moines University

Marie Nguyen, Ph.D., Assistant Professor - Microbiology and Immunology and Master of Science in Biomedical Sciences, Des Moines University

Scott Roberts, D.O.'15, Des Moines University

Julie Ronnebaum, P.T., GCS, D.P.T., Assistant Professor - Doctor of Physical Therapy, Des Moines University

Eric So, D.P.M.'15, Des Moines University

Vanessa Ross, CMP, Manager - Continuing Medical Education, Des Moines University

*The planning committee indicated they have no financial relationships to disclose relevant to the content of this session of the CME activity.*

## Target Audience

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Des Moines University faculty, staff and students. External researchers and health professionals from the Des Moines area and surrounding hospitals are also invited to participate.

## CME Credit

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**AOA:** Des Moines University and the AOA Council on Continuing Medical Education approve this program for a maximum of 1.5 hours of AOA Category 1-A CME credits and 2.0 hours of AOA Category 2-B CME credits.

**CPME:** Des Moines University is approved by the Council of Podiatric Medical Education as a sponsor of continuing education in Podiatric Medicine. This program has been reviewed and approved for a maximum of 3.75 continuing education contact hours.

**IBON:** Des Moines University continuing education (provider #112) is approved by the Iowa Board of Nursing as an accredited provider. This program has been reviewed and approved for a maximum of 4.5 continuing education contact hours.

**Physical Therapists/Occupational Therapy:** The Iowa Board of Examiners does not pre-approve continuing education; this course meets the State of Iowa criteria for continuing education in these professions.

**Physician Assistants:** The Iowa Board of Physician Assistants does not pre-approve continuing education; this course meets the State of Iowa criteria for continuing education in these professions.

**Other:** Attendees will be given a certificate of participation for a maximum 3.75 continuing education hours.

Des Moines University (DMU) prohibits discrimination in employment, educational programs, and activities on the basis of race, national origin, color, creed, religion, sex, age, disability, veteran status, sexual orientation, gender identity, or associational preference. The University also affirms its commitment to providing equal opportunities and equal access to University facilities. Individuals with disabilities are encouraged to attend DMU sponsored events. If you have questions/concerns, please contact the DMU Continuing Medical Education office at 515-271-1596 or [cme@dmu.edu](mailto:cme@dmu.edu).

# **Mark Rupp's Presentation Slides**



## When Opportunity Knocks... Conduct a Study: Clinical & Translational Research in Infection Prevention



Mark E. Rupp, MD  
Professor & Chief, Division of Infectious Diseases  
Medical Director, Infection Control & Epidemiology  
University of Nebraska Medical Center

## Potential Conflict of Interest Disclosure

### In past 5 years:

- Research contracts to UNMC:
  - Cubist, Becton Dickinson, 3M, Molyndcke, Sanofi, Cardinal Healthcare Foundation
- Consultant:
  - Semprus, Microbiotix, Bard, Baxter, 3M
- Honoraria:
  - Baxter, 3M, Care Fusion

## Objectives

- Recognize and consider opportunities to conduct clinical-translational research projects to answer clinically-relevant questions
- Describe some of the pitfalls of clinical research study design and more rigorous quasi-experimental study design
- Identify some of the gaps in our knowledge base in infection prevention

## Background and Career Path



## Lessons Learned

Sometimes you  
get burned and  
other times you  
see the light!

It is Hard Work to Get Studies  
Published and Grants  
Funded...

Be Prepared for Rejection and  
Disappointment

## Perseverance Don't Give Up!

- Few things are impossible to diligence and skill. Great works are performed not by strength, but perseverance.

Samuel Johnson



- "Never, never, never give in!"

Winston Churchill



## Negative Studies and Publication Bias

- Studies that don't conform to popular belief or have negative data are important and should be published
- There is a strong bias by journal reviewers and editors (and by investigators) to publish positive data or studies that confirm conventional wisdom.

## Hand Hygiene



- "Hand hygiene is the single most important method of preventing and controlling infection" CDC
- "Most health care-associated infections are preventable through good hand hygiene – cleaning hands at the right times and in the right way." (World Health Organization)

## Hand hygiene – support not as ironclad as you might think



- Simmons et al. ICHE 1990. "No one has shown that handwashing practices can be easily improved and that this prevents endemic nosocomial infection."
- Silvestri L, et al. J Hosp Infect, 2005. "under ideal circumstances, handwashing can only influence 40% of all intensive care unit infections. A randomized clinical trial is required to support handwashing as the cornerstone of infection control."
- Eckmanns T, et al. J hosp Infect 2006. There was no correlation between the incidence of transmission episodes and hand rub consumption or hand hygiene compliance."

## Does improved hand hygiene prevent HAIs in today's hospital?



INFECTION CONTROL AND HOSPITAL EPIDEMIOLOGY JANUARY 2008, VOL. 33, NO. 1

ORIGINAL ARTICLE

### Prospective, Controlled, Cross-Over Trial of Alcohol-Based Hand Gel in Critical Care Units

Mark E. Rupp, MD; Teresa Fitzgerald, RN; Susan Puumala, MS; James R. Anderson, PhD;  
Rita Craig, RN; Peter C. Iwen, PhD; Dawn Jourdan, RN; Janet Koushek, RN; Nedra Marion, RN;  
DeWayne Peterson, RN; Lee Sholtz, RN; Valerie Smith, RN

- Quasi-experimental design: 2 year, prospective, controlled, cross-over trial
- 2 adult ICUs, baseline observations, identical education programs, introduction of gel in one unit and withheld from other – after 1 year switch
- Monitor compliance (validated observers, randomize observations), feedback data to units, measure hand microbiology, monitor HAIs/MRSA/VRE/CDAD

## Results and Conclusions

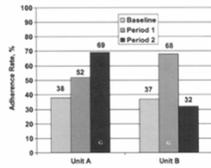


TABLE 2. Comparison of Rates of Device-Associated Infection in Intensive Care Unit (ICU) A and ICU B According to the Availability of Alcohol-Based Hand Gel

Infection	No. of infections per 1,000 device-days					
	Unit A, by study period			Unit B, by study period		
	Baseline	No gel <sup>a</sup>	Gel <sup>b</sup>	Baseline	No gel <sup>a</sup>	Gel <sup>b</sup>
Catheter-associated UTI	1.10	1.98	3.87	2.99	4.37	3.37
CVC-associated BSI	1.51	3.49	1.49	3.01	3.49	3.22
VAP	0.00	0.68	0.73	2.95	0.00	0.75

- 1) Hand hygiene compliance increased significantly
- 2) Hand gel associated with fewer microbes on hands
- 3) Fingernail length > 2mm and rings assoc with increased microbes on hands
- 4) Gel allowed for increased compliance at higher workloads
- 5) No detectable change in HAIs or MDROs

## Discussion and Study Limitations

- "...the lack of effect should not necessarily be interpreted to mean that hand hygiene is not important... but it may serve to temper unrealistic expectations that HAIs will plummet as a result of a simple, unifocal intervention."
- "It should be noted that the baseline rates of nosocomial infection were low and despite the 2 year length of the study, it was underpowered ..."
- "...hand hygiene adherence rate of 70% achieved when hand gel was available was not great enough to cross an unknown threshold at which transmission of nosocomial pathogens or infections is prevented. The threshold may depend on pathogenicity of the microbe, size of inoculum, host defenses, and a variety of other risk factors for HAI."
- "Prevention of HAI is a multifaceted issue and hand hygiene is only one part of the equation."



## Hand Gels Alone May Not Curb Infections



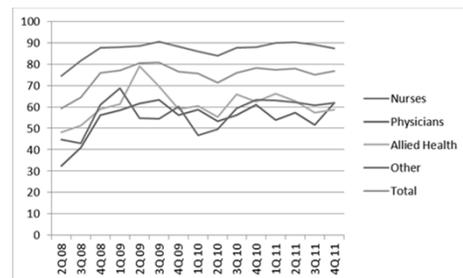
...the findings appear to contradict hospital guidelines from the Centers for Disease Control and Prevention that say better hand hygiene has been shown to cut the spread of hospital infections.



Hand gels don't stop infections

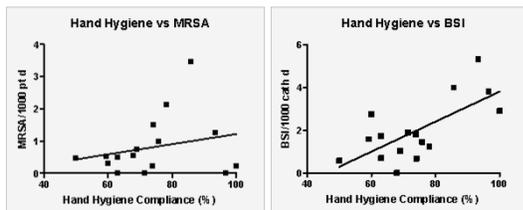
Don't believe everything you read in the medical literature or the lay press

## Hand Hygiene at NMC 5/08-12/11



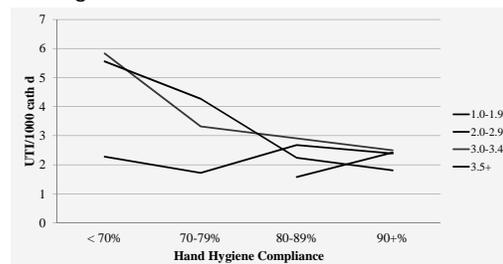
Total hand hygiene compliance increased from 58% to 77%  
Total of 80,942 opportunities for hand hygiene in database

## Effect of Hand Hygiene on HAIs: the Role of Confounding Variables



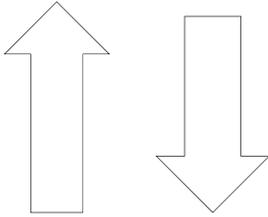
Severity of Illness, Co-morbidities, Antimicrobial usage, Personnel, Device Utilization, Disinfection/Sterilization, etc

## Relationship between hand hygiene, nurse staffing ratio, and CA-UTI



CA-UTI appears to correlate somewhat with hand hygiene (higher rate when compliance was <70% (p=0.06)) and patient-to-nurse ratio (lower rate when ratio was 1.0-1.9 (p=0.04) and 2.0-2.9 (p=0.09)). CA-UTI rates decrease with increasing hand-hygiene.

## A Counter-intuitive Observation



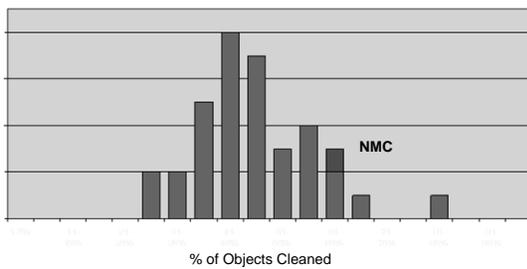
## Provide a Clean Environment



- Use of a UV marking solution to assess environmental cleaning

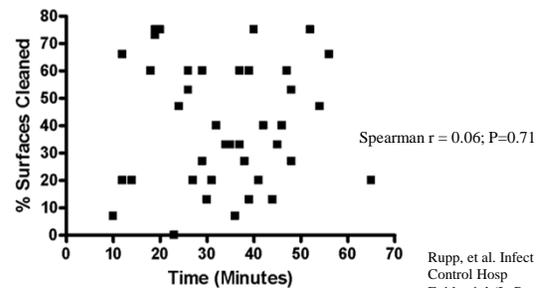
## Improving Cleaning of the Environment Surrounding Patients in 36 Acute Care Hospitals

Philip C. Carling, MD; Michael M. Parry, MD; Mark E. Rupp, MD; John L. Pa, MD, PhD; Brian Dick, MS, CIC; Sandra Von Behren, RN, BSN, MS, CIC, for the Healthcare Environmental Hygiene Study Group



ICHE, 2008

## The Time Taken to Clean a Hospital Room Does Not Correlate with How Clean it is



Rupp, et al. Infect Control Hosp Epidemiol (In Press)

## Quasi-Experimental Studies



## Quasi-Experimental Studies

- Nonrandomized studies designed to establish causal link between intervention and outcome
- Pre-post intervention study is most common form: "make a change and see what happens"

### Advantage:

- Can be done in situations when immediate action is required (outbreak), randomization is impossible or unethical, logistically easier than RCT

### Disadvantages

- Difficult to control for confounding
- Poor link to causality and subject to "regression to the mean"

**“I had come to an entirely erroneous conclusion which shows, my dear Watson, how dangerous it always is to reason from insufficient data”**

Arthur Conan Doyle – Sherlock Holmes  
The Adventure of the Speckled Band

**“Not everything that can be counted counts, and not everything that counts can be counted”**

Albert Einstein

Parachute use to prevent death and major trauma related to gravitational challenge: systematic review of randomised controlled trials  
Gordon C S Smith, JG P 200

BMJ, 2003



(Another Message: You don't have to have your sense of humor surgically removed in order to be in academic medicine)

**Abstract**

**Objectives** To determine whether parachutes are effective in preventing major trauma related to gravitational challenge.  
**Design** Systematic review of randomised controlled trials.  
**Data sources:** Medline, Web of Science, Embase, and the Cochrane Library databases; appropriate internet sites and citation lists.  
**Study selection:** Studies showing the effects of using a parachute during free fall.  
**Main outcome measure** Death or major trauma, defined as an injury severity score > 15.  
**Results** We were unable to identify any randomised controlled trials of parachute intervention.  
**Conclusions** As with many interventions intended to prevent ill health, the effectiveness of parachutes has not been subjected to rigorous evaluation by using randomised controlled trials. Advocates of evidence based medicine have criticised the adoption of interventions evaluated by using only observational data. We think that everyone might benefit if the most radical protagonists of evidence based medicine organised and participated in a double blind, randomised, placebo controlled, crossover trial of the parachute.

**Quasi-Experimental Study Design**



**Quasi-Experimental Design**

- No Control Group:
  - 1 group pre/post: O1 X O2
  - Removed intervention: O1 x O2 remove X O3
  - Repeated Treatment: O1 x O2 washout O3 x O4

Harris AD, et al. Clin Infect Dis, 2005

**Quasi-Experimental Design**

- Control Group:
  - Untreated control group:
 

O1a	X	O2a
O1b		O2b
  - Cross Over:
 

O1a	x	O2a	O3a
O1b		O2b	X O3b

Harris AD, et al. Clin Infect Dis, 2005

## What is difference between bias and confounding?



- Bias: Systematic error that results from design or conduct of study (study produces an incorrect conclusion); can not be overcome by analysis
- Confounding: "mixing of effects" "distortion of the effect estimate caused by the presence of an extraneous factor"; confounding can be adjusted by statistical techniques

## There are three kinds of Lies: Lies, Damn Lies, and Statistics

Benjamin Disraeli  
UK Prime Minister (1874-1880)

## What is regression to the mean?



- Phenomena in which abnormally low or high rate will tend to moderate without specific intervention.
- Change in rate could wrongly be attributed to intervention when in fact it is due to chance.
- Infection control studies are particularly vulnerable because our efforts are often triggered by outbreaks or elevated rates.
- Variation: Maturation effects (seasonality)

## Recent Example of Quasi- Experimental Study



## Chlorhexidine Patient Bathing

Effectiveness of Chlorhexidine Bathing to Reduce Catheter-Associated Bloodstream Infections in Medical Intensive Care Unit Patients

Sean C. Blondeau, MD; William F. Trick, MD; Ines M. Gonzalez, MD; Raul D. Lyles, MD; Mary K. Hayden, MD; Robert A. Wenzel, MD Arch Intern Med 2007

Daily CHG baths in ICU pts decreased BSI from 16.8 to 6.4/1000 CVC d.

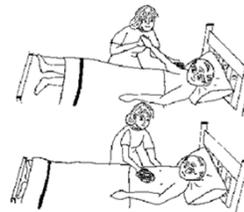
ORIGINAL ARTICLE

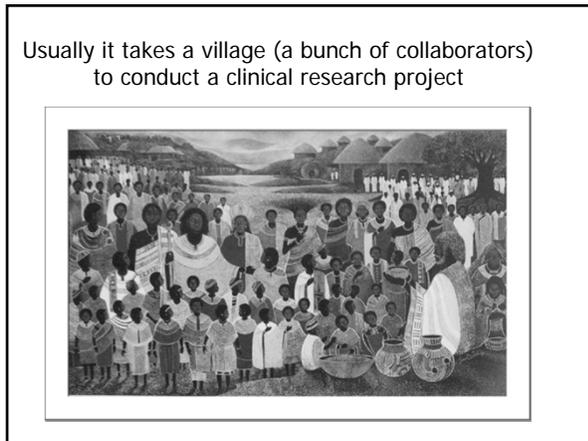
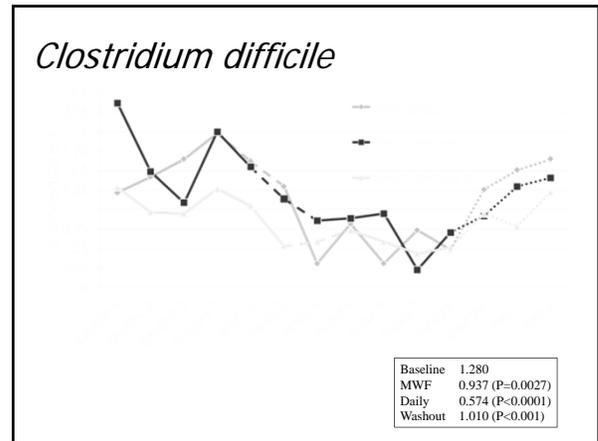
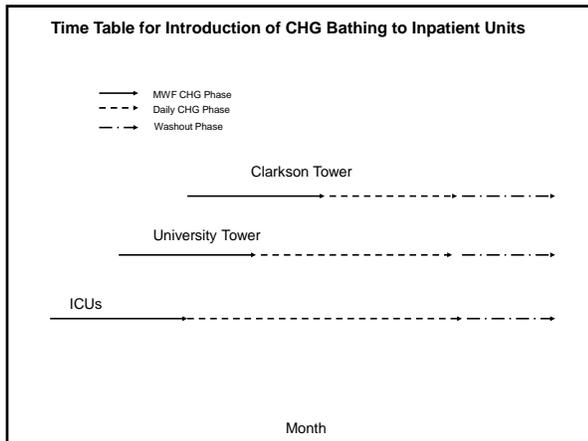
Selective Use of Intranasal Mupirocin and Chlorhexidine Bathing and the Incidence of Methicillin-Resistant *Staphylococcus aureus* Colonization and Infection Among Intensive Care Unit Patients

Glenn Blomauer, MD; Russell Lampen, DO; Jeff Federopis, Steve Kritchevsky, PhD; Edward Wong, MD; Michael Climo, MD ICHE 2007

CHG baths in ICU pts decreased MRSA infection by 52% (8.45/1000 pt d to 4.05/1000 pt d).

## Chlorhexidine Patient Bathing Project





### Multi-Disciplinary Research Teams

Improving Cleaning of the Environment Surrounding Patients in 36 Acute Care Hospitals

Philip C. Carling, MD; Michael M. Furr, MD; Mark E. Rupp, MD; John L. Fu, MD, PhD; Brian Dick, MS, CIC; Sandra Van Boven, RN, BSN, MS, CIC; for the Healthcare Environmental Hygiene Study Group

ORIGINAL ARTICLE

Prospective, Controlled, Cross-Over Trial of Alcohol-Based Hand Gel in Critical Care Units

Mark E. Rupp, MD, James Fitzgerald, MD, Susan Brumwell, MD, James R. Anderson, PhD, Rita Chang, RN, Peter C. Tane, PhD, David Swanson, RN, Janet Kowalek, RN, Nadia Mariani, RN, Patricia Pappas, PhD, Lisa Berlin, RN, Nancy Smith, RN

Genetic Variants and Susceptibility to Neurological Complications Following West Nile Virus Infection

Mark Lesh, Sasha Estrabalian, Mark Rupp, Neil Fattome, Louise Sankil, Jon Patterson, Jonathan Brumwell, Thomas Johnson, and Marlene Lerner

Effect of Hospital-Wide Chlorhexidine Patient Bathing on Healthcare-Associated Infections

Mark E. Rupp, MD, B. Jennifer Cavallari, RN, Elizabeth Liden, MD, Jennifer Kucera, MD, Marlene Marini, RN, James Fitzgerald, MD, Alan Tarr, MD, James R. Anderson, PhD, Thomas C. Smith-Brownell, MD

Adequate Disinfection of a Split-Septum Needleless Intravascular Connector with a 5-Second Alcohol Scrub

Mark E. Rupp, MD, Pauline Lee, Susan Hines, B. Jennifer Cavallari, RN, Rebecca Allen, MD, Paul D. Fox, MD, Steve Van Schooten, MD, James R. Anderson, PhD

Guidelines for the Prevention of Intravascular Catheter-related Infections

Nancy P. O'Grady, Mary Alexander, Lillian A. Burns, E. Pauline Dellinger, Jeffrey Garland, Stephen D. Runoff, Pamela A. Lipsett, Henry Hagan, Leonard A. Bernard, Michelle S. Pappas, James S. Rhee, Adrienne S. Ruppel, Mark E. Rupp, Sanjay Saini, and the Healthcare Infection Control Practices Advisory Committee (HICPAC) (Appendix 1)



### It Takes a Village

- Develop your network of collaborators, coworkers, and colleagues
- One of the great things about the field of medicine and science is that you are able to form professional friendships across the nation and around the world!

## Never Compromise on Issues of Scientific Integrity or Patient Safety



Hwang Woo Suk:  
South Korea Stem  
cell research

Dr Alfred Stein  
Schneider & cause  
of SIDS



Andrew Wakefield  
MMR & Autism



Charles Dawson  
Pitdown Man  
"Missing Link"



Depak Das:  
Reseratrrol (anti-aging drug)

## "Industry" is not a dirty word - (but it almost is, and it will be if we are not careful)



- 1990: 80% of clinical trials conducted in academic medical ctrs; 2004: 70% in private sector (commercial enterprises, less oversight, overseas, etc).
- Ghost writers and manufactured scientific journals
- Drug reps & tricks to sell drugs
- "Thought Leaders" "Key Opinion Leaders"
- "Disease Mongering" and Direct to Consumer Advertising

## "Industry" is not a dirty word - (but it almost is, and it will be if we are not careful)

- Investigator initiated research can be very interesting and rewarding:
  - Project is likely to be underfunded
  - Build fire walls carefully:

Acknowledgement from CHG bathing article: "Partial support for this project was obtained from Molnlycke Health Care, Norcross, Georgia, in the form of a contract to the University of Nebraska Medical Center and product supplied to the Nebraska Medical Center. The sponsor had no role in the design or conduct of the study; no role in the collection, management, analysis, or interpretation of data; and no role in the preparation, review, or approval of the manuscript."

## "Industry" is not a dirty word

- Industry sponsored studies can be of great value but should be considered carefully before participation as an investigator:
  - Professional/Scientific interest in condition/disease
  - Novel product or device
  - Genuine improvement in product or device



### Daptomycin versus Standard Therapy for Bacteremia and Endocarditis Caused by *Staphylococcus aureus*

Vanja G. Fowler Jr, M.D., M.H.S., Helen W. Brachman, M.D., G. Ralph Corey, M.D., Eliza Abraham, M.D., Adolf W. Karchner, M.D., Mark E. Rupp, M.D., Donald P. Levine, M.D., Henry F. Chambers, M.D., Francis P. Tenckhoff, M.D., Charles A. Higgins, M.D., Christopher W. Carroll, M.D., M. A. S. Arthur Shalika, M.D., Ignace Antkowiak, M.D., Scott C. Filler, M.D., Murray Grossman, M.D., Paul Gross, M.D., Jeffrey Penellum, M.D., and M. Ramarao, M.D.; Clinical Study Group; M.D. Gerson M. Caplan, M.D., Gerald L. Abraham, M.D., Katherine Carnica, M.D., Louise J. Berman, M.D., Heidi Rosenblatt Smith, M.D., Alan Tice, M.D., and Sara S. Coopers, M.D., for the S. aureus Endocarditis and Bacteremia Study Group

### Industry Studies: Investigator Initiated

- Effect of subinhibitory concentrations of ofloxacin, levofloxacin, d-ofloxacin, vancomycin, and cefazolin on the adherence to intravascular catheters and biofilm formation by *Staphylococcus epidermidis*. *J Antimicrob Chemother*, 41:155-161, 1998
- Comparative study of antimicrobial activity and postantibiotic effect of physiologic levels of clarithromycin, 14-hydroxyclarithromycin, and azithromycin against clinical isolates of *Haemophilus influenzae* and *Streptococcus pneumoniae*. *Antimicrob Agents Chemother*, 43:1291-93, 1999.
- Effect of LY333328 against vancomycin-resistant *Enterococcus faecium* in a rat central venous catheter model. *J Antimicrob Chemother*, 47:705-07, 2001.
- Prospective, Controlled, Cross-Over Trial of Alcohol-Based Hand Gel in Critical Care Units. *Infect Control Hosp Epidemiol* 29:8-15, 2008.
- Effect of Hospital-Wide Chlorhexidine Patient Bathing on Healthcare-Associated Infections. *Infect Control Hosp Epidemiol*, 33:1094-1100, 2012.

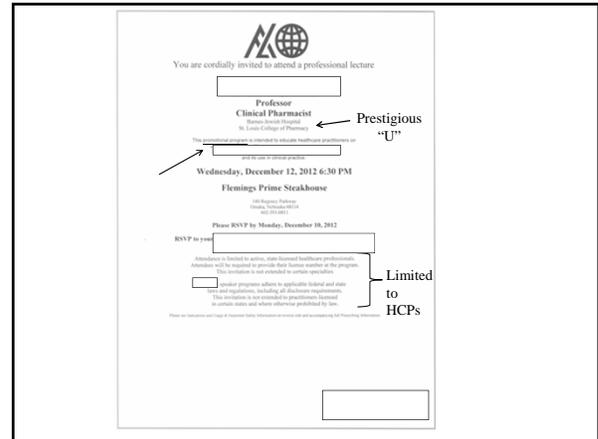
## Industry Studies

### Industry Initiated

- Effect of a second-generation chlorhexidine/silver sulfadiazine-impregnated central venous catheter on catheter-associated infections in intensive care unit patients. A randomized, double-blinded, controlled trial. *Annals of Internal Medicine*. 143:570-580, 2005.
- Daptomycin versus Standard Therapy for *Staphylococcus aureus* Bacteremia and Endocarditis. *N Eng J Med*. 355:653-65, 2006.
- A phase II, randomized, multicenter, double-blind, placebo-controlled, trial of a polyclonal anti-capsular immunoglobulin in the treatment of *Staphylococcus aureus* bacteremia. *Antimicrobial Agents and Chemotherapy*. 51:4249-54, 2007.

## "Industry" is not a dirty word (but it will be if we are not careful)

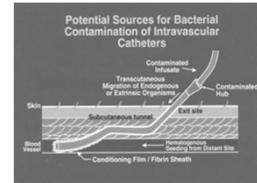
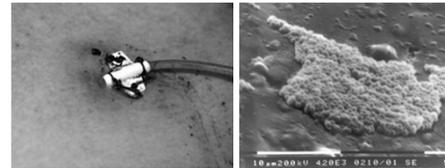
- Professional relationship with industry
  - Industry develops new products and devices and it is imperative that knowledgeable and ethical healthcare professionals interact with industry to positively impact on the process
  - Choices and ethical behavior:
    - Meetings with drug representatives and rules for interaction with staff
    - "free lunches" or other "bribes"
    - Samples
    - CME



Be Opportunistic...When a Question in Clinical Practice Arises, Think of it as an Opportunity

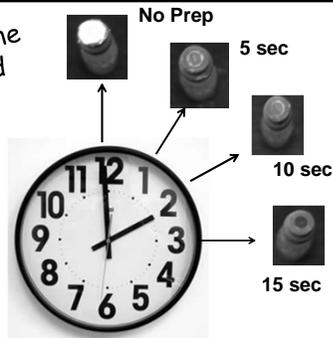


## Central Line Associated Bloodstream Infection



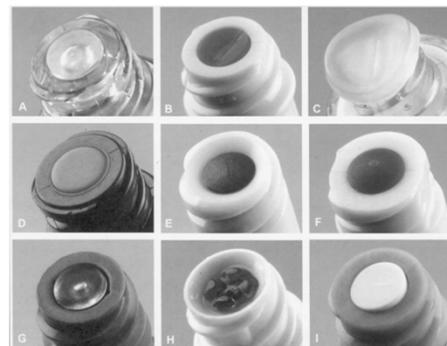
Do you have time for a 15 second alcohol scrub?

Infection Control Team, Riley Children's Hospital, Indianapolis, Indiana



These caps were coated with "microbial" powder that is visible under a black light. Notice the difference in amount of contaminant on the port that had been scrubbed for 15 seconds.

## Not All Mechanical Valves are Created Equal



### Adequate Disinfection of a Split-Septum Needleless Intravascular Connector with a 5-Second Alcohol Scrub

ICHE, 2012

Mark E. Rupp, MD;<sup>1,2</sup> Stephanie Yu,<sup>1</sup> Tomas Huerta,<sup>1</sup> R. Jennifer Cavalieri, RN;<sup>1</sup> Roxanne Alter, MS;<sup>1</sup> Paul D. Fey, PhD;<sup>1</sup> Trevor Van Schooneveld, MD;<sup>1,2</sup> James R. Anderson, PhD<sup>1</sup>

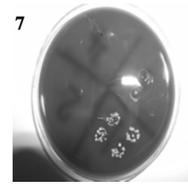
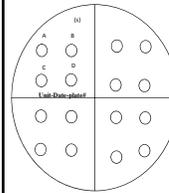
#### ■ Clinical component:

- 363 hubs from CVCs in use in adult inpatients were cultured by pressing the hub to an agar plate
- 0, 5, 10, 15, 30 second scrub with 70% alcohol pad

#### ■ Laboratory component:

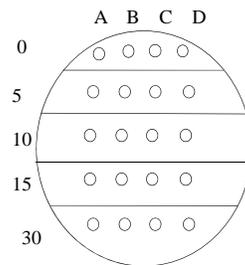
- 150 hubs were inoculated with  $10^3$ ,  $10^5$ ,  $10^8$  cfu of *S. epidermidis* (50 hubs at each inoculum)
- Disinfect with alcohol wipe for 0, 5, 10, 15 or 30 seconds and culture as above

### Clinical Component



- **0 time:** 87 valves  
66.7% contamination
- **5 sec:** 71 valves  
1.4% contamination
- **10 sec:** 70 valves  
2.9% contamination
- **15 sec:** 67 valves:  
1.5% contamination
- **30 sec:** 68 valves  
1.5% contamination  
(all  $P < 0.05$ )

### Laboratory Component



### Laboratory Component

- 100 % at baseline revealed heavy contamination
- At  $10^3$  and  $10^5$  inoculum all hubs yielded sterile cultures at scrub times of  $\geq 5$  seconds
- At  $10^8$  inoculum, 20% of 5 second scrub revealed low level breakthrough contamination (4 cfu & 9 cfu)

### Conclusion of Scrub-the-Hub

**OBJECTIVE.** Define optimum vascular catheter connector valve disinfection practices under laboratory and clinical conditions.

**DESIGN.** Prospective observational clinical survey and laboratory assessment of disinfection procedures.

**SETTING.** All adult inpatients at an academic healthcare center.

**METHODS.** In the clinical setting, contamination of needleless connectors was assessed in 6 weekly prevalence surveys in which the connector valves from central venous catheters (CVCs) in situ were cultured by pressing the connector diaphragm to an agar plate. Before culture, valves were disinfected by scrubbing the diaphragm with a 70% isopropyl alcohol pledget for 0, 5, 10, 15, or 30 seconds. In the laboratory, the diaphragms on 150 unused sterile connector valves were inoculated with  $10^3$ ,  $10^5$ , or  $10^8$  colony-forming units of *Staphylococcus epidermidis* and allowed to dry. After disinfection of the diaphragms by scrubbing with a 70% isopropyl alcohol pledget for 0, 5, 10, 15, or 30 seconds, the valves were sampled by pressing the diaphragm to an agar plate.

**RESULTS.** In the clinical setting, 363 connector valves from patients with CVCs were sampled, and 66.7% of nondisinfected valves revealed bacterial contamination. After 5-second disinfection with an alcohol pledget, only 1 (1.4%) of 71 yielded microbial growth ( $P < .005$ ). In the laboratory, at the  $10^3$  and  $10^5$  inoculum, all connector valves yielded sterile cultures when scrubbed for 5 or more seconds ( $P < .001$ ). At the  $10^8$  inoculum, 2 (20%) of 10 connector valves yielded minimal growth of *S. epidermidis*.

**CONCLUSIONS.** A 5-second scrub with a 70% isopropyl alcohol pledget yields adequate disinfection of a split-septum intravascular catheter connector valve under clinical and laboratory conditions.

*Infect Control Hosp Epidemiol* 2012;33(7):661-665

The New England Journal of Medicine

N Eng J Med, 2000

#### CEFTRIAXONE-RESISTANT SALMONELLA INFECTION ACQUIRED BY A CHILD FROM CATTLE

PAUL D. FEY, PH.D.,<sup>1</sup> THOMAS J. SAFRANEK, M.D.,<sup>1</sup> MARK E. RUPP, M.D.,<sup>1</sup> EILEEN F. DUNNE, M.D.,<sup>1</sup> M.P.H.,<sup>1</sup> EFRAN RIBOT, PH.D.,<sup>2</sup> PETER C. IWEN, M.S.,<sup>1</sup> PATRICIA A. BRADFORD, PH.D.,<sup>1</sup> FREDERICK J. ANGIULO, D.V.M., PH.D.,<sup>1</sup> AND STEVEN H. HENRICH, M.D.<sup>1</sup>

### Effect of silver-coated urinary catheters: Efficacy, cost-effectiveness, and antimicrobial resistance

Mark E. Rupp, MD;<sup>1,2</sup> Theresa Fitzgerald, RN;<sup>3</sup> Nedra Marion, RN;<sup>3</sup> Virginia Helget, RN;<sup>3</sup> Susan Puumala, MS;<sup>1</sup> James R. Anderson, PhD;<sup>1</sup> and Paul D. Fey, PhD<sup>1,2</sup>

Amer J Infect Control, 2004

No industrial support was received to conduct this trial, and the authors have no potential conflicts of interest regarding the medical device discussed in this study.

## A Career in Clinical Medicine and Clinical Research

- Don't compromise on issues related to patient safety or ethical conduct of research
- Don't give up
- Use clinical observations and questions to launch clinical investigation
- Question the status quo and publish papers that rub against the grain
- Have fun!





# Oral Abstracts



## Oral Abstracts Presentation Schedule

Time	<b>Biomedical Sciences</b> Academic Center Lecture Hall 2 Moderator: <i>Timothy Steele, Ph.D.</i>	<b>Movement Science and Education</b> Academic Center Lecture Hall 3 Moderator: <i>Mindi Feilmeier, D.P.M.</i>
2:30 p.m.	Quantification of Stereotypies and Hyperkinesia in Fragile X Syndrome Using a Novel Markerless Motion Analyses System <i>Joanne O’Keefe, PT, Ph.D., Hassan Khan, BS, D.O.’16*, Deborah A. Hall, M.D., Ph.D., Alejandro Espinoza Orías, AA, Ph.D., Markus A. Wimmer, MA, Ph.D., Elizabeth Berry-Kravis, M.D., Ph.D.</i>	Modified Paper Grip Test for Foot Muscle Performance: Measurement Properties and Preliminary Results of Individuals with Plantar Heel Pain <i>Ebonie Vincent, D.P.M.’15*, Shane McClinton, PT, DPT, OCS, FAAOMPT</i>
2:42 p.m.	C-Reactive Protein and Alpha 1-Antitrypsin Levels in Tears of Extended-Wear Contact Lens Patients <i>Aaron Barrett, Derek Gnehm*, Jordan Jones</i>	Managing the Frozen Shoulder <i>Sarah Potthoff, DC*</i>
2:54 p.m.	Probiotics in Yogurt Effect on Oral <i>Streptococcus mutans</i> <i>David R. Garner*, Mitchell W. Cooney, J. Scott Fannesbeck (Scott Wright)</i>	Comparison of Techniques Used to Place the Subtalar Joint in Neutral Position <i>J. Mahoney, D.P.M., V. Vardaxis, Ph.D., Eric So, D.P.M.’15*</i>
3:06 p.m.	Bacterial Species and Surgical Sites Involved in Contamination During Strabismus Surgery <i>Justin Bloomberg, D.O.’14*, Grace Wang, D.O., Donny Suh, M.D., Matthew Rauen, M.D.</i>	Can Students and Conspirators be Held Legally Accountable for Academic Dishonesty? <i>Denise M. Hill, JD, MPA*, Elaine Cook, Ph.D., MSN</i>
3:18 p.m.	Cytosolic Phospholipase A2 is Required for Human Smooth Muscle Cell Proliferation but not Migration to Platelet Derived Growth Factor BB <i>Powell J., Forrest R., Augustyn G., Carnevale K.A.*</i>	An Alternative Case-Based Learning Approach Improved Student Outcomes at DMU as Compared to a Lecture-Based Approach <i>Matt Henry, Ph.D.* and Pat Finnerty, Ph.D.</i>



## **Quantification of Stereotypies and Hyperkinesia in Fragile X Syndrome Using a Novel Markerless Motion Analyses System**

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Joanne O'Keefe, PT, Ph.D.<sup>1</sup>, **Hassan Khan, BS, D.O.'16<sup>2\*</sup>**, Deborah A. Hall, M.D., Ph.D.<sup>3</sup>, Alejandro Espinoza Orías, AA, Ph.D.<sup>2</sup>, Markus A. Wimmer, MA, Ph.D.<sup>2</sup>, Elizabeth Berry-Kravis, M.D., Ph.D.<sup>3,4</sup>  
<sup>1</sup>Anatomy and Cell Biology, <sup>2</sup>Motion Analysis Laboratory - Orthopedic Surgery, <sup>3</sup>Neurological Sciences, <sup>4</sup>Biochemistry and Pediatrics

**Background:** Individuals with Fragile X Syndrome (FXS) exhibit hyperkinesia including hyperactivity and stereotypic movements that interfere with social and school functioning. There are few published quantitative methods to measure abnormal behaviors in these populations.

**Methods/Protocol:** Movement resulting from hyperactivity and stereotypies was quantified in thirteen males (ages 10-32) with FXS and seven control subjects (ages 10-22) using the motion analysis system according to a standardized protocol. Motion data was analyzed in The Motion Monitor suite (Innsport, Chicago, IL) and reported parameters included: upper limb and head motion frequencies, feet and forearm segment movement distance. Hyperactivity and stereotypy rating scales were filled out by parents or guardians and correlated with the motion parameters. Unpaired 2-tailed *t*-tests were used to compare motion parameters between groups.

**Results:** Significant differences between FXS subjects and controls were found for average distance traveled by the feet ( $p < 0.008$ ), forearms ( $p < 0.008$ ) and total body COM ( $p = 0.028$ ) as well as frequency of forearm ( $p=0.02$ ), feet ( $p \leq 0.004$ ) and head motions ( $p \leq 0.004$ ). All parameters were significantly correlated with each other ( $|r| > 0.51$ ). Movement decreased sharply with increasing age ( $p \leq 0.03$ ) in FXS subjects, showing a relationship between age and all motion parameters. Almost all motion parameters correlated significantly with the stereotypy and hyperactivity subscale scores.

**Conclusions:** The system was able to effectively capture and record extremity and central body movement during the recording intervals. It differentiated between controls and males with FXS, who displayed significantly greater motions in all parameters. Correlation of motion data with rating scale scores for hyperactivity or stereotypic behaviors suggests valid measurements. Although this system yet requires reliability and further validity testing, it has potential as an outcome measure for quantifying hyperactive movement and stereotypies in investigations of efficacy for medications and/or therapeutic strategies attempting to reduce these behaviors in FXS and autism.

**Acknowledgements:** This work was supported by a grant from the FRAXA Research Foundation.

## **C-Reactive Protein and Alpha 1-Antitrypsin Levels in Tears of Extended-Wear Contact Lens Patients**

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Aaron Barrett, **Derek Gnehm\***, Jordan Jones  
*Department of Clinical Laboratory Sciences, College of Health Professions, Weber State University, Ogden, Utah*

The purpose of this work is to evaluate tear levels of C-Reactive Protein (CRP) and  $\alpha_1$ -antitrypsin as indicators of ocular surface inflammation in the extended wear of silicone hydrogel contact lenses. Ten current wearers of lotrafilcon B and seven wearers of senofilcon A were used in a cross-over study. Tear samples were collected after one week of non-contact lens wear to establish a baseline value. A second sample was collected after a week of extended wear to establish the test value. High sensitivity ELISA screenings were used to quantify the tear samples.

$\alpha_1$ -antitrypsin was significantly increased in tears of lotrafilcon B wearers. Senofilcon A wearers displayed a rise in  $\alpha_1$ -antitrypsin values that were not statistically significant. CRP did not show a significant increase in levels in either group. Clinical observations for inflammation were correlated with the quantified protein levels. Biochemical analysis of  $\alpha_1$ -antitrypsin in tears could be used as a reliable indicator of ocular surface inflammation. Further research could prove useful in determining the values of inflammation proteins in ophthalmic disease.

### **Probiotics in Yogurt Effect on Oral *Streptococcus mutans***

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**David R. Garner\***, Mitchell W. Cooney, J. Scott Fennesbeck (Scott Wright)  
*Clinical Laboratory Science Department, College of Health Professions*

Do probiotics found in yogurt affect the population of *Streptococcus mutans* in the oral cavity? *S. mutans* is the cause of common and extensive oral infections in 95% of the United States general population. One of the most common oral infections is dental caries, also known as cavities. In a double blinded study of 32 participants ages 18-40, participants were divided into two groups. Group 1 ate yogurt containing live probiotic organisms. Group 2 ate sterilized yogurt in which the bacteria were killed. The participants were evaluated over the course of nine weeks. They began the first three weeks by not eating yogurt. This was followed by three weeks of eating yogurt, and they finished with three weeks not eating yogurt. The *S. mutans* concentrations were evaluated from tooth scrapings using Dentocult® SM Strip Mutans kits over the nine week course of the experiment. While the results of previous published research completed in Finland suggest live cultures will reduce the population of *S. mutans* in the oral cavity, this is not what was observed in this study. No statistically significant difference was observed in the *S. mutans* concentrations between the groups that ate yogurt with live culture vs. those that ate the sterilized yogurt.

### **Bacterial Species and Surgical Sites Involved in Contamination During Strabismus Surgery**

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**Justin Bloomberg, D.O.<sup>1,4\*</sup>**, Grace Wang, D.O.<sup>2</sup>, Donny Suh, M.D.<sup>1,3,4</sup>, Matthew Rauen, M.D.<sup>3</sup>  
<sup>1</sup>Des Moines University, <sup>2</sup>Bronx-Lebanon Medical Center, <sup>3</sup>Wolfe Eye Clinic, <sup>4</sup>University of Nebraska Medical Center

**Introduction:** Residual bacterial colonization of the eye after strabismus surgery is common. This study aims to identify the bacterial pathogens and contaminated sites involved during strabismus surgery.

**Methods:** Prospective, case-control study of 44 patients age 1 to 78 years that underwent strabismus surgery. 5% povidone-iodine was used to sterilize the surgical site in all cases. Intraoperative swabs were taken from conjunctival incision site, scleral surgery site, lid specula, and all sutures used. Bacteria isolates were identified by culture growth and Gram staining. Positive and negative control samples were collected.

**Results:** Samples from 13 of 44 cases (29.5%) were positive for growth of bacteria. The conjunctival incision site was involved in 9 cases (69.2%). The most common concomitant contamination was the conjunctival incision site and the lid speculum (38.5%) with coagulase-negative *Staphylococcus epidermidis*. Mean age in positive cultures was 19.9 years. All 13 colonized plates grew coagulase-negative *Staphylococcus epidermidis*. *Staphylococcus aureus* was present on 1 of 13 colonized plates (7.7%) and was associated with the only case of post-operative infection (2.3%). The *Staphylococcus aureus* cultured came from both the conjunctival incision site and the lid speculum.

**Discussion:** Despite a 29.5% contamination rate, incidence of clinically significant infection was low. There was no elevated risk associated with age or gender. Irregular tear film can contribute to post-operative complications.

**Conclusion:** Contamination of the conjunctival incision site in strabismus surgery is common. Regardless of the mechanism, we should continue to focus our efforts on reducing intraoperative conjunctival bacterial load.

**Cytosolic Phospholipase A<sub>2</sub> is Required for Human Smooth Muscle Cell Proliferation but not Migration to Platelet Derived Growth Factor BB**

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Powell J., Forrest R., Augustyn G., **Carnevale K.A.\***

Platelet derived growth factor BB (PDGF BB) has an important influence on smooth muscle cell proliferation in restenosis and atherosclerosis. Our understanding of different signal transduction pathways involved in the response of smooth muscle cells to PDGF BB is potentially significant for understanding and manipulating these processes. Prior studies have demonstrated a crucial activation of cytosolic phospholipase A<sub>2</sub> (cPLA<sub>2</sub>) in smooth muscle cells to PDGF BB with the production of arachidonic acid and prostaglandin E<sub>2</sub>. In these studies we investigated the role for another PLA<sub>2</sub>, calcium-independent PLA<sub>2</sub> (iPLA<sub>2</sub>) in comparison to cPLA<sub>2</sub> on smooth muscle cell migration and proliferation. Pharmacological inhibitors of cPLA<sub>2</sub> were found to substantially inhibit proliferation, but not migration. AACOCF<sub>3</sub> (cPLA<sub>2</sub> and iPLA<sub>2</sub> inhibitor) and 1,2,4-trisubstituted pyrrolidine derivative (cPLA<sub>2</sub> inhibitor) both inhibited smooth muscle proliferation where Bromoenol lactone (iPLA<sub>2</sub> inhibitor) had no effect. None of these inhibitors prevented smooth muscle chemotaxis to PDGF BB in a modified Boyden chamber. In reconstitution experiments, arachidonic acid fully restored smooth muscle cell proliferation after the cells were treated with 1,2,4-trisubstituted pyrrolidine derivative. These data demonstrate a distinct role of cPLA<sub>2</sub> on smooth muscle cell proliferation which is a critical step in the pathogenesis of restenosis and atherosclerosis.

## Movement Science and Education

Academic Center Lecture Hall 3

Moderator: Mindi Feilmeier, D.P.M.

### Modified Paper Grip Test for Foot Muscle Performance: Measurement Properties and Preliminary Results of Individuals with Plantar Heel Pain

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**Ebonie Vincent, D.P.M.'15\*** and Shane McClinton, PT, DPT, OCS, FAAOMPT  
*Des Moines University, Des Moines, IA*

**Introduction:** Plantar heel pain (PHP) is one of the most prevalent lower extremity disorders. Impaired foot muscle performance is one factor associated with PHP although objective clinical measures have not been described. The modified paper grip test (mPGT) test provides an objective measure of great and lesser toes flexor muscle performance. The purpose of this study is to assess mPGT in individuals with and without PHT.

**Methods:** The mPGT was performed on the great and lesser toes of 8 healthy volunteers 2 times within the same day to determine test reliability. In addition, mPGT was performed on 7 individuals with and 4 individuals without PHP. To perform the mPGT, the force required to pull a standard business card placed from beneath the grip of the first great or lesser toes is measured using a digital pinch gauge.

**Results:** The mPGT demonstrated an ICC of 0.80 and 0.94 for the great and lesser toes, respectively. The 95% minimum detectable change (MDC) of the mPGT was 0.92 kg for the great toe and 0.36 kg for the lesser toes. The involved side of individuals with PHP demonstrated lower performance beyond the MDC of the great or lesser toes in 33% when compared to the uninvolved side and in 83% compared to the median of the control cases.

**Discussion:** The mPGT demonstrated acceptable clinical reliability and revealed impairments in individuals with PHP compared to the uninvolved extremity and healthy individuals. Further testing is needed to provide normative standards and clinical utility details.

### Managing the Frozen Shoulder

---

**Sarah Potthoff, DC\***

Frozen Shoulder is often a very painful and prolonged condition that is commonly managed in primary care settings. Although the pathology is common, its cause is not well understood. Therefore careful clinical diagnosis and management should be taken to help patients recover without long-term residual effects. Managing the Frozen Shoulder Presentation will define the problem, risk factors, symptoms, and differential diagnosis according to the most recent literature on this topic. The presentation will explain the most effective treatment strategies in conjunction with the specific rehabilitation exercises, which have deemed the most success in treating Frozen Shoulder.

**Background:** Dr. Sarah Potthoff published the Ebook Managing The Frozen Shoulder, at Walter Reed National Medical Center in Jan. 2012. This Self-Care Guide is available at [http://www.wrmmmc.capmed.mil/Health%20Services/Surgery/Orthopaedics%20and%20Rehabilitation/Physical%20Medicine%20and%20Rehabilitation/Chiropractic/Shared%20Documents/Frozen\\_Shoulder\\_Ebook.pdf](http://www.wrmmmc.capmed.mil/Health%20Services/Surgery/Orthopaedics%20and%20Rehabilitation/Physical%20Medicine%20and%20Rehabilitation/Chiropractic/Shared%20Documents/Frozen_Shoulder_Ebook.pdf).

Dr. Potthoff gave Managing the Frozen Shoulder Presentation in July to the Veteran's Administration Hospital in Des Moines, Iowa for Continuing Education Credits for Medical VA Staff.

## **Comparison of Techniques Used to Place the Subtalar Joint in Neutral Position**

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J. Mahoney, D.P.M., V. Vardaxis, Ph.D., **Eric So, D.P.M.'15\***  
*Des Moines University, Des Moines, IA*

The underlying theory behind podiatric biomechanics as developed by Root(1) maintains that foot pathology can be corrected by restoring the foot as close to subtalar joint (STJ) neutral as possible. Over the course of time, Root's definition of STJ neutral as Subtalar Joint Neutral, Range of Motion (SJNR) has been modified as being Neutral Calcaneal Stance Position (NCSP) or Subtalar Joint Neutral Palpation (SJNP). Given that there is more than one method to place the foot in the STJ neutral position, there is a need for testing the precision of these methods as it pertains to STJ neutral position. Therefore, the purpose of this project is to differentiate the static positions of the foot between the original and modified methods. The position of the subtalar joint was assessed using data collected from three-dimensional static captures of 13 healthy young adult males. This study to date has shown that there is significant imprecision from all three STJ neutral methods, and therefore our data suggest that these methods should not be considered exact methods of each other. Further work needs to be done to assess the significance of this in relation to the most ideal foot position for fabricating orthoses.

### **Abbreviations:**

**SJNR** - Subtalar Joint Neutral, Range of Motion: While in prone, non-weightbearing position, researcher bisects the calcaneus during maximal inversion and maximal eversion. The inversion/eversion angle measurements are used to calculate the degree at which the subtalar joint is in neutral position by utilizing the formula that neutral position is 1/3 of the total range of subtalar joint motion from the maximally everted position.

**NCSP** - Neutral Calcaneal Stance Position: The angle formed by the bisection of the posterior heel and the supporting surface when the subtalar joint is in neutral position. This is based on palpating for proper placement of the talar head's congruency with the calcaneus while weightbearing.

**SJNP** - Subtalar Joint Neutral, Palpation: This method involves palpating the talar head for congruency to approximate subtalar joint into neutral while non-weightbearing.

### **References:**

Root ML, Orien WP, Weed JH. Normal and Abnormal Function of the Foot, Vol 2, Clinical Biomechanics Corporation, Los Angeles, 1977.

## **Can Students and Conspirators be Held Legally Accountable for Academic Dishonesty?**

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**Denise M. Hill, JD, MPA<sup>1\*</sup>** and Elaine Cook, Ph.D., MSN<sup>2</sup>

<sup>1</sup>*Des Moines University, Des Moines, IA*, <sup>2</sup>*Program Director, Bachelor of Science in Nursing, Mount Mercy University*

Cheating and other forms of academic dishonesty have been ongoing concerns for academic institutions at all levels. However, recent advances in technology and online learning have exponentially increased the opportunities for wide-spread cheating, misrepresentation and dishonesty—including graduate programs in the health professions. Individuals and companies hoping to capitalize on the increased opportunity to cheat the system now offer to take tests, provide papers, falsify documents, or even impersonate students for a fee. The increase in unethical dishonest academic behavior could call into question the integrity of the entire educational system. In response to some of these concerns, the Department of Education implemented October 31, 2012 Final Program Integrity Rules obligating postsecondary institutions participating in the Federal Financial Aid programs to confirm that the federal government is not paying student aid tuition for students who are not attending classes. While putting the onus for enforcement on institutions is one approach; the scholarly research addressed in this presentation explores potential legal remedies that could be used to hold students and other co-conspirators involved (e.g. online cheating and falsification websites) directly accountable through fraud statutes, the Federal False Claims Act or other laws already used successfully in non-academic settings.

## Movement Science and Education

Academic Center Lecture Hall 3

Moderator: Mindi Feilmeier, D.P.M.

### An Alternative Case-Based Learning Approach Improved Student Outcomes at DMU as Compared to a Lecture-Based Approach

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**Matt Henry, Ph.D.\*** and Pat Finnerty, Ph.D.

*Department of Physiology & Pharmacology, Des Moines University, Des Moines, IA*

Case-based learning (CBL) is a format aimed at engaging the learner in a way not achievable with a traditional lecture-based (LB) approach. However, little conclusive evidence documents an increased efficacy of this format over LB approaches. Historically, the gastrointestinal section of the *Introduction to Physiology* course at DMU was taught using an LB approach for 9 lectures (7.5 hrs) followed by 1.8 hours of CBL. In 2011, the unit was restructured to incorporate cases throughout the unit and allow for simultaneous engagement with cases during the presentation of new material. This progressive-case based (PCB) approach resulted in a reduction in student seat time (from 9.3 hrs to 7.5 hrs), a reduction in lecture time (from 7.5 hrs to 3.5-4 hrs), and an increase in active learning time (from 1.8 hrs to 3.5-4 hrs). Most notably, student performance was significantly greater ( $p < 0.005$ ) on test items in the gastrointestinal unit when students underwent the PCB format as compared to the LB format, 88.5% vs 81.5% respectively. As a control, student performance during the entire *Introduction to Physiology* course was compared between the groups. Although the PCB students performed better in the gastrointestinal unit, this group did not perform better overall in the course. Therefore, migrating course content from a LB format to a PCB format increased the efficiency of content delivery, created more active learning time, and increased student performance. Incorporation of the PCB method into the curriculum may provide a format to both decrease student seat time while increasing student performance.

# Poster Abstracts



## How to Read a Poster Abstract

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A common approach for evaluating posters involves considering the following factors in the technical, visual and presenter categories. This tool can be used when reviewing posters at this meeting and as a helpful guide for constructing your posters in the future.

Category	Notes
<b>Technical</b>	
Research topic clearly described with adequate introduction and a clear hypothesis.	
Good use of the space of the poster with sections on methods, results, and discussion as appropriate.	
Conclusion section which emphasizes the relevance of the research in the field of study.	
<b>Visual</b>	
Title, author(s), affiliations, and contact info included.	
Poster design logical and easy to follow with appropriate visuals (methods, results, etc.).	
Text easy to read, understand and free of errors.	
Graphics clearly contribute to the overall presentation.	
<b>Presenter</b>	
Able to communicate in-depth technical information in an easy-to-understand manner.	
Able to interpret the data properly, and clearly answer questions related to project.	
Recognize limitations of the project's procedures.	
Courteous and professional.	



Poster Abstracts

	Poster	Page
<b>Biomedical Sciences</b>		
A Telomerase Inhibitor MST-312 Reduces the Efficiency of Herpes Simplex Virus Replication..... <b>Scott Roberts*</b> , Prajakta Pradhan, Marie L. Nguyen	1	41
Human Cytomegalovirus Resistance to Cyclopropavir Maps to a Base Pair Deletion in <i>UL97</i> Resulting in a Viral Protein Lacking an Active Kinase Domain..... <b>Laura E. Vollmer*</b> , Ellie D. Hall, Katherine Z. Borysko, Julie M. Breitenbach, Jiri Zemlicka, Jeremy P. Kamil, John C. Drach, Brian G. Gentry	2	41
Human Cytomegalovirus Resistance to the Deoxyribosylindole Nucleosides Maps to a Point Mutation in the Terminase Subunit Encoded Gene <i>UL89</i> ..... <b>Quang Phan*</b> , Julie M. Breitenbach, Katherine Z. Borysko, Leroy B. Townsend, John C. Drach, Brian G. Gentry	3	42
Molecular Analysis of Incompatibility Groups from Conjugally-Transferrable <i>Salmonella</i> Plasmid..... <b>Holly J. Hulsebus*</b> , Allen J. Kempf, Samina Akbar	4	42
Examining the Effects of Multi-Drug Resistant CMY2 Plasmids on Environmental Fitness of <i>Salmonella enterica</i> ..... <b>Taylor Hircocock*</b> , Allen Kempf, Samina Akbar	5	43
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## A Telomerase Inhibitor MST-312 Reduces the Efficiency of Herpes Simplex Virus Replication

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Herpes simplex viruses (HSVs) are the causative agents of cold sores and genital herpes. Once HSV has been contracted, it remains in a latent phase and cannot be eradicated. A possible therapeutic strategy is to target cellular host factors needed by the virus to complete its life cycle. One such potential target is telomerase. Telomerase is the enzyme responsible for replicating the telomeres, which are non-coding regions at the end of chromosomes that prevent loss of DNA after every round of replication. Previous results in our laboratory have shown that a telomerase inhibitor, MST-312, had a negative effect on the replication of the KOS1.1 strain of HSV-1. To determine if telomerase plays a role in the life cycle of other HSV strains, HEp-2 cells were infected with several laboratory derived strains or a recent clinical isolate of HSV-1 and an HSV-2 strain in the presence or absence of MST-312. In all viral strains tested, we saw a reduction of viral replication from samples that were treated with the telomerase inhibitor as measured by plaque assay. We also found a reduction in the accumulation of the late viral protein VP22. These results led us to conclude that MST-312 has a negative impact on the HSV-1 and HSV-2 life cycles. We further determined that MST-312 led to reduced VP22 protein accumulation in cells that use an alternative, telomerase independent mechanism for lengthening telomeres (U2OS). This suggests that MST-312 may be acting on HSV through a telomerase independent mechanism.

## Human Cytomegalovirus Resistance to Cyclopropavir Maps to a Base Pair Deletion in *UL97* Resulting in a Viral Protein Lacking an Active Kinase Domain

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Human cytomegalovirus (HCMV) is a widespread pathogen in the human population affecting many immunologically immature and immunocompromised patients, and can result in severe complications such as interstitial pneumonia, hearing loss, and mental retardation. Current chemotherapies for the treatment of systemic HCMV infections include ganciclovir (GCV), foscarnet, and cidofovir. However, high incidences of adverse effects (neutropenia and nephrotoxicity) are prevalent and limit the use of these drugs. Cyclopropavir (CPV), a guanosine-nucleoside analog, demonstrates 10-fold greater activity ( $IC_{50} = 0.46 \mu M$ ) when compared to GCV ( $IC_{50} = 4.1 \mu M$ ). We hypothesize that the mechanism of action is similar to GCV; phosphorylation to a monophosphate by viral pUL97 protein kinase, further phosphorylation to a triphosphate by endogenous kinases, and incorporation into HCMV DNA resulting in viral DNA polymerase inhibition. To test this hypothesis, we isolated a CPV resistant virus, sequenced the drug resistant viral genome, and discovered that base pair 498 of *UL97* was deleted. This caused a frame shift in *UL97* resulting in a truncated protein that lacks a kinase activity domain. To determine if this base pair deletion is responsible for drug resistance, the mutation was re-engineered into the virus wild-type genome and then subjected to increasing concentrations of CPV. The results demonstrate that the re-engineered virus was approximately 170-fold resistance to CPV ( $IC_{50} = 42.2 \mu M$ ) when compared to wild-type virus ( $IC_{50} = 0.25 \mu M$ ). We, therefore, conclude that this mutation is necessary and sufficient for drug resistance and that pUL97 is involved in the mechanism of action of CPV.

### Human Cytomegalovirus Resistance to the Deoxyribosylindole Nucleosides Maps to a Point Mutation in the Terminase Subunit Encoded Gene *UL89*

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Human cytomegalovirus (HCMV) infection can result in severe disease including retinitis and encephalopathy in immunocompromised patients and mental retardation, vision and/or hearing loss in immunologically immature patients. Current FDA-approved therapies for managing HCMV infections include ganciclovir (GCV), cidofovir, and foscarnet, but can result in serious adverse effects including hematological abnormalities or nephrotoxicity. Furthermore, these agents all target and inhibit the viral DNA polymerase, preventing viral replication. Thus, the prevalence for cross-resistance is high. Deoxyribosylindole nucleosides is a new class of compounds that demonstrate 20-fold greater activity ( $IC_{50}=0.34\mu M$ ) when compared to GCV ( $IC_{50}=7.4\mu M$ ) without any observed increase in toxicity. Previous studies have demonstrated that HCMV resistant to the chemically related benzimidazole ribonucleosides is also resistant to indole nucleosides. The benzimidazoles act late in the viral replication cycle by inhibiting the viral terminase but fail to serve as a viable clinical candidates due to poor pharmacokinetics profiles *in vivo*. HCMV terminase, encoded by genes *UL56* and *UL89*, is an enzyme that cleaves high-molecular-weight DNA concatemers necessary for viral genome processing and packaging making it an excellent target for anti-viral chemotherapy. Therefore, we hypothesize that the indole nucleosides target the HCMV terminase. To test this hypothesis, an indole-resistant HCMV was isolated, its genome sequenced, and a G766C base pair mutation in the exon 1 of *UL89* was identified. This mutation resulted in an E256Q amino acid change. We surmise that this mutation is responsible for HCMV resistance to the indole nucleosides, but further studies are necessary to confirm this hypothesis.

### Molecular Analysis of Incompatibility Groups from Conjugally-Transferrable *Salmonella* Plasmids

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Salmonellosis is a significant cause of morbidity and mortality worldwide. Some *Salmonella* species carry multiple antimicrobial resistance genes both in the chromosome and on mobile genetic elements. *Salmonella* species carrying antibiotic resistance plasmids can potentially disperse new resistance genes, such as *cmv2*, to other *Salmonella* species and enteric bacteria commonly found in the human and animal gut. These plasmids are often categorized into incompatibility groups based on their mode of replication and maintenance within the bacterial cell. We hypothesize that plasmid-bearing *Salmonella* have variable efficiency and capacity to transfer plasmids from certain incompatibility groups. To test our hypothesis, we obtained human and animal isolates of plasmid-bearing *Salmonella enterica* and attempted to conjugate each with an *E. coli* recipient strain. We used TSI slants as well as plasmid DNA purification from the test colonies to confirm that our recipient strains had received the plasmid(s) and were true transconjugants. We then performed multiplex PCR to determine which plasmid incompatibility groups were conjugally transferred. Our experiments thus far show that 1.) Our 16 *Salmonella enterica* isolates carry a broad range of incompatibility groups; 2.) 4 out of 15 CMY2 plasmid-bearing *Salmonella* isolates, and 1 isolate containing a large non-CMY2 plasmid, were able to conjugally transfer one or more plasmids to an *E. coli* recipient strain; and 3.) The A/C and I1 incompatibility groups are the most consistently transferred. These experiments will enhance our understanding of the mechanisms and conditions required for the natural spread of multiple drug resistance among enteric bacteria.

## Examining the Effects of Multi-Drug Resistant CMY2 Plasmids on Environmental Fitness of *Salmonella enterica*

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Presence of CMY2 plasmids in *Salmonella enterica* confers antibiotic resistance to the bacterial cells, but may also contribute to virulence and fitness of the bacteria. In some bacteria, genetic elements conferring antibacterial resistance also have components which increase virulence. Sequencing of the CMY2 plasmid shows certain regions contain homology to cell division genes and possibly invasive mechanisms. Due to its chief presence in the gastrointestinal tract, *Salmonella* must have an ability to thrive in harsh environments, so it is important to determine if CMY2 plasmids play a role in their survival in those environments. It has been shown that some genes in *Salmonella* are involved in both antibiotic resistance and virulence (via bile salt tolerance) and that those exhibiting drug resistance had also increased resistance to bile salts (1). It is also possible that upon acquisition of drug-resistance traits or plasmids, the extra energy required to retain them in the face of selective pressure may reduce bacterial fitness. Knowing the effect these genes have on environmental fitness helps us understand the bacteria's ability to thrive and the likelihood of these genes to be passed on.

## Degradation and Utilization of Complex Carbohydrates by *Trichomonas vaginalis*

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**Ryan Huffman\***, Lauren Nawrocki, Tyler Nielsen, Andrew Brittingham, Wayne Wilson  
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*Trichomonas vaginalis* is a protozoan parasite that is the causative agent of trichomoniasis, a widespread sexually transmitted disease that affects millions worldwide. Several reports suggest that infection with this protozoan correlates with a decrease in the glycogen content of the vaginal epithelium. Most studies of *T. vaginalis* include the maintenance of parasites in media containing either glucose or maltose as carbohydrate sources. Here, we demonstrate that *T. vaginalis* grows equally well in media containing the glucose polymers amylopectin or glycogen as the principal carbon source. Having demonstrated the ability of *T. vaginalis* to grow and utilize these polymers to support growth, we sought to analyze cell pellets and culture supernatant for hydrolytic activity towards amylopectin. We hypothesized that *T. vaginalis* utilizes glucose polymers by first degrading the polymers into smaller subunits. Our data indicate that *T. vaginalis* possess both cell-associated and secreted hydrolytic activity towards glucose polymers and that activity accumulates in the medium during growth. Furthermore, carbohydrate limitation triggers an increase in both activities. Our initial analysis of the secreted activity reveals enzymatic properties consistent with those of an  $\alpha$ -amylase. Collectively, our data provide evidence for a potential role of glucohydrolases in the growth of *T. vaginalis*.

## Screening of a Comprehensive Yeast Mutant Collection for Boric Acid Resistance

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A yeast mutant collection was screened for boric acid (BA) resistant strains. After three rounds of stringent selection, 25 mutations were identified as causing BA resistance in yeast. A gene ontology analysis showed that the group of BA-resistant mutants is enriched in strains with defects in nuclear chromatin proteins, particularly proteins of the chromatin remodelling complexes that are involved in negative regulation of gene silencing.

## Boric Acid Suppresses Hyphal Growth of *Candida albicans* and *Saccharomyces cerevisiae*

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**Martin Schmidt\***, Scott Miller, Michael Boyer  
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Boric acid (BA) is a time-tested remedy for the treatment of vaginal yeast infections. It has been observed that *C. albicans* exposed to BA lose their ability to undergo a morphogenetic transition from the planktonic, unicellular form to a mycelial, invasive growth pattern. In the present study, we show that this inhibition occurs at low, sub-inhibitory concentrations of BA. A similar phenomenon can be observed with the nonpathogenic baker's yeast, which in the presence of BA loses its ability to respond to nitrogen starvation by switching to an invasive growth mode. The influence of BA on the morphogenetic transition of both *C. albicans* and *S. cerevisiae* depends on the presence of Hog1, a MAP kinase that coordinates the cellular responses to a wide variety of environmental stressors.

## Protein Acetylation Defects Delay Expression of Stress Response Protein Tps1p

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N-terminal protein acetylation is a common post-translational modification in eukaryotes. An acetylation-deficient *nat3* mutant of the yeast *Saccharomyces cerevisiae* was isolated in a screen for boric acid sensitive strains. In order to understand the significance of N-terminal protein acetylation for the maintenance of boric acid resistance, we examined the expression of the stress response protein Tps1p during exposure to boric acid and high osmolarity. It was found that under both stress conditions, the expression of Tps1p was significantly weaker and slower in the *nat3* mutant than in the corresponding wildtype. We hypothesize that a deficiency in N-terminal protein acetylation impairs protein synthesis.

## Proliferation and Cytotoxicity of an Aggressive Natural Killer Cell Leukemia is Inhibited by Combination Statin and Chemotherapy Treatment

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**Timothy Steele, Ph.D.\*** and Austin Henslee  
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Aggressive natural killer cell leukemia is an acute neoplastic proliferation of natural killer cells, resulting in progressive disease and a poor prognosis. Establishing an effective treatment plan for aggressive natural killer cell leukemia has not been successful and death within several months of diagnosis. In recent years statin drugs, known for their cholesterol lowering ability, have been shown to have certain anti-tumor effects. In this study, the effect of combination chemotherapy and statin treatment on proliferation, cell cycle time and cytotoxicity was investigated using the aggressive natural killer cell line known as YT-INDY. In terms of anti-proliferative effect, combination treatment of YT-INDY with doxorubicin with atorvastatin, fluvastatin or simvastatin resulted in significant inhibition of tumor cell proliferation compared to either agent alone. A similar effect was observed with paclitaxel. Lovastatin, when used with doxorubicin or paclitaxel provided no significant inhibition compared to controls. Atorvastatin or fluvastatin, in combination with teniposide or topotecan, significantly inhibited YT-INDY proliferation. Consistent with the effects on proliferation, combination therapy with atorvastatin and doxorubicin, paclitaxel, teniposide or topotecan increased the cell cycle time of YT-INDY. In addition to the anti-proliferative effect of chemotherapy and statin together, combination treatment with paclitaxel and fluvastatin or lovastatin resulted in significant inhibition of natural killer cell cytotoxicity compared to any single agent. These results suggest that statins in combination with certain chemotherapeutic agents could provide a better anti-tumor response and improved patient outcomes, compared to chemotherapy alone, in those individuals with aggressive natural killer cell leukemias.

## Synergistic Effects of Statins and Aminoglycosides on *Staphylococcus aureus*

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Sepsis is the 10<sup>th</sup> leading cause of death in the United States. The emergence of antimicrobial resistant strains has limited treatment options. Studies have shown that HMG-CoA reductase inhibitors, or statins, have pleotropic effects beyond their intended cholesterol lowering capabilities. This study examines the potential synergistic effects of statins and antimicrobials on *Staphylococcus aureus*. Thirteen *S. aureus* strains, five MSSA and eight MRSA, were utilized in this study. Bacterial growth was measured by optical density (OD<sub>600nm</sub>) comparing controls to treatment combinations of five statins and ten class representative antimicrobials. Subtherapeutic concentrations of aminoglycosides (gentamicin; 0.125µg/mL, amikacin; 1.0µg/mL, kanamycin; 1.0µg/mL) had a significant synergistic effect on *S. aureus*, when combined with inactive simvastatin (15µM). Synergism was not observed with any other antimicrobial class. Statins induced a dose-dependent decrease in bacterial cell growth, as they increased in concentration (7.5µM-60µM), when gentamicin concentration was held constant (0.125µg/mL). There was no significant difference between MSSA and MRSA. In combination, aminoglycosides and statins have a synergistic antimicrobial effect on *S. aureus*. This effect was limited to aminoglycosides and was not observed with any other antimicrobial class. While all statins show a synergistic antimicrobial effect, generally fungal derived statins (simvastatin and lovastatin) are more potent than synthetic statins (atorvastatin and fluvastatin). Inactive simvastatin was the most potent and efficacious statin tested. Of clinical relevance, this antimicrobial effect is independent of methicillin resistance. Therefore, as statins enhance the antimicrobial action of aminoglycosides at subtherapeutic concentrations, they should be explored further as a possible aid in sepsis treatment.

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## GPER Interacts with Stim1 and Regulates Store-Operated Ca<sup>2+</sup> Entry in Vascular Endothelial Cells

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The novel G protein-coupled estrogen receptor (GPER) has been found to participate in numerous cardiovascular functions. Store-operated Ca<sup>2+</sup> entry (SOCE) is an essential mechanism that is required for many cellular functions. The stromal interaction molecule 1 (Stim1) was recently been found to function as a Ca<sup>2+</sup> sensor in the ER lumen that oligomerize upon depletion of the store Ca<sup>2+</sup> content and interact with PM Ca<sup>2+</sup> channels to activate them, triggering SOCE. We have observed that activation of GPER using the GPER specific agonist G1 is associated with a dose-dependent inhibition of SOCE in primary vascular endothelial cells. Interestingly, the GPER specific antagonist G15 increases SOCE in cells unstimulated by GPER intrinsic or exogenous ligand. In addition, preliminary experiments using GPER antisense oligomer suggest that GPER knockdown can increase SOCE by up to 80% compared to scrambled oligomer treatment. Coimmunoprecipitation revealed that GPER exists in endothelial cells as a glycosylated protein and forms a complex with Stim1 even in the absence of ER store depletion or Ca<sup>2+</sup> entry. These data suggest that GPER may be an important regulatory input of store-operated Ca<sup>2+</sup> entry via its interaction with Stim1.

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## Multifaceted Regulation of Ca<sup>2+</sup> Efflux via the Plasma Membrane Ca<sup>2+</sup>-ATPase by 17β-estradiol in the Vascular Endothelium

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Many of the beneficial effects of estrogen in the vasculature involve Ca<sup>2+</sup>-dependent activities. Ca<sup>2+</sup> efflux via the plasma membrane Ca<sup>2+</sup>-ATPase (PMCA) represents a major component of the Ca<sup>2+</sup> signaling machinery in cells. The acute and chronic effects of estrogen on PMCA activity and the mechanisms are not known. We observed in

vascular endothelial cells that chronic exposure to physiological concentrations of 17 $\beta$ -estradiol causes a substantial increase in total agonist-induced Ca<sup>2+</sup> signal. Measurement of PMCA activity in living cells demonstrates that 17 $\beta$ -estradiol dose-dependently decreases PMCA activity without affecting PMCA expression levels. Inhibition of Src kinase activity not only restores PMCA activity in cells treated with 17 $\beta$ -estradiol, but increases it by 50%. Both acute and chronic 17 $\beta$ -estradiol treatment promotes tyrosine phosphorylation at both the 135-kDa (PMCA) and 60-kDa levels, suggesting that PMCA interacts with a 60-kDa phosphotyrosine protein. We identified this 60-kDa protein to be a glycosylated form of the novel G protein-coupled estrogen receptor 1 (GPER). Tyrosine phosphorylation of GPER is increased by estrogen treatment and is prevented by inhibition of Src kinase activity. Consistent with the 50% increase in PMCA activity upon Src inhibition in estrogen-treated cells, the interaction between PMCA and calmodulin is increased by 50%, an effect that occurs independently of Src kinase activity. This increase is consistent with a 2-fold upregulation in total calmodulin expression level. These results indicate that estrogen inhibits PMCA activity by promoting Src-dependent tyrosine phosphorylation and interaction with GPER, effects that mask the stimulatory effect of enhanced CaM binding.

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### **Increased Arrhythmogenesis and Expression of Left Ventricular pS368-Connexin43 Following Acute Myocardial Ischemia in Female Ovariectomized Rats**

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Estrogen has been previously shown to be protective against ventricular arrhythmias following myocardial infarction possibly through changes in connexin 43 (Cx43) expression and phosphorylation. Phosphorylation of Cx43 at S368 is induced with acute myocardial infarction (AMI), suggesting that phosphorylation at this site plays a role in arrhythmogenesis. The goal of the current study was to determine if there is a direct correspondence between phosphorylation of left ventricular (LV)-Cx43 at S368 and the arrhythmogenic response to AMI, and to further examine if this effect is augmented following loss of estrogen. Anesthetized, ventilated female ovariectomized (n=3) and intact (n=3) Sprague-Dawley rats were subjected to 20-minutes of AMI produced through ligation of the left coronary artery. The arrhythmic burden in response to AMI was measured using a standard lead II ECG, and quantified through an established scoring method. Total LV-Cx43 expression and pS368-Cx43 expression were measured through standard Western blotting techniques. Ovariectomized animals had a greater arrhythmic burden versus intact animals following AMI. Correspondingly, ovariectomized animals also had an increase in the pS368-Cx43/Total Cx43 ratio. When data were further examined using a linear regression analysis, results show a direct positive correlation between the level of pS368-Cx43 expression and arrhythmic burden ( $R^2 = 0.94$ ).

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### **Moderate Intensity Exercise Training Reduces the Incidence of Supraventricular Arrhythmias and Increases Atrial Connexin40 Expression in Young and Aged Rats**

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The gap junction protein connexin 40 (Cx40) is the primary regulator of electrical conduction within the atria. Alterations in Cx40 expression within the atrial myocardium are associated with the development of atrial arrhythmias. Aging is associated with an increase incidence of atrial arrhythmias. Interestingly, excessive, high intensity exercise training (ET) has been shown to increase the occurrence of cardiac arrhythmias, while the effects of lower intensity ET are unclear. We hypothesized that aging would result in reduced atrial Cx40 expression accompanied by increased supraventricular arrhythmias, and that moderate intensity exercise training would counteract these effects. Groups of both young (4-6 months) and aged (24-25 months) F344 rats underwent 10-11 weeks of treadmill ET (11-14 m/min, 60 min/day, 5 day/week) or sedentary handling. Subcutaneous electrocardiographic leads were implanted allowing for data acquisition via the Actiwave telemetry system. The arrhythmic index (AI) was calculated using a modified scoring system totaling supraventricular

arrhythmias during a baseline period, sympathoexcitation (isoproterenol s.c. injection), and psychological stressor. Total supraventricular AI was significantly reduced in young compared to aged rats ( $p < 0.05$ ). Similarly, the impact of exercise trended toward reducing the supraventricular AI, compared to sedentary rats ( $p = 0.09$ ) in both groups. Preliminary data demonstrates reduced Cx40 expression in aged compared to young rats while exercise training tended to increase this expression in both groups. These results support our hypothesis that moderate intensity exercise has cardioprotective effects through increasing Cx40 expression and decreasing supraventricular arrhythmias.

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### **The Effects of Exercise Training (ET) on Cardiac Arrhythmias and Left Ventricular (LV) Connexin 43 (Cx43) Expression in Aged and Young Rats**

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Reduced LV expression of the myocardial gap junction protein Cx43 is associated with increased arrhythmogenesis. The occurrence of cardiac arrhythmias increases with age although mechanisms are unknown. We hypothesized that aging would result in increased cardiac arrhythmias and decreased LV Cx43 expression while ET would reverse these effects in young (4-6 mo) and aged (24-25 mo) F344 rats. Rats underwent 10-11 weeks of treadmill ET or sedentary handling. Subcutaneous electrocardiographic leads were implanted after the young sedentary (YS  $n=9$ ), young exercise (YEx  $n=7$ ), aged sedentary (AS  $n=6$ ), and aged exercise (AEx  $n=6$ ) protocols to allow for data acquisition via the Actiwave telemetry system. The arrhythmic index (AR) was calculated using a modified scoring system during baseline (BL), sympathoexcitation (isoproterenol (ISO), 0.15mg/kg, s.c.) and brief restraint (BR). The total AR (BL+ISO+BR) was significantly higher in aged vs young rats ( $p < 0.05$ ) while ET showed a trend toward reversing this effect ( $p = 0.065$ ). Western blot analysis (YS=3, YEx=3, AS=3, AEx=2) revealed reduced Cx43 expression in aged vs young rats while exercise partially reversed this effect in AEx rats. These data support the hypothesis that ET provides a protective benefit against cardiac arrhythmias in young and aged rats. Future studies will further investigate the role of Cx43 in mediating this response.

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### **Effects of Social Isolation on Connexin 43 Expression in the Left Ventricle of Female Prairie Voles**

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Social stress plays a key role in the relationship between cardiovascular disease (CVD) and depression. Previous studies in animals have shown that social isolation leads to depressive like behaviors and increased incidence of arrhythmias. Alterations in the expression of left ventricular (LV) connexin43 (Cx43) has been identified in the pathogenesis of cardiac arrhythmias in some forms of CVD. Prairie voles, which are socially monogamous rodents, were used to investigate the hypothesis that social isolation leads to increased depressive like behaviors and decreased LV Cx43 expression. Adult prairie voles were paired with or isolated from a sibling for 4 weeks. Then, half of the paired and isolated animals were exposed to 7 days of chronic mild stressors (CMS) while the other half remained undisturbed. The animals were subjected to the forced swim test (FST) as an index of depressive behavior. Following the FST, hearts were collected and LV Cx43 expression was determined by Western blotting. Data indicate a significant increase in depressive behavior during the FST exhibited by the paired+CMS, isolated, and isolated+CMS groups compared to the paired group. The expression of LV Cx43 was significantly lower in all groups as compared to the paired group. We conclude that a reduction in the expression of LV Cx43 may be a mechanism for the increased arrhythmogenesis in animals that exhibit depressive like behaviors. MH77581, HL112350, IOER 3726

## Daily Spontaneous Running (DSR) Decreases Phosphorylation of Left Ventricular (LV) Connexin-43 (Cx43) at Pathological Sites in Female Sprague-Dawley Rats

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Cx43 is a gap junction expressed primarily in the LV of the heart that ensures efficient cell to cell communication. Regulation of Cx43 protein by post-translational modification can enhance or down-regulate gap junction assembly and function. Studies have illustrated that phosphorylation at residues S368, S255, and S279/282 is associated with down-regulation of function, while S325/328/330 and S262 phosphorylation has been correlated with improved functionality of Cx43. Down-regulation of gap junctions often correlates with a pathological cardiovascular state, including ischemia and increased arrhythmogenesis. Cardiovascular conditioning via exercise training has been well documented to prevent the incidence of arrhythmias. Previous studies have demonstrated that altering the conditioned state of the heart will cause changes in the expression and/or phosphorylation of Cx43, however the precise impact is not well understood. We hypothesized that cardiovascular conditioning with exercise training would elicit a reduced phosphorylation at sites known to decrease Cx43 function (S255, S279/282, and S368), indicating a possible mechanism by which cardiovascular conditioning results in a cardioprotective state. To simulate a conditioned state, rats underwent 9 weeks of DSR (n=4), compared to cage controls (n=4). Subsequently, Western blot analysis was performed to measure total and phosphorylated forms of Cx43 from the LV. Data indicate no change in Cx43 expression. However, the phosphorylation status was altered by DSR, with the greatest impact on S368. Specifically, there was a significant decrease in hyperphosphorylated Cx43-pS368. Thus, cardiovascular conditioning with exercise may alter Cx43 phosphorylation status in a manner consistent with a cardioprotective effect against arrhythmogenesis.

## An Investigation into the Relationships of Incompatibility Groups within *bla<sub>cmv2</sub>* gene Containing Plasmids, and their Effects on Fitness and Virulence

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Frequent outbreaks of Salmonellosis are a problem of both national and international significance. Some *Salmonella* species carry multiple antimicrobial resistance genes both in the chromosome and on mobile genetic elements, or plasmids. Plasmids can be classified using incompatibility (Inc) typing to determine the type of replication machinery a plasmid encodes. These Inc groups can be used to monitor the epidemiological relationships between an outbreak and the types of plasmids associated with it. We hypothesize that in our human and animal *Salmonella* isolates *cmv2* gene containing plasmids belong to a specific Inc group. To test our hypothesis we obtained human and animal isolates of *Salmonella enterica* and screened them using a 3-panel multiplex PCR assay, as well as with simplex PCR for the *bla<sub>cmv2</sub>* gene. This approach is used as a screening tool to distinguish between plasmids in strains which possess multiple plasmids. Ultimately, we wish to examine the fitness effects of these plasmids in isogenic *Salmonella* Typhimurium and *Salmonella* Newport strains. Our data thus far suggests that 1) all 13 of our CMY2 plasmids contain the A/C Inc group. 2) Inc groups FII (35%), and I1 (46%) are prevalent in the (multiple plasmid bearing) A/C strains examined. Based on our data, we propose that these groups may be related, or act as helper plasmids which assist with the ability of the strains to possess multiple plasmids. This study hopes to lead to an increased understanding of the role(s) these plasmids play in both the fitness and virulence of *Salmonella* strains.

## Monoolein and Monolaurin Blends for Thermo-responsive Local Drug Delivery Systems

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Systemic administration of chemotherapy in the treatment of malignant brain tumors has historically been ineffective as a treatment alone because of its difficulty in reaching the therapeutic site of action and its toxic effects of distribution throughout the body. Therefore, a thermo-responsive local drug delivery system, created by a blend of monoglycerides, could provide a much more safe and effective means of treating these types of tumors. The goals of this study were to understand the thermo-mechanical properties of the liquid crystalline phases of blends of monoolein (MO) and monolaurin (ML) and design a thermo-responsive drug delivery system that could trigger the release of a lipid-soluble model drug, nifedipine (NIFE), from a matrix of 70% MO: 30% ML. The crystallization behavior of binary blends of MO and ML as characterized by Differential Scanning Calorimetry (DSC) did show temperature dependent phase transitions. Therefore, the drug release from the formulation was studied at 37°C and 42°C and analyzed using High Performance Liquid Chromatography (HPLC). The main findings supported the hypothesis that the formulation released more drug at 42°C than at 37°C. A binary blend of these monoglycerides show good potential in thermo-responsive drug delivery of chemotherapy in malignant brain tumors.

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## Microarray-Based Analysis of Gene Expression in Postmortem Prefrontal Cortex of Depressed Subjects

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Major depression disorder (MDD) has been linked to changes in function and activity of the prefrontal cortex (PFC), one of the forebrain regions involved in regulation of emotions and mood. The exact cellular and molecular mechanisms underlying PFC alterations in response to stress are yet to be fully characterized. In this study, we examined the genetic profile of postmortem PFC from subjects diagnosed with MDD and comparison healthy subjects (n=27) matched for sex, race and age. Tissue samples were obtained from the University of Pittsburgh Brain Tissue Donation Program. Gene expression profile of the PFC was assessed by 48K human HEEBO whole genome microarrays, and a real-time polymerase chain reaction (PCR) method was used to confirm microarray analysis results for certain genes of interest. Preliminary microarray results and subsequent pathway analysis suggest changes in the regulation of genes involved in immune responses, cellular architecture, and synaptic function/structure. Interestingly, down-regulation of several genes such as the early response transcription factor c-Jun and PDK1, a kinase crucial for the activation of AKT pathway, is similar to our previous microarray findings in the hippocampal subregions of subjects with MDD. Studies are currently underway to characterize these effects and to further investigate the functional consequences of these changes in rodent models of chronic stress and antidepressant treatment. Together these studies may contribute to a better understanding of the pathophysiological events underlying the development of MDD and to identification of potential therapeutic and diagnostic targets for this disorder.

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## Performance of the PlusoptiX A08 Photoscreener for the Detection of Amblyopia Risk Factors in Children 0 to 5 in Central Iowa

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**Purpose:** To evaluate the accuracy of plusoptiX A08 photoscreener in detecting risk factors for amblyopia in children 0-5 years in central Iowa.

**Methods:** Retrospective study of two hundred ninety children examined consecutively in the office. Each patient had a photoscreening with plusoptiX and a comprehensive pediatric ophthalmology examination. Photoscreening results, per our age-based criteria, were compared with the comprehensive examination findings. Patients were considered to have amblyopia or amblyogenic risk factors in the comprehensive examination based on the American Association for Pediatric Ophthalmology and Strabismus (AAPOS) referral criteria guidelines.

**Results:** Sixty six percent of the children were found to have amblyopia or amblyogenic risk factors during the pediatric ophthalmology examination by use of AAPOS guidelines. PlusoptiX offered an overall testability rate of 97.6%, sensitivity of 86.8%, specificity of 88.0%, positive predictive value of 93.2%, and negative predictive value of 77.9%. The sensitivity for detection of strabismus  $\leq 20$  PD was 51.9%.

**Conclusions:** PlusoptiX can be a useful tool for objective vision screening in preverbal children that cannot do routine vision screening. In accordance with other studies in older patients, plusoptiX has high overall sensitivity, specificity and positive predictive value in this younger population. PlusoptiX showed high sensitivity for detection of refractive amblyogenic risk factors and had a high testability rate in infants. However, plusoptiX had low sensitivity for detecting strabismus, including both exotropia and esotropia if magnitude of deviation was  $\leq 20$  prism diopters. Future studies can improve sensitivity by pairing the instrument with the cover test or a stereo test.

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## Hopping Changes Over Time

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**Background and purpose:** The *Feldenkrais Method* of somatic education claims to improve function and adaptable behavior throughout life. To assess these claims, we conducted the first of its kind longitudinal behavioral observation of participants in a *Feldenkrais* Professional Training Program vs. control group matched by age, gender, and activity level. This section of the study analyzes pre-to-post changes in a timed 6 meter hopping task.

**Method:** In each of 8 sessions (2/year over 4 years), we determined participants' dominant and non-dominant legs. Participants completed 3 trials on each leg. We averaged these trials, calculated training and control group means, and examined pre-to-post changes within and between groups.

**Results:** Training group (n=8) dominant leg hopping time decreased 10.15%; non-dominant leg time increased 5.10%. Control group (n=8) dominant leg time increased 6.23%; non-dominant time decreased 2.78%. Repeated measures ANOVA was not significant. Cohen's *d* test revealed a moderate effect size (.39) for pre-to-post change in the training group dominant leg.

**Conclusions:** Repeated measures ANOVA results were likely due to the small *n*. The magnitude of change in time was greater in both groups on the dominant leg than on the non-dominant leg. The magnitude of change in hopping time was greater for the training group than control group on dominant and non-dominant legs. These findings suggest the *Feldenkrais Method* may effectively preserve or enhance dominant leg hopping speed with aging. Further analyses, including determination of hopping skill levels, are planned to evaluate the effects of a 4-year *Feldenkrais* Training Program.

## Short Term Effect of Manual Therapy on Cervical Neck Flexor Strength on Individuals with Neck Pain

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**Introduction:** Previous studies have linked loss of strength and endurance in the neck flexor musculature to patients with neck pain.<sup>1-5</sup> The primary muscles used for segmental control of the anterior cervical spine are the longus capitis and longus colli. The longus colli is also the principle muscle to support and control the cervical spine<sup>6</sup> against the tendency towards increased lordosis generated from head weight and contraction of the cervical extensor muscles.<sup>7,8</sup> Manual therapy interventions have demonstrated positive outcomes to patients with cervical disorders and cervicogenic headache.<sup>9,10,11</sup> The purpose of this study was to analyze performance of the deep neck flexors before and after manual therapy to the cervical region. We hypothesized that manual therapy intervention will improve performance of the cervical flexor muscles.

**Subjects:** 11 patients with unilateral neck pain.

**Methods:** Subjects were assessed using the Neck Flexor Endurance Test<sup>12</sup> pre- and post-intervention. The test was measured using a stopwatch in seconds. The examiner terminated the test if the patient's skin folds separated or significant compensations were noted using accessory musculature. Manual therapy interventions administered included both thrust and non-thrust techniques to the cervical and thoracic spine. Results of within groups differences were analyzed using a paired t-test with  $\alpha < 0.05$ .

**Results:** There were no statistically significant differences between neck flexor endurance pre- and post-intervention.

**Conclusion:** Our hypothesis was not supported; manual therapy intervention did not significantly improve immediate neck flexor endurance.

**Clinical relevance:** Manual therapy in isolation has not been supported as sufficient for increasing neck flexor endurance. Clinicians should utilize manual therapy in conjunction with a home exercise program to improve strength and therefore decrease neck pain.

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## Changes in Balance Measures and Pain after an Aquatic Physical Therapy Program in Older Adults

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**Background:** Aquatic Physical Therapy (APT) is used for a variety of movement disorders and diagnoses. Current research indicates multiple benefits of APT including decreased pain, increased mobility, and improved well being. However, limited research exists evaluating APT on patients with balance deficits. The purpose of this study is to determine the effects of APT on balance and pain levels in older adults.

**Methods:** Twenty-five subjects, ages 60-85, were included in the study. Inclusion criteria were patients referred to APT who had fallen in the last year, had a fear of falls, had been referred to APT for balance training, or had scored >14 seconds on the Timed Up and Go (TUG) test. Each APT session lasted 30 minutes with 20 minutes focusing on balance training for an average of 12 sessions for 5 weeks. Specifics of the APT were determined by individual therapists depending on the patient's goals. Patients were assessed pre and post APT with the Berg Balance Scale (BBS), TUG, and Numerical Rating Scale for pain (NRS).

**Results:** The BBS improved significantly post APT ( $t=-3.02$ ,  $p=0.006$ ). TUG ( $t=0.831$ ,  $p=0.414$ ) and NRS ( $t=2.054$ ,  $p=0.51$ ) did not significantly improve post APT. NRS was not correlated with BBS ( $r=.071$ ,  $p=.736$ ) or TUG scores ( $r=-.050$ ,  $p=.812$ ).

**Conclusions:** APT improved static balance in older adults but did not show improvement in dynamic balance or pain. More dynamic aquatic activities and transitioning patients to functional land therapy might improve outcome measures.

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## Analysis of Turn Initiation and Termination

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**Background:** Turning is an essential component of being independent in the community. During activities of daily living, 20-50% of steps occur in a turning motion rather than in a straight line. (Sedgeman et al. (1994) & Glaister et al (2008)). Falling during a turn increases the risk of serious injury in individuals of any age. There are multiple ways of classifying the beginning and end of a turn, but there is no universally accepted measure or definition. The purpose of this study is to establish a method of identifying where a turn is initiated and terminated based on GAITRite® assessment.

**Methods:** A healthy sample of 27 young adults and 22 older adults participated in this study. Each participant completed five trials of right turns, left turns, and a Timed-Up-and-Go Test on the GAITRite® electronic walkway. Based on previously utilized measures of initiation and termination of a turn, an analysis will be conducted on collected trials using the movement analysis software PKMAS.

**Results:** Forthcoming.

**Discussion/Application:** Determining the initiation and termination of a turn will ensure all researchers are measuring turns in the same way. Similar to the Functional Ambulation Profile used for straight-line gait, a standardized 'turning index' may be developed to analyze an individual's risk of falling during a turn.

## Lower Extremity Stiffness During Transition from Stair Descent to Walking in Unilateral THA Subjects

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**Introduction:** Total hip arthroplasty (THA) is a common treatment for patients with hip osteoarthritis<sup>1</sup>. Asymmetrical loading of the lower extremity (LE) is common post surgery and can potentially accelerate pathology in other joints<sup>2</sup>. The purpose of this study was to analyze bilateral total leg stiffness during the transition from stair descent to walking. We hypothesized THA subjects would demonstrate greater stiffness with the involved LE.

**Subjects:** 12 THA subjects; 7 controls.

**Methods:** Kinetic and kinematic data was collected at pre, 3, 6, and 12 months post-surgery. Subjects were instructed to descend three six inch steps onto a floor imbedded force plate and continue walking. The LE was modeled as a linear spring<sup>3,4</sup>, defined as the center of pressure location on the force plate to the contralateral ASIS. The LE stiffness, bilateral peak load, and loading rate ( $BW \cdot L^{-1}$ ) were evaluated from initial contact to toe off. Two-way repeated measures ANOVA identified bilateral differences in LE dynamics and changes over time. Two sample t-test identified between group differences,  $\alpha < 0.05$  (SPSS 18).

**Results:** THA subjects demonstrated significantly lower peak load, loading rate, and LE stiffness on the involved LE. Controls demonstrated significant load and stiffness values comparatively.

**Conclusion:** Our hypothesis was not supported; THA subjects appear to divide the activity into two parts, lowering the body weight down and walking forward. Control subjects use greater LE stiffness to execute the task in one motion.

**Clinical relevance:** Clinicians treating patients post THA should utilize strategies focusing on symmetry and eliminating the dual task approach<sup>2</sup>.

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## Gender Disparity in Transverse Plane Foot Structure Changes with Load

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**Background:** Women have a higher prevalence of lower extremity musculoskeletal injuries and deformities compared to men. Several papers have been written in an attempt to determine why this is. Hallux abducto valgus (HAV) is an example of this disparity. The purpose of this study is to evaluate how four commonly observed angle measurements differ under three different load conditions between asymptomatic males and females.

**Methods:** The right foot of forty asymptomatic individuals (20 men, 20 women) with no known foot deformities or previous surgeries was assessed using transverse plane x-rays under three different load conditions (low, medium, and high). The following angles were measured from each radiograph: Hallux abductus angle (HAA), Intermetatarsal angle (IMA), the Metatarsus adductus angle (MAA), and the Proximal articular set angle (PASA).

**Results:** Significant changes were detected in individual angle measurements for both groups with load. The MAA angle was found to decrease with load across all three load conditions independently from gender. A gender

disparity was noted in the female group showing a decrease in the HAA with high load and in the male group a significant decrease in the IM5 angle under low to medium load.

**Conclusion:** The load effect on the transverse plane measures seem to be in the same direction for both genders. The changes observed here reflect mid- to forefoot, as well as, the relationship between structures of the forefoot. The medial forefoot structures are predominantly affected by low to medium load transitions, in contrast to the lateral forefoot structures which are affected by transition from medium to high load. The disparity in angle changes between genders indicates potential functional differences in males and females feet. These findings underscore the need for further research in foot dynamic function under load as a promising methodology to explain disparities in foot pathology.

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## **Ibuprofen and Acetaminophen Have Trivial Effects on Core Temperature and Performance During High Intensity Cycling**

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**Purpose:** To examine the physiological and performance effects of Ibuprofen (IB), acetaminophen (AC), or placebo (PL) to high intensity cycling. It was hypothesized that the analgesic and anti-pyretic effects of IB and AC would attenuate the increase in heart rate and core temperature, and increase performance.

**Methods:** Six experienced cyclists were administered either 1000 mg of acetaminophen (AC), 400 mg of ibuprofen (IB), or placebo (PL) followed by 60 minutes of fixed pace (FP) cycling at 60% of the power output that elicited maximum  $\text{VO}_2$ . After a 5 min rest, subjects performed a 10 mile simulated time trial (TT). During these tests the following variables were assessed: heart rate, core temperature using ingestible core temperature sensors, rating of perceived exertion on 6-20 Borg scale, pain on a 0-10 visual analog scale, arterial oxygen saturation, and gas exchange variables. Subjects were provided 200 ml of water during scheduled water breaks during each cycling phase. The data were analyzed with single factor repeated measures ANOVAs and omega squared ( $\omega^2$ ) for effect size.

**Results:** There were no statistically significant differences between the conditions for any of the dependent variables, and all effect sizes were trivial in size. For brevity, we report only the results for time trial performance, core temperature, and heart rate. For time trial performance, PL =  $1726 \pm 181$  seconds, AC =  $1712 \pm 81$  s, IB =  $1801 \pm 231$  s ( $\omega^2 = .005$ ). Similar results were found for maximum heart rate (Fixed Pace: PL =  $165 \pm 18$  bpm, AC =  $164 \pm 19$ , IB =  $160 \pm 21$ ,  $\omega^2 = .03$ ; Time Trial: PL =  $178 \pm 15$  bpm, AC =  $180 \pm 12$ , IB =  $176 \pm 16$ ,  $\omega^2 = .03$ ), and core temperature (Fixed Pace: PL =  $37.4 \pm 1.2$  C, SC =  $37.5 \pm 1.0$ , IB =  $38.2 \pm 1.6$ ,  $\omega^2 \sim 0.0$ ; Time Trial: PL =  $37.6 \pm 1.3$  C, AC =  $37.8 \pm 1.0$ , IB =  $38.4 \pm 2$ ,  $\omega^2 \sim 0.0$ ).

**Conclusions:** The results of this study indicate that there are only trivial effects of the common, over the counter, anti-pyretic/analgesics, acetaminophen and ibuprofen, on performance and physiological measurements during prolonged cycling. While the sample size of this study is small, the vanishingly small  $\omega^2$  values suggest that the drugs do not affect endurance performance, core temperature, or heart rate.

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## **Reliability of Clinical Measures: Subtalar Neutral Orthotic Casting**

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The reliability and validity of the subtalar neutral position during orthotic casting has been shown to be unreliable. The purpose of this study was to compare clinical measures for subtalar neutral position through intrarater and interrater reliability. Three exams were recorded to determine reliability for a total of 20 participants. We found that the Intrarater reliability (ICC) ranged from 0.29 to 0.65 suggesting poor to moderate agreement while the

Cronbach's Alpha ranged from 0.46 to 0.78. The Interrater reliability (ICC) ranged from 0.14 to 0.39 suggesting poor to fair agreement and Cronbach's Alpha (Alpha) ranged from 0.24 to 0.68. The clinical measures are congruent with the statements regarding poor reliability of the subtalar neutral position during orthotic casting. However, the clinical measures for relaxed calcaneal stance position (ICC) were consistently more reliable at 0.64 and 0.52 for intrarater and interrater respectively, suggesting moderate reliability. Thus the reliability of all the clinical measures varies with certain measures much more reliable than others.

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## Non-Union Jones Fracture: Alternative Conservative Treatment Modalities

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**Introduction:** The Jones fracture is a common and management challenging condition with a well documented history of bone healing complications. The purpose of this review was to examine the success of different conservative treatment protocols in the management of hypertrophic non-unions with application to Jones fracture non-unions.

**Methods:** A literature search was performed on PubMed using the terms, "conservative treatment, non-union, and Jones fracture." Three high level evidence articles were selected from the search. (1) Cacchio compared extracorporeal shock-wave therapy (ESWT) to surgical intervention on long bone non-unions (Level I), (2) Furia compared ESWT to intermedullary screw fixation for non-union Jones fractures (Level III) and (3) Scott performed a prospective double-blinded trial of electrical capacitive coupling versus placebo treatment for lower leg long bone non-unions (Level I).

**Results:** Mean follow-up time for the 126 subjects in the Cacchio study was 21.7 months. Primary healing rates at six months showed no significant difference between ESWT and surgical intervention. Clinical outcome scores at three and six months favored ESWT with fewer complications. In the Jones fracture study, 20/23 subjects treated with shockwave therapy and 18/20 subjects treated surgically were consolidated by three months. The major difference was the increased complication rate with surgical intervention. The Scott study examined 21 non-union fracture subjects. 6/10 subjects in the bone stimulator group formed a solid union after 21 weeks while 0/11 subjects in the placebo group healed, there was a significant association between electrical capacitive coupling and fracture union ( $p=0.02$ ).

**Conclusion:** Combined with cast immobilization, both electrical bone stimulation and ESWT reduce the time to radiographic healing in patients with non-unions. Both are safe and as effective as surgical intervention in healing hypertrophic non-unions, including the difficult Jones fracture, without the complications associated with surgery.

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## Lateral View Radiographic Measurements of the Foot with Load

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*Research was performed at Des Moines University (Des Moines, IA), and all authors were affiliated with the University (students or faculty) at the time of participation.*

**Background:** Consistent radiographic technique is essential for evaluating the structure and stability of the foot when diagnosing clinical disorders, planning surgical treatment, and evaluating the effectiveness of treatment. The purpose of this study is to investigate how lateral radiographic angular measurements change with increasing load and how they compare to the clinical Arch Height Index (AHI).

**Methods:** The right feet of 40 healthy individuals with no foot deformities were evaluated using x-ray from a lateral view under progressive weight-bearing conditions. The following measurements were obtained from the films of each lateral x-ray: medial longitudinal angle (MLA), lateral longitudinal angle (LLA), calcaneal inclination

(CI), metatarsal inclination of the first ray (M1I), metatarsal inclination of the fifth ray (M5I), and Arch Height Index (AHI).

**Results:** Approximately 78% of deformation occurred between low and medium load. The angles for MLA increased and CI decreased with high significance ( $p < 0.001$ ) for both low to medium and medium to high loads. M1I decreased significantly ( $p < .05$ ) and the LLA significantly increased ( $P < 0.001$ ) from low to medium load. from high to medium load. Neither M1I nor LLA changed significantly from medium to high load. M5I increased significantly from medium to high load only. The AHI ratio changed significantly for both low to medium and medium to high loads.

**Conclusion:** The largest deformation of the foot occurs during low load conditions questioning the necessity of unilateral full weight-bearing x-rays. The lateral aspect of the foot (M5I) seems to deform only under high load conditions, suggesting weight distribution changes on the foot between bilateral and unilateral stance.

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### **Conservative Treatment of Predislocation Syndrome with Kinesiotape Using Two Distinct Taping Methods**

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Predislocation syndrome (PDS) is a pathology that affects the plantar forefoot. PDS involves progressive inflammation and degeneration of the lesser metatarsophalangeal joints leading to subluxation and dislocation of the joint. PDS is typically a diagnosis of exclusion and is commonly misdiagnosed. Surgical intervention is the preferred method for the treatment of PDS, but there remains a need for conservative treatment strategies in patients either unable or unwilling to consider surgery. Taping of the affected toe has long been a common conservative treatment for patients with PDS, but traditional athletic tape has a number of disadvantages that limit its long-term efficacy. Kinesiotape has a number of advantages over traditional athletic tape, as it is more durable, can tolerate water, and maintains its stretch over time. However, no research exists regarding the effectiveness of kinesiotape in treating PDS. Our study will measure the effectiveness of two different methods of kinesiotaping in patients diagnosed with PDS. One method of taping will be the conventional taping method while the other method will be a novel taping technique. Patients will be asked to rate their pain using the ACFAS scoring scale for forefoot pain at the beginning of the study and after three weeks of continuous taping. At the conclusion of this study, we hope to elucidate whether or not kinesiotape reduces pain in patients with PDS and, if so, which taping method is most effective.

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### **Relationship of Frontal Plane Rotation of the First Metatarsal to Proximal Articular Set Angle and Hallux Alignment in Patients Having Tarsal Metatarsal Arthrodesis for Hallux Abducto Valgus: A Case Series and Critical Review of the Literature**

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Rotation of the first metatarsal, a component of hallux abducto valgus, is rarely discussed and is not addressed as a component of most hallux valgus corrective procedures. Frontal plane rotation of the first metatarsal is an integral component of HAV deformity and de-rotation is necessary for complete deformity correction. Change was observed in angular measurements commonly used in the evaluation of hallux valgus deformity in patients who underwent a Modified Lapidus Procedure. We measured the intermetatarsal angle, hallux abductus angle, proximal articular set angle and tibial sesamoid position on weight bearing radiographs of 25 feet of 24 patients who underwent tarsal metatarsal corrective arthrodesis and lateral capsular release. Attention was given to reduction of the frontal plane rotation of the first metatarsal during correction. Results show a change in the angular measurements observed by 4 investigators to be: Mean change in IM angle of 10.1 degrees ( $p < 0.0001$ ).

Mean change in HAA of 17.8 degrees ( $p < 0.0001$ ). Mean change in PASA of 18.7 degrees ( $p < 0.0001$ ). Mean change in tibial sesamoid position of 3.8 ( $p < 0.0001$ ). Also, a consistent valgus, or everted position of the first metatarsal was noted as a component of the HAV deformity in our patient population and was corrected by varus rotation or inversion of the metatarsal.

We discuss the literature related to anatomic changes in the first ray in hallux valgus patients and review our hypothesis regarding the reduction in PASA which we believe to be related to frontal plane rotation of the first metatarsal resulting in radiographic artifact.

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## Practice Patterns and Costs of Physical Therapy and Podiatry Management of Plantar Heel Pain

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**Introduction:** Plantar heel pain (PHP) is a common foot condition seen in podiatry and physical therapy (PT). Clinical evidence and guidelines support PT and podiatry intervention for PHP, but no studies have described actual practice patterns including resource use associated with treatment. The purpose of this study is to describe practice patterns and costs of PHP management by PTs and podiatrists at an academic medical center clinic.

**Methods:** Medical and billing records of 29 patients were selected from all PHP cases occurring between February 2008 – August 2011. The frequency of Current Procedural Terminology (CPT) and pharmacy codes were tabulated to describe practice patterns and to estimate cost of treatment based on the Centers for Medicare and Medicaid Services Physician Fee and common drug schedules in addition to generic-equivalent drug prices.

**Results:** Primary interventions used by PTs included therapeutic exercise with written instruction, manual therapy, neuromuscular re-education, and iontophoresis. Podiatrists used an educational handout, medication, orthotics, and injections. Patients were seen on average 7.4 visits in PT compared to 3.4 in podiatry. The cost of PT was \$428.00/patient and \$59/visit compared to \$358.00/patient and \$104/visit for podiatry.

**Discussion:** Physical therapists and podiatrists provide unique services in the management of PHP, each with cost implications to the patient and the healthcare system. Further research is needed to understand quality of care and clinical outcomes associated with the practice and cost patterns of each specialty. Additional outcome-based research will help to identify the most cost effective multi- or intra-disciplinary options for PHP management.

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## Social Media as a Support for Reflective Practice Among First-Year Medical Students

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**Purpose:** This study examined the use of the Yammer social networking platform for first year medical students to share experiences, reflections and assignments in a clinical and experiential learning course. Social networking can enable persistent communication that enhances learning. We used qualitative research methods to analyze student messages for evidence that medical students construct meaning through brief communications mediated by social networking.

**Methods:** 120 first year medical students spent 3 weeks in an emersion experience with community-based primary care preceptors, supplemented by a distance learning component. Preceptors were spread across a wide geographical area. Students were asked to share their experiences using microblog reflections posted on Yammer. Reflections were evaluated by coding and thematic analysis using NVivo software.

**Results:** Yammer provided privacy, ease of access and flexibility that allowed posting of discussions, documents and video assignments. There was a spirited exchange of ideas, reflecting the power of social networking to enhance engagement. The course director was able to encourage professionalism and facilitate social presence. Student reflections revealed knowledge building through discussions integrating clinical experiences with didactic coursework in the basic sciences.

**Conclusions:** To our knowledge, there are no descriptions in the medical education literature of pre-clerkship courses that incorporate social networking. Many faculty members are scarcely aware of social media. Institutions struggle with the complexities of ensuring professionalism within this communication context. Using Yammer in a low-stakes clinical learning environment has helped bridge some of these gaps.

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## Cultural Competency in Podiatry

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**Background:** Des Moines University College of Podiatric Medicine and Surgery (CPMS) is implementing a cultural competency program to third-year podiatric medical students. This study assessed the effectiveness of the new educational program on cultural competency at CPMS. The authors conducted an analysis comparing pre-test and post-test scores of students from the CPMS graduating classes of 2013 and 2014.

**Methods:** Students from the class of 2013 completed a 10 week course on cultural competency and 2014 students did not. A pre-test and post-test about cultural competency were developed. The questions were categorized to assess either “knowledge acquisition” or “attitudinal change.” 2013 students completed the pre-test prior to the course and a post-test after completing the course. 2014 students completed the same pre-test and post-test separated by 10 weeks. A repeated measure analysis of variance (ANOVA) was used to compare the knowledge acquisition scores, attitudinal change scores, and overall scores of the two classes.

**Results:** The repeated measure ANOVA revealed the course significantly impacted the students’ attitudinal change ( $F=15.244$ ,  $p<.001$ ). The course did not show a significant impact on knowledge acquisition ( $F=.719$ ,  $p=.399$ ) or overall scores ( $F=3.019$ ,  $p=.086$ ).

**Conclusion:** The analysis showed a statistically significant increase in attitudinal change scores. Although knowledge acquisition and overall score increases were not statistically significant, the authors feel the analysis suggests there was a benefit to taking the course. The study suggests there needs to be a greater knowledge acquisition component to the cultural competency course at CPMS.

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## Correlation of Osteopathic Manual Medicine (OMM) Grades at an Osteopathic Medical School with COMLEX OPP Item Scores

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**Context:** OMM (OPP) encompasses hands-on diagnosis and treatment as part of providing maximum patient care. OPP has been identified as a core competency. COMLEX is a useful tool for assessing osteopathic candidates’ competency. To our knowledge, a study has not been performed examining grades in the OMM courses compared with performance on OPP items of COMLEX 1. The aims of this study were to examine the relationship of COMLEX 1 performance on OPP sub-score with OMM course grades and determine if these grades would be predictive of COMLEX 1 OPP performance and might be of value in determining potential at-risk students.

**Methods:** COMLEX 1 and OPP sub-scores, OMM grades (written, practical and total for years 1 and 2), gender, age, Total MCAT, Undergraduate GPA (science, non-science and composite), Anatomy and Physiology scores and medical school GPA (year 1 and 2) were collected, The data was analyzed by a correlation analysis.

**Results:** Records were obtained for 217 subjects. The COMLEX Total and OPP-subscore yielded a significant correlation with all factors except for the undergraduate GPA variables. Though significant, many the correlations were moderate, at best. A Factor Analysis revealed a model of Med School GPA (Yr 2), OMM-1 Total and OMM-2 Written best described the relationship with the COMLEX 1 OPP subscore. Multiple regression analysis produced two models. Model 1 using only the OMM-2 Written score ( $r = 0.559$ ) and Model 2, adding the OMM-1 Total, ( $r = 0.574$ ). Using transformed 'z' scores and an arbitrarily selected COMLEX 1 score of 425 for the at-risk pool suggested a cut score for the OMM-1 Total of  $z = -1.1$  (1.1 standard deviations below the mean) and a  $z = -1.3$  for the OMM-2 Written. While the Specificity was fairly high, the Sensitivity and thus predictive value of a positive are low.

**Conclusions:** Several factors were identified as having significant associations with COMLEX 1. The best predictors for the OPP subscore were the OMM- 1-Total and OMM-2-Written scores. While the specific scores are not accurate predictors alone, there is value in assessing these as indicative of performance.

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### Improving Adult Immunization Rates Through Patient Centered Medical Home Medical Student Clerkship

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Many adults do not receive the vaccines recommended by the CDC, leaving them vulnerable to illness as their childhood immunity wanes. Adult vaccinations have not been a focus of public health beyond yearly flu vaccinations. We implemented a proactive approach to inform patients of the CDC recommendations in an effort to improve vaccination rates among patients greater than 65 years old at Broadlawns Family Health Center. Medical students on a Patient Centered Medical Home Clerkship performed audits of 313 charts of patients over age 65. A letter was then sent to each patient that was in need of any of the recommended vaccinations. There was an improvement in all recommended vaccinations (Tetanus, Pertussis, Herpes Zoster, and Pneumococcal). There was a statistically significant improvement in Tetanus (65% increase), Pertussis (93% increase), and Herpes Zoster (300% increase). Patient reminders do results in a statistically significant improvement in vaccination rates but should only be a part of a comprehensive vaccination program.

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### Improving Adolescent Immunization Rates Through Patient Centered Medical Home Medical Student Clerkship

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The Advisory Committee on Immunization Practices (ACIP) has made several new recommendations which affect the adolescent age group (ages 13-18). Adolescents are typically healthy and have less regular doctor visits. For this reason, this group of patients are difficult to keep up to date with their recommended vaccinations We implemented a proactive approach to inform patients of the new recommendations in an effort to improve vaccination rates. Medical students on Patient Centered Medical Home Clerkship performed audits of 124 patient charts and sent letters if they were in need of any of the recommended vaccinations. The rates of all recommended vaccinations improved with statistical significance in Tetanus (19% increase), Pertussis (22% increase), the second dose of Hepatitis A (51% increase), and second dose of Meningococcal (89% increase).

## Impact of Group Diabetic Visits on HgbA1c, a Retrospective Study

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Group visits are an innovative approach and present the potential to improve the care of patients with chronic conditions. This retrospective study was conducted at Broadlawns Medical Center using patients from the Broadlawns Family Health Center with a diagnosis of Type II Diabetes for greater than one year and a hemoglobin a1c (HgbA1c) greater than 9. Four patients completed the study by attending the majority of the visits. After attending group visits for 6 months, reductions in HgbA1c were analyzed. We saw a significant improvement in hemoglobin A1c in each participant that participated in the majority of the visits. An average HgbA1c of 10.2% improved to an average of 6.8%. We propose that a larger study be conducted to show statistical significance.

## Improvement in Diabetic Lab Capture and Targets Through the Use of a Patient Centered Medical Home Medical Student Clerkship

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Clinical trials have supported the use of pre-visit planning and the use of disease registries to achieve benchmarks in chronic disease management. Disease registries provide population data and facilitate the possibility of performing clinical outcome studies through quality improvement projects. The objective of our project was to improve the capture of American Diabetes Association (ADA) recommended labs by contacting patients that had not been seen in the clinic in that last 6 month. A chart audit of all diabetes patients in the chronic disease registry was performed. Pre-visit planning was performed by medical students on a Patient Centered Medical Home clerkship over a 8 month period. We saw a statistically significant improvement in the capture of all of the recommended labs (hemoglobin A1c (19% increase), Cholesterol (26% increase), and Microalbumin (34% increase). A positive finding was a statistically significant improvement in the number of patients at goal for hemoglobin A1c (24% increase) and LDL (26% increase) over the same time period.

## A Snapshot of Health Sciences Students' Perceptions of Research Literacy Skills

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**Purpose:** Healthcare providers are no longer merely diagnosticians, but expected to be professional consumers of research. Statistics courses and brief immersion in on-going research may not be the most effective methods for promoting research literacy. The goal of this study is to assess health professional students' perceptions of research, its role in their future careers and their skills with respect to research activity.

**Methods:** A survey instrument adapted from one used in a broader study of research literacy was used to assess students' perceptions of medical research, their skills and the influence of research education and skills on professional development and activity.

**Results:** Of the 416 students enrolled in the DMU Colleges of Health Sciences and Podiatric Medicine and Surgery, 213 (51%) responded. Students' research experience and comfort in their skill level differed somewhat with their current research involvement among all programs. CPMS students were more interested in research than their colleagues. The percentage of students currently involved in research is similar across programs and

involves 15-20% of the students. A majority of students agreed that research relates to patient safety and care. The research climate is viewed favorable among all programs although lack of a mentor and time to were perceived as limitations, especially in the PA program.

**Conclusions:** The results of this study demonstrate that student experience and interest in research outweighs current participation and perceived accessibility of opportunities at Des Moines University. This may be tied to the faculty's personal interest in research or the differences in research expectations per college. Time is a limiting factor in all programs.

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## The Power of Professional Learning Communities

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**Denise M. Hill, JD, MPA\***

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Academic literature supports use of learning communities to promote active and collaborative learning. When designed and implemented correctly, professional learning communities have been proven to enhance satisfaction and achieve learning goals for faculty and other group members. This presentation will introduce participants to professional learning communities, evidence-based design principles/techniques, and assessment methods that can make professional learning communities truly powerful—regardless of whether they are face-to-face or online groups. Attendees will be challenged to identify at least one area where they can utilize a professional learning community to meet strategic learning objectives for their organizations.

**Disclosure Statement:** While the intent of this presentation is primarily focused upon sharing the research and recommendations about professional learning communities outlined in the forthcoming text (listed below), it should be noted that as a co-author, Denise Hill receives a very small authors' royalty when books are purchased. Lenning, O.T., Hill, D.M., Schaefer, K., Solan, A. A. & Stokes, A. 2013. *Powerful Learning Communities: A Guide to Developing Student, Faculty and Professional Learning Communities to Improve Student Success and Organizational Effectiveness*. Sterling, VA: Stylus.

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## The Use of Rubrics in the Improvement of Clinical Evaluation of Podiatric Medical Students

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**Background:** The purpose of this study is to assess the effectiveness of a rubric as a clinical evaluation tool.

**Methods:** A rubric evaluation tool was developed to assist house faculty in grading students Clinical Professionalism Objective Scores (CPOS). The class of 2012 consisted of 53 students which were evaluated without a rubric, and the class of 2013 consisted of 36 students which were evaluated with a rubric. Each of the students in these groups rotated twice with each physician who graded them, thus generating a score 1 (CPOS1) and score 2 (CPOS2). As a way to evaluate the pre-rubric and rubric evaluation tools effectiveness an outside objective measure of student academic performance was used, such as Grade Point Average (GPA). A Pearson Correlation Coefficient analysis was performed to determine the effectiveness of the recently implemented rubric evaluation tool.

**Results:** The Pearson correlation analysis of 2012 CPOS with rotations one and two to GPA data were:  $r = +0.233$ ,  $N = 53$ ,  $p < 0.093$ , two tails and  $r = +0.290$ ,  $N = 53$ ,  $p < 0.035$  two tails respectively. The correlation analysis of the 2013 CPOS with rotations one and two to GPA data was  $r = + 0.525$ ,  $N = 36$ ,  $p < 0.001$ , two tails and  $r = + 0.730$ ,  $N = 36$ ,  $p < 0.000$ , two tails respectively

**Conclusion:** The correlation for the data revealed that the evaluation of podiatric medical students' CPOS with a rubric and the students' pre-clinical grades were significantly related.

## Examining the Use of High-Fidelity Simulators in a Podiatric Curriculum: The Students' Perspective

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**Background:** The purpose of this study was to analyze the perceptions podiatric students had on the use of simulators after completing a 3<sup>rd</sup> year simulation rotation. This type of study has never been described in podiatric educational literature, and attempts to influence the podiatric community to increase studies that help test the effectiveness of simulation in the podiatric curriculum.

**Methods:** Data came from rotation evaluations of 44 students from the 2011-2012 academic year. The analysis relied on a mixture of the use of scale items from the simulation evaluations and the result of a textual analysis of the written comments by students. Basic descriptive statistics of student responses to 11 items allowed for the analysis of central tendencies and variations. Textual analysis was performed on comments that were coded into themes based on similar properties and characteristics that the comments shared.

**Results:** The descriptive statistics revealed that the simulation was well liked as 100% of the students rated the overall simulation rotation as being superior. Textual analysis showed that students enjoy simulation as an educational tool because it helps to enhance their clinical skills while also applying their didactic education into a practical experience. Clear evidence was presented that students want more cases and time to spend in the simulation lab in order to continue increasing their medical skills.

**Conclusions:** The student perception of simulation is that it is well liked and an effective educational tool. Further testing is needed in order to prove simulation efficacy in a podiatric curriculum.

## Implementing a Laparoscopic Surgical Skills Curriculum into a Surgical Residency Program

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**Purpose:** simulation exercises are increasingly being used for teaching and assessing surgical skills, yet little has been reported on how these experiences translate into operative laparoscopic skill in osteopathic surgery residents. We hypothesize that use of the Fundamentals of Laparoscopic Surgery (FLS) tutorial with a simulated skill experience for surgical residency training will result in an increase in resident skill level, intra-operative proficiency, and improved resident confidence when assessed during serial porcine cholecystectomy procedures.

**Methods:** Three first year osteopathic surgery residents participated in the study. Three serial laboratory sessions took place over a 4 month period with participants completing the FLS between the second and third session. Each session consisted of the residents individually performing laparoscopic cholecystectomies on live anesthetized pigs with controlled assistance from upper level residents. Resident skill was assessed by attending surgeons using the previously validated Global Assessment of Laparoscopic Skill (GOALS) at each session. Proficiency was measured by operative time. Resident confidence was assessed by surveys filled out immediately after session. This study was approved by the appropriate institutional oversight committees.

**Results:** GOALS scores, intra-operative proficiency, and resident confidence all increased with each session. Improvements in the five areas assessed by GOALS: depth perception, bimanual dexterity, efficiency, tissue handling and autonomy occurred with each laboratory. Proficiency, (mean time to completion) also improved with each session (62.5 to 36.5 min). Resident surveys showed an appreciable increase in skills and confidence. All residents rated their experience as highly beneficial and useful in their careers as surgeons.

**Conclusions:** Results of this small study correlating simulated learning with improved operative performance during porcine cholecystectomy suggests a value for implementation of FLS into osteopathic surgery residency programs.

## Metric as a Tool in Improving Diabetic Care and Fulfilling Educational Requirements for Family Medicine Residents

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**Background:** The American Board of Family Medicine has various educational requirements to obtain and maintain board certification. Some of these requirements involve demonstrating improved patient care. One possible option available to practicing physicians to fulfill this requirement is the METRIC tool.

**Objectives:** To describe the integration of METRIC into a family medicine residency program. To evaluate the impact of METRIC use to improve diabetes care.

**Methods:** Retrospective chart review of 70 diabetic patients was completed by seven Family Medicine residents. Each resident inputted selected information from 10 diabetic patient's charts into the METRIC online database based on the American Diabetic Association's (ADA) Guidelines. Following 3 months of implementing awareness of the guidelines, each of the seven physicians inputted a second set of 10 diabetic patient's charts into the METRIC database.

**Results:** Seven family medicine residents successfully utilized METRIC to improve the diabetic care of their patients. There was an increase of appropriate laboratory measurement of A1c (90 to 97%), LDL (62 to 90%), blood pressure (95 to 100%), and urine microalbumin (62 to 87%). There was also improvement with appropriate use of aspirin (40 to 47%), annual retinal (32 to 47%) and foot exams (58 to 67%) as well as a decrease in smoking (42 to 33%).

**Conclusion:** METRIC is a convenient tool that utilizes evidenced based medicine guidelines to guide physicians through a quality improvement process in an effort to improve patient care. Successful integration of activities like METRIC are beneficial to resident education and relicensure.

## Differential in Healthcare-Seeking Behavior for Mothers Versus Children in Rural India

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**Background:** Healthcare-seeking behavior is affected by socio-economic, physical and cultural factors. Understanding these factors may improve access to healthcare and focus the development of health programs. Determinants that may influence and differentiate healthcare-seeking behaviors for children compared to care for their mothers were studied.

**Method:** Cross-sectional health survey of women, 18-45 years, conducted by female interviewers in a hospital clinic and sixteen surrounding villages in rural Gujarat, India. Respondents were asked the reason for postponing healthcare when they need it. Respondents with a living child were asked same question with regards to seeking care for their children.

**Results:** Survey was completed by 681 women. Of 493 women having a living child, 195 (39.5%) did not postpone their own healthcare. Of the remaining 298 mothers who identified a primary factor for postponing their healthcare, 191 (64%) selected cost. In contrast, 272 (55%) mothers reported not postponing healthcare for their children ( $\chi^2, p < 0.0001$ ) and of those who did postpone their child's healthcare, only 72 (32.5%) did because of cost ( $\chi^2, p < 0.0001$ ). Quality of care is more frequently the reason in postponing healthcare for children by mothers (25%) than for themselves (9.5%) ( $\chi^2, p < 0.0001$ ). Impact of healthcare expenditure on family spending was the strongest predictor of healthcare-seeking behavior.

**Conclusion:** Healthcare-seeking behavior is an important variable in the success of health programs. High burden of healthcare expenditure restricts mother from seeking healthcare. Additionally, mothers consider quality of care more frequently when seeking care for their children in contrast to themselves.

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## Immigrant and Refugee Health Care in Central Iowa

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**Background:** Immigrants and refugees are being recruited by business and settling and resettling in small towns in the Midwest. Access to culturally and linguistically appropriate health care services presents challenges to health care and public health systems in these communities. This qualitative study examines the health care providers' perspective on access to health care and public health services for these populations.

**Methods:** Focus groups and interviews were conducted with health care providers, hospital personnel, and public health workers in a small central Iowa town with high percentage of immigrants and refugees. Data from these sessions were coded into primary and secondary themes.

**Preliminary Findings:** Major themes include lack of knowledge of patients' desires for alternative health care and inability to provide such alternatives when requested, difficulty meeting communication needs for non-English speaking, non-Spanish speaking immigrants and refugees.

**Conclusions:** Provider systems, procedures and resources are in place for providing health care for Spanish-speaking immigrants but is more challenging for other non-English speaking populations. The major resource is use of a telephonic language line to facilitate basic communication. Immigrant and refugee patients are not encouraged to discuss their own cultural values and preferences for health care based on their country of origin.

**Discussions:** A community needs assessment may be beneficial to determine appropriate resources to best provide health care and public health services for immigrant and refugee populations in this community.

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## The Impact of Civic Engagement on Doctor of Physical Therapy Students' Attitudes Towards Service: A Literature Review

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**Background & Purpose:** Civic engagement has been shown to benefit professional and education development as well as enhance understanding of patient-centered care for physical therapy students. Many physical therapy programs have implemented service learning to fulfill the guidelines put in place by the American Physical Therapy Association (APTA) Core Values and the Commission on Accreditation for Physical Therapy Education (CAPTE) criteria. The purpose of this literature review was to determine Doctor of Physical Therapy students' attitudes on service after participating in civic engagement.

**Methods:** A targeted literature review was conducted using electronic database keyword searches from PubMed. Key terms from the MeSH Database included service learning, physical therapy, clinical education, and community-based learning.

**Results:** One study demonstrated an increase in knowledge and skills in physical therapy students' perceptions after providing services to high school students for one session. Another model demonstrated an increase in understanding related to aging and older persons after semester long service learning ranging from group activities to one-on-one activities. Pre and post-test measurements were employed to measure changes in students' attitudes towards elders.

**Conclusions:** Participation in civic engagement is an effective approach to provide opportunities to acquire the knowledge, skills, and behavior associated with prevention, health promotion, and wellness for physical therapy students. Further research is needed to examine students' perspectives, attitude and personal reflections regarding civic engagement after completing at least one session of service learning utilizing a pre and post-test survey.

**Keywords:** Civic engagement, physical therapy, service learning.

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## Resident Physician and Nurse Knowledge About Pain Medications

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**Background:** Pain management has been identified as an area to improve patient care for many years. Deficiencies of knowledge and pain management skills among physicians and nurses have been reported. Research has shown that analgesic care delivered by physician residents is inconsistent.

**Objectives:** To assess current knowledge of pain medications among resident physicians and nurses.

**Methods:** An eight question survey was given to nurses and resident physicians at Broadlawns Medical Center. Questions focused on appropriate indications, maximum doses, common side effects, conversions and drug content.

**Results:** Results of the survey will be presented at the meeting. The results of the survey will be used to formulate educational initiatives among nurses and resident physicians in 2013.

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## Hospital Capacity and Utilization in Iowa

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Network analyses have been used as the basis to determine the need for resources at hospitals by comparing the pattern of hospital utilization to the capacity of each hospital. The goal of this project is to perform a network analysis on the hospital utilization pattern in Iowa. Using various geographical software programs, the bypass percentage and hospital utilization percentages have been determined. The amount of patients that bypass a hospital nearest them to go to a different hospital was calculated to be 59%. Geographical hospital utilization studies have revealed five major hospitalization areas centered by a certain city or region of Iowa. These five main areas include Iowa City (30.9%), Des Moines (28.6%), northwest Iowa (24.4%), eastern Iowa (10%), and northern Iowa (6.2%). Future research will investigate the causation of hospital utilizations patterns and compare the hospital utilization pattern to the hospital capacity.

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## Postoperative Infections in Patients Utilizing Anti-TNF for Management of Rheumatoid Arthritis Undergoing Orthopedic Surgery

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**Introduction:** Anti-Tumor Necrosis Factor (anti-TNF) agents provide relief to many rheumatoid arthritis (RA) patients, however pose an increased risk of serious infection. In addition, RA patients often require orthopedic surgery. The aim of this study is to determine if the use of anti-TNF pharmacological agents increases the risk of postoperative infection in RA patients undergoing orthopedic surgery.

**Method:** A PubMed® systematic search of the English-language literature from 2002-2012 was conducted. Inclusion criteria included: primary research design, anti-TNF therapy group, anti-TNF naïve group, established RA, orthopedic surgery performed, and disclosure of postoperative infections. Data were compiled in a meta-analysis. Statistical analysis of combined data included odds ratio (OR) and number needed to harm (NNH).

**Results:** Four studies with 1,595 total procedures were included. Two concluded an increased risk in postoperative infection, while two showed no increased risk. An OR of 2.05 was obtained and a NNH of 26.

**Conclusion:** An OR of 2.05 suggests an increased risk of postoperative infection with orthopedic surgery in RA patients utilizing anti-TNF  $\alpha$  therapy when compared to those not utilizing the pharmacological agents. Additionally, the NNH of 26 implies that one would expect to treat approximately 26 of these patients to encounter one infectious outcome. Overall, we found the research on this topic to be sparse and conflicting, however, conclude that there should be a higher level of suspicion for orthopedic postoperative infections in RA patients utilizing anti-TNF agents to manage their RA.

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### A 3D Scaffold for the Polarization of Retinal Ganglion Cells

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**Purpose:** The inability of the adult mammalian retina to replace or regenerate retinal ganglion cells (RGCs) following injury motivates the study of cell and tissue engineering approaches. However, it is not sufficient to merely create a scaffold supporting cell growth, it is also necessary to orient axon growth. Here we describe an electrospinning (ES) method and a novel collector to create radially aligned ES scaffolds that direct axon growth towards a central point, mimicking retinal axon growth towards the optic nerve head. Netrin-1, an axon guidance molecule homologous to laminin, is involved in RGC axons exit from the retina into the optic nerve head. This molecule may direct and polarize RGCs on the scaffold.

**Methods:** Radial aligned scaffolds were spun from a polylactic acid (PLA) solution using a grounding collector with a center pole surrounded by a conducting rim. Scaffold fiber diameter and alignment were determined by scanning electron microscopy. RGCs dissected from postnatal Sprague-Dawley rats were purified to 99.9% homogeneity by immunopanning. Scaffolds were sterilized and coated with laminin, crosslinked with netrin-1, seeded, and cultured in a defined serum-free media for 2-3 days. Following culture, cells were fixed and neurites stained with a monoclonal  $\beta$ 3 tubulin antibody to quantify radial alignment.

**Results:** ES scaffolds under various flow rates and electric potentials produced PLA fibers ranging from 191 to 423 nm in diameter. Alignment Analysis showed directional coherency ranging from 50-78% based upon spinning conditions; control (random) alignment had a coherency of 10-14%. RGC axon growth showed a significantly higher orientation of axon growth along the radial orientation of the scaffold fibers compared to that in control cultures. There was a 2 fold increase in polarization when comparing the use of Netrin-1 to a control.

**Conclusions:** Seeding RGCs onto a radially aligned scaffold directs axon growth towards a central point, potentially creating both a model to study optic nerve formation and also a translatable tissue implant for the injured inner retina.

 = Resident



