SOUTHERN BIOMEDICAL ENGINEERING CONFERENCE

34th Annual Meeting
March 8-10, 2018
Charlotte, North Carolina

Holiday Inn Charlotte Airport
2707 Little Rock Road
Charlotte, North Carolina; Phone: 704-394-4301; FAX: 704-398-2225

http://sbec18.org

http://thequickglimpse.files.wordpress.com/2010/02/vitruvian-man.jpg
34th SOUTHERN BIOMEDICAL ENGINEERING CONFERENCE

Program

March 8-10, 2018

Program Organizers

Conference Chair
Dr. Ahmed El-Ghannam;
University of North Carolina at Charlotte;
Phone: 704-687-7730;
arelgha@uncc.edu

Conference Co-Chair
Dr. Ham Benghuzzi;
University of Mississippi Medical Center;
Phone: 601-984-6324;
hbenguzzi@umc.edu

Program Coordinator
Dr. Michelle Tucci;
University of Mississippi Medical Center;
Phone: 601-815-1043;
mtucci@umc.edu

Major Sponsor of 34th SBEC

Mississippi Academy of Sciences

Sponsors
University of Mississippi Medical Center
**SBEC HISTORY**

The Southern Biomedical Engineering Conference (SBEC) series was conceived by bioengineering professionals from academia and industry located primarily in the South of the United States in 1982. The first Southern Biomedical Engineering Conference was held at the LSU Medical Center, Shreveport, Louisiana, in 1982. Since then it has been held annually in different cities, mostly in the southern United States, and has grown to become a global event that regularly attracts attendees from all over the world. Submitted Papers are peer-reviewed, and those papers accepted for presentation and publication appear in the yearly issue of SBEC proceedings.

The SBEC serves a special purpose by emphasizing participation from young professionals and advanced students. Since established investigators present papers in the same sessions with the students, it encourages a high level of professionalism as a standard for young investigators and students. Submission of papers from individuals from around the world is encouraged. However, if their papers are accepted, an author or co-author must attend the conference to present their work and to interact with other attendees. In keeping with the emphasis on student participation, the SBEC presents best paper and presentation awards to undergraduate, graduate, and professional students.
Conference Information
The format of the conference is to have concurrent sessions, with each presentation limited to 15 minutes (12-minute presentation and three minute discussions). Room assignments for each session will be posted at the conference. Poster presentations will be held in Earhart room. The poster display dimensions are: 48” wide x 36” length. Push pins and tapes will be provided (poster format should include: Title, Authors, Affiliations, Introduction or background, Methods, Results, Discussion and summaries, References and Acknowledgments.

The Conference will be held at the Holiday Inn Charlotte Airport, 2707 Little Rock Road Charlotte, North Carolina; Phone: 704-394-4301; FAX: 704-398-2225, which is located approximately is located just one mile away from Charlotte Douglas International Airport and minutes from the Queen City’s finest attractions. SBEC participants can make reservations by calling the hotel directly at 1-704-394-4301 (www.hicharlotteairport.com). Please indicate that you are attending the SBEC to receive the discounted rate (Single @ $119 +tax or Double @ $125 +tax/includes complimentary breakfast/complementary shuttle from and to the airport).

All the accepted abstracts/papers will be published in a Special Issue of the Journal of Mississippi Academy of Sciences, as well as, an archival proceeding book entitled BIOMEDICAL ENGINEERING: RECENT DEVELOPMENTS that will be available at the meeting. A highly scored manuscripts by the reviewers will be invited to be published in the summer issue of Biomedical Science Instrumentation (International peer-review Journal).

Registration
Registration Fee includes access to all conference events, program copy, manuscript proceeding fee, lunches, coffee breaks and snacks. Initial on-site registration will be held from 5:00–8:00 p.m., Thursday, March 8, 2018, and will continue all day Friday and Saturday. Participants are encouraged to pre-register by February 2nd, 2018 to take advantage of the reduced registration rates. More information in how to register can be found at: http://sbec18.org.

<table>
<thead>
<tr>
<th>Registration Fees</th>
<th>(for more information and how to register can be found at: <a href="http://sbec18.org">http://sbec18.org</a>)</th>
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<tr>
<td>Conference registration fee before February 2, 2018</td>
<td>$280</td>
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<td>Conference registration fee after February 2, 2018</td>
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<td>Conference registration fee for students before February 2, 2018</td>
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<td>Conference registration fee for students after February 2, 2018</td>
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Conference registration fees are non-refundable after February 15, 2018 (refund prior 2/15 is subject to service fee of 75% (food and beverages, printing cost ..etc for presenters will be paid for by 2/15.)

Abstract will be removed from the program if presenter fails to register according to the time lines.
# Track Chairs

I. Biomedical Systems Modeling and Dynamics  
   Dr. Jafar Vossoughi  
II. Biomechanics and Signals Acquisition  
   Dr. Ahmed El-Ghannam  
III. Biomaterials and Nanotechnology  
   Dr. Felix Adah  
IV. Biomedical Education and Ethics  
   Dr. Subrata Saha  
V. Drug Delivery and Chemistry  
   Dr. Ham Benghuzzi  
VI. Biosensors and Diagnostic Systems  
   Dr. Paul Frenger  
VII. Clinical Applications and Therapeutics  
   Dr. Michelle Tucci

# Session Chairs

<table>
<thead>
<tr>
<th>Track</th>
<th>Session</th>
<th>Chair</th>
<th>Co-Chair(s)</th>
</tr>
</thead>
</table>
| I     | Session I: Biomaterials-Tissue Engineering I | **Session Chair:** Didier, Ph.D., Dréau, University of North Carolina at Charlotte  
       |         | **Co-Chair:** Dilip Depan, Ph.D., University of Louisiana at Lafayette |
| IV    | Session II: Patient Rehab | **Session Chair:** Felix Adah, Ph.D., University of Mississippi Medical Center  
       |         | **Co-Chair:** Ibrahim Farah, Ph.D., Jackson State University |
| I     | Session III: Math and Modeling | **Session Chair:** Elgenaid Hamadain, Ph.D., University of Mississippi Medical Center  
       |         | **Co-Chair:** Harish Cherukuri, Ph.D., Chemical, Biological and Bio Engineering of NC  
       |         | **Co-Chair:** Mohammed Benalla, Ph.D., North Western State University of Louisiana |
| IV    | Session IV: Education and Research Training | **Session Chair:** Joseph A. Cameron, Ph.D., Jackson State University  
       |         | **Co-Chair:** Zelma Cason, Ph.D., University of Mississippi Medical Center |
| III   | Session V: Tissue Engineering II | **Session Chair:** David A. Pulpeo, Ph.D., University of Kentucky  
       |         | **Co-Chair:** Thomas Dziubla, Ph.D., University of Kentucky |
| VI    | Session VI: Molecular-Clinical Markers | **Session Chair:** Kirill Afonin, Ph.D., University of North Carolina at Charlotte  
       |         | **Co-Chair:** Joel Stitzel, Ph.D., Wake Forest University School of Medicine |
| VII   | Session VII: Radiology and Diagnostics | **Session Chair:** Vladimir Reukov, Ph.D., Clemson University  
       |         | **Co-Chair:** Rafael Davalos, Ph.D., Virginia Tech Center |
| V     | Session VIII: Biomaterials and Drug Delivery | **Session Chair:** Narayan Bhattarai, Ph.D., North Carolina A&T State Univ.  
       |         | **Co-Chair:** Kenneth Butler, Ph.D., University of Mississippi Medical Center  
       |         | **Co-Chair:** Saami K. Yazdani, Ph.D.; University of South Alabama |
| VII   | Session IX: Neuroscience | **Session Chair:** Lir-Wan Fan, Ph.D., University of Mississippi Medical Center  
<pre><code>   |         | **Co-Chair:** Teresa Murray, Ph.D., Louisiana Tech University |
</code></pre>
<p>|       | Poster Session I | Chairs: Jafar Vossoughi Ph.D., Fischell Department of Bioengineering University of Maryland. | |</p>
<table>
<thead>
<tr>
<th>Category</th>
<th>Name</th>
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<tbody>
<tr>
<td>Poster Session II</td>
<td>Subrata Saha, Ph.D., Department of Biomedical Engineering, Florida International University, Min Huang, Ph.D., University of Mississippi Medical Center, Ham Benghuzzi, Ph.D., University of Mississippi Medical Center</td>
</tr>
<tr>
<td>Student Awards</td>
<td>Michelle Tucci, Ph.D., University of Mississippi Medical Center, C. LaShan Simpson, Ph.D., Mississippi State University</td>
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</tbody>
</table>

Sponsored by

[ MAS Logo ]

Endorsed by

[ Society For Biomaterials Logo ]
34th Annual Meeting

Program
Thursday, March 8, 2018

5:00-8:00: Registration and Reception

Hotel Lobby
Friday, March 9, 2018

7:00 am-4:00 pm  Registration (Hotel Lobby)

8:00-8:15 am  Opening of the Meeting (Room: Earhart)

Conference Chair
Dr. Ahmed El-Ghannam; University of North Carolina at Charlotte

Conference Co-Chair
Dr. Ham Benghuzzi; University of Mississippi Medical Center

Program Coordinator
Dr. Michelle Tucci; University of Mississippi Medical Center

8:15-8:20 am  MAS Representative (Major Sponsor)
Dr. Ken Butler, MAS President

8:20-8:50 am:  Introduction of Keynote Speaker-I: Dr. Ham Benghuzzi  (Room: Earhart)

Keynote Speaker-I:
Subrata Saha, Ph.D., FAIMBE, FASME, FBMES, FNYAM

Dr. Subrata Saha is presently a Research Professor in the Department of Biomedical Engineering at the Florida International University in Miami, Florida and an Affiliated Professor in the Department of Restorative Dentistry and the Department of Oral and Maxillofacial Surgery at the University of Washington, in Seattle, Washington. He was previously the Director of Musculoskeletal Research and Research Professor in the Department of Orthopaedic Surgery & Rehabilitation Medicine, and the Director of the Biomedical Engineering Program in the School of Graduate Studies at SUNY Downstate Medical Center in Brooklyn, New York. Previously, he was a faculty member at Loma Linda University, Clemson University, Alfred University, and Yale University. Dr. Saha received a BS in Civil Engineering from Calcutta University in 1963, an MS in Engineering Mechanics in 1969 from Tennessee Technological University, and Engineering and PhD degrees in Applied Mechanics from Stanford University in 1972 and 1974, respectively. He has been a faculty member at Yale University, Louisiana State University Medical Center, Loma Linda University, Clemson University, and Alfred University. Dr. Saha has received many awards from professional societies, including Orthopedic Implant Award, Dr. C. P. Sharma Award, Researcher of the Year Award, C. William Hall Research Award in Biomedical Engineering, Award for Faculty Excellence, Research Career Development Award from NIH, and Engineering Achievement Award. He is a Fellow of The Biomedical Engineering Society (BMES), The American Society of Mechanical Engineers (ASME), and the American Institute for Medical and Biological Engineering (AIMBE).

He has received numerous research grants from federal agencies (NIH and NSF), foundations, and industry. Dr. Saha is the founder of the Southern Biomedical Engineering Conference Series. He also started the International Conference on Ethical Issues in Biomedical

Title:
Ethical Challenges in Biomedical Engineering Research

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He has received numerous research grants from federal agencies (NIH and NSF), foundations, and industry. Dr. Saha is the founder of the Southern Biomedical Engineering Conference Series. He also started the International Conference on Ethical Issues in Biomedical
Engineering. Dr. Saha has published over 90 papers in journals, 35 book chapters and edited volumes, 347 papers in conference proceedings, and 84 abstracts. His research interests are bone mechanics, biomaterials, orthopedic and dental implants, drug delivery systems, rehabilitation engineering, and bioethics.

Dr. Saha is presently the Editor-in-Chief of the Journal of Long-Term Effects of Medical Implants and Associate Editor of the International Journal of Medical Implants & Devices and was an Associate Editor of the Annals of Biomedical Engineering and Trends in Biomaterials and Artificial Organs. He has been a Member of the Editorial Boards of many journals, including Journal of Biomedical Materials Research; Medical Engineering and Physics; Journal of Applied Biomaterials; Medical Design and Material; Biomaterials, Artificial Cells, and Immobilization Biotechnology; Biomaterials, Medical Device and Artificial Organs; Journal of Bioengineering, Biotelemetry and Patient Monitoring; Journal of Basic & Applied Biomedicine and TM Journal.

8:50-9:15 am: Introduction of Keynote Speaker-II: Ahmed El-Ghannam, Ph.D., (Room: Earhart)

Keynote Speaker-II (Room: Earhart)

Michelle A. Tucci, MS, PhD, FAIMBE
Professor, Department of Anesthesiology
University of Mississippi Medical Center
Chief Editor, Biomed Sci Instrumentation
Chief Editor, Journal of Mississippi Academy of Sciences

Title
“The Effects of Sustained Delivery of NPY Receptor Antagonist on Cells Types Within the Intervertebral Disc”

Dr. Michelle Tucci, Professor of Anesthesiology at the University of Mississippi Medical Center. Dr. Tucci has been involved in a leadership role for various state, national and international organizations. After completing her undergraduate training at Seton Hill University, in Pennsylvania she completed a Master’s degree in Biology at the University of Dayton in Ohio. Following her move to Mississippi, she completed her PhD in pharmacology and Toxicology in 2000. Aside from her work supervising and overseeing resident’s basic science research in orthopedic surgery for several years, she has also mentored and supervised a number of undergraduate and graduate students from diverse disciplines. She has served on over 60 doctoral dissertation committees, has published over 300 full journal publications (several in prestigious journals such as J. of Investigative Surgery, J. of Clin Investigation, Analytical Biochemistry, J. of Immunology, Infection & Immunity, Cancer Investigation, Microsurgery, Alcohol, Critical Reviews in Biomed Eng, J. of Gerontology, Pediatric Research, Annals of Pharmacotherapy, J. of Spinal Disorders and Techniques, J. Oral Pathol Med, to name a few), and published over 400 abstracts at state, regional, national and international meetings (Italy, France, Spain, Canada, Poland, and China). Her leadership role in various societies includes Director and program chair at the Rocky Mountain Biomedical Engineering Society; Program Chair at the Academy of Surgical Research, Program and conference organizer at the Southern Biomedical Engineering meetings, Chair of Pathology Implant SIG at the Society for Biomaterials, to name a few. She served/serving in editorial boards in several journals as well as member of various NIH special review panels. She is serving as Chief Editor of the Biomed Science Instrumentation and Chief Editor for Journal of the Mississippi Academy of Sciences. Previously, she has been recognized for her work and service by the Academy of Surgical Research, the Mississippi Academy of Sciences Outstanding Contribution to Science, Peeler Dudley Outstanding Service Award, Douglas Walker Award and recently was inducted as fellow in American Institute of the Biomedical and Biological Engineering.

9:15-9:30 am: Break (Lobby)
### Session I: Biomaterials-Tissue Engineering

**Session Chair:** Dr. Didier Dréau, University of North Carolina at Charlotte  
**Co-Chair:** Dilip Depan, Ph.D., University of Louisiana at Lafayette

<table>
<thead>
<tr>
<th>Time</th>
<th>Abstract #</th>
<th>Title</th>
<th>Authors</th>
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<tbody>
<tr>
<td>9:30</td>
<td>1</td>
<td>PULSED LASER DEPOSITION OF BIOACTIVE COATING FROM WHITE PORTLAND CEMENT</td>
<td>Svitlana Fialkova1, Sergey Yarmolenko1, Jagannathan Sankar1, Geoffrey Ndungu2, Kevin Wilkinson2</td>
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<td>1NC A&amp;T State University, Greensboro, USA. 2Dentsply Sirona USA, Tulsa, USA.</td>
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<tr>
<td>9:45</td>
<td>2</td>
<td>VASCULARIZED 3D TISSUE CULTURE MODEL USING MICROFLUIDIC CASSIE-BAXTER SURFACES</td>
<td>Soroosh Torabi, Linzhang Li, Jonathan Grabau, Bradley Berron, Ren Xu, Christine Trinkle</td>
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<td>University of Kentucky, Lexington, USA.</td>
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<tr>
<td>10:00</td>
<td>3</td>
<td>3D HETEROGENEOUS BREAST TISSUE MICROENVIRONMENT USING POLYLACTIDE BEADS</td>
<td>Bryanna Sierra, Didier Dréau</td>
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<td>University of North Carolina Charlotte, Charlotte, USA.</td>
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<tr>
<td>10:15</td>
<td>4</td>
<td>HYBRID NETWORK STRUCTURE OF CHITOSAN FOR SOFT TISSUE INJURY WITH ANTIMICROBIAL AND CONTROLLED DRUG RELEASE ATTRIBUTES</td>
<td>Dilip Depan1, Elizabeth Owuor1, Saad Bux1, Harshit Doshi2, Melanie Sanders1</td>
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<tr>
<td></td>
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<td>1University of Louisiana at Lafayette, Lafayette, LA, USA. 2Women’s and Children’s Hospital, Lafayette, LA.</td>
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<tr>
<td>10:30</td>
<td>5</td>
<td>FIBROUS BRANCHED-CLUSTERS AS MODULAR BUILDING UNITS FOR TISSUE REGENERATION TEMPLATES</td>
<td>Benjamin Minden-Birkenmaier, Gary Bowlin</td>
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<td>University of Memphis, Memphis, TN, USA.</td>
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**Break**

### Session II: Patient Rehab

**Session Chair:** Dr. Felix Adah, University of Mississippi Medical Center  
**Co-Chair:** Dr. Ibrahim Farah, Jackson State University

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<th>Time</th>
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<tr>
<td>9:45</td>
<td>6</td>
<td>THE EFFECT OF TROGLITAZONE ON C - REACTIVE PROTEIN IN INDIVIDUALS WITH PREDIABETES: DATA FROM THE DIABETES PREVENTION PROGRAM</td>
<td>Khalid Mokhtar, Elgenaid Hamadain, Ham Benghuzzi</td>
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<td>University of Mississippi Medical Center, Jackson, MS, USA.</td>
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<td>10:00</td>
<td>7</td>
<td>THE EFFECTS OF MIRROR THERAPY ON UPPER EXTREMITY FUNCTION POST-STROKE: A SYSTEMATIC REVIEW</td>
<td>Janet Slaughter</td>
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<td>University of Mississippi Medical Center, Jackson, USA.</td>
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<tr>
<td>10:15</td>
<td>8</td>
<td>THE EFFECTIVENESS OF DRY NEEDLING ON THE REDUCTION OF PROXIMAL UPPER QUADRANT PAIN USING COHEN'S D: A SYSTEMATIC REVIEW</td>
<td>Felix Adah and Min Huang</td>
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<td></td>
<td>University of Mississippi Medical Center, Jackson, MS USA</td>
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<td>10:30</td>
<td>9</td>
<td>ATTITUDES OF MISSISSIPPI NURSES’ TOWARDS EDUCATION ON COMPLEMENTARY &amp; ALTERNATIVE MEDICINE IN MISSISSIPPI UNIVERSITIES</td>
<td>Lashanda Brumfield, Ham Benghuzzi, Elgenaid Hamadain</td>
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<td>University of Mississippi Medical Center, Jackson, MS, USA.</td>
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<td>Time</td>
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<td>10:45-11:00</td>
<td>Break (Lobby)</td>
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**Scientific Sessions: Concurrent Sessions III & IV**

**Friday Morning**

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<th>Time</th>
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<tr>
<td><strong>Session III: Math and Modeling</strong>&lt;br&gt;Session Chair: Dr. Elgenaid Hamadain, University of Mississippi Medical Center&lt;br&gt;Co-Chair: Dr. Harish Cherukuri, Chemical, Biological and Bioengineering of UNC&lt;br&gt;Co-Chair: Dr. Mohammed Benalla, North Western State University of Louisiana</td>
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<td>11:00</td>
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**Friday Morning**

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<th>Time</th>
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<th>Conference Room: Kitty Hawk</th>
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<tr>
<td><strong>Session IV: Education and Research Training</strong>&lt;br&gt;Session Chair: Dr. Joseph A. Cameron, Jackson State University&lt;br&gt;Co-Chair: Dr. Zelma Cason, University of Mississippi Medical Center</td>
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<td>11:15</td>
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Title:
A new concept for hydroxyapatite in bone remodeling-the nanostructure and response to mechanical strain

By
Miho Nakamura, Ph.D.
Associate Professor,
Tokyo Medical and Dental University

Miho Nakamura earned a Ph.D. in Biomaterials in 2007 and a Master’s Degree in Medical Science in 2003 from Tokyo Medical and Dental University. Dr. Nakamura has received several awards, such as: The International Society for Ceramics in Medicine Excellence Award in 2016, Award for Young Researcher in The Ceramic Society of Japan in 2014, Award for Young Researcher in Japanese Society for Biomaterials in 2013, Award for Encouragement of International Exchange in Japanese Society for Biomaterials in 2012, Award for Young Researcher in Japanese Association of Inorganic Phosphorus Chemistry in 2010, and Award for Encouragement of Research in Materials Science in 2008. Dr. Nakamura is presently the Associate Professor with the Institute of Biomaterials and Bioengineering at Tokyo Medical and Dental University in Tokyo, Japan. She is also a Visiting Professor with the Department of Anatomy and Cell Biology at the University of Oulu in Oulu, Finland.

1:45-3:00 Poster Session I (Room: Earhart)

<table>
<thead>
<tr>
<th>Poster Session I: Co-Chairs</th>
<th>P#</th>
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</thead>
<tbody>
<tr>
<td>Jafar Vossoughi, Ph.D. Fischell Department of Bioengineering University of Maryland. Matthew B. A. McCullough, Ph.D., North Carolina A&amp;T State University Amit Roy Chowdhury IIEST, Shibpur, Howrah, India</td>
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<tr>
<td>NEAR-INFRARED CAMER FOR EARLY DETECTION OF DIABETIC ULCERS</td>
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<td>Mariah Carp, Elizabeth Gaston, Ben Glace, Reagan Leonard, Vladimir Reukov Clemson University, Clemson, NC, USA</td>
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<td>THE EFFECT OF GABA RECEPTOR ANTAGONIST IN TRAMADOL AND TRAMADOL/GABAPENTIN MEDIATED ANTINOCICEPTION IN MICE TAIL-FLICK TEST</td>
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<td>Xin Li, Min Huang, Lir-Wan Fan, Ike Eriator, Claude Brounson University of Mississippi Medical Center, Jackson, MS, USA</td>
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<td>NEONATAL SYSTEMIC EXPOSURE TO LIPOPOLYSACCHARIDE ENHANCES ADULT SUSCEPTIBILITY TO THE NEURODEGENERATIVE DISORDER INDUCED BY PARAOXIDATIVE</td>
<td>4</td>
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<td>Silu Lu1, Lu-Tai Tien2, Jonathan Lee1, Yi Pung1, Norma Ojeda1, Abhay Bhatt1, Renate Savick1, Lir-Wan Fan1</td>
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<tr>
<td>1University of Mississippi Medical Center (Pediatrics), Jackson, MS, USA 2Fu Jen Catholic University, New Taipei City, Taiwan</td>
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<td>PATIENT-SPECIFIC TREATMENT PLANNING FOR IRREVERSIBLE ELECTROPORATION: A NUMERICAL ANALYSIS WITH USING DYNAMIC ELECTRICAL TISSUE PROPERTIES FROM HUMAN PANCREATIC TISSUE</td>
<td>5</td>
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<tr>
<td>Melvin Lorenzo, Natalie White, Rafael Davalos Virginia Tech, Blacksburg, VA, USA</td>
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<td>DEACTIVATION OF NEMATODE EGGS IN WASTEWATER FOR PARASITIC DISEASE MITIGATION</td>
<td>6</td>
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<td>Michael Dryzer1, Caitlin Niven1, Scott Wolter1, Christopher Arena2, Edgard Ngaboyamahina1, James Thostenson1, Charles Parker2, Brian Stoner3, Jeffrey Glass1, Brian Hawkins4, Katelyn Sellgren1</td>
<td>7</td>
</tr>
<tr>
<td>1Elon University, Elon, USA. 2Virginia Tech, Blacksburg, VA, USA. 3Duke University, Durham, NC, USA. 4RTI International, Research Triangle Park, NC, USA</td>
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<tr>
<td>FABRICATION OF 3D ALGINATE HYDROGEL SCAFFOLDS</td>
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<td>Shalini Khanal, Sara Tatsum, Jagannath Sankar, Narayan Bhattachr</td>
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<td>North Carolina A &amp; T State University, Greensboro, NC, USA</td>
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<td>BIODEGRADABLE SIMVASTATIN-CONTAINING POLYMERIC PRODRUGS FOR IMPROVED DRUG RELEASE</td>
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<td>A.D. Thilanka Livana, David Puleo University of Kentucky, Lexington, KY, USA</td>
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</tbody>
</table>

14
<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHARACTERIZATION OF BLUE LIGHT CROSSLINKED POLY(B-AMINO ESTER)S</td>
<td>8</td>
</tr>
<tr>
<td>Nicholas Kohrs, David Puleo</td>
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<td>University of Kentucky, Lexington, KY, USA</td>
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<tr>
<td>CONCENTRICALLY AND AXIALLY MULTIZONAL HYBRID POLYMERIC SCAFFOLDS</td>
<td>9</td>
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<tr>
<td>Amir Najjarzadeh, David Puleo</td>
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<td>University of Kentucky, Lexington, KY, USA</td>
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<td>LASER PROBE WITH INTEGRATED COOLING FOR SUBSURFACE TISSUE THERMAL</td>
<td>10</td>
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<td>REMODELING</td>
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<td>Chun-Hung Chang, Nathaniel Fried</td>
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<tr>
<td>FABRICATION OF PLGA/PLC COMPOSITE FIBERS FOR CONTROLLED DRUG RELEASE</td>
<td>11</td>
</tr>
<tr>
<td>Sheikh Saud1, Narayan Bhattarai</td>
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<tr>
<td>1North Carolina A &amp; T State University, Greensboro, NC, USA. 2Joint</td>
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<td>School of Nanoscience and Nanoengineering, Greensboro, NC, USA</td>
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<td>MAGNESIUM OXIDE INCORPORATED ELECTROSPUN NANOFIBER OF NATURAL-SYNTHETIC</td>
<td>12</td>
</tr>
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<td>COMPOSITE POLYMER BLENDS</td>
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<td>Udbhad Adhikari, Jagannathan Sankar, Narayan Bhattarai</td>
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<td>CHITIN BASED ELECTROSPUN NANOFIBERS AND FILMS FOR APPLICATIONS IN</td>
<td>13</td>
</tr>
<tr>
<td>BIOMEDICAL FIELDS</td>
<td></td>
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<tr>
<td>GENERATION OF RAPID In Situ FORMING CHANNELS WITHIN SOFT BIOMATERIALS</td>
<td>14</td>
</tr>
<tr>
<td>VIA BIODEGRADABLE FIBER POROGENS</td>
<td></td>
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<tr>
<td>Alexander Chen, David Puleo</td>
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<td>University of Kentucky, Lexington, KY, USA</td>
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<td>CRYOGENIC PRESERVATION OF HEPATOCYTE ENCAPSULATES</td>
<td>15</td>
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<td>Erika Johnson1, Shalil Khanal1, Jeffery Macdonald2, Jagannathan</td>
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<td>OBSERVING TRENDS IN VITAMIN D SUPPLEMENTATION: NATIONAL HEALTH AND</td>
<td>16</td>
</tr>
<tr>
<td>NUTRITION EXAMINATION SURVEY 2009-2014</td>
<td></td>
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<td>Shamonica King, Hamed Benghuzzi</td>
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<tr>
<td>BLUETOOTH ENABLED SMARTPHONE APPLICATION FOR WIRELESS</td>
<td>17</td>
</tr>
<tr>
<td>PHOTOPLETHYSMOGRAPHY MONITORING DEVICES</td>
<td></td>
</tr>
<tr>
<td>Daniel Cruz, Michelle Patiño, Michael Mikhail, Mohammad Ghamari,</td>
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<tr>
<td>IDENTIFICATION OF PATIENTS WITH REACTIVE AIRWAYS AT AMBIENT</td>
<td>18</td>
</tr>
<tr>
<td>TEMPERATURES</td>
<td></td>
</tr>
<tr>
<td>Shivani U. Patel, Robert Rosen, Arthur T. Johnson, Jafar Vossoughi</td>
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<td>Fischell Department of Bioengineering, University of Maryland,</td>
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<td>College Park, MD, USA</td>
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<tr>
<td>CARDIOVASCULAR RESPONSES FOLLOWING DIFFERENT TYPES OF BREATHING</td>
<td>19</td>
</tr>
<tr>
<td>EXERCICES</td>
<td></td>
</tr>
<tr>
<td>Min Huang, XL Dai, Z. Pan, Q. Fang, F. Adah, L. Barnes, and H.</td>
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<td>Benghuzzi</td>
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<td>Department of Physical Therapy, School of Health Related Professions,</td>
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<td>University of Mississippi Medical Center, Jackson, MS, USA</td>
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<td>EFFECT OF A 3D ASSEMBLY TECHNIQUE ON UROTHELIAL TISSUE STRATIFICATION</td>
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<td>Irene Cheng, Jiho Nagatomi, PhD</td>
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<td>Clemson University, Clemson, USA</td>
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<td>THE EFFECTS OF SUSTAINED DELIVERY OF DANAZOL PLUS TESTOSTERONE ON</td>
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<td>THE FUNCTIONAL ACTIVITY OF KIDNEY USING ADULT RATS AS A MODEL</td>
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<td>Adel Mohamed1, HA Benghuzzi2, and MA Tucci2</td>
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<td>1Anatomy &amp; Cell Biology, College of Medicine, University of</td>
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<td>Saskatchewan, Canada.</td>
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<td>2University of Mississippi Medical Center, Jackson, MS, USA</td>
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<td>THE EFFECTIVENESS OF PAP OVER DIFF QUICK (DQ) STAINING METHODS ON</td>
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<td>THE ASSESSMENT OF ESTRUS CYCLE UPON THE EXPOSURE TO SUSTAINED</td>
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<td>DELIVERY OF ESTROGEN BENZOATE USING ADULT SD RATS AS A MODEL</td>
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<td>Zelma Cason, Hamed Benghuzzi, and Michelle Tucci.</td>
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<td>NANOCRYSTALLINE CERIUM OXIDE CONJUGATED WITH SOD’S</td>
<td>23</td>
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<td>ANTI-OXIDANT ACTIVITY AFTER HEATING</td>
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<td>Bradley Skelton1, Mikhail Bredikhin2, Vladimir Ivanov2, and Vladimir</td>
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<td>Reukov1</td>
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<td>1Clemson University, Clemson, North Carolina, USA and 2Kurnakov</td>
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<td>Institute, Moscow, Russian Federation</td>
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<td>THE EFFECTS OF SSRI’s ON THE ADRENAL GLAND OF ADULT MALE RATS</td>
<td>24</td>
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<td>Gerri Wilson, Michelle A. Tucci and Hamed Benghuzzi</td>
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<td>University of Mississippi Medical Center, Jackson, MS, USA</td>
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<tr>
<td>IMPACT OF ATRA ON OVALBUMIN AND MOLD-SENSITIZED F344 RATS AND</td>
<td>25</td>
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<td>REVERSAL OF HEALTH-RELATED IMPLICATIONS BY CITRAL</td>
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<tr>
<td>Ibrahim Farah1, Carlene Holt-Gray1, Joseph Cameron1, Michelle Tucci,</td>
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<td>Hamed Benghuzzi2</td>
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<tr>
<td>1Jackson State University, Jackson, MS, USA and 2University of</td>
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# Scientific Sessions: Concurrent Sessions V & VI

<table>
<thead>
<tr>
<th>Friday Afternoon</th>
<th>Abstract #</th>
<th>Conference Room: Earhart</th>
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</thead>
<tbody>
<tr>
<td><strong>Time</strong></td>
<td><strong>Abstract</strong></td>
<td><strong>Session V: Tissue Engineering</strong></td>
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<td><strong>Time</strong></td>
<td><strong>Abstract</strong></td>
<td><strong>Session V: Tissue Engineering</strong></td>
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<tr>
<td><strong>3:00</strong></td>
<td>19</td>
<td>NOVEL PROTEIN THERAPY TO REVERSE AND INHIBIT CALCIFICATION OF VASCULAR SMOOTH MUSCLE CELLS</td>
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<tr>
<td><strong>3:15</strong></td>
<td>20</td>
<td>COMBINATION OF NANOTECHNOLOGY AND SPERM BIOLOGY TO ENHANCE REPRODUCTION PERFORMANCE</td>
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<tr>
<td><strong>3:30</strong></td>
<td>21</td>
<td>COMPARISON OF CELL VIABILITY, MORPHOLOGY AND MINERALIZATION OF MESENCHYMAL STEM CELLS FOLLOWING A SINGLE EXPOSURE TO ELECTROMAGNETIC FIELD OR LOW-LEVEL LASER THERAPY</td>
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<td><strong>3:45</strong></td>
<td>22</td>
<td>USE OF A PROTEIN-BASED INHIBITOR TO REGULATE THE PHENOTYPIC SWITCH OF SMOOTH MUSCLE CELLS</td>
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<tr>
<td><strong>4:00</strong></td>
<td>23</td>
<td>A DIME-SIZED HUMAN-IMPLANT-READY MULTI-CHANNEL NEUROSTIMULATION DEVICE MOVES TOWARD NETWORKED WIRELESS CAPABILITY</td>
</tr>
<tr>
<td><strong>4:15</strong></td>
<td>24</td>
<td>DO THE PROTEINS IN A FINGERNAIL OFFER INSIGHT INTO THE BONE HEALTH OF THEIR DONOR?</td>
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<td><strong>4:30</strong></td>
<td>25</td>
<td>MEDICAL ROBOTS MUST HAVE ARTIFICIAL EMOTIONS</td>
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<tr>
<td><strong>4:45</strong></td>
<td>Discussion</td>
<td>Discussion</td>
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**THE EFFECT OF MANNOSE 6 PHOSPHATE ON TENDON HEALING**
Jessica Gilbert1, Michelle Tucci2, David Black2, Gerri Wilson2, and Ham Benghuzzi2

1 Jackson State University, Jackson, MS, USA and 2 University of Mississippi Medical Center, Jackson, MS USA
## 34th SOUTHERN BIOMEDICAL ENGINEERING CONFERENCE

### Friday Afternoon

<table>
<thead>
<tr>
<th>Time</th>
<th>Abstract #</th>
<th>Conference Room: Kitty Hawk</th>
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<td></td>
<td></td>
<td><strong>Session VI: Molecular-Clinical Markers</strong></td>
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</table>
|      |            | **Session Chair:** Kirill Afonin, PhD, University of North Carolina at Charlotte  
**Co-Chair:** Joel Stitzel, Ph.D., Wake Forest University School of Medicine |
| 3:00 | 26         | siRNA GENE DELIVERY MEDIATED BY MESOPOROUS SILICA NANOPARTICLES TO TREAT CANCER  
Ridhima Juneja, Lauren Rackley, Kirill Afonin, Juan Vivero-Escoto  
University of North Carolina at Charlotte, Charlotte, NC, USA. |
| 3:15 | 27         | IMMUNOLOGICAL RECOGNITION OF THERAPEUTIC NUCLEIC ACIDS: TRANSLATIONAL FOCUS ON NOVEL CONCEPTS AND THEIR DELIVERY PLATFORMS  
Marina Dobrovolskaia  
Frederick National Laboratory for Cancer Research, Frederick, VA, USA |
| 3:30 | 28         | A SIMPLE AND SAFE METHOD TO INCREASE TUMOR BLOOD PERFUSION IMPROVED TUMOR RESPONSE TO RADIATION THERAPY  
Angelica Patiño1,2, Mara Junqueira1,2, Xiaomeng Zhang3, Kate Bailey4, Arig Ibrahim-Hashim4, Robert Gilles4, Roger Chummas4,5  
1Faculdade de Medicina da Universidade de Sao Paulo, Sao Paulo, Brazil. 2Instituto do Cancro do Estado de Sao Paulo, Sao Paulo, Brazil. 3Moffitt Cancer Center, Tampa, USA. 4Moffitt Cancer Center, Tampa, USA. 5Instituto do Cancro do Estado de Sao Paulo, Sao Paulo, Brazil. |
| 3:45 | 29         | FIBER- AND POLYGONS-FORMING RNA-DNA HYBRIDS FOR SIMULTANEOUS ACTIVATION OF MULTIPLE FUNCTIONALITIES  
Weina Ke1, Enping Hong2, Mathias Viard2, Martin Panigaj3, Marina Dobrovolskaia2, Kirill Afonin1  
1UNCC, Charlotte, NC USA. 2NCL, Frederick, VA, USA. 3NCI, Frederick, VA, USA. |
| 4:00 | 30         | A NOVEL ANTI-MUC1 CAR T CELL DRIVING IMMUNITY AGAINST PANCREATIC CANCER  
Mahboubeh Yazdanifar, Ru Zhou, Priyanka Grover, Laura Moore, Pinku Mukherjee, Shuta Wu  
UNC-Charlotte, Charlotte, NC, USA. |
| 4:15 | 31         | COMBINATORIAL THERAPY USING POLYMERIC MICELLE NANOCARRIER FOR AXON REGENERATION AFTER CNS INJURY  
So Jung Gwak1, Christian Macks1, Michael Lynn2, Ken Webb1, Jeoung Soo Lee1  
1Clemson University, Clemson, USA. 2Greenville Health System, Greenville, NC, USA |
| 4:30 | 32         | LAB-ON-A-CHIP IMMUNOASSAY FOR THERMOELECTRIC QUANTITATION OF TNF-A  
Saif Bari, Gergana Nestoova  
Louisiana Tech University, Ruston, LA, USA. |

### 5:30 pm  
Steering Committee Business Meeting (Members and Invitees)

### End of Friday’s Sessions
Ahmed El-Ghannam, Ph.D.
President, International Society for Ceramics in Medicine
Associate Editor, Journal of Biomedical Materials Research
Associate Professor of Tissue Engineering and Biomaterials,
Department of Mechanical Engineering and Engineering Science,
University of North Carolina at Charlotte

Title:
“A Bioactive Ceramic for Treatment of Stress Urinary Incontinence: Analysis of the Mechanism of Action

Dr. Ahmed El-Ghannam holds a BSc in Chemistry, MSc in Glass Science and Technology, and an MS and Ph.D. in Bioengineering from the University of Pennsylvania. He has over 30 years of experience in material science and bioceramics engineering. He has six US patents, many world renowned collaborators, and has been invited as a keynote and plenary speaker to various national and international meetings. He is the Associate Editor for the Journal of Biomedical Materials and a leader in various prestigious societies. Dr. El-Ghannam’s lab focuses on the development of bioceramics for multifaceted applications in drug delivery to treat cancer and infection, augment soft tissue and reconstruct bone. Dr. El-Ghannam’s team includes clinicians, molecular biologists, and scientists who are widely published.

8:45-9:00 am Break

Scientific Sessions: Concurrent Sessions VII & VIII

<table>
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<tr>
<th>Saturday Morning</th>
<th>Abstract #</th>
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<tbody>
<tr>
<td>Time</td>
<td></td>
<td>Session VII: Radiology and Diagnostics</td>
</tr>
<tr>
<td>9:00</td>
<td>33</td>
<td>Session Chair: Vladimir Reukov, Ph.D., Clemson University Co-Chair: Rafael Davalos, Ph.D., Virginia Tech</td>
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</table>

**EFFECT OF PEDICLE-SCREW FIXATION IN LUMBAR SPINE AT L3-L5 LEVEL: A FINITE ELEMENT STUDY**
Jayanta Kumar Biswas1, Sreerup Banerjee1, Santanu Majumder1, Sandipan Roy2, Subrata Sah1, Amit RoyChowdhury1
1IIEEST, Shibpur, Howrah-711103, India. 2Dept. of Bio Engineering, National Institute of Technology, Agartala, Barajala, Jirania, West Tripura-799055, India. 1Dept. of Mechanical Engineering, SRM University, Kattankulathur - 603203, Tamilnadu, India. 3Department of Biomedical Engineering, Florida International University, Miami, FL, USA. 4Department of Oral & Maxillofacial Surgery, School of Dentistry, University of Washington, Seattle, WA, USA

19
### Session VIII: Biomaterials and Drug Delivery

**Session Chair:** Narayan Bhattacharai, Ph.D., North Carolina A&T State Univ  
**Co-Chair:** Kenneth Butler, Ph.D., University of Mississippi Medical Center  
**Co-Chair:** Saami K. Yazdani, Ph.D.; University of South Alabama

**Time** | Abstract # | Conference Room: Kitty Hawk
--- | --- | ---
9:00 | 40 | PRELIMINARY EVALUATION OF ELECTROSPUN POLYDIOXANONE TEMPLATES ELUTING ACTIVE CL-AMIDINE TO INHIBIT HUMAN PAD4  
Allison Fetz\(^1\), Marko Radic\(^2\), Gary Bowlin\(^3\)  
\(^1\)University of Memphis, Memphis, TN, USA.  
\(^2\)University of Tennessee Health Science Center, Memphis, TN, USA

9:15 | 41 | PRE-CLINICAL INVESTIGATION OF LOCAL LIQUID PACLITAXEL DELIVERY VIA A NOVEL PERFUSION CATHETER  
Megan Erwin, Emily Turner, Marzieh Atigh, Saami Yazdani  
University of South Alabama, Mobile, AL, USA

9:30 | 42 | COMPUTATIONAL FLUID DYNAMICS OF AN AORTIC BENCH-TOP MODEL  
Jonathan Primeaux, Charles Taylor, Jacob King, Clint Bergeron  
University of Louisiana at Lafayette, Lafayette, LA, USA
<table>
<thead>
<tr>
<th>Time</th>
<th>Abstract #</th>
<th>Title</th>
<th>Authors</th>
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<tbody>
<tr>
<td>9:45</td>
<td>43</td>
<td>EFFECTS OF SIMVASTATIN-CONTAINING POLYMERIC PRODRUGS ON BONE FORMATION IN VIVO</td>
<td>Nandakumar Venkatesan¹, Aravwawala Don Thilanga Liyanage¹, Jaime Castro-Núñez², Theodora Asafo-Adjei³, Larry L Cunningham³, David A Puleo¹</td>
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<td>¹F. Joseph Halcomb III, M.D. Department of Biomedical Engineering, University of Kentucky, Lexington, KY, USA. ²Division of Oral and Maxillofacial Surgery, University of Kentucky, Lexington, KY, USA. ³Department of Chemical and Materials Engineering, University of Kentucky, Lexington, KY, USA.</td>
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<td>10:00</td>
<td>44</td>
<td>AN EXPERIMENTAL AND COMPUTATIONAL STUDY OF THE EFFECT OF BIOCERAMIC POROSITY ON DRUG RELEASE KINETICS</td>
<td>Rahul Upadhyay, Ahmed El-Ghannam, Harish Cherukuri</td>
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<tr>
<td>10:15</td>
<td>45</td>
<td>SUSTAINED DELIVERY OF ESTROGEN AS A MODEL FOR REPLACEMENT THERAPY USING OVARIECTOMIZED RODENTS</td>
<td>Kenneth Butler, Ham Benghuzzi, Zelma Cason and Michelle Tucci</td>
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<tr>
<td>10:30</td>
<td>46</td>
<td>ATOMIC LAYER DEPOSITION OF NANO-COATINGS ON FABRICS FOR ANTIBACTERIAL APPLICATIONS</td>
<td>Renee Puvvada, Michael Bellavia, Todd Sulcheck Mark Losego</td>
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<td>10:45</td>
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### Scientific Sessions: Concurrent Sessions IX

**Saturday Morning**

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<thead>
<tr>
<th>Time</th>
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<th>Title</th>
<th>Authors</th>
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<tr>
<td>11:00</td>
<td>47</td>
<td>HIGH-RATE MECHANICAL INSULT CONTRIBUTES TO ALTERATIONS IN BRAIN CELL SIGNALING AND REACTIVITY</td>
<td>Nora Illavac², Pamela VandeVord¹⁷</td>
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<td></td>
<td></td>
<td>¹Virginia Tech, Blacksburg, USA. ²Salem Veterans Affairs Medical Center, Salem, NC, USA</td>
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<tr>
<td>11:15</td>
<td>48</td>
<td>ALLOSTERIC DRUG DESIGNING FOR HORMONE THERAPY RESISTANT BREAST AND PROSTATE CANCERS</td>
<td>Pradip K Biswas</td>
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<td>Tougalo College, Tougalo MS, USA</td>
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<tr>
<td>11:30</td>
<td>49</td>
<td>ANTI-INFLAMMATORY CYTOKINE INTERLEUKIN-1 RECEPTOR ANTAGONIST REDUCES LIPOPOLYSACCHARIDE-INDUCED BRAIN HIPPOCAMPAL INJURY AND IMPROVES COGNITIVE IMPAIRMENT IN JUVENILE RATS</td>
<td>Lir-Wan Fan¹, Jonathan Lee¹, Silu Lu¹, Oluwatosin Akinvemi¹², Iman Washington¹³, Brenkeevia Langston¹⁵, Norma Ojeda¹, Yi Pang¹, Abhay Bhart¹, Renate Savichi¹, Lu-Tai Tien¹</td>
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<td>¹Department of Pediatrics, Division of Newborn Medicine, University of Mississippi Medical Center, Jackson, MS, USA. ²Base Pair Program, University of Mississippi Medical Center/Murrah High School, Jackson, MS, USA. ³Mississippi INBRE Research Scholars Program, Jackson, MS, USA. ⁴School of Medicine, Fu Jen Catholic University, New Taipei City, Taiwan</td>
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<tr>
<td>11:45</td>
<td>50</td>
<td>OXIDATIVE STRESS IS ASSOCIATED WITH DYSFUNCTIONAL NEURODEVELOPMENT IN RAT OFFSPRING EXPOSED TO PLACENTAL INSUFFICIENCY</td>
<td>Norma Ojeda¹, Iman Washington⁴, Brenkeevia Langston³, Oluwatosin Akinvemi¹, Colin Muncie¹, Jonathanah Lee¹, Silu Lu¹, Lir-Wan Fan¹</td>
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<td>¹University of Mississippi Medical Center, Jackson, USA. ³Mississippi-INBRE, Jackson, MS, USA. ⁴Base Pair Program-UMMC, Jackson, MS, USA</td>
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12:00  
51  
HIGH SENSITIVITY MICROBIOSENSORS FOR DETECTION OF GLUTAMATE AND DOPAMINE IN BRAIN TISSUE  
Teresa Murray, Chao Tan, Md. Imran Hossain, P. Tim Do, Chelsea Pernici, Jessica Scoggin, Shabnam Siddiqui, Prabhu Arumugam  
Louisiana Tech University, Ruston, LA, USA

12:15  
BREAK

12:30 -2:00  Lunch and Keynote Speaker IV  
(Room: Earhart and Kitty Hawk)

“Ceramic Delivery Systems and Future Impact on Health and Disease”  
Hamed Benghuzzi, MS, PhD, FBSE, FAIMBE

Dr. Benghuzzi is a Professor at the University of MS Medical Center. He is known nationally and internationally as a pioneer in Ceramic Drug Delivery Systems. He has over 250 PubMed indexed articles and over 700 abstracts detailing the release characteristics of various biologicals from the bioceramic carriers. He has trained more than 35 PhD students who are actively involved in academic careers. He has mentored students at all levels (from high school, undergrad, grad, post doc and faculty). He has served as a mentor for residents and faculty on more than 10 funded grants. He has been in research leadership roles in many organizations such President of the Academy of Surgical Research, Vice President of the Rocky Mountain Bioengineering Society, President of MAS, Academy’s Executive Director, and also organized and chaired several regional, national and international society programs. He has also served on numerous NIH special emphasis panels including R-25, K01, KO8, T-35, and the P-60 center grants. In addition, he has received numerous awards from various organizations during his career. A few of his awards included: (1) The Presidential Award from the RMBS, (2) Presidential Award from SEM International, (3) the Endocrine’s Society Outstanding Investigator Award, (4) MAS Contribution to Science Award, (5) The MAS Dudley Peeler Award, and (6) HEADWAE Award, (7) C. Hall Award, Outstanding Contribution to Biomedical Engineering (32nd SBEC), and (8) ISCM Excellence Award from the International Society for Ceramics in Medicine. He was invited as a keynote/plenary to speak at state, national and international levels including recent invitations in France, Italy, Spain, Greece, China, Poland, Dubai and Canada. He is a fellow of the American Institute for Medical and Biological Engineering (AIMBE) as well as an International Fellow of Biomaterials Science and Engineering (FBSE).

March 10, 2018

2:00-3:00 pm Poster Scientific Session

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<thead>
<tr>
<th>Poster Session II Co-Chairs: Subrata Saha, Ph.D., Department of Biomedical Engineering, Florida International University, Min Huang, Ph.D., University of Mississippi Medical Center, Ham Benghuzzi, Ph.D., University of Mississippi Medical Center</th>
<th>P#</th>
</tr>
</thead>
</table>
| NEAR-INFRARED CAMERA FOR EARLY DETECTION OF DIABETIC ULCERS  
Mariah Carp, Elizabeth Gaston, Ben Glace, Reagan Leonard, Vladimir Reukov  
Clemson University, Clemson, NC, USA | 1 |
| THE EFFECT OF GABA RECEPTOR ANTAGONIST IN TRAMADOL AND TRAMADOL/GABAPENTIN MEDIATED ANTINOCEPTION IN MICE TAIL-FLICK TEST  
Xiaoli Dai, Min Huang, Li-Wan Fan, Ike Eriator, Claude Brounson  
University of Mississippi Medical Center, Jackson, MS, USA | 2 |
| NEONATAL SYSTEMIC EXPOSURE TO LIPOPOLYSACCHARIDE ENHANCES ADULT SUSCEPTIBILITY TO THE NEURODEGENERATIVE DISORDER INDUCED BY PARAQUAT  
Siho Li1, Lu-Tai Tien2, Jonathan Lee2, Yi Pang2, Norma Ojeda1, Abhay Bhatt1, Renate Savick2, Lin-Wan Fan1  
1University of Mississippi Medical Center (Pediatrics), Jackson, MS, USA. 2Fu Jen Catholic University, New Taipei City, Taiwan | 3 |
<table>
<thead>
<tr>
<th>ID</th>
<th>Title</th>
<th>Authors</th>
<th>Institution(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>34</td>
<td>PATIENT-SPECIFIC TREATMENT PLANNING FOR IRREVERSIBLE ELECTROPORATION: A NUMERICAL ANALYSIS WITH USING DYNAMIC ELECTRICAL TISSUE PROPERTIES FROM HUMAN PANCREATIC TISSUE</td>
<td>Melvin Lorenzo, Natalie White, Rafael Davalos</td>
<td>Virginia Tech, Blacksburg, VA, USA</td>
</tr>
<tr>
<td>35</td>
<td>DEACTIVATION OF NEMATODE EGGS IN WASTEWATER FOR PARASITIC DISEASE MITIGATION</td>
<td>Michael Dryzer(^1), Caitlin Niven(^1), Scott Wolter(^1), Christopher Arena(^1), Edgard Ngabayamahina(^1), James Thostenson(^1), Charles Parker(^1), Brian Stoner(^1), Jeffrey Glass(^1), Brian Hawkins(^1), Katelyn Sellgren(^1)</td>
<td>(^1)Elon University, Elon, USA. (^2)Virginia Tech, Blacksburg, VA, USA. (^3)Duke University, Durham, NC, USA. (^4)RTI International, Research Triangle Park, NC, USA</td>
</tr>
<tr>
<td>36</td>
<td>FABRICATION OF 3D ALGINATE HYDROGEL SCAFFOLDS</td>
<td>Shashl Khanal, Sara Tatsum, Jagannathan Sankar, Narayan Bhattarai</td>
<td>North Carolina A &amp; T State University, Greensboro, NC, USA</td>
</tr>
<tr>
<td>37</td>
<td>BIODEGRADABLE SIMVASTATIN-CONTAINING POLYMERIC PRODRUGS FOR IMPROVED DRUG RELEASE</td>
<td>A.D. Thilanga Liyanage, David Puleo</td>
<td>University of Kentucky, Lexington, KY, USA</td>
</tr>
<tr>
<td>38</td>
<td>CHARACTERIZATION OF BLUE LIGHT CROSSLINKED POLY(B-AMINO ESTER)S</td>
<td>Nicholas Kohrs, David Puleo</td>
<td>University of Kentucky, Lexington, KY, USA</td>
</tr>
<tr>
<td>39</td>
<td>CONCENTRICALLY AND AXIALLY MULTIZONAL HYBRID POLYMERIC SCAFFOLDS</td>
<td>Amir Najarzadeh, David Puleo</td>
<td>University of Kentucky, Lexington, KY, USA</td>
</tr>
<tr>
<td>40</td>
<td>LASER PROBE WITH INTEGRATED COOLING FOR SUBSURFACE TISSUE THERMAL REMODELING</td>
<td>Chun-Hung Chang, Nathaniel Fried</td>
<td>University of North Carolina at Charlotte, Charlotte, NC, USA</td>
</tr>
<tr>
<td>41</td>
<td>FABRICATION OF PLGA/PCL COMPOSITE FIBERS FOR CONTROLLED DRUG RELEASE</td>
<td>Sheikh Sadiq(^1,2), Narayan Bhattarai(^2)</td>
<td>(^1)North Carolina A &amp; T State University, Greensboro, NC, USA. (^2)Joint School of Nanoscience and Nanoengineering, Greensboro, NC, USA</td>
</tr>
<tr>
<td>42</td>
<td>MAGNESIUM OXIDE INCORPORATED ELECTROSPUN NANOFIBER OF NATURAL-SYNTHETIC COMPOSITE POLYMER BLENDS</td>
<td>Udhah Adhikari, Jagannathan Sankar, Narayan Bhattarai</td>
<td>NCAT, Greensboro, NC, USA</td>
</tr>
<tr>
<td>43</td>
<td>CHITIN BASED ELECTROSPUN NANOFIBERS AND FILMS FOR APPLICATIONS IN BIOMEDICAL FIELDS</td>
<td>Sunghyun Jun, Udhah Adhikari, Jagannathan Sankar, Narayan Bhattarai</td>
<td>NCAT, Greensboro, NC, USA</td>
</tr>
<tr>
<td>44</td>
<td>GENERATION OF RAPID In Situ Forming Channels Within Soft Biomaterials Via Biodegradable Fiber Porogens</td>
<td>Alexander Chen, David Puleo</td>
<td>University of Kentucky, Lexington, KY, USA</td>
</tr>
<tr>
<td>45</td>
<td>CRYOGENIC PRESERVATION OF HEPATOCYTE ENCAPSULATES</td>
<td>Erika Johnson(^1), Shashl Khanal(^1), Jeffery Macdonald(^1), Jagannathan Sankar(^1), Narayan Bhattarai(^1)</td>
<td>(^1)NCAT, Greensboro, NC, USA. (^2)University of Mississippi Medical Center, Jackson, MS, USA</td>
</tr>
<tr>
<td>46</td>
<td>OBSERVING TRENDS IN VITAMIN D SUPPLEMENTATION: NATIONAL HEALTH AND NUTRITION EXAMINATION SURVEY 2009-2014</td>
<td>Shamonica King, Hamed Benghuzzi</td>
<td>University of Mississippi Medical Center, Jackson, MS, USA</td>
</tr>
<tr>
<td>47</td>
<td>BLUETOOTH ENABLED SMARTPHONE APPLICATION FOR WIRELESS PHOTOPLETHYSMOGRAPHY MONITORING DEVICES</td>
<td>Daniel Cruz, Michelle Patiño, Michael Mikhail, Mohammad Ghamari, Homer Nazarian</td>
<td>University of Texas at El Paso, El Paso, TX, USA</td>
</tr>
<tr>
<td>48</td>
<td>IDENTIFICATION OF PATIENTS WITH REACTIVE AIRWAYS AT AMBIENT TEMPERATURES</td>
<td>Shiyan U. Patel, Robert Rosen, Arthur T. Johnson, Jafar Vossoughi</td>
<td>Fischell Department of Bioengineering, University of Maryland, College Park, MD, USA</td>
</tr>
<tr>
<td>49</td>
<td>CARDIOVASCULAR RESPONSES FOLLOWING DIFFERENT TYPES OF BREATHING EXERCISES</td>
<td>Min Huang, XL Dai, Z. Pan, Q. Fang, F. Adah, L. Barnes, and H. Benghuzzi</td>
<td>Department of Physical Therapy, School of Health Related Professions, University of Mississippi Medical Center, Jackson, MS, USA</td>
</tr>
<tr>
<td>50</td>
<td>EFFECTS OF 3D ASSEMBLY TECHNIQUE ON UROTHELIAL TISSUE STRATIFICATION IN VITRO</td>
<td>Irene Cheng and Jiro Nagatomi</td>
<td>Clemson University, Clemson, NC, USA</td>
</tr>
<tr>
<td>51</td>
<td>THE EFFECTS OF SUSTAINED DELIVERY OF DANAZOL PLUS TESTOSTERONE ON THE FUNCTIONAL ACTIVITY OF KIDNEY USING ADULT RATS AS A MODEL</td>
<td>Adel Mohamed(^1), HA Benghuzzi(^2), and MA Tucci(^2)</td>
<td>(^1)Anatomy &amp; Cell Biology, College of Medicine, University of Saskatchewan, Canada. (^2)University of Mississippi Medical Center, Jackson, MS, USA</td>
</tr>
<tr>
<td>Title</td>
<td>Page</td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>THE EFFECTIVENESS OF PAP OVER DIFF QUICK (DQ) STAINING METHODS ON THE ASSESSMENT OF ESTRUS CYCLE UPON THE EXPOSURE TO SUSTAINED DELIVERY OF ESTROGEN BENZOATE USING ADULT SD RATS AS A MODEL</td>
<td>22</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zelma Cason, Hamed Benghuzzi, and Michelle Tucci. University of Mississippi Medical Center, Jackson, MS, USA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NANOCRYSTALLINE CERIUM OXIDE CONJUGATED WITH SOD'S ANTIOXIDANT ACTIVITY AFTER HEATING</td>
<td>23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bradley Skeleton¹, Mikhail Bredikhin¹, Vladimir Ivanov², and Vladimir Reukov²</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clemson University, Clemson, NC, USA Kurnakov Institute, Moscow, Russian Federation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>THE EFFECTS OF SSRI's ON THE ADRENAL GLAND OF ADULT MALE RATS</td>
<td>24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gerri Wilson, Michelle A. Tucci and Hamed Benghuzzi University of Mississippi Medical Center, Jackson, MS, USA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IMPACT OF ATRA ON OVALBUMIN AND MOLD-SENSITIZED F344 RATS AND REVERSAL OF HEALTH-RELATED IMPLICATIONS BY CITRAL</td>
<td>25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ibrahim Farah¹, Carlene Holt-Gray¹, Joseph Cameron¹, Michelle Tucci², Hamed Benghuzzi²</td>
<td></td>
<td></td>
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<tr>
<td>¹ Jackson State University, Jackson, MS, USA and ² University of Mississippi Medical Center, Jackson, MS USA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>THE EFFECT OF MANNOSE 6 PHOSPHATE ON TENDON HEALING</td>
<td>26</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jessica Gilbert, Michelle Tucci, David Black, Gerri Wilson, and Hamed Benghuzzi University of Mississippi Medical Center, Jackson, MS USA</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3:00-4:00 pm: Student Award Presentations

Conclusions: Earhart and Kitty Hawk

Note Page
**ABSTRACTS**

**MULTIFUNCTIONAL BIOCERAMIC FOR INNOVATIVE THERAPY**

Ahmed El-Ghannam, Ph.D.

University of North Carolina at Charlotte, Charlotte, NC, USA

Silica and calcium phosphate are important ingredients in synthetic bone grafts due to their significant role in new bone formation and vascularization. Of prime importance is for the synthetic bone graft to be able to present its stimulating elements in an amendable format for osteoblasts during new bone formation. Studies on Silica-Calcium Phosphate composite (SCPC) demonstrated that the silica phase provided guided cell growth and bone matrix deposition. Loading porous SCPC granules with antibiotic provided sustained release of a therapeutic dose for more than 28 days. Implantation of the antibiotic-loaded SCPC granules in a critical size calvarial defect in rabbit demonstrated the ability of the graft material to stimulate new bone formation. Moreover, on the cellular level, the SCPC-vancomycin hybrid stimulated osteoblast phenotypic expression and the released antibiotic demonstrated bactericidal effect against Staph aureus.

**Session I: Biomaterials-Tissue Engineering**

**PULSED LASER DEPOSITION OF BIOACTIVE COATING FROM WHITE PORTLAND CEMENT**

Svitlana Fialkova1, Sergey Yarmolenko1, Jagannathan Sankar2, Geoffrey Ndungu2, Kevin Wilkinson2

1NC A&T State University, Greensboro, NC, USA. 2Dentsply Sirona USA, Tulsa, OK, USA.

Objective. We report the study of feasibility to produce the thing bioactive coating from White Portland cement (WPC) using pulsed laser deposition (PLD) technique. Methods. The targets for PLD system (disks 30 mm in diameter × 5 mm thick) were sintered from micronized powder of set Alborg White Portland cement. The parameters for sintering process were chosen based thermo-gravimetric analysis and differential scanning calorimetry (TGA/DSC). The coatings were deposited by PLD on silicon substrates. The effect of laser power on coating crystallinity and morphology was evaluated by scanning electron microscope (SEM) and X-ray diffraction (XRD). The material transfer from target to substrate were evaluated by X-ray fluorescence (XRF) and X-ray energy dispersive spectroscopy (EDS). The bioactivity of deposited films was evaluated by ability produce the hydroxyapatite (HA) layer on a surface of specimen immersed in a simulated body fluid (Dulbecco’s Phosphate-Buffered Saline (DPBS)). The formation of hydroxyapatite was confirmed by SEM, X-ray energy dispersive spectroscopy (EDS), XRD and micro-Raman spectroscopy. The formation of HA was evaluated after 1, 3, 7, 14, and 21 days of immersion. Results. This study demonstrated that White Portland cement can be used as a target material for manufacturing of bio-functional coatings. The films deposited on Si substrates have mainly amorphous structure; the crystallinity of the film can be achieved by increasing the laser power. The biological performance of deposited films was tested by HA forming ability in simulated body fluid. The HA layer was formed on a coated surface after first day of immersion.

**VASCULARIZED 3D TISSUE CULTURE MODEL USING MICROFLUIDIC CASSIE-BAXTER SURFACES**

Soroosh Torabi, Linzhang Li, Jonathan Grabau, Bradley Berron, Ren Xu, Christine Trinkle

University of Kentucky, Lexington, KY, USA.

In medical and pharmaceutical research, there is a pressing need for biologically relevant in vitro cell culture models that can capture critical aspects of the biochemistry, mechanics and physiology of the in vivo microenvironment, such as cell-ECM interactions and vascularized dynamic nutrition delivery. Integrating 3D culture with microfluidic systems makes it possible to mimic the nutrition delivery via microcirculation and can be used to study a variety of complex cellular behaviors such as angiogenesis, chemotaxis and cell migration. In this work, we developed a microfluidic platform that adopts a novel method of using topography-induced vapor entrapment to integrate 3D cell culture with an array of microchannels. This enables barrier free nutrition delivery from the cell culture media flow in the microchannels to the cells in the 3D hydrogel. Also, a removable lid provides physical access to the 3D cell culture which is useful for further biochemical and morphological analysis of the cells. Wettability analysis on the microchannels was performed both theoretically and experimentally, and the dynamic solute exchange between the flow and the 3D cell culture was illustrated. Also, in order to demonstrate the functionality of microfluidic device as a cell culture platform, the viability of MDA-231 breast cancer cells was studied over an extended period of time.

**3D HETEROGENEOUS BREAST TISSUE MICROENVIRONMENT USING POLYLACTIDE BEADS**

Bryanna Sierra, Didier Dréau

University of North Carolina Charlotte, Charlotte, NC, USA.

The microenvironment composition and density critically affect the breast epithelial cells behavior and can promote cancer development and progression. Those parameters are more suitably investigated in 3D in vitro culture systems. However, current 3D breast tissue systems poorly account for the heterogeneous density and composition of the extracellular matrix (ECM) observed within breast tissue. Here we investigated whether 3D matrices embedded with polylactide beads more closely mimicked the heterogeneous microenvironment of breast tissue. Briefly, breast epithelial...
cells were grown in 3D collagen / Matrigel® matrices embedded with polylactide beads and the development of complex structures i.e., acinus- and duct-like structures was monitored over time. Results indicate that polylactide beads coated with either media (117±4 um) or Collagen I (124±2um) had significantly smaller diameters on average than control beads in PBS (133±3um). The cells formed complex structures surrounding cluster of beads with cell strands migrating outward. The cell strands included both acinus- and duct-like structures. The length and the complexity of the cell strands formed in 3D matrix embedded with polylactide beads differed based on the beads coating. Thus, embedding polylactide beads in an in vitro 3D test system may model the density heterogeneity of normal breast tissue. This study was supported, in part, by a grant from the National Science Foundation EFRI program (CBE0736007).

HYBRID NETWORK STRUCTURE OF CHITOSAN FOR SOFT TISSUE INJURY WITH ANTIMICROBIAL AND CONTROLLED DRUG RELEASE ATTRIBUTES

Dilip Depan1, Elizabeth Owuor1, Saad Bux1, Harshit Doshi2, Melanie Sanders1

1University of Louisiana at Lafayette, Lafayette, LA, USA.
2Women’s and Children’s Hospital, Lafayette, LA.

Traumatic injury is a life-threatening prospect for soldiers in combat as well as civilians in serious accidents, such as motor vehicle accidents. Uncontrolled hemorrhage i.e. excessive loss of blood due to injury is a leading cause of death in soldiers and civilians. Hemorrhage can be controlled by applying pressure on the wound, however, this approach might not be suitable for injuries that occur in soft-tissues or organs such as eyes, lungs, liver, kidney, spleen, and neural tissue damage. This research is involved in the formulation of a gel that can be applied on a soft tissue to prevent excessive blood loss while providing anti-inflammatory and antibacterial benefits. The gel was prepared using chitosan, which is considered as the second most abundant biopolymer on this planet. The gel was loaded with a non-steroidal anti-inflammatory drug ibuprofen (Ibu) and silver nanoparticles (AgNPs) for antibacterial properties. Tri-polyphosphate (TPP) was used to prepare the cross-linked chitosan nanoparticles, and the degree of crosslinking was varied in order to understand the effect of cross-linking density on the microstructure of the gel. Our results suggest a novel strategy and potential biomaterial for soft tissue engineering applications.

FIBROUS BRANCHED-CLUSTERS AS MODULAR BUILDING UNITS FOR TISSUE REGENERATION TEMPLATES

Benjamin Minden-Birkenmaier, Gary Bowlin
University of Memphis, Memphis, TN, USA.

Electrospun templates were processed into fibrous branched-clusters and then separated by size via centrifugation. Fibroblasts were combined in culture with various amounts of fibrous clusters, and either centrifuged down or allowed to settle under gravity. After 3 weeks of culture, the fibrous clusters and cells formed three-dimensional tissue-mimicking constructs. Pycnometry was used to measure construct density, and found the densities (1.2-1.6 g/mL) were comparable to those of native soft tissues. Cryosectioning and DAPI staining revealed uniform cell distributions throughout all construct types (1.3-3.2 mm in diameter). Immunostaining for Ki67 indicated little ongoing proliferation throughout the construct after 3 weeks. These results demonstrate the ability of these branched-clusters to serve as building blocks for cells to create constructs with homogenous cell distributions not yet realized from traditional electrospun templates. These experiments are currently being replicated using chondrocytes to explore the potential of this template system in creating cartilage analogues.

Session II: Patient Rehab

THE EFFECT OF TROGLITAZONE ON C - REACTIVE PROTEIN IN INDIVIDUALS WITH PREDIABETES: DATA FROM THE DIABETES PREVENTION PROGRAM

Khalid Mokhtar
School of Graduate Studies in the Health Sciences, Jackson, MS, USA. University of Mississippi Medical Center, Jackson, MS, USA.

Background: Limited studies investigated the effect of troglitazone on CRP levels in individuals with prediabetes. The Diabetes Prevention Program (DPP) evaluated the effect of different interventions including metformin and intensive lifestyle modifications (ILS) compared to placebo on the prevention of DM. The DPP included 3,234 subjects with prediabetes. In this study we evaluated the effect of troglitazone on CRP levels in a subgroup from the DPP population. Materials and Methods: The effect of troglitazone on CRP levels at baseline & at 12 months was studied in a subgroup of a total of 3,171 subjects from the original DPP study population and compared to the other three interventions. Results: Overall, the median percentage change in CRP at 1 year from baseline was -20.00% in the troglitazone arm (p <0.001 for all between group analysis. The effect of the interventions was also reported by sex. In women, the median percent change was -27.08% in the troglitazone arm (P<0.001 for troglitazone vs. placebo & troglitazone vs. metformin: P=0.001). In men, troglitazone reported a median percentage change of -4.64% in CRP levels (P<0.05 for troglitazone vs. lifestyle & troglitazone vs. placebo: P = 0.012). Conclusion The decrease in CRP levels demonstrated by our analysis was significantly greater than the effect of metformin or placebo as presented in the previous DPP study which analyzed the effect of ILS, metformin, and
THE EFFECTS OF MIRROR THERAPY ON UPPER EXTREMITY FUNCTION POST-STROKE: A SYSTEMATIC REVIEW
Janet Slaughter
University of Mississippi Medical Center, Jackson, MS, USA.

Background and Significance: Impairment in UE function post stroke is detrimental to independence in activities of daily living. During mirror therapy (MT), the patient watches the movement of the unaffected hand in the mirror giving the patient the illusion of correctly moving the paretic hand. The purpose of this study was to determine if mirror therapy improved upper extremity function in patients post-stroke.

Methods: A systematic search of the literature was performed to include randomized control trials comparing conventional treatment and/or sham treatment to MT for UE weakness/paresis and independence in activities of daily living. Five articles met the inclusion criteria. Study quality was evaluated using the PEDro scale, a 10-point scale developed to assess the internal validity of clinical trials in physical therapy. Studies were also scored using the 2011 Centre of Evidence Based Medicine (CEBM) scale, a 5-level scale, in which lower numbers indicate higher levels of evidence.

Results: Evidence in four out of the five articles demonstrated that MT led to statistically significant improvements in function (p<0.05), as shown on the Functional Independence Measure (FIM). The mean PEDro score was 6.2 with a range of 5 to 7. The CEBM levels of evidence included three level II studies and two level III studies.

Conclusion: This systematic review provides evidence to support the use of MT as a therapeutic intervention in patients with chronic or subacute stroke to increase UE motor function and functional skills.

THE EFFECTIVENESS OF DRY NEEDLING ON THE REDUCTION OF PROXIMAL UPPER QUADRANT PAIN USING COHEN’S D: A SYSTEMATIC REVIEW.
Felix Adah, Min Huang
University of Mississippi Medical Center, Jackson, MS, USA.

Purpose: To determine if Dry Needling treatment in patients with proximal upper quadrant pain reduced pain intensity in comparison to controls/interventions using Cohen’s d for effective clinical difference.

Number of Subjects: 11 articles.

Methods: Literature search was performed using Pubmed, Embase, and PEDro databases. Inclusion criteria required intervention of DN into the trapezius muscle, clinical trials published within 10 years, musculoskeletal pain in the proximal upper quadrant, and comparing effects of dry needling to alternative treatments for pain reduction. PEDro risk of bias assessment was used. Information taken from the articles includes population, intervention group, comparison group(s), and post-intervention and follow up pain outcomes (VAS). We calculated Cohen’s d of each article. Number of participants, mean, and standard deviation between two groups were used in the calculation of effect size (ES) and 95% confidence interval (CI).

Results: Eleven randomized clinical trials were reviewed. The mean PEDro score of the studies was 6.5 with a range of 4 – 8. Using Cohen’s d to measure efficacy of DN treatment, DN had a large effect and significant, on pain control in five studies compared to the controls/interventions (ES range of 0.81 to 17.46; CI of 0.08 – 1.50 and 15.19 – 19.50 respectively); moderate effect in one study which was not significant (ES of 0.52; CI: -0.15 – 1.8).

Conclusions: DN is more effective for pain reduction than controls and other interventions in five of the eleven studies; inconclusive in three studies. It is suggested that DN be taken into consideration pain management.

ATTITUDES OF MISSISSIPPI NURSES’ TOWARDS EDUCATION ON COMPLEMENTARY & ALTERNATIVE MEDICINE IN MISSISSIPPI UNIVERSITIES
Lashanda Brumfield, Hamed Benghuzzi, Elgenaid Hamadain
University of Mississippi Medical Center, Jackson, MS, USA.

The growing consumer demand for complementary and alternative therapies (CAM) in health care has had an effect on all health professionals. The discipline of nursing is rooted in many holistic processes but the role of providing such services has not been fully defined in many states, including the state of Mississippi. Nurses are the members of the healthcare team who often initiate such a conversation with patients about CAM. We took a look at the state of Mississippi nurses and their perception of such a growing consumer demand, with effective healthcare services in mind. This was a descriptive quantitative study, with a sample size of 116 Mississippi Nurses. Participants in attendance to the 2016 MS Nurses Association Annual Meetings & Conventions voluntarily completed a questionnaire. Results found that 66.39% of participating nurses felt comfortable talking about CAM with patients, but only 20% of participating nurses felt prepared educationally. That left 80% of the nurses feeling unprepared when discussing CAM with patients. Only 38.60% nurses said they actually initiate any type of discussion with patients on CAM. These findings support our hypothesis that there is a lack of congruence between nurses’ beliefs and knowledge of CAM, and the incorporation of CAM into their current practice.

Session III: Math and Modeling

USING ORDINAL LOGISTIC REGRESSION WITH PROPORTIONAL ODDS TO ANALYZE HEALTH CARE DATA WHERE THE OUTCOME VARIABLE CAN BE ORDERED
Jamil Ibrahim1, Saja Ibrahim2, Ibrahim J Ibrahim3

1University of Mississippi Medical Center, Jackson, MS, USA.
2University of Jordan School of Medicine, Amman, Jordan.
3Arab American University, Jenin, Palestine
This study was conducted based on a sample of 384 people to determine how satisfied patients were with their primary care professionals' services based on a Likert scale (1 = very dissatisfied and 4 = very satisfied). People in the sample were characterized by site (Clinic A = 1 and clinic B = 0), gender (1 = females, 0 = males), socioeconomic status (0 = Low class, 1 = middle class, 2 = Upper class), and age. In this study, 384 patients (218 females, 166 males) were available for investigating the association between their ratings of professional health care services and the factors of gender, clinical location, socioeconomic status and age as a covariate. A cumulative odds ordinal logistic regression with proportional odds was run to determine the effect of these predictors on patients' satisfaction with health care services at these clinics. Power analysis for a multiple regression with four predictors was conducted in G-POWER to determine a sufficient sample size using an alpha of 0.05, a power of 0.80, and a medium effect size ($f = 0.15$). A thorough description of the results of the OLR models will be presented. IBM Statistical Package for the Social Sciences (SPSS) software version 23 and G-POWER 3.0.10 were used to analyze the data.

**META-ANALYSIS USING COMPREHENSIVE META-ANALYSIS SOFTWARE: PRACTICAL APPROACH WITH EXAMPLES**

Elgenaid Hamadain
University of Mississippi Medical Center, Jackson, MS, USA.

Meta-analysis is a statistical analysis that combines results of multiple studies. The basic idea is that there is a common truth behind all similar studies, but which has been measured with an error within individual studies. The aim is to use statistical approach to derive a pooled estimate closest to the unknown common truth. Meta-analysis contrasts results from different studies and identify patterns among study results and sources of disagreement. When effect size is consistent, meta-analysis is used to identify this common effect. When the effect varies, meta-analysis is used to identify the reason for the variation. A key benefit is the aggregation of information leading to a higher statistical power and more robust point estimate than is possible from the measure derived from any individual study. Comprehensive Meta-analysis software (CMA) will be used to illustrate this concept. CMA is a powerful computer program with a wide array of computational options and sophisticated graphics. The process begins with a systematic review, which is a lengthy process that includes formulating a research problem, searching the literature using MEDLINE, EMBASE, and other search engines, deciding which studies to include in the synthesis based on objective criteria, and then performing meta-analysis. Once an appropriate group of studies has been identified, the relevant data will be abstracted. This presentation provides a brief overview of important features of meta-analysis with emphasis on concepts and practical applications. Several topics such as fixed and random effects model, potential for bias, and conducting subgroup analyses will be discussed.

**DATA ANALYTICS FOR IMPROVED DECISION MAKING AT THE VETERANS AFFAIRS MEDICAL CENTERS**

Ajay Mahajan1, Alex Russell1, Padmini Selvaganesan1, Parag Madhani2, Sanjeevi Chitikeshi3

1University of Akron, Akron, OH, USA. 2VA Medical Centre, Marion, OH, USA. 3Old Dominion University, Norfolk, VA, USA.

This paper reports on a data-driven methodology for decision making at the Veterans Affairs (VA) Medical Centers to improve patient outcomes, specifically SMR30 (30-day Standardized Mortality Ratio). The quarterly SAIL (Strategic Analytics for Improvement and Learning) reports are used to visualize the data, study trends, provide actionable recommendations and potential consequences. A case study using more than four years of data is used to demonstrate the power of the methodology. Let us say that after seeing the data and studying the trends of other VAs, a decision is made to reduce the SMR30 by 5%. After running correlation algorithms, IHC (In Hospital Complications) is shown to be the most correlated with SMR30. A regression model is then developed between the two that says that IHC would have to be decreased by 44% to attain the desired result. Data shows that this is certainly feasible, and then a principal component analysis is done to create models between IHC and other metrics to see the consequence of the change. The models then predict that MRSA (Methicillin-Resistant Staphylococcus aureus) infection rate would decrease by 16.9%, but CAUTI (Catheter associated urinary tract infection) and PSI (Patient Safety Indicator) would increase by 17.7% and 7.7% respectively. This then lays the groundwork for a healthy discussion between the executives, staffs and clinicians on the path forward, resources required, and more importantly a progress dashboard that reflects weekly progress (data obtained from IT department) rather than waiting three months for the SAIL report to come.

**THE MODEL OF INTERDISCIPLINARY COLLABORATION IN PERIOPERATIVE SETTING FROM THE PERCEPTIONS OF THE IDT PROFESSIONALS**

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Background: Interdisciplinary collaboration (IC) is viewed as the product of synchronization and harmonization of team efforts supporting the move away from fragmentation of care. Research about the model of IC in perioperative setting (PS) is primarily qualitative and is not sufficient for developing the interventions with measurable effects. Often the latest developments in team and collaborative theory are not considered. Further elucidation of ICPS is necessary for better understanding of this collaborative process and advancing its
Session IV: Education and Research Training

ADVANCED BIOMEDICAL EDUCATION AND RESEARCH TRAINING

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In an effort to increase the number of well-trained minority health care professionals and basic science researchers, Jackson State University, (JSU, a historically black institution) in partnership with the University of Mississippi Medical Center,(UMMC, a major research-oriented medical center) and consultant biomedical researchers/health care professionals at various professional and academic institutions, established a Collaborative Advanced Level Minority Institutional Research Training Program (MIRTP). The purpose of the MIRTP was to enhance: 1. underrepresented minority graduate students training in cardiovascular, pulmonary and/or hematological related areas, the acquisition of Master’s degrees and trainee motivation to seek advanced degrees (doctorate) in the biomedical and health sciences areas and 2. Provide specialized advanced training for minority postdoctoral recipients. The program involved faculty and administrators at each institution in the planning and implementation of all programmatic aspects, including trainee selection, advisement procedures and program activities. JSU MIRTP students were recruited from historically black colleges and universities (HBCU’S) and majority institutions nationwide.

MIRTP students were trained in cardiovascular, pulmonary and hematological related research laboratory methodologies, responsible conduct of research concepts, literature survey mechanisms, and scientific writing techniques by mentors at JSU, UMMC and various consulting institutions. Students engaged in specific, mentor supervised, individualized research projects for Masters theses and presented their research findings at local and national scientific meetings e.g., MAS, ABRCMS, FASEB, AHA and the Endocrine Society. The results show that enhanced education and research training in cardiovascular areas can enhance the acquisition of advanced degrees and training by minority students. (HL07635).

THE IMPACT OF STEM FACULTY MENTORING ON MINORITY COLLEGE STUDENTS FOR CAREER SUCCESS

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Historically Black Colleges and Universities (HBCUs) have a long history in providing quality college education to minority students. HBCUs account only for 2% of nation’s colleges and universities but award a great number of degrees. The awarded degrees are in social and liberal arts, but there has been an increase in the number of science and engineering degrees and there are efforts to broaden the participation in STEM.

Nationally there is a collective effort to increase minority students in STEM through: 1) student mentoring; and 2) online distance learning. Mentoring can alleviate and help the students to navigate the years of college with success and graduate. Having a mentor is important to any person in the early years of career. A mentor is a person with a lot of experience, professionally stable, someone that will share his experience, insight, and knowledge on how to deal with stress, how to meet deadlines, and how to still take advantage of college life outside of the classroom. The development and implementation of online distance education courses represents an avenue to provide the students to enroll in STEM. The online distance learning is a structured and well-planned teaching and learning approach that uses an array of modern technologies with access by the educator and the student. The online distance learning offers flexibility and virtual interactions that encourages the students to continue education. These activities will advance student’s understanding of STEM disciplines and prepare them for STEM careers particularly of graduates from underserved groups.

TEACHING WITH TECHNOLOGY: DOES IT REALLY WORK?

Gloria Miller

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The rise of social media and technology has changed the way educators teach, how students learn, and the way teachers and students communicate. Since students are already interested
and engaged in technology, teachers can harness that attention for educational proposes. Leaders in government, business, and higher education are calling for today's students to show a mastery of broader and more sophisticated skills like evaluating and analyzing information and thinking creatively about how to solve real-world problems. This paper will share ideas on ways to utilize technology to: 1) engage students and create active learners, 2) encourage individual learning and growth, and 3) facilitate peer collaboration. We will discuss some of the benefits and limitations of technology in the classroom, best practices for using technology in the classroom, and ways to balance traditional methods and the use of technology in order to maximize effectiveness. Our aim is for the reader to discover that teaching with technology is not just about staying current on the latest tools, rather, it is about knowing how to successfully incorporate the best tools into teaching when and where it makes sense.

TEACHING AND LEARNING IN AN ACTIVE LEARNING CLASSROOM – A MIXED-METHODS CASE STUDY

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In the era of ubiquitous use of technology, education in all settings is impelled to incorporate technology into classroom settings in order to meet student needs and facilitate student learning. A southeastern academic medical center took the initiative and transformed a traditional classroom (TC) into a technology-advanced active learning classroom (ALC). In this case study, we conducted a mixed-methods cohort study aiming to find out how an instructor utilized the ALC, how students perceived the room, and whether the room yielded better learning outcomes. To find answers, we conducted a year-long observations of a dental hygiene instructor teaching two consecutive courses. We recorded and transcribed 19 classes, and took observational notes of classroom happenings. Towards the end of the academic year, we interviewed the instructor following a 13-question guide and surveyed the students with a 25-question questionnaire. We also collected six-year grades of the same two courses by this instructor, which included five-year historical grades earned in the TCs and one-year grades from the ALC. Our multi-perspective data gained a variety of examples of how instructor flexibly utilized different features in the room to facilitate individual or group activities. Student survey data indicated that approximately 50% preferred to take classes in the ALC rather than TCs. They especially enjoyed unobstructed views, spaciousness, and ease of screen sharing and interactions in group activities. Our grades data showed that there was a mean increase in both courses, however, significant differences were not found between grades earned in the ALC and TCs.

Session V: Tissue Engineering II

NOVEL PROTEIN THERAPY TO REVERSE AND INHIBIT CALCIFICATION OF VASCULAR SMOOTH MUSCLE CELLS

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Vascular calcification is an active process related to cardiovascular disease resulting from the osteoblastic differentiation of smooth muscle cells (SMC). This leads to the calcification of the medial and intimal layers of the arterial wall. In order to inhibit and potentially reverse this process, research has focused on the circulating protein, Fetuin-A, that binds to free calcium and phosphate in the serum, preventing mineral deposition. Our goal is to understand the mechanisms behind this protein and determine how it can be utilized as a therapeutic agent for calcification. In this study, we cultured and treated human vascular SMCs to induce calcification and determine the level of fetuin required to reverse it. Cells were cultured in calcification media, treated with bovine fetuin, and analyzed for calcium content using 0-cresolphthalein kit, PCR, western blots, and staining, using xylene orange for calcification and DAPI counterstain for nuclei. Preliminary western blot data showed that under calcifying conditions, SMCs lose their native α-SMA marker, representing a change from the SMC phenotype bone-forming osteoblasts. In PCR results, groups that lost α-SMA markers in western blots expressed RUNX2 in 2-fold expression, a gene only found in bone cells. On day 14, treating the cells with high fetuin (15 μM) produced significantly lower calcium/protein (μg/mg) content, with a p-value < 0.05, confirmed through staining. In future research, we want to formulate a uremic in vitro model observe and manipulate the effects of fetuin in sites of calcification conditions to determine whether this therapy is effective.

COMBINATION OF NANOTECHNOLOGY AND SPERM BIOLOGY TO ENHANCE REPRODUCTION PERFORMANCE

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Nanotechnology allows for the beneficial use of nanoparticles in reproductive medicine to improve understanding of animal fertility. Here we tested various fluorescent nanoparticles for effective and harmless interactions with mammalian spermatozoa. Boar spermatozoa were adjusted to 2 x 10⁸/ml
of PBS and mixed with 60 µg of fluorescent liposomes, 0.05 nM of copper (CuI/ZnS), or 0.05 nM of cadmium (CdSe/ZnS) core-shell quantum dots (QD) nanoparticles. After co-incubation, sperm were evaluated for motility and morphology characteristics and fluorescence emission. Data were analyzed by ANOVA-1 with significance set at P<0.05. Liposomes and CuI/ZnS QD significantly increased the proportions of motile spermatozoa, while CdSe/ZnS QDs did not affect the perm motility (P>0.05). The proportion of forward progressive spermatozoa was significantly increased by the presence of liposomes, but was decreased by both QDs (P<0.05). The proportions of spermatozoa with bent tail and distal cytoplasmic droplets were significantly decreased by the presence of each tested nanoparticles (P<0.05). Fluorescence imaging showed successful binding of nanoparticles with the entire sperm length. Contrarily to liposomes, both CuI/ZnS and CdSe/ZnS QDs showed potential sperm toxicity despite the CuI/ZnS exhibiting greater enhancement of sperm motility and morphology characteristics. Findings are important for harmless labeling and tracking of spermatozoa in physiological conditions to improving fertility outcomes during assisted reproduction. Supported by USDA-ARS Biophotonics Initiative #58-6402-3-018.

**COMPARISON OF CELL VIABILITY, MORPHOLOGY AND MINERALIZATION OF MESENCHYMAL STEM CELLS FOLLOWING A SINGLE EXPOSURE TO ELECTROMAGNETIC FIELD OR LOW-LEVEL LASER THERAPY**

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Mesenchymal stem cells (MSCs) are multipotential cells capable of differentiating into osteoblasts, adipose cells or neural cells, but they differentiate slowly. Electromagnetic field (EMF) and low-level laser therapy (LLLT) are methods that have been used in vitro and clinically to accelerate this process. Increases cell viability, differentiation and mineralization of mesenchymal stem cells grown in osteogenic medium and exposed to either EMF or LLLT have been reported. Osteogenic medium has been used to enhance osteogenic differentiation of mesenchymal stem cells. The goals of this experiment were: (1) to determine the effects of EMF at a distance of 3 inches for a period 30-minutes on cell viability, morphology and mineralization of murine MSCs grown in osteogenic medium at 7, 14 and 21 days; and (2) to determine the effects of a single dose of LLLT at 10 joules on cell viability, morphology and mineralization of murine MSCs grown in osteogenic medium at 7, 14 and 21 days. At 7 and 14 days the EMF treated cells were more numerous than controls while the LLLT treated cells were fewer in number but larger in size than the controls. At 21 days, both treat cell groups were similar in size, shape and numbers as the control group. While neither EMF nor LLLT exposure at recommended dosages caused a detrimental effect on the viability of the murine MSCs used, both produced increases in proliferation and differentiation. However, at 7 and 14 days, the cells treated with LLLT had a significant increase in mineralization.

**USE OF A PROTEIN-BASED INHIBITOR TO REGULATE THE PHENOTYPIC SWITCH OF SMOOTH MUSCLE CELLS**

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Cardiovascular complications are one of the leading causes of death in patients with diabetes or kidney disease. Vascular calcification used to be considered a passive process resulting from elevated calcium-phosphate interactions. However, it is now known to be a cell-mediated process. The competition of calcification promoted by proteins and inhibitors which cause arteries to harden is what drives this process. Current research has shown that the hardening of these arteries is reminiscent to bone development. When exposed to high levels of glucose, calcium, phosphate, and cholesterol, it is thought that smooth muscle cells (SMCs) in arteries that are healthy experience a phenotypic switch to osteoblast-like cells. Even though this phenotypic switch is known to researchers, the cellular and molecular mechanisms that promote calcification are still unknown.

The *in vitro* model that we have developed is used to induce vascular calcification and recognize the switching of healthy SMCs to osteoblast-like cells. The goal of using our *in vitro* model is to analyze the Wnt Signaling pathway that is involved in vascular calcification. We also want to block the activation of the Wnt pathway by using Sclerostin (Sost). By doing this we will be able to examine and determine the effects that Sost and Wnt have on vascular calcification.

**A DIME-SIZED HUMAN-IMPLANT-READY MULTI-CHANNEL NEUROSTIMULATION DEVICE MOVES TOWARD NETWORKED WIRELESS CAPABILITY**

Caroline Bjune, Jake Hellman, Alejandro Miranda, Matt Mareshan, Andrew Czarnecki, John Lachapelle, Jesse Wheeler Draper, Cambridge, MA, USA.

The ability to put active recording/ stimulation systems in close proximity of neural sites greatly improves ability to target sites and retrieve neural information with accuracy, lower noise, and a greater multiplicity of sites. Here we describe a networked implantable neuromodulation device with on-the-fly reconfiguration of sensing and stimulation. The system is being developed in three configurations: 1) Passive electrode leads for percutaneous use, 2) Dime-size active modules with electrodes for percutaneous use and networking to an implantable hub, and 3) Wirelessly networked active electrode modules. The system leverages custom ASICs and dense hermetic packaging to reduce the burden of bulky electronics, leads, and connectors. Our systems achieve 1µV RMS noise,
selectable single-ended or bipolar referencing, stimulation between 1µA and 6mA, and ISO-14708 and IEC-60601 validation for human use. The system, and lessons learned through for-human-use testing and validation will be discussed.

DO THE PROTEINS IN A FINGERNAIL OFFER INSIGHT INTO THE BONE HEALTH OF THEIR DONOR?

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Objective: Do the proteins that constitute human fingernail offer a window into their donor’s bone health? Materials and Methods: A cross-sectional, multi-centre study, ‘Fracture Risk Assessment by Nail correlation study’ (FRAN) tested the link between nail keratin and bone health of the nail donors. Raman spectroscopy was applied to nail clippings from 633 postmenopausal women, from six clinical sites, of whom 42% had experienced a fragility fracture. The Raman spectra were recorded by a Sierra Reader (Snowy Range, WY). Results: The differences identified in the spectra of nails sourced from non-fracture and fracture groups can be attributed to changes in the order of the keratotic proteins. Nails sourced from donors who have not experienced a fracture contain highly organised alpha helical structures with amphi intra-chain disulphide bonding whereas those sourced from donors who have experienced a fracture exhibit less ordered, ‘random’ secondary structures with a breakdown in intra-chain disulphide bonding. Conclusions: Raman spectra of human fingernails may present a surrogate marker of bone protein structure status. Disclosures: Both RB and MT are shareholders in Crescent Ops Ltd, who own intellectual property rights on the relationship between nail structure and fracture risk.

MEDICAL ROBOTS MUST HAVE ARTIFICIAL EMOTIONS

Paul Frenger

A Working Hypothesis, Inc., Houston, TX, USA

Medical robots are establishing well-defined roles in healthcare. These include companionship, supervision and eldercare; medical consultation, autonomous surgery and monitoring of astronauts are coming very soon. Some authorities insist these machines must appear indistinguishable from humans, to elicit believable intellectual, personality and emotional responses (avoiding Masahiro Mori’s “uncanny valley”). The author has researched artificial emotions for 45 years, designing analog, digital and microprocessor-based circuitry and software. His emotion simulator of 1973 uses a summing operational amplifier with Schmitt Trigger output. He’s designed over 50 types of McCulloch-Pitts and Hebb’s artificial neurons. His 2000 ANNIE robot, a biologically-inspired design, emulates many aspects of the human experience: self-awareness, recognition of other persons, a fear reaction and trust-love response, artificial hormones, sexual function, addiction to substances and video games, appetite control, ethics, beliefs and emotions. Every item known to ANNIE contains an emotional value. ANNIE’s body has a multiprocessor / multitasking plug-and-play computer network, a complex hand, machine vision, multi-sensor system, facial expressiveness and speech I/O. Recently the author devised a carbon-based brainstem coprocessor for a more human-like robot qualia experience. Taken together, ANNIE’s systems provide a smart, emotive quality to which colleagues, patients and other people can react naturally.

Session VI: Molecular and Clinical Markers

siRNA GENE DELIVERY MEDIATED BY MESOPOROUS SILICA NANOPARTICLES TO TREAT CANCER

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siRNA therapeutics have gained popularity for treating cancer, and has shown promising results owing to their target specificity to improve the effectiveness of the treatment. Mesoporous silica nanoparticles (MSNs) has emerged as a promising nanocarrier for the efficient delivery of active pharmaceutical ingredients (APIs). This comes from the properties possessed by MSNs, such as high-surface area, tunable particle/pore size, stability and biocompatibility. Also, the surface of MSNs can be functionalized to carry multiple types of cargo such as DNA, APIs, and other small nanoparticles (e.g., siRNA-nanocconstructs, QDs or superparamagnetic nanoparticles). Taking advantage of these attractive features, we present the synthesis of polyethylene imine (PEI)-coated fluorescent MSN material as efficient delivery vehicle for therapeutic nucleic acids. In our present work, we have synthesized PEI-coated MSNs modified with fluorescein in the interior surface. Meanwhile, the external surface was utilized to load ds-DNA, or ds-siRNA or siRNA nanoparticles through the electrostatic interaction between the positive amine groups from PEI polymer and the negative charge of the DNA/siRNA phosphate backbone. The MSN material was characterized using different techniques. In addition, in vitro studies (cellular uptake and cell viability assay) were performed in a breast cancer cell line (MDA-MB-231) to elucidate the behavior of our MSN system. To evaluate the transfection efficiency of our MSN platform, gene silencing studies in MDA-MB-231 cell line overexpressing GFP was carried out. As a future endeavor, to develop a combinatorial system, this platform can be used for co-delivering a chemotherapeutic-drug and therapeutic siRNA.

32
Radiation. Prior HSS increased the efficacy of radiation treatment. We analyzed the effects of treating animals with either PBS or HSS before exposing tumor-bearing animals to ionizing radiation. The distribution increased in the HSS group (p=0.002). Finally, dynamic contrast enhanced MRI (DCE-MRI) was observed in normal tissues (kidney p=0.957; muscle p=0.104). Dynamic contrast enhanced MRI (DCE-MRI) was observed in normal tissues (kidney p=0.957; muscle p=0.104). Dynamic contrast enhanced MRI (DCE-MRI) was observed in normal tissues (kidney p=0.957; muscle p=0.104). Dynamic contrast enhanced MRI (DCE-MRI) was observed in normal tissues (kidney p=0.957; muscle p=0.104).

Functional imaging studies. Blood velocity (Color Doppler Ultrasound) increased after HSS injection compared to PBS in animals engrafted with B16F10 (p=0.019), SK-MEL-147 (p=0.028) and 4T1-derived tumors (p=0.015). Dynamic contrast enhanced ultrasound (CEUS) was used to assess functional blood volume in B16F10, HCT-116 and MDA-MB-231 tumor xenografts, kidney and muscle tissues (n=3 per group). Relative tumor blood volume was increased in B16F10 (p=0.022) and HCT-116 (p=0.039) but not on MDA-MB-231 (p=0.186). A non-significant mild change was observed in normal tissues (kidney p=0.957; muscle p=0.104). Dynamic contrast enhanced MRI (DCE-MRI) was performed in B16F10 tumors (n=4) and showed that contrast distribution increased in the HSS group (p=0.002). Finally, we analyzed the effects of treating animals with either PBS or HSS before exposing tumor-bearing animals to ionizing radiation. Prior HSS increased the efficacy of radiation therapy in 4T1-derived tumor bearing animals. In conclusion, HSS transiently and safely increased blood supply on specific tumors, and therefore could be used to enhance intratumoral delivery of different molecules for either tumor diagnosis or treatment.

Fiber- and polygon-forming RNA-DNA hybrids for simultaneous activation of multiple functionalities

We introduce a new rational design of DNA-RNA hybrids that depending on connectivity rules can either assemble as fibers or as closed polygons. The hybrids are programmed to activate multiple split functionalities upon their intracellular activation. The functionalities are exemplified in this work by FRET, RNA interference and formation of functional NF-κB (nuclear factor kappa-light-chain-enhancer of activated B cells) decoys. NF-κB is a transcription factor that plays a critical role in regulating the expression of cytokine secretion. It was reported that NF-κB activation can be altered through gene therapy based interventions. Rational design of NF-κB decoys mimics the kB consensus sequence in order to prevent NF-κB binding to these sequences into the nucleus, thus stop cytokine production. By this means, during the re-association of RNA-DNA hybrids, the immunogenic response is efficiently decreased while RNAi and FRET are being activated. This work further expands the possibilities of dynamic RNA nanotechnology.

A novel anti-MUC1 CAR T cell driving immunity against pancreatic cancer

Chimeric antigen receptor T cells (CAR-T cells) have shown remarkable success in treating hematologic cancers. However, this success has not been extrapolated in solid tumors. Among them, pancreatic ductal adenocarcinoma (PDA) is the fatal malignancy with extremely poor prognosis. Treatment options are very limited and commonly associated with numerous side effects. Targeted therapy, which only target cancer cells and not the normal cells, have shown promising result regarding lower toxicity and fewer side effects. Mucin 1 (MUC1) which is a glycoprotein expressed in tumor condition. This aberrant form of MUC1 (tMUC1) is over-expressed in various types of cancers including pancreatic cancer. We have previously developed a patented monoclonal antibody (TAB-004) that only targets tMUC1 and spares the normal MUC1. Here we develop and characterize a novel CAR based on TAB004 antibody specific to tMUC1.
which is expressed in many carcinomas. TAB-CAR T cells specifically bind to high MUC1 expressing pancreatic cancer cells and perform robust cytotoxicity against most of pancreatic cancer cell-lines, while spare the normal cells. Moreover, its function in controlling tumor growth in xenograft mouse model is shown. TAB-CAR T cell killing is coupled with IFNγ and granzyme B release. This study demonstrates the specificity and effectiveness of a novel anti-MUC1 CAR-T cell, against variety of pancreatic cancer cells and tumors in vivo, which introduces a potential targeted therapy for PDA and other MUC1 positive solid tumors.

COMBINATORIAL THERAPY USING POLYMERIC MICELLE NANOCARRIER FOR AXON REGENERATION AFTER CNS INJURY

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Spinal cord injury results in permanent disruption of axonal pathways that leads to loss of motor and sensory function. The goal of our work is to develop amphiphilic copolymers (PgP) for combinatorial delivery of bioactive molecules targeting different barriers to neurotrauma and axonal regeneration. In this study, we investigated the ability of PgP carrying rolipram (Rm) and RhoA siRNA (siRhoA) to improve axonal regeneration. Rm can reduce the secondary injury following insults. RhoA is a shared target of signaling pathways activated by diverse extracellular molecules present in the injured spinal cord. To evaluate Rm loaded PgP (Rm-PgP) effect on secondary injury, Rm-PgP was injected at the injury lesion and the cAMP level using ELISA assay, apoptosis by TUNEL, and inflammatory response by ED1 staining was evaluated. RhoA knockdown on axon regeneration by PgP/siRhoA injection was evaluated by histological analysis. We observed that cAMP level was increased and reduced presence of activated immune cells and apoptotic cells in Rm-PgP treated group. RhoA mRNA expression was significantly reduced in animals receiving PgP/siRhoA nanoparticles compared to the untreated SCI group. We also observed an extensive necrotic cavity and significant astrogliosis in the untreated SCI group, while reduced cavitation/astrogliosis and axonal regeneration into the lesion site in the treated group was observed. Finally, we evaluated the synergistic effect of Rm-PgP and PgP/siRhoA co-administration on functional recovery by Basso-Beattie-Bresnahan (BBB) locomotor rating scale in rat SCI model and functional recovery was significantly improved in nanoparticle treated group than untreated animal group.

LAB-ON-A-CHIP IMMUNOASSAY FOR THERMOELECTRIC QUANTITATION OF TNF-α

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We report thermoelectric lab-on-a-chip immunoassay for quantitation of TNF-α, an inflammatory cytokine that is released by human astrocytes in cell culture media. Since the method is based on detection of the heat released during an enzymatic reaction the thermoelectric immunoassay can be performed using different enzymes. The substrate can be introduced multiple times after the thermoelectric signal returns to baseline level that allows increase the statistical significance of the results. The immunoassay was performed in a microfluidic device with an integrated antimony-bismuth thermopile sensor that has 60 thermocouple pairs. The device had two inlets and single outlet and was fabricated using xurography technique. Anti-TNF-α monoclonal antibody was used to capture the analyte that was followed by detection via glucose oxidase-conjugated secondary antibody. Glucose (100mg dL⁻¹) was injected through a sample loop into the fluid flowing within the microfluidic device. Nanovolt meter connected to the thermoelectric sensor recorded the voltage change caused by the enzymatic reaction. COMSOL simulations were performed to analyze the effect of flow velocity on the diffusion rate of glucose in the microfluidic device. The magnitude of the thermoelectric signal was proportional to the concentration of TNF-α in the biological sample. Standard calibration curve, y = 0.0315 + 2.5296, R² 0.994, was generated using various concentrations of synthetic TNF-α (0-2000pg mL⁻¹) by plotting the calculated area under the curve of the thermoelectric response versus the concentration of the analyte. TNF-α was quantified using both traditional ELISA protocol (287 pg mL⁻¹) and the microfluidic thermoelectric immunoassay (251 pg mL⁻¹).

Session VII: Radiology and Diagnostics

EFFECT OF PEDICLE-SCREW FIXATION IN LUMBAR SPINE AT L3-L5 LEVEL: A FINITE ELEMENT STUDY

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Deformities in the spine often require pedicle screw insertion, which alters the mechanical environment in the spine resulting in implant loosening and failure. This study examined the alteration of the state of strain at the bone-implant interface in the lumbar spine after pedicle screw insertion. Three-dimensional (3D) geometry of the lumber region (L1-S) and CAD model of pedicle screw was subjected at L3-L5 level to finite element (FE) analysis to examine the strain condition at the 6 selected locations at the bone-implant interface using different screw diameters (5 mm and 6 mm), implant materials (stainless steel and titanium), bone
conditions (very strong, strong, normal, weak and very weak) and loading conditions (420 N, 490 N and 588 N). Screw diameter was observed to be the most crucial factor in determining the strain environment. The 6 mm diameter screw did not alter the strain environment significantly (p<0.05) as compared to un-implanted bones. Stronger bones, smaller loads and stainless steel did not alter strain environment significantly after the implantation. This preliminary analysis will help in understanding the effect of different physiological and implant parameter on the mechanical environment at the bone-implant interface and will help to design better pedicle screw implants.

EVALUATING A SINGLE NEEDLE HIGH-FREQUENCY IRREVERSIBLE ELECTROPORATION (H-FIRE) PROBE FOR PANCREATIC ABLATION IN VIVO

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INTRODUCTION: Most pancreatic tumors are unresectable due to vascular involvement. Irreversible electroporation (IRE) uses multiple electrodes around the tumor to induce cellular apoptosis while sparing the underlying tissue architecture. High frequency IRE (H-FIRE) is an experimental alternative to commercial IRE that obviates the need for muscle paralysis and cardiac synchronization. We have developed a novel dual electrode-single needle (DESN) probe for H-FIRE delivery to enable rapid H-FIRE delivery.

METHODS: A DESN H-FIRE probe placed in the pancreas head or tail in a swine model and, in the absence of paralytics or cardiac synchronization, H-FIRE ablations (2,250V) were performed in 6 animals using a 1-5-1ms, 2-5-2ms, and 5-5-5ms (on-off-on) waveform. RESULTS: All animals survived the experimental period with no EKG abnormalities or muscle spasm during H-FIRE delivery. Necropsy demonstrated reproducible pancreatic ablations (903±70mm³ vs 935±148mm³ vs 2498±343mm³; 1-5-1 vs 2-5-2 vs 5-5-5). Histological analysis revealed extensive cell death within the ablative field in the absence of damage to vascular or ductal structure. Whole tissue staining and immunohistochemistry revealed the area immediately surrounding the probe was stained extensively for caspase 3 activity indicating apoptotic cell death.

CONCLUSION: H-FIRE delivery using the DESN rapidly and reproducibly ablated pancreatic tissue without the need for paralytics or cardiac synchronization. Overcoming the need to place multiple needles, and optimizing pulse delivery settings, raises the possibility of developing H-FIRE for minimally invasive use.

A PREDICTIVE DOSIMETRIC MODEL FOR ESOPHAGITIS INDUCED BY RADIOTHERAPY FOR LUNG CANCER

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Purpose: To establish a predictive model for the incidence of esophagitis for lung cancer patients treated with radiotherapy.

Methods and Materials: 139 treatment charts of lung cancer patients treated with radiation therapy or combined chemoradiotherapy from January 01, 2014 to June 30, 2017 at University of Mississippi Radiation Oncology were retrospectively reviewed. Mean esophagus dose (MED) and the endpoints of esophagitis grade 1 and 2 based on Radiation Therapy Oncology Group (RTOG) definitions were derived from the Pinnacle treatment planning system (TPS) and the EPIC electronic medical record (EMR) system, respectively. Binary logistic regression and Probit statistical analysis were used to determine the relationship between the probability of grade 1 and 2 esophagitis with the mean esophagus dose.

Results and Conclusions: The regression model of the incidence of grade 1 and 2 esophagitis was established. The results suggest that MED is a good predictor of the risk of radiation-induced esophagitis. The mean esophagus doses associated with a 50% incidence probability (TD50) for grade 1 and 2 esophagitis were determined as 1,510 cGy and 4,594 cGy, respectively. The parameters, n, m and TD50 as described in the Lyman Kutcher Burman (LKB) model were fitted and compared with other published findings. Our findings may be useful as additional clinical guidelines in treatment planning and plan evaluation, as well as obtaining informed patient consent.

COMPARING RIB CORTICAL THICKNESS MEASUREMENTS FROM COMPUTED TOMOGRAPHY (CT) AND MICRO-CT

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Motor vehicle crashes accounted for 35,000 deaths in the U.S., with many serious injuries occurring in the thorax. Predicting and preventing thoracic injuries can be difficult due to the compositional changes in the thorax with aging. Cortical bone thickness changes were analyzed in anatomical regions and cross-sectional quadrants of the ribs from clinical computed tomography (CT) scans and compared to cortical thicknesses obtained from micro-CT cadaver scans. A cortical thickness estimation algorithm was applied to retrospective CT scans of clinical resolution from 73 males, ages 10-92 years, and compared to thickness measurements from micro-CT scans of six male cadavers. Anterior and lateral regions of the 4th-7th left ribs were analyzed and thicknesses were compared between superior, interior, inferior, and exterior
quadrants of rib cross-sections. In both CTs and micro-CTs, ribs were thinner in the anterior compared to lateral regions and interior quadrants were thickest. The average thickness for clinical CTs was 0.79mm for anterior vs 0.94mm for lateral regions (0.15mm difference). Average thickness for micro-CTs was 0.62mm for anterior vs 0.84mm for lateral regions (0.22mm difference). Interior quadrant thickness from clinical CTs was 1.06mm (average of 0.27mm thicker than other quadrants). Interior quadrant thickness from micro-CTs was 1.05mm (average of 0.42mm thicker than other quadrants). This study demonstrates the feasibility of the cortical thickness algorithm for analyzing rib cortical thickness from clinical CT scans. A better understanding of cortical thickness changes with age will lead to more biofidelic thorax models and improved occupant safety for all ages.

VALIDATION OF DETAILED ORGAN MODULARITY IN A SIMPLIFIED HUMAN BODY MODEL

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The significant computational resources required to execute detailed human body finite element models has motivated the development of faster running simplified models (e.g. GHBMC M50-OS). Previous studies have demonstrated the ability to modularly incorporate the validated GHBMC M50-O brain model into the simplified model (GHBMC M50-OS+B), which allowed for localized analysis of the brain at a substantially reduced computational cost. This study expands on this concept through modular incorporation of detailed thoracoabdominal organs into the simplified model (M50-OS+O). The force-deflection responses between the M50-O, M50-OS, and M50-OS+O were compared through a test matrix of 5 hub-style biomechanics impacts, consisting of a frontal chest hub, oblique hub, lateral plate, and two abdominal bar simulations. Normalized run times for the various models used in this study were 16.8 min/ms for the M50-O, 0.30 min/ms for the M50-OS, and 1.57 min/ms for the M50-OS+O. Response from the abdominal bar simulation shows comparable results between the M50-O, M50-OS+O and the experimental data. The incorporation of the detailed organs into the M50-OS has shown the ability to obtain abdominal force-deflection response comparable to the experimental data and M50-O response, but with a runtime reduction of 90%.

MODULATION OF STEM CELLS WITH ELECTRICAL STIMULATION DELIVERED VIA PENETRATING NANOELECTRODES

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The application of electrical stimulation to stem cells is currently being explored as a method to facilitate their differentiation into various cell lineages. The potential differentiation of adipose-derived stem cells (ADSCs) to cardiac or neural phenotypes is particularly interesting due to the ubiquitous nature of adipose cells throughout the body, their ease of extraction and rapid expansion. In this work, the electrical stimulation is delivered using penetrating nanoelectrodes Penetrating electrodes provide direct access to the cell’s interior in a minimally invasive fashion, and with enhanced cell-electrode coupling. Nanoelectrodes (pillars and fins) of controlled height, diameter, and density are fabricated on silicon using nanofabrication techniques. Extensive experiments confirmed the ability of the nanoelectrodes to penetrate cells. ADSC were then modulated by applying electrical stimulus of 500-500 mV/cm for 15 minutes per day for 5 days. The differentiated neural phenotypes were validated using various stem cell surface markers and electrophysiology measurements.
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The results of this study were to determine the effectiveness of a perfusion catheter to deliver liquid paclitaxel directly to the arterial wall. The perfusion catheter was tested in a perfusion chamber, which simulated physiological conditions, to evaluate the ability of the drug to inhibit NETosis.

PRE-LIMINARY EVALUATION OF ELECTROSPUN POLYDIOXANONE TEMPLATES ELUTING ACTIVE CL-AMIDINE TO INHIBIT HUMAN PAD4

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Neutrophils modulate the microenvironment around tissue regeneration templates through the release of neutrophil extracellular traps by NETosis, a form of regulated cell death dependent on protein deaminase 4 (PAD4) activity. Recently, using human neutrophils, we showed that electrospun polydioxanone (PDO) templates selectively modulate the degree of NETosis, with small diameter (SD) fibers (0.30±0.1 µm) eliciting a higher degree of NETosis than large diameter (LD) fibers (1.9±1.0 µm), which translated to fibrotic encapsulation of SD templates in vivo. In this study, Cl-amidine (1-5 mg/mL), an irreversible inhibitor of PAD4, was electrospun with PDO into SD and LD templates, and elution from the templates (n=6) was evaluated over 1 hour using a PAD4 inhibitor assay. At 30 min, SD templates achieved greatest inhibition of PAD4 activity at 99.5±2.1%, which was significantly greater inhibition (p<0.05) than LD templates at 52.5±24.7%. This effect may be due to the high surface-area-to-volume ratio of the SD templates, resulting in a significant burst release of Cl-amidine, which may be beneficial for down-regulating PAD4 activity and NETosis, potentially translating to improved tissue regeneration in vivo. Future work includes executing an in vitro study with human neutrophils to evaluate the ability of the drug to inhibit NETosis.

PRE-CLINICAL INVESTIGATION OF LOCAL LIQUID PACLITAXEL DELIVERY VIA A NOVEL PERFUSION CATHETER

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Non-stent drug delivery platforms have recently emerged as an alternative treatment of peripheral arterial disease. Perfusion catheters have the potential to directly deliver drugs to the medial arterial layer to prevent restenosis. The purpose of this study was to determine the effectiveness of a perfusion catheter to deliver liquid paclitaxel, a proven anti-proliferative agent. A mathematical model was developed to test the impact of pressure on drug penetration into the medial wall. A bench-top model was utilized to determine the varying parameters of a perfusion catheter to maximize liquid paclitaxel delivery using pharmacokinetic evaluation and fluorescent microscopy. In addition, bilateral rabbit iliac arteries were treated with the perfusion catheter and pharmacokinetic evaluation performed at 1 hour to 3 days. The mathematical model demonstrated penetration of drug into the arterial wall is based on treatment chamber pressure. Bench-top testing demonstrated uniform and circumferential penetration of paclitaxel within the treated arteries. The results of the ex vivo test identified two groups with and without an excipient with similar loading conditions. The in vivo pharmacokinetic analysis of these two groups demonstrated the use of contrast agent increased arterial paclitaxel levels and maintained initial paclitaxel dosing up to 3 days (with excipient: 1 hr: 107±62 ng vs. 3 days: 40±23 ng, p = 0.824; no excipient: 1 hr: 247±120 ng vs. 3 days: 2.92±2.9 ng, p=0.009). These results demonstrate the feasibility to deliver liquid paclitaxel directly to the medial layer via a perfusion catheter.

COMPUTATIONAL FLUID DYNAMICS OF AN AORTIC BENCH-TOP MODEL

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In treating diseases within the aorta, minimally invasive endovascular techniques like transcatheter aortic valve replacement (TAVR) are becoming more prevalent. In order to evaluate and optimize the design of catheter devices a robust and durable aortic bench-top model was created for experimentation and testing. In this study, numerous computational fluid dynamic (CFD) simulations were performed on the aortic bench-top model in order to influence hardware settings like effective fluid resistance at the aortic branches and descending aorta. By introducing and manipulating nozzles at the bench-top model outlets, it was found that the model is capable of producing aortic branch fluid resistance values from 1.5 - 2000 mmHg/L/min, which is well within the range of physiological relevance. Once determining the dependence of fluid resistance on nozzle geometry, effective fluid resistance values were applied to the branching arteries and descending aorta to perform pulsatile flow CFD simulations with both blood and water glycerol to verify water glycerol as a blood analog. Water glycerol generated flow profiles and volume flow waveforms comparable to blood on the aortic bench-top model, thus verifying the mixture created in the lab as an effective blood analog.

EFFECTS OF SIMVASTATIN-CONTAINING POLYMERIC PRODRUGS ON BONE FORMATION IN VIVO

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Previous research on simvastatin-containing polymeric prodrugs demonstrated slow degradation in vitro. The objective of the current study was to evaluate in vivo degradation and the bone-forming potential of simvastatin-containing polymeric prodrugs in a rodent model. Poly(ethylene glycol)-block-poly(simvastatin) and poly(ethylene glycol)-block-poly(simvastatin)-ran-glycolide were synthesized by ring opening polymerization and pressed into disks of 6 mm diameter and 2 mm thickness. Poly(lactide-co-glycolide) (PLGA; 75:25) and simvastatin-loaded PLGA of similar dimensions were used as control. Disks were implanted over the calvarium and directly under the periosteum of male Sprague-Dawley rats. Animals were euthanized at predetermined time intervals and the calvaria analyzed for new bone formation by histology and microcomputerized tomography. Woven bone was observed with all samples, and the thickness of the woven bone was increased at the periphery. Bone formation was greatest with poly(ethylene glycol)-block-poly(simvastatin), whereas severe skin ulceration was observed at weeks 1 and 2 post-implantation with the faster-degrading poly(ethylene glycol)-block-poly(simvastatin)-ran-glycolide. Increased swelling, severe skin ulceration, and bone resorption were also observed with simvastatin-loaded PLGA at 4 weeks post-implantation. Of the prodrugs tested, poly(ethylene glycol)-block-poly(simvastatin) promoted new bone growth with less inflammation. This study shows that polymeric prodrugs with controlled degradation and sustained release limit the inflammatory responses and promote bone formation.

AN EXPERIMENTAL AND COMPUTATIONAL STUDY OF THE EFFECT OF BIOCERAMIC POROSITY ON DRUG RELEASE KINETICS
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Porous bioceramics are explored as drug carriers in targeted drug delivery applications. The drug release rate, cumulative drug release (CDR) and the duration of release are dependent on the porosity characteristics of the carriers. In this study, Cristobalite disks with different porosities are studied as carriers of the drug Vancomycin. The experimental work involved preparation of Cristobalite disks followed by a study of the drug binding and release kinetics. Cristobalite disks with different porosity characteristics were loaded with Vancomycin. Drug release kinetics were then studied by immersing the disks in PBS in polystyrene jars. The amount of drug released during various time intervals was measured and CDR was calculated. In addition, SEM analyses of Cris-PEG disk sections were performed to study the pore size distribution of the disks. Computational work was carried out to study the significance of various mechanisms driving drug from the ceramic disks and to aid in optimal delivery systems. Drug release process from the disks involves burst-release and sustained-release phases. These two mechanisms are modeled using the Fickian Theory of Diffusion and the Finite Element Method. Axisymmetric finite element models of the disk and the PBS region were developed and solved using the FEM package ABAQUS and MATLAB. The diffusion and mass-diffusion efficiencies, essential for these models, were obtained by matching the computational and experimental values of CDR. Relation between the drug release kinetics and the pore size distribution was also studied to identify the pore size categories controlling the release kinetics.

SUSTAINED DELIVERY OF ESTROGEN AS A MODEL FOR REPLACEMENT THERAPY USING OVERIECTOMIZED RODENTS
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Tricalcium phosphate lysine (TCPL) delivery system was used effectively to deliver various organic compounds at sustained levels in many different models. The specific aim of this investigation was to utilize TCPL delivery system as a model for estrogen (E) replacement therapy in post-ovariectomized adult rats mimicking a postmenopausal condition. A total of 24 adult female rats were used in this study. The animals were randomly divided into three different groups: groups 1, and 2 were ovariectomized (OVX), and OVX plus E (20 mg loaded TCPL), respectively. Group 3 animals (n=4) served as intact control group. Blood samples were collected biweekly for four weeks. Vaginal smears were taken and screened daily during the entire investigation. The total serum levels of E, P, luteinizing hormone (LH), and follicle stimulating hormone (FSH) were measured by means of radioimmunoassay procedure. Data obtained from this investigation suggest the following: (I) OVX resulted in an increase in total serum levels of LH and FSH within 2 days post-ovariectomy, (II) TCPL were capable of releasing sustained levels of E (15-48 pg/ml) at the end of second day and continued until the four weeks, (III) the sustained level of E was able to suppress the post ovariectomy rise of LH and FSH to almost undetectable levels, (IV) sustained delivery of E resulted in maturation of vaginal epithelium and the smears exhibited the estrus phase throughout the investigational period.

ATOMIC LAYER DEPOSITION OF NANO-COATINGS ON FABRICS FOR ANTIBACTERIAL APPLICATIONS
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About 1.7 million Americans contract hospital-acquired infections every year, resulting in 99,000 inadvertent deaths and an estimated $20 billion in healthcare costs. Here, we investigate the use of atomic layer deposition (ALD) to treat various fabrics with antimicrobial inorganic materials to create unique antibacterial textiles. Our protocols include...
biological testing of the antimicrobial performance of ALD-treated fabrics against DH5-α, a strain of E. coli that is engineered to be suitable for laboratory purposes. Antibacterial performance is tracked as a function of ALD cycle number at a deposition temperature of 90°C. DH5-α is exposed to the fabrics and incubated for 20 hours, after which cultures are diluted, spotted onto Petri dishes, and incubated for another 20 hours. Colony counting is then used to quantify antimicrobial effectiveness. For ZnO ALD coatings of 0, 1, 10, and 100 cycles, we find that only the 100-cycle sample is sufficiently cytotoxic to kill all of the E. coli bacteria. Interestingly, for 1 and 10 cycles of ZnO, bacteria grow more rapidly. We attribute this increased growth rate to the Zn²⁺ ions acting as a nutrient for the bacteria. It is known that in order to be an effective antimicrobial agent, ZnO must be “nano-sized” or larger; ZnO, which dissolves into Zn²⁺ in PBS, acts instead as a bacterial metabolite. A more detailed investigation of this transition from nutrient to antimicrobial will be discussed. We will also examine how long these antimicrobial effects last, as well as the stability of ZnO in environments of varying pH.

**Session IX: Neuroscience**

**HIGH-RATE MECHANICAL INSULT CONTRIBUTES TO ALTERATIONS IN BRAIN CELL SIGNALING AND Reactivity**  
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Traumatic brain injury (TBI) is complex pathology with numerous long-term debilitating symptoms associated with damage to the brain parenchyma. It is necessary to better understand TBI at the cellular and molecular level in order to mitigate organ-level dysfunction. In particular, there is a lack in understanding the interplay of injury mechanics and mechanobiological responses in brain cells. This study aimed to analyze such effects from higher-rate injuries, through an *in vitro* injury model of primary mixed brain cells (neurons and astrocytes). Neurons and astrocytes interact in the proper functioning of neural networks and are critical components in the injury response of the central nervous system. The goal of this study was to analyze expression of abundant structural and adhesion molecules expressed by neurons and astrocytes to understand how intra- and intercellular signaling may be compromised as a result of high-rate mechanical insult. Target expression was measured for β-actin, vinculin, β-tubulin, ezrin, connexin-43, and glial fibrillary acidic protein. Transient alterations in both neuron and astrocyte-specific molecules occurred over the time course of 48 hours after insult. This has implications for compromised cell-cell communication and provides potential molecular targets for mechanobiological mechanisms associated with neuron and astrocyte dysfunction following high-rate mechanical insult.

**ALLOSTERIC DRUG DESIGNING FOR HORMONE THERAPY RESISTANT BREAST AND PROSTATE CANCERS**  
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Hormone therapy resistant breast and prostate tumors present a major challenge in drug designing. In about 30% of the cases these tumors, once responded to hormone therapy, are found to lead to progression even in the presence the therapy. In order to address the issue, we identify alternate protein targets by elucidating protein-protein and protein-DNA interfaces of ERα and AR and use them to develop new generation of anti-cancer agents. Using the crystal structures of ERα and AR Ligand binding and DNA binding domains, molecular modeling, molecular dynamics simulations, and bioinformatics we identified the hydrogen-bonding contact motifs that are responsible for dimerization and/or DNA recognition. The crucial amino acids of a motif are then grafted on stable helices (alanine and glutamine) in order to develop peptic inhibitors. In ERα, using the dimerization sequence motif LQXXHQXXAQ (497-506) as a template we have developed designer peptides AAHQALAAAAA and AADQAQQAAAAA which exhibit significant suppression of ER-expression in MCF-7 breast cancer cell lines. The designer peptides inhibit ERα dimerization – an essential process in ER mediated transcription. In AR, protein-protein binding contacts are insignificant. The LCAXRXD motif (578-584) that binds with AR and DNA is being targeted for develop inhibitor peptide. Author acknowledges financial support from MS-INBRE funded by NCRR/NIH-5P20RR016476-11 and NIGMS/NIH-8P20GM103476-11.

**ANTI-INFLAMMATORY CYTOKINE INTERLEUKIN-1 RECEPTOR ANTAGONIST REDUCES LIPOPOLYSACCHARIDE-INDUCED BRAIN HIPOPCAMPAL INJURY AND IMPROVES COGNITIVE IMPAIRMENT IN JUVENILE RATS**  
Lir-Wan Fan¹, Jonathan Lee¹, Silu Lu¹, Ohwatosin Akinyemi¹², Iman Washington¹², Brenkeeva Langston¹³, Norma Ojeda¹, Yi Pang¹, Abhay Bhatt¹, Renate Savich¹, Lu-Tai Tien⁴  
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Inflammation in neonatal human and animal models has been shown to be associated with cognitive dysfunction later in life. Our previous studies have shown that administration of interleukin-1 receptor antagonist (IL-1ra) can protect against lipopolysaccharide (LPS)-induced sensorimotor dysfunction...
and brain inflammation in neonatal rats. The objective of this current study is to further determine whether IL-1ra protects against LPS-induced chronic brain inflammation, hippocampal injury, and cognitive dysfunction in juvenile rats. Intraperitoneal (i.p.) injections of LPS (2 mg/kg) or saline was performed in postnatal day 5 (P5) Sprague-Dawley rat pups, and IL-1ra (100 mg/kg) or vehicle was administered (i.p.) at 5 min, 24, 48, and 72 hours after LPS injection. Neurobehavioral tests were carried out from P14 to P22, and brain injury was examined at P22. Our results showed that neonatal systemic LPS exposure resulted in cognitive deficits and chronic inflammation in juvenile rats which were associated with hippocampal neuronal injury, as indicated by loss of NeuN (neurons) immunoreactivity in the hippocampus of the P22 rat brain. IL-1ra treatment significantly attenuated LPS-induced cognitive deficits and hippocampal injury. IL-1ra administration also significantly attenuated LPS-induced increases in the numbers of Iba1+ cells (microglia) and increases in IL-1β concentration in the hippocampus of the P22 rat brain. These results suggest that IL-1ra provides protection against neonatal LPS exposure-induced chronic inflammation, hippocampal injury, and cognitive deficits in juvenile rats, which may be associated with the blockade of LPS-induced pro-inflammatory cytokine IL-1β.

OXIDATIVE STRESS IS ASSOCIATED WITH DYSFUNCTIONAL NEURODEVELOPMENT IN RAT OFFSPRING EXPOSED TO PLACENTAL INSUFFICIENCY

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Placental Insufficiency is a pregnancy complication compromising the delivery of blood and nutrients to the fetuses. The effects of exposure to this condition on the neurodevelopment of newborn and juvenile offspring are not well understood. We hypothesized that exposure to placental insufficiency is associated with increased oxidative stress status and dysfunctional neurodevelopment in rat offspring. To test our hypothesis, we performed the reduced uterine perfusion (RUP) surgery in pregnant rats at 14 days of gestation to induce placental insufficiency. Motor skills were significantly delayed in placental insufficiency-exposed offspring compared to controls (P<0.05). These findings suggest that placental insufficiency is associated with an increase in oxidative stress and dysfunctional neurodevelopment in newborn and juvenile rat offspring.

HIGH SENSITIVITY MICROBIOSENSORS FOR DETECTION OF GLUTAMATE AND DOPAMINE IN BRAIN TISSUE

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Enhanced neurochemical microsensors were developed for brain slice recordings where higher sensitivity is required to detect small, dynamic changes in glutamate and dopamine levels. Glutamate microbiosensors were created by drop coating a mixture of 0.1 U/µL glutamate oxidase, 1% BSA and 0.125% glutaraldehyde. After curing, a size-exclusion polymer, m-phenylenediamine, was electrochemically deposited to prevent ascorbic acid, an interferent, from reaching the electrode surface. Dopamine microsensors were created by electrochemically depositing ~100-nm thick multiwall carbon nanotubes (MWCNT) onto platinum microelectrode arrays and then drop casting 0.2 µL of 5% wt. nafion solution. Murine coronal brain slices were maintained in artificial cerebral spinal fluid. Caudate putamen was used to test dopamine and parietal cortex was used to test glutamate microbiosensors. Current responses to biphasic stimulation, were recorded on a F.A.S.T. 16mkIII system (Quanteon). Responses were compared to standard curves from 1-40 µM of glutamate and 10-400 nm dopamine. The open pores present in the MWCNT film contributed to a significant increase in the electroactive area and adsorption sites for dopamine. In vitro calibration studies showed that with nafion coating, the MWCNT modified microelectrode had a 100-fold increase in DA sensitivity (20 nA/µM). The glutamate microbiosensor showed a sensitivity of 25 pA/µM, which is much higher than similar commercial probes (<15 pA/µM) reported in the literature. Future work includes combining these microsensors into a single probe and further refinement of the coatings for chronic, in vivo recordings. Funding from NSF EPSCoR RII-2 FEC OIA1632891.

USING ORDINAL LOGISTIC REGRESSION WITH PROPORTIONAL ODDS TO ANALYZE HEALTH CARE DATA WHERE THE OUTCOME VARIABLE CAN BE ORDERED

Posters

NEAR-INFRARED CAMERA FOR EARLY DETECTION OF DIABETIC ULCERS

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40
Peripheral Arterial Occlusive Disease (PAOD), also known as diabetic foot ulceration, is the leading cause of lower extremity amputation. In order to combat this, a near infrared camera prototype has been constructed using a Raspberry Pi system with optical filters. Due to deoxygenated nature of venous blood, blood accumulation can be detected and photographed at near infrared wavelengths. In conjugation with a MATLAB photograph processing program, the device can monitor the progress of ulceration formation by the change in diameter of the blood vessels. Loss of sensation in the peripheral extremities is a common symptom of PAOD, which can allow the formation of ulcers to proceed without the patient's knowledge. In order to detect ulcerations prior to severe complications, regular inspections of the afflicted area are necessary by the physician. This process is costly, time-consuming, and inconvenient for the patient. To improve this process, a handheld, low-cost prototype was developed for patients to self-monitor the progression of their ulceration at home. The current goal of the project is to determine the optimal wavelength, LED arrangement, and imaging conditions to produce the most accurate representation of the vasculature. Multiple images have been captured, processed, and evaluated through the usage of a MATLAB processing code. Further prototype improvements include data sharing between the patient and physician, enhancing user-friendliness, and ensuring universal usage.

THE EFFECT OF GABA RECEPTOR ANTAGONIST IN TRAMADOL AND TRAMADOL/GABAPENTIN MEDIATED ANTINOCICEPTION IN MICE TAIL-FLICK TEST

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Pain prevention as well as treatment is among the major concern for the healthcare authorities across the world. Adequate therapeutic treatment for pain management is still a major clinical target. Our previous studies have demonstrated that gabapentin [a γ-aminobutyric acid (GABA) derivative] potentiates tramadol antinociception and attenuates the tolerance to tramadol in mice tail-flick test. The underlying mechanisms are not clear. It had been acknowledged for that GABA receptors play important role in pain modulation. To induce a change in GABA receptor activity could offer a suitable approach. The present study is focused on whether GABA receptors antagonists induced activity involve in tramadol alone and tramadol in combination with gabapentin mediated antinociception in mice tail-flick test. Experiments were conducted in NIH Swiss male mice (8/treatment group). GABA_A receptor antagonist bicuculline (2 mg/kg), GABA_B receptor antagonist 2-hydroxysaclofen (3 mg/kg) and gabapentin (75mg/kg) were administered to mice 30 min before tramadol (60mg/kg) administration respectively. Mouse tail-flick response latencies to heat stimuli were tested 30 min after tramadol administration for the evaluation of nociceptive reaction. Data were expressed as mean ± standard errors of the mean (SEM). The results showed that GABA receptor antagonist alone did not induce the antinociceptive effect. However, use of tramadol, tramadol/gabapentin in combination with bicuculline, the response latency increased from 6.73±0.25, 7.86±0.33 (sec) to 7.63±0.34, 8.66±0.42 (sec) (p<0.05). GABA_A receptor involved in the tramadol and tramadol/gabapentin mediated antinociception.

NEONATAL SYSTEMIC EXPOSURE TO LIPOPOLYSACCHARIDE ENHANCES ADULT SUSCEPTIBILITY TO THE NEURODEGENERATIVE DISORDER INDUCED BY PARAQUAT

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We have previously shown that neonatal intracerebral injection of lipopolysaccharide (LPS) increases the risk of rotenone (a commonly used pesticide)-induced dopaminergic damage in adult rats. This study was designed to further test whether neonatal systemic LPS exposure also increases the vulnerability of adult dopaminergic neuron to paraquat, a widely used herbicide. LPS (2 mg/kg) was administered intraperitoneally into postnatal day 5 (P5) rats. On P70, rats were challenged with paraquat through subcutaneous minipump infusion at a dose of 0.3 mg/kg per day for 14 days. This paraquat treatment regimen ordinarily does not produce toxic effects on behaviors in normal adult rats. However, LPS pre-exposed rats developed Parkinson’s disease-like motor neurobehavioral impairments after paraquat treatment, including bradykinesia (prolongation of the movement time), akinesia (prolongation of the reaction time), and rigidity (increase in muscle tone or magnitude of stretch reflexes). Structural examination of the nigrostriatal pathway revealed that neonatal LPS exposure enhanced paraquat neurotoxicity to cause a significant loss of tyrosine hydroxylase immunoreactive neurons in the substantia nigra, and a decrease in retrogradely labeled nigrostriatal dopaminergic projecting neurons of rats. Our results indicate that perinatal brain inflammation may cause the nigrostriatal system in the adult brain to become more vulnerable to damage by environmental toxins at an ordinarily non-toxic or sub-toxic dose, leading to the development of Parkinson’s disease-like motor dysfunction and pathological features.

EFFECT OF A 3D ASSEMBLY TECHNIQUE ON UROTHELIAL TISSUE STRATIFICATION IN VITRO

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The transitional urothelium of the bladder is comprised of layers of umbrella, intermediate, and basal urothelial cells that each serve important physiological functions including; barrier function, elasticity, and signal transduction. The objective of this study was to investigate the effects of a 3D,
multilayer assembly technique on urothelial cell differentiation and stratification in vitro. UROtsa cells (urothelial cell line) were coated with fibronectin and gelatin (FN-G) in a layer-by-layer method and seeded at a high density to form multiple layers onto FN-G coated cell culture inserts. Controls were cells seeded without the ECM coating and both groups were cultured in growth media under standard conditions (37 °C, humidified, 95% air, 5% CO2). After 48 hours, cell morphology and phenotypic marker expression were evaluated via histology and immunofluorescence. The results showed that urothelial cells formed tightly packed multilayers when both cells and the substrate were coated with FN-G. While all groups displayed basal and superficial urothelial cell phenotypic markers, the multilayer structure showed higher expression of umbrella cell markers and tight junction markers at the apical surface. These results indicated that the 3D microenvironment of cultured urothelial cells impacts their phenotype and such 3D constructs may serve as a better microenvironment of cultured urothelial cells impacts their surface. These results indicated that the 3D microenvironment of cultured urothelial cells impacts their phenotype and such 3D constructs may serve as a better urothelial tissue model for testing of pharmacological compounds than conventional monolayer cultures.

**IMPACT OF ATRA ON OVALBUMIN AND MOLD-SENSITIZED F344 RATS AND REVERSAL OF HEALTH-RELATED IMPLICATIONS BY CITRAL**

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The objective of this study was to evaluate their interaction as a remedy for hypervitaminosis A. This IACUC approved in vivo study used Fischer 344 rats (n = 80, 229 to 273g), which were randomly assigned to controls as well as ovalbumin and mold-sensitized treatment groups (0.80 mg/kg and 1X109 mold spores combined from 4 strains/100 μl intra-tracheal; all others were dosed by intra-peritoneal injection at days 1 and 7 with 80 mg/kg each of ATRA as well as 20 and 50 mg/kg each of Citrals 1 or 2 individually or in combination to represent all four chemicals and mold spores treatments. Animals were housed in rat cages at the JSU Research Animal Core Facilities and were placed on a 12:12 light–dark cycle. A standard rodent diet and water access were provided ad-libitum. Rat weights were recorded on day 1 and 21, all animals were sacrificed on day 21 and blood was collected and processed for hematological parameters. Results showed that even though C1 and C2 were not toxic individually, their combination at high dosing was lethal. Exposure of ovalbumin-sensitized rats to ATRA showed various levels of weight losses and negative hematological implications that were ameliorated by exposure to Citrals at various combinations with retinoic acid. Taken together, the study showed that there are variable pathophysiological responses from the interaction of ovalbumin, mold spores and retinoic acid and that Citrals were found to be individually effective in reversing health-related pathophysiologys.

**PATIENT-SPECIFIC TREATMENT PLANNING FOR IRREVERSIBLE ELECTROPORATION: A NUMERICAL ANALYSIS WITH USING DYNAMIC ELECTRICAL TISSUE PROPERTIES FROM HUMAN PANCREATIC TISSUE**

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Irreversible electroporation (IRE) is a minimally invasive focal ablation technique used to nonthermally ablate soft tumor tissue. Due to its nonthermal mechanism of ablation, IRE can be safely implemented in unresectable tumors located near critical vasculature. Although effective, widespread use of IRE is hindered by challenges associated with accurate treatment planning protocols and the total duration of treatment. Our group has established a pre-treatment planning methodology for IRE procedures in locally advanced pancreatic cancer (LAPC). In order to better inform these numerical models, human pancreatic tissue samples from both malignant and healthy tissue were subjected to pulsed electric fields and the resulting voltage and current waveforms were analyzed to determine the changes in tissue impedance as a function of electroporation. This relationship was applied to the numerical model. By simulating Joule Heating effects and heat transfer within biological tissue (Pennes Modified Bioheat Equation), we determined the rise in temperature due to IRE therapy (<12°C) and established that the use of multiple monopolar or bipolar probes are capable of ablating large tumors with minimal rise in temperature. Additionally, by incorporating a dose-dependent thermal damage integral, we calculated the volume of tissue ablated by thermal means, and show this volume to be minimal compared to IRE ablation volume.

**DEACTIVATION OF NEMATODE EGGS IN WASTEWATER FOR PARASITIC DISEASE MITIGATION**

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The eggs of parasitic helminth worms are incredibly resilient—possessing the ability to survive changing environmental factors and exposure to various chemical treatments—and while conventional sanitation methods are able to inactivate the eggs, they are largely inefficient in doing so. This research reports on the effectiveness of electroporation to dispatch the eggs of Caenorhabditis elegans (C. elegans), a helminth surrogate, and explores applications for wastewater sanitation. This technique which has traditionally used electric pulses to increase cell membrane permeability is used to open pores in non-parasitic nematode eggshells in the current study. This is the first report of such...
an application, to the best knowledge of the authors. A parametric evaluation of electric field strength and treatment duration of eggs and worms in phosphate buffer solution was performed using a 1-Hz pulse train of 0.01% duty cycle. The extent of pore formation was determined by quantifying the fluorescence intensity of propidium iodide, a fluorescent label that targets C. elegans embryonic DNA. Both in-situ and ex-situ fluorescent microscopic imaging of C. elegans during treatment was performed in custom designed test cells. The results of this research demonstrate that electroporation increases eggshell permeability through potential channel formation within the shell. No obvious change in the geometric size and shape of the eggs was observed. Based on our observations thus far, we discuss current treatment conditions and associated energy consumption requirements for destroying C. elegans eggs, and by extension helminth parasites, in wastewater.

**FABRICATION OF 3D ALGINATE HYDROGEL SCAFFOLDS**

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Sodium alginate, a natural polymer with low toxicity and proven biocompatibility, has been investigated for cell encapsulation in biotechnology and medical applications like, new drug development, toxicity testing, tissue engineering and controlled release of therapeutic agents. This research focused on fabrication of alginate based hydrogel encapsulates with three different types of cells: primary rat hepatocytes, human liver carcinoma cell (HepG2) and human bronchial epithelium (BEAS 2B). Cell encapsulates were made by using electrostatic process. High densities, 25-40 million per ml of cells were successfully encapsulated in the hydrogel microbeads. The encapsulation efficiency was nearly 100 %. Microbeads size was in the range of 300-600 µm, which was determined by using inverted microscopy. Microbeads retained their stable 3D morphology even after 2 weeks of incubation in cell media. LDH assay showed viability of the encapsulated cells at 80% after 24 h incubation. This is also supported by live dead staining of encapsulated cell. These microbeads could be potentially used in different field of biotechnology including tissue engineering and organ specific toxicity testing.

**BIODEGRADABLE SIMVASTATIN-CONTAINING POLYMERIC PRODRUGS FOR IMPROVED DRUG RELEASE**

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The use of simvastatin for bone regeneration is a promising and growing area of research. Simvastatin can promote osteoblastic activity and inhibit osteoclastic activity, which is important for bone regeneration. Our group previously developed and explored the physical and chemical properties of a simvastatin containing polymeric prodrug [RSC Adv 4: 58287, 2014]. The hydrophobic nature of the prodrug component of the block co-polymer, however, leads to slow release of simvastatin in vitro. In this study, we hypothesized that degradation could be accelerated by chemically modifying the polymer backbone by introducing glycolide and lactide co-monomers. Copolymers were formed by ring-opening polymerization using 5 kDa monomethyl ether poly(ethylene glycol) (mPEG) as the initiator in presence of triazabicyclodecene catalyst. In addition to simvastatin, modified reaction mixtures contained lactide or glycolide. In vitro drug release was evaluated using small prodrug pellets (~20 mg) prepared by solvent casting on Teflon. Discs were incubated in phosphate-buffered saline, pH 7.4, under continuous shaking at 37ºC. Incorporation of the less hydrophobic glycolide monomer in the reaction resulted in a polymer that released more simvastatin compared to incorporation of the hydrophobic lactide monomer. In summary, we modified simvastatin release from the degradable polymeric prodrug by chemically modifying the polymer backbone.

**CHARACTERIZATION OF BLUE LIGHT CROSSLINKED POLY(B-AMINO ESTERS)**

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Current methods of poly(β-amino ester) (PBAE) crosslinking involve the use of toxic solvents and harmful ultraviolet (UV) irradiation, both of which raise cytotoxicity concerns for in situ polymerization. The aim of this study was to develop an aqueous blue light (BL) crosslinking protocol and compare it to UV crosslinking. Poly(ethylene glycol) diacrylate (H), tetra(ethylene glycol) diacrylate (D), and di(ethylene glycol) diacrylate (A) were reacted with isobutylamine (6) using a 1.2:1 molar ratio of acrylate to amine, based on previous research [Adv Mater 18:2614, 2006]. Five different macromers were synthesized: H6, DH6 3:1, AH6 3:1, D6, and A6. Degradation and swelling ratios, along with mechanical studies, were used to characterize the two polymerization methods. There were no differences in degradation profiles between the crosslinking methods, but BL crosslinked hydrogels had higher swelling ratios, lower density, and lower modulus when compared to those prepared by UV crosslinking. In summary, BL polymerization imparts differences in mechanical properties, swelling, and density of the PBAEs tested while still retaining the degradation profiles associated with the UV polymerization method.

**CONCENTRICALLY AND AXIALLY MULTIZONAL HYBRID POLYMERIC SCAFFOLDS**

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Spatiotemporal control and patterning of signals is a critical design element in the engineering of scaffolds to mimic and maintain the complex structure of tissues. In the present study, concentrically and axially graded systems were examined to determine the compositional relationship, mass loss, and
pattern of porosity development to design application-based scaffolds.

**LASER PROBE WITH INTEGRATED COOLING FOR SUBSURFACE TISSUE THERMAL REMODELING**

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Introduction: Over 6.5 million women in U.S. suffer from stress urinary incontinence (SUI). Only ~200,000 women choose surgery. There is a role for a non-surgical, minimally invasive procedure that provides thermal shrinkage/remodeling of submucosal collagen in endopelvic fascia. This study describes design, characterization, and preliminary testing of a novel probe with integrated contact cooling for potential use in transvaginal laser treatment of SUI. Methods: Laser energy at 1075 nm was delivered through a 600-micron-core fiber optic patchcord into a 90° side-firing probe (19 x 22 mm) with integrated flow cell and sapphire window cooled to -4°C by circulating an alcohol-based solution. An inflatable balloon attached to probe insured contact with vaginal wall. A force sensor and thermocouples monitored pressure and temperature. Thermal lesions were created in three cadavers in a dose escalation study (P = 4.6-6.4 W, Spot = 5.2 mm, Time = 30 s). Results: Thermal lesion areas measured 3.1-4.6 mm², while preserving vaginal wall to a depth of 0.8-1.1 mm. Consistent tissue contact and cooling was maintained using force sensors. Conclusions: Preliminary cadaver studies demonstrated subsurface treatment of endopelvic fascia with partial preservation of vaginal wall. Future studies will optimize parameters for thermal remodeling with tissue surface preservation.

**FABRICATION OF PLGA/PCL COMPOSITE FIBERS FOR CONTROLLED DRUG RELEASE**

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Controlled release of drug with implanted medical devices are useful to avoid high drug dose to limit non-target site toxicities. In traditional drug delivery system, the amount of drug in blood could remain between a maximum and minimum level where the maximum level indicates toxicity to the body and the minimum value implies the ineffectiveness of the drug. However, in controlled drug delivery system, controlled release rate of drug, slow or fast, enables to maintain constant level of drug in blood for the desired period. In our research electrospun composite nano fibrous scaffolds of Poly (d-Lactic-co-glycolic) acid (PLGA) and polycaprolactone (PCL) were designed and fabricated for controlled drug release. Electrospinning is a useful tool in drug delivery as it allows to control diameter, material composition, and geometry of fibers. PLGA and PCL have been chosen because of their long track record to produce various structures and drug delivery devices since they have high profile of biocompatibility and biodegradability. These polymers can disperse into biologically suitable molecules that can be absorbed and removed from our body through metabolic process. The release of drug can be adjusted by varying polymer weight ratio. We have investigated the nanofibrous composite scaffold’s surface morphology, drug release profile in phosphate-buffered saline (PBS) and mechanical properties for its potential application as a biomedical implant device.

**MAGNESIUM OXIDE INCORPORATED ELECTROSPUN NANOFIBER OF NATURAL-SYNTHETIC COMPOSITE POLYMER BLENDS**

Udhab Adhikari, Jagannathan Sankar, Narayan Bhattarai NCAT, Greensboro, NC, USA.

The ability to produce composite nanofibers of inorganic particles, natural and synthetic polymers represents a significant advancement in the development of composite materials for potential biomedical applications because they capitalize on the favorable biological properties of the natural polymer and the ceramic, and superior mechanical properties of the synthetic polymer. However, effective synthesis of well-blended composite fibers remains a great challenge due to the poor miscibility between polymers and ceramic particles at the molecular level. In this study, composite nanofibers of magnesium oxide (MgO), poly(e-caprolactone) (PCL) and chitosan (CS) with diameters in the range of 0.7–1.3 µm were fabricated by electrospinning their blend solutions in trifluoroethanol and water. To support the potential use of these nanofibrous membranes for biomedical applications their physicochemical properties such as morphology, mechanical strength, and integrity in aqueous medium, were studied. Cellular compatibility was determined using cell viability assays and microscopy imaging, with the results showing that the nanofibrous membranes support 3T3 cell viability and attachments. The new composite nanofibrous membranes developed in this study can mimic the physical structure and function of tissue extracellular matrix (ECM) and thus have potential for many tissue engineering applications.

**CHITIN BASED ELECTROSPUN NANOFIBERS AND FILMS FOR APPLICATIONS IN BIOMEDICAL FIELDS**

Junghyun Jun, Udhab Adhikari, Jagannathan Sankar, Narayan Bhattarai NCAT, Greensboro, NC, USA.

Tissue Engineered scaffolds should be composed of biocompatible and biodegradable materials, exhibit mechanical properties like those of target tissue as well as have the structural and chemical properties closely mimicking those of the extracellular matrix (ECM). In this research, we explore the possibility of using poly(caprolactone) (PCL) and chitin to prepare nanofibrous mesh and films as suitable devices for biomedical implant applications. Chitin, a natural
polymer is nontoxic, biodegradable, biocompatible and has been widely used for wound healing, enzymes immobilization, drug delivery and space-filling implants. PCL, an aliphatic synthetic polymer is biocompatible and has mechanical properties superior to natural polymers. Composite scaffolds of PCL and chitin were fabricated using electrospinning and spin coating technology in the form of nanofibrous mesh and films respectively. Scanning electron microscopy (SEM), Atomic force microscopy (AFM), Fourier transform infrared (FTIR), and mechanical test were done to evaluate the properties of composites in general for biomedical applications.

**GENERATION OF RAPID In Situ FORMING CHANNELS WITHIN SOFT BIOMATERIALS VIA BIODEGRADABLE FIBER POROGENS**

**Alexander Chen, David Paleo**

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Generation of continuous predefined channels within soft biomaterials is a challenge facing scaffold design for oriented tissues. Traditional methods of controlled pore generation in biomaterials depend on leaching of rigid sacrificial materials (e.g., sodium chloride, sucrose, and poly(lactic acid)). Such sacrificial casting methods employ harsh solvents and form features prone to damage and collapse during handling. Use of *in situ* degrading porogens circumvents porous material weakness by providing transient stabilization as well as additional drug delivery options. The purpose of this study was to evaluate the viability of rapidly degrading poly(b-amino acid) (PBAE) fibers as continuous *in situ* degrading porogens. PBAEs form versatile hydrogels with mechanical properties appropriate for soft tissue applications and can rapidly degrade via hydrolysis, but have not previously formed fibers. Preliminary thermopolymerization methods demonstrate rapid and consistent discrete fiber production. Encapsulated fibers with exposed ends form channels with defined edges within soft PBAE matrices within 3-5 days of immersion in phosphate-buffered saline. Channels are absent of obstruction and appear to be continuous from end to end. However, completely encapsulated fibers exhibited delayed or incomplete path clearance. Preliminary results indicate that rapidly degrading PBAE fibers may be used to generate continuous paths within soft biomaterials without requiring additional solvent rinses to remove embedded porogens.

**CRYOGENIC PRESERVATION OF HEPATOCYTE ENCAPSULATES**

**Erika Johnson¹, Shalil Khanal¹, Jeffery Macdonald², Jagannathan Sankar¹, Narayan Bhattarai¹**

¹NCAT, Greensboro, USA. ²NCAT, Greensboro, NC, USA.

Cryopreserved hepatocyte encapsulates often have reduced viability and metabolic function in comparison with fresh cells and hence are often not suitable for clinical use. The lack of specific methodology for the cryopreservation of engineered cell encapsulates however, poses a challenge in creating a sustained post-thaw model. The aim of this study was to modify the different steps in the standard cryopreservation procedure in an attempt to improve the overall outcome. Controlled rate cryogenics is an attractive option for maximizing cell viability and preserving liver functions. The solution holds numerous potential benefits because primary hepatocytes experience expedited loss of metabolic function ex-vivo. In this work, we designed alginate encapsulated hepatocyte microencapsulates, and subsequently we developed a cryopreservation protocol. Different compound including fructose, alpha lipolic acid, ADP and dexamethasone (DEX) were used in pre-incubation culture to improve encapsulates viability. Encapsulates preincubated in DMEM culture media, DEX media and sugar media showed relatively better viability after thaw and post thaw culture at different time points. It was also found that dynamic post-thaw culture greatly improved sustained viability. Ongoing studies stemming from this research will include varying concentrations of the identified sugars and define application amongst other types of 3D engineered constructs.

**OBSERVING TRENDS IN VITAMIN D SUPPLEMENTATION: NATIONAL HEALTH AND NUTRITION EXAMINATION SURVEY 2009-2014**

**Shamonica King, Hamed Benghuzzi**

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Decades of research have proven the efficacy of vitamin D in health and wellness, as well as, disease prevention. Adequate consumption of vitamin D is not commonly obtained by nutrient consumption in food alone. Therefore vitamin D supplementation is commonly recommended or prescribed to obtained adequate intake of vitamin D. This study analyzed trends in the frequency of Vitamin D supplement consumption for cycle year 2009-2010 through 2013-2014. Supplement information was obtained from National Health and Nutrition Examination Survey (NHANES) responses. Supplements which contained vitamin D were uniquely included in this study. This supplement information was used to observe the trends in vitamin D consumption in the total population, and by gender, race/ethnicity and age groups. The results of this study revealed that vitamin D is consumed mostly through multivitamins. The results also revealed an incline of vitamin D supplement consumption and a decline of those who consume calcium supplements containing vitamin D. This study concludes a positive trend in the consumption of the supplements containing vitamin D, which may be due to years of vitamin D research.

**BLUETOOTH ENABLED SMARTPHONE APPLICATION FOR WIRELESS PHOTOPLETHYSMOGRAPHY MONITORING DEVICES**

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**Purpose:** The purpose of this study was to determine the effect of different types of breathing exercises on blood pressure, heart rate, and respiratory rate. **Subjects:** The study was performed on 45 healthy volunteer subjects ranging from 21-50 years of age. **Methods:** Subjects were randomly divided into three equal groups: control breathing (C, n=15), shallow breathing (SB, n=15) and combined breathing (diaphragmatic and pursed-lip breathing techniques used together; CB, n=15). Blood pressure (BP), heart rate (HR), and respiratory rate (RR) were recorded before and after the breathing exercises. Each subject was instructed and given a demonstration of their specific breathing exercise. Each subject successfully performed the assigned breathing exercise for fifteen minutes. All data were analyzed using repeated analysis of variance. **Results:** The mean RR in C group before and after breathing exercises were 14.27±2.84 and 14.53±4.61, respectively. The mean RR in SB group before and after breathing exercises were 15.27±3.26 and 17.47±4.07, respectively. The mean RR in CB group were 14.33±3.75 and 12.67±2.50, respectively. SB had significantly increased RR (P<0.05) and CB had significantly decreased RR (P<0.05). There were no significant changes in blood pressure and heart rate. **Conclusion:** This pilot study indicates that 15 minutes of breathing exercises has no effect on BP and HR, but SB significantly increases respiration and CB significantly decreases RR. **Clinical relevance:** It has been shown that an increase in RR is associated with an increase in stress and a decrease in respiratory efficiency and endurance. Therefore, this pilot study results may suggest that CB breathing technique could be used to decrease RR, to relieve stress and to increase respiratory efficiency. Future study is needed to determine the long term effect of CB breathing on cardiovascular and stress responses, especially for patients with respiratory problems and those patients in stress induced situations.

**THE EFFECTIVENESS OF PAP OVER DIFF QUICK (DQ) STAINING METHODS ON THE ASSESSMENT OF ESTRUS CYCLE UPON THE EXPOSURE TO SUSTAINED DELIVERY OF ESTROGEN BENZOATE USING ADULT SD RATS AS A MODEL**

Zelma Cason, Hamed Benghuzzi, and Michelle Tucci. University of Mississippi Medical Center, Jackson, MS, USA

The short length of the estrous cycle in rats (4 days) considered an excellent model to assess the effectiveness of mode of delivery of hormones by means of tricalcium phosphate devices. The advantage would be rapid observations of changes that occur during the reproductive cycle. The aim of the present work was to provide the literature with more insights regarding the distinction between PAP over Diff Quick (DQ) staining methods upon sustained delivery of estrogen benzoate. The target of assessment was to observe the distribution of cornified cells during proestrus,
estrus, metestrus and diestrus. Eight female rats (four control and four experimental) were (R1-R8) used in this study. Cyclic activity at 2, 4, 8, 12, 24, 36, 48, 72 hours were determined. Briefly, 0.5 ml Hank’s solution was placed within the vaginal canal for few seconds followed by aspiration. This mixture was then smeared onto microscopic slides and stained using a routine PAP and Diff Quick (DQ) staining methods. Data obtained revealed that the PAP stain proved to be a better staining technique than the DQ stain in both nuclear and cytoplasmic details. Histologically, keratinization of the vaginal epithelium appeared to be evident at the estrus phase (day 4) of a 4-day cycle (3 rats out 4). This keratinization process is dependent on the endogenous estradiol secreted between the evening of diestrus 2 (day 2) and that of proestrus (day 3). In the second stage of this experiment, the rats labeled R1-R4 were used as controls, whereas lab rats R5-R8 had estrogen administered (2mg/ml) to them for three days. The results showed a significant increase in the proliferation of degenerative cells in the E treated rats compared to control animals. Inhibition of vaginal keratinization was obvious and this protocol can be used as a rapid and convenient \textit{in vivo} investigational model for screening the effects of agents that have antikeratinizing activity.

THE EFFECTS OF SUSTAINED DELIVERY OF DANAZOL PLUS TESTOSTERONE ON THE FUNCTIONAL ACTIVITY OF KIDNEY USING ADULT RATS AS A MODEL

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Androgens such as danazol (D) therapy has shown to be efficacious in treatment of endometriosis. Several attempts to utilize the native androgen (testosterone (TE)) have shown different physiological responses. The specific objective of this study was to investigate the role of sustained delivery of D alone or in combination with TE on the functional and structural capacity of the kidney using adult female rats as a model. A total of 40 adult female rats were subdivided into five equal groups. Groups I-II were ovariectomized (OVX), rats in groups II and II were implanted with tricalcium phosphate lysis (TCPL) drug delivery system loaded with 40 mg of D or D+TE and rats in group V served as a control (intact) group. At the end of 60 days post treatment the animals were sacrificed and vital organs were collected and analyzed (H&E). The results of this investigation suggest: (i) TCPL delivery system released D and D+TE at a sustained level for 60 days (D= 3-5 ng/ml, TE= 5-7 ng/ml), (ii) the wet weights of kidneys (normalized to body weight) were increased (p<0.05) in rats exposed to D compared to control, (iii) no changes in other vital organs (spleen, heart, lungs, and liver), and (iv) animals exposed to sustained delivery of D or D+TE had remarkable kidney tubular epithelial injury. In conclusion, this study suggests that exogenous D or D+TE therapy in female animals could lead to irreversible tubular damage and consequently renal system complication.

NANOCRYSTALLINE CERIUM OXIDE CONJUGATED WITH SOD’S ANTIOXIDANT ACTIVITY AFTER HEATING

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After a patient suffers a myocardial infarction, his/her heart has an imbalance between oxygen supply and demand and blood flow must be restored to reduce tissue damage. Oxidative stress, in the form of reactive oxygen species (ROS), plays a large role in this damage. In an effort to reduce the impact of the oxidative stress, superoxide dismutase (SOD) is often used. SOD is an enzyme that catalyzes the transition of superoxide anion into hydrogen peroxide, an inhibitor of SOD. A possible solution for this is conjugating it with nanocrystalline cerium dioxide (nanoceria). Cerium dioxide is known for its antioxidant properties caused by mixed valence states. Since the conjugates need to remain in the body for a long duration, the thermal stability is important. Ceria-SOD conjugates were prepared by mixing the solutions at five different particle ratios including 1:0, 1:5, 1:10, 1:20, and 1:50. The conjugates were heated to 60, 70, 80, and 90 degrees Celsius for 30 minutes. Our unheated sample showed that an increase in nanoceria helped the free radical disproportionation up until 1:10 particle ratio where it hit its maximum. As the heat increased the SOD began to denature and disproportioned fewer free radicals. Increasing the nanoceria in the samples allowed the heated samples to disproportionate more free radicals as compared to the SOD only samples. Results also showed that nanoceria provides an increase in free radical scavenging when conjugated with SOD.
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