

33rd Annual Meeting

March 17-19, 2017

Courtyard by Marriott Beachfront, Gulfport, MS



Program and Abstracts

For

33rd ANNUAL SOUTHERN BIOMEDICAL ENGINEERING CONFERENCE

March 17-19, 2017

Program Co-Chairs

Hamed A. Benghuzzi, Ph.D.

Department of Diagnostic and Clinical Health Sciences
University of Mississippi Medical Center
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University of Mississippi Medical Center
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Amol Janorkar, Ph.D.

Ibrahim Farah, Ph.D.

Joseph A. Cameron, Ph.D.

Felix Adah, Ph.D.

Gerri Wilson, Ph.D._c

Tom Rich, Ph.D.

Ken Butler, Ph.D.

Lynne Jones, Ph.D.

Lir-Wan Fan, Ph.D.

Adel Mohamed, M.D.

Jafar Vossoughi, Ph.D.

Elgenaid Hamadain, Ph.D.

Tom Fields, MS

Olga McDaniel, Ph.D.

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Angelia Garner, Ph.D.

Zelma Cason, Ph.D.

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Amol Janorkar, Ph.D.

Tom Rich, Ph.D.

Adel Mohamed, M.D.

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Zelma Cason, Ph.D.

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Bryant Hollins, Ph.D.

Teresa Murray, Ph.D.

Saami Yazdani, Ph.D.

Leon Iaesmidis, Ph.D.

Min Huang, Ph.D.

Jamil Ibrahim, Ph.D.

C. Lashan Simpson, Ph.D.

Ramesh Patel, M.D.

MD. Alagmir Hossain, Ph.D.

Pradip Biswas, Ph.D.

Ahmed El-Ghannam, Ph.D.

Vinoy Thomas, Ph.D.

Gene Bidwell, Ph.D.

Silas Levesley, Ph.D.

Ali Abu El Humos, Ph.D.

Xiaoli Dai, M.D.

Jens Rosenberg, Ph.D.

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33rd SOUTHERN BIOMEDICAL ENGINEERING CONFERENCE

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.

The Conference will be held at the **Courtyard by Marriott Gulfport Beachfront** which is located approximately 75 miles east of New Orleans, LA on interstate 10, and 65 miles from Mobile International Airport. SBEC participants can make reservations by calling the hotel directly at **1-228-864-4310**. Please indicate that you are attending the SBEC to receive the discounted rate (\$129 per night includes breakfast). The hotel is easily accessible from I-10 East and West, Exit at Gulfport Interstate 49 South toward interstate 90. Take a left on interstate 90 and it is approximately 0.5 miles on the left hand side.

Registration and Fees

Initial on-site registration will be held from 5:00–8:00 p.m., Thursday, March 16, 2017, and will continue all day Friday and Saturday. Participants are encouraged to preregister on the website or by returning the registration post-marked by February 17, 2017 to take advantage of the reduced registration rates.

Fees before February 17, 2017

Students:	\$190
Faculty/Staff:	\$280

Fees after February 17, 2017

Students:	\$225
Faculty/Staff:	\$375

Conference registration fees are non-refundable after February 17, 2017

Abstracts and papers (if submitted) will be removed from the program if presenter fails to register according to the timelines.

Major Sponsor of 33rd SBEC



Mississippi Academy of Sciences

Sponsors

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Track Chairs

Biomedical Systems Modeling and Dynamics	Leon Iaesmidis (Sessions VII and XIII)
Biomechanics and Signals Acquisition	Ahmed El-Ghannam (Session I)
Biomaterials and Nanotechnology	Amol Janorkar (Sessions III and X)
Biomedical Education and Ethics	Subrata Saha (Sessions II, VI, and XII)
Drug Delivery and Chemistry	Hamed Benghuzzi (Sessions IX and VIII)
Biosensors and Diagnostic Systems	Jafar Vossoughi (Session IV)
Clinical Applications and Therapeutics	Michelle Tucci (Sessions V and XI)

Session Chairs

#	Session	Chair	Co-Chair
I	Biomaterials-Tissue Engineering	Amol Janorkar	Vinoy Thomas
II	Biomechanics - I	Saami Yazdani	Subrata Suha
III	Biomaterials-Chemistry	Pradip Biswas	Alagmir Hossain
IV	Education and Research Training	Joseph A. Cameron	Zelma Cason
V	Molecular-Clinical Markers	Olga McDaniel	David Pasco
VI	Biomechanics - II	Mohammed Benalla	Bryant Hollins
VII	Modeling-Patient Safety	Elgenaid Hamadain	Ramesh Patel
VIII	Drug Delivery	Kenneth Butler	Gene Bidwell
IX	Nutraceuticals - Tissue Engineering	Ibrahim Farah	Larry McDaniel
X	Biomaterials	Jafar Vossoughi	Ahmed El-Ghannam
XI	Technology in Healthcare	Thomas Rich	Teresa Murray
XII	Therapeutics in Rehabilitation	Felix Adah	Angelia Garner
XIII	Neuroscience	Lir-Wan Fan	Min Huang
XIV	Poster	C. LaShan Simpson	Jamil Ibrahim

33rd Annual Meeting

Program



Friday, March 17, 2017

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

8:00-8:15 am **Opening of the Meeting (Coastal A and B)**
Ham Benghuzzi, Ph.D. Program Co-Chair
Michelle Tucci, Ph.D. Program Co-Chair

8:15-8:45 am: Keynote Speaker – I

“Multifunctional Bioceramics for Innovative Therapy”

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



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.

8:45-9:15 am: Keynote Speaker – II

“Clinical Trial of Medical Devices”

Jafar Vossoughi, Ph.D.

President, Biomedical Research Foundation
President, Engineering and Scientific Research Associates
Adjunct Professor, Fischell Department of Bioengineering University of Maryland,
Fellow: American Institute of Medical and Biological Engineers
Fellow: American Society of mechanical Engineers
Fellow: European Academy of Sciences
Fellow: Washington Academy of Sciences



Dr. Vossoughi received his Ph.D. degree in Applied Mechanics and Biomechanics from the Catholic University of America in Washington, DC in 1989. He has been a faculty member at the Catholic University of America, University of District of Columbia, and the University of Maryland. Dr. Vossoughi has taught many engineering, biomedical, and clinical courses to engineering students, residents, and physicians. For his work in the area of applied biomechanics he has been recognized by numerous professional societies, including the Arthur Guyton Award on Cardiovascular Physiology, Samuel Sideman Award of Cardiovascular Biomechanics, C. William Hall Research Award in Biomedical Engineering, and several dedicated service awards. He serves as a guest scientist and consultant to the FDA Center for Devices and Radiological Health along with several other government and private agencies. He has published over 250 peer reviewed papers, 14 book chapters, and 16 books.

9:15-9:30 am: Break

March 17, 2017

Scientific Sessions: Concurrent Sessions I & II

Friday Morning	Talk #	Conference Room Coastal A
Time		Session I: Biomaterials - Tissue Engineering Session Chair: Amol Janorkar Co-Chair: Thomas Vinoy
9:30	1	NANOSTRUCTURED SCAFFOLDS FOR REGENERATIVE MEDICINE AND TISSUE ENGINEERING Jafar F. Al-Sharab and Mohammed Benalla <i>Northwestern State University Natchitoches, LA, USA</i>
9:45	2	CHANGES IN NEURAL CELLS GROWN ON NOVEL HIGH ASPECT RATIO SCAFFOLD VERSUS MONOLAYER CULTURE Kayla Ponder, Mark DeCoster, and Teresa Murray <i>Center for Biomedical Research and Rehabilitation Science, Ruston, LA, USA</i>
10:00	3	USING POLYMER BULK DIFFUSION AS A MECHANISM FOR ADVANCING TISSUE ENGINEERING APPLICATIONS Kelsey Phelan and Bryant Hollins <i>Louisiana Tech University, Ruston, LA, USA</i>
10:15	4	BENEFICIAL EFFECTS OF SEMEN PURIFICATION WITH MAGNETIC NANOPARTICLE Casey Durfey ¹ , Sabrina Swistek ^{1,2} , Wei Tan ³ , Henry Clemente ⁴ , Peter Ryan ^{1,4} , Scott Willard ^{1,2} , and Jean Feugang ¹ <i>¹Departments of Animal and Dairy Sciences, ²Biochemistry and Molecular Biology & Entomology and Plant Pathology, ³Basic Sciences, ⁴Pathobiology and Population Medicine at Mississippi State University, ⁵Clemente Associates, Madison, CT, USA</i>
10:30	5	THE EFFECT OF LOW LIGHT LASER ON MESENCHYMAL STEM CELLS David Gordy, Gerri Wilson, Felix Adah, Osasua Adah, Min Huang, Michelle Tucci, and Hamed Benghuzzi <i>University of Mississippi Medical Center, Jackson, MS, USA</i>
10:45		BREAK

Friday Morning	Talk #	Conference Room Coastal B
Time		Session II: Biomechanics - I Session Chair: Saami Yazdani Co-Chair: Subrata Saha
9:30	6	EFFECT OF MUSCLE ENGAGEMENT AND MEASUREMENT POSITION ON ELECTRICAL IMPEDANCE OF THIGH MUSCLES Joseph Mathews and Todd Freeborn <i>The University of Alabama Tuscaloosa, AL, USA</i>
9:45	7	HEAT TRANSFER MODEL OF HUMAN THIGH: IMPLICATIONS FOR TOURNIQUET USE Luke Smith and David Nelson <i>University of South Alabama, Mobile, AL, USA</i>
10:00	8	FUNDAMENTALS OF LOAD TRANSFER MECHANISMS IN BIOSTRUCTURES: A COMPLEX NETWORK APPROACH Reena Patel ¹ , Guillermo Riveros ¹ , and David Thompson ² <i>¹US Army Engineer Research and Development Center, Vicksburg, MS, USA, ²Mississippi State University, Starkville, MS, USA</i>
10:15	9	MECHANO-MORPHOLOGICAL AND CELLULAR DEPENDENCE ON FIBER CHARACTERISTICS IN WET-LAID SCAFFOLDS Andrew Wood ¹ , Dominique Everett ¹ , Sanjay Kumar ² , and Vinoy Thomas ¹ <i>¹University of Alabama Birmingham, AL and ²Alabama State University, Montgomery, AL, USA</i>
10:30	10	VARIABILITY OF ELECTRICAL IMPEDANCE MEASUREMENTS COLLECTED FROM HUMAN FOREARM USING MULTIPLE ELECTRODE CONFIGURATION Shelby Critcher and Todd Freeborn <i>The University of Alabama, Tuscaloosa, AL, USA</i>
10:45		BREAK

33rd SOUTHERN BIOMEDICAL ENGINEERING CONFERENCE

Scientific Sessions: Concurrent Sessions III & IV

Friday Morning	Talk #	Conference Room: Coastal A
Time		Session III: Biomaterial - Chemistry Session Chair: Pradip Biswas Co-Chair: Algimir Hossain
11:00	11	PROSPECT OF BIOFLAVONOIDS AS G₄/C₄ LIGANDS: SPECTROSCOPIC INVESTIGATIONS Bidisha Sengupta <i>Tougaloo University, Tougaloo, MS, USA</i>
11:15	12	STRUCTURAL KINETICS OF OXIDATIVE DNA DAMAGE FROM HYDROGEN ATOM TRANSFER Pradip Biswas <i>Tougaloo University, Tougaloo, MS, USA</i>
11:30	13	DIRECT ARYLATION POLYMERIZATION SYNTHESIS OF A SERIES OF NEW SILOLE-BENZAZOLE COPOLYMERS Colleen Scott ³ , Milind Bisen ¹ , Sam McKinnon ³ , Dominik Stemer ² , and Christine Luscombe ² ¹ <i>Southern Illinois University, Carbondale, IL, USA</i> , ² <i>University of Washington, Seattle, WA, USA</i> , ³ <i>Mississippi State University, Mississippi State, MS, USA</i>
11:45	14	VISUAL SENSING OF ANIONS BY SYNTHETIC RECEPTORS Algimir Hossain, Maryam Emami Khansari, Corey R. Johnson, and Bobby Portis <i>Jackson State University, Jackson, MS, USA</i>
12:00	15	STRUCTURAL MOTION OF DI-HEME PROTEIN MAUG AND ITS FUNCTIONAL ROLE Manliang Feng <i>Department of Chemistry, Tougaloo College, Tougaloo, MS, USA</i>

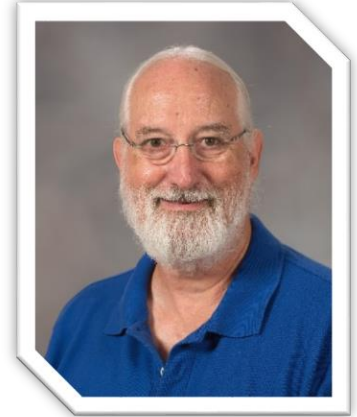
Friday Morning	Talk #	Conference Room: Coastal B
Time		Session IV: Education and Research Training Session Chair: Joseph A. Cameron Co-Chair: Zelma Cason
11:00	16	INTERACTIVE BIOMEDICAL EDUCATION AND RESEARCH TRAINING Joseph A. Cameron ¹ , Ibrahim Farah ¹ , Ramaiyer Venkatraman ¹ , Hilda Wells ² , Michelle Tucci ³ and Hamed Benghuzzi ⁴ ¹ <i>Department of Biology, Jackson State University, Jackson, MS, USA</i> ; ² <i>Department of Biology, Hinds Community College, Jackson, MS, USA</i> ; ³ <i>Department of Anesthesiology, University of Mississippi Medical Center</i> and ⁴ <i>Department of Clinical Health Sciences, School of Health Related Professions, University of Mississippi Medical Center, Jackson, MS, USA</i>
11:15	17	ATTAINING STEM EXCELLENCE THROUGH RESEARCH TRAINING AT HBCU Maricica Pacurari <i>Jackson State University, Jackson, MS, USA</i>
11:30	18	FIRST THINGS FIRST: LAYING A FOUNDATION FOR STUDENT ENGAGEMENT IN THE CLASSROOM Gloria Miller <i>Jackson State University, Jackson, MS, USA</i>
11:45	19	TAILORING GITLAB FOR COMPUTER SCIENCE PROGRAMMING COURSES Mesafint Fanuel ¹ and Tzusheng Pei ^{1*} , Ali Abu El Humos ¹ , Andrew Villarrubia ¹ , and Hyunju Kim ² ¹ <i>Jackson State University, Jackson, MS, USA</i> and ² <i>Department of Mathematics and Computer Science, Wheaton College, Wheaton, IL, USA</i>
12:00	20	ACTIVE LEARNING CLASSROOMS - TECHNOLOGICAL INNOVATION OR EDUCATIONAL EVOLUTION? A MIXED-METHODS COHORT STUDY EXPLORING THE IMPACT OF ACTIVE LEARNING CLASSROOMS ON STUDENT LEARNING OUTCOMES Xiaoshan Gordy <i>University of Mississippi Medical Center, Jackson, MS, USA</i>

12:30-1:45 pm: Lunch and Workshop: Conference Room: Coastal A & B

“Scientific Writing and Publishing”

Dr. Larry McDaniel

After completing his education and training, Dr. McDaniel has held teaching positions at the University of Mississippi Medical Center, the University of Southwestern Louisiana, University of Oklahoma and the University of Alabama at Birmingham, as well as other positions in the private sector. He is active with editorial service and holds several patents. Dr. McDaniel's research interests include host pathogen interactions and molecular basis of infectious disease. The goal of the workshop is to initiate the development of skills needed to write and submit a scientific manuscript. Insight will be provided into the processes required to successfully publish a scientific article. A brief discussion of ethics in scientific writing will be presented.



**“Power and Sample Size Analysis:
Importance in Research and Approaches to Best Practices”**

Dr. Elgenaid Hamadain

Dr. Hamadain obtained both his MS and PhD degrees from Mississippi State University in the area of Entomology/Toxicology/Statistics. He has held faculty positions at Jackson State University (JSU) and at the University of Mississippi Medical Center (UMMC). During his tenure at JSU he established and was director of an NIH funded Biostatistical Support Unit. As Director of the Core he provided statistical advice to faculty and graduate students within the College of Science, Engineering, and Technology. Dr. Hamadain joined the UMMC faculty in 2006 and has been instrumental in the development and implementation of the biostatistical core courses in the Clinical Health Science graduate program. He has served as the major advisor for 15 students and has been on the advisory committee for over 50 graduate students. He provides statistical advice on all aspects of experimental design, including sample size determination, probability and hypothesis testing, regression and correlation analysis, and parametric and non-parametric analysis. He has significant experience with data analysis using SAS, MINITAB, STATA, and SPSS statistical packages with particular emphasis on experimental design, factorial analysis, Factor Analysis, ANCOVA, logistic and probit analysis, survival analysis, and analysis of risk factors associated with diseases. Dr. Hamadain has conducted biostatistical educational workshops and seminars at local and state level meetings. His interests and publications are in the areas of outcome, epidemiology, analysis of health surveys, and meta-analysis research. The goal of this workshop is to enlighten graduate students and faculty on the importance of power analysis prior to implementing the experiment.



33rd SOUTHERN BIOMEDICAL ENGINEERING CONFERENCE

3:00	31	BIOCOMPATIBILITY OF NOVEL COPPER-CONTAINING BIOCOMPOSITES IN QUANTIFIABLE MODEL CELL SYSTEM Kahla St Marthe, Mark DeCoster, Neha Karekar, and Anik Karan <i>Louisiana Tech University, Ruston, LA, USA</i>
3:15	32	AN EFFORTLESS NON-INVASIVE RESPIRATORY DIAGNOSTIC DEVICE Jafar Vossoughi and Arthur Johnson <i>University of Maryland College Park, College Park, MD, USA</i>
3:30		BREAK

Scientific Sessions: Concurrent Sessions VII & VIII

Friday Afternoon	Talk #	Conference Room: Coastal A
Time		Session VII: Modeling - Patient Safety Session Chair: Elgenaid Hamadain Co-Chair: Ramesh Patel
3:45	33	IN VIVO EVALUATION OF THE EFFECT OF RESONANCE FREQUENCY ON DELIVERING INSULIN NON-INVASIVELY USING ULTRASOUND Khalid Lweesy <i>Jordan University of Science and Technology, Irbid, Jordan</i>
4:00	34	BEHAVIORAL RISK FACTORS ASSOCIATED WITH ADULT OBESITY AND INFLUENCE OF THE BUILT ENVIRONMENT Shelia Baitey and Elgenaid Hamadain <i>University of Mississippi Medical Center, Jackson, MS, USA</i>
4:15	35	COMPARING COLORECTAL CANCERS IN MISSISSIPPI BY RACE, STAGE, AGE, REGION, AND AREA-BASED SOCIOECONOMIC STATUS Deirdre Rogers and Elgenaid Hamadain <i>University of Mississippi Medical Center, Jackson, MS, USA</i>
4:30	36	THE RELATIONSHIP BETWEEN EFFECT SIZE AND STATISTICAL SIGNIFICANCE Jamil Ibrahim ¹ and S Ibrahim ² <i>¹University of Mississippi Medical Center, Jackson, MS, USA and ²Arab American University, Jenin, Palestine</i>
4:45	37	ANTICOAGULANT EFFECTS ON PURE PLATELET-RICH PLASMA Sofia Galdames, Andrea Shimojo, Angela Luzo, and Maria Santana <i>Unicamp Campinas, SP, Brazil</i>
5:00	38	PREVALENCE AND TRENDS OF EARLY CHILDHOOD CARIES EXPERIENCE AND UNTREATED CARIES IN THE MISSISSIPPI HEAD START POPULATION Kristin Nalls, Elgenaid Hamadain, and Denise Krause <i>University of Mississippi Medical Center, Jackson, MS, USA</i>
5:15	39	APPLICATIONS OF RAMAN SPECTROSCOPY AND IMAGING IN MEDICINE Shan Yang <i>Jackson State University, Jackson, MS, USA</i>
5:30		END OF FIRST DAY

Friday Afternoon	Talk #	Conference Room: Coastal B
Time		Session VIII: Drug Delivery Session Chair: Kenneth Butler Co-Chair: Gene Bidwell
3:45	40	THERAPEUTIC GROWTH FACTOR DELIVERY USING THE ELASTIN-LIKE POLYPEPTIDE BIOPOLYMER PLATFORM Gene Bidwell and Alejandro Chade <i>University of Mississippi Medical Center, Jackson, MS, USA</i>
4:00	41	DRUG LOADED HALLOYSITE CLAY NANO TUBES AS TABLET COMPRESSION EXCIPIENT Raghuvara Yendluri ¹ , Yuri Lvov ¹ , and Melgardt De Villiers ² <i>¹Louisiana Tech University, Ruston, LA, USA and ²University of Wisconsin, Madison, WI, USA</i>

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4:15	42	IN VITRO ASSESSMENT OF A KERATOSE-PACLITAXEL DRUG COATED BALLOON Emily Turner ¹ , Marzieh Atigh ¹ , Luke Burnett ² , and Saami Yazdani ¹ <i>¹Department of Mechanical Engineering, University of South Alabama, Mobile, AL, USA and KeraNetics, Winston-Salem, NC, USA</i>
4:30	43	THE EFFECT OF SUSTAINED DELIVERY OF NPY RECEPTOR ANTAGONIST ON BODY WEIGHT Jill Clayton, Michelle Tucci, and Hamed Benghuzzi <i>University of Mississippi Medical Center, Jackson, MS, USA</i>
4:45	44	INCREASED GLUTATHIONE in CAOv-3 OVARIAN CANCER CELLS FOLLOWING DELIVERY OF THYMOQUINONE Jennifer Harpole, Michelle Tucci, and Hamed Benghuzzi <i>University of Mississippi Medical Center, Jackson, MS, USA</i>
5:00	45	LOCAL LIQUID DRUG DELIVERY VIA PERFUSION CATHETER FOR PERIPHERAL ARTERY DISEASE Megan Erwin, Marzieh Atigh, Emily Turner, and Saami Yazdani <i>University of South Alabama, Mobile, AL, USA</i>
5:15	46	MORPHOMETRIC DIFFERENCES IN FIBROUS TISSUE SURROUNDING AMINO ACID COATED UHMW-PE IMPLANTED IN SOFT TISSUE Kenneth Butler, Michelle Tucci, and Hamed Benghuzzi <i>University of Mississippi Medical Center, Jackson, MS, USA</i>
5:30		END OF FIRST DAY

End of Friday's Sessions

5:45 pm: Steering Committee Business Meeting (Members and Invitees)

Saturday, March 18, 2017

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

8:00-8:15 am Opening of the Meeting (Coastal A and B)
Ham Benghuzzi, Ph.D. Program Co-Chair
Michelle Tucci, Ph.D. Program Co-Chair

8:15-8:45 am **Keynote Speaker – III**

“Computational Tools for Prediction Toxicity of Nanomaterials”

Dr. Jerzy Leszczynski

Professor of Chemistry

President’s Distinguished Fellow

Director, NSF Interdisciplinary Nanotoxicity CREST Center

Jackson State University

Jackson, MS



Dr. Leszczynski, a computational quantum chemist, joined the faculty of the JSU Department of Chemistry in 1990. He attended the Technical University of Wroclaw (TUW) in Wroclaw, Poland where he obtained his MS (1972) and Ph.D. (1975) degrees. Two areas of his most notable research contributions are: investigations of DNA fragments and development of novel techniques for investigation of properties and toxicity of nanomaterials.

Dr. Leszczynski has served as referee for over 50 journals and has published about 900 refereed papers and over 70 book chapters. He has given about 1000 presentations, with over 200 of those being invited presentations. His papers have been cited about 20,000 times and, according to the Web of Science, his Hirsh Index amounts to 64. He is the recipient of the White House Millennium Award for Teaching and Research Excellence in Mathematics, Science, and Engineering. Other selected awards include Member of the European Academy of Sciences, 2002; Guest Professorship, Chinese Academy of Sciences, Shanghai, 2002; Honorary Doctorate, Dnipropetrovsk National University, 2003; and Honorary Professorship. He is the chairman of the organizing committee for the annual International Conference Series on Current

Trends in Computational Chemistry (since 1992); chairman of the organizing committee for Southern Schools on Computational Chemistry and Material Sciences Series (since 2001); editor and member of editorial boards of eight journals; editor of a total of 36 books including four book series: “**Computational Chemistry: Reviews of Current Trends**” World Scientific; “**Challenges and Advances in Computational Chemistry and Physics**,” (Springer); “**Practical Aspects of Computational Chemistry**” (Springer); and editor of two editions of the “**Handbook of Computational Chemistry**” (Springer); “**Lecture Notes in Chemistry**” (Springer).

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Scientific Sessions: Concurrent Sessions IX & X

Saturday Morning	Talk #	Conference Room: Coastal A
Time		Session IX: Nutraceuticals - Tissue Engineering Session Chair: Ibrahim Farah Co-Chair: Larry McDaniel
9:00	47	IMPACT OF SOME COMMON ORGANICS ON CELLULAR GLYCOLYSIS AND THE DIFFERENTIAL SURVIVAL OF LUNG FIBROBLAST AND LUNG CARCINOMA CELL LINES Ibrahim Farah <i>Jackson State University, Jackson, MS, USA</i>
9:15	48	UNRAVELING THE MECHANISM OF ACTION(S) FOR THYMOQUINONE AND EGCG ON CANCER CELLS Michelle Tucci and Hamed Benghuzzi <i>University of Mississippi Medical Center, Jackson, MS, USA</i>
9:30	49	TRISENOX INDUCES CELL CYCLE REGULATION AND APOPTOSIS THROUGH MODULATION OF MAPK PATHWAY IN ACUTE LEUKEMIA CELLS Sanjay Kumar and Paul Tchounwou <i>Jackson State University, Jackson, MS, USA</i>
9:45	50	EFFECTS OF CURLY KALE BRASSICA OLERACEA VAR. SABELLICA ON VIABILITY OF CULTURED MOUSE MELANOMA CELLS Bilal Qizilbash and Ibrahim O. Farah <i>Department of Biology, Jackson State University, Jackson, MS, USA</i>
10:00	51	GARLIC EXTRACT DESTROYS THE MEMBRANE INTEGRITY OF HUMAN LEUKEMIA (HL-60) CELLS Sylvianne Njiki, Keara Johnson, and Clement Yedjou <i>Natural Chemotherapeutics Research Laboratory, NIH/NIMHD RCMI-Center for Environmental Health, College of Science, Engineering and Technology, Jackson State University, Jackson, MS, USA</i>
10:15	52	NANOCERIA AND CATALASE CONJUGATES AS A FREE-RADICAL SCAVENGING SYSTEM Brendan Ward ¹ , Dmitry Gil ¹ , Vladimir Ivanov ² , and Vladimir Reukov ^{1,3} ¹ <i>Department of Bioengineering, Clemson University Clemson, SC USA;</i> ² <i>Kurnakov Institute of General and Inorganic Chemistry Moscow Russia;</i> ³ <i>Institute for Biological Interfaces of Engineering, Clemson University Clemson, SC, USA</i>
10:30		BREAK

Saturday Morning	Talk #	Conference Room: Coastal B
Time		Session X: Biomaterials Session Chair: Jafar Vossoughi Co-Chair: Ahmed El-Ghannam
9:00	53	ON THE DEVELOPMENT OF GRADIENT BIOMATERIALS FOR INTERFACE TISSUE ENGINEERING Vinoy Thomas <i>Department of Materials Science & Engineering, University of Alabama at Birmingham, Birmingham, AL, USA</i>
9:15	54	THE INVESTIGATION OF TOXICITY OF METAL OXIDE NANOMATERIALS Qilin Dai <i>Jackson State University, Jackson, MS, USA</i>
9:30	55	ELECTROSPINNING ALGINATE-BASED NANOFIBERS Kathryn Penton, William Weeks, Scarlett Salter, Amber Wilson, Tia Brown, Doug Miller, and Sharon K. Hamilton <i>Delta State University, Cleveland, MS, USA</i>
9:45	56	DILUTE SOLUTION BEHAVIOR OF BLOCK COPOLYMERS OF ELASTIN-LIKE POLYPEPTIDE AND POLYELECTROLYTES Jared Cobb and Amol Janorkar <i>University of Mississippi Medical Center, Jackson, MS USA</i>

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10:00	57	NONLINEAR FINITE ELEMENT ANALYSIS OF MICRO-LATTICE STRUCTURES FOR PATIENT SPECIFIC IMPLANTS Prashant Athanker and Amit Singh <i>MNIT Jaipur, India</i>
10:15	58	FINITE ELEMENT ANALYSIS OF CYCLIC AMP DIFFUSION AND SIGNALING BETWEEN CELLS Steven Shettlesworth, Nicholas Stone, Anh-Vu Phan, and Thomas Rich <i>University of South Alabama, Mobile, AL, USA</i>
10:30		BREAK

Scientific Sessions: Concurrent Sessions XI & XII

Saturday Morning	Talk #	Conference Room: Coastal A
Time		Session XI: Technology in Healthcare Session Chair: Thomas Rich Co-Chair: Teresa Murray
10:45	59	USING iOS DEVICES AS AN INTERACTIVE LAB ENVIRONMENT Francis Tului, Latrice Evans, Terrance Eubanks, Aaron James, LaDamanion Harness, and Traeshaun Hiley <i>Jackson State University, Jackson, MS, USA</i>
11:00	60	AN ON-BODY CONFORMAL PRINTED ARRAY ANTENNA AT MM WAVE FREQUENCIES FOR HEALTHCARE APPLICATIONS Saeed Latif and David Nelson <i>University of South Alabama, Mobile, AL, USA</i>
11:15	61	THE USE OF COMPLEX CLINICAL DATA AND TOPOLOGICAL DATA ANALYSIS FOR PERSONALIZED MEDICINE John Clemmer, W. Andrew Prueett, Kenneth R. Butler, and Robert L. Hester <i>University of Mississippi Medical Center Jackson, MS, USA</i>
11:30	62	VISUALIZING HEALTH IN MISSISSIPPI: THERE'S AN APP FOR THAT! Denise Krause <i>University of Mississippi Medical Center, Jackson, MS, USA</i>
11:45	63	LESSONS FROM THE FIELD: SETTING UP AND OPERATING A NETWORK OF MOLD SPORE SAMPLERS Bruce T. Brackin ¹ , Fazlay Farugue ² , Martha N. Brackin ³ , and Gailen D. Marshall ⁴ ¹ Mississippi State Department of Health, Jackson, MS, USA ² Department of Preventive Medicine, University of Mississippi Medical Center, Jackson, MS, USA ³ Independent Consultant, Brandon, MS, USA ⁴ Allergy & Immunology, University of Mississippi Medical Center, Jackson, MS, USA
12:00	64	A NEW EXCITATION-BASED TECHNIQUE FOR ESTIMATING FRET EFFICIENCY John Robert Griswold, Naga Annamdevula, Joshua Deal, Thomas Rich, and Silas Levesley <i>University of South Alabama, Mobile, AL, USA</i>
12:15		BREAK

Saturday Morning	Talk #	Conference Room: Coastal B
Time		Session XII: Therapeutics in Rehabilitation Session Chair: Felix Adah Co-Chair: Angelia Garner
10:45	65	MIRROR THERAPY FOR LOWER EXTREMITY RECOVERY AND GAIT IN SUBACUTE STROKE: A RANDOMIZED CONTROL TRIAL Lisa J. Barnes and Kim Curbow Wilcox <i>University of Mississippi Medical Center, Jackson, MS, USA</i>
11:00	66	THE EFFECTS OF AQUATIC THERAPY ON FATIGUE AND QUALITY OF LIFE IN PATIENTS WITH MULTIPLE SCLEROSIS: A SYSTEMATIC REVIEW Kimberly Willis and Lisa J. Barnes <i>University of Mississippi Medical Center, Jackson, MS, USA</i>
11:15	67	THE EFFECTS OF THERAPEUTIC ULTRASOUND ON ADULT PATIENTS WITH NON-SPECIFIC CHRONIC LOW BACK PAIN: A SYSTEMATIC REVIEW Sherry Colson and Lisa J. Barnes <i>University of Mississippi Medical Center, Jackson, MS, USA</i>

33rd SOUTHERN BIOMEDICAL ENGINEERING CONFERENCE

11:30	68	THE EFFECTS OF HIPPOThERAPY ON GROSS MOTOR FUNCTION IN CHILDREN WITH CEREBRAL PALSY: A SYSTEMATIC REVIEW Janet Slaughter and Lisa J. Barnes <i>University of Mississippi Medical Center, Jackson, MS USA</i>
11:45	69	THE EFFECT OF DRY NEEDLING ON PAIN CONTROL AND POSSIBLE MECHANISM Felix Adah, Min Huang, and Mark Weber <i>University of Mississippi Medical Center, Jackson, MS, USA</i>
12:00	70	QUANTITATIVE MEASURES OF THE IMPACT OF EXERCISE AMONG ELDERLY Matt Gibson, Ham, Benghuzzi, and Michelle Tucci <i>University of Mississippi Medical Center, Jackson, MS, USA</i>
12:15		BREAK

Lunch and Keynote Speakers IV and V: Coastal Room A and B

12:15-1:00 pm: Keynote Speaker – IV
“Translational Research and Major Challenges to Basic Scientists”
Dr. Hamed Benghuzzi

Dr. Benghuzzi is a professor at the University of Mississippi 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 Ph.D. 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 served in leadership roles in many organizations such as President of the Academy of Surgical Research, Vice President of the Rocky Mountain Bioengineering Society, President of Mississippi Academy of Sciences (MAS), and Executive Director-MAS; he has 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 include: (1) the Presidential Award from the RMBS, (2) the Presidential Award from SEM International, (3) the Endocrine Society's Outstanding Investigator Award, (4) the MAS Contribution to Science Award, (5) The MAS Dudley Peeler Award, (6) the HEADWAE Award, (7) the C. William Hall Award- Outstanding Contribution to Biomedical Engineering (32nd SBEC), and (8) the ISCM Excellence Award from the International Society for Ceramics in Medicine. He was invited as a keynote/plenary speaker 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).



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2:45	74	INTRAUTERINE GROWTH RESTRICTION IS ASSOCIATED WITH LONG-LASTING BRAIN CHANGES Norma Ojeda ¹ , Jonathan W Lee ¹ , Silu Lu ¹ , Emily C Turbeville ¹ , Colin B Muncie ² , and Lir-Wan Fan ¹ ¹ <i>Department of Pediatrics, Division of Newborn Medicine, University of Mississippi Medical Center, Jackson, MS, USA</i> ² <i>Department of Pediatrics, Division of Surgery, University of Mississippi Medical Center, Jackson, MS, USA</i>
3:00	75	DEVELOPMENT OF A LONGITUDINAL IMAGING SYSTEM FOR A MURINE MODEL OF TRAUMATIC BRAIN INJURY Chelsea Dressel and Teresa Murray <i>Louisiana Tech University, Rushton, LA, USA</i>
3:15		BREAK

March 18, 2017

3:15-4:30 pm Poster Session (Student Posters Judging)

Poster Scientific Sessions-Coastal A & B

Session Co-Chairs: C. LaShan Simpson, Jamil Ibrahim, and Tom Field	P#
THE EFFECT OF DRILL HOLE LOCATION ON THE LOAD BEARING CAPACITY OF TIBIAS Christopher Yiachos <i>SUNY Downstate Medical Center, Brooklyn, New York, USA</i>	1
PHENOTYPIC SWITCH OF VASCULAR SMOOTH MUSCLE CELLS IN VASCULAR CALCIFICATION Kelsey McArthur and C. LaShan Simpson <i>Mississippi State University, Starkville, MS, USA</i>	2
SYNTHESIS OF HYBRID IRON-POLYDOPAMINE NANOPARTICLES FOR IMAGING-GUIDED PHOTOTHERMAL THERAPY ON CANCER CELLS Devin Guillory, Terriona Cowan, and Yongfeng Zhao <i>Jackson State University, Jackson, MS, USA</i>	3
MICROCONTROLLER SIMULATION OF AN ARTERY UNDER DEFORMATION Ricky Greer II, Carson Schaff, Saami Yazdani, Andrew Faulk, and Jesus Estaba <i>University of South Alabama, Mobile, AL, USA</i>	4
DESIGN OF A BIOREACTOR SYSTEM WITH PERIPHERAL MOVEMENT Carson Schaff, Ricky Greer, Saami Yazdani, Andrew Faulk, and Jesus Estaba <i>University of South Alabama, Department of Mechanical South Alabama, Mobile, AL, USA</i>	5
MODELING THE EFFECTS OF PRESSURE AND VISCOSITY ON PENETRATION OF DRUG VIA A PERFUSION CATHETER DELIVERY SYSTEM Brandon Rittelmeyer and Saami Yazdani <i>University of South Alabama, Mobile, AL, USA</i>	6
A MATHEMATICAL MODEL TO SIMULATE REENDOTHELIALIZATION FOLLOWING STENTING Erin McKee, John Faulk, Justin Phillips, Maria Byrne, and Saami Yazdani <i>University of South Alabama, Mobile, AL, USA</i>	7
ALTERED GENOMIC EXPRESSION IN THE HIPPOCAMPAL DENTATE GYRUS IN DEPRESSION Gouri Mahajan ¹ , Hamed Benghuzzi ¹ , Craig Stockmeier ¹ , Eric Vallender ¹ , Michael Garrett ¹ , L Challagundla ² , JC Overholser ² , G Jurjus ² , and Lesa Dieter ² ¹ <i>University of Mississippi Medical Center, Jackson, MS, USA</i> and ² <i>Case Western Reserve University, Cleveland, OH, USA</i>	8
OPTIMIZING QUALITATIVE MAGNETIC RESONANCE IMAGING (QMRI) FOR BRAIN IRON DEPOSITION ASSESSMENT IN ALZHEIMER'S DISEASE. Edward Florez, Kenneth Butler, Alyson Stacks, Majid Khan, and Ali Fatemi <i>University of Mississippi Medical Center, Jackson, MS, USA</i>	9
THE EFFECT OF COMBINATION TREATMENTS OF EPIGALLOCATECHIN-3-GALLATE, THYMOQUINONE, AND 5-FLUOROURACIL ON FADU NASOPHARYNGEAL CARCINOMA CELLS Sharita Williams, Hamed Benghuzzi, and Michelle Tucci <i>University of Mississippi Medical Center, Jackson, MS, USA</i>	10
THE EVALUATION OF ANTIHYPERTENSIVE AGENTS USING CARDIOMYOCYTES Shana Nelson, Hamed Benghuzzi and Michelle Tucci <i>University of Mississippi Medical Center, Jackson, MS, USA</i>	11

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<p>DEVELOPMENT OF A PORTABLE NEAR INFRARED CAMERA FOR SELF DIAGNOSIS OF DIABETIC ULCERS Vladimir Reukov, Margarita Portillo, Katherine Bryant, Silas Adams, Rebecca Schrody, Elizabeth Gaston, Colin Fair, Ben Glace, Omar Abdeladl, Alex Giron, and Ben Sleeper <i>Clemson University, Clemson, SC, USA</i></p>	12
<p>GENDER DIFFERENCES IN THE ANTINOCICEPTIVE EFFECT OF OPIOID AGENTS, ALONE OR IN COMBINATION WITH NON-OPIOID AGENTS Xiaoli Dai, Ike Eriator, and Claude Brounson <i>University of Mississippi Medical Center, Jackson, MS, USA</i></p>	13
<p>TOWARDS THE PREVENTION OF OXIDATIVE DAMAGE VIA NOVEL ANTIOXIDANT CONJUGATES Jeannette Rodriguez, Dmitry Gil¹, Vladimir Ivanov², and Vladimir Reukov^{1,3} ¹ <i>Department of Bioengineering, Clemson University Clemson, SC USA;</i> ²<i>Kurnakov Institute of General and Inorganic Chemistry Moscow Russia;</i> ³ <i>Institute for Biological Interfaces of Engineering, Clemson University Clemson, SC, USA</i></p>	14
<p>DEVELOPING AN APPARATUS TO TREAT PLANTAR FASCIITIS Jack McGreevey, Benjamin Shumpert, Eddie Bear, Bryce Kunkle, Jushawn Macon, Vladimir Reukov <i>Clemson University, Clemson, SC, USA</i></p>	15
<p>LOCALIZATION OF THE EPILEPTOGENIC FOCUS FROM EEG FREQUENCY BANDS BY NETWORK CONNECTIVITY ANALYSIS OF SEIZURES OF TEMPORAL LOBE ORIGIN Jousha Adkison¹, Bharat Karumuri², Ioannis Vlachos¹, and Leonidas Iasemidis² <i>Department of Mathematics and Statistics, Louisiana Tech University, Ruston, LA, USA and Department of Biomedical Engineering, Louisiana Tech University, Ruston, LA, USA</i></p>	16
<p>THE RESPONSE OF INTERLEUKIN-STIMULATED A549 HUMAN ALVEOLAR BASAL EPITHELIAL CELLS UPON EXPOSURE TO HYDROCORTISONE IN CULTURE Jana Bagwell <i>University of Mississippi Medical Center, Jackson, MS, USA</i></p>	17
<p>NEONATAL EXPOSURE TO INTERLEUKIN-1B ENHANCES ADULT VULNERABILITY OF NIGROSTRIATAL DOPAMINERGIC SYSTEM TO ROTENONE NEUROTOXICITY Lir-Wan Fan¹, Lu-Tai Tien², Jonathan W Lee¹, Silu Lu¹, Rick CS Lin³, Xiaoli Dai⁴, Norma B Ojeda¹, Abhay J Bhatt¹, Renate D Savich¹, and Yi Pang¹ ¹<i>Department of Pediatrics, Division of Newborn Medicine, University of Mississippi Medical Center, Jackson, MS, USA;</i> ²<i>School of Medicine, Fu Jen Catholic University, Xinzhuang Dist, New Taipei City, Taiwan;</i> ³<i>Department of Neurobiology and Anatomical Sciences, University of Mississippi Medical Center, Jackson, MS, USA;</i> and ⁴<i>Department of Anesthesiology, University of Mississippi Medical Center, Jackson, MS, USA</i></p>	18
<p>MINOCYCLINE AMELIORATES BRAIN INJURY, AND IMPROVES SENSORIMOTOR BEHAVIORAL PERFORMANCE IN NEONATAL RATS EXPOSED TO SYSTEMIC LIPOPOLYSACCHARIDE Silu Lu¹, Jonathan W Lee¹, Lu-Tai Tien², James P Shaffery³, Yi Pang¹, Norma B Ojeda¹, Abhay J Bhatt¹, Renate D Savich¹, and Lir-Wan Fan¹ ¹<i>Department of Pediatrics, Division of Newborn Medicine, University of Mississippi Medical Center, Jackson, MS, USA;</i> ²<i>School of Medicine, Fu Jen Catholic University, Xinzhuang Dist, New Taipei City, Taiwan;</i> ³<i>Department of Neurobiology and Anatomical Sciences, University of Mississippi Medical Center, Jackson, MS, USA;</i> and ⁴<i>Department of Anesthesiology, University of Mississippi Medical Center, Jackson, MS, USA</i></p>	19
<p>IL-1 RECEPTOR ANTAGONIST PROTECTS AGAINST LONG-LASTING LEARNING IMPAIRMENT AND HIPPOCAMPAL INJURY IN ADULT RATS FOLLOWING NEONATAL EXPOSURE TO LIPOPOLYSACCHARIDE Lu-Tai Tien¹, Ku-Mao Lan^{1,2}, Yi Pang³, Silu Lu³, Abhay J Bhatt³, and Lir-Wan Fan³ ¹<i>School of Medicine, Fu Jen Catholic University, New Taipei City, Taiwan;</i> ²<i>Department of Anesthesiology, Chi-Mei Medical Center, Tainan, Taiwan;</i> ³<i>Department of Pediatrics, Division of Newborn Medicine, University of Mississippi Medical Center, Jackson, MS, USA</i></p>	20
<p>LOW LEVEL LASER THERAPY IMPROVES MICROCIRCULATION IN SKELETAL MUSCLE VASCULAR BEDS IN ZUCKER RATS Silu Lu, Lusha; Xiang, Robert L. Hester, Lisa Barnes, Ham Benghuzzi, and Min Huang <i>Departments of Physical Therapy, Physiology and Biophysics, University of Mississippi Medical Center, Jackson, MS, USA</i></p>	21
<p>EVALUATION OF ANISOTROPIC DIFFUSION FILTERING ALGORITHMS FOR ANALYSIS OF 3-DIMENSIONAL MICROSCOPY IMAGE DATA OF FÖRSTER RESONANCE ENERGY TRANSFER PROBES Kenny Trinh¹, Naga Annamdevula^{1,3}, Rachel Sweat¹, Thomas Rich^{2,3}, and Silas Leavesley^{1,2,3} ¹<i>Chemical And Biomolecular Engineering,</i> ²<i>Pharmacology,</i> ³<i>Center For Lung Biology</i> <i>University Of South Alabama, Mobile, AL, USA</i></p>	22
<p>ADIPOGENIC DIFFERENTIATION OF HUMAN ADIPOSE DERIVED STEM CELLS ATOP AN ELASTIN-LIKE POLYPEPTIDE-POLYELECTROLYTE COATED SURFACE Sarah Fitzgerald, Jared Cobb, and Amol Janorkar <i>University of Mississippi Medical Center Jackson, MS, USA</i></p>	23
<p>QUANTITATIVE ASSESSMENT OF SEMINIFEROUS TUBULE ALTERATION ASSOCIATED WITH LONG-TERM EXPOSURE TO SUSTAINED DELIVERY OF ANDROGENS Hamed Benghuzzi and Michelle Tucci <i>University of Mississippi Medical Center, Jackson, MS, USA</i></p>	24
<p>DEVELOPMENT OF A NEW FUZZY C-MEANS CLUSTERING ALGORITHM FOR AUTOMATIC DETECTION OF OSA USING P-WAVE SHAPE AND TIME CHANGES Khalid Lweesy <i>Jordan University of Science and Technology, Irbid, Jordan</i></p>	25

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AUDITORY PROCESSING IMPAIRMENT PREDICTS PERCEIVED HEARING PROBLEM IN INDIVIDUALS WITH NORMAL PURE-TONE THRESHOLDS Charles Bishop, Elgenaid Hamadain, Mary Johnson, Lauren McNichol, and Christopher Spankovich <i>University of Mississippi Medical Center, Jackson, MS, USA</i>	26
SULFORAPHANE, A DIETARY COMPONENT OF BROCCOLI SPROUTS ATTENUATES HYPERTENSION AND MAINTAINS RENAL STRUCTURE ON SHRsp RATS Ali Banigesh ¹ , Ramlah Iqbal ¹ , Adam Murabit ¹ , Kaushik Desai ² and Adel Mohamed ¹ <i>¹Department of Anatomy and Cell Biology, College of Medicine, University of Saskatchewan, Saskatoon, Saskatchewan, Canada, and Department of Pharmacology, College of Medicine, University of Saskatchewan, Saskatoon, Saskatchewan, Canada.</i>	27
EFFECT OF CHRONIC DELIVERY OF SSRI ON MALE REPRODUCTIVE TISSUES Gerri Wilson, Hamed Benghuzzi, and Michelle Tucci <i>University of Mississippi Medical Center, Jackson, MS, USA</i>	28
THE RESPONSE OF CONNECTIVE TISSUE FOLLOWING SINGLE DOSE OR SUSTAINED ADMINISTRATION OF PRP Jessica Gilbert ¹ , Jeremy Stokes ² , Joseph A. Cameron ¹ , Hamed Benghuzzi ² , David Black ² , and Michelle Tucci ² <i>¹Jackson State University, Jackson, MS, USA and ²University of Mississippi Medical Center, Jackson, MS, USA</i>	29

**4:45-5:15 pm: Reception, Student Award Presentations, and
Conclusions: Coastal A & B**

Sunday, March 19, 2017

TBA – Program Committee Meeting to discuss the 34th Annual Meeting

ABSTRACTS

March 17, 2017

Keynote Speaker

MULTIFUNCTIONAL BIOCERAMIC FOR INNOVATIVE THERAPY

Ahmed El-Ghannam, Ph.D.

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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

NANOSTRUCTURED SCAFFOLDS FOR REGENERATIVE MEDICINE AND TISSUE ENGINEERING

Jafar F. Al-Sharab and Mohammed Benalla

Northwestern State University, Natchitoches, LA, USA

There is a continuous need for new organs and tissues due to lack of donor organs necessary to help combat some the debilitating diseases. To close the gap between demand of organs and those who are indeed, regenerative medicine and tissue engineering must be utilized. In our research we utilize Electrospinning of nanofibers as a method of forming scaffolds. Due to the high charge density of polymers under the influence of electrospinning, it lends itself to the idea that a magnetic field has the capability of controlling and aligning the high-charge density fibers to the field, forming regular, aligned and thus effective scaffolds for the engineering of tissue. In this paper we will be presenting examples related to the effect of process parameters on the various properties of the fabricated fibers.

CHANGES IN NEURAL CELLS GROWN ON NOVEL HIGH ASPECT RATIO SCAFFOLD VERSUS MONOLAYER CULTURE

Kayla Ponder, Mark DeCoster, and Teresa Murray

Center for Biomedical Research and Rehabilitation Science, Ruston, LA, USA

Neural cells, such as PC12 and SH-EP1 cells, are typically grown as monolayers in tissue culture treated polystyrene dishes. Alterations in protein expression can occur when cells are grown as monolayers in dishes versus a three-dimensional (3D) environment. This can skew results for in vitro experiments making it more difficult to translate in vitro findings into in vivo models. Several strategies have been developed to culture cells in 3D, including growing them on polymer scaffolds. These have their own limitations. Here, we report on the differences in neural cells grown on tissue culture treated polystyrene versus a novel, biodegradable biocomposite containing copper that forms a high

aspect ratio scaffold. This work will lay the foundation for new 3D cell culture models of neurodegeneration and regeneration.

USING POLYMER BULK DIFFUSION AS A MECHANISM FOR ADVANCING TISSUE ENGINEERING APPLICATIONS

Kelsey Phelan and Bryant Hollins

Louisiana Tech University, Ruston, LA, USA

Advances in biopolymers have long been sought to advance fields of biomedical engineering, with particular focus in biomicrofluidics and tissue engineering. We recently demonstrated that PDMS, a commonly used polymer in biological applications, can be used to intentionally leach molecules into a sample. In this work, we characterize the diffusion of fluorescein into water from the bulk PDMS, with a focus on calculating the diffusion rate of molecules from the polymer bulk into its surrounding aqueous environment. We look at diffusion from the bulk over a period of days in an attempt to formulate a fluorescein diffusion model from PDMS. Our results can guide future work in tissue engineering application studies, as we establish a framework with fluorescein for determining the properties of molecules capable of diffusion from bulk PDMS. This strategy can be used as a tool for creating self-regulating microfluidic chambers for drug discovery, cell culture, and chemical monitoring applications, as well as a substrate for guiding cell growth and migration in tissue engineering applications.

BENEFICIAL EFFECTS OF SEMEN PURIFICATION WITH MAGNETIC NANOPARTICLES

Casey Durfey¹, Sabrina Swistek^{1,2}, Wei Tan³, Henry Clemente⁵, Peter Ryan^{1,4}, Scott Willard^{1,2}, and Jean Feugang¹

¹Departments of Animal and Dairy Sciences, ²Biochemistry, Molecular Biology, Entomology, & Plant Pathology, ³Basic Sciences, ⁴Pathobiology and Population Medicine, Mississippi State University, Mississippi State, MS, USA and ⁵Clemente Associates, Madison, CT, USA

Semen contain both viable and non-viable spermatozoa which equilibrium affects male fertility. Current techniques for detecting non-viable spermatozoa in semen ejaculates lack specific targeting for their subtraction. Here we used magnetic nanoparticle conjugates to selectively target and remove non-viable spermatozoa, and assess the motion characteristics and viability of residual spermatozoa.

Boar semen were mixed with (nanopurified) or without (control) magnetic nanoparticle conjugates and incubated to allow specific targeting of non-viable (or moribund) spermatozoa. Afterwards, mixtures were placed against a powerful magnet trapping moribund spermatozoa and permitting elution of viable spermatozoa. Before and after incubation, sperm motion and viability parameters were respectively analyzed with a Computer-Assisted-Sperm-Analyzer and flow cytometry after specific staining to evaluate the viability status of spermatozoa. Data (mean±sem) were compared with SAS package.

The proportion of static sperm significantly decreased after purification (8.9±0.5% vs. 11.3±0.5% for the control; P<0.05). Motion parameters (total and progressive motility, straightness, linearity, straight line velocity or VSL, and beat cross frequency or BCF) of nanopurified spermatozoa were significantly increased, while the amplitude lateral head displacement or ALH was decreased (P<0.05). Sperm viability parameters (plasma and acrosome membrane integrity and mitochondrial potential) were comparable between both groups (P>0.05).

Findings indicate the successful removal of moribund (static) spermatozoa without impairing the viability of residual spermatozoa. Beneficial effects on sperm motion

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COMPARISON OF MORPHOLOGICAL CHANGES IN MESENCHYMAL AND NASOPHARYNGEAL CANCER CELLS FOLLOWING EXPOSURE TO LOW LEVEL LASER THERAPY

David Gordy, Osasu Adah, Gerri Wilson, Felix Adah, Min Huang, Michelle Tucci, and Hamed Benghuzzi
University of Mississippi Medical Center, Jackson, MS

Low level laser therapy (LLLT) has been shown to increase cellular proliferation and cellular activity in some cell types and decrease proliferation of other cell types. The precise biochemical mechanisms underlying the therapeutic effects of LLLT are not yet well-established. From observation, it appears that LLLT has a wide range of effects at the molecular, cellular, and tissue levels. In addition, its specific modes of action may vary among different applications. Within the cell, there is strong evidence to suggest that LLLT acts on the mitochondria to increase adenosine triphosphate (ATP) production, modulate reactive oxygen species (ROS), and induce transcription factors. LLLT has shown promise for down regulating inflammation by reducing the presence of reactive oxygen species (ROS). In normal cells, high levels of ROS are damaging to the cells and the cells have the ability to squelch the production of ROS enzymatically. Cancer cells exhibit elevated levels of ROS due to their accelerated metabolism needed for maintaining cellular proliferation. The goals of this experiment were (1) to determine the effects of LLLT for a period of 30 minutes on laryngeal cancer cell survival; and (2) to determine the effects of LLLT on mesenchymal cell survival. Both cell types are rapidly proliferating and require substantial amounts of ATP for survival. Laryngeal and MSC cell types were grown on coverslips in six well plates and treated with 830 nm laser once to mimic a 30 minute therapeutic treatment. The coverslips were harvested at 24, 48, and 72 hours following the treatment period. The results show that LLLT was effective in reducing the number of laryngeal cancer cells within the first 24 hours following treatment, and were ineffective in reducing MSC cell survival for the duration of the experiment. These findings are important since laryngeal cancer is difficult to resect, and laser therapy could be guided into the area to reduce the tumor size or used following resection.

Session II: Biomechanics – I

EFFECT OF MUSCLE ENGAGEMENT AND MEASUREMENT POSITION ON ELECTRICAL IMPEDANCE OF THIGH MUSCLES

Joseph Mathews and Todd Freeborn
The University of Alabama, Tuscaloosa, AL, USA

Electrical impedance measurements are being widely investigated as a means to monitor physiological change in many biological tissues, with applications for non-invasive real-time monitoring in both health and athletics. This pilot study aimed to determine if there are differences in the electrical impedance measurements collected for relaxed and tensed states of the thigh muscle, in both sitting and standing orientations. Understanding how both muscle engagement and measurement position effect the electrical impedance will be useful for systems to monitor localized muscle injury or fatigue in free-living environments, which will not have controlled conditions typical of clinical environments. For this comparison, seven sets of measurements were collected over a fourteen-day period from both right and left thighs of a single subject in four different orientations (sitting relaxed, sitting tensed, standing relaxed, and standing tensed). Each set of measurements were collected using an ImpediMed SFB7, from 3 kHz to 1 MHz, with a tetra-polar electrode configuration placed on the skin surface external to the quadriceps muscles. From these results, there was an increase of the electrical impedance in the tensed state compared to the relaxed state for all orientations on most days,

with the decreases (averaged using the 3 kHz to 50 kHz measurements) ranging from 2% to 6%.

HEAT TRANSFER MODEL OF HUMAN THIGH: IMPLICATIONS FOR TOURNIQUET USE

Luke Smith and David Nelson
University of South Alabama, Mobile, AL, USA

Tourniquets are employed to restrict blood flow to limbs incurring severe bleeding. With prolonged application, ischemic and reperfusion tissue damage can occur, leading to potential loss of limb. A decrease in temperature through cooling can potentially reduce tissue damage. Protocols to improve limb salvage outcomes can be developed using heat transfer models. A commercial thermal analysis solver (TAITherm) was used with a heterogeneous model of the human thigh as a multi-layered 3-dimensional mesh. The model monitored thermoregulation between bone, muscle, fat, and skin within the body; observing tissue cooling as a function of ambient temperature. Blood flow was restricted to the thigh to mimic the effects of tourniquet application.

When subjected to steady-state environments of varying temperature, core tissue temperatures were noticeably reduced from lack of blood flow. This difference increased with environmental temperature, with a difference of several degrees. Over a six hour period of exposure to 20°C, 30°C, and 40°C environmental temperatures, blood flow was responsible for a tissue temperature difference of 1.2, 1.5, and 3.0 degrees, respectively. We can further observe changes from additional clothing layers and body sizes with this model.

FUNDAMENTALS OF LOAD TRANSFER MECHANISMS IN BIOSTRUCTURES: A COMPLEX NETWORK APPROACH

Reena Patel¹, Guillermo Riveros¹, and David Thompson²
¹US Army Engineer Research and Development Center, Vicksburg, MS, USA, ²Mississippi State University, Starkville, MS, USA

Biostructures are unique owing to the multiple functions they are designed to accomplish coupled with the complex hierarchical geometrical arrangement that makes them strong, tough, lightweight, and energy dissipative. This work presents an integrated, interdisciplinary approach that utilizes computational and experimental mechanics with complex network strategy to obtain fundamental insights into failure mechanisms of high performance, light weight, structured composites by investigating structural and material properties of the rostrum. Although computational mechanics experiments give an overall distribution of stresses in the structural systems, due to the large numbers of degrees of freedom the underlying kinematics which plays a vital role in load transfer mechanisms and the formation of the strong and weak links in the network is unknown. Towards this end, the rostrum will be formulated as a network flow problem. The nodes and edges of the rostrum's network will be extracted from the numerical model used in the computational mechanics experiments. The flow network will be weighted based on the parameter of interest, which may be stresses, energy dissipation etc. The changing kinematics of the system is input to the mathematical algorithm that will compute the maximum flow of the stresses at uniform cost. This research investigates the load transfer mechanisms for the rostrum of the paddlefish by conducting computational mechanics experiments; identify the formation of the force chains in the rostrum by employing maximum flow /minimum cut mathematical algorithm and demonstrate preliminary results of the advantages of the flow network to solve this type of engineering problems.

MECHANO-MORPHOLOGICAL AND CELLULAR DEPENDENCE ON FIBER CHARACTERISTICS IN WET-LAID SCAFFOLDS

Andrew Wood¹, Dominique Everett¹, Sanjay Kumar², Vinoy Thomas¹

¹University of Alabama, Birmingham, AL, USA and ²Alabama State University, Montgomery, AL, USA

Fiber-reinforced materials have been used across a number of applications as a means to fabricate composites with properties similar to more massive, economically undesirable materials. In areas of biomaterials, fibers offer this increased mechanical response but also serve as a pathway to direct cellular attachment and proliferation. For continuous phases with in vivo mimicry, hydrogels are a class of materials that closely simulate the extracellular matrix found in natural biological systems. Composed of a fibrous network with large volumes of entrapped aqueous solutions, these materials are soft, ductile, and formable, but they are plagued by inherent low mechanical properties. For applications in tissue engineering, the lack of a directional cue within the hydrogels is undesired in some applications as cells require a guide for organized proliferation. In this work, we have investigated the role of poly (lactic acid) (PLA) fiber length, concentration, and surface treatment as a reinforcement phase in hydrogels matrices and the resultant mechanical and cellular responses. With increasing fiber length and concentration, we hypothesize that the mechanical properties will increase while cellular penetration into the bulk will decrease. After surface treatment, we hypothesize that the mechanical properties will increase due to greater interfacial bonding. Together, the results indicate that the wet-lay process can be optimized for a specific set of mechanical and cellular values depending on the desired application site.

VARIABILITY OF ELECTRICAL IMPEDANCE MEASUREMENTS COLLECTED FROM HUMAN FOREARM USING MULTIPLE ELECTRODE CONFIGURATION

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Electrical impedance measurements quantify the resistance of a material to an injected electrical stimulus and have been used to detect physiological changes in biological tissues. Recently, these measurements have been applied to monitor muscle tissue towards determining if they can detect muscle fatigue. While electrodes in clinical applications can be precisely placed, their precise application for athletic monitoring may prove challenging. Therefore, it is important to understand how electrode placement impacts the measured impedance. This study collected electrical impedance measurements of the human forearm from 16 tetrapolar electrode configurations; with stimulus electrodes fixed and measurement electrodes varied along a 3 cm by 3 cm grid. Measurements from 3 kHz to 1 MHz using a ImpediMed SBF7 were collected from a single participant on three consecutive days. Results show maximum relative deviations from <1% to 52% for the real impedance and <1% to 81% for the imaginary for all days when electrodes were moved from the reference position. The relative deviations of the real impedances showed less variability with frequency (<10% relative change across all frequencies) than the imaginary components, which in some cases exhibited errors ranging of 0.215% at 92 kHz to 80.9% at 1 MHz.

Session III: Biomaterials – Chemistry

PROSPECT OF BIOFLAVONOIDS AS G4/C4 LIGANDS: SPECTROSCOPIC INVESTIGATIONS.

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G- and C- quadruplex (G4 and C4) forming sequences in telomeric DNA and c-myc promoter regions of human DNA are associated with tumorigenesis. Ligands that can facilitate or stabilize the formation and increase the stabilization of G4 and C4 can prevent tumor cell proliferation and have been regarded as potential anti-cancer drugs. In the present study, steady state and time-resolved fluorescence measurements provide important structural and dynamical insights into the free and bound states of therapeutically potent plant flavonoid fisetin (3,3',4',7-tetrahydroxyflavone) and quercetin (3,5, 7,3',4'-pentahydroxyflavone) in G4 and C4 DNA matrices. We have exploited dual luminescence properties of fisetin and quercetin along with their chromophores 3-HF and 7HF to examine their efficacy of binding and compare their interactions with DNA, which is one of the macromolecular targets of flavonoids in physiological systems. Following the sequence of the human telomeric DNA 5'-d(CCCTAA)_n/(-TTAGGG)_n-3', two single stranded DNA oligonucleotides, 5'-d(C3TA2)3C3-3' and 5'-d(T2AG3)4-3', and their duplex were used as receptors to study the binding. Circular dichroism (CD), differential absorption, Raman spectra and thermal melting studies provide evidences for the formation of tetraplex DNAs and size exclusion chromatography (SEC) proves the binding and 1:1 stoichiometry of flavonols in the DNA matrix. Comparative analysis of binding in presence of EtBr proves that fisetin favors binding at the face of the G-quartet, mostly along the diagonal loop. Preliminary results indicate fisetin to be a prospective candidate as a G4 ligand.

STRUCTURAL KINETICS OF OXIDATIVE DNA DAMAGE FROM HYDROGEN ATOM TRANSFER

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Elucidating the molecular pathways of oxidative DNA damage reactions by radicals is essential to assess the secondary effect of ionizing radiation, oxidants, and to design biosensors and DNA cleavage molecules. Employing a Density Functional Theory based multiscale Quantum-Mechanical-Molecular-Mechanical simulation on explicitly solvated systems of single and double stranded DNA, we reveal the molecular pathways resulting from hydrogen abstraction by OH radicals. Targeting the H4' hydrogen of the sugar moiety, we reveal how the hydrogen abstraction leads to the formation of a ketone (C4'=O4') and the break the sugar ring. The H4' abstraction dynamics further reveals that the initial energy transfer to the P-O3' and P-O5' bonds dissipates in time leaving only a permanent weakening of these bonds if no other secondary reaction is allowed. However, when the H5' hydrogen is targeted, the hydrogen abstraction alone leads to DNA cleavage at P-O5'. Results, while mimic the experimentally observed oxidative states, provide further insight into the structural kinetics essential to design biosensors and DNA cleavage molecules.

DIRECT ARYLATION POLYMERIZATION SYNTHESIS OF A SERIES OF NEW SILOLE-BENZAZOLE COPOLYMERS

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Electron withdrawing substituents such as fluoro and cyano groups play an important role in organic electronics, due to their ability to change the optoelectronic properties of organoelectronic

materials. Particularly, difluoro-benzothiadiazole (DFBT), difluorobenzo-selenadiazole (DFBSe), difluorobenzo-triazole (DFBTA) have received much attention as they have been shown in some cases to improve the performance of optoelectronic devices. Due to the harsh reaction conditions that are usually used to prepare polymers containing these compounds, direct arylation provides an environmentally benign alternative method to prepare these high performance optoelectronic materials. Siloles are another set of compounds that have continued to generate much attention in materials science due to their unusual electronic and photophysical properties. It is well known that siloles possess lower lying LUMO energies compared to other similar heteroles such as thiophene and pyrrole. These low LUMO energies are a result of the overlap between the s^* orbital on the silicon atom and the p^* orbitals of the butadiene unit. Siloles are therefore being explored in p-conjugated polymers as a means of lowering the LUMO orbitals thus leading to lower band gap materials. In this presentation we will discuss the preparation of a series of p-conjugated polymers containing a silole unit copolymerized with strong electron acceptors units of the benzazole family using the direct arylation polymerization reaction, including the relatively unexplored acceptor 5,6-dicyano-2,1,3-benzothiadiazole (DCBT). These polymers possess long absorbance and emission wavelengths resulting in low band gaps – below 1.8 eV and respectable hole mobilities, $\sim 3.51 \times 10^{-2} \text{ cm}^2/\text{V.s}$.

VISUAL SENSING OF ANIONS BY SYNTHETIC RECEPTORS

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Visual sensing of anions by synthetic receptors is an active area of research, because it provides fast and direct method to identify anions which plays important roles in chemistry, biology and environment. Selective binding of anions is important from the views of both fundamental and technological aspects. Although, a several classes of synthetic receptors have been known showing high affinity for anions, synthetic anion sensors capable of visual and optical discrimination of anions are still limited. In our studies, we synthesized several types of chemical sensors using conventional synthetic protocols, and characterized by NMR, mass and elemental analysis. The new compounds were then investigated for a variety of anions in solutions, suggesting that the new receptors are capable of selective binding of anions, displaying optical and visual color change. Acknowledgements: The project described was supported by Grant Number G12MD007581 from the National Institutes of Health.

STRUCTURAL MOTION OF DI-HEME PROTEIN MAUG AND ITS FUNCTIONAL ROLE

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MauG is a di-heme protein that contains two distinct heme groups, a penta-coordinated high spin heme and a hexa-coordinated low spin heme. The biological role of MauG is to catalyze post-translational modification of pre-MADH to synthesis mature MADH. In the catalytic reaction the penta-coordinated high-spin directly reacts with oxygen donating substrates forming a catalytically active bis-Fe(IV) species through charge-resonance. Resonance Raman spectra of MauG at various temperature reveal two structural sub-states of the high-spin heme site. The two species exhibit temperature dependent equilibrium. At lower temperature, the high spin heme is mainly 5-coordinated while at higher temperature it appears as a mixture of penta/hexa coordinated high-spin heme. The presence of two structural sub-states was further confirmed by Fourier Transformed Infrared (FTIR) spectra of ferrous MauG-CO and UV-Vis spectrophotometric titration of MauG with cyanide ions. The frequencies of the $\nu_{\text{Fe-CO}}$ and $\nu_{\text{C=O}}$ point to two distinct

structures of the high-spin heme that differ both in the proximal and distal structures. Titration of MauG by various ligands indicates that the affinity of the high spin heme to exogenous ligand is affected by the charge on the ligand as well as the temperature. K_d for MauG-HCN complex is 0.00073 M while that for imidazole is $K_d=0.024$ M at 20°C. For the MauG-HCN complex K_d for HCN is 10 times smaller (higher affinity) than that measured at the room temperature. These results are all consistent with a two-structure state model. Kinetics of MauG with oxygen was conducted to elucidate the role of the two sub-states and their inter-conversion in electron-transfer and catalysis. This work is supported by NSF Research Initiation Award under HBCU-UP program (Award number: 1505446).

Session IV: Education and Research Training

INTERACTIVE BIOMEDICAL EDUCATION AND RESEARCH TRAINING

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In an effort to enhance the number of well-trained minority health care professionals and basic science researchers, Jackson State University, (JSU, a historically black institution) in partnership with Hinds Community College (HCC, a 2-year college) and consultant biomedical researchers/health care professionals at the University of Mississippi Medical Center, established an interactive research training Bridges to the Baccalaureate Degree Program (BBDP). The purpose of the BBDP was to increase HCC students transfer rates to 4 year institutions by providing interactive research training and biomedical education to motivate trainees to seek Baccalaureate and advanced degrees in the biomedical and health sciences areas. The program involved faculty and administrators at each institution in the planning and implementation of all programmatic aspects, including student selection, advisement procedures and program activities. HCC students (280) were recruited (94.5 % of whom were African American) and trained in interactive groups in research laboratory methodologies, responsible conduct of research concepts, literature survey mechanisms, scientific writing techniques and basic science concepts in biology, chemistry, mathematics, physics, etc., during the academic year. Students engaged in specific individualized research projects during the summer and presented their research findings at local scientific seminars and professional meetings e.g., Mississippi Academy of Sciences, ABRCMS, FASEB, and the Endocrine Society. The results show that enhanced education and research training in biomedical sciences can enhance transfer rates and advanced degrees. (GM050117)

ATTAINING STEM EXCELLENCE THROUGH RESEARCH TRAINING AT HBCU

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A high percentage of high school students have intentions to choose STEM disciplines, however the realizations of such ambitions is less successful. Recent studies show that half of those choosing STEM earn a degree within 4 to 6 years after entering the college. These studies suggest that: 1) the STEM programs need to be well developed to sustain STEM students throughout the 4 year program; and 2) STEM programs must offer a comprehensive education pathway to ease student's learning and sustain student's passion for STEM. Thus, in order to attain and sustain STEM

student's excellence, the entire community STEM colleges, funding agencies, local funding agencies, and high schools must collaborate to develop education pathways to engage the students starting early in high schools and continuing throughout the college years. Also, many factors that influence students sustainability in the STEM including course sequence, quality of teaching, undergraduate learning environments, and student extracurricular activities must be addressed to circumvent the effect. In order to increase STEM students' sustainability and excellence in STEM disciplines, we propose: 1) re-examination of the existing science-based curriculum and reconfiguration of course objectives to emphasize problem-based learning, and critical-thinking skills; 2) develop and implement inquiry-based courses and real-world research through undergraduate research collaborations to emphasize real-world research experience. We believe that these activities will prepare and sustain STEM students throughout the STEM education to choose STEM career. These activities will advance student's understanding of STEM disciplines and prepare them for STEM careers particularly of STEM graduates from underserved groups.

FIRST THINGS FIRST: LAYING A FOUNDATION FOR STUDENT ENGAGEMENT IN THE CLASSROOM

Gloria Miller

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The term Student Engagement is frequently used to describe a student's willingness to participate in routine school activities, such as attending class, submitting required work, and following teachers' directions in class. Whereas disengaged students are generally passive, they do not try hard, they tend to give up easily when challenged, and they can be bored, depressed, anxious, or even angry about their presence in the classroom. Disengaged students can also be withdrawn from learning opportunities or even rebellious towards teachers and classmates. Since the college drop-out rate for first-time-in college degree-seeking students here in the United States is nearly 50%, student engagement is increasingly seen as an indicator of successful classroom instruction, and as a valued outcome of school reform. Although much is fundamental to the student, research has found that teachers actually do play a vital role in their students' motivation and engagement. It is, therefore incumbent upon the teacher to actively seek to create the conditions that foster and/or encourage student engagement. This paper will discuss some of the strategies and best practices that teachers may find useful in laying a foundation for student engagement in the classroom.

TAILORING GITLAB FOR COMPUTER SCIENCE PROGRAMMING COURSES

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In light of the fact that teamwork is crucial in the development of new software or the maintenance of old systems; our project has built an in-house version control system using only open source products to provide students with the platform to experience collaborative development. This educational environment will instruct students on Open Source Software community. It will familiarize students with writing large scale software code and introduce them to version control tools hugely utilized in software development. Students will experience the various aspects of software development by playing different roles while allowing instructors to easily track student activities. The communities' code repository will work as a knowledge base for student projects, and thus students can reuse the code and artifacts as examples or basic frame works for their development. Progress in software engineering education can easily be measured using the historical archives of this repository, giving computer science departments and instructors insight about their students overall standing.

ACTIVE LEARNING CLASSROOMS - TECHNOLOGICAL INNOVATION OR EDUCATIONAL EVOLUTION? A MIXED-METHODS COHORT STUDY EXPLORING THE IMPACT OF ACTIVE LEARNING CLASSROOMS ON STUDENT LEARNING OUTCOMES

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In the past decade, increasing criticism has pointed to the inadequacy of the traditional teaching methodology as it fails to take student learning into account. Education reformers started paying more and more attention to "active learning" in recent years. Consequently, active learning classrooms (ALC) emerged in order to accommodate the new concept of learning. Are active learning classrooms more conducive to student learning than the traditional classrooms (TC)? The current study sets out to conduct a mixed-methods cohort investigation aimed at discovering whether different learning spaces result in different learning outcomes. Two consecutive courses in allied health taught by the same instructor in a newly built active learning classroom were observed and observational field notes were taken. Each class was audio/video recorded and transcribed. Final course grades earned in an active learning classroom and four-year historical grades of the same course taught by the same instructor in the traditional classrooms have been collected and compared. Student surveys and a faculty focus group interview have also been conducted. The results from both quantitative and qualitative data were analyzed to evaluate the impact of the active learning classroom on student learning outcomes. Quantitative data indicate that teaching in the ALC yields no difference in student grades from teaching in the TCs. However, qualitative data show that ALC presents greater enjoyment in learning, and both faculty and students believe that the ALC enhances group activity efficiency, deepens engagement, amplifies interaction, and fosters the development of creative ideas.

Session V: Molecular Clinical Markers

UTILIZATION OF CHEMOID® ASSAY IN THE MANAGEMENT OF MALIGNANT GLIOMAS AND DRUG DISCOVERY

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The prognosis of glioblastoma (GBM) treated with standard-of-care maximal surgical resection and concurrent adjuvant temozolomide (TMZ)/radiotherapy remains very poor (less than 15 months). Glioblastomas have been found to contain a small population of cancer stem cells (CSCs) that contribute to tumor propagation, maintenance, and treatment resistance. The highly invasive nature of high-grade gliomas and their inherent resistance to therapy lead to very high rates of recurrence. Administration of ineffective anticancer therapy is not only costly but more importantly burdens the patient with unnecessary toxicity and selects for the development of resistant cancer cell clones. We have developed a drug response assay (ChemoID®) that identifies the most effective chemotherapy against CSCs and bulk of tumor cells from a panel of potential treatments, offering great promise for individualized cancer management. A prospective study was conducted evaluating the use of the ChemoID® drug response assay in 41 glioblastoma patients. Data regarding tumor response, time to recurrence, progression-free survival (PFS), overall survival (OS), odds Ratio (OR) associations of 12-month recurrence estimated for CSC, bulk tumor and combined assay responses will be discussed. Additionally, the use of the

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ChemoID® drug response assay as a discovery platform using natural product extracts in combination with the standard-of-care on patients' derived cancer primary cell lines will be discussed.

ACTION OF NATURAL PRODUCTS ON PATIENT-DERIVED CANCER STEM CELLS AND BULK TUMOR CELLS

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Genetic and epigenetic events that contribute to the transformation of normal cells into cancerous cells result in the abnormal functioning of many cell signalling pathways. This realization has led to the search for agents that target these pathways. We have utilized a battery of 13 inducible luciferase reporter gene vectors where expression is driven by enhancer elements that bind to specific transcription factors. Several thousand crude plant extracts and pure compounds were run through this screen using HeLa cells. Several compounds exhibited diverse activity profiles and were subsequently tested in the ChemoID assay against patient-derived bulk tumor cells and cancer stem-like cells. These cells were isolated from patients bearing Non-small cell lung cancer, triple negative breast cancer or Temodar-resistant Glioblastoma Multiforme. The natural products tested demonstrated either patient or tumor-type specificities for bulk vs tumor stem-like cells *in vitro*. Some natural products showed either additive or more than additive cytotoxicity in combination with many chemotherapeutic agents. Some reduced the effectiveness of certain chemotherapeutic agents. This represents an approach that could afford us an important and unique niche in the Precision Medicine Initiative – identifying patient/tumor-specific natural product-chemotherapeutic combinations that are effective against both bulk tumor cells and tumor stem-like cells.

IN VITRO ANALYSIS OF MICRORNA-181A ROLE IN LUNG INFLAMMATION

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Inflammation is the underlying mechanism of many lung pathologies including, lung cancer. TNFalpha is the master cytokine released during lung injury that initiates a cascade of inflammatory signaling. MicroRNAs are short strands of RNAs that regulate gene expression. Using bioinformatics tools, we identified microRNA-181a novel targets Col3A1 and Notch2. Col3A1 is a component of ECM with a role in lung remodeling. Notch 2 is known to regulate epithelial progenitor cells differentiation during lung development and plays a role in NSC lung cancer. In the present study, using an *in vitro* system of lung cells, we investigated whether TNFalpha regulates microRNA-181a and Col3A1 and Notch2. Using A549 lung cells, we analyzed the regulation of miR-181a, Col 3A1 and Notch2 by TNFalpha using qPCR and western blot. A549 cells were exposed to TNFalpha (1 and 10 ng/ml) for 6 or 24 h. miR-181a, Col3A1 and Notch2 mRNA were analyzed. Notch 2 expression was analyzed using Notch2 antibodies. Low concentration of TNFalpha (1 ng) and short exposure (6h) slightly decreased miR-181a (0.86- vs 1.0-fold change of control). High concentration of TNFalpha (10 ng) and short exposure increased miR-181a (1.86- vs 1.0-fold change of control). After 24h, low concentration of TNFalpha inhibited miR-181a (0.27- vs 1.0-fold change) whereas high dose of TNFalpha had no effect on miR-181a. TNFalpha significantly increased Notch2 mRNA. Immunohistochemistry showed a strong immunodetection of Notch 2 at cell periphery. Overall these data suggest that *in vitro* system models are suitable to study the mechanisms by which TNFalpha modulates lung inflammation and underlying pathologies.

A NEW METHOD FOR EARLY DIAGNOSIS OF COLON CANCER USING FLUORESCENCE EXCITATION-SCANNING HYPERSPECTRAL IMAGING

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Colon cancer is the second leading cause of cancer death in the United States. Early detection and diagnosis is an important step in reducing morbidity and mortality making the ultimate goal of screening exams to identify lesions prior to advancement into cancer or tissue invasion. The objective of this study is to examine the potential of hyperspectral imaging for measuring spectral changes that are concurrent with changes in colon cancer compared to surrounding normal tissue. Specimen pairs of fresh normal and adenocarcinoma were obtained from surgical resections of colon tissue in collaboration with the University of South Alabama Departments of Surgery and Pathology. All procedures were carried out in accordance with Institutional Review Board protocol # 13-120. Tissues were scanned by excitation scanning hyperspectral imaging using a novel microscope constructed at the University of South Alabama. Multiple fields of view (FOV) were acquired from each specimen and MATLAB and ENVI were used to correct for background signal and to draw regions of interest and extract the average spectra for each region. When comparing spectra averaged over several areas of normal colon, results demonstrated consistent spectral information images with similar peak wavelengths and shapes. However, in colon cancer, extracted spectra demonstrated high heterogeneity. High heterogeneity likely indicates variation in structural organization and molecular composition that is divergent from normal tissue composition. We conclude that hyperspectral fluorescence excitation-scanning may be a viable technology for detecting abnormal changes in the colon tissue based on spectral changes in the mucosa of the colon.

FUNCTIONAL ANALYSIS OF AIF-1 IN ASSOCIATION WITH CARDIAC ISCHEMIA REPERFUSION (IR)

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The mechanisms by which sterile inflammation is induced, after ischemia/reperfusion (IR) during organ procurement contributes significantly to tissue injury and may cause early organ dysfunction after transplantation. Genes associated with innate immunity are prime activators of early inflammatory responses to an allograft that lead to host-induced inflammation and organ rejection. We hypothesized that endogenous substances or damage-associated molecular patterns (DAMPs), released after allograft reperfusion such as allograft inflammatory factor 1 (AIF-1)/Daintain could promote activation of innate immune responses through the activation of cardiac TLRs and may contribute to allograft dysfunction. We have investigated expression levels of AIF-1 and TLRs during cardiac IR in a rat model of the left anterior descending artery (LAD) occlusion which generates ischemia in the left ventricle (LV). AIF-1 and TLR mRNA transcripts were significantly increased in a time dependent-manner after IR. These markers were upregulated as early as 10 minutes after reperfusion and further they were increased several-fold after 60 minutes of reperfusion in tissue and peripheral blood cells as compared to the control group. Functional activity of AIF-1 was confirmed in an *in vitro* model using human coronary

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vascular smooth muscle cells (CVSMC), treated with IFN- γ as well as using HEK293 cells transfected with h-TLR2 or TLR4 in which the end product was determined by production of IL-18 cytokine. Thus, elucidation of the mechanisms of an induced inflammation within the allograft has the potential for the development of novel anti-inflammatory strategies that could improve outcomes for solid organ transplant recipients.

SERS MONITORING OF PROSTATE CANCER PHOTOTHERMAL THERAPY USING GOLD NANOMATERIALS

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Prostate cancer is the most common malignancy among US men. The Southern states, including MS has one of the highest prevalence and fatality rates due to prostate cancer in the nation. Currently available treatments of radiation, surgery, and chemotherapy have severe side effects and are mostly ineffective in advanced stages. Recent advances in Nanotechnology have provided new approaches to treat this disease. We use the Surface Enhanced Raman Spectroscopy (SERS) for detection and monitoring of photothermal destruction of prostate cancer cells. Raman signal is normally quiet weak but can be enhanced over 10 orders of magnitude in gold nanoparticles and adsorbed molecules on such nanoparticles, thus making it a highly sensitive probe to detect the presence of cancer cells. We bind Rh6g attached RNA Aptamers followed by attaching anti PSMA antibodies corresponding to proteins overexpressed in the LNCaP prostate cancer cells, to join to popcorn shaped gold nanoparticles. These multifunctional gold nanomaterials selectively aggregate on LNCaP prostate cancer cells. We monitor the SERS signal of the Rh6g dye. In presence of LNCaP cells we clearly see a strong SERS signal detectable to less than 100 cells per ml. The SERS signal diminishes as we perform photothermal therapy with 785 nm continuous Near Infrared Laser until all the prostate cancer cells are destroyed. This work was supported by the Mississippi INBRE, funded by an Institutional Development Award (IDeA) from the National Institute of General Medical Sciences of the National Institutes of Health under grant number P20GM103476.

Session VI: Biomechanics – II

ACCURATE DETERMINATION OF THE DYNAMIC PERMEABILITY OF THE LACUNAR–CANALICULAR SYSTEM IN HUMAN CORTICAL BONE

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A new method for the experimental determination of the permeability of a small sample of a fluid-saturated hierarchically structured porous material is described and applied to the determination of the lacunar–canalicular permeability (*KLC*) in bone. The interest in the permeability of the lacunar–canalicular pore system (LCS) is due to the fact that the LCS is considered to be the site of bone mechanotransduction due to the loading-driven fluid flow over cellular structures. The permeability of this space has been estimated to be anywhere from 10–17 to 10–25 m². However, the vascular pore system and LCS are intertwined, rendering the permeability of the much smaller-dimensional LCS challenging to measure. In this study, we report a combined experimental and analytical approach that allowed the accurate determination of the *KLC* to be on the order of 10–22 m² for human osteonal bone. It was found that the *KLC* has a linear dependence on loading frequency, decreasing at a rate of 2×10–24 m²/Hz from 1 to 100 Hz, and using the proposed model, the porosity alone was able to explain 86% of the *KLC* variability.

EFFECT OF MUSCLE FATIGUE ON ELECTRICAL IMPEDANCE OF BICEP MUSCLES DURING EXERCISE OF VARYING INTENSITY: A CASE STUDY

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Electrical impedance measurements quantify the resistance of a material to an injected electrical stimulus and have been used to detect physiological changes in biological tissues. Previous studies have indicated that exercise induced fatigue results in a decrease of the electrical impedance of muscle tissues compared to pre-fatigue values. However, studies have failed to explore the impact of exercise intensity on this decrease, which is an important consideration if this technique is to be used for personalized, real-time fatigue monitoring for athletes during training and competition. During this case study, a single subject performed sets of bicep curls until failure on multiple days at 60%, 75%, or 90% of their assessed one repetition maximum towards inducing fatigue in their bicep muscle. Electrical impedance measurements from 5 kHz to 1 MHz were collected using a tetra-polar electrode configuration and Keysight E4990A impedance analyzer immediately pre- and post-exercise. The electrical impedance of the bicep muscle showed decreases after each of the fatigue protocols, consistent with previous research, with resistance/reactance decreases of 1.5%/3%, 7.2%/15.3%, and 5.8%/15.5% immediately post the 90%, 75%, and 60% protocols, respectively, compared to pre-exercise measures.

APPLICATIONS OF INERTIAL MICRO-ELECTRO-MECHANICAL SYSTEMS ON AMERICAN FOOTBALL PLAYERS AND EQUIPMENT

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North American football players often hurt themselves because of incorrect football positions. The idea of using orientation sensing to help younger football players with football position development was studied in this research. This paper discusses how an orientation sensor can be created to help younger football players develop a better tackling position. After reviewing three inertial measurement devices, the raspberry pi coupled with a lis331 accelerometer was chosen. The MATLAB program reads the x, y, and z gravity components of the accelerometer and inputs them into the Euler angle equations. Once these angles were found, they were inserted into a flight path equation which was formulated into an orientation matrix. This allowed the sensor to measure the orientation of the football players. However, variance in the resolution of the sensor most likely occurred due to a mismatch of the input excitation voltage in the power surge which was 12 volts and the sensor's threshold voltage which was 3.3 volts. Further work must be done to enhance the signal output or sensitivity of the sensor.

CHARACTERIZATION AND OPTIMIZATION OF COLLAGEN-ELASTIN-LIKE POLYPEPTIDE COMPOSITE SCAFFOLDS FOR BONE TISSUE ENGINEERING

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Collagen scaffolds for guided bone regeneration (GBR) have poor mechanical properties and fail due to lack of rigidity and rapid degradation by collagenases. We have reinforced the collagen matrix with elastin-like polypeptide (ELP) and optimized the mechanical properties using a novel statistical method of response surface methodology (RSM). 2-7mg/mL collagen and 0-24mg/mL ELP were used in 11 different proportions to form the composites. Physical properties characterized by swelling ratio, differential scanning calorimetry, and FTIR spectroscopy revealed that the addition of ELP in composites reduced the residual water content. Scanning electron microscopy images of the control collagen-only hydrogels showed porous collagenous microstructure, but the ELP-

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collagen composites showed a dense collagenous microstructure with characteristic ELP aggregates. Mechanical properties determined by uniaxial tensile testing revealed variation with composition. Likely because of its low water content and dense microstructure, the 6:18mg/mL collagen:ELP composite had the maximum strength and modulus, but had lower toughness than many composites. Using just 5 compositions (versus the 11 we had to prepare for mechanical testing) RSM directed us to a new composition (6:12mg/mL collagen:ELP) that may have high toughness without negatively impacting strength and modulus. Overall, RSM efficiently performed optimization of composite composition by considering target levels, minimal requirements, and relative importance of the mechanical properties and predicted a new composition for future testing. Taken together, the composites prepared in this research can form good quality, rigid porous structures required for GBR as well as other tissue engineering applications.

BIOCOMPATIBILITY OF NOVEL COPPER-CONTAINING BIOCOMPOSITES IN QUANTIFIABLE MODEL CELL SYSTEM

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Biomaterials demonstrate great promise for use as tools in a wide range of biomedical applications. Specifically, the use of these materials for the treatment and study of nervous system disorders is becoming increasingly important as the diversity of synthesized materials increases. Biomaterial scaffolds can be used as bridges, cell carriers, and targeted drug delivery vehicles, for transporting regenerative and therapeutic agents to damaged neuronal circuits. Our lab has recently discovered a novel, copper-containing and amino acid (cystine)-based biocomposite material with potential for drug delivery due its degradability and low agglomeration in physiological conditions. Here, we used a quantifiable model cell system to demonstrate that delivery of moderate levels of HARS has little effect on cell function. More specifically, we have shown that exposure of increasing concentrations of the HARS from 2 to 50 μ g/ml, results in a dose-dependent diminishing viability and capacity of PC12 cells to extend neurites in response to the biological cue i.e. nerve growth factor. We have also exposed astrocytes, primary neurons and microglia to this material to study cytotoxicity of the material with naturally occurring brain cells. The results of cell viability studies using HARS material with our quantifiable system indicate that HARS are biocompatible, and this demonstrates their utility in neuronal experiments. For example, as an additive step in engineering HARS, due to the cystine content of our biocomposite, these novel materials could be functionalized with growth factors or antibodies for targeted delivery in the brain.

AN EFFORTLESS NON-INVASIVE RESPIRATORY DIAGNOSTIC DEVICE

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We have developed a simple inexpensive respiratory diagnostic device, the Airflow Perturbation Device (APD) that evaluates the respiratory resistance non-invasively and effortlessly while the subject normally breathes into the device, i.e. unlike other devices such as the spirometers that require considerable effort. APD detects the breathing flow and pressure. The respiratory resistance is then automatically calculated by dividing the breath pressure (in cmH₂O) by the breath flow (in L/s), resulting in respiratory resistance in cmH₂O/L/s. Although the device is still being enhanced, it is in its final stage of clinical trial. We have collected respiratory resistance values for over 3,500 subjects, both normal and those with asthma, COPD and vocal cord dysfunction. The competing methods consist of spirometry, plethysmography (body box), and impulse oscillometry (IOS). Spirometer is a simple inexpensive device, but requires considerable effort and is not

reliable. Both plethysmograph and impulse oscillometer are expensive and very difficult to use and interpret their results. The APD is most useful in diagnosing the respiratory disorders of young children, we have even successfully used the APD in neonates.

Session VII: Modeling and Patient Safety

IN VIVO EVALUATION OF THE EFFECT OF RESONANCE FREQUENCY ON DELIVERING INSULIN NON-INVASIVELY USING ULTRASOUND

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Single element ultrasound atomizing circular transducers with different resonance frequencies were studied for the purpose of non-invasively delivering insulin transdermally, in order to overcome the daily pain and the risk of contamination associated with injection. Frequencies ranging from 20 kHz to 2.1 MHz were tested for this purpose. Each transducer was housed with plexiglas material which included a reservoir to hold insulin during the experiments. For each transducer, twenty white rats (weight: 200-240g) were used and divided into four groups (two control and two exposure). The rats were anesthetized by intramuscular injection of 0.5 ml of a mixture of Kitamine and Xylazine after overnight fasting. Ultrasound was delivered in pulses for a duration of 20 minutes, and the blood glucose level was measured every 10 minutes through a period of one hour. The blood samples for the strips were taken from the tail (through the jugular vein). For each transducer, the skin was closely examined after ultrasound exposure for any signs of injury to notice the thermal effects if existed. For the control experiments, the same setup was followed up except that the power generator was turned off. Ultrasound transducers in the kHz range performed better than those in the MHz range; with the best performance achieved at a frequency of 40 kHz. A 40% reduction in Glucose level was achieved at 40 kHz while the reduction was only 5% at a frequency of 2.1 MHz.

THE INFLUENCE OF PHYSICAL ACTIVITY AND FRUIT AND VEGETABLE CONSUMPTION ON ADULT OBESITY

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Obesity is an epidemic that leads to severe chronic health complications, and is preventable by physical activity and consumption of fruits and vegetables. The objective of this study was to compare behavioral risk factors associated with adult obesity among six different States as an attempt to explain the differences in obesity levels among the six states of the leanest Colorado and Hawaii; the middle of Maine and Georgia; and the most obese Louisiana and Mississippi. Data was collected from the Behavioral Risk Factor Surveillance System (BRFSS). First, the results confirmed that there was a significant difference among the six states with respect to prevalence of obesity ($P < 0.05$). Results also, indicates a significant difference in weekly Physical activity among the six selected states ($p < .05$). As the levels of physical activity increased, the prevalence of obesity decreased. Fruit and vegetable consumption was also significant ($p < .05$). Results indicate that as people consume five or more servings per day significantly impacted obesity rates. In addition, there was a significant difference among the income groups ($p < .05$). As mean household income went up, prevalence of obesity went down. Results on children Grade 9-12 demonstrated a fair positive and significant correlation ($r = 0.669$, $p < 0.05$) between watching TV three hours or more and the prevalence of obesity. Obesity tends to worsen from children to adults if intervention is not provided. No significant difference between males and females was observed for all the six states. Differences between the six selected states were significant ($p < .05$) for education level. Overall, as the education level rose, the prevalence of obesity declined supporting

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the fact that the more educated the people are, the better choices in life they may have generally. In conclusion, physical activity and consumption of fresh fruits and vegetables have vital impact on the prevalence of obesity. An increase in physical activity, and consumption of fresh fruits and vegetables is key to eliminating obesity. More must be done to influence people to become more active in their daily life. There should be facilitators to encourage regular consumption of fruits and vegetables and make them available for people at reasonable cost.

COLORECTAL CANCER SURVIVAL IN THE DELTA AND NON-DELTA REGIONS OF MISSISSIPPI

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Introduction: Colorectal cancer is the second most common cancer in Mississippi affecting both males and females. Mississippi ranks second in the country for incidence and first in mortality from colorectal cancer based on 2013 data. Geographic region or neighborhood can have an impact on survival. **Methods:** A retrospective cohort research design was used to study data collected by the Mississippi Cancer Registry. The data set included colorectal cancer cases diagnosed between 2003 and 2011 with passive follow-up through 2011. Relative survival was analyzed by Delta and non-Delta region for Mississippi with stage and race included in the survival model. **Results:** The non-Delta region was significantly more likely to be diagnosed with advanced stage disease. For both whites and blacks, the non-Delta region had significantly higher survival compared to the Delta region. For both local and advanced stages of disease, the survival differences between the races in each region remained significant. **Discussion:** Race and stage do impact survival, but are not the only reason for the survival differences between the Delta and non-Delta regions. Stage and region do not completely account for the survival differences between the races.

THE RELATIONSHIP BETWEEN EFFECT SIZE AND STATISTICAL SIGNIFICANCE

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In research practice, the most common requests to statisticians from investigators are sample size calculations or sample size justifications. Determining sample size is one of the most important steps in designing a study. In order to have reliable and valid results, it is important to determine the right sample in combination with high quality data collection efforts. Sometimes, researchers have different opinions as to how sample size should be calculated. Statisticians usually choose from many available formulas that can be applied for different types of data and study designs. The aim of this workshop is to clarify this issue and to provide examples on how to calculate sample size. The components of sample size calculations will be discussed and what factors to consider in choosing the sample size. Other concepts related to this issue such as power analysis, confidence intervals, variability, type I error, type II error, and minimum effect size of interest will also be discussed.

PREVALENCE AND TRENDS OF EARLY CHILDHOOD CARIES EXPERIENCE AND UNTREATED CARIES IN THE MISSISSIPPI HEAD START POPULATION

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Background: Early Childhood Caries (ECC) is “the presence of one or more decayed, missing (due to cavities) or filled tooth surfaces in any primary tooth in a child 71 months of age or younger”. ECC is the most common childhood disease, is linked to periodontal disease, poor academic performance, and increased likelihood of chronic disease in adulthood and poor quality of life for the children who are affected and their families [2]. ECC

disproportionately affects low-income and minority children. Head Start is a federal preschool program aimed to identify and provide support for low-income children and their families. Due to the federal mandates for Head Start grantees, children participating in these programs are in a position to receive increased access to dental care through oral screenings and referrals to dentists for oral health treatment. Studies have shown that Head Start enrollees are almost three times more likely to obtain a dental screening than those enrolled in other preschool centers. Even with these parameters in place, a great amount of tooth decay is still present in Head Start children. There is a need to evaluate present interventions as a starting point for oral health reform in this underserved population. The **purpose** of this study is to investigate and report the demographics and the current oral health status of MS Head Start children, as well as to determine any statistical difference with national prevalence reported by The National Health and Nutrition Examination Survey (NHANES). **Methods:** The study used the oral screening data from the Mississippi State Department of Health’s (MSDH) *Make a Child’s Smile Program* for the time period 2009-2014 and data retrieved from NHANES to examine prevalence of caries experience and untreated caries over the study time period, and to compare the oral health status of MS Head Start Children to national reported levels. **Results:** The sample was majority African American, between the ages of 3 and 5 years of age, displaying a burden of caries experience and untreated diseases significantly higher than the reported national percentages, ($p < 0.01$). Gender was not found to have a significant impact within the sample, however, the prevalence of caries experience and untreated caries were significantly higher than the nationally reported rates, ($p < 0.01$). **Conclusions:** Caries experience and untreated caries is a significant problem in MS Head Start Children. Further research is needed to develop more effective interventions and oral health policies.

ANTICOAGULANT EFFECTS ON PURE PLATELET-RICH PLASMA

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Platelet-rich plasma (PRP) is frequently used to restore adequate number of platelets and thus maintain hemostasis. Nowadays, PRP has been widely used in regenerative medicine as an important tool. However, different protocols of preparation affect the properties of PRP, making result comparison more difficult. We investigated the effects of anticoagulants on blood cells and on plasma partitioning behavior after centrifugation, adopting a standardized protocol. P-PRP type (rich in platelets and poor in leukocytes) was prepared with one centrifugation cycle (100xg, 10 min), using a range of hematocrit of 30% to 45% from 10 healthy donors. Results show that anticoagulants primarily affected the morphology of the red blood cells (RBC) and the centrifugal portioning of plasma. As a consequence, different RBC packing levels and PRP volumes were obtained upon centrifugation. This study demonstrates how important is the standardized protocol and also that the investigated anticoagulants affected the preparation of P-PRP.

APPLICATIONS OF RAMAN SPECTROSCOPY AND IMAGING IN MEDICINE

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Raman scattering is a great analytical tool based on the identifying the characteristic vibrational energies of molecules presented in a material. Raman scattering based spectroscopy and imaging technologies have high potential in resolving medical problems, and the new applications are emerging continuously. In this presentation, recent studies in medical applications of Raman spectroscopy and imaging will be reported. The studies include portable Raman device for gout crystal analysis, direct Raman imaging for early tooth decay detection, and bounded and

unbounded water analysis in bone. The status of these research will be presented: the portable Raman device has shown clinical trial results superior to current available clinical analysis method, the preliminary data shows Raman imaging is feasible in detection early tooth decay, and unbounded water can be discriminated from bounded water with Raman spectroscopy.

Session VIII: Drug Delivery

THERAPEUTIC GROWTH FACTOR DELIVERY USING THE ELASTIN-LIKE POLYPEPTIDE BIOPOLYMER PLATFORM

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Therapeutic delivery of growth factors is an emerging area for treatment of a multitude of disorders, including regenerative medicine and pro-angiogenic therapy for chronic ischemia. However, free endogenous growth factors have poor pharmacokinetic and plasma stability profiles and do not make good pharmacological agents. The focus of this area of research is to develop a biopolymer delivery system to achieve a means for purification, extended plasma half-life, and tissue targeting of therapeutic growth factors. We are specifically developing isoforms of vascular endothelial growth factor (VEGF) family members for therapeutic angiogenesis in ischemic renal disease. VEGF family members were fused to the elastin-like polypeptide (ELP) biopolymer, a thermally responsive drug carrier which allows for easy purification, reduced immunogenicity, and extended plasma half-life of fused therapeutics. We demonstrated that ELP-VEGF has a long plasma half-life in a swine model. Furthermore, intrarenal administration of ELP-VEGF induced an increase in microvascular density and an improvement in renal function in a swine model of chronic renal artery stenosis. Ongoing studies are extending this approach by utilizing a kidney targeting peptide to dramatically improve renal targeting after systemic administration. The kidney targeting peptide increased renal deposition and specificity of ELP relative to the non-targeted polymer in both rat and swine models, and current studies are examining the efficacy of the kidney targeted form of ELP-VEGF via systemic administration for restoration of microvascular density and improvement of renal function in the swine renovascular disease model.

DRUG LOADED HALLOYSITE CLAY NANO TUBES AS TABLET COMPRESSION EXCIPIENT

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Naturally formed nanotubes of halloysite clay were explored as a vehicle for delivery of anti-bacterial, anti-hypertensive, anti-cancer and cosmetic agents. Halloysite is an aluminosilicate tubule material with 15 - 20 nm diameter lumen which can be used for loading and release of drugs; these biocompatible clay nanotubes may be used either in their pristine form or with chemically modifying the inner or outer surface. However, halloysite drug composites which were prepared previously were not included in any practical medical formulation. In the current study, flow and compressibility properties of halloysite such as angle of repose, Carr's index and Hausner ratio were analyzed as applied for tablets. Halloysite nanotubes were loaded with nifedipine with 5-6% loading efficiency and incorporated in to tablets at 50 wt %. Sustained drug release was studied from pristine halloysite and tablets in simulated gastric and intestinal media. Halloysite was found to be a potential compression excipient material with good to excellent flow properties. Drug release from halloysite incorporated tablets extended up to 20 hours at a sustained rate, as compared with only 3-4 hours for a standard over the counter nifedipine tablet.

IN VITRO ASSESSMENT OF A KERATOSE-PACLITAXEL DRUG COATED BALLOON

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Drug coated balloons (DCB) represent a novel approach to develop a superior intervention for the treatment of peripheral artery disease (PAD). Currently, DCB are coated with antiproliferative drugs, typically paclitaxel, which combat restenosis. When coated alone, paclitaxel has poor retention due to its diffusion from the artery following treatment. Excipients have marginally improved paclitaxel retention, however retention rates are still suboptimal. Keratose, a form of keratin, is a potential paclitaxel excipient due to its biocompatibility and tunable drug release properties. The goal of this project is to evaluate keratose paclitaxel excipient in DCB. Briefly, paclitaxel-containing keratose hydrogels were formed. Keratose degradation and paclitaxel release were quantified up to 45 days. Keratose-paclitaxel DCB were coated, visualized under scanning electron microscopy (SEM), and quantified for paclitaxel dosage. Drug retention was quantified in porcine carotid arteries 1 hour post-treatment. Results demonstrated that keratose-paclitaxel hydrogels released paclitaxel as a function of keratose concentration. SEM revealed a uniform coating comparable to commercially available DCB. Drug load averaged 2 µg/mm². Paclitaxel retention at 1 hour was 43.6 ng/mg, which falls in the therapeutic range of paclitaxel. These studies highlight the potential of a keratose to provide a safe and controllable drug release profile for PAD treatment.

THE EFFECT OF SUSTAINED DELIVERY OF NPY RECEPTOR ANTAGONIST ON BODY WEIGHT

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NPY is a neuropeptide that plays a major role in feeding behavior. The hyperphagia associated with menopause is thought to be a result of increased levels of NPY as estrogen declines. Female rats were ovariectomized and when the level of estrogen declined they were implanted with either empty tricalcium phosphate (TCP) delivery systems or TCP delivery devices capable of delivering 5 ng/day of a selective NPY 1 receptor antagonist. Body weights were obtained weekly, and blood was collected at 2, 4, and 8 weeks following insertion of the delivery device. The results showed a statistically significant reduction in body weight as early as two weeks in animals receiving the NPY 1 receptor antagonist when compared to ovariectomized control animals and ovariectomized animals with a sham (empty) delivery device. The blood estrogen, leptin and NPY levels were not different between the groups at any time point. The data indicates that antagonism of the NPY1 receptor may be an important target for reversal of post-menopausal weight gain.

INCREASED GLUTATHIONE IN CAOV-3 OVARIAN CANCER CELLS FOLLOWING DELIVERY OF THYMOQUINONE

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Thymoquinone (TQ) is an antioxidant that has possible anti-cancer effects. Studies have shown that TQ can exhibit inhibitory effects on the cell proliferation of many cancer cell lines. These results indicate that TQ inhibits tumor angiogenesis, tumor growth, and could be used as a potential drug candidate for cancer therapy. Cancer cells are constantly exposed to oxidative stress which can be detected by glutathione levels. The glutathione assay measures glutathione peroxidase which protects the organism from oxidative damage. This study investigates the glutathione levels after the conventional and sustained delivery of TQ to the ovarian cell line Caov-3. One-hundred thousand cells were plated according to standard lab protocols and subdivided into three groups of six

wells each. Group 1 served as control and groups 2 and 3 were treated with TQ (16 μ M). Glutathione biomarker evaluations were performed following standard lab techniques. The results of the study revealed: (1) for conventional delivery, glutathione levels were not statistically different ($p>0.05$) following the administration of TQ at all time periods and (2) for sustained delivery, glutathione levels were statistically different ($p<0.05$) following the administration of TQ at 72 hours. Overall conclusion: TQ only affected glutathione levels when administered by a sustained delivery system.

LOCAL LIQUID DRUG DELIVERY VIA PERFUSION CATHETER FOR PERIPHERAL ARTERY DISEASE

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One of the leading causes of morbidity in the US is Peripheral Artery Disease (PAD), a manifestation of atherosclerosis, which causes hardening and narrowing of the artery. The gold standard for treatment of PAD has been drug eluting stents. However, drug eluting stents are ineffective in the treatment of PAD due to high rates of strut fracturing and restenosis. This has led to the development of non-stent drug delivery systems to deliver anti-proliferative drugs to diseased peripheral arteries. One such novel drug delivery system is the perfusion catheter, which provides local liquid drug delivery between two occlusion balloons. The goal of this project is to evaluate the perfusion catheter as a non-stent drug delivery system. The perfusion catheter was evaluated delivering paclitaxel with different excipients using a bench top model using native, living porcine carotid arteries. Drug retention was quantified in 90 arteries using HPLC-MS at time points ranging from 1 hour to 7 days. Preliminary data indicate that the perfusion catheter successfully delivered paclitaxel to the arterial wall, including to the medial layer, and maintained drug levels up to 3 days. In conclusion, these studies demonstrate the feasibility of local liquid drug delivery using a perfusion catheter.

MORPHOMETRIC DIFFERENCES IN FIBROUS TISSUE SURROUNDING AMINO ACID COATED UHMW-PE IMPLANTED IN SOFT TISSUE

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Polyethylene materials used in orthopedic applications are biocompatible and non-immunogenic with host tissues. The purpose of this investigation was to determine the relationship of fibrous tissue capsule components following implantation of ultra-high molecular weight polyethylene (UHMW-PE) rinsed with saline (control) or coated with arginine-glycine-aspartic acid (RGD) or arginine-glycine-glutamic acid (RGE) into the abdominal cavity of 12 adult male rats. Implants and surrounding tissue were harvested at 90 days post-implantation. The animals were euthanized, and the UHMW-PE implants and the fibrous tissue capsules surrounding them were harvested. Microscopic examination of routinely stained sections (5 microns, Hematoxylin & Eosin) of the fibrous tissue capsules revealed macrophage, fibrocytes, and vascularity counts were highest in the saline treated group. There was a scant number of neutrophils in the saline and RGD coated groups. There were statistically significant differences (ANOVA, $p < 0.05$) of all three experimental groups compared to control with respect to macrophages, fibrocytes, and vascularity. These findings indicate that coating UHMW-PE implants with RGD and RGE limits the tissue-implant response compared to saline in soft tissue (peritoneal cavity) applications. These results provide further evidence that the intensity of the chronic inflammatory reaction to UHMW-PE can be manipulated to some extent by simple amino acid coatings that may enhance biocompatibility.

Session IX: Nutraceuticals – Tissue Engineering

IMPACT OF SOME COMMON ORGANICS ON CELLULAR GLYCOLYSIS AND THE DIFFERENTIAL SURVIVAL OF LUNG FIBROBLAST AND LUNG CARCINOMA CELL LINES

*Ibrahim Farah
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The role of energetic modulations and use of glycolytic inhibitors on cancer/normal cell survival is not clearly established in the literature. The purpose of this study was to evaluate six potential glycolytic modulators namely, Pyruvic acid, oxalic acid, Zn acetate, sodium citrate, fructose diphosphate (FDP) and sodium bicarbonate at μ M concentrations on growing A549 (lung cancer) and MRC-5 cell lines. Exposed and non-exposed cells were tested with phase-contrast micro-scanning, survival/death and metabolic activity trends through MTT-assays, as well as death end-point determinations by testing re-growth on complete media and T4 cellometer counts. Results showed that oxalic acid and Zn acetate both influenced the pH of the medium and resulted in differential massive cell debris within the exposure period. Pyruvic acid, sodium citrate, sodium bicarbonate and FDP did not cause pH changes; however, they caused detectable cell disfigurement and loss of metabolic activity, viability and survival/ death end points with the resultant death of the A549 cell line. The MRC-5 cell line was differentially unaffected by exposure to pyruvic acid, sodium citrate, sodium bicarbonate, FDP and Zn acetate, underwent complete recovery and remained both attached and healthy for 6 weeks upon subculture when transferred to a new complete medium. Oxalic acid did not show differential modulation with the consequent loss of survival and death of the MRC-5 cell line. Phase contrast, metabolic activity, cell counts as well as death end-point findings confirmed our hypothesis. These studies show the potential possibly for exploiting cellular metabolic differences in cancer control.

UNRAVELING THE MECHANISM OF ACTION(S) FOR THYMOQUINONE AND EGCG ON CANCER CELLS

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Natural products like EGCG and Thymoquinone have been shown to be effective in interrupting the growth of many different types of cancer cells. The exact mechanism of action are not currently known. We have investigated both compounds for their effectiveness in reducing cancer cell loads in numerous cell lines and each compound appears to an IC_{50} dose that is cell line specific as well as targets different signaling pathways. Overall, both compounds may be effective alone and in combination with other chemotherapeutic agents.

TRISENOX INDUCES CELL CYCLE REGULATION AND APOPTOSIS THROUGH MODULATION OF MAPK PATHWAY IN ACUTE LEUKEMIA CELLS

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Trisenox (TX) has been used successfully in the treatment of acute promyelocytic leukemia (APL) patients alone or combination with all trans retinoic acid (ATRA). It inhibited APL cells growth at higher concentration through cell cycle regulation and apoptosis. However, TX –induced cells growth inhibition mechanisms still remain poorly understood. We hypothesized that TX induced cell growth inhibition mediated by oxidative stress, clastogenic effect and cell cycle arrest forced cells into apoptosis depended on P38 MAPK signalling cascade in APL cells. To test the hypothesis, we used both APL cell line and mice model of APL by western blotting, confocal imaging and other molecular techniques for investigation of TX induced modulation of P38 MAPK signaling

cascade. We found that the phosphorylation levels of p38 and Erk modulated in HL-60 and NB4 cells treated with TX concentration dependent manner. Whereas, phosphorylation of JNK was increased in HL-60 cells, but down regulated in NB4 cells concentration dependent manner. Our specific inhibitor studied of p38 and JNK phosphorylation revealed p38 MAPK signaling pathway involved in TX induced cell cycle regulation and apoptosis in APL cells. It is a novel target for treatment of APL patients by TX and also designing of new anti-leukemic drugs.

EFFECTS OF CURLY KALE *BRASSICA OLERACEA* VAR. *SABELLICA* ON VIABILITY OF CULTURED MOUSE MELANOMA CELLS

Bilal Qizilbash and Ibrahim O. Farah

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The challenge with many cancers is not just killing the malignant cells, but doing so in a non-toxic manner. Plants are sources of many anti-cancer compounds, many of which have been developed into chemotherapies, e.g. taxanes from the bark of the Pacific yew tree and vinblastine from vincas. These chemotherapies are delivered in large doses and reduce tumor growth, but have severe side effects on normal tissue. Cruciferous vegetables such as broccoli, cabbage, and kale contain anti-cancer compounds which are being isolated and examined. Some of the compounds are antioxidants, while others have yet to be identified. Numerous studies have been conducted on curly kale, *B. oleracea sabellica*, to identify some of the compounds responsible for the health benefits of consuming the plant, in its raw or juiced form. Much of this research focused on sulforaphane, an isothiocyanate that is also found in foods such as broccoli, brussels sprouts, and cauliflower. Sulforaphanes, among other compounds, have been shown to decrease cell proliferation, reduce inflammation, and induce protective autophagy *in vitro*. There are no studies that have examined the effect of kale juice on cells. We hypothesize that the natural context of kale's bioactive compounds may provide significant anti-cancer effects. To test this hypothesis, kale juice was prepared and added to melanoma, epithelial, and fibroblast cells. Initially, four forms of juice were tested: juice made with a blender and three juices made with an electric juicer (juiced kale, juice that was filter-sterilized, and juice that was sonicated and then filter-sterilized). Serial dilutions were tested on B16F10 melanoma cells to determine the optimum dosage for inducing cell death. There was a dose-dependent decrease in cell growth and the lowest effective concentration was chosen for all subsequent experiments. The growth rate of cells treated with an equivalent amount of unfiltered lettuce juice was not different from the untreated cells. The sonicated and filter-sterilized extract also significantly reduced growth, but had different effects on melanoma and epithelial cells. When these experiments were repeated with non-cancerous cell lines, the juiced kale was found to be non-toxic to the epithelial cells and the fibroblasts at the dosage that kills melanoma cells. Future experiments will assess the safety and efficacy of kale juice for treating melanoma *in vivo*.

GARLIC EXTRACT DESTROYS THE MEMBRANE INTEGRITY OF HUMAN LEUKEMIA (HL-60) CELLS

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Garlic supplementation in diet has been shown to be beneficial to cancer patients. Recently, its pharmacological role in the prevention and treatment of cancer has received increasing attention. However, the mechanisms by which garlic extract induces cytotoxic effects in cancer cells remain largely unknown. The present study was designed to use HL-60 cells as a test model to determine the cytotoxic efficacy of garlic after treatment of human leukemia cells. Human leukemia (HL-60) cells were treated

with different concentrations of garlic extract for 12 hr. Live and dead cells was determined by trypan blue exclusion test using the cellometer vision. In addition, the cell viability was determined by the MTT assay. Data obtained from the trypan blue exclusion test indicated that GE significantly ($p < 0.05$) reduced the viability of HL-60 cells in a concentration-dependent manner. Similar trend was observed in the data obtained from the MTT results. Finding from the present study demonstrates that at therapeutic concentrations, garlic treatment induced cytotoxic effects in HL-60 cells. **Acknowledgements:** Research supported by NIH-RCMI Grant # G1200MD007581 at Jackson State University and part by the Mississippi INBRE (NIGMS-P20GM103476).

NANOCERIA AND CATALASE CONJUGATES AS A FREE-RADICAL SCAVENGING SYSTEM

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Reactive oxygen species (ROS), found as a product of cellular respiration, are present in any given aerobic organism at any time. However, ROS has been proven to play a role in the propagation of the immune response, causing cellular growth and apoptosis. Nanocrystalline cerium dioxide (nanoceria) is known for its pronounced antioxidant activity. It was shown that nanoceria possesses similar activity as SOD, converting free oxygen radicals into hydrogen peroxide. Catalase, a naturally occurring enzyme found in peroxisomes, can convert hydrogen peroxide molecules into water and oxygen. The goal of this project is to combine nanoceria and catalase into an ROS scavenging system to take a free radical oxygen and convert it to a water and oxygen molecule. When implemented, this system could drastically reduce the amount of ROS, ultimately reducing its contribution to the harmful effects on the immune response.

Session X: Biomaterials

ON THE DEVELOPMENT OF GRADIENT BIOMATERIALS FOR INTERFACE TISSUE ENGINEERING

Vinoy Thomas

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Development of interface materials with zone-dependent properties for interface tissue engineering (ITE) and biomaterials for hard-soft interface tissues is a rapidly developing field that aims to fabricate biological tissue alternates with the goal of repairing or regenerating the functions of diseased or damaged zones at the interface of different tissue types ("interface tissues"). Notable examples of the interface tissues in the human body include ligament-to-bone, tendon-to-bone and cartilage-to-bone. Engineering interface materials requires a spatially organized material chemistry, composition and morphologies and in the case of ITE of hard-soft interfaces, cell types and signaling molecules are required additionally. Therefore, the use of conventional biomaterials (monophasic or composites) for ITE has certain limitations to help stimulate the tissue integration or recreating the structural organization at the junction of different tissue types. The advancement of 3D printing and nanotechnologies enable us to integrate and develop systems with gradients in biomaterials properties that encourage the differentiation of multiple cell phenotypes and subsequent tissue development. As an example, we focus on the fabrication of gradient scaffold/membrane for favoring the repopulation of regenerative cells for scaffold-based tissue regeneration or high throughput screening of biomaterials. Recent developments on new composite membranes with nHA gradient for potential membrane for periodontal tissue engineering

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by promoting the bone growth and preventing the bacterial colonization and graded-blood tubular graft for vascular tissue regeneration by promoting endothelial cells will be presented.

THE INVESTIGATION OF TOXICITY OF METAL OXIDE NANOMATERIALS

Qilin Dai

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Metal oxide nanomaterials (MONs) in nano-photodynamic therapy (PDT) are associated with cell destruction under the light irradiation due to the ability of generating reactive oxygen species (ROS). However, some potential risks of nanomaterials in biomedical applications still remain. There are many reports about the toxicity of the metal oxide nanomaterial used in nano-PDT, but there is no systematically studies on the influence of physicochemical properties of MONs, including size, morphology and surface structure, on their toxicity. Advancing our knowledge on these issues is very urgent and critical to the development of nano-PDT. In this work, MONs with different sizes, surface structures and morphology are synthesized by chemical solution method, including CdMoO₄, Zn₂SnO₄, Y₂O₃, CuO, ZnO and TiO₂. ternary oxides have more freedom to tune the properties of the MONs. We synthesized ternary CdMoO₄, Zn₂SnO₄ and indium tin oxide nanospheres and nanowires for the nanotoxicity study. The correlations between the physicochemical parameters and toxicological end-point responses of the study MONs are demonstrated in our work.

DILUTE SOLUTION BEHAVIOR OF BLOCK COPOLYMERS OF ELASTIN-LIKE POLYPEPTIDE AND POLYELECTROLYTES

Jared Cobb and Amol Janorkar

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Elastin like polypeptide-polyelectrolyte (ELP-PE) block copolymer coatings have been shown to promote three-dimensional spheroid arrangement of multiple cell types in in vitro cell cultures. This arrangement closely mimics cells' natural orientation within the body. This model is currently limited by the non-uniformity in both ELP-PE coating thickness and the distribution of the polyelectrolyte on the surface. This can lead to a large variation in spheroid size and an erratic scattering of spheroids across the coated surface. We have investigated the effect of important processing parameters (solvents, solutes, and temperature) on a large and small molecular weight ELP-PE block copolymer. These factors have been explored using dynamic light scattering to determine the transition temperature and radius of hydration (Rh) of the ELP-PE block copolymers. It was found that with an increase in temperature from 25 to 60°C the Rh of the polymers in solution increased, indicating that the polymers keep the inverse phase transition behaviour of the ELP. Upon addition to a 0.2M NaCl solution, the Rh for the polymers exhibited a two-fold increase in size to approximately 950 nm. As the concentration of the NaCl solution was increased to 1M, the Rh for the low molecular weight ELP-PE increased to a size of 2000 nm while the larger molecular weight ELP-PE remained at 950 nm. These studies will help determine the structural profiles of the polymers in different media, ultimately providing well characterized coating surfaces to enhance our understanding of how cells interact with the polymers based on their conformations.

INVESTIGATING ELECTROSPUN ALGINATE- AND CHITOSAN-BASED FIBERS

Kathryn Penton, William Weeks, Scarlett Salter, Amber Wilson, Tia Brown, Doug Miller, Sharon K. Hamilton
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Recent evolutions in the field of biomaterials have focused on developing materials that can facilitate interface with biological systems to treat or replace tissues or functions of the body. Natural polymers, including polysaccharides, have been investigated as suitable biomaterials to mimic the environment of body tissues and

facilitate tissue regeneration. Electrospinning natural polymers, like alginate and chitosan, yields nanofibers that have shown promise as tissue scaffolds and drug delivery vehicles. However, little research has been published on the controlled delivery of drugs from polymeric nanofiber dressings. The lack of studies in this area is due in part to the difficulty of electrospinning charged polymers, like alginate and chitosan. This research has taken a two-pronged approach towards the investigation of natural polymer-based fibers. One facet focuses on the development of novel alginate-based, degradable nanofibers. It is anticipated that the degradable alginate nanofiber scaffolds can be used for drug delivery and future studies will investigate the time-release of small molecules from these fibers. Another facet focuses on the preparation of a variety of drug loaded, alginate- and chitosan-based fibers via electrospinning and the exploration of the release profiles of these novel scaffolds. This represents a first attempt to create a drug release profile catalog from negatively and positively charged natural polymer-based electrospun scaffolds. Studies from both approaches will lead to improved understanding of alginate- and chitosan-based wound healing materials, especially in the field of modern drug-laden, wound dressings.

NONLINEAR FINITE ELEMENT ANALYSIS OF MICRO-LATTICE STRUCTURES FOR PATIENT SPECIFIC IMPLANTS

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The primary objective of this research paper is design and nonlinear finite element analysis of micro-lattice of Ti-6Al-4V implants using the Bauschinger effect. Micro-lattice cellular Ti-6Al-4V structures are commonly used for orthopedic application with an organized porosity and pore sizes appropriate for tissue ingrowth and organic process. In this research paper CAD model of different unit lattice structures with design variables such as strut length, strut cross-section and pore size using Intra-Lattice software were designed. Intra-Lattice software is a parametric lattice demonstrating tool and is developed based on Grasshopper, a graphic algorithm editor for Rhino CAD software. In this study, three different unit cells are presented including a Grid (simple cubic), Star (body centered cubic) and Tesseract (hypercubic) structure. The finite element analysis (FEA) technique is presented to analyze the mechanical properties of these three types of lattices-based cellular structure. For FE modeling, beam elements have been used to model the micro-lattice structures under different loading conditions (i.e. tension and compressive). The FE simulations were carried to predict the functional effectiveness and load-bearing effectiveness for the above three unit cells. In the last phase of this investigation, the unit cell topology was improved to increase the stiffness and yield stress under loading conditions. Finite Element Simulations demonstrate that the stiffness and yield strength can be enhanced by changing the unit cell geometry. The results of the above investigation will then be applied to patient-specific implants.

FINITE ELEMENT ANALYSIS OF CYCLIC AMP DIFFUSION AND SIGNALING BETWEEN CELLS

Steven Shettlesworth, Nicholas Stone, Anh-Vu Phan, and Thomas Rich

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Second messengers, such as cyclic adenosine monophosphate (cAMP), are responsible for a plethora of cellular functions. The essential role cAMP signaling plays in living organisms is well understood, yet there is still much debate on the information stored within these signals. In the last decade, mathematical models have been developed for explaining concentration of cAMP gradients, including our finite element analysis (FEA) models of the diffusion, degradation and synthesis of cAMP within a single cell. In this work, we present the development of a two-dimensional FEA model of cell-cell interaction to simulate cAMP diffusion and signaling between adjacent cells. The governing equation

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employed in our previously developed models is also adopted in the new FEA model. The direct contact cell signaling mechanism is assumed. Some preliminary numerical results will be presented to discuss the validity of the proposed model.

Session XI: Technology For Healthcare And Education

USING iOS DEVICES AS AN INTERACTIVE LAB ENVIRONMENT

*Francis Tului, Latrice Evans, Terrance Eubanks, Aaron James, LaDamion Harness, and Traeshaun Hiley
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Interactive laboratory sessions in undergraduate science and engineering disciplines, help improve the understanding of principles and theory. Using smart devices, such as smart phones and tablets for data collection and visualization facilitates performing many interactive lab activities, which are otherwise tedious and laborious for the students. Here, we describe a novel method of data collection and visualization on iOS devices by interfacing external sensor with a view to perform interactive and inquiry-based lab activities. The iOS devices (smart phone and tablets), microcontroller, WiFi module, and external sensors are interfaced to collect real time data, visualize the data trends, and publish for analysis and behavior of a subject of interest. A proto model of weather environment physical system consisting of temperature, humidity, and light sensor is designed to study real time monitoring of the environment. For example, over a period of one hour the corresponding variables are observed for the changes of a surrounding environment in a location and a certain time, and found to be 62 F to 64 F, 86% to 86.5%, and 45 to 52 (arbitrary units). The measured data are within an accuracy of 1% and the results are found to agree with the traditional data of corresponding variables. The proposed model displays the data as a dashboard in different graphical formats such as 2D plots, gauge meters among others. The study and analysis of data is simple and interesting to the students to further their learning of physical principles of dynamic systems.

AN ON-BODY CONFORMAL PRINTED ARRAY ANTENNA AT mmWAVE FREQUENCIES FOR HEALTHCARE APPLICATIONS

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On-body printed antenna is a rapidly growing research area targeted for healthcare, biomedical, public safety and military applications. Printed antennas in both microwave (MW) and millimeter wave (mmWave) frequency bands have been found useful for Wireless Body Area Networks (WBAN) and medical devices. While miniaturization, conformability and good near-field patterns have prime importance in the antenna design, the interaction of RF signals with human body and the effective signal penetration need to be assessed carefully during the design phase. An on-body 2×2 printed antenna array is designed at mm Wave frequencies on a flexible material. The antenna is designed such that it radiates directly into the human body. Its performance parameters including return loss, near-field patterns and radiated power are evaluated when placed on a human phantom. Measured specific absorption rate (SAR) and power density (PD) profile on an experimental phantom using a high-resolution infrared camera will be presented at the symposium.

THE USE OF COMPLEX CLINICAL DATA AND TOPOLOGICAL DATA ANALYSIS FOR PERSONALIZED MEDICINE

*John Clemmer, W. Andrew Pruett, Kenneth R. Butler, and Robert L. Hester
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Methodologies that could identify subgroups of patients that may or may not respond to a given treatment could be a revolutionary tool in personalized medicine, a new concept for treating a specific patient based on their particular health or physiology. The association between obesity and several of its comorbidities, including diabetes, hypertension, dyslipidemia, stroke, and cardiovascular disease, is well established. However, variability from patient to patient complicates the translation of these risk factors to the clinic to give actionable information about a patient's optimal treatment. Based on 36 physiological variables, we analyzed a cohort of 2700 patients from the Genetic Epidemiology of Network of Arteriopathy (GENOA) Study using topological data analysis (TDA), a new clustering algorithm tool. Variables used for the analysis included blood pressure, BMI, age, renal function, and metabolic markers. TDA clustered and separated out 6 distinct subgroups of obese patients with similar BMI but differed in over 100 variables including renal disease, serum inflammatory biomarkers, and prevalence of stroke, diabetes, and hypertension. This suggests that the association between obesity and its comorbid conditions is not always clear. These methodologies could potentially be used to discover patterns in a patient's physiology and advance personalized medicine.

VISUALIZING HEALTH IN MISSISSIPPI: THERE'S AN APP FOR THAT!

*Denise Krause
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Introduction. An interactive, web-based application using geographic information systems has been developed to visualize health providers, services, statistics, and outcomes in Mississippi. This user-friendly application is useful for workforce planning, recruitment, and health services and population health research. The tool was developed to assist in improving access to health care and health outcomes for all Mississippians. Methods. Data including active health professionals were collected from health professional licensure boards. These datasets, combined with other proprietary and public datasets, were prepared, processed, catalogued, and stored in our Healthy Mississippi Data Lake. An ArcGIS 10 server application was developed in JavaScript, which can run on most platforms, including mobile devices, to query and visualize the geographic distribution of the health workforce, health statistics, and health outcomes. Key findings. The application allows users to identify and query geographic locations of health professions filtering by selected criteria, to perform drive-time or buffer analyses, and to explore health-related and socio-demographic population data by selected geographic area. The application is particularly useful to medical students, the Rural Physician/Dentist Scholarship Programs, the Office of Physician Workforce, the Mississippi State Department of Health, and many other state and private organizations. Implications. This application visually represents health in Mississippi and provides access to much needed information for state-wide health workforce planning, health services, and population health research. It is an expandable tool that enables Mississippi to become more proactive in addressing the needs for health care providers, services, and interventions to improve health.

LESSONS FROM THE FIELD: SETTING UP AND OPERATING A NETWORK OF MOLD SPORE SAMPLERS

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The University of Mississippi Medical Center conducted an 18 month study to evaluate the mold spore abundance in Central Mississippi and their variations with seasons. Aeroallergens,

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including common fungal spores can be triggers for those with allergies, asthma and other respiratory conditions. A network of standard free standing ground-based volumetric spore traps was designed, procured, built and operated to collect mold spores samples from the study area. Common meteorological variables were also collected using weather data logging stations. Topics covered will include the site selections, gaining property owners to house stations, assistance in sample media changes, and more importantly the instrumentation related problems and their solutions. Five of the 6 sites were solar powered and air flow rates of these samplers started to vary between daylight and dark hours. Another power supply related problem was due to inefficiency of the deep cycle batteries, particularly in the colder days. An additional problem encountered when ambient temperature and pressure changed resulting in variations in air volume. This presentation will include the field data collection process and will highlight the solutions to the unanticipated problems to main data integrity required for the project.

A NEW EXCITATION-BASED TECHNIQUE FOR ESTIMATING FRET EFFICIENCY

John Robert Griswold, Naga Annamdevula, Joshua Deal, Thomas Rich, and Silas Levesley
University of South Alabama, Mobile, AL, USA

We have developed a novel hyperspectral imaging microscopy technique that filters excitation wavelengths and collects a bulk emission signal. We have previously shown that this excitation-based system can detect multiple fluorophores in live cells with high signal-to-noise ratios. Furthermore, this system is capable of faster acquisition times than conventional emission-based methods. This project aims to adapt our excitation-scanning technique for a new purpose: Förster Resonance Energy Transfer, or FRET. Though FRET is a ubiquitous tool in the biological sciences for measuring intermolecular distances, current spectral FRET detection methods suffer from poor signal-to-noise ratios, making it difficult to capture rapid cell-signaling events. This study's hypothesis was that excitation-scanning could provide improved signal strength for these measurements. Data were collected from HEK-293 cells transfected with a Turquoise-Epac-Venus FRET probe to monitor cyclic AMP, and treated with Forskolin, an adenylyl cyclase activator. Excitation light was provided by a Sutter VF-5 filter system connected to a 300W Xe arc lamp. Samples were excited from 380 to 490 nm, at 5 nm increments, and an image was acquired at each wavelength. Donor and acceptor excitation signals were resolved using linear unmixing and a spectral library acquired from single-labeled samples. FRET efficiency was determined by comparing donor signals at two dichroic filter cut-off wavelengths (458 and 495 nm). Results indicate that excitation-scanning could be a high-signal method for FRET estimation, but further optimization is required. If successful, this system will allow rapid acquisition of live-cell FRET image data along with simultaneous detection of other fluorescent markers.

Session XII: Therapeutics and Rehabilitation

MIRROR THERAPY FOR LOWER EXTREMITY RECOVERY AND GAIT IN SUBACUTE STROKE: A RANDOMIZED CONTROL TRIAL

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Stroke often leads to decreased mobility, strength, and motor control. During mirror therapy (MT), observing mirrored images of movement of the unaffected limb produces the appearance of movement on the affected side. MT has been shown to increase cortical activity in the affected hemisphere. The purpose of this study was to examine the effect of MT on lower extremity

impairments in patients with sub-acute stroke. Participants were recruited upon admission to inpatient rehabilitation. Those meeting inclusion/exclusion criteria were randomly assigned to groups using computer randomization. The control group received traditional physical therapy (PT). The treatment group received traditional PT and daily mirror therapy exercises. Data was collected at admission and discharge. Thirty patients participated, ages 26 - 79 years, with 17 in the control and 13 in the treatment group. Results indicate improved mean scores for all outcome measures at discharge. A significant difference was shown in between-group scores for lower extremity function measured by the Stroke Rehabilitation Assessment of Movement (STREAM) ($p < .05$); however, the control group had higher scores. No significant differences were found for the Functional Independence Measure locomotor score, the Timed Up and Go, or the basic mobility scores in the STREAM. Using MT as an adjunct intervention may benefit patients with subacute stroke by improving motor control and gait. However, this study did not indicate significant differences in outcomes compared to traditional physical therapy. Additional research is needed to determine the value of MT for rehabilitation of patients with subacute stroke.

THE EFFECTS OF AQUATIC THERAPY ON FATIGUE AND QUALITY OF LIFE IN PATIENTS WITH MULTIPLE SCLEROSIS: A SYSTEMATIC REVIEW

Kimberly Willis and Lisa Barnes
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Purpose/Hypothesis: The purpose of this systematic review is to determine the effectiveness of aquatic therapy on decreasing fatigue and improving quality of life in patients with MS. **Methods:** PubMed and CINAHL databases were searched in September 2015 using search terms related to multiple sclerosis, aquatic therapy, and fatigue, both individually and in combination. Electronic limitations included English language, date range 2010 - 2015, and humans. Inclusion criteria were patients with MS, aquatic therapy, and outcome measures assessing fatigue. Exclusion criteria were systematic reviews and case studies. **Results:** Following the screening process, four articles were included in the systematic review. Results of the article review suggest that aquatic therapy focusing on strength, flexibility, balance, and functional mobility may be beneficial in improving quality of life and reducing fatigue in patients with MS. **Conclusions:** When comparing aquatic cycling to land cycling, aquatic exercise showed no significant benefit; however, total body aquatic therapy interventions showed improvements in quality of life and function with some evidence of decreased fatigue. Patients who began aquatic therapy programs with higher levels of fatigue showed greater improvements in the reduction of fatigue. One study suggested that aquatic therapy was more beneficial in reducing fatigue and improving quality of life compared to routine daily behaviors. Findings suggest that aquatic therapy may be beneficial for improving quality of life for those living with MS, and for some it may successfully decrease fatigue levels.

THE EFFECTS OF THERAPEUTIC ULTRASOUND ON ADULT PATIENTS WITH NON-SPECIFIC CHRONIC LOW BACK PAIN: A SYSTEMATIC REVIEW.

Sherry Colson and Lisa Barnes
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Background and Significance: Therapeutic ultrasound (US) is a commonly used physical therapy intervention, specifically for those suffering from non-specific chronic low back pain. The efficacy of passive US specific to chronic low back pain has recently been challenged. In addition, the APTA Choosing Wisely campaign has stated "Don't employ passive physical agents except when necessary to facilitate participation in an active treatment program." The purpose of this systematic review is to determine the effectiveness of therapeutic ultrasound for decreasing pain and improving the quality of life for patients with non-specific chronic

low back pain. Methods: PubMed database was searched February 2015. Relevant studies were found using a search strategy including: back pain or lumbago and therapeutic ultrasound. Electronic limitations were English language and RCT. Inclusion criteria: age > 18 years, nonspecific chronic low back pain > 3 months. Studies were scored using PEDro and the 2011 Oxford Centre of Evidence Based Medicine (CEBM) scales. Results: Five articles met all the criteria for the systematic review. The average PEDro score was 6/10. CEBM levels of evidence scores revealed one study at level II and four studies at level III. Conclusion: Ultrasound combined with exercise may be more effective than exercise alone or placebo US combined with exercise to decrease pain and increase QOL measures in patients with chronic LBP. However, US does not appear to be more effective than other passive modalities such as phonophoresis and electrical stimulation. Evidence showing the independent effects of US without other interventions seems lacking.

THE EFFECTS OF HIPPOThERAPY ON GROSS MOTOR FUNCTION IN CHILDREN WITH CEREBRAL PALSY: A SYSTEMATIC REVIEW

Janet Slaughter and Lisa Barnes

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Background and Significance: Functional limitations can affect the proficiency of motor skills and the level of participation in daily activities in children with cerebral palsy (CP). Hippotherapy is an intervention that uses horseback riding and has been suggested to increase motor control and functional ability in children with CP. The purpose of this systematic review is to explore the effectiveness of hippotherapy as a therapeutic intervention to improve functional outcomes in children with CP. Methods: PubMed Database was searched through February 5, 2015. Specific search terms included those related to hippotherapy and children with CP limited to the English language. Inclusion criteria were children with CP, clinical trials, and the Gross Motor Function Measure (GMFM) as a functional outcome measure. Exclusion criterion was the use of horse simulators. Results: After a stepwise selection process, 5 articles remained for review. Four out of five articles showed a statistically significant improvement in gross motor function in children with CP after receiving hippotherapy as a therapeutic intervention.

Conclusion and Clinical Implications: Evidence in all five articles demonstrated that hippotherapy led to clinically meaningful improvements in functional outcomes when compared to traditional physical therapy interventions. This systematic review supports the use of hippotherapy as a therapeutic intervention in children with CP as evidenced by consistently greater mean differences in functional outcomes for the hippotherapy groups compared to traditional physical therapy.

THE EFFECT OF DRY NEEDLING ON PAIN CONTROL AND POSSIBLE MECHANISM

Felix Adah, Min Huang and Mark Weber

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Background and Significance: Pain is a common problem of patients seen in physical therapy clinic that attracts varying therapeutic interventions. Recently, the literature is replete with conflicting reports that dry needling (DN) can reduce pain, reduce inflammation and thereby improve function. There are conflicting reports in the literature that DN of myofascial trigger points (MTrPs) or trigger points (TrPs) is efficacious in reducing spinal pain. Therefore, the purpose of this study to evaluate the effect of DN treatment in patients with neck pain and to review the literature for possible mechanism of action of dry needling if there is a preponderance evidence of DN in pain control. **Methods:** The PubMed database was accessed through January 27, 2016 using dry needling for patients with neck or back pain. Specific search terms and combination strategies are presented. Electronic

limitations included randomized control trial. Inclusion criteria included spine and/or neck regions, pain measurements, and local needling. Exclusion criteria included injections as primary interventions. Study quality was evaluated using PEDro criteria. The PEDro is a 10-point scale for assessing internal validity (higher scores indicating higher quality). The studies were also scored using the 2011 Centre of Evidence Based Medicine (CEBM) scale. This is a 5-level scale that determines a study's level of evidence based on the study's design with lower numbers indicating higher levels of evidence. The described search strategy identified seven studies meeting all requirements. The mean PEDro score of the studies was 6.57 with a range of 5 to 8. The CEBM frequency included three level II studies and four level III studies. Conclusion: The study demonstrated that DN treatment resulted in significant pain reduction and decreased sensitivity of pain in six of seven studies with the non-significant study also trending towards pain reduction. Six studies that measured ROM for an outcome measure demonstrated increased ROM of the cervical region after DN. **Discussion:** With the positive effect of DN treatment on pain reduction and increased ROM, one can deduce that patients with pain treated with DN can have an increase in function and ultimately improved quality of life. The possible mechanisms by which DN control pain are presented. The studies used in this systematic review had CEBM levels of II and III, which indicated a grade of B due to all 7 studies having CEBM levels of III or higher. **Conclusion and Clinical Implication:** DN as a modality is new in physical therapy. Chronic pain, such as neck pain, that may not respond to the traditional physical therapy (heat, exercise, and massage) may be relieved with DN treatment. It is suggested that, when considering treatment options for spinal pain and other chronic pain, DN treatment should be taken into consideration. More research is necessary to elucidate the mechanism by which DN reduces chronic pain and to carry out comparative studies between DN and other physiotherapeutic modalities.

QUANTITATIVE MEASURES OF THE IMPACT OF EXERCISE AMONG ELDERLY

Matt Gibson, Ham, Benghuzzi, and Michelle Tucci

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Twenty percent of the US population will be over the age of sixty-five by 2030. All age groups within the greater than sixty-five population are growing, but those over the age of eighty-five are the fastest growing cohort of the US population. The specific aims of this investigation were (1) to determine if a correlation exists between maintaining a relationship with a primary care provider and heightened exercise levels among an elderly population and (2) to determine if a correlation exists between exercise among the elderly and the completion of more preventive screenings than those elderly who do not exercise. We hypothesized that those elderly who have an active relationship with a primary care provider are more prone to exercise and those elderly who exercise complete more preventive screenings. Results of this survey based investigation revealed that maintaining a relationship with a primary care physician is the norm for the vast majority of the Auburn, AL and New Orleans, LA population. Furthermore, the communication of exercise guidance during primary care physician appointments was inconsistent in the Auburn, AL population and not overwhelming in the New Orleans, LA population. Unfortunately, the discussion of such exercise guidance during an outpatient clinic appointment has not equated to a change in exercise levels among the survey respondents in the either population. Overall conclusion: this study provided the literature with more insights regarding knowledge and awareness of the relationship between primary care and preventive healthcare consumption and exercise levels among the elderly.

Session XIII: Neuroscience

OPTIMIZING NEUROMODULATION TO ENHANCE STEPPING IN SPINAL CORD INJURY

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After spinal cord injury (SCI), residual neural circuits for stepping can be augmented with afferent stimulation. We have now systematically determined how well that stimulation can be optimized to enhance stepping in patients using spinal cord and peripheral nerve stimulation. Twelve subjects with cervical or thoracic SCI of varying severity were studied in the Lokomat gait orthosis. Stimulation was provided as transcutaneous spinal cord stimulation (TSCS) or at either distal tibial or common peroneal nerve sites. Stimulation parameters that were varied included frequency (all 3 sites) and timing or duration during the gait cycle (peripheral sites). Real time forces recorded by the Lokomat guided the development of an input/output model in each subject such that stimulation parameters were eventually optimized to decrease assistance forces from the robot. Using our optimization protocol, stimulation parameters were found that improved subject generated stepping forces over random or no stimulation. At the peripheral nerve sites, we found that high frequency stimulation, delivered at the swing to stance transition, for more than 20% of the gait cycle duration improved stepping forces in most patients. With TSCS, stimulation frequencies between 30 and 50 Hz augmented stepping the best. Further analysis revealed that stimulation frequencies below 25 Hz best augmented stance and between 25 and 50 Hz best augmented swing. There was some variability between subjects and for 1/3 of them, the best TSCS stimulation was 0 Hz.

BLAST OVERPRESSURE-INDUCED VESTIBULAR DEFICITS IN RATS

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As an air-filled structure and directly exposed to the surrounding air, unprotected ears are among the most frequently damaged sites during blast exposure. Vestibular symptoms, such as dizziness and imbalance, are common complaints among the blast victims. However, little is known about how and to what extent blast overpressure damages the vestibular system. In the present study, the effects of blast shock exposure through the external ear canal on the vestibular system were studied in rats. Under isoflurane anesthesia, animals were exposed to a blast shock (peak intensity of 185 dB SPL) delivered to the external ear canal. Twenty-four hours following the exposure, single unit recording was performed on the ipsilateral superior vestibular nerve. A total of 442 afferents were recorded from 7 blast-exposed rats and 7 control rats. Blast exposure significantly reduced the baseline firing rate of regular anterior semicircular canal (AC), horizontal semicircular canal (HC), otolith organ afferents and irregular otolith organ afferents. Blast exposure also significantly reduced the sensitivity of irregular HC and AC afferents to 0.5-2Hz sinusoidal head rotation. Fluorescein-conjugated phalloidin staining, which labels the filamentous actin in sensory cilium and cuticular plate of hair cells, revealed substantial sensory stereocilia bundle damage in both crista ampullaris and macula of saccule and utricle after blast exposure. Macrophage activation was observed in brainstem of blast exposed rats indicating that blast overpressure waves entering the ear canal can impact the brain. Blast exposure, however, did

not result in significant changes in gains or phases of the horizontal rotational and translational vestibular-ocular reflex (VOR). These results suggest that blast overpressure waves entering the ear canal causes damages in the peripheral vestibular system and brain that may contribute to the vestibular symptoms experienced by blast victims. Understanding the underlying mechanisms will reveal the urgency of ear protection in personnel at risk of blast exposure not just or protection of hearing and balance, but also for protecting the brain. [Supported by NIH R01DC012060 (HZ), R01DC014930 (WZ) R21EY025550 (WZ)]

NEUROPROTECTIVE AND REGENERATIVE ROLES OF THE WNT-3A PATHWAY AFTER FOCAL ISCHEMIC STROKE IN MICE

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Wnt signaling is a conserved pathway involved in expansion of neural progenitors and lineage specification during development. However, the role of Wnt signaling in the post-stroke brain has not been well-elucidated. We hypothesized that Wnt-3a would play an important role for neurogenesis and brain repair. Adult male mice were subjected to a focal ischemic stroke targeting the sensorimotor cortex. Mice that received Wnt-3a (2 µg/kg/day, 1 hr after stroke and once a day for the next 2 days, intranasal delivery) had reduced infarct volume compared to stroke controls. Wnt-3a intranasal treatment of 7-days upregulated the expression of brain derived growth factor (BDNF), increased the proliferation and migration of neuroblasts from the subventricular zone (SVZ), resulting in increased numbers of newly formed neurons and endothelial cells in the penumbra. Both the molecular and cellular effects of Wnt-3a were blocked by the Wnt specific inhibitors XAV-939 and Dkk-1. In functional assays, Wnt-3a treatment enhanced the local cerebral blood flow (LCBF) in the penumbra, as well as improved sensorimotor functions in a battery of behavioral tests. Together, our data demonstrates that the Wnt-3a signaling can act as a dual neuroprotective and regenerative factor for the treatment of ischemic stroke.

INTRAUTERINE GROWTH RESTRICTION IS ASSOCIATED WITH LONG-LASTING BRAIN CHANGES

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Epidemiological and experimental studies suggest that intrauterine growth restriction (IUGR) can cause neurodevelopmental impairments. Our previous studies demonstrated that IUGR alters brain size and behavioral performances in both neonatal and juvenile rats. To further examine whether IUGR has long-lasting effects on brain function, we examined brain structure and rat's behavior in 6 months old rats, exposed to IUGR. Offspring exposed to IUGR showed significantly lower birth weight compared to offspring from control dams. IUGR offspring showed motor deficits in the open field test, with brain size alteration, as indicated by the reduction of total brain, cortical, and hippocampal volume, along with the dilation of ventricles. Additionally, IUGR offspring had impairments of dendrites (MAP2+) and myelin (RIP+), and brain inflammation, as indicated by increases in microglia and astrocytes in the brain. The current study suggests that IUGR causes long-lasting behavioral disturbances and

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persistent brain changes, which may be associated with brain inflammation. This model may be useful for studying mechanisms involved in the development of brain changes associated with IUGR and for developing future potential therapeutic strategies. (This work was supported by Newborn Medicine Funds from the Department of Pediatrics, University of Mississippi Medical Center.)

DEVELOPMENT OF A LONGITUDINAL IMAGING SYSTEM FOR A MURINE MODEL OF TRAUMATIC BRAIN INJURY

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Following traumatic brain injury (TBI), secondary injury cascades can lead to axonal damage, white matter degeneration, and persistent microglia activation in subcortical regions of mice. Current techniques, such as diffusion tensor imaging (DTI) and histology can be used to observe features related to damage, but DTI lacks cellular resolution and histology is conducted on fixed tissue, preventing longitudinal studies in the same mouse. The combination of cranial windows and multiphoton microscopy (MPM) has been used to image cells in the upper layers of the mouse cortex, but resolution rapidly degrades with imaging depth, making it difficult to observe white matter damage following TBI. In order to obtain longitudinal data related to this secondary damage, gradient refractive index (GRIN) lenses (diameter = 0.5 mm, length = 1.7 mm) attached to low profile head plates were surgically implanted into the brain of mice to acquire time-lapse images of white matter for 60 days following midline fluid percussion injury. Thy1-YFP mice were used to compare changes in white matter fiber tracts and Cx3cr1-tdTomato mice were used to compare microglial activation levels over time versus mice with sham injuries and negative controls. These longitudinal images will provide comprehensive information concerning degeneration, inflammation and remodeling of white matter following injury.

Scientific Poster Session

THE EFFECT OF DRILL HOLE LOCATION ON THE LOAD BEARING CAPACITY OF TIBIAS

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Fracture fixation plates stabilize a fractured long bone to facilitate healing. The drill holes used to secure the implant may decrease the load bearing capacity of the bone. We investigated whether a drill hole in a compressive/tensile location had any measurable difference in load bearing capacity of tibias vs. a neutral location. Sixty-eight human cadaveric paired tibias were used. One bicortical hole was drilled into each bone in the experimental groups using a 4.1-mm drill-bit. Three groups were created: 0°/180°, 90°/270°, and 135°/315°. Each corresponded to placement of the bicortical drill hole along the circumference. Each bone underwent a four-point bend test. Maximum load bearing capacity was measured. Our results showed a statistically significant ($P < 0.05$) decrease in strength of all tibias with a hole drilled at 0°/180°, and 135°/315° compared to their controls. The tibias in these groups experienced average decreases in strength of 43.4% ($\pm 6.5\%$) and 35.3% ($\pm 25.7\%$) respectively. Since the drill hole was bicortical, both of these holes represent compressive/tensile locations. Decrease in load bearing capacity for bones in the 90°/270° group (neutral location) was statistically insignificant ($P > 0.05$). The percent difference in load bearing capacity of tibias in the 90°/270° group showed that experimental bones retained an average of 95.6% ($\pm 8.5\%$) the strength of their control counterparts. We conclude from these results that holes drilled at 90°/270° from the compression or tension surface of a long bone will minimize loss of bone strength. This finding can be used to guide surgical placement of drill holes.

PHENOTYPIC SWITCH OF VASCULAR SMOOTH MUSCLE CELLS IN VASCULAR CALCIFICATION

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One of the leading causes of death in patients with kidney disease or diabetes is cardiovascular complications. Past studies considered vascular calcification a passive process that resulted from elevated calcium-phosphate interactions. However, it is now considered an active cell-mediated process. This occurs through competition of proteins that promote calcification and inhibitors which cause arteries to harden. Current research has shown that these arteries harden analogously to bone development. It has been suggested that smooth muscle cells (SMC) in healthy arteries experience a genetic switch to osteoblast-like cells when exposed to high levels of glucose, calcium, phosphate, and cholesterol. While many researchers have recognized this anomaly, the molecular and cellular mechanisms that facilitate calcification remains unclear. Our in vitro model was developed to prompt vascular calcification and distinguish the genetic switching from healthy smooth muscle cells to osteoblast-like cells. Our goal is to use this in vitro model to examine the Wnt Signaling pathway and its relationship to the LRP5 pathway. From this, we can determine the effects these pathways have on calcification.

SYNTHESIS OF HYBRID IRON-POLYDOPAMINE NANOPARTICLES FOR IMAGING-GUIDED PHOTOTHERMAL THERAPY ON CANCER CELLS

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According to American Cancer Society, about 1,658,370 new cases of cancer were expected to occur in 2015 with an expected death toll of about 589,430. Magnetic resonance imaging (MRI) offers high-detailed morphological information on large regions of soft tissue. Photothermal therapy (PTT) of cancer eliminates the invasive side effects of current clinical therapies. PTT uses photo-absorbers that absorb near-IR wavelength and converts this light energy into heat energy. Magnetic resonance imaging works well in combination with PTT. Nanoparticle utilization in PTT has gained notoriety but there are safety concerns with metals. Our designed natural product nanoparticles will be metal-chelated for imaging guided PTT. Inorganic nanoparticles raise concern with high toxicity and low biocompatibility, factors not of concern with natural and naturally-derived products. These nanoparticles are usually not biodegradable and can remain in the body for extended periods of time, as well. Polydopamine (PDA) is a natural product from eumelanin, pigment found in dark hair and skin. PDA has strong photothermal capabilities; it has strong optical absorption and high photothermal efficiency. Essentially, PDA will provide photo-absorption for photothermal therapy; organic PDA also has low toxicity, high biocompatibility/degradability with shorter body retention. The approach to PTT guided by imaging requires a high-contrast component. Iron is a high-contrast agent that also has a lower toxicity retention than other metals used for MRI. Iron has shorter clearance and metabolism in the body. The proposal of this work is to produce a natural product polydopamine nanoparticle chelated with iron for magnetic resonance imaging-guided photothermal therapy.

MICROCONTROLLER SIMULATION OF AN ARTERY UNDER DEFORMATION

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Treatment of peripheral artery disease is highly dependent on therapeutic drugs targeting and remaining at the disease site within the peripheral arteries. The dissipation of a drug through the arterial wall is dependent on the tortuosity and porosity of the wall membrane. These metrics are affected by peripheral movements

that translate to compression, tension, and twisting of the artery in the body. To better understand how movements affect drug dissipation into arterial walls, a simulation has been designed to mimic these movements. An Arduino microcontroller in conjunction with multiple stepper motors was designed to control the tension, compression, and twisting of a sample artery under pulsatile flow conditions. Since different arteries have different real world deformation characteristics, the system was designed to provide tension at a rate of at least 1.02 mm/s and torsion/twisting of at least 3.46°/cm. The custom Arduino code enabled the system to be adapted to various testing criteria. The developed bioreactor system will thus be used to study the impact of arterial mechanical deformation on current and next generation interventional devices.

DESIGN OF A BIOREACTOR SYSTEM WITH PERIPHERAL MOVEMENT

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Peripheral Arterial Disease is the buildup of plaque in the peripheral arteries, usually in the legs. If left untreated, it can lead to health problems including heart attack and stroke. If the disease site is below the knee, a stent cannot be placed to hold the artery open due to the high fracture rates caused by cyclic motions from walking. Evidence has been presented that some drug eluting balloons do not work as well below the knee. To understand the effects that deformation has on arteries and pharmacokinetics, an ex vivo system is needed to apply the torsional and contractile movements produced from walking. This system utilizes servomotors to apply torsion and contraction/elongation to an artery. The system fits within a standard sized incubator and can be connected to a pump to allow cell culture media to pulse through it. The inlet valve allows the use of interventional devices to be deployed at a controllable position inside of the artery. The artery is surrounded with agarose to mimic the extracellular matrix and provide support. This helps eliminate kinks during the movement process. Test results agree that this system can apply accurate and repeatable movements to a live porcine artery.

MODELING THE EFFECTS OF PRESSURE AND VISCOSITY ON PENETRATION OF DRUG VIA A PERFUSION CATHETER DELIVERY SYSTEM

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The perfusion catheter is a relatively new medical device used to administer drugs locally within arteries by perfusing a drug solution into the wall of the artery. In practice, it would be desirable for the drug solution to penetrate as deeply into the wall as possible to maximize the benefit of the treatment, and this would require knowledge of the optimal combination of delivery pressure and viscosity of the drug solution. A computer model of an aortic wall with pressure-dependent geometric and material properties was used to predict drug penetration for a range of delivery pressures and drug viscosities. The results provide, for the first time, theoretical predictions of drug penetration using a perfusion catheter system, which are suitable for experimental validation.

A MATHEMATICAL MODEL TO SIMULATE REENDOTHELIALIZATION FOLLOWING STENTING

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Drug eluting stents (DES) reduce the occurrence of restenosis but increase the risk of late stent thrombosis. Thrombosis subsequently creates reblockage of the artery requiring additional clinical procedures. Late stent thrombosis occurs as endothelial regrowth is inhibited due to an anti-proliferative drug coating, such as Paclitaxel, on the implanted stent. Although smooth muscle cells

are the main target, anti-proliferative drugs are not cell type specific. The regrowth rate of endothelial cells post DES remains unknown. One way of determining the regrowth of endothelial cells, in conjunction with the DES, is to create a mathematical model and simulation. This model and simulation could determine factors that may reduce or even prevent stent thrombosis. A computer simulation, which models individual endothelial cell behavior, was implemented and defined by varying parameters carried out by a specific algorithm. Our goal was to simulate the anti-proliferative drugs concentration into the artery over time and due to fluid flow establish a gradient of concentration ratios. With this simulation, we have some insight as to how the endothelial cells interact with varying levels of anti-proliferative drugs. This mathematical model can potentially assist in identifying the ideal dosage and release kinetics of anti-proliferative drugs on DES and possibly eliminate stent thrombosis associated them.

ALTERED GENOMIC EXPRESSION IN THE HIPPOCAMPUS IN DEPRESSION

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Major Depressive Disorder (MDD) has a lifetime prevalence of 17% among US adults, and the available pharmacotherapies are not effective for many depressed patients. Suppression of neurogenesis -related genes may underlie the decrease in hippocampal volume noted with increasing duration of illness. Tissue punches were collected from the dentate gyrus from 23 subjects with MDD (medication-free) and 24 age-matched psychiatrically normal controls. Whole transcriptome paired-end RNA-sequencing was performed using an Illumina NextSeq 500 to quantify expression of mRNA in a region of hippocampal neurogenesis. A Cuffdiff bioinformatic algorithm was used in an initial analysis to statistically compare the two cohorts. Controlling for false discovery, 32 genes were differentially expressed. The following genes were decreased in expression in MDD: several with inflammatory function (e.g. ISG15, IFI44L, IFI6 related to interferon function; NR4A1) and the GABA(B)R1 gene. The following genes were increased in expression in MDD: two genes with cytokine function (SOC3, CCL2), two genes inhibiting angiogenesis (ADM, ADAMTS9) and the KANSL1 gene, a member of the histone acetyltransferase (HAT) complex. Gene Ontology analysis will be used to identify altered gene products in terms of biological processes, cellular components and molecular functions. Additional bioinformatic analyses will also be performed to assess the impact of potentially confounding factors such as postmortem interval, age, gender, death by suicide, duration of depression, and age of onset of depression. qRT-PCR will also be used to validate altered gene expression in MDD. Supported by COBRE P30 GM103328

OPTIMIZING QUALITATIVE MAGNETIC RESONANCE IMAGING (qMRI) FOR BRAIN IRON DEPOSITION ASSESSMENT IN ALZHEIMER'S DISEASE.

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Deposition of iron in the brain has been associated with chronic neurodegenerative diseases such as Alzheimer's disease. Purpose: To assess the iron deposition more accurately using our proposed T2 weighted MR imaging technique. Materials and Methods: As a first stage, this project used phantoms that were housed in a flat-bottomed plastic vessels, containing the following set of iron standard concentrations typically found in the brain: 1, 1.5, 2, 2.5 and 3ml. MRI imaging protocol was executed using our phantoms on the Siemens Skyra 3.0T scanner. Based on the resulting images, a calibration curve was calculated and a relationship between T2

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weighted MRI signal and the iron concentration was found. A map of iron concentrations using the polynomial function of second degree through an image processing algorithm in MATLAB® was done. Finally, twenty real MRI images from the brain (IRB approved retrospective T2 weighted images) were analyzed through our algorithm. These images included normal and volunteer patients with Cognitive impairment. Results: In this preliminary study, results clearly shows the high level of iron in brain areas directly related to patients who have been diagnosed with cognitive impairment. Conclusions: Brain iron deposition map, as extra routine procedure performed in MRI images, allows to identify iron deposition in particular areas of the brain which are directly associated with degenerative diseases such as Alzheimer's disease. It could also be used as a tool to recognize patients with an advanced stage or high-risk, as well as an accurate indication for implementing a convenient therapy.

THE EFFECT OF COMBINATION TREATMENTS OF EPIGALLOCATECHIN-3-GALLATE, THYMOQUINONE, AND 5-FLUOROURACIL ON FADU NASOPHARYNGEAL CARCINOMA CELLS

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Nasopharyngeal carcinoma (NPC) is a rare tumor that arises from epithelial neoplasms in the nasopharynx. It is a rare malignancy in most of the world. NPC is often misdiagnosed and mistreated due to the location of the tumor and non-specific symptoms. The cancer is poorly controlled with current treatment modalities. There is a need for treatment modalities that eradicate the cancer better with lesser side effects. FaDu squamous cell carcinoma cell line was used to test combination treatments of natural (EgCg and TQ) drugs and a chemotherapeutic (5-FU) drug to determine if combining drugs with different cell cycle targets would be more effective at destroying cancer cells than one drug that only targets one phase of the cell cycle. There were a total of four different combinations. One combination consisted of all three treatments: EgCg, TQ, and 5-FU. The other three combinations were as follows: EgCg + TQ, EgCg + 5-FU, and TQ + 5-FU. The combination treatments were measured at 24, 48, and 72 hours. There were significant reductions in cell number at each time increment. The combination of all three drugs proved to be most effective in cell reduction. EgCg or TQ can be combined with 5-FU to reduce cell number. The combination of two drugs specifically a natural drug plus a chemotherapeutic drug proved to be more effective than single individual drugs in eradicating cancer. Natural drugs can be paired with a chemotherapeutic drug to yield significant reductions in cell number producing less adverse side effects.

THE EVALUATION OF ANTIHYPERTENSIVE AGENTS USING CARDIOMYOCYTES

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Cardiovascular disease (CVD) is the leading cause of death and hospitalization in the United States. Risk factors that lead to an increase in developing CVD include genetic, behavioral, psychosocial factors, and other underlying conditions. Hypertension is one example of underlying conditions that are risk factors and comorbidities. Treatment options for CVD and other underlying factors may affect the course of the disease. Antihypertensive drugs, such as calcium channel blockers (CCB), beta blockers (BB), or angiotensin converting enzyme inhibitors (ACEI) are used to treat hypertension. The objective of our study was to compare the cellular effects of an ACEI, captopril, on cardiomyocytes. Cardiomyocytes were grown in a tissue culture environment under normal conditions and challenged with therapeutic concentrations of captopril. Over time in culture there were significant changes in cellular protein and intracellular glutathione concentration.

DEVELOPMENT OF A PORTABLE NEAR INFRARED CAMERA FOR SELF DIAGNOSIS OF DIABETIC ULCERS

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Venous blood accumulation, or high levels of deoxygenated blood within a tissue, can indicate poor blood circulation and increased risk of ulceration. This condition is associated with Peripheral Arterial Occlusive Disease, or diabetic foot ulceration, which is classified as the most common cause for lower extremity amputation. Due to the loss of sensation, ulcers can form without the patient's knowledge. Regular inspection of the afflicted area by a physician is the best prevention method for this condition. To simplify the process of examination, a low-cost system for self-monitoring by patients was developed. A near infrared camera was built utilizing a Raspberry Pi System and optical filters in conjunction with MATLAB to detect venous blood in tissues. Tests to optimize the best wavelength and imaging conditions were conducted to determine the optimal settings for the device. Further development includes the creation of an interface to allow data sharing between patients and physicians possible.

GENDER DIFFERENCES IN THE ANTINOCICEPTIVE EFFECT OF OPIOID AGENTS, ALONE OR IN COMBINATION WITH NON-OPIOID AGENTS

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Opioids are the most powerful analgesics available to date. However, the use of strong opioids such as morphine is often limited by their intolerable adverse side effects, which motivate the continuing search for new treatment regimen to reduce its side effects. Rational combinations of analgesics with different actions, such as an opioid plus a non-opioid agent, can achieve improved efficacy and safety compared with equianalgesic doses of the individual drugs. We investigated morphine, tramadol alone or in combination with non-opioid agents -mediated antinociceptive effect and gender differences in acute pain model in mice. Experiments were conducted in adult NIH Swiss male and female mice with 6-8 mice per treatment group. Morphine and a weak mu receptor agonist tramadol were administered to mice alone and in combination with non-opioid agents that including antidepressant, NMDA receptor antagonist and GABA receptor antagonist respectively. Mouse tail-flick response latencies to heat stimuli were determined before drug administration and 30 min after morphine, tramadol administration. Results showed that there are gender differences in the antinociceptive effect of opioid agents in combination with non-opioid agents in mice tail-flick test.

TOWARDS THE PREVENTION OF OXIDATIVE DAMAGE VIA NOVEL ANTIOXIDANT CONJUGATES

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Congestive heart failure affects 6 million Americans and results in a 35% mortality rate in the year immediately following diagnosis; one of the most common causes of heart failure is the loss of myocardial function. Success of treatment methods depend on the extent of oxidative damage to the myocardium caused by reactive oxygen species (ROS). Sufficient amount of ROS in the myocardial environment may lead to the incomplete regeneration of myocardium by myocardial stem cells. In order to decrease oxidative damage, superoxide dismutase (SOD), a class of enzymes, provides pronounced antioxidant effects. However, SOD activity is inhibited by its dismutation products. It is herein

proposed that nanocrystalline cerium dioxide (nanoceria) is used with SOD to scavenge hydrogen peroxide, thereby reducing oxidative damage. Nanocrystalline ceria was synthesized using a solvothermal method and characterized by various means, including: X-ray powder diffraction, transmission electron microscopy (TEM), and dynamic light scattering (DLS). SOD-nanoceria conjugates were prepared by mixing the individual parts. The conjugates' antioxidant activity was assessed by an enzymatic activity assay and was found to have significantly higher antioxidant activity when compared to non-functional nanoceria and pure SOD.

DEVELOPING AN APPARATUS TO TREAT PLANTAR FASCIITIS

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Plantar fasciitis is a disorder that affects approximately 3 million people per year. The affliction is directly caused by microscopic tears in the plantar fascia tendon, causing great pain in elementary tasks such as walking and standing. The most viable non-invasive treatment is the stretch of the tendon to regain flexibility and strength while decreasing localized inflammation. In order to combat this disease, we have designed a mobile and robust apparatus that uses a stretch transducer to evaluate the amount of stretch resulting from flexion of the foot. The apparatus uses a common sock with a sensor placed such that it is parallel to the sole of the foot. Any type of flexion by the foot results in resistance values interpreted by the sensor that are related to a Bluetooth Low Energy (BLE) device. This device is programmed to interpret the resistance values as integers that increase with the resistance and therefore the amount of stretch by the tendon. These values are transmitted via Bluetooth to a smartphone that displays the integer values and stores the data for the purposes of tracking progress by the patient and the clinician. Furthermore, the app also tracks the patient's level of pain day-to-day and allows for programming by the patient and clinician in order to determine the optimal type and amount of stretch necessary to effectively treat the disease.

LOCALIZATION OF THE EPILEPTOGENIC FOCUS FROM EEG FREQUENCY BANDS BY NETWORK CONNECTIVITY ANALYSIS OF SEIZURES OF TEMPORAL LOBE ORIGIN

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Identification and resection of the epileptogenic focus constitutes a potential treatment for abatement of recurrent seizure activity in patients with refractory epilepsy. Analysis of the epileptogenic focus via functional brain networks may assist in this direction. In order to measure the interactions between brain sites and construct functional brain networks, successive 3sec non-overlapping intracranial electroencephalographic (iEEG) segments from multiple brain regions during typical seizures from 9 patients with temporal lobe epilepsy were analysed in the frequency domain using the Generalized Partial Directed Coherence (GPDC) measure, along with surrogate data analysis, to determine the statistically significant connections between the nodes of the network. We subsequently employed the topological measure of Betweenness Centrality (BC) to quantify the importance of each node in each constructed network. The obtained BC values were then averaged over frequencies (the traditional frequency bands [alpha],[beta],[gamma],[delta],[theta] and the full frequency band (0-50Hz)) and all available ictal EEG segments per patient. The brain site with the maximum averaged BC value estimated from the [delta] band (0-4Hz) was found to be within the clinically assessed epileptogenic focus in all 9 patients, whereas the ones

from other bands, including the full frequency band, did not have the same level of success (e.g. the one estimated from the full frequency band was located within the focus in only 6 of the 9 patients). These results indicate the importance of considering specific frequency bands, especially the lowest ([delta]) frequency band, in brain network analysis of ictal periods for robust localization of the epileptogenic focus.

THE RESPONSE OF INTERLEUKIN-STIMULATED A549 HUMAN ALVEOLAR BASAL EPITHELIAL CELLS UPON EXPOSURE TO HYDROCORTISONE IN CULTURE

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The A549 human adenocarcinoma cell line is theorized to produce chemokines in response to inflammatory cytokines. Eotaxin, a CC chemokine, may play a role in recruitment and activation of eosinophils to the site of inflammation in obstructive lung diseases such as asthma. The objective of this study was to evaluate the influence of hydrocortisone on A549 cells after cytokine exposure, such as interleukin 1 β (IL-1 β) and interleukin 4 (IL-4) in culture. The objective of this study is to assess the levels of eotaxin (CCL11), when combined with hydrocortisone. Confluent A549 cells were stimulated separately with IL-1 β and IL-4 in concentration variation at ten-fold serial dilution in a 96-well plate. Standard laboratory protocols and sterile techniques were followed throughout the experimentation. The cells were treated independently and allowed to incubate for 24 and 48 hours. Cellular viability, oxidative stress and cell membrane were measured along with analysis of cellular morphology to determine overall cellular health. Eotaxin levels were determined by immunoassay. ANOVA indicated there was no significant difference in groups with IL-1 β at 24 and 48 hours when comparing all treatment groups. Only the 48 hours IL-4 group had a significant difference in groups, with the highest eotaxin level in the hydrocortisone group combined with 10.0 ng/dL of IL-4. The results from this study indicate that eotaxin levels are influenced by hydrocortisone in cellular model but not reduced. In this study, hydrocortisone had an increased influence on eotaxin levels when A549 cells were subjected to IL-4 at higher levels.

NEONATAL EXPOSURE TO INTERLEUKIN-1 β ENHANCES ADULT VULNERABILITY OF NIGROSTRIATAL DOPAMINERGIC SYSTEM TO ROTENONE NEUROTOXICITY

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Early life brain inflammation has been proposed to play important roles in the development of neurodegenerative disorders in adult life. Our previous studies showed that interleukin-1 β (IL-1 β), a proinflammatory cytokine, plays an important role in mediating dopaminergic neuronal injury in the neonatal rat brain. To examine whether neonatal IL-1 β exposure enhances dopaminergic neuron susceptibility to rotenone neurotoxicity at adult ages, Sprague-Dawley male rats at postnatal day 5 (P5) were pre-treated with IL-1 β (1 μ g/kg) via intracerebral injection, and then challenged with rotenone through subcutaneous mini-pump infusion (1.25 mg/kg per day for 14 days) at P70. A single IL-1 β exposure resulted in motor function deficits during the developmental period but were spontaneously recoverable by P70. Single IL-1 β exposure also suppressed tyrosine hydroxylase (TH) expression in the substantia nigra (SN) at P70. A low dose of

rotenone treatment resulted in Parkinsonism-like symptoms including bradykinesia, akinesia and rigidity in rats with neonatal exposure to IL-1 β , but not in those without the neonatal IL-1 β exposure. Neonatal IL-1 β exposure also enhanced adult susceptibility to rotenone-induced loss of dopaminergic neurons as indicated by reduced numbers of TH+ cells and Fluoro-Gold (FG)+ nigrostriatal projecting neurons in the SN of P98 rats. These results suggest that perinatal neuroinflammation may enhance adult susceptibility to develop neurodegenerative disorders triggered by environmental toxins at an ordinarily non-toxic or sub-toxic dose. Our model may be useful for studying mechanisms involved in the pathogenesis of nonfamilial Parkinson's disease. (Supported by NIH Grant NIH/NINDS R01NS080844, and Newborn Medicine Funds from the Department of Pediatrics, University of Mississippi Medical Center)

MINOCYCLINE AMELIORATES BRAIN INJURY, AND IMPROVES SENSORIMOTOR BEHAVIORAL PERFORMANCE IN NEONATAL RATS EXPOSED TO SYSTEMIC LIPOPOLYSACCHARIDE

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Inflammation plays an important role in brain injury in neonatal human and animal models. Our previous studies have shown that systemic administration of endotoxin lipopolysaccharide (LPS) induces brain injury and behavioral deficits in the neonatal rats, which is associated with activation of microglia. The objective of the current study was to determine whether minocycline, a putative suppressor of microglial activation, ameliorates LPS-induced brain inflammation, brain damage, and neurological dysfunction. Intraperitoneal (i.p.) injection of LPS (2 mg/kg) was performed in P5 rat pups and minocycline (45 mg/kg) or vehicle was administered (i.p.) 5 min after LPS injection. The control rats were injected (i.p.) with sterile saline. Neurobehavioral tests were performed and brain injury was examined on P6. Our results showed that minocycline protected against LPS-induced neurobehavioral impairments, including reduction of mean latency times in wire hanging maneuver and hind-limb suspension. Minocycline treatment also provided protection against LPS-induced brain damage, including loss of oligodendrocytes as well as reduction of white matter size. Minocycline significantly attenuated LPS-induced increment in the number of activated microglia and concentration of IL-1 β in the neonatal rat brain and serum. These results suggest that minocycline may provide protection against systemic LPS exposure-induced brain injury and neurobehavioral disturbance, and that the protective effects are associated with its ability to attenuate LPS-induced microglial activation. (Supported by NIH grant NIH/NINDS R01NS080844, and Newborn Medicine Funds from the Department of Pediatrics, University of Mississippi Medical Center)

IL-1 RECEPTOR ANTAGONIST PROTECTS AGAINST LONG-LASTING LEARNING IMPAIRMENT AND HIPPOCAMPAL INJURY IN ADULT RATS FOLLOWING NEONATAL EXPOSURE TO LIPOPOLYSACCHARIDE

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We have previously reported that neonatal lipopolysaccharide (LPS) exposure resulted in an increase in interleukin-1 β (IL-1 β) content, injury to the hippocampus, and cognitive deficits in juvenile male and female rats, as well as female adult rats. The present study aimed to determine whether an anti-inflammatory cytokine, interleukin-1 receptor antagonist (IL-1ra), protects against the neonatal LPS exposure-induced inflammatory responses, hippocampal injury, and long-lasting learning deficits in adult rats. LPS (1 mg/kg) or LPS plus IL-1ra (0.1 mg/kg) was injected intracerebrally to Sprague-Dawley male rat pups at postnatal day 5 (P5). Neurobehavioral tests were carried out on P21, P49, and P70, while neuropathological studies were conducted on P71. Our results showed that neonatal LPS exposure resulted in learning deficits in rats at both developmental and adult ages, reduced hippocampal volume, and reduced number of Nissl+ cells in the CA1 region of the middle dorsal hippocampus of P71 rat brain. Those neuropathological and neurobehavioral alterations by LPS exposure were associated with a sustained inflammatory response in the P71 rat hippocampus, indicated by increased number of activated microglia as well as elevated levels of IL-1 β . Neonatal administration of IL-1ra significantly attenuated LPS-induced long-lasting learning deficits, hippocampal injury, and sustained inflammatory responses in P71 rats. Our study demonstrates that neonatal LPS exposure leads to a persistent injury to the hippocampus, resulting in long-lasting learning disabilities related to chronic inflammation in rats, and these effects can be attenuated with an IL-1 receptor antagonist. (Supported by NIH Grant NIH/NINDS R01NS080844, Newborn Medicine Funds from the Department of Pediatrics, University of Mississippi Medical Center, grants NSC102-2320-B-030-011 and MOST103-2320-B-030-005-MY3 from the National Science Council of Taiwan, and a grant CMFJ10006 from Chi-Mei Medical Center in Taiwan)

LOW LEVEL LASER THERAPY IMPROVES MICROCIRCULATION IN SKELETAL MUSCLE VASCULAR BEDS IN ZUCKER RATS

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Purpose/Hypothesis: It has been reported that low level laser therapy (LLLT) can reduce pain, inflammation and increase wound healing. But there is a lack of information regarding the effect of LLLT on the microvascular reactivity. Therefore the main purpose of this study was to determine the effect of LLLT on skeletal muscle vascular function and the underlying mechanisms. We hypothesized that LLLT induces vasodilation in skeletal muscle vascular beds in Zucker rats. Number of Subjects: Five 12-13 weeks old Zucker rats were used in this study. Arteriolar diameter of the spinotrapezius (n=5) or mesenteric vascular beds (n=5) were observed for analysis. Materials/Methods: Zucker rats (12-13 weeks old) were injected with pentobarbital (50mg/kg, ip). Depth of anesthesia was monitored by the palpebral reflex test. Then the trachea was intubated to enable the rat to spontaneously breathe 30 % oxygen and 70% nitrogen. Deep esophageal temperature was maintained at 37°C by using heating pad or heating lamp. Either the right spinotrapezius muscle or mesenteric vascular beds were prepared for in vivo microscopy as we have used in previously published studies (Lu et al, 2013). At all times during the surgery and subsequent experiment, the vascular beds were kept at in situ dimensions and were continuously perfused with a physiological salt solution (mM): 118.07 NaCl, 6.17 KCl, 2.55 CaCl₂, and 25 NaHCO₃, equilibrated with gases containing 5% CO₂, 95% N₂ (pH= 7.4, 35°C). Animals were allowed to stabilize for 30 minutes after surgery. A third-order arcade arteriole segment was selected for analysis. Arteriolar diameter of the spinotrapezius or mesenteric vascular beds were observed with a Nikon UM-22 microscope and measured during a control period and following LLLT (20 sec). At the end of the

experiment, adenosine (10 μ M) and sodium nitroprusside (10 μ M) were added to the perfusate to determine maximal diameter. These experiments lasted 2-4 hours. For all studies the animals did not recover from anesthesia. The animals were euthanized by an overdose of sodium pentobarbital in the end of the experiment. Results: LLLT significantly increased arteriole vasodilation in spinotrapezius muscle ($19.6 \pm 3 \mu$ m) compared with basal vascular diameter ($15.6 \pm 2 \mu$ m). LLLT has no effect on mesenteric vascular beds ($14 \pm 1 \mu$ m) compared with basal condition ($14 \pm 0.81 \mu$ m). Conclusions: LLLT induces vasodilation and improves microcirculation in skeletal muscle vascular beds. Clinical Relevance: LLLT may have good potential to improve functional outcomes in patients with neurologic deficits, soft tissue injury, pain, wound healing by increasing blood flow by inducing vasodilation of arterioles in the microcirculation.

EVALUATION OF ANISOTROPIC DIFFUSION FILTERING ALGORITHMS FOR ANALYSIS OF 3-DIMENSIONAL MICROSCOPY IMAGE DATA OF FÖRSTER RESONANCE ENERGY TRANSFER PROBES

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Förster Resonance Energy Transfer (FRET) has been utilized for many different applications in cellular imaging including protein folding, signaling studies, and enzyme kinetics measurements. However, traditional FRET microscope approaches have been limited to 2 spatial dimensions. A large factor preventing FRET experiments from being extended into 3 dimensions is that approaches to measure FRET probes have commonly had poor signal strength, as compared to single label assays. The low signal-to-noise ratio (SNR) of FRET measurements often results in compromises being made between the quality of images acquired, the resolution, the imaging speed, and the ability to perform 3-dimensional imaging. The goal of this work was to evaluate the ability of post-acquisition image processing algorithms for improving the quality of FRET microscopy images. Specifically, we evaluated 2 general classes of smoothing functions: Gaussian smoothing (a standard smoothing algorithm available in MATLAB) and Perona-Malik anisotropic diffusion (available on MATLAB Central, authored by Daniel Lopes), using a range of settings. Experiments were performed using a cyclic AMP FRET reporter (Turquoise-Epac-Venus H188 FRET probe) expressed in either pulmonary microvascular endothelial cells or HEK 293 cells. All image data were acquired using a Nikon A1R spectral confocal microscope. We found that simple smoothing algorithms can be used to increase the SNR. However, by increasing the SNR the resolution of the cell's boundaries is reduced. We also evaluated Perona-Malik algorithms for non-linear smoothing. By applying anisotropic diffusion 3D FRET image data, we were able to increase the SNR while preserving accurate discrimination of the cell's boundaries.

ADIPOGENIC DIFFERENTIATION OF HUMAN ADIPOSE DERIVED STEM CELLS ATOP AN ELASTIN-LIKE POLYPEPTIDE-POLYELECTROLYTE COATED SURFACE

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In today's society, obesity has become an epidemic that ultimately causes a variety of potentially deadly metabolic diseases. Therefore, it is important to study the behavior of adipocytes (fat cells) on the cellular level, to more efficiently combat the problem of obesity. Current three-dimensional in vitro model for adipocyte culture, which primarily uses collagen based hydrogels to encapsulate adipocytic cell conglomerates, allows for better intracellular communication compared to two-dimensional monolayer cell culture. However, the conglomerate size and adipose-specific cell function are diminished due to the

compressive forces placed on cells by the hydrogels. Such forces do not exist on adipocytes in vivo. Elastin-like polypeptide polyelectrolytes (ELP-PE) have been tested and used in the past for several different cell types, in which positively-charged polyelectrolytes encourage cells to form three-dimensional spheroids while tethering themselves to the surface of a cell plate. We hypothesize that adipocytes grown on an ELP-PE coated surface would show an uninhibited growth from any scaffold-generated compressive forces, and thus grow larger and function better than in the current collagen hydrogel based model. To investigate this, we will use culture surfaces coated with ELP-PEs prepared using PEs of different molecular weights conjugated to ELP. Human Adipose-derived stem cells will be differentiated and matured into adipocytes atop these coatings and their growth will be monitored using optical microscopy. The adipocyte functionality will be tested using DNA assay, total protein assay, and triglyceride assay. Overall, our research will provide a proven cell culture model for future studies involving adipocytes.

QUANTITATIVE ASSESSMENT OF SEMINIFEROUS TUBULE ALTERATION ASSOCIATED WITH LONG-TERM EXPOSURE TO SUSTAINED DELIVERY OF ANDROGENS

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The specific aim of this study was to assess, morphometrically, the seminiferous tubules area and germ layers upon the exposure to sustained delivery of androgen through tricalcium phosphate lysine devices (TCPLD). A total of 105 adult Male rats (270-280 gm) were randomly divided into three equal groups. Group 1 animals were implanted with Tricalcium Phosphate Ceramic Delivery Devices (TCPLD) loaded with 40 mg androgen by following standard lab protocols. Groups 2 and 3 animals served as a sham group (empty devices), and an intact control group. For the treatment and sham groups, serum testosterone, LH and FSH levels were monitored at periodic intervals of 1, 3, 6, 9, and 12 months. Histopathological evaluation of testicular tissues (H&E) was conducted for each phase following standardized lab procedures. Results of this study indicated that: (i) endogenous testosterone and gonadotropin (LH/FSH) levels were suppressed (<0.2 ng/mL) for a 1-year period by the sustained delivery of androgen compared to control and sham groups, (ii) a decrease in the luminal areas of seminiferous tubules retrieved from treated group ($P < 0.05$), (iii) an arrest of germ layers at the secondary spermatocyte at the end of the 3 month treatment and continued for the rest of the study, and (iv) spermatogonia were intact and exhibited normal N/C ration for treated animals compared control group. Overall conclusion obtained from this study indicated that androgen loaded TCPLD delivery devices can be used to induce azoospermia without any untoward side effects.

DEVELOPMENT OF A NEW FUZZY C-MEANS CLUSTERING ALGORITHM FOR AUTOMATIC DETECTION OF OSA USING P-WAVE SHAPE AND TIME CHANGES

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This paper describes the development and implementation of a new fuzzy c-means (FCM) clustering algorithm to automatically detect obstructive sleep apnea (OSA) stages from regular electrocardiogram (ECG) recordings based on shape and time changes of the P-wave. ECG signals from 25 subjects known to have OSA symptoms were recorded, pre-processed, and segmented to extract the P-waves; then three P-wave parameters were extracted: the P-wave duration, the P-wave dispersion, and the time interval from the peak of the P-wave to the R-wave. The new FCM clustering algorithm was then applied to the three parameters taken two at a time then taken the three together. Applying the new

proposed FCM clustering algorithm using the parameter combination of the P-wave duration and the time from the peak of the P-wave to the R-wave resulted in a good performance with sensitivity, selectivity, specificity, and accuracy values of 87.7 ± 2.9 , 86.9 ± 2.8 , 87.1 ± 2.1 , and 87.4 ± 1.1 , respectively. A better performance was achieved when applying the new proposed FCM clustering algorithm to the three parameters taken together; the sensitivity, selectivity, specificity, and accuracy values were 89.2 ± 1.1 , 88.3 ± 0.9 , 89.8 ± 1.3 , and 89.1 ± 1.4 , respectively.

AUDITORY PROCESSING IMPAIRMENT PREDICTS PERCEIVED HEARING PROBLEM IN INDIVIDUALS WITH NORMAL PURE-TONE THRESHOLDS

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Normal pure tone threshold sensitivity does not necessarily indicate normal hearing. The auditory processing of a sample of 1322 participants of the Jackson Heart Study, a prospective epidemiological study of cardiovascular disease and health disparities in African Americans, was assessed between 2008 and 2013. Here we present cross-sectional data on participants with normal pure tone thresholds with and without perceived hearing loss and relationship to central auditory processing outcomes, Quick Speech-in-Noise (SIN) and Dichotic Digits. The results suggest that perceived hearing problems, despite

A DIETARY PHASE 2 ENZYME INDUCER IN ANIMAL MODEL OF ESSENTIAL HYPERTENSION USING AN EXTERNAL ARTERIAL CATHETER

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By 2025, one billion individuals Worldwide are hypertensive. However, dietary intervention could be a simple solution for this complex multifactorial problem which increases at an alarming rate. Previous studies in our laboratory have shown that broccoli sprouts rich in glucoraphanin, a precursor of a potent phase 2 protein inducing isothiocyanate sulforaphane, decreases oxidative stress and ameliorates hypertension using tail cuff method. In addition, in another study, pure sulforaphane ameliorates hypertension using tail cuff method. The question this study addressed: using the external arterial catheter (another method), can we see the same therapeutic effect of sulforaphane? After 1 week of adaptation, the 12 week old male SHRsp and SD rats were divided into two groups: (i) Corn oil (vehicle) alone (Control); (ii) sulforaphane (10 $\mu\text{mol/kg}$ body weight) in corn oil. BP was determined using an external arterial catheter. The treatment lasted for 7 weeks. At the end of the treatment period, the animals were sacrificed. For comparison, age-matched normotensive Sprague Dawley (SD) rats were treated in the same manner. SHRsp control rats had significantly higher Systolic Blood Pressure (SBP) (158.4 ± 8.3 mm Hg) than SD control rats (108.07 ± 3.91). Sulforaphane treatment lowered SHRsp blood pressure to 150.66 ± 8.33 (around 7 mm Hg unit). Interestingly, sulforaphane had more potential effect on diastolic BP; It reduced the diastolic BP by 47.47 mmHg unit, comparing with the control SD rats. There was no significant effect of sulforaphane treatment on SD rat SBP (84.35 ± 7) when compared with SD control rats (90.96 ± 7). We conclude that the health benefit previously demonstrated in our laboratory is due to pure sulforaphane and the external arterial catheter BP data is in parallel confirmed the results obtained by tail cuff method in previous experiment.

THE EFFECTS OF ACUTE AND CHRONIC FLUOXETINE ADMINISTRATION ON ADULT RAT TESTES

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The effects of acute and chronic ingestion of the SSRI fluoxetine on testicular cells were investigated in Sprague Dawley adult male rats. The animals were exposed to either 10 or 20 mg/kg fluoxetine administered via cookie dough for two or 16 weeks. Fluoxetine administration of either dose did not result in changes in body weight over time. The wet weights of the reproductive organs were normalized to body weight and then compared to their respective controls. Differences between the groups were apparent as early as two weeks in the epididymis of the high dose groups when compared with the low dose group and control. The epididymal weights in the high group were larger than control and statistically greater than low dose treatment. By 16 weeks there were no differences in the normalized epididymal weights between the groups. Normalized testicular weights were statistically higher in the high dose group after four months when compared to both the low and control animals. Histomorphometric analysis of the testicular cell population showed decreases in the number of both primary and secondary spermatocytes and spermatid for both doses when compared to control at two and 16 weeks. Overall, long-term ingestion of either dose for 16 weeks causes a significant decrease in spermatogenesis in seminiferous tubules of the testes, which can impact fertility. Assessment of the reproductive hormones testosterone, FSH, and LH are being investigated to determine the role of the SSRI on the hypothalamic-pituitary-gonadal axis.

THE RESPONSE OF CONNECTIVE TISSUE FOLLOWING SINGLE DOSE OR SUSTAINED ADMINISTRATION OF PRP

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Tendon ruptures and lacerations requiring suture repair can have post-operative complications that limit function. Appropriate care must include early range-of motion exercises to prevent adhesions and loss of motion and limited early weight bearing because of potential loss of excursion or even rupture. Refinement in repair technique has increased the immediate post-operative strength of the tendons, lessening the risk of rupture. However, no surgical technique or adjunct treatment exists that effectively prevents adhesions or decreases recovery time. Platelet rich plasma is rich in growth factors and has the potential to increase the repair potential and decrease the time to complete tissue healing. In this study, forty eight Sprague Dawley rats were used to investigate the effects of a single bolus dose of PRP or continuous delivery of PRP on healing of a surgically induced trauma and repair of the Achilles tendon. The injury and repair process did not induce untoward harm to the animal's behavior or ability to move freely and independently within the cage. It did not hamper the animal's ability to access food. After two weeks, a single bolus dose of PRP resulted in an increased tissue response compared to injury alone. Sustained release of the PRP induced a significant increase in the number of adipocytes present within the tissue. After eight weeks the initial increase in tissue response seen in the single dose PRP treatment was no longer evident and no differences were detected compared to the injury alone group. The Sustained PRP group still had an increase in the number of adipocytes present along with a much larger portion of fibrotic tissue at the wound site. Overall, it appears that both timing and dose are critical factors that must be taken into consideration when using PRP to enhance healing.