31st SOUTHERN BIOMEDICAL ENGINEERING CONFERENCE

31st SBEC Annual Meeting Program

April 30th--May 2nd, 2015

Crowne Plaza New Orleans Airport, Kenner, LA

http://thequickglimpse.files.wordpress.com/2010/02/vitruvian-man.jpg

Endorsed by the Society for Biomaterials ***Sponsored by Mississippi Academy of Sciences***

31st SOUTHERN BIOMEDICAL ENGINEERING CONFERENCE

Program

31st ANNUAL SOUTHERN BIOMEDICAL ENGINEERING CONFERENCE

April 30- May 2, 2015

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Program Co-Chairs

Hamed A. Benghuzzi, Ph.D.;FBSE,FAIMBE
Department of Diagnostic and Clinical Health Sciences
University of Mississippi Medical Center
Jackson, MS 39216

Michelle A. Tucci, MS;Ph.D.
Department of Orthopedics
University of Mississippi Medical Center
Jackson, MS 39216

Program Committee

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.

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Conference Information

The format of the conference is to have two concurrent sessions, with each presentation limited to 15 minutes (12-minute presentation and three minute discussions). Room assignments for each session is posted in the program contents,

The Conference will be held at the **Crowne Plaza New Orleans Airport, Kenner, LA,** which is located approximately 10 miles west of New Orleans, LA on interstate 10, and 1.5 miles from New Orleans International Airport. SBEC participants can make reservations by calling the hotel directly at 1-504-467-5611 or 1-800-227-6963. Please indicate that you are attending the SBEC to receive the discounted rate ($119 per night). The SBEC room rate includes: on complimentary breakfast, complementary airport transportation, complementary parking, complementary high speed internet access in guest rooms, complementary high speed internet in meeting area.

Airport

Louis Armstrong New Orleans International Airport (MSY)

- Distance from hotel: 1.5 MI/ 2.41 KM North East l
- Complimentary hotel shuttle available
- Driving directions: Take Airport Service Road going northeast to Veterans Blvd. Turn right; the hotel is on the left.

Train

AMTRAK

- Distance from hotel: ~15 MI/ 24.14 KM East
- Head on Williams Blvd toward Veterans Blvd. Make a U-turn at Veterans Blvd 0.1 mi. Merge onto I-10 E via the ramp to New Orleans Take the exit toward Superdome. Turn right at Girod St/W Stadium Dr Continue to follow Girod St. Turn right at Loyola Ave.

Registration and Fees

Initial on-site registration will be held from 4:00–8:00 p.m., Thursday, April 30, 2015. Participants are encouraged to preregister by April 4, 2015 to take advantage of the reduced registration rates.

Fees before April 4, 2015

Students:	$190
Faculty/Staff:	$280

Fees after April 4, 2015

Students:	$225
Faculty/Staff:	$375

Student Awards: There will be 8 students awards given as follows: 1. First Place Outstanding Student Presentation; 2. Second Place Outstanding Student Presentation; 3. Third Place Outstanding Student Presentation; 4. First Place Outstanding Student Poster Presentation; . 5. Second Place Outstanding Student Poster Presentation; 6. Third Place Outstanding Student Poster Presentation; 7. Outstanding Student Manuscript Award, Subrata Saha Outstanding Student Award.

Session Chairs

Session I: Animal Models
Session Chair: Dr. Lynne Jones

Session II: Tissue Engineering
Session Chair: Dr. LaShan Simpson Co-Chair: Dr. Amol Janorkar

Session III: Imaging I & Bioinstrumentation
Session Co-Chair: Dr. Thomas Rich Co-Chair: Dr. Hongtao Yu

Session IV: Drug Delivery Systems
Session Co-Chair: Dr. Joseph A. Cameron Co-Chair: Dr. Kenneth Butler

Session V: Respiratory/Imaging II
Session Co-Chair: Dr. Ramesh Patel Co-Chair: Dr. Samarendra K Mohanty

Poster Session
Session Co-Chairs: Drs. Zelma Cason, Aaron Puckett, Ken Heard, Min Huang, Hamed Benghuzzi, Felix Adah

Session VI: Inflammation/Injury/Health Care
Session Chair: Dr. Olga McDaniel Co-Chair: Dr. Larry McDaniel

Session VII: Tissue Engineering/ Scaffolds/Bone
Session Co-Chair: Dr. Subrata Saha Co-Chair: Dr. Jafar Vossoughi

Session VIII: Modeling
Session Co-Chair: Dr. Elgenaid Hamadain Co-Chair: Dr. Jens Rosenberg

Session IX: Cancer Research
Session Co-Chair: Dr. Pradip Biswas Co-Chair: Dr. Ibrahim Farah

31st Annual Meeting

Program

Major Sponsor of 31st SBEC

Mississippi Academy of Sciences

Thursday
April 30, 2015

4:00 PM-8:00 PM Registration and Reception

Hotel Lobby

Friday
May 1, 2015

8:00 AM-4:00 PM: Registration (Hotel Lobby)

8:45-8:55 AM: Opening of the Meeting
Dr. Ham Benghuzzi, Program Chair

May 1, 2015

Scientific Sessions

Friday Morning	Talk #	Conference Room: Salon 3
Time		**Session I: Animal Models** **Session Chair: Dr. Lynne Jones**
9:00-9:05	1	**Opening Remarks Dr. Lynne Jones**
9:05-9:25	2	**Hip Dogs: A Canine Model for Coxofemoral Joint Pathogenesis and Therapy** Mandi J. Lopez, DVM, MS, PhD *Diplomat, American College of Veterinary Surgeons* *Professor & Director* *Laboratory for Equine & Comparative Orthopedic Research* *Department of Veterinary Clinical Sciences*
9:25-:9:40	3	**Animal Models of Osteopenia and Osteoporosis** Michelle Tucci, PhD University of Mississippi Medical Center Jackson, MS,
9:40-10:00	4	**Biotechnology and Orthopaedic Research: Selecting the Most Appropriate Animal Model** Lynne C. Jones, Ph.D. Associate Professor, Orthopaedic Surgery Director of Resident Research Johns Hopkins University School of Medicine Baltimore, MD
10:00		**BREAK**

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Friday Morning	Talk #	Conference Room: Salon 3
Time	5	**Session II: Tissue Engineering:** **Session Chair: Dr. LaShan Simpson Co-Chair: Dr. Amol Janorkar**
10:15	6	**Genetic Switiching of Vascular Smooth Muscle Cells** Amber Kay, Joshua Grant, C. LaShan Simpson Department of Agricultural and Biological Engineering, Mississippi State University, Mississippi State, MS
10:30	7	**3D Diabetic Matrix Mediates Fibroblast Phenotypic and Functional Differentiation Through AGE/RAGE and PKC-Zeta Signaling** CM Cerosky, ZN Syed, S Kundu, JA Stewart, Jr Department of Biological Sciences, and Bagley School of Engineering, Mississippi State University, Starkville, MS
10:45	8	**Isolation and Analysis of Exosomes from Conditioned Media of Suprachiasmatic Nuclei Cells** Dan Zhao[1], Jiaxu Li[1], David Earnest[2], Morgan Farnell[3], and Yuhua Farnell[1] [1] Department of Biochemistry, Molecular Biology, Entomology, and Plant Pathology, Mississippi State University, Starkville, MS, [2]Department of Neuroscience and Experimental Therapeutics, Texas A&M Health Science Center, Bryan, TX, and Department of Poultry Science, Mississippi State University Extension Service, Mississippi State, MS
11:00	9	**Functionalized Polylactide Scaffolds for Bone Tissue Engineering Application** Cheryl Gomillion[1,4], Rubinder Lakhman[2], Rajeswari Kasi[2], RA Weiss[3], Liisa Kuhn[1], and A. Jon Goldberg[1] [1] Department of of Reconstructive Sciences, University of Connecticut Health Center, Farmington, CT, [2]Institute of Material Sciences, University of Connecticut, Storrs, CT, [3]Department of Polymer Engineering, University of Georgia, Athens, GA
11:15	10	**Engineered Cartilage on Chitosan Phosphate Scaffolds for Osteochondral Defects** Anuhya Gottipati and Steven Elder Department of Agricultural and Biological Engineering, Mississippi State University, Mississippi State, MS
11:30	11	**Anisotropic Compressive Properties of Porcine Muscle Tissue** Renee Pietch, Benjamin Wheatley, Tammy Haut-Donahue, Ryan Gilbrech, Raj Prabu, Jun Liao, and Lakiesha Williams Department of Agricultural and Biological Engineering, Mississippi State University, Mississippi State, MS
		BREAK

Friday Morning	Talk #	Conference Room: Salon 5-6
Time	**12**	**Session III: Imaging I and Bioinstrumentations** **Session Co- Chair: Dr. Thomas Rich Co-Chair: Dr. Jens Rosenberg**
10:15	13	**Efficacy of Real-Time Optical Measurement System** Nicholas Carroll, Emily Gould, Sung Kim, Jon Morrison University of South Alabama, Mobile, AL
10:30	14	**Hyperspectral Illumination Device for Microscopic and Endoscopic Applications** Sam Mayes[1], Silas Levesley[1,2], Thomas Rich[2,3] [1] University of South Alabama Department of Chemical and Biomolecular Engineering, Mobile AL, University of South Alabama Department of Pharmacology, Mobile, AL, and University of South Alabama Center for Lung Biology, Mobile, AL
10:45	15	**Single and Multiple CoAxial Inputs to Excite a Cylindrical Waveguide for Traveling Wave MRI at 21.1 T** Samuel Grant[1,2], Smiriti Sagaran[2,3], Jose Muniz[1,2], and Jens Rosenber[1] [1]Chemical and Biomedical Engineering, Florida State University, Tallahassee, FL, National High Magnetic Field Laboratory, Florida State University, Tallahassee, FL, and Electrical and Computer Engineering, Florida State University, Tallahassee, FL
11:00	16	**Metabolic Confinements in Normal and Stroked CNS in vivo Revealed by Localized Double Pulse-Field Gradient MRS at 21.1 T** Jens Rosenberg[1], Noam Shemesh[3], Jean Niclolas Dumez[2], Lucio Frydman [1,2] and Samuel Grant[1] [1] Florida State University, 2Weizmann Institute of Science, Rehovot Israel, and [3]Champalimaud neuroscience programme, Lisbon Portugal
11:15	17	**Spatio-Temporal Dynamics of Epileptic Spikes**

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		Balu Krishnan[1], Ioannis Vlachos[2], Aaron Faith[4], Stephen Mullane[5], Korwyn Williams[3]and Leonidas Iasemidis. [1]Cleveland Clinic Foundation, Cleveland, OH, [2]Louisiana Tech University, Rushton, LA, [3]Phoenix Children's Hospital, Phoenix, AZ, [4] Arizona State University, Tempe, AZ, and [5] Biotronik Lake Oswego, OR
11:30	18	**Differential Diagnosis of Sleep Disorders Based on EEG Analysis** Sai Mohan Rudrashetty, Ashmit Pyakurel, Rui, Lui, Bharat R Karumuri, Ioannis Vlachos, and Leonidas Iaesmidis Louisiana Tech University, Rushton LA, and Louisiana State University Medical School, Shreveport, LA
		BREAK

12:00 -1:00 PM: Lunch & Keynote Speaker

Keynote Speaker: Dr. Rodney Baker

Title: Contribution of Phosphatidic Acid to Intracellular Signaling

Friday Afternoon Time	Talk #	Conference Room: Salon 3
		Session IV: Drug Delivery Systems **Session Co-Chair: Dr. Joseph A. Cameron Co-Chair: Dr. Kenneth Butler**
1:00	19	**Ex vivo System for Pharmacokinetic Analysis of Catheter-Based, Vascular Drug Delivery** Emily Turner, Marzieh Atigh, Saami Yazdani University of South Alabama, Mobile, AL
1:15	20	**Development of Environmentally Responsive Micro and Nanosystems for Targeted Drug Delivery Applications** Nehal Patel, Luke Villermin, Neesha Sirivardane, Cam Tran, Abitha Hemibuck and Caldorera-Moore Louisianan Tech University, Rushton, LA
1:30	21	**Site Specific Delivery of Antibiotics During Experimental Otitis Media** Larry McDaniel Department of Microbiology, University of Mississippi Medical Center, Jackson, MS
1:45	22	**Effect of Chain Length, Number of Chains and Charge on the In vitro Cytotoxicity of Surface Coating Agents Used on Nanoparticles** Ying Zhang, Salma Begum, Makiesha James, and Hongtao Yu, Department of Chemistry and Biochemistry, Jackson, State University, Jackson, MS
2:00	23	**The Synergistic Effect of Thymoquinone and Epigallocatehin-3-Gallate on the Functional Capacity of CaOV-3 Ovarian Cancer Cells.** Jennifer Harpole, Michelle Tucci, and Hamed Benghuzzi University of Mississippi Medical Center, Jackson, MS
2:15	24	**D-Glucose-Induced Cytogenotoxicity and Apoptosis of Human Breast Adenocarcinoma (MCF-7) Cells** Clement G. Yedjou, Christine K. Tchounwou, Ibrahim Farah, and Paul B. Tchounwou Natural Chemotherapeutics Research Laboratory, NIH-Center for Environmental Health, College of Science, Engineering and Technology, Jackson State University, 1400 Lynch Street, Box 18540, Jackson, Mississippi
		BREAK

Friday Afternoon Time	Talk #	Conference Room: Salon 5-6
		Session V: Respiratory/Imaging II **Session Co-Chair: Dr. Rameesh Patel Co-Chair: Dr. Samarendra K. Mohanty**
1:00	26	**Role of PDE Isoforms in Regulating cAMP Compartmentalization and Pulmonary Microvascular Endothelial Cell (PMVEC) Barrier Permeability** Naga Srilakshmi Annamdevula, Andrea Britain, Thomas C. Rich, and Silas Leavesley University of South Alabama, Mobile, AL
1:15	27	**Excitation Scanning Hyperspectral Imaging of Autofluorescence in Decellularized Rat Lungs** Peter Favreau[1], Lauren Cichon[1], Diego F. Alvarez[2], Thomas C. Rich[1], and Silas J Leavesley[1] [1]University of South Alabama, Mobile, AL and [2] Center for Lung Biology, Mobile, AL
1:30	28	**Skin Blood Flow Measurement Using Millimeter Wave Energy: Modeling and in**

		vitro Experiments Erin Lowery, Todd Hamlin, Silas Leavesly, and David Nelson University of South Alabama, Mobile, AL
1:45	29	**Impulse Oscillometry Reference Values in Anglo and Hispanic Children** Roya Edalapour[1], Homer Nazeran[1], Carlos Rodrigues[1], and Erika Meraz[2] [1]The University of Texas at El Paso and [2]Universidad Autonoma de Ciudad Juarez, Chihuahua, Mexico
2:00	30	**Hotspot Analysis for Examining the Association Between Spatial Air Pollutants and Asthma in New York State, USA Using Kernel Density Estimation (KDE)** [1]Francis Tuluri and [2]A.K. Gorai [1]Department of Technology, Jackson State University, Jackson, MS and [2]Department of Mining Engineering, National Institute of Technology, Rourkela, Odisha, India
2:15	31	**Optical Sensing Of Citrate By A Macrocycle-Based Synthetic Receptor In Water** Md. Alamgir Hossain*[1], Md Mhahabubur Rhaman,[1] Azmain Alamgir,[1] Chinyere D. Jones,[1] and Douglas R. Powell[2] Department of Chemistry and Biochemistry, Jackson State University, Jackson, MS [2] University of Oklahoma, Norman, OK
		BREAK

May 1, 2015

2:30-5:00 PM: Poster Session (Student Posters Judging)

Scientific Sessions-Poster Session will be held in Salon 4

Session Co-Chairs: Zelma Cason, Aaron Puckett, Felix Adah, Min Huang, and Hamed Benghuzzi	**P#**
Sodium Intake And Arterial Pressure In Normotensive And Doca-Salt Hypertensive Rats During Chronic Minoxidil Treatment Min Huang[1], Hamed Benghuzzi[2], Michelle Tucci[3], and Robert L .Hester[4], Departments of Physical Therapy[1], Diagnostics and Clinical, Health Sciences[2], Orthopedics[3], and Physiology[4] University of Mississippi Medical Center, Jackson, MS	P1
Tumor Necrosis Alpha Temporally Regulates micro-RNA-181a and its Target in A549 Cells Maricica Pacurari Department of Biology, Jackson State University, Jackson, MS	P2
Manipulation of the Macrophage Response Using Amino Acid Coated UHMW-PE Implanted Subcutaneously Kenneth R. Butler, Jr., PhD, Hamed Benghuzzi, PhD, Michelle Tucci, PhD, Aaron Puckett, PhD University of Mississippi Medical Center, Jackson, MS	P3
Impact of Some Common Organics on Cellular Glycolysis and the Differential Survival of Lung Fibroblast and Lung Carcinoma Cell Lines Ibrahim Farah Jackson State University, Jackson, MS	P4
Examining the Structural Integrity of Human Gingival Fibroblasts after Exposure to Dental Adhesives Combined with Nifedipine or Cortisol in an Infectious Environment Angelia Garner, Hamed Benghuzzi[1], and Michelle Tucci[2] [1]School of Health Related Professions and [2]Department of Orthopedic Surgery University of Mississippi Medical Center, Jackson, MS 39216	P5
Modified PEGDF and PEDGI Polymers for Non-Viral Gene Delivery in HEK 293 Cells Anh. Le, Xizi Dai, and Yen-Chih Huang Florida International University, Miami, FL	P6
Paper-based 3D Cell Culture Devices for Rapid, Antibiotic Assays Alexander. Williams, Chenzhong Li and Mehenur Sarwar Florida International University, Miami, FL	P7
Intervention to Reduce *Pseudomonas aeruginosa* Related Infections in Neonatal Intensive Care Unit Elham Ghonim and Hamed Benghuzzi University of Mississippi Medical Center, Jackson, MS 39216	P8
GFP Transfected Autologous Schwann Cells Are Rejected After Transplantation In The Spinal Cord Injury in a Minipig Model AJ Santamaria1, J.T. Rosenberg[2], FC Benavides[1], Y Nunez[1], AE Brooks[1], JP Solano[1], JD Guest[1], SC Grant[1] [1]University of Miami, Miami, FL and [2]Florida State University, Tallahassee, FL	P9
Restoration Of Spermatogenesis In Testosterone Acetate Induced Azoospermic Rats Ham Benghuzzi* and Michelle Tucci Department of Diagnostic and Clinical Health Sciences and Department of Orthopaedic Surgery and Rehabilitation , University of Mississippi Medical Center, Jackson, MS	P10

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Frequency Dependence of Focus Localization from EEG by Directional Information Measures Joshua Adkinson, Ioannis Vlachos, and Leonidas Iasemidis Louisiana Tech university, Rushton, LA	P11
Demonstration of the Safety of the Neonatal Airflow Perturbation Device Jafar Vossoughi[1,2], Arthur Johnson[2], Khushbu Shukla[3], Alyse Laliberte[3], Martin Keszler[3] [1]ESRA (Vvossoughi@verizon.net), [2]Bioengineering Department, Maryland, and [3]Women and Infant Hospital of Rhode Island RI	P12
Noninvsive Evaluation of Neonatal Respiratory Resistance Jafar Vossoughi[1,2], Arthur Johnson[2], Khushbu Shukla[3], Alyse Laliberte[3], Martin Keszler[3] [1]ESRA (Vvossoughi@verizon.net), [2]Bioengineering Department, Maryland, and [3]Women and Infant Hospital of Rhode Island, RI	P13
The Effect Of Neuropeptide Y On The Female Rat Reproductive Tract Zelma Cason, Hamed Benghuzzi, and Michelle Tucci University of Mississippi Medical Center, Jackson, MS 39216	P14
Arsenic-Induced Changes In Human-Induced Pluripotent Stem Cells (IPSC) **BE Graham and K Ndebele** Laboratory of Cancer Immunology, Target Identification and Validation, Department of Biology, Center of Environmental Health, RCMI Center of Environmental Health, Department of Biology (BEG, KN,), Jackson State University, Jackson, MS	P15
Pthalate (DEHP) Modulates Cell Invasion, Migration, and Anchorage Independent Growth Through Targeting s100P in Glioblastoma Cells Jennifer Sims, Barbara Graham, Paul Tchounwou and Kenneth Ndebele Laboratory of Cancer Immunology Target Identification and Validation, College of Science and Engineering and Technology, Jackson State University, Jackson, MS	P16
Towards the Design of a Distractive and Mobility-Enabling Back Support Device Denis DiAngelo and John Sims The University of Tennessee Health Science Center, Memphis, TN	P17
Treatment Depth Effects Of The Zavation Lumbar Bone Growth Stimulator Gerri A. Wilson, Jonathan M. Mitchell, Michelle A. Tucci, and Hamed A. Benghuzzi, University of Mississippi Medical Center, Jackson, MS	P18
Antinociceptive Efficacy Of Chronic Fluoxetine Treatment Gerri A. Wilson, Jonathan M. Mitchell, J. Scott. Bittle, Yatrik J. Patel, Jennifer E. Naylor, Kevin B. Freeman, Michelle A. Tucci, and Hamed A. Benghuzzi, University of Mississippi Medical Center, Jackson, MS	P19
Evidence of Structural Alteration of Caov-3 Ovarian Like Cell Line Upon the Exposure to Potential Herbal Antioxidants Jennifer Harpole, Hamed Benghuzzi[1], and Michelle Tucci[2] [1]School of Health Related Professions and [2]Department of Orthopedic Surgery University of Mississippi Medical Center, Jackson, MS	P20
AGES AND AGING: ELIMINATING RAGE EXTENDS LIFESPAN Carter G Holland, Jack Sudduth, Paul Hogue, Donna Gordon, and James Stewart Mississippi State University, Starkville, MS USA	P21
Proliferation, Cell Viability, Toxicity, And Protein Expression Analysis Of MCF7 Breast Ductal Epithelial Adenocarcinoma Cells Cultured With *Pseudognaphalium Obtusifolium* Dichloromethane-Derived Extract Indicates A Possible Anti-Carcinogenic Treatment Alternative Mary McDonnell Mississippi College, Clinton, MS	P22
The Effects Of Insulin And EGCG on Panc-1 Cell Survival Victoria Hodges, Michelle Tucci, and Hamed Benghuzzi University of Mississippi Medical Center, Jackson, MS	P23
Structure Elucidation of G-Quadruplex within the Mid-Region of the kRAS Promoter and Identification of Stabilizing Small Molecules as Promising Transcriptional Silencers Rhianna Morgan[1] Khondaker Miraz Rahman[2],and Tracy Brooks [1]University of Mississippi, University, MS and [2] Institute of Pharmaceutical Sciences, King's College London, England	P24
PROLIFERATION OF ENDOGENOUS T-REG CELLS IMPORVES THE PATHO-PHYSIOLOGY ASSOCIATED WITH PLACENTAL ISCHEMIA OF PREGNANCY Tarek Ibrahim, Lukasz Przybyl, Ashlyn Harmon, Lorena Amaral, Denise Cornelius, Janae Moseley, Jessica Faulkner, Babbette LaMarca, and Ralf Dechend University of Mississippi Medical Center, Jackson,MS	P25
Verruca Localization Predominately In Black Tattoo Ink **Kristen Ramey, Robert Brodell, And Jamil Ibrahim** **University of Mississippi Medical Center Jackson, MS**	**P26**

5:00-7:30 PM: Banquet Event/Salon 3

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Saturday
May 2, 2015

Scientific Sessions

Saturday Morning	Talk #	Conference Room: Salon 3
Time		**Session VI (Inflammation/Injury/Health-Care)** **Session Chair: Dr. Olga McDaniel Co-Chair: Dr. Larry McDaniel**
8:30	32	**Tracking Stem Cells in Irradiated Traumatic Brain Injury Models using ^{1}H MRI at 11.75 T** Nastaren Abad[1], Abdol Aziz Ould Ismail[2], Ali Darkazalli[3,4], Cathy Levenson[3], and Samuel Grant[1] [1]Chemical and Biomedical Engineering, Florida State University, Tallahasse, FL, [2]National High Magnetic Field Laboratory, Florida State University, Tallahassee, FL, [3]Neuroscience Program, Florida State University, Tallahassee, FL, and [4]Biomedical Sciences, Florida State University, Tallahassee, FL
8:45	33	**Discovering Unknown Genes** Michael Robinson, Florida International University, Miami, FL
9:00	34	**A Hybrid Sequence-Specific Oligonucleotide ELISA Method for Rapid Detection of Bacteremia** D. Olga McDaniel[1] Jason Guillot[1], Larry McDaniel[1], William Turner[1,2], Ross Fremin[1], Gita Subramony[1], and Mark Williams[1,3] [1]University of Mississippi medical Center, Jackson, MS, [2] University of Texas Health Science Center, Dallas, TX, and [3]University of Colorado, Colorado Spring, CO
9:15	35	**Morphological Alteration of the Liver and Adrenal by Statin Released by Means of Tricalcium Phosphate Lysine Delivery System in a Defect and Segmental Femoral Injury in an Animal Model** Felix Adah[1], Hamed Benghuzzi[1], Michelle Tucci[1], and Barry England[2]. [1]University of Mississippi Medical Center, Jackson, MS and [2]University of Michigan Medical School, Ann Arbor, MI
9:30	36	**Inflammatory Molecules Released During Ischemia/Reperfusion in a Rat Model of Cardiac LAD Occlusion** Danielle Redd[1], Larry McDaniel[2], Lance Majors[2], Alan Simeone[2], and D. Olga McDaniel[2] [1]Tougaloo College, Jackson, MS and [2]University of Mississippi Medical Center, Jackson, MS
9:45	37	**Morphometric Evaluation Of The Tissue Implant Response Surrounding Subcutaneous TCP, HA, And ALCAP Bioceramic Implants** Kenneth R. Butler, Jr., PhD, Hamed Benghuzzi, PhD, Michelle Tucci, PhD, Aaron Puckett, PhD University of Mississippi Medical Center, Jackson, MS
10:00	38	**β-Estradiol Induces Cytotoxic Effects To Human T-Lymphoma (Jurkat) Cells Through Oxidative Stress** Clement Yedjou, Joseph Cameron, Ariane T. Mbemi, and Paul Tchounwou Natural Chemotherapeutics Research Laboratory, NIH-Center for Environmental Health, College of Science, Engineering and Technology, Jackson State University, 1400 Lynch Street, P.O. Box 18540, Jackson, Mississippi
10:15	39	**Toxicity of Gold Nanoparticles and Gold Ions to Bacteria** Thabitha Shareena Dasari, Neil Hammond, and Hongtao Yu Department of Chemistry and Biochemistry, Jackson State University, Jackson
		BREAK

Saturday Morning	Talk #	Conference Room: Salon 5-6
Time		**Session VII: Tissue Engineering/ Scaffolds/Bone** **Session Co- Chair: Dr. Subrata Saha Co-Chair: Dr. Jafar Vossoughi**
8:30	40	**Comparing Scaffold Formulation for Three Dimensional Bone Tissue Engineering** Patrick Bierdeman, Bhuvaneswari Gurumurthy, Amol Janorkar University of Mississippi Medical Center, Jackson, MS
8:45	41	**Regional Variations on Microstructure and Biomechanical Properties of the human Vertebral Endplate and Trabecular Bone** Fred Xavier, Rozen Wynter, Martin Pendola, Gavriel Feuer, Westley Hayes, Subrata Saha

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		Department of Orthopaedic Surgery and Rehabilitation Medicine SUNY Downstate Medical Center, Brooklyn NY
9:00	42	**A Three Dimensional Tissue Engineering Approach to Generate Functional Cardiac Muscle from Mouse Embryonic Stem cells in vitro** Sasmith Rath, Florida International University, Miami, FL
9:15	43	**Hubiogel Enriched Fibro-porous Scaffolds for Tissue Engineering** Vinoy Thomas[1], Harsh Patel[1], Steven Pogwizd[1], Raj Singh[2], Yogesh Vohras[1] [1] University of Alabama at Birmingham, Birmingham, AL and [2]Vivo Bioscience Inc, Birmingham, AL
9:30	44	**Role of Physical Cues in Axonal Guidance** Samarendra K. Mohanty Biophysics and Physiology Group, Department of Physics, The University of Texas at Arlington, Arlington, TX
9:45	45	**Material and Mechanical Properties of Osteophytes and Non-Osteophytic Cortical Bone: A Preliminary Study** Fred Xavier, Rozen Wynter, Martin Pendola, Gavriel Feuer, Westley Hayes, Subrata Saha Department of Orthopaedic Surgery and Rehabilitation Medicine SUNY Downstate Medical Center, Brooklyn, NY
10:00	46	**Osteochondral Xenograft Development for Articular Cartilage Repair** Andrew Garza and Steven Elder Mississippi State University, Starkville, MS
10:15	47	**Robotized Method for Comparative Testing of Back Support Device** Denis DiAngelo and John Simmons, The University of Tennessee Health Science Center, Memphis, TN
10:30-11:00		**BREAK**

Saturday Morning	**Talk #**	**Conference Room: Salon 3**
Time		**Session VIII: Modeling** **Session Co-Chair: Dr. Elgenaid Hamadain Co-Chair: Dr. Hongtao Yu**
11:00	48	**MREPT at 21.1 T** Ghoncheh Amouzandeh[1,2], Jens Rosenberg[2,3], and Samuel Grant[2] [1]Physics, Florida State University, Tallahassee, FL , [2]National High Magnetic Field Laboratory, Florida State University, Tallahassee, FL, and [3]Chemical and Biomedical Engineering, Florida State University, Tallahassee, FL
11:15	49	**Ultrafast in vivo Diffusion Imaging of Stroke at 21.1 by Spatiotemporal Encoding** Jens Rosenberg[1] Avigdor Leftin2, Eddy Salomon[2], [3]Fabian Calixto Bejarano[1], Lucio Frydman[1], and Samuel Grant[1] [1]Florida State University, Tallahassee, FL,[2] Weizmann Institute of Science, Rhovot Israel
11:30	50	**Scoliosis Analog Model for the Evaluation of Bracing Technology** Cloe Chung, and Denis DiAngelo, The University of Tennessee Health Science Center, Memphis, TN
11:45	51	**Multiple Path Particle Dosimetry Simulation of Respiratory Deposition of Nanoaerosol in the Mouse Lung** Mohammed Ali[1], Bradford Gutting[2], Victor Morozov[3], and Monique van Hoek[4], [1]Dept of Industrial Systems and Technology, Jackson State university, Jackson, MS, Naval Surface Warfare Center, Dahlgren VA, [3]Institute of Theoretical and Experimental Biophysics of the Russian Academy of Sciences, Pushchino, Moscow, [4]George Mason University, Manassas, VA
12:00	52	**Choice Of Statistical Techniques: Parametric Versus Non Parametric Methods** Elgenaid Hamadain, University of Mississippi Medical Center

12:15 -2:00 PM: Lunch & Keynote Speaker Followed by Student Award Presentation

Keynote Speaker: Dr. Ham Benghuzzi,

Title: Advances in Ceramic Drug Delivery Systems

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Saturday Morning	Talk #	Conference Room: Salon 5-6
Time		**Session IX (Cancer)** **Session Chair: Dr. Pradip Biswas Co-Chair: Dr. Ibrahim Farah**
11:00	53	**Dietary Stilbenes and Epigenetic Regulation for Prostate Cancer Chemoprevention and Treatment** Levenson AS[1,2]*, Swati Dhar[1], Avinash Kumar[1], Agnes M. Rimando[3], Janice M. Lage[2], Jack R. Lewin[2] and Xu Zhang[4] [1]Cancer Institute and [2]Department of Pathology, [4] Center of Biostatistics and Bioinformatics, University of Mississippi Medical Center, Jackson, MS [3]United States Department of Agriculture, Agricultural Research Service, Natural Products Utilization Research Unit, University, MS
11:15	54	**Identifying Hormone Independent Targets & Drug Designing For Breast And Prostate Cancers** Pradip K Biswas Laboratory of Computational Biophysics & Bioengineering, Department of Physics, Tougaloo College, Tougaloo, MS
11:30	55	**Theranostic Hybrid Graphene Materials With Label-Free Biosensing And Combined Therapy Capability** Paresh C Ray**,** Christine Tchounwou, Stacy Jones, Yongliang Shi, Aruna Vangara, Rajashekhar Kanchanapally, Bhanu Priya Viraka Nellore, Sudarson Sekhar Sinha, Avijit Pramanik, Suhash Reddy Chavva Department of Chemistry and Biochemistry, Jackson State University, Jackson, MS
11:45	56	**Novel Antibody Conjugated Hybrid Gold-Graphene Oxide Nanoparticles For The Treatment Of Cytomegalovirus Infection** Madeline A. Aylward[1], Karen Stokes[2], Sudarson S. Sinha3, Paresh C. Ray3 and Ritesh Tandon[1*] [1]Department of Microbiology and Immunology, University of Mississippi Medical Center, 2500 North State Street, Jackson, MS, USA. [2] Department of Molecular and Cellular Physiology, Center for Cardiovascular Disease and Sciences, Center for Molecular and Tumor Virology, Louisiana State University Health Sciences Center, Shreveport, LA. [3]Department of Chemistry and Biochemistry, Jackson State University, Jackson, MS
12:00	57	**New Sites for Old Suspects: Environmental Allosteric Modifiers of Human Estrogen Receptors** Rajendram V Rajnarayanan University of Buffalo, Buffalo, NY
		LUNCH

12:15-2:00 PM: Lunch & Keynote Speaker Followed by Student Award Presentation
Keynote Speaker: Dr. Ham Benghuzzi,
Title: Advances in Ceramic Drug Delivery Systems

5:00 pm- 9:00 pm Program Committee Meeting

See You at the 32nd SBEC

Note Page

ABSTRACTS

Friday
May 1, 2015

Session I
(Animal Models)

Hip Dogs: A Canine Model for Coxofemoral Joint Pathogenesis and Therapy

Mandi J. Lopez, DVM, MS, PhD
Diplomate, American College of Veterinary Surgeons
Professor & Director
Laboratory for Equine & Comparative Orthopedic Research
Department of Veterinary Clinical Sciences

Coxofemoral joint (CFJ) disease is a prevalent, debilitating condition with significant global impact. A large animal model of CFJ degeneration will contribute to improved diagnostic and treatment strategies. We characterized a canine colony with CFJ disease in a series of investigations that assessed weight gain, gait kinetics and joint morphology. Imaging studies incorporated radiographs, 2-D computed tomography (CT) images and 3-D CT models and included novel 3-D assessments as well as measures routinely performed on human and canine CFJ images. Relationships among measures within and between ages during development and their predictive value for osteoarthritis were evaluated. Results indicate that the rate of weight gain does not adversely impact CFJ joint laxity nor does joint laxity affect kinetic parameters in puppies. Computed tomography measures reflect articular cartilage microdamage, and most are repeatable and reproducible regardless of age or joint disease. Within colony members, volumes of CFJ structures change predictably during development, and CFJ characteristics associated with radiographic development of osteoarthritis are detectable as early as 16 weeks of age and vary with disease severity. This novel, predictable large animal model of canine CFJ degeneration provides an important opportunity for study of CFJ pathogenesis and the efficacy of therapeutic intervention.

Animal Models of Osteopenia and Osteoporosis

Michelle Tucci, PhD
University of Mississippi Medical Center
Jackson, MS,

Osteoporosis is a disease characterized by a decrease in bone mass (osteopenia) and a deterioration in bone microarchitecture that leads to a greater risk of fracture.as a result of a weakened skeleton. To date, non-human primates, dogs, cats, rodents, rabbits, sheep, guinea pigs and minipigs, all have been used to study osteoporosis and each has advantages and disadvantages. Selection of a suitable animal model is difficult. Many factors must be taken into consideration when selecting the appropriate model. This review will discuss features of the different animal models for osteoporosis and osteopenia. Currently, there is no animal model that exactly mimics the condition of postmenopausal osteoporosis; however, some there are several key features that allow us to mimic specific aspects of osteoporosis. Understanding the biological significance of the bone loss coupled with the limitations of the various model will allow us to further characterize the available animal models for postmenopausal osteoporosis, for the understanding of the pathogenesis of the disease, investigation of new therapeutic targets, and for the evaluation of implants for use in osteoporotic patients.

Biotechnology and Orthopaedic Research: Selecting the Most Appropriate Animal Model

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Biotechnological advances are being made in medical devices and implants for orthopaedic applications (joint, bone defects, spinal fusion) at a rapid pace ranging from applications of nanotechnology to developing novel tissue substitutes to surface modification using selected ligands to combination products. The regulatory review process for new implants or new applications for existing implants begins with proof-of-concept studies and preclinical testing. *In vivo* testing using various animal models is integral to this process. The testing encompasses assessments of biocompatibility, toxicity, and physiology.

There are several animal models that have been used historically to evaluate musculoskeletal implants. The results of these studies do not necessarily correlate with the clinical experience in humans. Therefore, the question needs to be asked: how closely does the animal model need to mimic the clinical situation for which it is intended? This depends, in part, on the question being asked. At first, the question may be basic: is there a potential for a specific interaction? Or, does a material elicit a hypersensitivity reaction? But eventually, you would like to predict how the implant will behave in the environment simulating the clinical condition. Animal models not only permit us to evaluate the biological response to the implant but to determine the effect of the biological environment on the implant itself (e.g., wear, degradation products, and protein adherence to the surface).

There are several factors that need to be addressed in the selection of an appropriate animal model. These include the selection of the animal (rabbits, dogs, rats, goats, mice, monkeys, sheep, pigs and piglets, chickens, ponies and horses, emus, etc.) and determining what facilities your institution may have to house and treat the animals. The sex and age of the animal may be important; do the epiphyses need to be closed (i.e., skeletal maturity)? The size of the animal may have a bearing on whether the techniques to be performed are feasible and whether there will be sufficient tissue to study. What is the specific location where your implant will be placed clinically (human)? For example, if it is a bone graft substitute, will it be placed into cortical or cancellous bone? While you may want to use an animal model of a specific pathological disease or condition, you may also want to be able to tease out specific factors or histopathology. Care must be taken to select the right stage of the natural history of a disease. There may be differences between surgically created animal models and induced or naturally occurring models of pathology. Do you want an animal model of early stage pathology or late stage pathology? A model which promotes too severe of an inflammatory response, for example, may make it difficult to determine the effect of your intervention. Over the past two decades, transgenic mice have been generated with specific musculoskeletal phenotypes. These animals include global and local knockouts. These animals may play a role in future studies particularly with biologics and gene therapy.

Session II
(Tissue Engineering)

Genetic Switching of Vascular Smooth Muscle Cells

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Department of Agricultural and Biological Engineering, Mississippi State University, Mississippi State, MS

Cardiovascular disease is the leading cause of death in the United States and the state of Mississippi has the highest rate of cardiovascular disease than any other state. Vascular calcification was once considered an end-stage passive crystallization process but is now known to be a regulated process involving numerous cell types and protein interactions to cause a hardening of the arteries. More recently, research has shown that the process in which the arteries calcify is similar to the biomineralization process of bone. It has been hypothesized that smooth muscle cells native to healthy arteries undergo a genetic switch and become osteoblast-like cells in the presence of high levels of calcium, glucose and cholesterol. Many researchers have identified this phenomenon but there is still no clear understanding of the mechanism by which this happens. Our research group has developed an *in vitro* cell culture model to induce calcification in human vascular smooth muscle cells. In this model, cells were grown to 80% confluency and then treated with calcification media that included Dulbecco's Modified Eagle Medium (DMEM), 10% Fetal Bovine Serum, 1% penicillin/streptomycin, and 6-mmol inorganic phosphate. After 14 days in calcification media, the calcium content was measured with atomic absorption and normalized according to the cellular protein content. It was determined that 670.901 ± 139.732 μg of calcium/mg of protein was present as compared to the control with 33.617 ± 12.148 μg of calcium/mg of protein. Utilizing this model, this project will examine the genes that change during the process of calcification. The experiments include performing a gene array of healthy versus diseased (calcified) smooth muscle cells. The genes that change from the healthy to diseased smooth muscle cells would be identified. These genes could later be manipulated to control the process of calcification in smooth muscle cells. This technology could additionally be used to develop treatments for cardiovascular disease.

3D Diabetic Matrix Mediates Fibroblast Phenotypic and Functional Differentiation Through AGE/RAGE and PKC-Zeta Signaling

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The purpose of this study was determined whether increases in advanced glycation endproducts (AGEs) in a 3D diabetic collagen matrix will differentiate wild type (WT) cardiac fibroblasts to a profibrotic myofibroblast phenotype. 3D collagen matrices were prepared from collagen extracts from non-diabetic (Db/db) and leptin receptor deficient, diabetic (db/db) mouse tails. Rheological measurements demonstrated significantly increased mechanical stiffness in db/db collagen extracts. Immunohistochemical staining for AGEs revealed high levels of AGEs in db/db collagen extracts. Primary cardiac fibroblasts isolated from WT and AGE receptor deficient (R-/-) mice and were seeded onto both Db/db and db/db 3D collagen matrices for 7 days (chronic exposure). Additionally, on day 5 of exposure, these cells were treated with inhibitors UO126 (ERK 1/2 inhibitor; 10μM) and PKC-zeta Pseudosubstrate (PKC-zeta inhibitor; 1μg/ml). On day 6 of exposure a RAGE ligand-glycated albumin (AGE-BSA; 0.5mg/ml) was used to robustly induce RAGE activation. Chronically exposed R-/- cells were unchanged, however WT cells exhibited phenotypic and functional markers for fibroblast differentiation, such as increased alpha-smooth muscle actin and RAGE expression as well as enhanced collagen gel contraction. Blockade of ERK1/2 and PKC-zeta restored WT expression to those observed in cells exposed to non-diabetic collagen. Therefore, chronic exposure to AGE-crosslinked diabetic ECM resulted in phenotypic and functional alterations in WT fibroblasts. These changes were mediated through AGE/RAGE interactions resulting in a profibrotic cell phenotype.

Isolation and Analysis of Exosomes from Conditioned Media of Suprachiasmatic Nuclei Cells

Dan Zhao[1], Jiaxu Li[1], David Earnest[2], Morgan Farnell[3], and Yuhua Farnell[1]
[1] Department of Biochemistry, Molecular Biology, Entomology, and Plant Pathology, Mississippi State University, Starkville, MS, [2]Department of Neuroscience and Experimental Therapeutics, Texas A&M Health Science Center, Bryan, TX, and Department of Poultry Science, Mississippi State University Extension Service, Mississippi State, MS

Mammalian suprachiasmatic nuclei (SCN) are autonomous clocks that generate coordinated rhythms and drive oscillations in other peripheral tissues. We have identified that the conditioned media (CM) of SCN2.2 cells confer molecular rhythmicity to co-cultured fibroblasts via some diffusible factors. However, the type of signal that SCN cells use to coordinate circadian rhythmicity in fibroblast cells is currently unknown. Exosomes are extracellular nanoparticles that contain distinct subsets of RNAs and proteins. They play important roles in cell signaling, and intercellular communication. One potential mechanism of diffusible factors transfer from the SCN2.2 cells to the other cells is through exosomes. Therefore, studies were conducted to characterize SCN2.2 cell-derived exosomes. Exosomes were isolated and purified from CM of SCN 2.2 cells using a differential ultracentrifugation method. The morphology and size of the exosomes were visualized by transmission electron microscopy. The purified exosomes were disc-shaped vesicles with lipid bilayer membranes, and ranged from 30 to 150 nm in diameter. The exosomes were positive for exosomal marker CD63 by Western blot analysis. The exosomal RNA profile was different to those found in SCN2.2 cells, and revealed the presence of large amounts of small RNAs. There were approximately 50 proteins present in SCN-derived exosomes analyzed by the two-dimensional polyacrylamide gel electrophoresis. These studies demonstrated that exosomes were released from SCN2.2 cells. The characterization of SCN-derived exosomes is essential in furthering our understanding of the biological role of exosomes in circadian clock.

Functionalized Polylactide Scaffolds for Bone Tissue Engineering Application

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[1] Department of Reconstructive Sciences, University of Connecticut Health Center, Farmington, CT, [2]Institute of Material Sciences, University of Connecticut, Storrs, CT, [3]Department of Polymer Engineering, University of Georgia, Athens, GA

Bone auto grafts are the clinical gold standard for bone grafting procedures; however, healthy autologous tissue is not always readily available for tissue repair, thus necessitating alternative bone regeneration strategies based on tissue engineering. Successful bone tissue engineering requires control of osteoprogenitor cell behavior on or within a biomaterial scaffold. Identifying an optimal scaffold for bone tissue engineering has been an ongoing challenge for investigators because of the complex characteristics required for engineering bone.

Degradable synthetic materials, such as polylactic acid (PLA), have been widely investigated for tissue engineering strategies because of its biocompatibility, ease of processing, and capacity for modification of its mechanical properties. However, due to its hydrophobic nature, PLA has a low affinity for cell attachment, which can cause low initial cell seeding, resulting in minimal cell

growth, and thus limiting the success of PLA for tissue regeneration. Accordingly, there have been continued efforts to modify PLA to enhance cell-biomaterial interactions.

End-capping of biodegradable polyesters is being developed in the field of polymer recycling as a method to control the characteristics of PLA and its copolymers. In this approach, a permissive functional group, such as carboxyl, is covalently bound to the ends of the full polymer chains, resulting in a PLA polymer with available carboxylic acid end groups to which bioactive molecules may be attached, creating polymer compositions effective for mediating cellular behavior. The objective of this work was to prepare functionalized PLA polymers via endcapping and to evaluate the effects of those polymers on osteoprogenitor cell behavior.

Engineered Cartilage on Chitosan Phosphate Scaffolds for Osteochondral Defects

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Department of Agricultural and Biological Engineering, Mississippi State University, Mississippi State, MS

Treatment of injuries to articular cartilage is challenging as the tissue has limited capacity of intrinsic healing due to lack of blood vessels. This study explores one approach to cartilage tissue engineering, whereby cartilage forms *in vivo* on top of biodegradable composite chitosan-calcium phosphate (CHI-CaP) scaffolds. CHI-CaP microbeads are fused to make cylindrical scaffolds of approximately 35% porosity. The scaffold supports bone ingrowth and provides a platform for cartilage formation. Stem cells or chondrocytes are seeded onto the scaffolds at high density such that they produce a layer of cartilage through self-assembly. Completed experiments have demonstrated the cell adhesion, rate of proliferation, the influence of cells seeding technique, and the effects of coating scaffolds with type I collagen. Coating the scaffolds with collagen made them more hydrophilic and increased cell attachment and chondrogenesis. It also facilitated formation of a continuous layer of hyaline-like cartilage over the area of cell seeding. Experiments to determine CHI-CaP biocompatibility to osteoblast-like cells, as well as to determine the ideal bead size for making composite CHI-CaP scaffolds, are in progress. Studies to date indicate the potential for creating a bilayered construct consisting of an osteoconductive CHI-CaP phase and a tissue-engineered cartilage phase.

Anisotropic Compressive Properties of Porcine Muscle Tissue

Renee Pietch, Benjamin Wheatley, Tammy Haut-Donahue, Ryan Gilbrech, Raj Prabu, Jun Liao, and Lakiesha Williams
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The body has approximately 434 muscles, which makes up 40–50% of the body by weight. Muscle is hierarchical in nature and organized in progressively larger units encased in connective tissue. Like many soft tissues, muscle has nonlinear visco-elastic behavior, but muscle also has unique characteristics of excitability and contractibility. Mechanical testing of muscle has been done for crash models, pressure sore models, back pain, and other disease models. The majority of previous biomechanical studies on muscle have been associated with tensile properties in the longitudinal direction as this is muscle's primary mode of operation under normal physiological conditions. Injury conditions, particularly high rate injuries, can expose muscle to multiple stress states. Compressive stresses can lead to tissue damage, which may not be reversible. In this study, we evaluate the structure–property relationships of porcine muscle tissue under compression, in both the transverse and longitudinal orientations at 0.1 s_1, 0.01 s_1, or 0.001 s_1. Our results show an initial toe region followed by an increase in stress for muscle in both the longitudinal and transverse directions tested to 50% strain. Strain rate dependency was also observed with the higher strain rates showing significantly more stress at 50% strain. Muscle in the transverse orientation was significantly stiffer than in the longitudinal orientation indicating anisotropy. The mean area of fibers in the longitudinal orientation shows an increasing mean fiber area and a decreasing mean fiber area in the transverse orientation. Data obtained in this study can help provide insight on how muscle injuries are caused, ranging from low energy strains to high rate blast events, and can also be used in developing computational injury models.

Session III (Imaging)

Efficacy of Real-Time Optical Measurement System

Nicholas Carroll, Emily Gould, Sung Kim, Jon Morrison
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As advances in tissue engineering blood vessels are being made new technology is being developed to replace diseased arteries. Given that an artery is exposed to a variety of mechanical factors, such as pressure from pulse, shear stress from blood flow, and strain due to the elasticity of the blood vessel, it is important that their tissue engineered equivalents be able to withstand the same stressors over time. The aforementioned mechanical factors cause fatigue which can ultimately lead to damage or even complete failure. These new technologies therefore require fatigue testing in order to investigate at which point in their life cycle their structural integrity will be compromised. One method for determining this timeline is examining the arteries geometry, specifically the diameter, while it is subjected to these factors. The objective of this project was to develop an in-vitro system capable of measuring diameter changes of an artery in real time using an optical technique. To this end the system was designed using a low-cost charge-coupled device (CCD), and National Instruments LabVIEW software for edge detection and data acquisition. The results from preliminary testing showed that the system was capable of measuring the changes in diameter of an artificial artery in real-time. These results demonstrated the potential of this system for use testing the compliance and stiffness of arteries in real time.

Hyperspectral Illumination Device for Microscopic and Endoscopic Applications

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White-light endoscopy is the current standard for colorectal and lung cancer screening. Spectral imaging has been shown to improve specificity and sensitivity compared to white light imaging, for both microscopy and *in vivo* imaging. We have recently constructed a device that allows for a variety of wavelengths to be utilized for hyperspectral imaging of cells and tissues.

The spectral light source consists of electronic, optical, mechanical, and software subsystems. These subsystems were assembled to allow multiple wavelengths of light to be produced via light emitting diodes. Illumination from each LED is combined into one output via a novel lightpipe configuration. A computer interface facilitates control over multiple electronic components which send signals to the control board. In turn, the control board regulates the LED intensities.

The software subsystem controls all aspects of the hardware and was designed using LabVIEW. The electronic subsystem was designed to interface with this software subsystem, allowing analog and digital control. The digital and analog controls regulate wavelength switching and intensity. Additionally, the software

allows cycling of the LEDs sequentially. Save and load functionalities were also implemented to store LED intensities for future use.

Single and Multiple CoAxial Inputs to Excite a Cylindrical Waveguide for Traveling Wave MRI at 21.1 T

Samuel Grant[1,2], Smiriti Sagaran[2,3], Jose Muniz[1,2], and Jens Rosenber[1]
[1]Chemical and Biomedical Engineering, Florida State University, Tallahassee, FL, National High Magnetic Field Laboratory, Florida State University, Tallahassee, FL, and Electrical and Computer Engineering, Florida State University, Tallahassee, FL

Traveling wave MRI provides an alternative mechanism to the typical near field RF coil implementations seen at all available field strengths for MR. In this study, the traveling wave setup consists of a concentric setup with a dielectric waveguide surrounded by a hollow metallic waveguide. The imaging volume is located 15-20 cm away from the RF source. For Tx/Rx, coaxial cables were fed through the outer waveguide and into the dielectric medium. Excitation profiles can range from one to four individual coaxial cables for transmit and receive or any combination thereof, including quadrature operation, in order to improve B_1 homogeneity and reduce power requirements. The dielectric waveguide is composed of deionized water and allows for the dielectric waveguide to be imaged directly or using a sample submerged within the dielectric waveguide. MRI experiments were performed at 21.1 T. Also, electromagnetic simulations were performed with CST Microwave Studio. Simulations indicate that with more coaxial inputs, at least within the first half of the waveguide, the profile of the B_1 field along the length of the waveguide provides a more homogeneous field. When comparing single coaxial vs. two coaxial cables experimentally, as expected, the intensity increases when more than one coaxial cable is used.

Metabolic Confinements in Normal and Stroked CNS in vivo Revealed by Localized Double Pulse-Field Gradient MRS at 21.1 T

Jens Rosenberg[1], Noam Shemesh[3], Jean Niclolas Dumez[2], Lucio Frydman [1,2] and Samuel Grant[1]
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Diffusion MRI has been the gold standard in diagnostic evaluations of stroke. However it is an indirect and non-specific method that can be elusive. On the contrary, measurements of metabolic diffusion can be more specific and probing the compartmentalization of metabolites in the CNS microstructure is important for the understanding of stroke pathology and outcome. In this study we develop a so called double Pulsed-Field-Gradient (dPFG) MRI sequence for 21.1 T, the highest field available for *in vivo* studies of stroke. The sequence is based on previous reported studies of selectively targeting of stroke relevant metabolites (Lac, NAA, Cre and Cho) with no interference of the otherwise so destructive water peak. The dPFG module consists of two bipolar gradient pairs **G** of duration □ and separation □ together with a 3D localization module that only localize the signal to a desired 5x5x5 mm^3 voxel. Rats underwent stroke surgery and were investigated 24 hr later. The dPFG sequence was used to extract the apparent eccentricity □□L/R where L is compartment length and R in the stroke and contralateral hemisphere. Results show high fidelity spectra and SNR needed for these demanding dPFG studies. In addition, we show that certain metabolites are unambiguously confined to restricted randomly oriented structures in the normal brain. In the stroke, the metabolic eccentricity varies with stroke differentially and unrelatedly to their inherent ADC. These are important findings for CNS microstructure characterization of neurological diseases.

Spatio-Temporal Dynamics of Epileptic Spikes

Balu Krishnan[1], Ioannis Vlachos[2], Aaron Faith[4], Stephen Mullane[5], Korwyn Williams[3]and Leonidas Iasemidis.
[1]Cleveland Clinic Foundation, Cleveland, OH, [2]Louisiana Tech University, Rushton, LA, [3]Phoenix Children's Hospital, Phoenix, AZ, [4] Arizona State University, Tempe, AZ, and [5] Biotronik Lake Oswego, OR

The relationship of epileptic spikes to seizures has been a matter of debate with researchers reporting higher or lower spike rates before or after seizures. To elucidate a possible role of epileptic spikes in ictogenesis (seizure generation) we developed a mathematical framework to investigate the spatio-temporal dynamics of spikes in the epileptic brain. Long-term (5-10 days) intracranial electroencephalograms (iEEGs) from 2 patients with mesial temporal lobe epilepsy (TLE) who underwent presurgical evaluation for localization of candidate epileptic foci were used in the study. First, interictal spikes were detected using an in-house spike detection algorithm. To characterize the spatio-temporal changes in interictal spikes a novel spatial synchronization measure (SSM) of spikes was developed. SSM was first tested on spiking neuronal models and subsequently applied to iEEG data. Finally a measure of resetting was devised based on the number of spatially synchronized brain sites in terms of their spiking activity.

Application of SSM to iEEG revealed monotonically increasing long-term (order of hours) preictal (period before seizures) synchronization between spike trains at brain sites that included the focal epileptogenic zone. The presence of preictal synchronization of interictal spikes hours to minutes prior to the onset of seizures indicates a possible predictive value of interictal spike synchronization for seizure occurrence. Furthermore, across seizures and patients, we observed that desynchronization of epileptic spikes at critical brain sites mostly occurred in postictal (period after seizures) epochs. We characterized these observed changes between preictal and postical spike synchronization by a measure of resetting based on the fraction of pairs that synchronize preictally and desynchronize postictally. On the basis of this resetting measure, we showed that resetting of epileptic spike synchronization occurs more commonly at seizures than interictally ($p<0.05$). These results are in agreement with our previously postulated hypothesis that seizures occur to reset a pathologically established preictal hypersynchrony of EEG dynamics among critical brain sites.

Differential Diagnosis of Sleep Disorders Based on EEG Analysis

Sai Mohan Rudrashetty, Ashmit Pyakurel, Rui, Lui, Bharat R Karumuri, Ioannis Vlachos, and Leonidas Iaesmidis
Louisiana Tech University, Rushton LA, and Louisiana State University Medical School, Shreveport, LA

The aim of this study was to test the hypothesis that sleep disorders can be differentiated from one another and from controls through analysis of the sleep electroencephalogram (EEG). Healthy subjects and patients with periodic limb movement behavioral disorder (PLMBD), rapid eye movement behaviour disorder (REMBD), insomnias and nocturnal frontal lobe epilepsy (NFLE) were included in the study. Spectral (median frequency and spectral entropy) and signal complexity (Higuchi fractal dimension) measures per sleep stage and the sleep-specific activity of the Cyclic Alternating Pattern (CAP) were estimated from the EEG records over time and used as features. Univariate analysis of variance (ANOVA) of the features was used to compare five groups of subjects: PLMBD (10 patients), REMBD (22 patients), NFLE (37 patients), insomnia (9 patients) and healthy (11 "control") (CAP sleep database - Physionet). ANOVA revealed significant differences (α=0.05) between particular but not all groups. Subsequent multivariate analysis of variance (MANOVA) was successful in differentiating between all five groups using the top 5 features out of the combined sleep stage-based and CAP-based features. These results indicate that proper EEG-based analysis of

sleep may assist in the differentiation of sleep disorders and thus assist with their proper diagnosis and treatment.

Session IV (Drug Delivery)

Ex vivo System for Pharmacokinetic Analysis of Catheter-Based, Vascular Drug Delivery

Emily Turner, Marzieh Atigh, Saami Yazdani
University of South Alabama, Mobile, AL

Peripheral artery disease (PAD) afflicts 8.5 million Americans and costs over 4 billion dollars annually. Treatment is targeted at expanding the occluded artery and restoring blood flow, but conventional balloon angioplasty treatment is less than ideal with restenosis rates of 70% 6-months post-treatment. The use of antiproliferative drugs such as paclitaxel can improve success of treatment by combating neointimal hyperplasia and reducing restenosis. These drugs can be delivered by drug coated balloons or perfusion catheters which deliver drug directly into the vessel wall, although an ideal excipient (drug-carrier) has yet to be established. Excipients prolong paclitaxel retention, however to what degree remains an expensive and time-consuming proposition. Therefore this study aims to develop an *ex vivo* system to serve as an intermediate step before *in vivo* analyses. The *ex vivo* bioreactor consists of a flow reservoir, pump, vessel housing compartment, and distal flow constrictor. A LabVIEW program generates a pulsatile waveform and flow and pressure are monitored and controlled. A freshly harvested porcine carotid artery was treated with a perfusion catheter that delivered paclitaxel at 2 ATM for 1-minute. Pharmacokinetic analysis was performed at 1 hour, 1 day, and 3 days post-treatment and compared to pre-clinical data. Results indicated successful paclitaxel delivery and pharmacokinetics similar to *in vivo* patterns. These results demonstrate a viable platform for evaluating drug-release kinetics of interventional vascular devices *ex vivo*. We assert that this system can dramatically reduce the time and expense of vascular device testing *in vivo*, particularly to measure and quantify drug retention.

Development of Environmentally Responsive Micro and Nanosystems for Targeted Drug Delivery Applications

Nehal Patel, Luke Villermin, Neesha Sirivardane, Cam Tran, Abitha Hemibuck and Caldorera-Moore
Louisianan Tech University, Rushton, LA

The emergence of nanotechnology has spawned new opportunities for novel drug delivery vehicles capable of simultaneous detection, monitoring, and localized treatment of specific disease sites. Recent developments in polymeric drug delivery systems allow for targeted delivery of a wide variety of traditional hydrophobic chemotherapeutic drugs, proteins, and diagnostic contrast agents. The Caldorera-Moore lab combines traditional micro- and nanoscale fabrication methods with intelligent biomaterials to create new and improved systems for drug delivery and tissue regeneration applications. Our lab works on the development of a new class of micro- and nanocarriers composed of pH- and/or biomolecule-responsive grafted hydrogel networks that can be tailored to deliver drugs to a targeted site, efficiently. In collaboration with the Newman lab at Louisiana Tech University, our lab also explores the affects material and surface properties has on stem cell differentiation into cardiomyocytes for regeneration of cardiac tissue. Our lab also works on the development of micro- and nanocarrier systems for oral delivery of a variety of therapeutic agents. Our lab focuses on the design, fabrication, characterization, and use of advanced micro/nano biosystems for targeted delivery. Targeted treatment of a variety of diseases including heart diseases and cancer using delivery systems has the potential to increase therapeutic effectiveness, increase patients' quality of life while also lowering treatment cost.

Site Specific Delivery of Antibiotics During Experimental Otitis Media

Larry McDaniel
Department of Microbiology, University of Mississippi Medical Center

Otitis media (OM) is among the most frequently diagnosed infectious diseases of children in the United States. It is estimated that more than 20 million pediatric visits occur each year due to OM. *Streptococcus pneumoniae* remains the leading cause of bacterial OM despite the development of pneumococcal vaccines. The current treatment protocol for pneumococcal OM is a 10-day course of oral broad-spectrum antibiotics. This approach has been shown to drastically alter the microbiota of the recipient and can potentially give rise to drug resistant bacteria. Ototopical drug delivery represents an alternative to oral antibiotic therapy that can reduce the potential systemic effects of antibiotic treatment. We used a chinchilla model of OM to examine trans-tympanic antibiotic treatment. The chinchillas were infected with a nonencapsulated *S. pneumoniae* (NESp) clinical isolate by trans-bullar injection to assure consistent infection. Disease progression was assessed by otoscopic examination for inflammation, fluid behind the tympanic membrane, and biofilm formation. Within 48 hours of signs of infection, a hydrogel containing antibiotic was applied to the tympanic membrane via a slotted speculum attached to an otoscope. At various times post-treatment, animals were euthanized and the bulla was extracted to enumerate the bacteria present. We found that a single treatment at the tympanic membrane significantly reduced the number of bacteria recovered. However, the single treatment had a variable effect on the amount of biofilm within the middle ear. We demonstrated that a single trans-tympanic administration of antibiotic reduced the level of infection during experimental OM.

Effect of Chain Length, Number of Chains and Charge on the In vitro Cytotoxicity of Surface Coating Agents Used on Nanoparticles

Ying Zhang, Salma Begum, Makiesha James, and Hongtao Yu,
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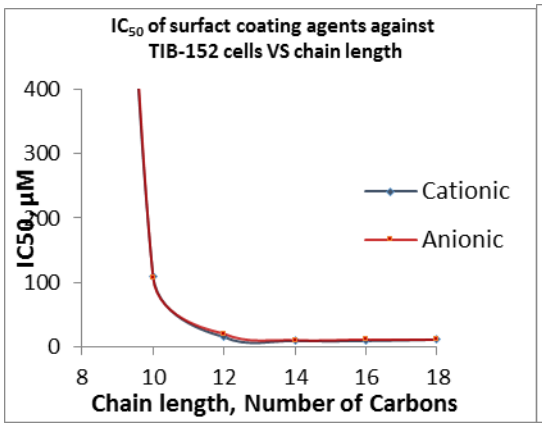
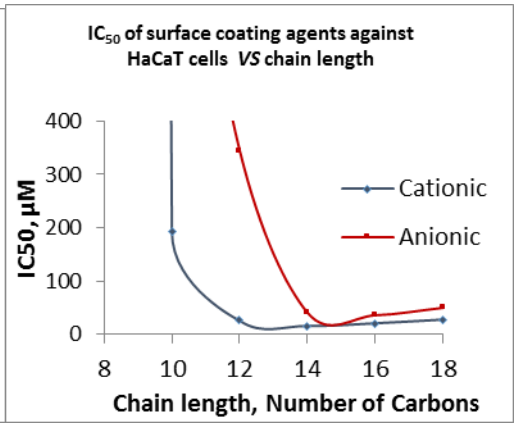
The research and application of nanotechnology has grown tremendously in the last decade. Surface coating agents (surfactants) are an integral part of nanoparticles for shape and size control, surface protection, and stability. Therefore, the study of nanoparticle toxicity must consider the effects from the surfactants used. Here we report the *in vitro* cytotoxicity of both cationic (alkyl ammonium salts) and anionic (alkyl sulfates) surfactants in two cell lines: human skin keratinocytes (HaCaT) and blood T lymphocytes (TIB-152) with consideration of chain length, number of chains and charge. Both cationic and anionic surfactants with chains length of ≤ 8 C are not cytotoxic on both cell lines. The cytotoxicity of the surfactants increases with the increase of the chain length from 10 to 12 carbons, and then levels off from 12 to 18 carbons, except the cationic surfactants on HaCaT cells where the leveling off chain length is 14 carbons. The cationic *di*-dodecyl surfactant is slightly more cytotoxic than the *mono*-dodecyl surfactant, while the cationic *di*-octadecyl (18) surfactant is not cytotoxic due to micelle formation in the concentration range tested. For HaCaT cells, the cationic surfactants are more cytotoxic than anionic surfactants with the same chain length, but for TIB-152 cells, both classes of surfactants are on the same cytotoxicity level. Both of these two classes of surfactants are more cytotoxic to TIB-152 cells than to HaCaT cells. There appears to be a threshold concentration for some surfactants that cytotoxicity is not observed until it reaches this threshold concentration.





The Synergistic Effect of Thymoquinone and Epigallocatehin-3-Gallate on the Functional Capacity of CaOV-3 Ovarian Cancer Cells.

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Ovarian cancer is the leading cause of mortality among gynecologic cancers. Recent studies have indicated that antioxidant exposure may slow the progression in major neoplastic diseases. The objective of this study was to investigate the synergistic effect of antioxidants Thymoquinone (TQ) and Epigallocatechin-3-gallate (EGCG) using Caov-3 cell line as a model. A total of 144 wells were plated with 10^5 Caov-3 ovarian cancer cells. The wells were divided into groups of 72 wells for conventional and sustained delivery, respectively. Each group was subdivided into 4 groups of 6 wells. Group 1 served as control and groups 2, 3, and 4 were treated with TQ (16 µM), EGCG (3 µg/ml), and TQ + EGCG, respectively. Biomarker evaluations were performed following standard lab techniques. The results of the study revealed: (1) there were no differences in cellular protein concentrations between TQ, EGCG, and control in conventional and sustained delivery for 24 and 48 phases; conversely at 72 hours, protein concentration of TQ was significantly increased in conventional and unchanged in sustained delivery ($p<0.05$) and (2) an increase in nitric oxide following administration of EGCG and combination therapy at 24 and 72 hours regardless of route of administration. Overall conclusion: the results of this study provided the literature with more insights regarding manipulation of ovarian cancer behavior through potent antioxidants such as TQ and EGCG. The results also indicated the use of sustained delivery of TQ + EGCG inhibited the metabolic activities of Caov-3 ovarian cancer cell line in culture.

D-Glucose-Induced Cytogenotoxicity and Apoptosis of Human Breast Adenocarcinoma (MCF-7) Cells

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Introduction: Glucose is a simple sugar that plays an important role in energy production in biological systems. However, it has been linked to many long-term health problems including the risk of heart disease and stroke, erectile dysfunction in men and pregnancy complications in women, and damage to the kidneys, nerves, eye and vision. Also, the underlying mechanisms of diabetic complications are poorly understood.

Methods: In the present study, D-glucose-induced cytotoxic, genotoxic, and apoptotic effects were studied using MCF-7 cells as an *in vitro* test model. Cell viability was determined by MTT assay. Genotoxic damage was tested by the means of alkaline single cell gel electrophoresis (Comet) assay. Cell apoptosis was measured by flow cytometry assessment (Annexin-V/PI assay).

Results: The results of MTT assay indicated that D-glucose significantly reduces the viability of MCF-7 cells in a dose and time-dependent manner. Similar trend was obtained with the trypan blue exclusion test. Data obtained from the Comet assay indicated that D-glucose causes DNA damage in MCF-7 cells in a dose-dependent manner. The flow cytometry assessment (Annexin V FITC/PI) showed a strong dose-response relationship between D-glucose exposure and annexin V positive MCF-7 cells undergoing early apoptosis.

Conclusion: Taking together, these data provide clear evidence that D-glucose induces cytotoxic, genotoxic, and apoptotic effects on MCF-7 cells. This finding represents the basis for further studies addressing the pathophysiological mechanisms of action of glucose overdose.

Session V (Respiratory/Imaging)

Role of PDE Isoforms in Regulating cAMP Compartmentalization and Pulmonary Microvascular Endothelial Cell (PMVEC) Barrier Permeability

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An emerging concept in the field of signal transduction is that cAMP signals are compartmentalized and localized to discrete locations in the cell and that spatial localization dictates signaling specificity. For example, in the pulmonary microvasculature, cAMP produced by membrane-bound adenylyl cyclase (AC) has been shown to be barrier protective, while cAMP produced by soluble AC is membrane disruptive. Several studies suggest that phosphodiesterases (PDEs) play a key role in regulating the spatial spread of cAMP signaling. PDE4 is primarily responsible for cAMP – PDE activity in PMVECs. However, the distribution of PDE4 isoforms in PMVECS and their contribution to cAMP compartmentalization is not well understood.

We are using hyperspectral FRET imaging and analysis techniques to determine the subcellular localization of cAMP signals in PMVECs. WT and PDE4B KO PMVECs were infected using a soluble Epac FRET probe (CFP-EPAC-YFP). We labeled nuclei (Hoechst), mitochondria (Mitotracker Red) and plasma membrane (WGA-Tritc). Time–lapse hyperspectral image data were acquired using an A1 spectral confocal microscope. A library containing the pure spectra of endmembers (CFP, YFP, Hoechst, Mitotrackerred, Tritc) was used to determine the abundance of respective fluorophores/labels in the hyperspectral images. We then utilized automated and unbiased analysis techniques, to measure the FRET efficiency in the subcellular compartments. We will assess cAMP levels using FRET efficiency that was measured in different subcellular compartments within the cell or across different cell types. In future, we plan to assess the spatial distribution of PDE4 isoforms using isoform-specific antibodies and their role in maintaining endothelial permeability.

31st SOUTHERN BIOMEDICAL ENGINEERING CONFERENCE

Excitation Scanning Hyperspectral Imaging of Autofluorescence in Decellularized Rat Lungs

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Hyperspectral imaging is a recent technology adopted from satellite imaging for use in microscopy applications. Hyperspectral imaging samples many wavelength bands, forming a contiguous spectrum and providing improved sensitivity and specificity over traditional, epifluorescence techniques. Recently, our laboratory has shown a novel method of sampling excitation wavelength bands (excitation scanning) using hyperspectral imaging approaches in the lung. Our results indicate significant increases in sensitivity and specificity for detection of multiple fluorophores in the presence of lung autofluorescence, compared to both epifluorescence and standard (emission scanning) hyperspectral imaging approaches.

Skin Blood Flow Measurement Using Millimeter Wave Energy: Modeling and in vitro Experiments

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This work investigates the feasibility of using radio frequency (RF) energy in the millimeter wave band (MMW; 30 – 300 GHz), in conjunction with infrared thermography to measure blood flow in the skin. At low power, MMW exposure produces mild, shallow (< 1 mm) tissue heating. The rate of temperature increase is modulated by blood flow. Thus measurements of skin surface temperature during MMW exposure can be related to blood flow rates in the underlying tissue. This could yield a fast, easy method for quantitative measurements that would be useful in the diagnosis and management of Peripheral Artery Disease (PAD) and other cardiovascular conditions. Unlike current clinical methods, the proposed technique would yield a measurement that reflects flow in the dermal microvasculature.

Controlled perfusion experiments were performed using a custom-designed flow chamber and a thin layer of tissue equivalent material (TEM). Experiments were performed at three different water flow rates (0.07, 0.13 and 0.25 ml/min) which correspond approximately to low, medium and high rates of skin blood flow in humans. The surface temperature of the TEM was measured continuously with an infrared thermography camera during low-power MMW exposure. Temperature data were fit to a two-parameter (flow rate, incident power) mathematical model derived from the bio-heat transfer equation (BHTE). Preliminary results show the model accurately describes the data (R^2 > 0.99) at all measured flowrates. This suggests the method may be capable of measuring flow rates in skin.

Impulse Oscillometry Reference Values in Anglo and Hispanic Children

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[2] Universidad Autónoma de Ciudad Juárez, Cd. Juárez, Chihuahua, México

Lung function testing performed by the Impulse Oscillometry System (IOS) has been proven effective in the accurate diagnosis of small airway impairments in patients by measuring respiratory impedance (Z) in terms of resistance (R) and reactance (X) at 5 – 25 Hz. Research conducted by our group provides reference values for IOS in Anglo and Hispanic children living in the border region of El Paso, TX, using different IOS parameters. Our previous studies have shown that IOS parameters AX (the "Goldman Triangle") and the extended Resistor-Inductor-Capacitor (eRIC) model-derived parameter Cp (representing small airway compliance) are the most reliable parameters for tracking lung function. The predictive equations using the following parameters were determined from 112 Anglo and Hispanic asthmatic and non-asthmatic children: Resistance of the respiratory system at 5 Hz [R5], Resistance at 5Hz-20Hz [R5-R20] also called frequency-dependence of resistance (fdR), Reactance Area/"the Goldman Triangle" (AX), Resonant Frequency (Fres), and Peripheral (small airway) Compliance (eRIC Cp). Linear prediction equations were developed by regression analysis with measuring (R5, R5-R20, AX, Fres, eRIC_CP) as dependent variables regressed against height (H).

The prediction equations for R5 and AX are as follows:

$$R5: 1.4280 - 0.0063 \times height$$

$$AX: 1.2128 - 0.0052 \times height$$

Our results therefore provide an original frame of reference for different IOS model parameters in the Anglo and Hispanic adolescent population between the ages of 5-17, obtained from a standardized forced oscillation technique.

Hotspot Analysis for Examining the Association Between Spatial Air Pollutants and Asthma in New York State, USA Using Kernel Density Estimation (KDE)

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Air pollutants play a predominant role in effecting human health. Identifying hot spots of air pollutants in a location will facilitate in taking measures to improve human health and hence protecting the local people from health disorders. The present study examines the use of spatial analysis of air pollutants in New York State, U.S.A. Based on the availability of data in the study region, three air pollutants ($PM_{2.5}$, SO_2, and O_3) were considered for the hot spot analysis to identify zones with higher pollutant concentration levels for the period of 2005 to 2007. The corresponding asthma discharge rates were then determined for understanding the effect of exposure of high air pollutants to asthma discharge rate. In the present investigation, kernel density estimation (KDE) technique was used for hotspot analysis of air pollution from annual average air pollutants concentrations. Using KDE technique, air pollution hotspots and polluted sampling densities are clearly defined based on point data of air pollutants. In the study area, multiple hotspots were observed for these three air pollutants, and they are significantly correlated to the locations of asthma discharge rate. The spatial patterns of hazard probability reveal hotspots of PM2.5 are situated in the counties of Rockland, Westchester, Bronx, Queen, Brooklyn and Nassau. The hotspots of O3 coincide with that of PM2.5, and SO2 but many other hotspots areas were observed for O3. The major hotspots for asthma discharge rate are observed in the same counties as that of PM2.5, SO2, and O3. KDE technique enables capturing hot spots without requiring exhaustive sampling to identify risk prone areas.

Optical Sensing Of Citrate By A Macrocycle-Based Synthetic Receptor In Water

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Citrate is widely used in the pharmaceutical industry as an anticoagulant to stop blood clotting and in the food industry as a preservative across the broad spectrum of food and beverage products. Since citrate in urine is considered to inhibit the crystallization of calcium salt, a low amount of citrate in urine is associated with the increased risk of kidney stones and urological

diseases such as *nephrolithiasis* and *hypocitraturia*. Therefore, the development of simple and color-detecting molecular devices to identify citrate is highly desirable. During this study, a water soluble macrocycle-based dinuclear receptor has been synthesized and characterized by X-ray crystallography. The anion sensing properties of the receptor has been studied by fluorescence and colorimetric titrations in an indicator displacement approach using Eosin Y (EY) in water at pH 7.4. The results reveal an unprecedented high binding constant ($K = 6.5 \times 10^5$) for citrate over a wide range of inorganic and carboxylate anions, exhibiting the binding order as citrate > oxalate > glutamate > phosphate > adipate > tartrate > acetate > benzoate. The addition of citrate to receptor.EY adduct led to a large fluorescence enhancement, displaying a sharp colour change under both visible and UV lights.

Saturday
May 2, 2015

Session VI
(Inflammation/Injury/Health-Care)

Tracking Stem Cells in Irradiated Traumatic Brain Injury Models using ^{1}H MRI at 11.75 T

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Traumatic brain injury (TBI) is associated with an expansive set of symptoms and disabilities. In the U.S, 1.5 million TBI incidences are reported annually and about 2% of the American population lives with impairments associated with TBI. This study explores stem cell mediated therapies and effects on neurogenesis in TBI as detected by high field magnetic resonance imaging (MRI). To provide a clean backdrop for the analysis of stem cell therapies, irradiation has been shown to deplete multi-potent neural stem cells. Therefore, this study employs irradiation to eliminate endogenous cell populations and test functional recovery of TBI site following stem cell therapy. *ex vivo* rat brain imaging at 11.75 T is being conducted to generate ^{1}H images of the region of interest. Currently, MRI experiments are being performed using 3D-FLASH sequences with field of views (FOV) of 2.8 x 2.5 x 2.5 mm and 100-micron spatial resolution and diffusion weighted sequences of 2.5 x 2.5-mm FOV and 100-micron resolution. The goal of this effort is to detect changes in brain structure and connectivity due to the TBI and track progression of the injected stem cells.

Discovering Unknown Genes

Michael Robinson
Florida International University, Miami, FL

We are proposing a new method to discover unknown genes in any genome. Using our GenomePro framework we process raw genomic input files, of any size, from formats such as NGS, fasta, and GBK, extracting DNA, RNA or Protein sub-sequences of any length. Our work can be applied to any life form.

Human DNA contains approximately 20,000–25,000 known genes, with different genes in different cells getting activated and suppressed as a means of generating a diversity of cells for specific tissues including skin, liver, heart, and others. Of the 3.2 billion bases in the Human Genome we find genes in about 2% of the genome, the remaining 98% is known as dark matter. By examining the dark matter areas we embark in predicting the location of currently unknown genes.

The Encyclopedia of DNA Elements theorizes that at least 80% of the Human DNA serves some biochemical purpose. The new 1000 Genomes Project produces very large genomic files of Petabytes in size, needed to be understood. New technologies and improvements in current technologies allow us to arrive to clinical diagnostics in a shorter time.

Scientists have discovered that essentially all coding and non-coding RNA originates at the same types of locations along the human genome. They have been able to understand how genomic "dark matter"—called non-coding RNA— originates. Since the genetic origins of many diseases reside outside of the coding region of the genome, these findings may also help us to find where complex-disease traits reside.

A Hybrid Sequence-Specific Oligonucleotide ELISA Method for Rapid Detection of Bacteremia

D. Olga McDaniel[1] Jason Guillot[1], Larry McDaniel[1], William Turner[1,2], Ross Fremin[1], Gita Subramony[1], and Mark Williams[1,3]
[1]University of Mississippi medical Center, Jackson, MS, [2] University of Texas Health Science Center, Dallas, TX, and [3]University of Colorado, Colorado Spring, CO

The rapid diagnosis of bacteremia is essential to the efficient and appropriate antimicrobial management of the septic patient. It is the purpose of this study to test the practical application and sensitivity of PCR technology in a hybrid says using sequence-specific oligonucleotide (SSO) probes and an enzyme linked immuno-assay (ELISA) technique for the detection of bacteremia. Strains of bacteria frequently identified in surgical intensive care unit patients were tested. In the SSO-ELISA technique, species specific probes for detection of 2 staphylocucci (S. aureus and S. epidermidis), 4 streptococci (group G, group C, S. agalactiae, and S. pneumoniae) and Enterococcus faecalis were immobilized onto streptavidin treated polystyrene 96-well plates. Then biotin labeled PCR amplified DNA was captured by the immobilized probes. Streptavidin-alkaline phosphatase enzyme conjugate (SA-AP) was used to bind to the biotinylated targets. Positive signals were detected based on the intensity of color interpreted by a programmed ELISA reader. Our assay format currently allows simultaneous analysis of 12 test samples and the detection of seven common gram-positive clinical isolates in less than 6 hours. This is a highly versatile technique for detection of other bacteria and microorganisms. It could provide a rapid, sensitive and cost effective diagnostic method for identification of microorganisms causing bacteremia. In addition, the technique is simple and suitable for the clinical laboratory settings with the potential for automation, and integration into the laboratory electronic data-information system.

Morphological Alteration of the Liver and Adrenal by Statin Released by Means of Tricalcium Phosphate Lysine Delivery System in a Defect and Segmental Femoral Injury in an Animal Model

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Statins, which are 3-hydroxy-3-methylglutaryl coenzyme A (HMG-CoA) reductase inhibitors are widely used for the treatment of hyperlipidemia, and are largely metabolized in the liver. Recent studies and animal data suggest that statins promote osteogenesis and increase bone strength. Physiologically, marked reduction in total cholesterol level may interfere with the synthesis of reproductive and adrenal hormones. However, little is known about the effects of statins delivered by sustained delivery system to a

target site of a defect and segmental bone fractures on the morphology of the liver and adrenal gland. Therefore, the purpose of this study was to develop a targeted statin delivery system using Tricalcium Phosphate Lysine (TCPL) for defect and segmental femoral injuries and evaluate the effects on theinjured bones histomorphology of the liver and adrenal after sustained delivery of statin for a period of 30 days and 12 weeks post-surgery. At the end of 30 days (Phase I), and 12 weeks (Phase II), all the animals were euthanized (with overdose of halothane) and the vital organs (including the liver and adrenal), reproductive organs, the femoral bones were collected for histomorphological analysis. Simvastatin used in this study significantly increased fracture healing in both phases. However, in Phase I study, the adrenal wet weight recorded in the statin group was slightly higher than the weights recorded for the sham and the control groups, but the difference was not statistically significant ($p = 0.157$). Also, there was atrophy of the zona fasciculata and the zona reticularis, and compensatory hypertrophy of the medulla of the adrenal glands in the samples taken from two of the rats in Phase I. In addition, the wet weight of the liver in the statin group was not significantly different from the control and the sham groups ($p = 0.320$), although, there was an insignificant decrease of the wet weight compared to the control and sham groups. The histomorphological evaluation by the Image pro digital analysis showed that the liver morphology was different from the control. There appeared to be an atrophy of the liver, with a denser appearance compared to the control and sham groups. In Phase II study, there were no significant morphological and wet weight differences of the liver and adrenal glands in the statin group compared to the control and sham groups. In conclusion, sustained delivery of statin in a short period may lead to alteration of the histomorphology of the liver and adrenal gland in a rat model and with adaptation to normal morphology after a long period of sustained delivery of statin.

Inflammatory Molecules Released During Ischemia/Reperfusion in a Rat Model of Cardiac LAD Occlusion

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Background: Ischemia/reperfusion (I/R) during organ procurement contributes significantly to tissue injury and may cause early organ dysfunction after transplantation. The molecular markers associated with innate immune response are prime activators of early inflammatory response that leads to host-immune responses and organ rejection. Objectives: This study was undertaken to investigate the possible release of molecular markers during cardiac I/R in a rat model of the left anterior descending artery (LAD) occlusion.

Materials and Methods: Adult Sprague-Dawley rats randomly assigned to five groups of control; 30 min LAD occlusion; 60 min LAD occlusion; 30 min LAD occlusion/10 min reperfusion and 30 min LAD occlusion/60 min reperfusion. The LAD was occluded to generate ischemia in left ventricle (LV) of the heart. Blood and cardiac tissues were tested for presence of allograft inflammatory factor-1 (AIF-1) and Toll-like receptor 2 and 4 (TLR-2 and TLR-4) at different time intervals. Expression levels of these markers were tested using a semi-quantitative PCR.

Results: AIF-1 and TLR mRNA transcripts were significantly increased in a time dependent manner after I/R. These markers were upregulated as early as 10 minutes after reperfusion and further they were increased several-folds after 60 minutes of reperfusion in tissue and peripheral blood cells as compared to the control group. The markers were 2-fold higher in blood samples versus cardiac tissues.

Conclusion: myocardial I/R causes upregulation of molecular markers associated with the innate immunity which may result in activation of alloreactive inflammatory response and organ dysfunction in transplantation settings.

Morphometric Evaluation Of The Tissue Implant Response Surrounding Subcutaneous TCP, HA, And ALCAP Bioceramic Implants

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The objective of this investigation was to quantify and further elucidate the tissue-implant response in the fibrous tissue surrounding tricalcium phosphate (TCP), hydroxyapatite (HA), and aluminum calcium phosphate (ALCAP) implants when implanted subcutaneously. Sixteen animals in four experimental groups (n = 4/group) were implanted with one implant each: Group I (control, TCP), Group II (HA), and Group III (ALCAP). At 90 days post-implantation, the fibrous tissue surrounding the implants was harvested and submitted for routine histologic processing and staining. Sections of stained fibrous tissue (5 micron sections) cut every 20 microns throughout the depth of the tissues were evaluated for the presence of macrophages, fibrocytes, neutrophils, vascularity and thickness for all three groups using semi-automated quantitative methods. Data were reported as means±SD and were analyzed using ANOVA followed by Bonferroni multiple comparisons test (alpha=0.05). Group III demonstrated a significantly higher number of neutrophils but fewer macrophages and blood vessels per high power field and had a substantially thinner fibrous tissue capsule thickness compared to Groups I and II. Group II elicited a greater response of fibroblasts compared to Groups I and III suggesting HA may provide a slightly higher degree of stability to the implant. In total, these findings suggest both TCP and HA behave similarly *in vivo* when compared to ALCAP and may be better choices for subcutaneous soft-tissue application compared to ALCAP.

β-Estradiol Induces Cytotoxic Effects To Human T-Lymphoma (Jurkat) Cells Through Oxidative Stress

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β-estradiol is the most potent estrogen of a group of endogenous estrogen steroids which includes estrone and estriol. This steroid hormone is the most potent natural estrogen, produced mainly by the ovary, placenta, and in smaller amounts by the adrenal cortex, and the male testes. Although β-estradiol protects the renal and cardiovascular systems, the mechanisms involved remain unclear. In this research, we performed the MTT [3-(4, 5-dimethylthiazol-2-yl)-2,5-diphenyl tetrazolium bromide] assay to evaluate the effect of β-estradiol on human T-lymphoma (Jurkat) cells upon 24 and 48 hours, respectively. Lipid peroxidation assay was also performed to estimate the levels of malondialdehyde (MDA) production in β-estradiol-treated cells. The results from both MTT assay demonstrated that low, physiological levels of β-estradiol induce cellular proliferation in Jurkat T-cells. At higher dose of exposure (16μM), β-estradiol decreases the viability of Jurkat T-cells compared to the control cells. Data generated from lipid peroxidation assay resulted in a significant increase ($p < 0.05$) in the production of MDA with increasing doses of β-estradiol. Upon 48 h of exposure, MDA concentrations in the sample [μM] (mean ±SE, n = 3) compared to untreated control were 4.9 ± 1.7, 8.1 ± 1,6 11.5 ± 2.2, 21.1 ± 2.3, 19.5 ± 1.4, and 21.5 ± 2.6 in 0, 1, 2, 4, 8, and 16 μM β-estradiol, respectively. In summary, findings from this study demonstrated that β-estradiol is cytotoxic to Jurkat T-cells. This cytotoxicity is found to be associated with oxidative stress.

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Toxicity of Gold Nanoparticles and Gold Ions to Bacteria

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Gold nanoparticles (AuNPs) have applications in the fields of chemistry, biology, engineering, and medicine as catalysts and an agent for imaging, labeling, drug delivery, and sensing. There are many publications on the toxicity of AuNPs; however, majority of the research failed to disclose the information of Au (III) ion present with AuNPs. Here we report the effect of Au (III) ion on the toxicity of AuNPs to various bacteria. Bacteria used in this study include non-pathogenic and multidrug resistant *E. coli*, multidrug resistant *Salmonella* DT104, and the multidrug resistant *Staphylococcus* (MRSA). We compared the inhibition of bacterial growth of synthesized AuNPs centrifuged 1-4 times at 5000 rpm for 45 min each to remove excess Au (III). Spread plate counting method was used to determine the inhibition of bacterial growth. We also investigated the concentration and time dependent inhibition of Au (III) in all bacteria. Purified AuNPs (4× centrifugations) do not show any bacterial growth inhibition compared to the less than 2× centrifuged samples. We found that Au (III) itself induced both concentration-dependent and time dependent inhibition of all bacterial growth. This means that Au (III) is toxic to bacteria and maybe explored for antibacterial purposes. It also suggests that test of AuNPs toxicity must carefully separate co-existing chemicals especially Au (III).

Session VII
(Tissue Engineering/ Scaffolds /Bone)

Comparing Scaffold Formulation for Three Dimensional Bone Tissue Engineering

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According to the Center for Disease Control and Prevention, periodontal disease affects roughly 47% of adults above the age of 30, and increases with age. Periodontal disease can cause a wide variety of symptoms from bad breath to carries, or even loss of teeth. When teeth are lost, the alveolar bone surrounding the lost teeth is slow to grow together and often resorbs. Our aim is the find a substrate suitable to speed the growth of the alveolar bone to form a strong base for future dental treatments. We hypothesized that Human Adipose Derived Stem Cells (hADSCs) would differentiate along the osteoblastic lineage better in a firmer substrate. To this end, hADSCs were isolated from a patient undergoing elective abdominoplasty and were cultured over a period of 21 days in composite hydrogels prepared using various concentrations of collagen and elastin-like polypeptide (ELP). ELP was added to increase the modulus (firmness) of the scaffold as established in our previous studies. After 3 days of acclimation, the stem cells were differentiated using an osteogenic medium cocktail and the growth was analyzed on day 7, 14, and 21. After each culture period, the cells were harvested from the hydrogel scaffolds using collagenase. A live/dead assay performed on Day 21 indicated abundant cell growth with only a small population of dead cells. Cells were also examined using total protein assay, alkaline phosphatase assay, and alizarin red mineralization assay. Overall, our results suggest that the ELP-collagen hydrogels to be a suitable scaffold substrate for a long-term, 3-dimensional hADSCs culture and their subsequent osteogenic differentiation.

Regional Variations on Microstructure and Biomechanical Properties of the human Vertebral Endplate and Trabecular Bone

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Vertebral compression fractures represent one of the most common injuries resulting from osteoporosis with an incidence rate of 700,000 per year in the United States. However, there is limited data on the regional differences in the microstructure of the vertebral endplate and cancellous bone and their relationships with degenerative disc diseases and vertebral fractures. Spinal osteoporosis affects the anterior part of the vertebrae leading to its collapse and kyphosis. Does bone resorption occur at a higher rate in the anterior than in the lateral region of the vertebra?
Our preliminary data showed an increase in biomechanical properties from the antero-central to the lateral regions for both males and females. Mechanical strength increased by an average of 30% from central to lateral regions of both endplate and cancellous bone. However, this increase was 5-fold from anterior to lateral regions. Although not statistically significant, there was a 24% increase in BV/TV from central to peripheral regions of the cancellous bone. We observed a 31% increase in BV/TV from superior to inferior bony endplates. We also observed a decrease in the ratio osteoid/bone surface (OS/BS) by 20% from superior to inferior bony endplates. The density of vascular channels at the vertebral endplate decreased from central to lateral regions by 15%. We are currently investigating the relationship between osteoarthritis, stress shielding, and the resorptive effects of osteoclasts during bone remodeling.

A Three Dimensional Tissue Engineering Approach to Generate Functional Cardiac Muscle from Mouse Embryonic Stem cells in vitro

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Adult cardiac muscles damaged by myocardial infarction (MI) have very little capability to regenerate. MI is a state in which cardiac muscles become dysfunctional and eventually lead to cardiac failure. This study proposes a tissue engineered cardiac patch, which can replace these dead and dysfunctional muscle. Mouse embryonic stem cells (MES) were cultured and embryo-body were prepared by hanging drop method. Growth factors such as BMP-2 (3ng/ml) and BMP-4 (3ng/ml) were added to the culture medium to induce cardiomyocyte differentiation. Beating cardiac cells were regenerated after 9 to 12 days and carefully transferred to a fibrin gel matrix to create a cardiac tissue patch *in vitro*. Quantitative gene expression studies were performed to evaluate genetic characteristics of the undifferentiated tissue (Fig 1) and neo tissue. A maximum of 40% of MES were differentiated into cardiomyocyte and a collective cell beating was observed. Future study remains to develop a protocol that can increase the efficiency of differentiation of stem cells to cardiomyocytes. These cardiac tissues have potential to treat MI and also, can serve as a drug testing model in future.

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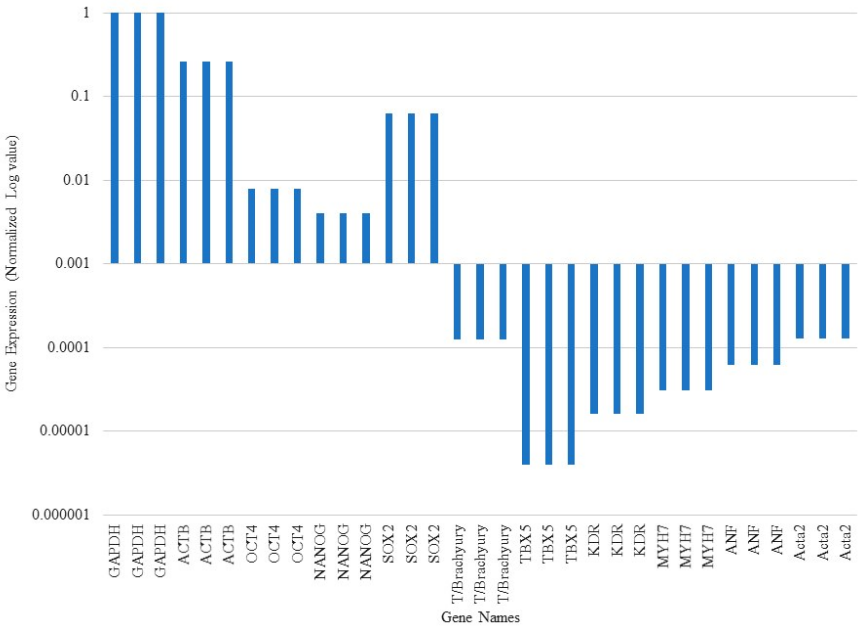

Hubiogel Enriched Fibro-porous Scaffolds for Tissue Engineering

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Key challenges in vascular tissue engineering are to create a small diameter graft which can behave similar to the native artery, promote a regeneration, and bioabsorb completely after the growth of neo-artery. Two principle qualities such as mechanical integrity and biocompatibility are essential for such vascular grafts to be a successful after implantation. Toward this end, a bio-hybrid fibro-porous tissue scaffold consists of polycaprolactone (PCL), poliglecaprone (PGC) and HuBiogel™ was fabricated by electrospinning and coated with HuBiogel (a human derived biomatrix consists of collagens, laminin, and proteoglycan). Electrospinning fabrication and process optimization of PCL/PGC provided a scaffold with comparable mechanical properties to native arteries (a burst pressure of ~ 1900 mm Hg). Spectroscopic (FT-IR and XPS) and microscopic (AFM and SEM) analyses were used to characterize the structural and morphological properties. The effect of coating of HuBiogel on the mechanical properties and surface hydrophobicity of the scaffold were evaluated The tensile strength values in situ condition for 3:1 PCL/PGC with and without biomatrix coating was found to be 1.45 MPa and 1.57 MPa respectively. The coating reduced the stiffness of scaffold from 4.76 MPa to 2.38 MPa after PBS hydration for 24 h. Similarly, water contact angle studies showed a decrease in surface hydrophobility. To understand biocompatibility of the bio-hybrid scaffold, human umbilical vein endothelial cells (HUVECs) were seeded on scaffold and monitored over two weeks period. Cells attachment and viability were enhanced with the HuBiogel coating. Overall results indicated the potential of HuBiogel enriched scaffolds for tissue engineering applications.

Role of Physical Cues in Axonal Guidance

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Functional neural circuitry formation requires highly accurate axonal pathfinding during neural development or regeneration. The direction of axonal outgrowth is dictated by the detection and integration of competing guidance cues found in the surrounding environment. Control of the attractive and repulsive chemical cues has allowed the modulation of axonal outgrowth and nerve regeneration after injury. Further, it is widely accepted that the precise neural connectivity observed during development, as well as accurate target reinnervation after nerve injury depends on the regulated action of specific molecular cues. This biochemical view has dominated the field since the discovery of the nerve growth factor, and the evidence of physical cues in guiding axons was lacking. Recently, we have demonstrated that various physical cues (e.g. force, fluid flow, and heat) can influence axonal guidance. We have employed various photonic tools (e.g. optical tweezers, optical spanners, neuronal beacon, microfluidics, laser microbeam, multi-photon cross-linking) for generation of highly-controllable physical cues. For example, force of focused laser beam impinging upon the leading edge of the neuronal growth cone has shown control on axonal guidance. Further, by use of microfluidic flow and micromotors generating localized fluid flow, we demonstrated steering of growth cones. Recently, we found highly effective repulsive-guidance of axons by localized temperature gradient created by near infrared laser beam. I will present an overview on these findings and their implications.

Material and Mechanical Properties of Osteophytes and Non-Osteophytic Cortical Bone: A Preliminary Study

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Introduction: Several studies have associated the development of spinal osteophytes with disc degeneration. Others have characterized them as adaptive bone remodeling in response to unusual stress/strain. No recent study examined the microstructure and mechanical properties of osteophytes.

Materials and Methods: Bone tissues were harvested from eight different human cadavers. Beams (length: 24mm; width: 4mm; thickness: 2mm) from lumbar osteophytes, lumbar anterior cortices (non-osteophytic), and femoral diaphyseal cortices were tested for three-point bending and micro-hardness. The specimens were subsequently divided into two parts for material density, ash density,

and histological analyses.

Results: Hardness values (HV) decreased by 39% from femoral cortical to spinal osteophytic samples. The maximum load to failure for osteophytic and non-osteophytic vertebral beams was 64 and 4 Newtons (N), respectively. Material density ranged from 1.40 to 2.0g/cm^3 and 1.18 to 1.70g/cm^3 for cortical bone and osteophyte, respectively. Undecalcified histology showed a disorganized structure of the osteophytic osteons as compared with the regular pattern observed in femoral diaphyseal cortical bones.

Significance: Vertebral osteophytes have higher load carrying capacity than vertebral cortical bone. However, femoral diaphyseal cortical bone presents a more mature and organized microstructure, which leads to higher mechanical strength than osteophytes.

Osteochondral Xenograft Development for Articular Cartilage Repair

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Although fresh osteochondral allografts are an effective treatment for large articular cartilage lesions, but their shelf life and supply are limited. We aim to develop decellularized osteochondrol xenografts with mechanical properties similar to those of human cartilage. This study characterizes the effect of antigen removal and chemical crosslinking on the biochemistry, biomechanics, and biocompatibility of porcine osteochondral tissue. Cylindrical samples, five millimeters in diameter and approximately 10 millimeters in length, were extracted from porcine stifle joints. For decellularization, samples were then processed with 2% sodium dodecyle sulfate (SDS) and 0.5 mg/ml DNase I for 48 h. Some samples were additionally crosslinked with 0.1% aqueous genipin, from gardenia jasminoides Ellis fruit, which gave the samples a dark blue coloration. DNA removal from cartilage after decellularization was approximately 25%. While decellularization did not significantly affect collagen content, glycosaminoglycan (GAG) content was reduced approximately 50%. Native, decellularized (no crosslinking), and crosslinked osteochondral samples were subjected to mechanical testing to determine the shear stiffness of the cartilage-subchondral bone interface. Data analyzed thus far show that the stiffness of native samples was 16.5 N/mm, compared to 16.0 N/mm for decellularized samples, and 20.1 N/mm for the genipin-crosslinked group. Cell culture experiments are underway to determine the response of chondrocytes and osteoblast-like cells to decellularized and genipin-crosslinked cartilage and bone, respectively. The preliminary data suggest that SDS substantially lowers DNA and GAG, but has negligible effect on the cartilage-bone shear stiffness; genipin crosslinking may provide further reinforcement of this interface

Robotized Method for Comparative Testing of Back Support Device

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Introduction: Many spinal diseases affect the mechanical integrity of the lower back causing instability and low back pain. Braces are often used as non-surgical treatment and serve to support the spine and alleviate the pain. More recently dynamic braces claiming to decompress the spine have been introduced. However no scientific data or testing methodology exists to determine how well back braces work. A mechanical analogue of the upper torso and lower spine was developed and integrated into a robotic testing platform to analyze spinal orthosis' mechanics.

Methods: Two orthoses were evaluated: a decompression stabilizing orthosis (DSO) and a new novel distractive mobility orthosis (DMO). Three loading conditions were simulated: upper torso loads up to 400N in upright stance, ii) initiation of flexion (5deg) and extension (3deg) from upright stance, and iii) extended ranges of flexion (28deg) and extension (10deg) from upright stance. Loads applied to the torso-orthosis assembly and transferred through the spine were used to determine the off-loading capacity of the orthoses and combined with the displacement changes to calculate the orthoses' rotational stiffness properties.

Results and Discussion: Both orthoses reduced spinal loading by 300N in upright stance. Initiation of flexion and extension required moments of 18Nm and 7.1Nm for the DSO and 9.4Nm and 5.5Nm for the DMO. The DMO reached 20Nm at 28deg flexion and 15Nm at 10deg extension. The DSO was too stiff for extended range testing.

Conclusion: The unique biomechanical test assembly was able to determine the biomechanical properties of two different back support devices.

Session VIII (Modeling)

MREPT at 21.1 T

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Biological tissues present an anisotropic conductivity distribution determined by the electrical properties of numerous interfaces and domains. Visualization of frequency-dependent conductivity and permittivity distribution in the range from DC to hundreds of MHz may expand our ability to provide diagnostic information about the physiological and pathological state of tissues and organs. Magnetic Resonance Electrical Property Tomography (MREPT) is a recently developed method for reconstructing images showing the complex permittivity distribution in target tissues. As such, MREPT can provide both a map of permittivity ε, which relates to energy storage in the medium, and a map of conductivity σ, which relates to the energy loss. Unlike related techniques such as electrical impedance tomography (EIT), MREPT makes use of a standard MRI system with no additional hardware or the need to inject current into the tissue under examination. Instead, the MREPT approach employs post processing of the magnetic field map of the applied RF pulse, making MREPT quantitative by yielding absolute values of σ and ε. Phantom and human experiments have proven the feasibility of MREPT, with ongoing clinical studies demonstrating encouraging results. In this study, the physical and mathematical principles of MREPT, novel data collection methods and reconstruction algorithms, and experimental techniques for phantom and in vivo rat acquisitions will be extended to operations at 21.1 T, corresponding to an operational

Ultrafast in vivo Diffusion Imaging of Stroke at 21.1 by Spatiotemporal Encoding

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Fast imaging techniques such as echo planar imaging (EPI) are popular techniques for imaging of neuronal injuries. However there is an inherent problem with these techniques by creating artifacts that distort not only anatomical information but also the quantification of relevant quantities, such as water diffusion. This study is aimed to utilize an ultrafast single-shot spatiotemporally encoded (SPEN) imaging sequences with diffusion gradients applied to measure apparent diffusion coefficient (ADC) in stroke at 21.1 T. While providing the highest sensitivity available, this system challenges DW-EPI because of susceptibility artifacts and gradients that are prominent at the ultra-high fields. This work compares *in vivo* diffusion quantification in ischemic stroke injuries of rats using SPEN-DWI, DW-EPI and DW spin-echo (SE) acquisition methods.

The sequence is based on EPI readout but with the 90^0 excitation pulse exchanged with a chirped pulse which allows for the SPEN encoding while in the present of a gradient. SPEN-DWI was obtained at six b-values along the principal axes. Post-processing of the SPEN-DWI datasets was carried out using MATLAB for echo alignment and the application of a super-resolution algorithm. ADC maps were calculated in MATLAB incorporating all background gradient corrections for the SPEN-DWI sequence. ADC data was acquired by 1 and 4 segmented DW-EPI for comparison. Our results show that the quality of the SPEN-DWI and resulting ADC maps make this form of single-shot acquisition a clear choice for comprehensive, high-throughput *in vivo* stroke studies at ultra-high fields and/or heterogeneous signal regions.

Scoliosis Analog Model for the Evaluation of Bracing Technology

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Introduction: Thoracolumbar braces are commonly used to treat Adolescent Idiopathic Scoliosis (AIS). Braces serve to reduce and prevent progression of the spinal curve by applying multidirectional corrective forces. These forces may cause translational (inward, upward) and derotational (twist) responses of the spine. The objective was to develop an assembly capable of quantifying brace structural stiffness properties by measuring the corrective forces components.

Methods: A novel mechanical equivalent analog model of the AIS condition was designed and developed to simulate a 40° spinal deformity. A linkage-based model was used in conjunction with a biorobotic testing platform to quantify scoliosis brace structural stiffness properties. Measurements of the force components applied to the model and displacement of the linkage assembly were used to calculate the brace stiffness. The brace was tested in both a constrained (via Velcro straps) configuration and an unconstrained configuration.

Results: Calculated stiffness was expressed as a resistive force relative to the angular change of the linkage system from 30° to 70°. For the unconstrained and constrained configurations, vertical forces ranged between 10 and 100N and stiffness values were 4.5 N/deg in the Z direction and 0.3 N/deg in the X direction, and 40 and 400N and 51.3 N/deg and 0.1 N/deg respectively.

Discussion: Structural properties provide a means to compare bracing technology and better understand design features. For example, addition of Velcro straps increased stiffness of the native brace 10 fold. This test assembly could be used as a design tool and to develop a standard for classifying braces.

Multiple Path Particle Dosimetry Simulation of Respiratory Deposition of Nanoaerosol in the Mouse Lung

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This study computationally predicted how inhaled particles, including nanoaerosol particles get transported, disseminated and deposited inside the mouse lung. Here, Multiple Path Particle Dosimetry (MPPD) program model was used to run simulations of experimental conditions and the deposition results were compared with reported literature. Antibiotic inhalation therapy is currently a topic of interest. Its application to treat lung infections in humans has been shown to be promising in cystic fibrosis. Nanoaerosol (particle approx. 100 nm) delivery of antibiotics has recently been proposed to promote survival of mice. However, the respiratory deposition of an antibiotic nanoaerosol in various regions of the lung is unknown. In this work the physical and mechanical properties of the antibiotic nanoaerosol were used to conduct simulation in MPPD specific to BALB/c mice lung morphology. Substantial widespread comparisons were infeasible since there are only a handful reported studies of inhalation of nanoparticles (NPs) for mice. A satisfactory agreement was found between the simulation results with the experimental data on titanium dioxide (TiO_2) nanoaerosol delivery to the mice. Tracheobronchial (TB) deposition result of this study has also shown good agreement when comparing with reported numerical deposition determined by typical path mathematical model. However, Head, TB and Pulmonary (P) deposition results have differed with those reported previously by another experimental study of radiolabelled aluminosilicate submicron particles.

Choice Of Statistical Techniques: Parametric Versus Non Parametric Methods

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The choice of statistical technique for any data has a profound influence on inference, interpretation, and therefore, the conclusion derived from it. Understanding this choice is important for critical evaluation of biomedical literature. A potential source of confusion in analyzing any data is whether to use parametric or non-parametric statistics. The importance of this issue cannot be underestimated. Knowledge of several statistical concepts are needed to understand the difference between parametric and nonparametric methods. If measurement scale is nominal or ordinal then one should use non-parametric statistics. If interval or ratio scales are used, then use parametric statistics. Other consideration is distribution of the data. If data are approximately normal, parametric methods should be used. Nonparametric tests are sometimes called distribution-free tests because they are based on fewer assumptions. Non-paramteric procedures are less powerful because they use less information in their calculation. If a distribution deviates markedly from normality, then you take the risk that the statistic will be inaccurate. The safest thing to do is to use an equivalent non-parametric statistic. If you get it wrong, you risk using an incorrect method or you may use a less statistically powerful procedure. If sample sizes are large, parametric tests are robust to departures from normality. However, because of cost and potential risks to humans and animals, many of the sample sizes in the biomedical literature are far from being large. It can sometimes be difficult to assess whether a continuous outcome follows a normal distribution and, thus, whether a parametric or nonparametric test is appropriate. Several statistical tests exist to assess normality including Kolmogorov-Smirnov test, the Anderson-Darling test, and the Shapiro-Wilk test. Each test is essentially a goodness of fit test. This presentation discusses all aspects of statistical test choice comparing parametric tests with equivalent nonparametric counterpart for t-test, Paired t-test, one-way ANOVA, and regression and correlation techniques with real examples using several statistical software primary, SPSS.

Session IX (Cancer)

Dietary Stilbenes and Epigenetic Regulation for Prostate Cancer Chemoprevention and Treatment

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Prostate cancer is the most often diagnosed cancer and the second leading cause of cancer deaths in males in the US. Prostate cancer arises through genetic and epigenetic alterations. Epigenetic

mechanisms implicated in prostate cancer include gene silencing via action of co-repressor complexes (i.e. deacetylation) and changes in microRNA profiles.

Epidemiological studies suggest association between diet and lower risk of prostate cancer. Dietary stilbenes (resveratrol and its potent analogs) are phenolic compounds with anti-inflammatory, anti-oxidant and anti-cancer activity. Importantly, these compounds can modulate epigenetics and influence cancer susceptibility and progression. In this presentation, I will provide compelling evidence on epigenetic mechanisms of resveratrol and its analogs through regulation of the chromatin modifier metastasis-associated protein 1 (MTA1), MTA1-associated network and certain oncomiRs and highlight the anticancer effects of these compounds in vitro and in preclinical models of prostate cancer. It is our hope that resveratrol's analogs with better bioavailability, thereby conferring superior pharmacological potency and greater anticancer effects through epigenetic mechanisms, may become strong candidates for clinical development.

Identifying Hormone Independent Targets & Drug Designing For Breast And Prostate Cancers

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Breast and prostate cancers together affect about three million people every year and kills about 30% of them (16% in USA!!). Estrogen Receptor (ER) alpha and Androgen Receptor (AR), are the two main nuclear hormone proteins that are responsible for the progressions of breast and prostate tumors, respectively, and represent the main targets for hormonal therapies. However, about 70% of breast and prostate tumors develop resistances in hormonal therapies and they sustain growth in hormone-independent manners. In order to develop hormone-independent inhibitors, we elucidate protein-protein and protein-DNA interfaces of ER and AR and identify and validate alternate targets for drug designing.

Using the crystal structures of ER and AR DNA and Ligand binding domains, molecular modeling, molecular dynamics simulations, and bioinformatics we identified the hydrogen-bonding contacts and the sequence motifs that are responsible for dimerization and/or DNA recognition. The crucial amino acids of a motif are then grafted on stable helices (alanine or leucine) in order to develop peptidic inhibitors.

In ER ligand binding domain, three sequence motifs are identified to recognize the ER dimerization interface and one of them LQXXHQXXAQ (497-506) has been used to develop inhibitor peptides. When subjected to in-vitro testing in MCF-7 cell lines, these inhibitors are found to inhibit ER expression in the presence of hormones in a competing manner as with 4-hydroxy-tamoxifen. In AR, no suitable target exists in the ligand binding domain but we identified a sequence motif LCAXRXD motif (578-584) in AR DNA binding domain. The key amino acids of this motif are grafted on stable helices and in-silico testing are in progress to design a hormone-independent inhibitor for prostate cancer.

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Theranostic Hybrid Graphene Materials With Label-Free Biosensing And Combined Therapy Capability

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Breast cancer is one of the major public health issue for women in this world, which kills more than half million women every year. It is now well recognized that the detection of breast cancer circulating tumor cells (CTCs) is an invaluable tool for monitoring the progression and finding possible therapies to save life. Since CTCs are extremely rare in blood, even for cancer patient, it is till now highly challenging to capture and identify them. Here I will discuss, our recent report on the development of theranostic hybrid grapehen oxide, graphene quantum dots and hybrid single wall carbon nanotube (SWCNT) for targeted capture of SK-BR-3 breast tumor cells from infected blood sample, followed by accurate multimodal diagnosis and effective photothermal killing of breast cancer. Reported data indicate that theranostic graphene nanomaterials can have enormous potential for real life CTC capture and therapy applications, once it is optimized properly in clinical settings.

Novel Antibody Conjugated Hybrid Gold-Graphene Oxide Nanoparticles For The Treatment Of Cytomegalovirus Infection

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Human cytomegalovirus (HCMV) is a herpesvirus that causes major health problems in neonates as well as in immunocompromised individuals (1). At present, a vaccine is not available for HCMV infection and available antiviral drugs suffer from toxicity, poor efficacy and resistance (1, 2). Earlier, we reported the efficacy of bioconjugated gold nanoparticles (GNP) as antiviral against HCMV (3). Here, we report the synthesis and application of antibody conjugated second-generation hybrid gold-graphene oxide nanoparticles for the inhibition of mouse cytomegalovirus (MCMV) infection, so that this approach can be tested in an animal model. Due to the high yield production, low cost, and interesting electronic and optical properties graphene and its derivative graphene oxide hold great promise for real life applications. By attaching the surface of graphene oxide with plasmonic nanoparticles, one can achieve a nanoplatform with huge surface area, higher sensitivity and selectivity, and better theranostic. These hybrid nanoparticles are superior to pure gold nanoparticles in several ways: (i) high yield and low cost of production. (ii) tremendously increased effective surface area, (iii) significantly improved sensitivity, selectivity and photothermal killing abilities, (iv) they can form a sheet structure for coating on detection devices, and because carbon is their major content, (v) the particles are expected to be inert in vivo. For the purpose of this project, we raised M55 (gB) monoclonal mouse antibody and conjugated it with the newly synthesized popcorn shaped gold graphene oxide hybrid nanoparticles to produce M55-GOPop. These nanoparticles block MCMV replication, virus-induced cytopathogenic effects and virus spread in cell culture without inducing cytotoxicity. When injected in BALB/c mice, these nanoparticles are tolerated well, as indicated by the comparable weight and health status of the M55-GOPop injected mice and the saline injected mice. MCMV-infected mice that are mock treated loose significant weight over a period of 14 days post infection; however, M55-GOPop treated mice continue to gain weight over this period indicating promising viral inhibition properties of M55-GOPop in vivo. Thus, we have not only designed a potential antiviral strategy that specifically blocks HCMV infection in cell culture but we have also characterized the effectiveness of this approach in a mouse model.

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New Sites for Old Suspects: Environmental Allosteric Modifiers of Human Estrogen Receptors

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Estrogen receptors (ER) play a critical role in development of breast carcinoma. Estrogen activates ER by directly binding to its ligand binding domain (LBD) and mediates a cascade of cellular signaling events that promote cell growth and proliferation. Upon activation, ER recruits co-activators which enable its activity at targeted genes. To date, no high resolution structure of a full-length estrogen receptor has been solved. Hence, a holistic view of the full-length receptor structure in its activated state and inactivated state is far from understood. Peroxisome proliferator activated receptor gamma (PPARγ) - retinoid x receptor alpha (RXRα) heterodimeric structures with intact DNA binding (DBD), ligand binding (LBD) and hinge domains provide crucial structural clues pertinent to nuclear receptor domain architecture and potential conformational changes involved in activity. Template driven theoretical models can be utilized as substitute for X-ray structures, however the predictions can be limited to helices and sheets. Hinges and loops which constitute major protein-protein interaction sites as well as allosteric sites are often beyond the scope of current tools and techniques available for protein folding and modeling. Here we introduce an innovative combination of state-of-the-art computational tools to capture dynamic receptor conformations, leverage pseudo-receptor shape filters to generate active hER models and access to predictive models discriminating aspects of ligand binding to accelerate the hit-to-lead optimization of compounds. Endocrine disrupting chemicals (EDC) including alkylphenols, bisphenols, and diethylstilbestrol (DES) binds directly to ER LBD and enable ER dimerization and estrogen response element (ERE) mediated transcription of target genes. While these EDCs have the required pharmacophore to induce agonist conformation of ER, many of them are classified as weak estrogens even though they produce considerable damage at low exposure. Plasticizers, alkoxybisphenols and phthalate esters, do not share estrogen's pharmacophore but are misclassified as compounds binding to ER-LBD. Here we report our integrated in silico and in vitro structure-activity analysis of phthalates and their ability to modulate ER-ERE based transactivation by acting on a non-ligand binding site. Compounds were assessed for their ability to bind to estrogen receptor using fluorescent polarization and to induce MCF7 and MDA-MB-231 breast cancer cell proliferation. Computational screening of a phthalate library containing 87,000 EDCs against pseudoreceptor-shape-based pharmacophores yielded a focused library of ER binding compounds. 1870 compounds were found to bind to ER-LBD and 267 bound to a specific non-ligand binding site near the co-regulator binding site. Phthalate esters diethylhexylphthalate, monoethylhexylphthalate, dimethylphthalate, butylbenzylphthalate, dibutylphthalate and dioctylphthalate bound to this sites with higher affinity than alkoxybisphenols.

Our unconventional approach employs dynamic three dimensional protein models as physical human computer interface (HCI) devices in combination with low to moderate resolution structural information generated via integrated fold and interface data from proteomics to predict near-crystal structure resolution structures to accelerate compound discovery. Flexible HCI devices generate an ensemble of conformations thereby exploring the viable chemical space.

Poster Session

Evidence of Structural Alteration of Caov-3 Ovarian Like Cell Line Upon the Exposure to Potential Herbal Antioxidants

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Ovarian cancer is a very devastating disease. Ovarian cancer is rarely diagnosed in its early stages and is usually quite advanced by the time diagnosis is made. This results in a poor diagnostic outcome. According to the literature, there were few studies documenting research dealing with the effect of different antioxidants and different stages of ovarian cancer. The purpose of this study was to investigate the effect of the antioxidants Thymoquinone (TQ) and Epigallocatechin-3-gallate (EGCG) using Caov-3 cell line as a model. A total of 144 wells were plated with 10^5 Coav-3 ovarian cancer cells. The wells were divided into groups of 72 wells for conventional and sustained delivery, respectively. Each group was subdivided into 4 groups of 6 wells. Group 1 served as control and groups 2, 3, and 4 were treated with TQ (16 µM), EGCG (3 µg/ml), and TQ + EGCG, respectively. Morphological evaluations were performed following standard lab techniques. The results of the study revealed that the combination of TQ and EGCG affects the structural activities of the Caov-3 ovarian cancer cells.

Sodium Intake and Arterial Pressure In Normotensive And Doca-Salt Hypertensive Rats During Chronic Minoxidil Treatment

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It has been well documented that sodium overload is often an important factor in the pathogenesis of various forms of experimental and clinical hypertension. In this investigation we hypothesized that chronic-salt loading pressure-natriuresis curve determines the level of arterial blood pressure in both normotensive and DOCA-salt hypertensive rats during chronic minoxidil exposure. The specific aim of this study was to determine if minoxidil treatment resulted in a decrease in arterial blood pressure in DOCA-salt hypertensive rats, without affecting the renal function curve. A total of 58 adult SD-tats were randomly divided into 8 groups (control, minoxidil (3 mg/day; Route: Oral), salt, salt-minoxidil, DOCA, DOCA-minoxidil, DOCA-salt (75 mg; Route: pellets), and DOCA-salt minoxidil). The rats in the salt groups drank saline while the rats in the non-salt groups drank tap water. Sodium intake was measured every 24 hours. Mean arterial blood pressure was measured at the end of 6 weeks post treatment. The results revealed that there were no significant differences in salt intake among any of the non-salt groups. Minoxidil treatment did not significantly change salt intake in any of the tap water or saline animals ($p<0.05$). Arterial pressures measured were 119±4 mmHg (control), 117±4 mmHg (minoxidil), 111±3 mmHg (salt), 111±3 mmHg (salt minoxidil), 139±8 (DOCA), 133±4 (DOCA minoxidil), 160±5 (DOCA-salt), and 146±9 (DOCA-salt minoxidil). There was a significant effect of DOCA and an interaction was observed between DOCA and salt treatment. Furthermore, this resulted in a significant increase in MAP. However, neither saline nor minoxidil treatment alone had a significant effect on MAP. Chronic minoxidil treatment did not shift the chronic salt-loading pressure-natriuresis curve in either normotensive or hypertensive rats. These results

indicate that chronic salt-loading pressure natriuresis curve plays a central role in long term control of arterial blood pressure and the development of DOCA-salt hypertension.

Manipulation of the Macrophage Response Using Amino Acid Coated UHMW-PE Implanted Subcutaneously

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Polyethylene materials used in orthopedic applications are biocompatible and non-immunogenic with host tissues. Recent studies in our laboratory have demonstrated the need for further study of these devices in vivo to further elucidate methods to modulate the tissue-implant response. The purpose of this investigation was to determine macrophage behavior after implantation of ultra-high molecular weight polyethylene (UHMW-PE) rinsed with saline (control) or coated with poly-L-lysine (PLL), arginine-glycine-aspartic acid (RGD), or arginine-glycine-glutamic acid (RGE) into 16 adult male rats subcutaneously (S/C). 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 counts were highest in the PLL coated group (3.1±0.80 cells/high power field). There was a decrease in mean macrophage counts per high power field for RGD (1.58±1.02), saline (1.32±0.46), and RGE (1±0.76) compared to PLL. There were statistically significant differences (ANOVA, $p < 0.05$) present. These findings indicate macrophage behavior at the tissue-implant interface and in surrounding fibrous tissue can be influenced using various amino acid combination coatings in subcutaneous applications. In addition, these results provide further evidence that the intensity of the chronic inflammatory reaction to UHMW-PE can be manipulated to some extent.

Impact of Some Common Organics on Cellular Glycolysis and the Differential Survival of Lung Fibroblast and Lung Carcinoma Cell Lines

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Tumor growth and abnormal cell survival were shown to be associated with a number of cellular metabolic abnormalities revealed by impaired oral glucose tolerance, depressed lipoprotein lipase activity leading to hypertriglyceridemia, and changes in amino acid profile as evidenced by increased plasma free tryptophan levels in patients with breast, lung, colon, stomach, and other cancers from various origins. The above findings seem to relate to or indicate a shift to non-oxidative metabolic pathways in cancer. In contrast to normal cells, cancer cells may lose the ability to utilize aerobic respiration due to either defective mitochondria or hypoxia within the tumor microenvironments. Glucose was shown to be the major energy source in cancer cells where it utilizes aerobic /anaerobic glycolysis with the resultant lactic acid formation. The role of energetic modulations and use of glycolytic inhibitors on cancer/normal cell survival is not clearly established in the literature. Therefore, the purpose of this study was to evaluate six potential glycolytic inhibitors namely, sodium ascorbate, oxalic acid, oxaloacetic acid, sodium citrate, fructose diphosphate (FDP) and sodium bicarbonate at mM concentrations on growing A549 (lung cancer) and MRC-5 (normal; human lung fibroblast) cell lines with the objective of determining their influence on cell survival. 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 oxaloacetic acid both influenced the pH of the medium and resulted in differential massive cell debris within the exposure period. Sodium ascorbate, sodium citrate, sodium bicarbonate and FDP did not cause pH changes; however, they caused detectable cell disfigurement and loss of metabolic activity and survival/ death end points with the resultant death of the A549 cell line. MRC-5 cells were differentially unaffected by exposure to sodium ascorbate, sodium citrate, sodium bicarbonate, FDP and oxaloacxetic acid, 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 findings as well as the cell counts confirmed the findings of other tests. These studies show the potential for exploiting cellular metabolic differences in cancer control.

Examining the Structural Integrity of Human Gingival Fibroblasts after Exposure to Dental Adhesives Combined with Nifedipine or Cortisol in an Infectious Environment

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The purpose of this study was to examine the structural integrity of Human gingival fibroblasts after being exposed to dental adhesives in combination with Nifedipine or Cortisol in an infectious environment. Human gingival fibroblasts are the predominant cell found in the periodontium. Fibroblasts aid in maintaining the structural integrity of the oral cavity due their role in the inflammatory response. The cytotoxicity of dental adhesives have been established due the abundant research utilizing biochemical analysis. Few studies have assessed the morphological effects resulted from exposing stressed fibroblasts to adhesives in combination with calcium channel blockers in the presence of periodontal pathogens. The fibroblasts were exposed to 0.1g of dental adhesives (PMMA, OptiBond®, and Prime & Bond®) in combination with *Porphyromonas gingivalis* Lipopolysaccharide (2µL) and Cortisol (10µL) or Nifedipine (10µL) for 48 Hours. When assessing metabolic activity, the experimental group exposed to the combination of Prime & Bond®, LPS-PG, and Nifedipine (.407±0.00801 IU/mg Protein) was statistically significantly different when compared to the control ($P<0.001$). The experimental groups exposed to the dental adhesives along with LPS-PG and Nifedipine all exhibited reduced glutathione levels ($P<0.001$). An increase in lactate dehydrogenase was evident in groups exposed to Prime & Bond®, LPS-PG, and Nifedipine; and PMMA, LPS-PG, and Cortisol. Hematoxylin and Eosin was the staining method used to assess for cellular morphology. The experimental groups appeared similar to the control. The study concluded that there were no significant morphological alterations to the structural integrity of the observed fibroblasts.

Modified PEGDF and PEDGI Polymers for Non-Viral Gene Delivery in HEK 293 Cells

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Gene therapy involves the use of nucleic acids, either DNA or RNA for the treatment, cure, or prevention of human diseases. Synthetic cationic polymers are promising as a tool for gene delivery because of their high level of design flexibility for biomaterial construction and are capable of binding and condensing DNA through electrostatic interactions. Our lab have developed a novel polymer (poly(polyethylene glycol-dodecanoate) (PEGD), a polyester of polyethylene glycol (PEG) and dodecanedioic acid (DDA). PEGD is a linear viscous polymer that self-assembles into a vesicle upon immersion in an aqueous solution. A copolymer of dodecanedioc acid and polyethylene glycol (PEG) was synthesized at a 1:1 ratio. Furmaric (FA) or itaconic acid (IA) was used to suppress DDA in the PEGD copolymer at an 80:20 ratio (DDA: furmaric/itaconic acid) to form the PEGDF/I variant. PEGDF/I are then modified through the michael addition of Protamine Sulfate (PEGDF/I-PS)

and Cys-Arg_8 (PEGDF/I-CA) peptide to the carbon-carbon double bond on the polymer backbone to introduce a positive charge. The modified PEGDF/I polymers were capable of binding and condensing DNA. Transfection of HEK 293 cells with GFP plasmid using modified PEGDF/I polymers were successful and the PEGDF/I-CA polymer was shown to be non-cytotoxic via Alamar Blue Assay.

Paper-based 3D Cell Culture Devices for Rapid, Antibiotic Assays

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The utilization of controlling and manipulating cells, both in cultures and individually, is usually amplified if the basis for analytical and distributive processing is accomplished at reduced levels such as the micro or nano-level. With paper-based microfluidic devices, there stands a more affordable process in suspending the cells within a media reservoir contained within the microfluidic device.

The microfluidic devices used will incorporate wax printing, which will be heated onto the paper using a standard hot plate. The patterning of the device will call for wells/ reservoirs to culture the bacterial cells with media exchanged throughout the wells using the microchannels. The rate at which cells can undergo apoptosis will also be investigated based off the time necessary for a cell culture to survive without access to any media exchange. The end result of this branch of experimentation will conclude the rates at which proliferation and cell death occur within the microfluidic device.

The next step for the project would be applied to embryonic stem cells' rates of proliferation and cell death when applied to the device. The differentiation of the stem cells and their rates would also be quantified in accordance to each situation's media and compound exchange within each well. At the conclusion of this branch of testing, the ultimate purpose succumbs to understanding whether the differentiation and proliferation of embryonic stem cells can be altered or influenced by the microfluidic flow, whether laminar or turbulent, of the cells.

Tumor Necrosis Alpha Temporally Regulates micro-RNA-181a and its Target in A549 Cells

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PURPOSE: MicroRNAs (miR) are short strands of RNAs that regulate gene expression thus mediating pathogenesis of human diseases including lung cancer. MiR-181a has been shown to regulate inflammatory genes. Moreover, studies suggest that miR-181a may indeed be considered a biomarker of inflammation. Using bioinformatics tools, we identified a novel miR-181a target Notch2. Notch2 is a member of the evolutionary conserved Notch family receptors involved in cell fate determination and differentiation. For example, in endothelial cells, Notch2 regulates angiogenic genes. In the present study, we investigated whether TNFalpha regulates miR-181a and its target Notch2. MATERIALS AND METHODS: Using A549, the regulation of miR-181a by TNFalpha and Notch2 were analyzed using real-time qPCR and western blot. SnoU47 was used as endogenous control microRNA. A549 cells were exposed to TNFalpha (1 and 10 ng/ml) for 6 or 24 h. Total RNA was extracted using Trizol method. microRNA cDNA and cDNA were generated followed by qPCR. RESULTS: Low concentration of TNFalpha and short exposure (6h) slightly decreased miR-181a (0.86- vs 1.0-fold change control). After 24h, TNFalpha at low concentration inhibited miR-181a (0.27- vs 1.0-fold change). High concentration of TNFalpha and short exposure, increased miR-181a (1.86- vs 1.0-fold change). After 24h, high dose of TNFalpha had no effect on miR-181a. Both concentrations of TNFalpha after short exposure had no effect on Notch2 mRNA. After 24h, TNFalpha regardless of concentration increased Notch2 mRNA (1.7- and 2.3-fold change). CONCLUSION: These results suggest that TNFalpha temporally regulates miR-181a and its target Notch2, thus temporally influencing lung inflammation

GFP Transfected Autologous Schwann Cells Are Rejected After Transplantation In The Spinal Cord Injury Minipig Model

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In spinal cord injury (SCI), the Yucatan minipig model has provided a pivotal platform for human studies. As a potential treatment for SCI, Schwann cells (SC) have shown evidence of salutatory effects after implantation in central nervous tissue and autologous SC (aSC) are evaluated in a clinical trial. For clinical studies MRI is the only feasible tool to evaluate the injury and cell therapies. In our previous studies, a <5% survival of aSC with marked immunogenicity has been found. Here we test if *ex vivo* expanded aSC are immunogenic after implantation and/or if the green fluorescent protein (GFP) commonly used in our studies causes an immune response towards the transplanted aSC. The SC tissues were evaluated with high resolution MRI and diffusion tensor imaging (DTI) together with histology. Five Yucatan minipigs underwent 3 left hemi-contusion SCIs. A nerve was extracted for cell preparations which were divided into a GFP transfected (GFP-aSC) and non-transfected (aSC) product. 52 days after SCI, cells were injected to the injury sites to fill the entire cavities. 70 days after transplantation animals were euthanized, and the SCs prepared for MRI and immunohistochemistry. Results show that high resolution MRI and DTI of excised Yucatan minipig SCI showed excellent correlation with histological analysis of the injury. Histological results demonstrated a lymphocytic reaction against GFP(+)aSC compared to a lesser or no response to GFP(-)aSC which in addition had superior survival and integration. Future work involves labelling aSC with an MRI contrast agent to better evaluate the transplants in MRI.

Restoration Of Spermatogenesis In Testosterone Acetate Induced Azoospermic Rats

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Previous studies conducted in our labs have demonstrated that sustained delivery of exogenous testosterone (3-5ng/ml) markedly suppressed serum LH, FSH and testicular testosterone levels. Consequently, spermatogonial number declined to approximately 72% of control levels while spermatids were completely devoid from seminiferous tubules. The specific aim of this study was to explore the possible restoration of spermatogenesis in previously induced azoopermic rats through sustained delivery of supraphysiological level of testosterone acetate (TE) loaded hydroxyapatite (HA) ceramic devices. A total of 36 adult Sprague Dawley rats were randomly divided into three (Control, Sham and Experimental) equal groups (BW 280-300 gm). Animals in the experimental group initially received TE (40 mg/SC) loaded HA ceramic implants for 12 weeks to induce azoospermia, followed by 8 weeks of exogenous sustained delivery of TE using HA implants loaded with 90 mg TE (15-22 ng/ml; SC). At the end of 8 weeks of second phase, the animals from each group were sacrificed and the testes were collected by following approved laboratory techniques. The tissues were fixed, processed, embedded, sectioned and stained (H&E) for histopathological evaluation. Germ cell numbers were evaluated using stereological methods and expressed as germ cell number per testis. The results of the study revealed that following the initial TE treatment, serum LH and FSH levels were reduced to 65% and 53% compared to sham operated and intact animals. At the end of 8 week of second phase, exogenous sustained delivery of TE, resulted in restoring testicular weights to 62- 79% of controls while serum LH and FSH levels were remained reduced to 60% and

46% respectively; compared to sham operated and intact animals. On the other hand, as expected, sustained delivery of supraphysiological level of TE was capable of restoring spermatogonial number by 78% at the end of 8 week phase compared to control group. Furthermore, increased number of round and elongated spermatids ($p < 0.05$) was evident in TE treated animals. We conclude that: (a) sustained delivery of TE by means of HA delivery devices is a dose dependent (i.e. low dose of TE induced azoospermia and suprphysiological level maintained spermatogenesis), and (ii) TE loaded HA delivery system can be utilized to regulate fertility in males.

Frequency Dependence of Focus Localization from EEG by Directional Information Measures

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For patients with focal epilepsy, a promising treatment to resolve recurrent seizure activity is resection of the brain tissue responsible for seizure generation (epileptogenic focus). Because of the associated risks with this invasive procedure, correct localization of the focus is of paramount importance. Computational analysis of recorded intracranial electroencephalographic (iEEG) signals from multiple brain regions can be effective in identifying the epileptogenic focus. Such multi-channel signals ideally require a multivariate analysis, in the time or frequency domain, that has helped us understand how different brain regions interact with the focus. The measure of Generalized Partial Directed Coherence (GPDC) was employed to measure in the frequency domain the directional flow of information between brain sites from long-term iEEG recordings in 4 patients with focal temporal lobe epilepsy. In 3 out of 4 patients, the maximal directed flow of information into brain sites (inflow) was found to be statistically significant ($p<0.01$) more frequent at the epileptogenic focus than other brain sites, and for frequencies greater than 10Hz. In our fourth patient, inflow of information in the same frequency range generated similar results at the location of the focus, with the exception that these results were not statistical significant at the $\alpha=0.01$ level. These preliminary findings indicate that optimal localization of the epileptogenic focus from the EEG by measures of directional information flow may strongly depend upon the employed frequency band(s) towards this goal.

Demonstration of the Safety of the Neonatal Airflow Perturbation Device

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Airflow Perturbation Device developed as a noninvasive respiratory diagnostic device that can rapidly quantify the respiratory resistance values of normal and those with a variety of pulmonary disorders such as asthma, COPD, Vocal Fold Dysfunction, etc.

APD has been used to collect respiratory resistance values for over 3,500 adults and children. In its new application the APD and its software have been modified to be usable for very small infants. The modified device is the Neonatal Airflow Perturbation Device (NAPD). Because of the vulnerability of neonates it was required to demonstrate the safety of using the APD in neonates. For this 4, vital signs: Heart Rate, Respiratory Rate, Pulse Oximeter reading, and Carbon Dioxide monitor reading were recorded before and after NAPD use. Table 1 shows the results.

Table 1. Vital signs before and after NAPD use

Vital Signs	Mean ± S.E Before	Mean ± S.E After	*P*- Value
Heart Rate (beats/ min)	154 (±1.9)	151 (±2.1)	0.039
Respiratory Rate (breaths/ min)	55 (±2.2)	59 (±2.6)	0.039
Oxygen Saturation (Pulse oximeter %)	98 (±0.24)	97 (±0.26)	0.001
Transcutaneous CO_2 Monitor	44 (±1.3)	45 (±1.4)	0.73

All the vital signs remained within the clinical norms and, therefore, the safety of the NAPD is demonstrated.
The support of the NIH Grant R43HL106366 is greatly acknowledged.

Noninvsive Evaluation of Neonatal Respiratory Resistance

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Pulmonary diagnostics of adults and children are routinely performed at Pulmonary Function Laboratories using spirometry, Plethysmography (bodybox), Impulse Oscillometry (IOS), etc. Spirometry is the most popular, but is highly effort dependent, therefore cannot be used by neonates. Other methods also have their own difficulties that limit/prohibit their use by neonates. We have developed a noninvasive effortless respiratory diagnostic device, Airflow Perturbation Device (APD). APD was used to collect respiratory resistance values on over 3,500 subjects 2 – 88 years old. The APD was further modified to collect respiratory resistance values for infants (NAPD). NAPD is noninvasive and effortless and requires only normal breathing into the device and can easily be used to evaluate infant respiratory resistance values.

During a small clinical trial we have used the NAPD to collect 107 infant respiratory resistance values. We obtained an average respiratory resistance value of 33.7 ± 2.37 $cmH_2O/L/s$ compared to the only 3 published works of 35.68 – 78.52 $cmH_2O/L/s$.

The support of the NIH Grant R43HL106366 is greatly acknowledged.

Intervention to Reduce *Pseudomonas aeruginosa* Related Infections in Neonatal Intensive Care Unit

Elham Ghonim

Background: Infections due to *Pseudomonas aeruginosa* pose a lethal risk to patients in neonatal intensive care units (NICU). In October 2013 surveillance detected increase of Pseudomonas blood stream and respiratory tract infections at our crowded 98 open-bed

tertiary referral NICU. Investigation of the outbreak led to interventions that attained a sustained decrease in infection.

Methods: Multi-drug resistant *Pseudomonas aeruginosa* was identified from blood and respiratory cultures from three infants within a limited time period, all three died. An Infection Control task force was formed and led by the hospital epidemiologist. Retrospective review of medical records led to the implementation of ongoing initiatives focusing on: hand hygiene, contact isolation, improved disinfection of respiratory equipment, reviewing cleaning records of biomedical equipment, screening new admits for carriage, environmental surveillance cultures, and typing all recovered Pseudomonas isolates.

Results:

Unit leadership initiated a unit wide "stand- down" (two day program of re-commitment of all staff to best practices in infection prevention) that contributed to increasing compliance with hand hygiene and isolation compliance from 80% prior to the intervention to 100% after the intervention. Typing of recovered Pseudomonas from patients and environment indicated likely environmental acquisition (table 1). Number of hospital acquired MDR-Pseudomonas infection declined from 5 per 661 admissions between January – November 2013 to zero per 702 admissions between December2013- October 2014 (Graph1). .

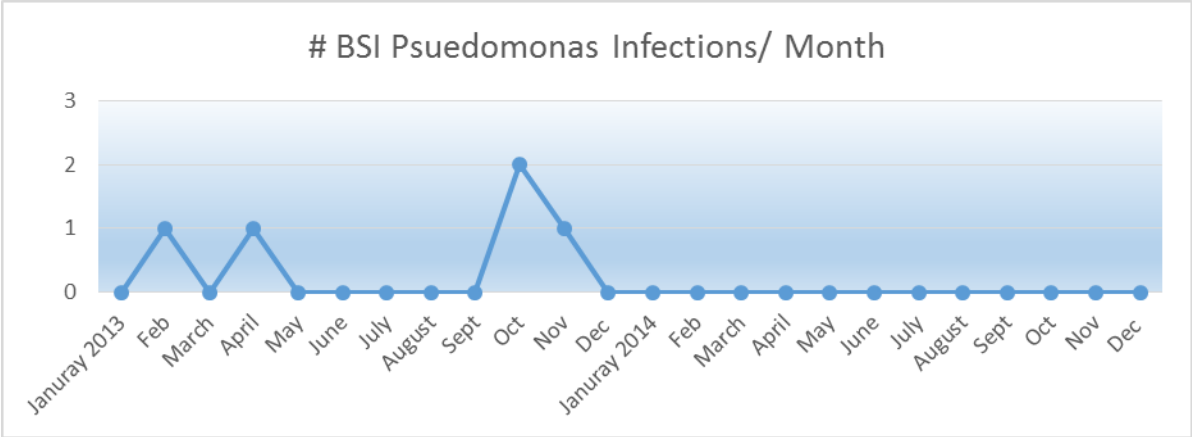

Table 1: Psuedomonas Genotyping Data

Isolate	acsA (155 alleles)	aroE (182 alleles)	guaA (135 alleles)	mutL (153 alleles)	nuo(97 alleles)	ppsA (126 alleles)	trpE (187 alleles)	Stain Type	patient name/MR
55	17	5	11	5	4	4	2	471	patient
70	17	5	11	5		4	2	471, 934	Patient
73	17		11	5	4	4	2	471	patient
74	17	5	11	5		50	63		patient
76	17	5	11	5	4	4	2	471	Environment
77	17	5	11	5	4	4	2	471	Environment
78	17	5	11	5		4	2	471	Environment

Conclusion: Stand-down and efforts by unit leadership to engage all care providers in importance of scrupulous compliance with infection control guidelines led to ending a Pseudomonas outbreak. Use of typing facilitated this education by demonstrating how environmental contaminants could infect and harm infants.

The Effect Of Neuropeptide Y On The Female Rat Reproductive Tract

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NPY plays a critical role in stimulating the episodic, basal pattern of luteinizing hormone (LH) release, as well as the preovulatory surge of LH release in several species. The stimulatory effect of NPY on LH secretion is dependent upon the presence of gonadal hormones and involves amplification of the response of other interacting stimulatory signals. In post-menopausal women circulating levels of NPY have been shown to be increased, and during menopause significant changes are observed within the cervix and uterus. The goal of the proposed study was to determine the changes in the rat uterus at menopause and correlate those changes with NPY Y1 receptor using a specific receptor antagonist. Female rats were divided into five groups containing 5 rats per group per time period. Rats in group 1 were ovary intact, rats in group 2-5 were ovariectomized. Animals in group 3 -5 were implanted with estrogen, antagonist to NPY Y1 (low dose), antagonist to NPY Y1 high dose; respectively. At 2, 4 and 8 week time periods, the uterus from all of the groups was evaluated for any morphologic variation from the intact control animal's uterus for cyclic activity. The uterus of the intact animals showed cyclic activity, while the OVX and the sham animals did not show any cyclic activity. The endometrial glands of the intact control animals was compose of tall columnar cells, cytoplasmic vacuolization apoptosis and some mitosis, while the endometrial glands of the OVX and sham animals was composed of cuboidal cells, cytoplasmic eosinophilia and lack of mitosis and apoptosis. The endometrial glands of the OVX + estrogen, OVX + Y low and OVX Y high were somewhat similar to the endometrial glands of the intact control animals. The OVX + E treated uterus showed persistent estrus, and the OVX + Y low and OVX + Y high did not show conclusive evidence of cyclic activity. In conclusion, NPY has a role in uterus associated changes at menopause.

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Arsenic-Induced Changes In Human-Induced Pluripotent Stem Cells (Ipsc)

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PURPOSE: Induced pluripotent stem cells (iPSCs) are somatic cells reprogrammed to a pluripotent or embryonic stem cell–like state with factors important for maintaining the defining properties of embryonic stem cells. Effects of arsenic on skin cells have been studied extensively, however, its effect on iPSCs is uncertain. We hypothesize that arsenic will induce changes in cellular morphology as well as, induce changes in gene expression of IPSCs. **DESIGN METHODS**: Using the iPS (Foreskin)-4, colonies were counted and exposed to arsenic for 24 hours. Changes in cell morphology were viewed and recorded using phase contrast microscopy technology. Colonies were also counted to determine detachment of adherent cells. Cells were harvested and microarray analysis was used to measure the expression levels. **RESULTS:** Significant phenotypically-induced morphological changes were observed in arsenic concentrations as low as 1ppm when compared to controls. Treated colonies were profoundly rounded, refractile in shape, and appeared as beaded-like structures floating on the substrate, in comparison to the controls which exhibited a regular phenotype and maintained cell adherence. A produced complex profile of activity showing some significant dose-dependent induction of changes in gene expression was shown: Oct3/4 and KLF4 showed no change in expression, HSP90, and GADD45 showed more than 2 fold increases. **CONCLUSION:** Arsenic induces morphological changes and detachment leading to the inhibition of cell growth and subsequent alteration of the rate of differentiation of iPSCs. Results provide a new insight into IPSCs ability to remain in a stem cell state, while changes occur in transcription factors.

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Pthalate (DEHP) Modulates Cell Invasion, Migration, and Anchorage Independent Growth Through Targeting s100P in Glioblastoma Cells

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Glioblastoma multiforme (GBM) is the most common aggressive brain cancer with a median survival of approximately 1 to 2 years. The standard treatment of GBM has been surgical resection of as much of the tumor is safe, followed by radiation therapy and chemotherapy. However, even when essentially removing all of the enhancing tumor seen on the MRI scan surgically and then treating the patient with radiation and chemotherapy, the mean survival of GBM is only extended from 2 months to 1 year. This poor prognosis has led to the focus on identifying novel molecular targets against glioblastoma and the signaling mechanism through which they act. S100P expression is described in many different cancers, and its expression is associated with drug resistance, metastasis, and poor clinical outcome. The functional role of S100P in glioblastoma has not been investigated. Therefore, we examine if the functional role of the environmental contaminant, DEHP, is mediated through S100P expression in glioblastoma. We hypothesize that silencing of S100P by lentiviral abrogates DEHP mediated anchorage independent growth and invasion in glioblastoma cancer cells. In this study, we have shown that silencing S100P gene expression in glioblastoma cancer cell lines significantly inhibited the proliferation of glioblastoma cancer cells compared to shGFP and control cells under normal adherent culture conditions. This growth inhibition was further enhanced by treating cells with DEHP. One of the hallmarks of oncogenic transformation is the loss of anchorage independent growth as demonstrated by the ability to form colonies on soft agar. To further evaluate the role of the S100P mechanisms of action in the maintenance of the transforming phenotype of glioblastoma cells, an agar assay was utilized. Glioblastoma cells infected with lenti-shS100P showed significant reduction in the colony formation. No apparent difference was found between the control cells treated with DEHP and the lenti-shS100P cells treated with DEHP. These efforts will provide stringent validation of whether S100P serves a rate-limiting role in glial maintenance and may provide target-dependent transcriptional and proteomic signatures that may be useful as drug response biomakers.

Towards the Design of a Distractive and Mobility-Enabling Back Support Device

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Introduction: Spinal orthoses have historically been designed to stabilize the spine and are used to treat low back pain (LBP). Recent bracing technologies claim to axially decompress the spine while restricting motion. However, no supportive experimental or clinical data exist. LBP patients also try therapeutic exercises, like water therapy, to distract and decompress the spine, but for short periods. The objective was to design a distractive mobility orthosis (DMO) that mimicked spinal traction and water therapy but did not restrict movement.

Methods: A mechanical analogue upper torso model and robotic testing platform were used to design features of the DMO: a mobility-enabling component (MEC) and a distractive force component (DFC). The MEC consisted of a rail and coaster system. A cable pulley array system and flexible graphite rods provided distractive force capabilities. Test conditions were 300N vertical torso load, initiation of flexion (5deg) and extension (3deg), and extended flexion and extension. Spinal off-loading capacity of the brace was measured and combined with displacement changes to calculate rotational stiffness.

Results and Discussion: The DMO reduced all spinal loading in upright stance and continued off-loading through 28deg flexion (172N) and 10deg extension (247N). Minimal moments were required to initiate flexion (7.1Nm) and extension (5.5Nm) and continued over extended ranges: 20Nm flexion and 15Nm extension. The extended rotational stiffness of the DMO (0.4Nm.deg) was comparable to the mechanical analogue spine (0.5Nm/deg).

Conclusion: Aspects of a novel back support device were designed that provided distractive forces across the spine during unconstrained flexion and extension.

Mississippi INBRE

Structure Elucidation of G-Quadruplex within the Mid-Region of the kRAS Promoter and Identification of Stabilizing Small Molecules as Promising Transcriptional Silencers

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Over 60% of pancreatic cancers harbor mutations in the kRAS oncogene, whose promoter has three distinct guanine-rich regions (near, mid, and far) capable of forming higher order G-quadruplexes (G4s). These important structures have transcriptional silencing potential and stabilizing compounds cause selective apoptosis in kRAS-addicted cells. Previous works in our laboratory have identified the mid-G4 region as having the highest silencing capacity, with little apparent roles for the near- or far-G4 regions.

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The structure of this mid-region G4 is being elucidated by electromobility shift assay, DNA polymerase stop assay, DMS footprinting, and circular dichroism (CD). In addition, small molecules are being screened by the Förster Resonance Energy Transfer (FRET) melt assay and confirmed by CD for their stabilization potential. We have identified multiple, equilibrating, intramolecular G4s forming within the mid- region of the kRAS promoter. Varying buffer conditions (cations, dehydration, and molecular crowding) affect these formations; the predominating isoform is a tetra-stacked mixed parallel and antiparallel structure with an 8:15:7 loop configuration. Over 1,600 compounds have been screened and several are being pursued as leads. Several compounds selectively stabilized the mid-G4 and suppress kRAS transcription. Our work highlights the mid-G4-forming region of the kRAS promoter a therapeutic target with the utmost promise for pancreatic cancer, and further features the stabilizing potential of targeted compounds. Studies are ongoing to vet the potential of other "hit" compounds from the FRET screen, as well as to elucidate the structure of the kRAS mid-G4 in chromosomal DNA.

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Proliferation of Endogenous T-Reg Cells Imporves the Patho-Physiology Associated With Placental Ischemia of Pregnancy

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Preeclampsia (PE), new onset of hypertension during pregnancy, is associated with pro-inflammatory cytokines and decreased regulatory immune responses including Tregs and decreased IL-10. We believe this decrease in immune regulatory mechanisms leads to much of the pathophysiology associated with PE such as elevated blood pressure and decrease in fetal weight. The RUPP rat model of induced placental ischemia exhibits similar characteristics as women with PE regarding high blood pressure, cytokine levels and immune cell activation and decreased Tregs and pup weight. Therefore, we hypothesized that administration of a CD28 superantagonist (SA) would increase the Treg profile in the RUPP rats which could reduce pro-inflammatory cytokines and blood pressure. Chronic Reduced Uterine Perfusion Pressure, the RUPP procedure, was performed at gestation day 14 (GD14); SA was administered intraperitoneally at GD15, GD18 carotid catheters inserted, and GD19 MAP and pup weight, serum and tissues were collected. MAP in NP rats was 99.5 +/- 2.1, 116.6 +/- 2.04 in RUPPs which significantly decreased to 108.5 +/- 1.9 mmHg in RUPP+SA. Circulating FoxP3+ Treg cells were 7.3% in NP, 0.48% in RUPP rats but significantly increased to 10.96% in RUPP+SA; IL-2 was 6.8 +/- 6 in NP, 89.4 +/- 24 in RUPP, and 126.3+/- 23.7 pg/mL in RUPP+SA. IL-10 was 24.6 +/- 13 in NP, 35.6 +/- 17 in RUPP and 158.7 +/- 120 pg/mL in RUPP+SA. IL-6 was 26.96 +/- 1.77 in NP, 42.6 +/- 7.14 in RUPP, and decreased to 24.76 +/- 0.943 in RUPP+SA. Pup weight was 2.135 +/- 0.23 in NP, 1.964 +/- 0.13 in RUPP, but increased to 2.2 +/- 0.1 mg in RUPP+SA. These data suggest an important role for up-regulating Treg cells to enhance the immune regulatory interactions and inhibit the hypertension while safely improving pup weight in response to placental ischemia during pregnancy.

Antinociceptive Efficacy of Chronic Fluoxetine Treatment

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Fluoxetine, a selective serotonin reuptake inhibitor, is one of the oldest second-generation antidepressants on the market. Recent studies have shown that fluoxetine has antinociceptive effects, but the results were based on acute doses of the drug. The objective of our pilot study was to compare the antinociceptive efficacy of two chronic doses of fluoxetine treatment to a naïve control using adult male Sprague-Dawley rats and a model of acute thermal pain involving a hotplate analgesiometer (Omnitech Electronics, Inc.; Columbus, OH) set at 52.5oC. The treatment groups received 10 mg/kg or 20mg/kg of fluoxetine that was delivered daily for four months via Pillsbury sugar cookie dough. The naïve control group received nothing. Each animal was habituated to the hotplate enclosure for one minute on the day prior to testing. For the study, each rat was placed on the hotplate apparatus, and a built-in timer was started as soon as all four of the animal's paws touched the surface. The timer was stopped as soon as the animal displayed one of the following responses: paw lift, paw lick, or jump. Our results show that both fluoxetine treatment groups had longer latencies than the naïve control group, and that the latencies between the two doses were not significantly different. These data confirm that chronic fluoxetine treatment does have an antinociceptive effect.

Treatment Depth Effects of the Zavation Lumbar Bone Growth Stimulator

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Lumbar spinal fusion is one of the more common spinal surgeries, and its use is on the rise. If the bone fails to fuse properly, then a pseudarthrosis or "false joint" develops and results in pain, instability, and disability (Reid 2011). Since 1974, three types of electrical stimulation technologies have been approved for clinical use to enhance spinal fusions. One such technology is inductive coupling, which includes combined magnetic fields (CMFs). The purpose of this study was to evaluate the effects of a CMF device known as the Zavation Lumbar Bone Growth Stimulator (Zavation, Brandon, MS) on MG-63 (ATCC® CRL1427TM) human osteosarcoma cells at treatment depths ranging from 0.5" to 6.0". The cells were grown to confluence on 4-well chamber slides that were kept in a nickel-alloy chamber within an incubator to shield the cells from unwanted environmental electromagnetic fields. During treatment, a specially designed apparatus held both the treatment device and the chamber slide. Briefly, the chamber slide was placed inside an acrylic tube at a specific distance from the transducer housing, and the device was turned on for 30 minutes. The chamber slides were then returned to the incubator to be assayed and stained at later dates. The alamarBlueTM cell viability assay and hematoxylin and eosin staining were used to demonstrate cell viability and morphology, respectively, at various time points including 3 days post-treatment (PT), 7 days PT, 14 days PT, and 21 days PT. Our results showed that compared to control cells, the cells located at 3" had the greatest increase in viability whereas those located from 0.5" to 1.5" had decreased viability and those from 4.5" to 6" showed no change. These data suggest that 3" is the ideal treatment depth for the

Zavation device. This treatment depth is consistent with that of a device already approved by the FDA.

Verruca Localization Predominately In Black Tattoo Ink

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There have been many reports of verruca localized in tattoos, yet none offered statistical evidence. Therefore, this study aimed to determine if warts preferentially located in black tattoo ink in patients identified to have warts in tattoos. A secondary analysis focused on verrucae preference in colored inks. Five patients were included in this retrospective case series assessing whether the appearance of verruca in tattoo ink is a matter of chance. For each patient, the wart count, wart size, and inked regions' surface area were recorded relative to black ink, color ink, or normal skin. 181 warts were identified in 5 patients. The average number of warts per 1,000 mm2 (s.d) reported with 95% confidence demonstrated a statistically significant difference (0.012). The black area had approximately 7 times more warts per 1,000 mm2 compared to the colored and normal areas combined. Also, the percentage of area involved by warts per mm2 demonstrated a statistically significant difference (0.024) between black ink and combined colored ink and normal skin. Approximately 4.16% of the black areas were involved

Proliferation, Cell Viability, Toxicity, and Protein Expression Analysis of MCF7 Breast Ductal Epithelial Adenocarcinoma Cells Cultured With *Pseudognaphalium Obtusifolium* Dichloromethane-Derived Extract Indicates a Possible Anti-Carcinogenic Treatment Alternative

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Pseudognaphalium obtusifolium, an annual herb and member of the Asteraceae family, has been extensively used for medicinal purposes throughout Native American traditions. The actual therapeutic benefits of this herb have yet to be scientifically determined. Extracts from this plant are known to contain various flavonoid species, their secondary metabolites, and other phytonutrients that help protect the plant. Flavonoids are polyphenolic molecules that have been shown to have possible anti-carcinogenic activity. There at least three flavonoid species found within *P. obtusifolium*. Of the available extracts, which were previously derived via a serial solvent extraction method, dichloromethane (DCM)-derived extract was chosen as the most likely to contain these flavonoid molecules. This research aims to determine if DCM-derived extracts from *P. obtusifolium* affect the proliferation, viability, and induction of apoptosis in MCF7 human breast ductal adenocarcinoma cells. MCF7 cells cultured with DCM-derived extract serially diluted in cell culture media were subjected to flow cytometry analysis for evaluation of changes in proliferation. The DCM-derived extract was found to decrease proliferation of the MCF7 cells in both a time and dilution-dependent manner. MTT cell viability and LDH toxicity assays were subsequently performed along with protein expression array analysis to determine changes in expression of various apoptotic factors. The data suggests that DCM-derived extracts obtained from *P. obtusifolium* could be an effective alternative treatment for cancer.

AGES AND AGING: ELIMINATING RAGE EXTENDS LIFESPAN

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Stable advanced glycation endproducts (AGEs) accumulate within the body over time. This phenomenon, commonly known as the Maillard theory of aging, has been demonstrated to be a determinant for the rate of aging. RAGE (Receptor for AGE), is normally expressed at low levels; however, its expression is increased during aging. The purpose of this study was to establish a mechanistic link whereby increased AGE/RAGE signaling contributes to the aging process by decreasing longevity. Casual observations of RAGE knockout (R-/-) mice noted these animals had significantly increased lifespans (6-7 years of age) compared to their wildtype (Wt) controls (2-3 years of age). RAGE activation has been demonstrated to trigger intracellular pro-inflammatory pathways culminating in the activation of the transcription factor, NF-KB, to increase pro-inflammatory gene expression. In this study R-/- and Wt mice were sacrificed at 15-18 months. Protein and RNA were isolated from cardiac tissue for biochemical analysis. There was a significant 18% decrease (0.72 + 0.02; p 2-fold increase or decrease in gene expression. We are currently validating these results using RT-PCR and 2D electrophoresis to be followed by proteomic analysis with the goal of understanding the role accumulated AGEs and RAGE activation play in longevity.

The Effects of Insulin and EGCG on Panc-1 Cell Survival

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There is less than a thirty percent survival rate for patients with a localized pancreatic tumor, and less than a ten percent survival rate for patients with metastases. There are diverse findings on the chemotherapeutic properties of insulin. Epigallacto-catechan (EGCG) is a polyphenolic antioxidant that has been shown to increase the AMPK pathway that increases cellular apoptosis. The objective of this study was to investigate the effectiveness of EGCG with a clinical dose of insulin (10μM) in reducing the survival of a pancreatic like cell line in culture. PANC-1 cells were plated onto three 24 well plates at a density of 1 x 10^6 cells per well. The experimental design consisted of four equal groups: Group 1 served as the control and groups 2-4 were treated with insulin, (EGCG) or insulin and EGCG, respectively. Biochemical and morphological evaluations were conducted following standard lab protocols. Results of this study show 10μM of insulin was unable to reduce cell growth or proliferation, however, after a 72 hour period cells treated with insulin increased compared to control untreated cells. Meanwhile, 50μM of EGCG alone or in combination with insulin were capable of reducing cell density and cellular protein levels at 24, 48 and 72 hours following treatment. The results show EGCG induced changes in cellular morphology which are characteristic of apoptosis. Overall, additional studies are needed to determine the effects of EGCG on AMPK and ATM pathways that are responsible in normal cellular apoptotic processes.