

30th Annual Meeting

April 10-12, 2014

Courtyard by Marriott Beachfront, Gulfport, MS



SOUTHERN BIOMEDICAL ENGINEERING CONFERENCE

Program For 30th ANNUAL SOUTHERN BIOMEDICAL ENGINEERING CONFERENCE

April 10-12, 2014

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Program Co-Chairs

Hamed A. Benghuzzi, PhD
Department of Health Sciences
University of Mississippi Medical Center
Jackson, MS 39216

Michelle A. Tucci, PhD
Department of Orthopedics
University of Mississippi Medical Center
Jackson, MS 39216

Program Committee

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Ibrahim Farah, PhD
Joseph A. Cameron, PhD

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Elgenaid Hamadain, PhD

Gerri Wilson, PhD(c)
Mary Green
Lisa McCammon

SBEC HISTORY

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

The SBEC serves a special purpose by emphasizing participation from young professionals and advanced students. Since established investigators present papers in the same sessions with the students, it encourages a high level of professionalism as a standard for young investigators and students. Submission of papers from individuals from around the world is encouraged. However, if their papers are accepted, an author or co-author must attend the conference to

present their work and to interact with other attendees. In keeping with the emphasis on student participation, the SBEC presents best paper and presentation awards to undergraduate, graduate, and professional students.

Conference Information

The format of the conference is to have a single session, with each presentation limited to 15 minutes (12-minute presentation and three minute discussions). Room assignments for each session will be posted at the conference.

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

Registration and Fees

Initial on-site registration will be held from 5:00 –8:00 p.m., Thursday, April 10, 2014. Participants may register anytime afterwards. Participants are encouraged to preregister by returning the registration post-marked by March 30, 2014 to take advantage of the reduced registration rates.

Fees before April 4, 2014

Students:	\$175
Faculty/Staff:	\$250

Fees after April 4, 2014

Students:	\$200
Faculty/Staff:	\$325

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30th SOUTHERN BIOMEDICAL ENGINEERING CONFERENCE

Session Chairs**Session I: Neuroengineering**

Session Chair: Ramesh Patel Co-Chair: Ibrahim Farah

Session II: Tissue Engineering

Session Chair: LaShan Simpson Co-Chair: Stacy Vance

Session III: Drug Delivery

Session Chair: Ken Butler Co-Chair: Felix Adah

Poster Session

Session Co-Chairs: Ham Benghuzzi, Michelle Tucci, Joseph A. Cameron, Mary Green,
Zelma Cason, and Glenn Thomas

Session IV: Imaging/Data Management

Session Chair: Tom Rich Co-Chair: Felicia Tardy

Session V: CVD/Health Care

Session Chair: Subrata Saha Co-Chair: Jafar Vossoughi

Session VI: Trauma Bone and Cartilage

Session Chair: Amol Janorkar Co-Chair: Renee Wilkins

Session VII: Modeling

Session Chair: Elgenaid Hamadain Co-Chair: Aaron Puckett

Session VIII: Cancer Research

Session Chair: Pradip Biswas Co-Chair: LaToya Moore

30th Annual Meeting

Program

30th SOUTHERN BIOMEDICAL ENGINEERING CONFERENCE

Thursday April 10, 2014

5:00-8:00: Registration

Hotel Lobby

Friday April 11, 2014

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

**8:30-8:35 AM: Opening of the Meeting
Dr. Ham Benghuzzi, Program Chair**

April 11, 2014 Scientific Sessions

Friday Morning	Talk #	Conference Room
Time		Session I: Neuroengineering Session Chair: Ramesh Patel Co-Chair: Ibrahim Farah
8:35	1	RESETTING OF THE EPILEPTIC BRAIN BY SEIZURES Leonidas Iasemidis, Louisiana Tech
9:00	2	WEARABLE EEG SYSTEM FOR DROWSINESS DETECTION Jenny Wang, Janet Spoonamore, Cliff Wang NC School of Science and Math, 1219 Broad St, Durham, NC 27705 NC State University, Raleigh, NC 27695
9:15	3	THE ROLE OF THE HYOID APPARATUSES OF WOODPECKERS FOR ENERGY DISSIPATION Nayeon Lee ^{a,c} , R. Prabhu ^{a,c} , Lakiesha N. Williams ^{a,c} , M.F. Horstemeyer ^{b,c} a Department of Agricultural and Biological Engineering, Mississippi State University, Mississippi State, MS 39762-9632, USA b Department of Mechanical Engineering, Mississippi State University, Mississippi State, MS 39762-9552, USA c Center for Advanced Vehicular Systems, Mississippi State University, Mississippi State, MS 39762-5405, USA
9:30	4	TRACKING OF HMSCS PRECONDITIONED WITH 0.5% O₂ IN ASSOCIATION WITH STROKE UTILIZING 1H AND ²³NA MRI AT 21.1 T Jens T. Rosenberg ^{1, 2} , Avigdor Leftin ³ , Fabian Calixto Bejarano ¹ , Michael M. Davidson ^{1,4} , Michelle Baird ¹ , Lucio Frydman ^{1,3} , Teng Ma ² And Samuel C. Grant ^{1,2} ¹ The National High Magnetic Field Laboratory, ² Chemical And Biomedical Engineering, FamU-Fsu College Of Engineering, And ³ Department Of Biological Science, The Florida State University, ⁴ Department Of Chemical Physics, Weizmann Institute Of Science
9:45	5	PLATELET-RICH PLASMA EFFECTS ON DEGENERATIVE DISC DISEASE: ANALYSIS OF HISTOLOGY AND IMAGING IN AN ANIMAL MODEL. Tucci, MA ¹ , Gullung, GB ¹ , Woodall, JW ¹ , James, JR ² , Black DA ¹ , McGuire, RA ¹ ¹ Orthopedic Surgery and Rehab and ² Department of Radiology, University of Mississippi Medical Center, Jackson, MS
10:00		BREAK

30th SOUTHERN BIOMEDICAL ENGINEERING CONFERENCE

Friday Morning	Talk #	Conference Room
Time		Session II (Tissue Engineering) Session Chair: LaShan Simpson Co-Chair: Stacy Vance
10:15	6	TREATMENT OF VASCULAR CALCIFICATION BY ELASTIN-TARGETED NANOPARTICLES Kevin A. Bennett, C. LaShan Simpson. Mississippi State, MS 39762
10:30	7	ENDOTHELIALIZED IN VITRO TUBULAR SILICONE SCAFFOLDS Marzieh K Atigh ¹ , Kristen Smith ² , Saami K. Yazdani ³ ¹ Department of Mechanical Engineering, University of South Alabama, Mobile, Alabama. ² Spanish Fort High School, Spanish Fort, Alabama ³ Department of Mechanical Engineering, University of South Alabama, Mobile, Alabama
10:45	8	SYNTHESIS AND CHARACTERIZATION OF AN ELASTIN-LIKE-POLYPEPTIDE-POLYARGININE CONJUGATE FOR THREE-DIMENSIONAL CELL CULTURE C. Andrew Weeks and Amol V. Janorkar* Department of Biomedical Materials Science, School of Dentistry, University of Mississippi Medical Center, Jackson, MS 39216
11:00	9	THE CORRELATION BETWEEN NEOVASCULARIZATION AND MACROPHAGE POPULATIONS UNDER THE INFLUENCE OF ANDROGENS Kenneth R. Butler, PhD, Hamed A. Benghuzzi, PhD, Michelle Tucci, PhD, Aaron D. Puckett, PhD University of Mississippi Medical Center, Jackson, Mississippi—USA
11:15	10	INTERCELLULAR SIGNALING BY CYCLIC AMP-CONTAINING MICROPARTICLES. Scruggs AK ¹ , Sayner SL ² , Bauer N ¹ , and Rich TC ¹ . ¹ Departments of Pharmacology, ² Cell Biology and Neuroscience, and the ^{1,2} Center for Lung Biology, Colleges of Medicine and Engineering, University of South Alabama, Mobile AL 36688.
11:30	11	QUANTITATIVE EVALUATION OF FRET-BASED cAMP MEASUREMENTS Kristal J. Webb ¹ , Silas J. Leavesley ^{2,3} , Thomas C. Rich ^{1,3} ¹ Center for Lung Biology and Departments of ² Chemical Engineering and ³ Pharmacology Colleges of Medicine and Engineering, University of South Alabama, Mobile, Alabama, 36688

12:00- 1:00 Lunch Break and Visit to the Poster Area

Friday Afternoon	Talk #	Conference Room
Time		Session III (Drug Delivery) Session Chair: Ken Butler Co-Chair: Felix Adah
1:00	12	ANDROGEN ADMINISTRATION AND FIBROBLAST BEHAVIOR IN THE TISSUE-IMPLANT RESPONSE Kenneth R. Butler, PhD, Hamed A. Benghuzzi, PhD, Michelle Tucci, PhD, Aaron D. Puckett, PhD University of Mississippi Medical Center, Jackson, Mississippi—USA
1:15	13	ELASTIN LIKE POLYPEPTIDE-COLLAGEN COMPOSITE HYDROGELS FOR DRUG DELIVERY APPLICATIONS Shruti S. Amruthwar and Amol V. Janorkar* Department of Biomedical Materials Science, School of Dentistry, University of Mississippi Medical Center, 2500 N. State Street, Jackson, MS 39216
1:30	14	KERATIN AS A NOVEL DRUG CARRIER FOR DRUG COATED BALLOONS Emily Turner ¹ , Seth Tomblyn ² , Luke Burnett ² , Saami K. Yazdani ¹ ¹ Mechanical Engineering, University of South Alabama ² KeraNetics, Winston-Salem, NC 27101
1:45	15	SUSTAINED DELIVERY OF MANNOSE 6 PHOSPHATE FOR TENDON HEALING Michelle Tucci, David Black, Gerri Wilson, and Ham Benghuzzi, University of Mississippi Medical Center, Jackson, MS 39216
2:00	16	THE USE OF ANTIOXIDANT LOADED TCP DEVICES TO SUPPRESS THE METABOLIC ACTIVITY OF SK-OV-3 OVARIAN CANCER LIKE CELLS Jennifer L. Harpole, PhD, Michelle Tucci, PhD, Hamed Benghuzzi, PhD University of Mississippi Medical Center, Jackson, MS 39216
2:15	17	MARKOV CHAIN BASED PREDICTIVE (BCI) SPELLER Jenny Wang, Janet Spoonamore, Cliff Wang NC School of Science and Math, 1219 Broad St, Durham, NC 27705 NC State University, Raleigh, NC 27695
2:30		BREAK

30th SOUTHERN BIOMEDICAL ENGINEERING CONFERENCE

April 11, 2014

3:00-5:00 PM Poster Session (Student Posters Judging)

Scientific Sessions-Poster Session

Session Co-Chairs: Ham Benghuzzi, Michelle Tucci, Joseph A. Cameron, Mary Green, Zelma Cason and Ken Heard	P#
THE EFFECTS OF THYMOQUINONE AND GREEN TEA EXTRACT ON LDL MODIFICATION IN HUMAN AORTIC ENDOTHELIAL CELLS Felicia M. Tardy ¹ , 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	P-1
IDENTIFICATION OF EPILEPTIC BRAIN STATES ON THE BASIS OF MATCHING PURSUIT DECOMPOSITION OF EEG Rui Liu ¹ , Ioannis Vlachos ¹ , Joshua Adkinson ¹ , Leonidas Iasemidis ^{1,2} ¹ Louisiana Tech University, Biomedical Engineering, Ruston, LA ² Louisiana State University Medical School, Shreveport, LA	P-2
MORPHOLOGICAL EVALUATION OF KIDNEY CELLS FOLLOWING CYCLOSPORINE ADMINISTRATION Stacy Hull Vance, Michelle Tucci and Hamed Benghuzzi Clinical Health Sciences Graduate Program, School of Health Related Professions, University of Mississippi Medical Center, Jackson, Mississippi, USA	P-3
EPILEPTIC FOCUS CONNECTIVITY PATTERNS DURING SEIZURES IN TEMPORAL LOBE EPILEPSY Joshua Adkinson, Rui Liu, Ioannis Vlachos, Leonidas Iasemidis Louisiana Tech University Biomedical Engineering, Ruston, LA	P-4
STUDY OF EPILEPTIC SEIZURE SUSCEPTIBILITY BY SPECTRAL ANALYSIS OF THE EEG Ankit Jain ¹ , Ioannis Vlachos ¹ , Loen Iasemidis ^{1,2} , Rui Lui ¹ , Joshua Adkinson ¹ ¹ Louisiana Tech University, Biomedical Engineering, Ruston, LA ² Louisiana State University Medical School, Shreveport, LA	P-5
QUANTITATIVE EEG ANALYSIS FOR DIFFERENTIATION OF SLEEP DISORDERS Sai Mohan Rudarshetty, Ashmit Pyakurel, Rui Lui, Bharath Red Karamuri, Leon D Iasemidis, Ioannis Vlachos ¹ Louisiana Tech University, Biomedical Engineering, Ruston, LA ² Louisiana State University Medical School, Shreveport, LA	P-6
INFLAMMATORY RESPONSE TO TRAUMA: A PROSPECTIVE CLINICAL STUDY Arun Aneja M.D., Ph.D., Edward Yang B.S., Lusha Xiang M.D., Boshen Liu B.S., Peter Mittweide B.S., Clark Walker M.D., Robert Hester Ph.D., George Russell M.D. University of Mississippi Medical Center, Jackson, MS	P-7
MORPHOLOGICAL EFFECTS OF GENISTEIN, THYMOQUINONE, 5-FU, AND LASER THERAPY ON LARYNGEAL CARCINOMA CELLS Osasu Adah, Gerri Wilson, Felix Adah, Michelle Tucci, and Hamed Benghuzzi Departments of Orthopaedic Surgery and Rehabilitation and Clinical Health Sciences University of Mississippi Medical Center, Jackson, Mississippi	P-8
MORPHOLOGICAL EVALUATION OF A549 CELLS FOLLOWING THE EXPOSURE TO OMEGA FATTY ACIDS IN CULTURE Jana Bagwell, Michelle Tucci, Ham Benghuzzi University of Mississippi Medical Center, Jackson, MS 39216	P-9
IMPACT OF HEARING AID USE IN INDIVIDUALS WITH UNILATERAL SENSORY HEARING IMPAIRMENTS Charles E. Bishop, Au.D. and Elgenaid Hamadain, Ph.D. University of Mississippi Medical Center, Jackson, MS 39216	P-10
PREDICTING OVERALL SURVIVAL IN PATIENTS WITH METASTATIC MELANOMA ON ANTI-ANGIOGENIC THERAPY AND RECIST STABLE DISEASE ON INITIAL POST-THERAPY IMAGES USING CT TEXTURE ANALYSIS - A SECONDARY ANALYSIS OF A PHASE II PROSPECTIVE CLINICAL TRIAL Mark Gray, Andrew Smith, Xu Zhang, Haowei Zhang, Sara Martin del Campo, Elgenaid Hamadain, William Carson University of Mississippi Medical Center, Jackson, MS 39216	P-11
DIFFERENTIAL BIOTHERAPEUTIC ADVANTAGES OF HONEY IN TARGETING THE WARBURG EFFECT AND SURVIVAL OF MRC-5 AND A549 CELL LINES Ibrahim O. Farah Department of Biology, Jackson State University, Jackson, MS 39217, USA	P-12
NOVEL APPLICATION FOR MONITORING COMPLIANCE WITH HAND HYGIENE AND ISOLATION ATTIRE AT A UNIVERSITY HOSPITAL Elham Ghonim, and Hamed Benghuzzi University of Mississippi Medical Center, Jackson, MS 39216	P-13
THE EFFECT OF TRANSCUTANEOUS ELECTRICAL NERVE STIMULATION AT ACUPUNCTURE POINTS ON SPINAL MOTOR NEURON EXCITABILITY IN PEOPLE WITHOUT KNOWN NEUROMUSCULAR DISEASES Min Huang ¹ , Howe Liu ¹ , Jian-Wei Gu ² , Ham Benghuzzi ¹ , Xuexiang Wang ² , Antonio V Hayes ³ , Rebecca H. Pearson ¹ , Felix Adah ¹ , and Dobrivoje S Stokic ³ . ¹ Neurophysiological Research Laboratories, The Methodist Rehabilitation Center, Jackson; ² Department of Physiology, and	P-14

¹ Department of Physical Therapy, University of Mississippi Medical Center, Jackson, MS	
THE EFFECT OF MANNOSE 6 PHOSPHATE IN REDUCING TRANSFORMING GROWTH FACTOR PROLIFERATION OF MCCOY FIBROBLAST CELLS Gerri A. Wilson, David A. Black, Michelle A. Tucci, and Hamed A. Benghuzzi University of Mississippi Medical Center, Jackson, MS 39216	P-15
MORPHOLOGICAL CHANGES TO LNCAP CELLS SUBJECTED TO TREATMENT WITH EPIGALLOCATECHIN-3-GALLATE, THYMOQUINONE, AND TANNIC ACID La'Toya Richards Moore*, PhD MLS (ASCP) ^{CM} , Hamed Benghuzzi, PhD Michelle Tucci, PhD, Elgenaid Hamadain, PhD University of Mississippi Medical Center, Jackson, MS 39216	P-16
PLATELET-RICH PLASMA EFFECTS ON HEALING TISSUE INTERFACES: HISTOLOGICAL ANALYSIS IN A SPINAL DECOMPRESSION MODEL James Woodall MD, PhD; Michelle Tucci PhD; Robert McGuire MD University of Mississippi Medical Center, Jackson, MS 39216	P-17
USE OF TCPL CERAMIC IMPLANTS TO DELIVER ESTROGEN IN OSTEOPOROTIC FEMALE RATS Jill White, Gerri Wilson, Zelma Cason, Hamed Benghuzzi, and Michelle Tucci University of Mississippi Medical Center, Jackson, MS 39216	P-18
SPHEROID ORGANIZATION AND ADIPOGENESIS ON COPOLYMERS OF ELASTIN-LIKE POLYPEPTIDES Paul A. Turner and Amol V. Janorkar* Department of Biomedical Materials Science, School of Dentistry, University of Mississippi Medical Center, Jackson, MS 39216	P-19
THE EFFECTS OF SUSTAINED DELIVERY OF ANTIOXIDANTS ON LPS STIMULATED RAW 264.7 MACROPHAGES Renee Wilkins, Michelle Tucci, Ham Benghuzzi University of Mississippi Medical Center, Jackson, MS 39216	P-20
THE USE OF ANTIOXIDANT TO SUPPRESS THE METABOLIC ACTIVITY OF SK-OV-3 OVARIAN CANCER LIKE CELLS Jennifer L. Harpole, PhD, Michelle Tucci, PhD, Hamed Benghuzzi, PhD University of Mississippi Medical Center, Jackson, MS 39216	P-21
EVALUATING EFFECTIVENESS OF LABORATORY TRAINING OF CYTOTECHNOLOGY STUDENTS USING TURNINGPOINT, A PRODUCT OFFERING OF TURNING TECHNOLOGIES, INC. Ken Heard, Zelma Cason, Ron Landreth, Hamed Benghuzzi University of Mississippi Medical Center, Jackson, MS 39216	P-22
THE EFFECTS OF SUSTAINED DELIVERY OF ESTROGEN ON THE GLOMERULI PATHOLOGY Zelma Cason, Michelle Tucci, Hamed Benghuzzi University of Mississippi Medical Center, Jackson, MS 39216	P-23
MORPHOLOGICAL CHANGES TO LNCAP CELLS SUBJECTED TO TREATMENT WITH EPIGALLOCATECHIN-3-GALLATE, THYMOQUINONE, AND TANNIC ACID La'Toya Richards Moore*, PhD; MLS (ASCP) ^{CM} , Hamed Benghuzzi, PhD; FBSE; FAIMBE, Michelle Tucci, PhD, Elgenaid Hamadain, PhD University of Mississippi Medical Center, Jackson, MS 39216	P-24
FROM EMERGENCY DEPARTMENT TO PRIMARY CARE: CONTINUITY OF CARE Linda M. Watkins MSN, RN, FNP-C and Elgenaid Hamadain, PhD University of Mississippi Medical Center, Jackson, MS 39216	P-25
STATISTICAL DECISION MAKING ON HOW TO SELECT THE BEST STATISTICAL TECHNIQUE Elgenaid Hamadain, Ph.D. Department of Diagnostics and Clinical Health Sciences, University of Mississippi Medical Center, Jackson, MS 39216	P-26
INDUCTION OF INTERLEUKIN-6 UPON THE SUSTAINED DELIVERY OF DANAZOL USING ADULT RATS AS A MODEL Hamed Benghuzzi*, Michelle Tucci, Adel Mohamed, and Joseph A. Cameron** University of Mississippi Medical Center, Jackson, MS 39216, and ** Jackson State University, Jackson, MS 39216	P-27
ASSESSING THE MORPHOLOGY OF HUMAN GINGIVAL FIBROBLASTS UPON EXPOSURE TO DENTAL ADHESIVES IN THE PRESENCE OF PORPHYROMONAS GINGIVALIS LIPOPOLYSACCHARIDE Angie Garner, Ham Benghuzzi, Michelle Tucci University of Mississippi Medical Center, Jackson, MS	P-28
DESIGN AND OPTIMIZATION OF A HIGH POWERED HYPERSPECTRAL ILLUMINATION SOURCE FOR PRE-CLINICAL AND CLINICAL IMAGING Arslan Arshad ¹ , Thomas Rich ^{2,3} , and Sials Leavesley ^{1,3} ¹ Chemical and Biomolecular Engineering, University of South Alabama, ² Center for Lung Biology, University of South Alabama, ³ Pharmacology, University of South Alabama	P-29

End of Friday's Sessions

30th SOUTHERN BIOMEDICAL ENGINEERING CONFERENCE

April 12, 2014

Scientific Sessions

Saturday Morning	Talk #	Conference Room
Time		Session IV (Imaging/Data Management) Session Chair: Tom Rich Co-Chair: Felicia Tardy
8:30	18	AN EXCITATION-SCANNING HYPERSPECTRAL MICROSCOPE FOR BIOMEDICAL IMAGING OF GFP IN HIGHLY AUTOFLUORESCENT LUNG TISSUE Peter Favreau ^{1,2} , Thomas Rich ^{2,3} , Ashley Stringfellow ² , Diego Alvarez ^{2,4} , Prashant Prabhat ⁵ , Silas Leavesley ^{1,3} ¹ Chemical and Biomolecular Engineering, University of South Alabama, ² Center for Lung Biology, University of South Alabama, ³ Pharmacology, University of South Alabama, ⁴ Internal Medicine, University of South Alabama, ⁵ Semrock, Inc., A Unit of IDEX Corp.
8:45	19	HYPERSPECTRAL FRET IMAGING AND ANALYSIS APPROACHES TO DETERMINE cAMP COMPARTMENTALIZATION IN PMVECs Naga S. Annamdevula ¹ , Andrea Britain ² , Thomas C. Rich ^{2,3} , Silas J. Leavesley ^{1,2} ¹ Department of Chemical and Biomolecular Engineering, ² Department of Pharmacology, ³ Center for Lung Biology, University of South Alabama, Mobile, AL, 36688
9:00	20	Transverse Relaxations of Selectively Excited Metabolites in Stroke at 21.1 T Jens T Rosenber ^{1,3} , Noam Shemesh ² , Jean-Nicolas Dumez ² , Lucio Frydman ^{1,2} and Samuel C. Grant ^{1,3} ¹ National High Magnetic Field Laboratory, The Florida State University, ² Chemical Physics, Weizmann Institute of Science, ³ Chemical & Biomedical Engineering, FAMU-FSU College of Engineering, The Florida State University
9:15	21	FRACTAL DIMENSION BASED DETECTION OF ARCHITECTURAL DISTORTION ANOMALIES IN MAMMOGRAPHY Dr. Erol Sarigul, Dr. Kwabena Agyepong Department of Advanced Technologies, Alcorn State University, Lorman, MS 39096
9:30	22	SMALL CLINIC DATA MANAGEMENT SYSTEM Vikasini Chandrashekar, Ali Abu-El Humos, Hyunju Kim and Tzusheng Pei Department of Computer Science, Jackson State University, Jackson, MS
9:45		BREAK

Saturday Morning	Talk #	Conference Room
Time		Session V (CVD/Health Care) Session Chair: Subrata Saha Co-Chair: Jafar Vossoughi
10:00	23	Special Presentation: STRESS-STRAIN ALTERATIONS IN THE MYOCARDIUM INDUCED BY MICROGRAVITY: A FINITE ELEMENT MODEL OF THE HEART Richard L. Summers ¹ , Weston Smith ² , Ryan Gilbrech ² , Jun Liao ² , Benjamin C. Weed ² , Sourav Patnaik ¹ Department of Emergency Medicine, University of Mississippi Medical Center, Jackson, Mississippi 39216 ² Cardiovascular Tissue Biomechanics Laboratory, Mississippi State University, Mississippi State, MS 39762.
10:15	24	DEVELOPMENT OF A NOVEL BENCH-TOP MODEL TO MIMIC THE LOWER EXTREMITY ARTERIES AND STENT MECHANICS Nicholas Carroll and Saami K. Yazdani Department of Mechanical Engineering, 150 Jaguar Drive, Mobile, AL 36688
10:30	25	TARGETED THERAPY TO TREAT CARDIOVASCULAR CALCIFICATION IN ESRD PATIENTS Janice Cunningham, C. LaShan Simpson, Erick S. Vasquez, Keisha B. Walters Mississippi State, MS 39762
10:45	26	CARDIOVASCULAR RESPONSE TO TWO AND FOUR MINUTES WALK USING A STANDARD WALKER AND/OR PLATFORM WALKER WITH WHEELS IN ONE FOOT NON-WEIGHT BEARING INDIVIDUALS Felix Adah, Neva Greenwald, Joy Kuebler, Becca Pearson, Elgenaid Hamadain, Janet Slaughter and Min Huang University of Mississippi Medical Center, Jackson, Mississippi

11:00	27	OSTEOCLAST-MEDIATED DEMINERALIZING OF MEDIAL VASCULAR CALCIFICATION Joshua Grant, C. LaShan Simpson Mississippi State University, MS 39762
11:15	28	FINITE ELEMENT ANALYSIS OF ARTERIAL VESSEL WALL STIFFNESS Angel Huot, Saami K. Yazdani Department of Mechanical Engineering, University of South Alabama
11:30	29	HEART RATE VARIABILITY SIGNALS FROM MULTIPLE PHOTOPLETHYSMOGRAPHIC (PPG) SENSORS Ajay K Verma, Sergio D Cabrera and Homer Nazeran Department of Electrical/Computer Engineering, The University of Texas at El Paso, El Paso, TX
11:45	30	INTELLIGENT MEDICATION DISPENSER M. H. Mohammed, W. M. Ahmedhassan, K. S. Ali, Elgenaid Hamadain, Jackson State University, Computer Engineering Department, Department of Diagnostic and Clinical Health Sciences, University of Mississippi Medical Center, Jackson, MS

12:00 -1:00 Lunch Break and Plenary Speaker:

Asim B. Abdel-Mageed, DVM, MS, Ph.D.
Zimmermann Endowed Professor of Cancer Research,
Director of Molecular Oncology Research,
Tulane University School of Medicine, LA

Saturday Afternoon	Talk #	Conference Room
Time		Session VI (Trauma Bone and Cartilage) Session Chair: Amol Janorkar Co-Chair: Renee Wilkins
1:00	31	DESIGN OF SCAFFOLDS OF ALGINATE/B-TRICALCIUM PHOSPHATE FOR THE LOADING AND DELIVERY OF VANCOMYCIN Taolin Fang, MD, PhD ¹ , Jian Dong, MD, PhD ² ¹ Division of Plastic Surgery, Department of Surgery, University of Mississippi Medical Center, Jackson, MS 39216 ² Department of Orthopedic Surgery, Zhongshan Hospital, Fudan University, Shanghai, China 200032
1:15	32	AMINO ACID COATED UHMW-PE IMPLANTS MODIFY NEOVASCULARIZATION IN THE TISSUE-IMPLANT RESPONSE Kenneth R. Butler, PhD, Hamed A. Benghuzzi, PhD, Michelle Tucci, PhD, Aaron D. Puckett, PhD University of Mississippi Medical Center Jackson, Mississippi—USA
1:30	33	ELECTRICAL AND MAGNETIC PARAMETERS AS A PREDICTOR OF RUST SCORE FOR FRACTURE UNION Kanika Gupta ¹ , G.K. Singh ² , Pravin Gupta ³ , Vikas Verma ⁴ , Santosh Kumar ¹ ¹ Department of Orthopaedics, King George's Medical University, Lucknow, Uttar Pradesh, India ² Founder- Director, All India Institute of Medical Sciences-Patna, Bihar, India ³ Department of Orthopaedics, Indraprastha Appolo Hospital, New Delhi, India ⁴ Department of Orthopaedics, All India Institute of Medical Sciences-Patna, Bihar, India
1:45	34	A COMPARISON OF DECELLULARIZATION METHODS APPLIED TO PORCINE OSTEOCHONDRAL XENOGRAFTS FOR ARTICULAR CARTILAGE REPAIR Mark Mosher ¹ , Ryan Butler ³ , Steven Elder ¹ , Andrew Claude ³ , Jim Cooley ² , Eric Gilbert ¹ , Anuhya Gottipati ¹ , Jun Laio ¹ , Robert Meyer ³ ¹ Agricultural & Biological Engineering, Mississippi State University, Mississippi State, Mississippi ² Department of Pathobiology and Population Medicine, College of Veterinary Medicine, Mississippi State University, Mississippi State, Mississippi ³ Department of Clinical Sciences, College of Veterinary Medicine, Mississippi State University, Mississippi State, Mississippi
2:00	35	EFFECTS OF GENIPIN ON DECELLULARIZED PORCINE CARTILAGE T. King ¹ , S. Elder ² ¹ Department of Animal and Dairy Sciences, Mississippi State University ² Department of Agricultural and Biological Engineering, Mississippi State University
2:15		BREAK

Saturday Afternoon	Talk #	Conference Room
Time		Session VII (Modeling) Session Chair: Elgenaid Hamadain Co-Chair: Aaron Puckett
2:30	36	DESIGN AND IMPLEMENTATION OF EMG/EEG FINITE STATE MACHINE FOR PROSTHETIC HAND CONTROLLING Mustaffa Alfatlawi and Dean Aslam Electrical and Computer Engineering Department Michigan State University, East Lansing, USA
2:45	37	OCT IMAGING FOR SMALL ANIMALS – A SWEEP SOURCE PLATFORM José P. Domingues ^{1,2} , Susana F. Silva ¹ , António Miguel Morgado ^{1,2} and Rui Bernardes ^{1,3} ¹ IBILI – Institute for Biomedical Imaging and Life Sciences, University of Coimbra, Portugal ² Department of Physics, Faculty of Sciences and Technology, University of Coimbra Portugal ³ Centre of New Technologies for Medicine, AIBILI, Coimbra, Portugal
3:00	38	DEVELOPMENT OF A THREE-DIMENTIONAL DIGITAL IMAGE CORRELATION FOR DISPLACEMENT AND STRAIN MEASUREMENT OF SEEDED ENDOTHELIAL CELLS Emily Gould, Nicholas Carroll, Dr. Gail D. Jefferson, and Dr. Saami K. Yazdani Department of Mechanical Engineering, 150 Jaguar Drive, Shelby Hall, Mobile, AL 36688
3:15	39	DEVELOPMENT OF SILICONE CORONARY BIFURCATION MODELS FOR IN VITRO FLOW EVALUATION Alex Parks, Saami K. Yazdani Department Of Mechanical Engineering, University Of South Alabama
3:30	40	HIGHLY SENSITIVE CONTINUOUS FLOW MICROFLUIDIC CHIP SENSOR WITH INTEGRATED BI/SB THERMOPILE FOR BIOCHEMICAL APPLICATIONS Varun Kopparchy ^{1,2} , Joshna Nimmala ^{1,2} , Eric. J. Guilbeau ^{1,2} ¹ Center for Biomedical Engineering and Rehabilitation Science, ² Institute for Micromanufacturing, Louisiana Tech University, Ruston, LA, 71272
4:00		BREAK

Saturday Afternoon	Talk #	Conference Room
Time		Session VIII (Cancer) Session Chair: Pradip Biswas Co-Chair: LaToya Moore
4:15	41	MULTIFUNCTIONAL NANOPLATFORMS FOR TARGETED MDRB AND CANCER THERANOSTIC APPLICATIONS Paresh Chandra Ray Department of Chemistry, Jackson State University, Jackson, MS, USA
4:30	42	PROBING G-PROTEIN COUPLED RECEPTOR CONFORMATIONAL DYNAMICS USING HUMAN COMPUTER INTERFACES Dr. Rajendram Rajnarayanan University of Buffalo, NY
4:45	43	THE ROLE OF RESVERATROL IN PREVENTION AND THERAPY OF HORMONE-DEPENDENT CANCERS: IN SILICO STUDIES Chakraborty S ¹ , Zhang L ² , Lin SY ² , Rimando AM ³ , Biswas PK ¹ and Levenson AS ^{2*} ¹ Laboratory of Computational Biophysics & Bioengineering, Depart of Physics, Tougaloo College, Tougaloo, MS ² Cancer Institute and Department of Pathology, University of Mississippi Medical Center, Jackson, MS ³ United States Department of Agriculture, Agricultural Research Service, Natural Products Utilization Research Unit, University, MS
5:00	44	INHIBITION OF CYTOMEGALOVIRUS INFECTION AND PHOTOTHERMAL LYSIS OF INFECTED CELLS USING BIOCONJUGATED GOLD NANOPARTICLES Bernadette M. DeRussy ¹ , Madeline A. Aylward ¹ , Zhen Fan ² , Paresh C. Ray ² and Ritesh Tandon ^{1*} ¹ Department of Microbiology, University of Mississippi Medical Center, 2500 North State Street, Jackson, MS 39216, USA. ² Department of Chemistry and Biochemistry, Jackson State University, 1400 J.R. Lynch Street, Jackson, MS
5:15	45	HORMONE-INDEPENDENT DRUG DESIGNING FOR BREAST CANCERS TARGETING RECEPTOR DIMERIZATION INTERFACE Pradip K Biswas ¹ , Rajendram Rajnarayanan ² , Sandipan Chakraborty ¹ , and Nicholas Rader ¹ ¹ Laboratory of Computational Biophysics & Bioengineering Department of Physics, Tougaloo College, Tougaloo MS ² Department of Pharmacology and Toxicology, University of Buffalo, Buffalo, NY 14260

5:30-6:30 PM: FREE TIME

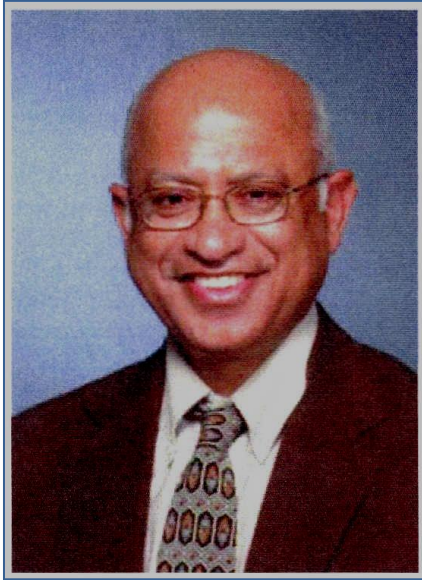
6:30-8:30 PM: *Banquet and Keynote Speaker

Given by Subrata Saha, Ph.D.

Title: Ethical Challenges in Biomedical Research

*** Student Awards**

Note Page



Keynote Presentation

Ethical Challenges in Biomedical Research

Given by

Subrata Saha, Ph.D.

Editor-in-Chief, Journal of Long Term Effects of Medical Implants; Ethics in Biology; Engineering & Medicine
Director, Biomedical Engineering Program, School of Graduate Studies
Research Professor and Director of Musculoskeletal Research.
Department of Orthopaedic Surgery and Rehabilitation Medicine.
Professor, Dept. Physiology & Pharmacology
SUNY Downstate Medical Center

Dr. Subrata Saha is the Director of Musculoskeletal Research and Research Professor in the Department of Orthopaedic Surgery & Rehabilitation Medicine at SUNY Downstate Medical Center in Brooklyn, New York. Dr. Saha received a BS in Civil Engineering from Calcutta University in 1963, an MS in Engineering Mechanics from Tennessee Technological University in 1969, and Engineering and PhD degrees in Applied Mechanics from Stanford University in 1972 and 1974, respectively. He has been a faculty member at Yale University, Louisiana State University Medical Center, Loma Linda University, Clemson University, and Alfred University. Dr. Saha has received many awards from professional societies, including Orthopedic Implant Award, Dr. C. P. Sharma Award, Researcher of the Year Award, C. William Hall Research Award in Biomedical Engineering, Award for Faculty Excellence, Research Career Development Award from NIH, and Engineering Achievement Award. He is a Fellow of the Biomedical Engineering Society (BMES), The American Society of Mechanical Engineers (ASME), and the American Institute for Medical and Biological Engineering (AIMBE). He currently chairs the Bioethics Committee of the International Federation of Medical and Biological Engineering (IFMBE) and the Development Committee of Sigma Xi, and is Co-Chair of the International Committee of AIMBE. He is the immediate past chair of the Ethics Committee of the American Association of Dental Research (AADR).

He has received numerous research grants from federal agencies (NIH and NSF), foundations, and industry. Dr. Saha is the founder of the Southern Biomedical Engineering Conference Series, and he also started the International Conference on Ethical Issues in Biomedical Engineering. Dr. Saha has published over 118 papers in journals, 45 book chapters and edited volumes, 382 papers in conference proceedings, and 151 abstracts. His research interests are bone mechanics, biomaterials, orthopedic and dental implants, drug delivery systems, rehabilitation engineering, and bioethics.

Abstract:

During the last fifty years, the field of biomedical engineering has been largely responsible for the dramatic advances in modern medicine. These include advanced therapeutic and diagnostic techniques (e.g., total joint replacements, heart-lung machines, artificial heart, computed tomography and magnetic resonance imaging) and that in turn has significantly improved the life span and quality of life of our patients. However, biomedical technology has also contributed to new ethical dilemmas and has challenged some of our moral values. Some of the areas that have shown immense promise but also raised public concern are Nanobiotechnology, stem cell research, cloning, genetic engineering and synthetic biology. Other topics that also often face ethical scrutiny are animal research, clinical trials and conflicts-of-interest. A discussion of ethical issues associated with these topics will be presented.

See you Next Year!

ABSTRACTS

30th SOUTHERN BIOMEDICAL ENGINEERING CONFERENCE

Friday, April 11, 2014

SESSION I (NEUROENGINEERING)

Invited Presentation:

RESETTING OF THE EPILEPTIC BRAIN BY SEIZURES

Leonidas Iasemidis and Ioannis Vlachos

Louisiana Tech University, Biomedical Engineering
Louisiana State University Medical School, Department of Neurology

Epilepsy is the third most common neurological disorder affecting 1% to 2% of the population worldwide. Epileptic seizures are hallmarks of epilepsy. Understanding the genesis of epileptic seizures is critical for the diagnosis and treatment of epilepsy. Seizures typically occur intermittently without a warning. However, by application of state-of-the-art mathematical analysis techniques to long-term electroencephalograms (EEGs) recorded from scalp and intracranial electrodes in patients undergoing clinical evaluation at specialized epilepsy monitoring units (EMUs) of tertiary medical centers, we have shown that seizures do not occur randomly but instead they result from a progressive increase of recruitment of normal brain sites by the epileptogenic focus. Moreover, evidence that epileptic seizures appear to also serve as dynamical resetting mechanisms of the brain has surfaced. In particular, we will present results from pre-clinical and clinical studies that the dynamically entrained brain areas with the epileptogenic focus before seizures disentrain faster and more frequently at epileptic seizures than at any other time point in between seizures periods. We expect these results to shed light into the mechanisms of epileptogenesis, timely intervention and seizure control, as well as into investigations of intermittent spatiotemporal state transitions in other complex biological and physical systems.

WEARABLE EEG SYSTEM FOR DROWSINESS DETECTION

Jenny Wang, Janet Spoonamore, Cliff Wang

NC School of Science and Math, 1219 Broad St, Durham, NC 27705
NC State University, Raleigh, NC 27695

Each year a high percentage of accidents are caused by drowsy drivers. We propose using Electroencephalography (EEG) signal to detect driver fatigue and alert drivers of potential drowsiness. EEG data sets of both alert and drowsy state were captured. The raw EEG data was transformed to frequency domain and band filtered into eight distinct frequency bands, from Delta to high Gamma band. Nonlinear Energy Operator was used to identify power spikes in each band. We studied and compared the spectrum power patterns of each band, between alert and drowsy state. Experiment results have shown that certain EEG band spectrum power spikes are reliable bio-indicators for detecting common fatigue phenomena, such as eye blinking, eye closing, and yawning. Based on this observation, we developed the fatigue detection algorithm and a corresponding Smartphone App for drowsy detection.

THE ROLE OF THE HYOID APPARATUSES OF WOODPECKERS FOR ENERGY DISSIPATION

Nayeon Lee^{a,c} (nayeon@cavs.msstate.edu), R. Prabhu^{a,c} (rprabhu@abe.msstate.edu), Lakiesha N. Williams^{a,c} (lwilliams@abe.msstate.edu), M.F. Horstemeyer^{b,c} (mfhorst@cavs.msstate.edu)

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In order to examine the role of the hyoid apparatuses of woodpeckers with respect to energy mitigation, we investigated its unique geometry using FEA (finite element analysis). It is believed that the hyoid apparatus' role is to aid in protecting the woodpecker's brain from damage by dissipating stress waves due to impact while pecking. The

woodpecker's hyoid apparatus has a unique structure compared to other birds' hyoid apparatus as it starts at the tip of the beak, which is the tongue, surrounds the woodpeckers' skull, and ends at the root of the upper beak. The hyoid apparatus has cartilage at its core, and the cartilage is surrounded by muscle. In this study, we constructed the model of the hyoid apparatus using ABAQUS-explicit FEA software, applied a blast pressure, and measured the change in pressures along various locations on the apparatus. The results showed that the impending longitudinal stress wave was decreased by 97.5% at the free end of the forked geometry, while the shear stress increased 74.7% at the same free end. We believe that this is due to the spiral geometry of the hyoid apparatus. The analysis of the woodpecker's hyoid apparatus provides additional insight into energy dissipation from the perspective of novel biological structural materials. Our focus is to develop protective gear for soldiers and athletes based on such designs in nature.

TRACKING OF HMSCS PRECONDITIONED WITH 0.5% O₂ IN ASSOCIATION WITH STROKE UTILIZING ¹H AND ²³Na MRI AT 21.1 T

Jens T. Rosenberg^{1,2}, Avigdor Leftin³, Fabian Calixto Bejarano¹, Michael M. Davidson^{1,4}, Michelle Baird¹, Lucio Frydman^{1,3}, Teng Ma² and Samuel C. Grant^{1,2}

¹The National High Magnetic Field Laboratory, ²Chemical and Biomedical Engineering, FAMU-FSU College of Engineering, and ³Department of Biological Science, The Florida State University, ⁴Department of Chemical Physics, Weizmann Institute of Science

As evaluated by ultra-high field ¹H and ²³Na MRI, human mesenchymal stem cells (hMSCs) exposed to 2% O₂ (hypoxia) have shown enhanced therapeutic effects once transplanted into an ischemic brain. In this study, we further investigate hypoxic preconditioning by using a sublethal exposure, 0.5% O₂, prior to intra-arterial injection of cells in to a stroked rat brain. Preconditioned hMSCs were transfected with an iron based contrast agent (SPIOs) for cell tracking. Serial MRI at 21.1 T was performed to acquire ¹H and ²³Na images of lesion progression and cell migration. Images of the ischemic stroke [1] lesion show increased signal as evidenced by the influx of extracellular water. Increases in tissue sodium concentration are seen by ²³Na MRI, and the SPIO labeled cells are visualized as signal voids. Histological tissue sections show the localization of the iron-labeled hMSCs in brain tissue. With Na MRI, the sublethal pretreatment showed a trend towards increased stroke recovery compared to normoxic and control; however, statistical significance was not reached. In fact, the 2% hypoxic pre-treatment is the only test group showing a significant difference as evaluated with Na MRI. With the respect to the permanence of the hMSCs, the average decrease is lower for the sublethal cells compared to both the 2% hypoxic pretreatment and to normoxic cells, but again statistical significance was not achieved. In conclusion, this study shows limited benefits for the sublethal pretreatment compared to previous hypoxic protocols.

PLATELET-RICH PLASMA EFFECTS ON DEGENERATIVE DISC DISEASE: ANALYSIS OF HISTOLOGY AND IMAGING IN AN ANIMAL MODEL

Tucci, MA¹, Gullung, GB¹, Ham Benghuzzi¹, Woodall, JW¹, James, JR², Black DA¹, McGuire, RA¹

¹Orthopedic Surgery and Rehab and ²Department of Radiology, University of Mississippi Medical Center, Jackson, MS

CLINICAL QUESTION: The objective of this study is to analyze the early and late phase effects of platelet-rich plasma (PRP) injection into and around the damaged intervertebral disc using an animal model.

METHODS: The L4-L5 intervertebral disc of 21 adult Sprague-Dawley rats was injured with a 21-gauge needle. Specimens received an immediate injection of PRP, a delayed injection of PRP, or no further intervention (sham). MRI was performed for a control at time 0 and each group at 4 weeks post injury. Three specimens were collected at 2 and 4 weeks post PRP injection, as well as 2 sham and 2 controls. Each disc was sectioned followed by histopathological analysis.

RESULTS: The sham group had clear degenerative changes with loss of organizational structure, empty space, fibrous tissue, and inflammatory cells. The PRP treated groups had fibers that were damaged with some empty spaces and inflammatory cells. However, there was maintenance of the ring structure and the nucleus appeared to have a healthy central portion. Overall, the PRP treated group retained more normal morphologic features, contained fewer inflammatory cells, and did not appear as damaged on MRI. The disk height was significantly different in the sham and immediate injection group at the 4 week interval.

CONCLUSIONS: The needle puncture technique is an effective method for creating a degenerative disk model. The administration of PRP has a protective effect on damaged disks and decreases the amount of inflammation in the acute and delayed injection settings. However, the greatest effect is noted with earlier injectio

SESSION II (TISSUE ENGINEERING)

TREATMENT OF VASCULAR CALCIFICATION BY ELASTIN-TARGETED NANOPARTICLES

Kevin A. Bennett, C. LaShan Simpson

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Vascular calcification is the deposition of calcium mineral in blood vessels and can cause increased vascular stiffness, resulting in an increased risk for cardiovascular complications. It has recently been determined that calcification resembles the active process of bone formation, with smooth muscle cells being able to differentiate into bone-forming osteoblast-like cells. Another key characteristic of vascular calcification is the breakdown of elastin, the protein responsible for providing blood vessels their elasticity. It is believed that degraded elastin could provide sites for the initiation of vascular calcification. A recent study has shown that bone-absorbing cells, osteoclasts, can demineralize calcified elastin. To improve upon this study, degraded elastin-targeted nanoparticles will be used to target sites of calcification and cause resident macrophages, inflammatory cells believed to be involved in vascular calcification, to differentiate into osteoclasts. Iron oxide nanoparticles, which have already been used in the imaging of macrophage-rich areas in arteries with magnetic resonance imaging (MRI), will be modified with anti-tropoelastin antibodies. Once injected, the nanoparticles will target sites of calcification, acting as a contrast agent for MRI and delivering 1,25 dihydroxyvitamin D₃ and macrophage colony-stimulating factor to the nearby macrophages and circulating monocytes to induce osteoclastic differentiation and facilitate demineralization of the calcified arteries. With an estimated 18 million people dying from cardiovascular diseases world wild, research in this field is essential, and this proposed research could be pivotal in the understanding, treatment, and diagnosis of vascular calcification.

ENDOTHELIALIZED IN VITRO TUBULAR SILICONE SCAFFOLDS

Marzieh K Atigh¹, Kristen Smith², Saami K. Yazdani³

¹Department of Mechanical Engineering, University of South Alabama, Mobile, Alabama.

²Spanish Fort High School, Spanish Fort, Alabama

³Department of Mechanical Engineering, University of South Alabama, Mobile, Alabama.

More than 81 million Americans suffer from some form of cardiovascular disease, making it the leading cause of death in the country. Atherosclerosis, the major cause of cardiovascular disease, is a condition in which an artery wall thickens and narrows as a result of the accumulation of fatty materials. Clinical studies has shown that plaque growth occur in specific regions of the artery, correlating with areas of flow disturbances. Endothelial cells align the inner surface of the blood vessel, and are susceptible to adverse changes in these flow-disturbed regions. It is hypothesized that these flow disturbances reduce the endothelial cells ability to function optimally, eventually leading to disease initiation such as lesion development and eventually to clinical complications. Therefore, the purpose of this project was to make an *in vitro* endothelial cell culture system, which mimics the geometry and hemodynamic conditions of an artery. A bioreactor system was developed to seed endothelial cells on the inner surface of silicone tubes. Briefly, silicone tubes with arterial geometry and similar mechanical compliance were created using Sylgard 184 elastomeric kit. The tubes were then sterilized with 70% sulfuric acid and coated with fibronectin. The inner surface of the tubes was then seeded with rat aortic endothelial cells. The bioreactor was then placed inside an incubator for a period of 48 hours. The result demonstrated endothelial cells successfully attached to the inner surface of the sylgard tube. This system can be used to examine endothelial cell responses to flow and flow gradients under defined and controllable conditions and potentially to assess cell behavior to varying therapeutic treatments.

SYNTHESIS AND CHARACTERIZATION OF AN ELASTIN-LIKE-POLYPEPTIDE-POLYARGININE CONJUGATE FOR THREE-DIMENSIONAL CELL CULTURE

C. Andrew Weeks and Amol V. Janorkar*

Department of Biomedical Materials Science, School of Dentistry, University of Mississippi Medical Center, 2500 N. State St., Jackson, MS 39216

* Corresponding author (Email: ajanorkar@umc.edu; Phone: 1-601-984-6170; Fax: 1-601-984-6087)

We have synthesized an elastin-like-polypeptide-polyarginine (ELP-PA) conjugate to be used as coating material for cell culture. Following synthesis and isolation of ELP-PA, the material was chemically characterized by sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS-PAGE) and o-Pthalaldehyde (OPA) primary amine assay. We then created two coating materials by diluting the ELP-PA product with neat ELP to render a “low charge” ELP/ELP-PA blend and a “high charge” ELP/ELP-PA blend. The resulting materials were deposited as thin films atop tissue culture polystyrene (TCPS) surfaces. The hydrophobicities of these surfaces were measured using water contact angle goniometry. Surface topography of dry coatings was explored using atomic force microscopy (AFM). Surface texture under culture conditions was assessed by optical microscopy. Our data indicates that higher amine content lowers water contact angle and significantly affects surface topography of the resultant coating.

THE CORRELATION BETWEEN NEOVASCULARIZATION AND MACROPHAGE POPULATIONS UNDER THE INFLUENCE OF ANDROGENS

Kenneth R. Butler, PhD, Hamed A. Benghuzzi, PhD, Michelle Tucci, PhD, Aaron D. Puckett, PhD

University of Mississippi Medical Center
Jackson, Mississippi—USA

Macrophages and blood vessels are critical components in the biocompatibility and functionality of implantable ceramic materials used in drug delivery applications. As part of the chronic inflammatory response, macrophages surround the implant, establishing the tissue-implant interface and produce cytokines critical for recruitment of other complementary cells involved in the response. Neovascularity also occurs and allows more direct access of cells and support in the tissue-implant response. The purpose of this study was to examine the correlation of macrophage and neovascularization by further defining their presence and relationship in the fibrous tissue capsule of calcium phosphate (TCP) ceramic drug delivery systems. Sixteen animals in four experimental groups were implanted with one TCP bioceramic each. Group I animals were implanted with a sham TCP ceramic not containing a steroid hormone (control group). Group II animals received the testosterone loaded TCP ceramic. Group III animals were implanted with the dihydrotestosterone loaded ceramic. Group IV animals received the androstenedione ceramic. At 90 days post-implantation, the implants and fibrous tissue capsules were extracted. Determination of macrophage populations and neovascularity was conducted microscopically following H&E staining and aided by ImagePro digital analysis software. Overall, macrophage counts were highly and significantly correlated with vascularity ($p < 0.05$). In individual group analysis, macrophages and vascularity in Groups II, III, and IV were highly correlated, while correlations for Group I was not statistically significant. These findings suggest that presence of macrophages is be directly related to neovascularity.

INTERCELLULAR SIGNALING BY CYCLIC AMP-CONTAINING MICROPARTICLES.

Scruggs AK¹, Sayner SL², Bauer N¹, and Rich TC¹.

¹Departments of Pharmacology, ²Cell Biology and Neuroscience, and the ^{1,2}Center for Lung Biology, Colleges of Medicine and Engineering, University of South Alabama, Mobile AL 36688.

Microparticles (MPs) are extracellular vesicles 0.1 to 1 μm in diameter that are released from many cell types under physiological and pathophysiological conditions. Endothelial-derived MPs are found circulating in blood and communicate with downstream target cells in a paracrine fashion. MPs contain a variety of functional protein and RNA that are likely to contribute to the information content delivered to target cells by MPs. The Bauer and Sayner laboratories recently determined that cyclic adenosine monophosphate (cAMP), a ubiquitous second messenger, is found in MPs from pulmonary microvascular endothelial cells (PMVECs); ongoing studies suggest that MPs isolated from PMVECs treated with β adrenergic agonists have increased cAMP levels. We developed mathematical models of MP-target cell interactions in order to better understand how cAMP and enzymes in the cAMP signaling pathway

delivered by MPs may alter target cell signaling. Simulations indicate that if cAMP contained in one MP were released into a near-membrane compartment of a target cell, cAMP levels within that compartment would be sufficient to activate protein kinase A for several minutes. However, if cAMP were released into the larger volume of the bulk cytoplasm it would have little or no effect on target cell function. These data indicate that a single MP may deliver cAMP payloads sufficient to trigger sustained responses in a target cell and may contribute to MP-mediated signaling events.

A QUANTITATIVE EVALUATION OF FRET-BASED cAMP MEASUREMENTS

Kristal J. Webb¹, Silas J. Leavesley^{2,3}, Thomas C. Rich^{1,3}

¹Center for Lung Biology and Departments of ²Chemical Engineering and ³Pharmacology
Colleges of Medicine and Engineering, University of South Alabama, Mobile, Alabama, 36688

In the last decade, several probes for measuring cyclic nucleotide signals in single cells have been developed. However, few studies have attempted to evaluate the ability of these probes to discern mechanisms of signaling specificity. Thus, we developed mathematical descriptions of cyclic nucleotide–probe interactions to assess the strengths and weaknesses of these probes for measurement of cyclic nucleotide signals. Our simulations indicate that care must be taken when interpreting data obtained using these probes. The most commonly used cyclic nucleotide probes are FRET–based. Current FRET probes have a low signal-to-noise ratio, are susceptible to environmental changes (e.g., pH), and are subject to photobleaching. Our models describe the kinetic properties of FRET–based probes used to measure cAMP signals. Simulations indicate that these probes are adequate to detect slow cAMP oscillations. Unfortunately, concentrations of fluorescent probes cannot be estimated in single cells. Thus, we cannot predict the magnitude of cyclic nucleotide buffering by heterologously–expressed probes. Model simulations suggest that buffering may dramatically alter the kinetics of free cAMP signals. Finally, the ability of these probes to discriminate between cAMP levels in intact cells has not been adequately assessed. We are currently using both spectrofluorometric and imaging measurements to estimate the dynamic range of these probes. These studies will facilitate the quantitative use of FRET probes for the measurement of intracellular processes in living cells.

SESSION III (DRUG DELIVERY)

ANDROGEN ADMINISTRATION AND FIBROBLAST BEHAVIOR IN THE TISSUE-IMPLANT RESPONSE

Kenneth R. Butler, PhD, Hamed A. Benghuzzi, PhD, Michelle Tucci, PhD, Aaron D. Puckett, PhD

University of Mississippi Medical Center
Jackson, Mississippi—USA

The purpose of this study was to further evaluate the presence of fibroblasts in the fibrous tissue capsules surrounding tricalcium phosphate (TCP) bioceramics loaded with androstenedione, dihydrotestosterone, and testosterone to that of a control to further explore the mechanisms involved in the tissue-implant response. The effect of steroid hormones on the chronic inflammatory response has been widely reported in the scientific literature. Sixteen animals in four experimental groups were implanted with one TCP bioceramic each. Group I animals were implanted with a sham TCP ceramic not containing a steroid hormone (control group). Group II animals received the testosterone loaded TCP ceramic. Group III animals were implanted with the dihydrotestosterone loaded ceramic. Group IV animals received the androstenedione ceramic. At 90 days post-implantation, the animals were euthanized. The implants and fibrous tissue capsules surrounding them were extracted and evaluated microscopically following routine H&E staining aided by ImagePro digital analysis software. Both Groups II and III demonstrated higher fibroblast counts per high power field compared to Groups I (control) and IV (androstenedione). Testosterone and dihydrotestosterone significantly intensified fibroblast migration into the fibrous tissue capsule surrounding the implants. The results of this study indicate that these hormones can significantly influence fibroblast behavior in the tissue-implant response.

ELASTIN LIKE POLYPEPTIDE-COLLAGEN COMPOSITE HYDROGELS FOR DRUG DELIVERY APPLICATIONS

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We compared the release characteristics of the collagen and elastin-like polypeptide (ELP)-collagen composite hydrogels loaded with a model protein (bovine serum albumin, BSA) and a commonly used antibiotic (doxycycline). Both BSA and doxycycline showed a gradual time dependent release and the release kinetics followed the power law model demonstrating that the release from the collagen and ELP-collagen hydrogels was predominantly through Fickian diffusion. The ELP-collagen hydrogels, in general, showed a slower release of the bioactive agents compared to the collagen hydrogels. These results suggested that drug molecular weight, target loading, and inter-chain interactions between collagen, ELP, and the bioactive agents were significant factors that affected the release kinetics.

KERATIN AS A NOVEL DRUG CARRIER FOR DRUG COATED BALLOONS

Emily Turner¹, Seth Tomblyn², Luke Burnett², Saami K. Yazdani¹

¹Mechanical Engineering, University of South Alabama

²KeraNetics, Winston-Salem, NC 27101

Drug coated balloons (DCB) represent a novel approach to develop a superior intervention for the treatment of peripheral artery disease (PAD). Currently, DCB are coated with anti-proliferative drugs which combat neointimal hyperplasia reducing the occurrence of restenosis. The common anti-proliferative drug used in DCB is paclitaxel, which when coated alone shows very poor retention rates due to its diffusion from the treated artery following deployment. Multiple excipients have marginally improved the retention of paclitaxel in the arterial wall such as urea, iopromide, polysorbate and sorbitol carriers, however retention rates are still less than 10% following a 24-hour period. Keratin, a protein derived from human hair, is a potential option for an excipient due to its intrinsic scaffolding characteristics and biocompatibility. The goal of this project was to evaluate the possibility of keratin as an excipient for paclitaxel and its efficacy in the inhibition of neointimal hyperplasia. Additionally, nonionic contrast medium, iohexol, was used as an additional excipient based on its previous success as a carrier for paclitaxel. Briefly, a cell proliferation assay was performed *in vitro* in which various combinations of keratin, paclitaxel, and iohexol were coated on the bottom of 6-well plates to form a hydrogel on which cells were seeded and proliferation was determined microscopically. Finally, a 4% solution of Keratose- α , a form of keratin, was dissolved in 1x PBS and an angioplasty balloon was coated using a dipping technique. To evaluate the coating thickness, the Keratose- α coated balloon was embedded in OCT, sectioned and stained by Hematoxylin, and evaluated by light microscopy. The results demonstrated inhibited cell proliferation in the cell proliferation assay. The coating on the balloon demonstrated uniform coating circumferentially with coating thicknesses ranging from 5 to 20 microns. These studies highlight the potential of a new biomaterial that can provide a safe and controllable drug release profile for treatment of PAD.

SUSTAINED DELIVERY OF MANNOSE 6 PHOSPHATE FOR TENDON HEALING

Michelle Tucci, David Black, Tracye Lawyer, Gerri Wilson, and Hamed Benghuzzi

University of Mississippi Medical Center, Jackson, MS

Flexor tendon repairs are plagued by the formation of peripheral adhesions that limit motion. No current adjunct therapy is available to prevent this complication. Mannose-6-phosphate (M6P) is a natural sugar that has been shown to interact with the M6P/IGF-II receptor on fibroblasts. It is hypothesized that sustained delivery of M6P to healing tendons would downregulate the production of unorganized scar collagen, allowing the tenocytes to guide tendon repair. Thirty-two (32) Sprague-Dawley rats underwent right Achilles tendon transection and suture repair. M6P was placed in a TCPL delivery system adjacent to the tendons of half of the rats prior to skin closure. Half of the animals in each treatment group were sacrificed after two weeks of healing, and the rest after four weeks. There were no post-operative complications (rupture, seroma, hematoma, infection). Histopathologic analysis was performed with H&E and elastin stains. Biomechanical analysis was performed to determine stress, strain, and elastic modulus. M6P was found to increase elastin production, decrease callus cross-sectional area, increase strain, and increase peak stress at failure. These changes were most evident at the two-week time point. The findings from this study support the continued investigation of M6P as an adjunct therapy to flexor tendon repair.

THE USE OF ANTIOXIDANT LOADED TCP DEVICES TO SUPPRESS THE METABOLIC ACTIVITY OF SK-OV-3 OVARIAN CANCER LIKE CELLS

Jennifer L. Harpole, Ph.D., Michelle Tucci, Ph.D., and Hamed Benghuzzi, Ph.D.

University of Mississippi Medical Center, Jackson, MS 39216

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 SK-OV-3 cell line as a model. A total of 144 wells were plated with 10^5 SK-OV-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 μ M), EGCG (3 μ g/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 SK-OV-3 ovarian cancer cell line in culture.

MARKOV CHAIN BASED PREDICTIVE (BCI) SPELLER

Jenny Wang, and Janet Spoonamore

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NC State University, Raleigh, NC 27695

Brain-Computer Interfaces (BCI) allow for hands free communication by correlating visual stimulation with surface electroencephalograph (EEG) signal responses. To overcome inefficiency in the current BCI speller, we created a Markov-chain based predictive method to help enhance letter selection. Based on the observation that the 100 most commonly used English words make up about half of all written material and the 300 most commonly used words make up about 65% of all written material, we analyzed the 100 and 300 most commonly used words and calculated the first order Markov Transition probability of next alphabetic character given the current letter. Based on the Markov transition probability, we created three optimized visual stimulation patterns for text input: 1) ordered row and column flashing of next possible letters in decreasing probability; 2) ordered row and column flashing of next possible letters

after re-arranging the list to top left corner diagonally; 3) ordered single character flashing of next possible letters in decreasing probability. Our simulation results showed a significant speed up in text entry over current methods.

POSTER SESSION

THE EFFECTS OF THYMOQUINONE AND GREEN TEA EXTRACT ON LDL MODIFICATION IN HUMAN AORTIC ENDOTHELIAL CELLS

Felicia M. Tardy¹, Hamed BENGHUIZI¹, and Michelle Tucci²

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Oxidatively modified low-density lipoprotein (LDL) has been implicated in the development of cardiovascular disease, the leading cause of morbidity and mortality worldwide. While the exact mechanism by which oxidized LDL contributes to CVD has not been fully elucidated, it is believed that inhibiting LDL oxidation may provide protection against CVD. Previous studies have indicated that antioxidants such as green tea (GT) and thymoquinone (TQ) may reduce the damage caused by oxidized LDL. Therefore, the specific aim of this study is to determine the effects of GT and TQ on the modification of LDL using endothelial cells as a model. Male and female human aortic endothelial cells (HAEC) were challenged with LDL, alone or in combination, with TQ and GT, and the functional capacity of the cells was evaluated. Results of the study suggest that TQ and GT may be effective in preventing the damage caused by LDL oxidation.

IDENTIFICATION OF EPILEPTIC BRAIN STATES ON THE BASIS OF MATCHING PURSUIT DECOMPOSITION OF EEG

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The epileptic brain typically transits into seizures (ictal states) with preceding (preictal) and following (postictal) states, while it behaves “normally” between seizures (interictal states). We set to automatically identify these brain states from the electroencephalogram (EEG). The ability to differentiate between epileptic brain states can find many valuable applications in the management of epilepsy. A time-frequency analysis via multivariate matching pursuit (MMP), which efficiently decomposes a multichannel signal into basic waveforms (e.g., Gabor functions), was performed peri-ictally and interictally to long-term intracranial multi-channel EEG recordings from 4 patients with intractable epilepsy. Novel features capturing EEG’s complexity, frequency content and energy were estimated from the resulted data. We used these features together with their time lags in a 4-class support vector machine (SVM) classification scheme per patient and tested it under a leave-one-out cross-validation (LOOCV) strategy. Synthetic Minority Oversampling Technique (SMOTE) was also used to treat the highly imbalanced datasets due to considerably longer span of the interictal state compared to the span of the other states. Our analytical scheme achieved high sensitivity in detecting each state in all 4 patients (e.g., 83%, 95%, 100% and 100% for the preictal state per patient respectively). These results suggest potential employment of the devised scheme to a wide range of applications, from seizure prediction and in-time intervention to abolish an upcoming seizure, to accurate and objective monitoring of seizure susceptibility over time, to fast and robust detection of different epileptic brain states hidden in days-long inpatient EEG recordings.

MORPHOLOGICAL EVALUATION OF KIDNEY FOLLOWING CYCLOSPORINE ADMINISTRATION

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Cyclosporine (CsA) is extracted from *Tolypocladium inflatum* Gams, which is metabolized through the superfamily of hepatic isoenzymes P-450. CsA has a mean life of 6.4-8.7 h, although this varies among different individuals. Ninety percent of the drug is withdrawn through biliary excretion and only 6% appears unchanged in the urine. The exact mechanism of action of CsA is unknown; however, CsA has the ability to act on the immune system by blocking the biosynthesis of some lymphokines produced by T lymphocytes and interleukine-2 synthesis at the transcriptional level. It has been suggested that CsA acts by interacting with cytoplasmic membrane and activates the intracellular calcium pathway, or binds to cytoplasmic proteins (Parra, 2003). At toxic levels, CsA also has the ability to cause renal damage and histological changes that can affect the function of a transplanted kidney (Kahn, 1989, Wang, 1994, Bagnis, 1996, Hansen, 1996). **Hypothesis:** A: Cyclosporine is a potent immunosuppressive agents that act on many cells of the body, including epithelial cells and may cause a decrease in the cell proliferation and increase markers for cell damage. **Specific Aim :** To evaluate kidney epithelial cells after exposure to various doses (low, medium, and high) of CsA and to measure changes in cellular proliferation, morphology and function with time. **Results:** The results from our study indicates that the admistration of CsA will result in cellular destruction and dysfunction. **Conclusion:** The findings from our study indicate that the overall the administration of cyclosporine resulted in changes as early as 24 hours in comparison to the control. By 72 hours the group treated with cyclosporine displaced devastating morphological changes, which can ultimately result in kidney dysfunction in comparison to the control.

EPILEPTIC FOCUS CONNECTIVITY PATTERNS DURING SEIZURES IN TEMPORAL LOBE EPILEPSY

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About 1% of the global population is afflicted with epilepsy and, of all adult epilepsy patients, 60% have focal epilepsy. It has been observed that, during the course of secondarily generalized focal seizures, epileptic activity propagates from focal to other brain sites. This could reflect changes in connectivity mappings. Computer assisted analysis of recorded electrographic activity of the brain (EEG) can allow the characterization and quantification and of brain connectivity patterns during seizures. We developed a method that uses the measure of Generalized Partial Directed Coherence (GPDC) to estimate the effective connections between brain sites, and by the use of surrogate data analysis determines the statistically significant ones. Assuming that the brain functions as a network of directionally interconnected nodes, we then use these derived connections to estimate the inward and outward density of connections for each node over time during seizures. The method was applied to EEG recordings of seizures from three patients with focal temporal lobe epilepsy. In 16 of 19 recorded clinical seizures across these patients, at the start of seizures, a relatively consistent and distinct increase of density of inward connections at focal brain sites was observed, accompanied by an increase of density of outward connections at non-focal brain sites. For some seizures and patients reversal of this pattern was observed as seizures were progressing. Subclinical seizures did not exhibit such a consistent or distinct pattern of connectivity. These findings shed further light on the underlying mechanisms governing seizure spatiotemporal dynamics and could be useful in the elucidation of seizure generation, accurate focus localization and seizure control.

STUDY OF EPILEPTIC SEIZURE SUSCEPTIBILITY BY SPECTRAL ANALYSIS OF THE EEG

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Epilepsy is one of the most common chronic neurological disorders, characterized by recurrent unprovoked seizure activity. In this work, we investigated the susceptibility to seizures by spectral analysis of the electroencephalogram (EEG). Assuming that periods close to a seizure correspond to higher seizure susceptibility, we estimated a multitude of measures in 10 sec epochs from long-term intracranial EEG recordings (e.g., spectral band power at the traditional frequency bands, spectral entropy, median frequency) and for different time-spans (from 1 to 10 hours) of proximity to a seizure for an epoch to be characterized as near-seizure or far-seizure (two classes). Using the joint mutual information feature selection criterion we determined the features that were more pertinent to such a classification and, using Fisher's discriminant analysis, we trained and tested our classification algorithm to differentiate between the two classes, under a 10-fold cross-validation scheme. Application of our analysis to EEGs from two patients with temporal lobe epilepsy revealed that the most significant measures for classification were related to low frequency activity (delta and theta spectral band power) at focal sites and medium frequency (alpha spectral band power) at extrafocal sites, using a time span of 6 hours. The classification accuracy achieved between the two classes for the two patients was 97.6% and 92.7%. These promising results indicate that identification of seizure susceptibility periods may be possible by proper analysis of the EEG, which may lead to either preventing related to seizures injuries or seizures themselves via timely interventions.

QUANTITATIVE EEG ANALYSIS FOR DIFFERENTIATION OF SLEEP DISORDERS

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Sleep disorders are amongst the most commonly encountered health problems. About 12.7% of the US population suffers from some form of chronic sleep disorder. Accurate diagnosis of sleep disorders is important because they could be an indicator of or lead to serious condition, such as kidney disease, anemia, diabetes, Parkinson's, heart problems etc. A common category of sleep disorders is parasomnias that include periodic leg movement disorder (PLM) and rapid eye movement behavior disorder (REMBD). The aim of this study was to test the hypothesis that sleep disorders can be differentiated from one another through analysis of the sleep electroencephalogram (EEG). Measures of frequency characteristics (median frequency and spectral entropy) and complexity (Higuchi dimension) of the EEG signal were estimated for each sleep stage (the average value of the measure per stage was considered a distinct feature). Multivariate and Univariate Analysis of Variance (MANOVA & ANOVA) of the features were used to compare three groups of subjects: PLM (10 subjects), REMBD (22 subjects) and controls (11 normal subjects) (CAP sleep database - Physionet). Based on Higuchi dimension, ANOVA revealed statistically significant differences (confidence level $\alpha=0.05$) between the groups of PLM and REMBD during sleep stages 1, 2 and REM. Statistically significant differences between the control and the patient groups were observed via MANOVA after combining two features: the median frequency during stages 2 and 3. These results indicate that proper EEG-based analysis of sleep may assist in the differentiation of sleep disorders, and thus their diagnosis and treatment.

INFLAMMATORY RESPONSE TO TRAUMA: A PROSPECTIVE CLINICAL STUDY

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Traumatic injury is often accompanied with hemorrhagic shock, hemodynamic instability, exaggerated inflammatory response and multiple organ failure. Inflammatory mediators and cytokines are known to increase vascular filtration, and cause tissue edema during the inflammatory response that leads to increased morbidity and mortality. We hypothesize that patients with major orthopedic trauma demonstrate an elevated inflammatory response that is even more so exaggerated in the obese trauma patient. Sixty five adult trauma patients admitted to a Level I trauma service were enrolled. Approximately half of the participants were obese. Race, age, gender, BMI, New Injury Severity Score (NISS), and severity of head and/or extremity injury of the patients were recorded. Blood samples were collected 24 hours after admission. Each blood sample was analyzed for inflammatory and stress hormone components. Obese patients had longer length of hospital stay, higher plasma glucose levels, and BUN levels. The obese trauma patient also displayed an altered immune response with elevated inflammatory cytokine (IL-8), but lower anti-inflammatory cytokine IL-10 levels. These markers did correlate with longer hospital length of stay indicating that obese trauma patients have an exaggerated and altered inflammatory response. The results provided from this study will help us in elucidating future studies directed at treatment against the exaggerated inflammatory response in hopes of decreasing morbidity and mortality associated with trauma.

MORPHOLOGICAL EFFECTS OF GENISTEIN, THYMOQUINONE, 5-FU, AND LASER THERAPY ON LARYNGEAL CARCINOMA CELLS

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Low level laser therapy (LLLT) may enhance or decrease cell proliferation, but more on the stimulation side of cellular activities. The precise biochemical mechanisms underlying the therapeutic effects of LLLT are not yet well-established. From observation, it appears that LLLT has a wide range of effects at the molecular, cellular, and tissue levels. In addition, its specific modes of action may vary among different applications. Within the cell, there is strong evidence to suggest that LLLT acts on the mitochondria to increase adenosine triphosphate (ATP) production, modulate reactive oxygen species (ROS), and induce transcription factors. LLLT has shown promise for down regulating inflammation by reducing the presence of reactive oxygen species (ROS). In normal cells, high levels of ROS are damaging to the cells and the cells have the ability to squelch the production of ROS enzymatically. Cancer cells exhibit elevated levels of ROS due to their accelerated metabolism needed to maintain proliferation. The goals of this experiment were (1) to determine the effects of LLLT for a period of 30 minutes on laryngeal cancer cell survival; and (2) to determine the effects of natural chemotherapeutic agents or a known conventional chemotherapeutic agent, 5-FU, along with exposure to LLLT on cancer cell growth. Cells were treated with laser, Thymoquinone (TQ), Genistein (G), 5FU, or laser in the presence of TQ, G, or 5-FU for 30 minutes followed by incubation for a period of 24 hours. The cells were harvested and cellular protein, intracellular glutathione, and morphology were evaluated. The results show a decrease in cell numbers following treatment with TQ and 5 FU for 24, 48, and 72 hours, while genistein treatment showed changes in cell number after 72 hours. Interestingly, the cells in the presence of Laser were reduced within 24 hours, and treatments with Laser + 5-FU, Laser + G, and Laser + TQ were significantly reduced further than when given the compound alone. The results show that laser and chemotherapeutic interventions may be synergistic and beneficial treatment for laryngeal cancer. These findings are important since laryngeal cancer is difficult to resect, and laser therapy could be guided into the area to reduce the tumor size or used following resection.

MORPHOLOGICAL EVALUATION OF A549 CELLS FOLLOWING THE EXPOSURE TO OMEGA FATTY ACIDS IN CULTURE

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The A549 cell line in which is derived from adenocarcinoma human alveolar basal epithelial cells has been used as a model for cancer research. This cell line has shown good suitability as a model for respiratory studies due to presence of type II alveolar functionality. Additionally, this cell type secretes surfactant that contains phospholipids in which plays a major role in reducing alveolar surface tension. The objective of this study was to evaluate the morphological features of the A549 cells upon the exposure to low and high doses of omega fatty acids. Sterile aseptic techniques were followed throughout the experimentations by following standard lab protocols. Morphological evaluation was conducted by using two different standard staining protocols namely: hematoxylin & eosin (H-E) stain was used (to evaluate general qualitative assessment of cell characteristics); and The alcian blue stain (to identify mucin production and assess the ability of the cells to produce phospholipid surfactant). A549 cells were treated with a low and high concentration of flaxseed oil, providing omega 3•6•9 fatty acids and allowed to incubate for 24, 48 and 72 hours. The results of this study revealed: (i) at the end 24 hours of incubation, the cells showed slight indication of growth qualitatively compared to the control group; (ii) at the end 48 and 72 hours of incubation, an increase in growth was observed with islands of confluent cells forming when compared to the control group; (iii) maintenance of cell functionality was observed by evidence of alcian blue mucopolysaccharide staining in and around the peripheral of the cell; (iv) no visible signs of debris or cytotoxicity were noted at both low and high doses and at all three incubation intervals. The results of this pilot study suggest that the exposure of Omega fatty acids to A549 cells can provide an adequate matrix for defining and identifying the components of an asthma inflammatory condition. Further investigations are highly recommended to assess the quantitative measurements of cell viability, integrity and actual cell count as well as functional capacity.

IMPACT OF HEARING AID USE IN INDIVIDUALS WITH UNILATERAL SENSORY HEARING IMPAIRMENTS

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Unilateral sensory hearing loss poses particular hearing difficulty for individuals in the way of reduced localization of sound and understanding speech in the presence of background noise. At present it is not clear in the published literature whether conventional hearing aids help individuals with this kind of impairment. To assess this we evaluated the speech perception in noise and hearing handicap outcome of 22 individuals dispensed a hearing aid for a three month field trial. Our results were found to be consistent with distinct improvements in speech perception in noise, as measured by the Quick speech in noise test (QuickSIN), presented at 0 and 45 degrees azimuth, with speech and noise spatially separated in sound field, with and without a hearing aid. Also, we noted reduced self- perceived hearing handicap in these individuals, as measured by the abbreviated profile of hearing aid benefit (APHAB) questionnaire.

PREDICTING OVERALL SURVIVAL IN PATIENTS WITH METASTATIC MELANOMA ON ANTI-ANGIOGENIC THERAPY AND RECIST STABLE DISEASE ON INITIAL POST-THERAPY IMAGES USING CT TEXTURE ANALYSIS - A SECONDARY ANALYSIS OF A PHASE II PROSPECTIVE CLINICAL TRIAL

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Purpose: To predict overall survival (OS) in patients with metastatic melanoma on bevacizumab and RECIST Stable Disease (SD) on initial post-therapy images using CT texture analysis.

Materials and Methods: IRB-approved HIPAA-compliant secondary analysis of 44 patients with metastatic melanoma treated with bevacizumab. In patients with SD on the initial post-therapy contrast-enhanced CT (N=24, median OS 1.6 yrs), target lesions on the baseline and initial post-therapy studies were evaluated by RECIST 1.1. and CT texture analysis using TexRad software. **Results:** A change in target lesion mean positive pixels (MPP) was a strong predictor of OS (HR=10.1 for MPP change $\geq 10\%$ vs $< 10\%$, $p=0.004$). Percent size change and baseline LDH were also associated with OS (HR=1.3 for every 5% increase in size, $p=0.091$; HR=1.5 for every 100 IU/L increase in baseline LDH, $p=0.006$). A prognostic index containing these three factors separated patients into SD Favorable (N=15) and SD Unfavorable (N=9) with median OS of 2.4 and 1.0 yrs., respectively ($p<0.0001$). A combination of change in MPP and change in size of target lesions on the initial post-therapy CT and baseline LDH levels was highly accurate for predicating OS at 18 months (AUC=0.979). **Conclusion:** A model incorporating CT texture analysis of target lesions on the initial post-therapy CT images was highly accurate in predicting OS in patients with metastatic melanoma treated with bevacizumab

DIFFERENTIAL BIOTHERAPEUTIC ADVANTAGES OF HONEY IN TARGETING THE WARBURG EFFECT AND SURVIVAL OF MRC-5 AND A549 CELL LINES

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Lung cancer is a one of the most prevalent and deadly cancers in United States. Experimental evidence support that cancer cells do exhibit higher glycolytic rates than normal cells (Warburg effect). To exploit this unique cancer-dependent ATP generation phenomenon, we hypothesize that exposure of cancer cells to organic inhibitors of glycolysis would negatively impact their survival and alter their growth and viability resulting from the vast decrease in their essential glycolytic ATP production; no negative consequences will be seen on normal lung cells. The human lung fibroblast cell line MRC-5 and the human alveolar epithelial cell line A549 were used as models for normal lung and lung cancer in vitro in this study. Using standard methods, both cell lines were maintained and exposed to honey reagent at concentration levels ranging from 31.3-2,000 $\mu\text{g/ml}$ in 96 well plates in quadruplets and experiments repeated at least three times using MTT, and cell counting (T4 Cellometer) assays as well as phase-contrast photo-imaging. Our results indicate that exposure of both cell lines to this natural organic nutraceutic resulted in concentration dependent cell destruction/cell survival depending on the cell line exposed. Honey showed statistically significant ($p<0.05$) differential negative effects on the A549 line in comparison to its unexposed control as well as to its effects on the MRC-5 cell line. Results show a promising role of honey as a metabolite of interest for selective management of cancerous cells.

NOVEL APPLICATION FOR MONITORING COMPLIANCE WITH HAND HYGIENE AND ISOLATION ATTIRE AT A UNIVERSITY HOSPITAL

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Issue: Strict adherence to good techniques in hand hygiene (HH) and isolation precautions (IP) can prevent at least a third of infections acquired as a result of hospitalization. Compliance with these practices remains poor in many hospitals. Monitoring employees for compliance with these practices is costly, labor intensive, and may result in confrontation between observers and health care workers (HCWs). To facilitate observation for compliance and circumvent said problems we created a novel desktop and handheld computer application. Observed episodes of non-compliance generated instant email notifications to offenders with escalating penalties for repeated offenses. .

Project: Pilot project began on Sept 1, 2012, in four inpatient hospital wards. Monitoring in all wards began January 1, 2013 (25 inpatient units within 4 hospitals). A minimum of 80 observations per month were required for each unit. Data was collected by volunteer nurses, medical students, and unit secretaries. Data included: Name of observer and the person observed, date, time, unit, occupation, HH indication, the method used to perform HH, type of IP, and compliance with the required isolation attire. The application was linked to the human resources database and allowed the display of images of observed care providers, ending problems with mis-attribution.

Results: From January- December 2013, a total of 22,338 HH observations were collected from the four wards; 15,446 nurses, compliance 99%, and 2585 physicians, compliance 96%. Over three thousand HCWs were monitored for compliance with isolation attire; 2416 nurses, compliance 98%, and 334 physicians, compliance 99%. Rates of

infections were monitored prior to and after the application, as a secondary outcome, where the decline was detected in the number of hospital acquired central line associated blood stream infection.

THE EFFECT OF TRANSCUTANEOUS ELECTRICAL NERVE STIMULATION AT ACUPUNCTURE POINTS ON SPINAL MOTOR NEURON EXCITABILITY IN PEOPLE WITHOUT KNOWN NEUROMUSCULAR DISEASES

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Background and Purpose: Any changes in the Hoffmann reflex (H-reflex) reflect the changes in spinal motor neuron excitability. The purpose of this study was to determine whether transcutaneous electrical nerve stimulation (TENS), applied over the acupuncture points, would alter the soleus muscle's H-reflex. **Subjects:** Forty-five volunteers without known neuromuscular diseases (mean years of age=25, SD=7.3, range=21-47) were studied. **Methods:** Subjects were randomly divided into three groups: control (C), TENS stimulation at sensory threshold (ST) and 1.5 times sensory threshold (1.5 ST), and TENS was administered for 15 minutes. Stimulation intensity varied according to group assignment. H-reflexes were recorded before and at 0, 5 and 10 minutes after TENS. **Results:** H-reflex amplitudes significantly increased following TENS at both the ST and 1.5 ST in 10 minutes, whereas H-reflex amplitudes did not change in 0 and 5 minutes following TENS at both the ST and 1.5 ST. **Conclusion:** Both of the low and high-intensity TENS at the acupuncture points increase H-reflex amplitudes in subjects without known neuromuscular diseases. **Clinical Relevance:** This study suggests that TENS at the acupuncture points may facilitate the recovery of patient with diagnosis of stroke.

THE EFFECT OF MANNOSE-6-PHOSPHATE IN REDUCING TRANSFORMING GROWTH FACTOR PROLIFERATION OF MCCOY FIBROBLAST CELLS

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Surgically repaired tendons are plagued by complications related to the healing response. Adhesion formation between the tendon and its sheath or surrounding tissues inhibits free gliding and results in a loss of excursion. The random orientation of collagen deposition at the site of repair creates a focal area of weakness, thereby rendering the tendon prone to rupture at this point. Even the strongest, most technically precise repair can be negated by excessive scar tissue. No widely accepted therapy currently exists to promote healing and prevent fibrosis in surgically repaired tendons. Transforming growth factor beta (TGF- β) is considered the active factor during healing that leads to scar formation. It does so by binding with a mannose-6-phosphate/IGF-II receptor on the Golgi apparatus, which changes the extracellular matrix and ultimately leads to fibrosis. Therefore, inhibiting TGF- β may be one method to reduce scar formation. The goal of this study was to determine the effects of mannose-6-phosphate (M6P) in inhibiting transforming growth factor β 1 (TGF- β 1) proliferation of fibroblast cells. McCoy fibroblasts were treated with low, medium, and high concentrations of mannose-6-phosphate for periods of 24, 48, and 72 hours, and with low, medium, and high concentrations of TGF- β 1 for periods of 24, 48, and 72 hours. Cell proliferation, damage, and morphology were evaluated at each time point. The results show that low dose TGF- β 1 treatment resulted in significant increases in cell number with distinct cytological changes within 48 hours of treatment. Mannose-6-phosphate reduced cell number within the first 48 hours and appeared to be dose dependent. A competitive assay was then developed using low concentration TGF- β 1 and medium concentration M6P at 48 hours to determine if M6P could interfere with TGF- β 1-induced fibroblast cell growth. Cell proliferation, damage, and morphology were evaluated. The results show that M6P is capable of reducing TGF- β 1-induced fibroblast proliferation, and it is suggested that this effect is through competitive inhibition of the M6P/IGF-II receptor of fibroblasts.

PLATELET-RICH PLASMA EFFECTS ON HEALING TISSUE INTERFACES: HISTOLOGICAL ANALYSIS IN A SPINAL DECOMPRESSION MODEL

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OBJECTIVE: To analyze the effects of autologous platelet-rich plasma (PRP) on soft tissue healing in the setting of laminectomy for spinal decompression. The focus will be on the characteristics of the tissue at bone and soft tissue interfaces. Our hypothesis was that PRP would create an ideal environment that enhanced the ability of soft tissues to heal without fibrosis that may contribute to epidural fibrosis or failed back syndrome.

METHODS: Thirty male Sprague Dawley rats were randomly divided into three equal groups evaluated at two time points. Laminectomies were created in twenty rats in two groups, and half received PRP treatment. Specimens were harvested at two and four weeks to evaluate soft tissue healing, at the bone soft tissue interface, both grossly and histologically.

RESULTS: The histological characteristics of the tissue planes surrounding the posterior spinal elements in the PRP treated animals grossly resembled control animals with the exception the layers were denser than control or sham. The color and texture of the tissues adjacent to the remaining lamina and spinous processes in the sham group were darker and irregularly configured. Microscopically the PRP treatment resulted in thicker more organized layers of muscle and fibrous tissue overlying the dura and bony elements. The PRP treatment groups consistently formed a band of tissue with characteristics of osteoid that served as a reattachment site for the muscle and soft tissues that had been released. There was also increased vascularity at these interfaces in the PRP group when compared to both control and sham.

CONCLUSIONS: Platelet derived growth factors have an impact on soft tissue healing when introduced to the local environment following injury. In this laminectomy model the resultant interface between bone and healing soft tissue was enhanced with an additional layer of tissue that served as a reattachment site for muscle fibers to bone. At the time of specimen harvest the muscle that was detached during the approach for laminectomy was more vascular and contained an adipose component after treatment with PRP when compared to sham.

THE EFFECTS OF SUSTAINED DELIVERY OF ESTROGEN ON BONE STRENGTH AND CARDIOVASCULAR PANELS IN OSTEOPOROTIC FEMALE RATS

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Osteoporosis and cardiovascular disease (CVD) are common age-related conditions, which are major public health problems leading to an increase in mortality, morbidity, and disability. There have been several connections found between CVD and osteoporosis such as common genetic factors, risk factors, and pathological mechanisms. There is a direct effect of estrogen on CVD and osteoporosis that is demonstrated by the manifestation of estrogen receptors on osteoblasts, osteoclasts, and vascular endothelial and smooth muscle cells. Loss of estrogen has been found to be involved in the pathogenesis of atherosclerosis and bone loss through modulation of other factors including cytokines and oxidized lipids. The goal of this proposed research was to determine if sustained delivery of estrogen is capable of regulating bone cell function while improving cardiovascular panels. Ovariectomized Sprague Dawley rats were administered estradiol at a rate of 5ng/day over an eight-week period. Body weights, estradiol levels, cholesterol levels, and bone strength were determined at 2, 4, and 8 weeks following sustained delivery of estradiol and compared with intact control and ovariectomized control animals. Estrogen replacement resulted in improved cholesterol panels without significant changes in bone flexural strength or improvements in bone porosity. Additional long term studies are needed to determine if the benefits of estrogen replacement outweigh the inherent risks associated with hormone replacement therapies.

SPHEROID ORGANIZATION AND ADIPOGENESIS ON COPOLYMERS OF ELASTIN-LIKE POLYPEPTIDES

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In this paper, we have demonstrated spheroid formation and differentiation of primary human adipose-derived stem cells (hASCs) with respect to spheroid dimensions and functional markers (protein and triglyceride accumulation, Oil red-O staining, CD36 expression). We propose spheroid culture techniques to be especially beneficial to adipogenesis by promoting cell-cell interactions and down regulating mitosis by minimizing surface interaction. Our spheroid culture also provides the unique benefit of maintained surface anchorage while allowing uninhibited cell expansion during lipogenesis.

THE EFFECTS OF SUSTAINED DELIVERY OF ANTIOXIDANTS ON LPS STIMULATED RAW 264.7 MACROPHAGES

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The use of sustained drug delivery has been implicated as a means of improving the effectiveness of epigallocatechin-3-gallate (EGCG) and thymoquinone (TQ). Both of these antioxidants are dose dependent in their actions; therefore, finding the most effective dose may offer a better understanding of the mechanisms of each of these antioxidants actions. Further, finding the most effective dose and utilizing it in a sustained method could offer an even better scenario. The goal of this study was to determine the effects of sustained delivery of EGCG and/or TQ on macrophages challenged with lipopolysaccharide (LPS). Tricalcium phosphate (TCP) capsules were loaded with EGCG (10 μ M) and/or TQ (10 μ M) and placed in wells containing macrophages challenged with LPS (0.01 μ g/mL) for 72, 96 and 120 hours. Cellular viability was assessed by cell number and cellular morphology. Cellular glutathione levels, malondialdehyde and nitric oxide levels determined cellular function. Inflammatory markers were quantitated by the use of multiplex ELISA technology. Nitric oxide levels remained elevated in all treatment groups, with the highest observed in the EGCG treatment group. Prolonged delivery of LPS on EGCG and TQ treated cells had various effects on the secretion of activated cytokines, including TNF- α , IL-1 α β , and IL-6, as well as the anti-inflammatory, IL-10. This study suggests that sustained delivery of EGCG and/or TQ may not be able to efficiently reduce the effects of prolonged LPS stimulation.

THE USE OF ANTIOXIDANTS TO SUPPRESS THE SK-OV-3 CELL LINE IN OVARIAN CANCER

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Ovarian cancer is the leading cause of mortality among the gynecologic cancers and is the 5th most common cancer among women. Recent studies have indicated that antioxidant exposure may slow the progression in major neoplastic diseases. The objective of this study was to investigate the pathophysiological effects of Thymoquinone (TQ) and Epigallocatechin-3-gallate (EGCG) using the SK-OV-3 cell line as a model. A total of 72 wells were plated with (10^5) SK-OV-3 ovarian cancer cells according to standard lab protocols. Each group was subdivided into 4 groups of 6 wells each. Group 1 served as control and groups 2, 3, and 4 were treated with TQ (16 μ M), EGCG (3 μ g/ml), and TQ + EGCG, respectively. Biomarker and morphological evaluations were performed following standard lab techniques. The results of the study revealed: (1) an increase in cellular protein concentration of the combination at 24 and 48 hours phases ($p < 0.05$); (2) an increase in nitric oxide following administration of EGCG and the combination at 24 and 48 hours; conversely at 72 hours, there was no significant difference between all agents ($p < 0.05$); (3) TQ and EGCG were shown to induce intracellular oxidative stress (glutathione levels) at the end of 72 hour phase; (4) there were no membrane or cellular damage to the cells at all phases. 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 in culture.

EVALUATING EFFECTIVENESS OF LABORATORY TRAINING OF CYTOTECHNOLOGY STUDENTS USING TURNINGPOINT, A PRODUCT OFFERING OF TURNING TECHNOLOGIES, INC.

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The newly developed software called “TurningPoint” represents one of the leading assessment delivery and data collection solutions for learning environments. It not only creates interactive presentations, but is proven to enhance effective instruction, increase knowledge retention, engage participants, and immediately assess understanding. TurningPoint includes data collection systems that securely transfer digital data for various assessment, testing, and certification programs. Today, an estimated six million Response Card keypads have been delivered to K-12 schools, universities, and businesses worldwide. The objectives of this study were to implement an interactive clinical diagnosis reporting system that would evaluate learning and student understanding, and that would be able to provide immediate feedback to the students. The clinical materials consisted of 1200 cases (150 cases per student) to be evaluated. Cytologic cases from five major diagnostic categories were selected, randomized, assembled into sets, and evaluated by students. The students were asked three questions on each case, which included their targeted diagnosis, specimen adequacy statement, and any other reportable finding. TurningPoint technology (the “Clicker”) was used to collect a student’s final answers. Cytotechnology faculty then printed out student responses, reviewed any discordant cases at the multiheaded microscope, and ultimately generated a final grade for the each individual session. Overall, the student’s responses in all five diagnostic categories progressively improved for the entire duration of the course involved. In conclusion, observations obtained from this study suggest that TurningPoint technology proved to be an effective tool in providing excellence in education for cytotechnology students.

THE EFFECTS OF SUSTAINED DELIVERY OF ESTROGEN ON THE GLOMERULI PATHOLOGY

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Several studies have indicated that estrogen replacement therapy in post-menopausal women may interfere with the functional capacity of the renal system. This study hypothesize that sustained delivery of estrogen will alter the glomerular function. The specific objective of this investigation was to evaluate the effect of physiological dose (10-20 pg/ml) of sustained delivery of estrogen on the glomerular histopathology using adult ovariectomized adult rats as a model. A total of 60 rats were divided into four equal groups and served as intact, control, sham (OVX), exposed to sustained delivery of E, respectively. At the end of 2, 4 and 8 weeks post treatment 5 animals from each group were sacrificed and the kidney were removed, fixed and processed for histopathological evaluation following standard laboratory protocols. The results of this study demonstrated that the wet weights of the kidneys collected from estrogen treated animals has shown a slight increase in weight compared to intact animals ($p < 0.05$). Histopathological evaluation revealed that the glomeruli appeared slightly larger in the E treated animals compared OVX, Sham and intact animals. This observation may contribute to a functional change in the filtration rate and has to be taken in consideration in the renal function assessment.

MORPHOLOGICAL CHANGES TO LNCAP CELLS SUBJECTED TO TREATMENT WITH EPIGALLOCATECHIN-3-GALLATE, THYMOQUINONE, AND TANNIC ACID

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Research studies on nutritional supplements and cancer risk has demonstrated that antioxidants and their derivatives play a major role in combating prostate cancer and reducing the risk of prostate cancer in men. It has been suggested that ample amounts of antioxidants, such as vitamin E, selenium, and their constituents may be effective in decreasing both the risk and incidence of prostate cancer. Epidemiological studies have evaluated these agents in certain populations and in specific prostate cell lines to compare the risk reduction as well as the magnitude of risk reduction [1,2]. The aim of this study was to use the human LNCaP prostate cancer cell line to analyze the morphological effects of conventional treatment with low and high doses of epigallocatechin-3-gallate (EGCG), thymoquinone (TQ), and tannic acid (TA) at 24, 48, and 72 hours. After 48 and 72 hours of incubation, the groups treated with the lower doses of EGCG, TQ, and TA revealed hyperchromatic, irregular, and fewer cells. Upon treatment with higher doses of EGCG and TQ, cells were also irregular and fewer in number after 48 and 72 hours of incubation. Overall findings of this study showed suppressed cell growth and cell number after conventional treatment with EGCG, TQ, and TA. This suppression may be due to disruptions in several cell-cycle checkpoints and the role of antioxidants along with their chemopreventive properties. Further research is needed in this era to assist with remedies for prostate cancer prevention.

FROM EMERGENCY DEPARTMENT TO PRIMARY CARE: CONTINUITY OF CARE

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Lack of proper handoff communication at patient care transition points contributes to medical errors, mistakes or near misses resulting in adverse patient outcomes including death(1). Patient safety is dependent upon accurate communication in health care (2). One of the most crucial points of communication occurring in the health care setting is from hospital to home and even more critical is the discharge from the emergency department to home (3). We examined the effect of the electronic Emergency Provider Written Plan of Discharge *e*EPWPD on outpatient testing and primary care follow-up. We reviewed the medical records of 132 low risk chest pain patients prior to the *e*EPWPD and 226 low risk chest pain patients after the implementation of the *e*EPWPD comparing the number of days for outpatient stress-test/myoview and primary care follow-up days. Two independent sample t-tests were performed on the pre-*e*EPWPD and post *e*EPWPD days to compare the two groups. Results showed that both outpatient stress-test/myoview days (mean= 78.78 ± 13.82 SE vs 36.97 ± 7.12 SE; p-value = 0.008) and primary care follow-up days (mean=90.30 ± 13.81 SE vs 49.69 ± 7.39; p-value = 0.01) were significantly higher in the control group. We conclude that the *e*EPWPD handoff communication appears to positively impact the safety and continuity of care for the patient discharged from the emergency department.

STATISTICAL DECISION MAKING ON HOW TO SELECT THE BEST STATISTICAL TECHNIQUE

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Statistics is very much used in the decision making process in our lives. Statistics can be a very challenging issue for many investigators and graduate students involved in research, because there are numerous statistical tests to select from. There are many different statistical methods that can be used in different situations. Decision of how to evaluate data must be the most important first step in planning a study. This poster presentation starts with several questions to answer before selecting appropriate statistical method for testing a particular hypothesis. Remarks of important factors to consider before choosing a statistical test will be given. Such factors including: type of independent and dependent variables, scale of measurement for the variables under study, number of groups in the study, and the assumptions of the selected test. Description of various variables, scale of measurements will be given.

Also, a broad overview of different available statistical procedures (parametric and non-parametric) with associated assumptions to help in the selection process will be demonstrated. When reporting results, it is important that the tests used are appropriate for the type of data that have been collected otherwise conclusions made may not be valid. Investigators may need to communicate effectively with statisticians so that the best way of handling data is achieved.

INDUCTION OF INTERLEUKIN-6 UPON THE SUSTAINED DELIVERY OF DANAZOL USING ADULT RATS AS A MODEL

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The specific objective of this study was to evaluate the physiological responses associated with sustained delivery of Danazol (D) through hydroxyapatite phosphate lysine (HAL) devices in a rat model. A total of twenty four rats were distributed randomly into three equal groups. Rats in group II were implanted (S/C) with empty HAL devices and served as sham controls. Group III rats were implanted with 1.61 (5ng/ml) g/cm³ devices containing 80 mg D each. Group I animals served as unimplanted controls. Upon sacrifice (6 weeks), the vital and reproductive organs were collected, fixed, embedded, and sectioned (H&E) by using standard lab protocols. Blood samples (500 ul) were collected three times per week and processed for biochemical analysis. Data obtained from this study revealed that HAL devices were capable of releasing D at sustained levels for 6 weeks. The release profiles ranged between 5 to 9 ng/ml serum. Biochemical analysis of the serum revealed that there is remarkable reduction in LH, FSH, and IL-1 (52%) . In contrast, the level of IL-6 increased (58%) in experimental animals compared to the sham operated animals. Histopathological evaluation showed an increase the wet weights of ventral prostate as well as an atrophied testicular tissues upon the exposure to D compared to control animals. There were no significant changes observed in vital organ tissues (spleen, kidneys, adrenals and heart). In addition, physiological levels of D could cause severe prostatic hypertrophy and regression to spermatogenesis after 6 weeks in rats.

ASSESSING THE MORPHOLOGY OF HUMAN GINGIVAL FIBROBLASTS UPON EXPOSURE TO DENTAL ADHESIVES IN THE PRESENCE OF *PORPHYROMONAS GINGIVALIS* LIPOPOLYSACCHARIDE

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This study aims to assess the morphology of human gingival fibroblasts upon exposure to dental adhesives in the presence of *Porphyromonas gingivalis* lipopolysaccharide (*LPS-PG*). Dental caries is not the only common disease of the oral cavity; periodontal disease has significant prevalence in the adult population. The fibroblasts were exposed to 0.1g of dental adhesives (PMMA, OptiBond®, and Prime & Bond®) in combination with *Porphyromonas gingivalis* lipopolysaccharide (2 µL) at phases of 24, 48, and 72 hours. At 48 hours, the cells exposed to the Prime & Bond® adhesive combined with *LPS-PG* (25.954±4.153 IU/mg Protein) demonstrated statistically significant increase (P=0.003) in LDH activity in the media compared to the control (7.014±1.395 IU/mg Protein). No significant differences in intracellular levels were detected at 24, 48, or 72 hours. Morphological evaluation at all phases demonstrated that the exposure of the cells to the three dental adhesives in combination with *LPS-PG* did not induce major toxicity or significant cellular death. While our morphological assessment did not provide evidence of structural damage of the cells, our biochemical analysis verified that at some level there was cellular damage.

DESIGN AND OPTIMIZATION OF A HIGH POWERED HYPERSPECTRAL ILLUMINATION SOURCE FOR PRE-CLINICAL AND CLINICAL IMAGING

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Hyperspectral light guides offer a variety of applications within the biomedical field such as in endoscopic cancer detection, noninvasive skin cancer detection, live-cell imaging, and transcutaneous oxygen monitoring. Exploration of solid, hyperspectral LED light guides is a novel approach in light transmission optics offering a much needed cost, space, time and effective alternative to current illumination sources in hyperspectral imaging. In this study, a hyperspectral illumination source, consisting of a solid Plexiglas light guide and narrow band LEDs was modeled, and its design and geometric configurations analyzed for optimization. 3D light guide geometries designed in Autodesk Inventor were imported for testing in TracePro, an optical raytrace software. Monte Carlo raytracing (10^6 rays/LED) realistically modeled light transmission through the light guide. Total entering and exiting light fluxes were used to calculate percent light transmission through the tested geometry, and used as a basis for geometric light transmission efficiency. Arc radii lower than 50mm and bends with angles $180^\circ \geq \varphi \geq 0^\circ$ decreased light transmission. In opposite, consecutively curved models, light transmission is more dependent on the primary curve arc radius than the secondary at arc lengths ≤ 50 mm. Light pipes such as those modeled offer a potential solution for translating sophisticated hyperspectral imaging technologies to clinical imaging applications.

Saturday, April 12, 2014

SESSION IV (IMAGING/DATA MANAGEMENT)

AN EXCITATION-SCANNING HYPERSPECTRAL MICROSCOPE FOR BIOMEDICAL IMAGING OF GFP IN HIGHLY AUTOFLUORESCENT LUNG TISSUE

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Hyperspectral imaging techniques have recently been applied to many biological applications to improve isolation of individual fluorophores in multi-label samples and identify fluorophores in the presence of highly autofluorescent tissue. Hyperspectral imaging is traditionally performed by collecting fluorescence emission over a broad wavelength range (emission scanning). However, significant light loss and long acquisition times can result from filtering the emission light.

Excitation scanning is a novel method of hyperspectral imaging that may provide higher sensitivity for detecting fluorophores than traditional emission-scanning techniques. Excitation scanning is performed by filtering the excitation light over many wavelengths, and subsequently collecting the emission at each excitation wavelength. This results in higher available signal, and shorter acquisition times.

Here, we report implementation of an excitation-scanning hyperspectral imaging microscope and preliminary results comparing excitation scanning to emission scanning. A comparative study was conducted using a model of lung injury featuring GFP-expressing pulmonary microvascular endothelial cells (PMVECs) in highly autofluorescent lung tissue. Our results indicate 1-2 orders of magnitude increased signal detection using excitation-scanning techniques compared to emission-scanning, and improved sensitivity for detection of GFP in autofluorescent lung tissue. Our future work will further test the efficacy of excitation scanning compared to emission scanning for applications in FRET detection, multi-label studies, and detection of changes in autofluorescence due to lung cancer.

HYPERSENSITIVITY FRET IMAGING AND ANALYSIS APPROACHES TO DETERMINE cAMP COMPARTMENTALIZATION IN PMVECS

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In the last 20 years, the importance of cAMP compartmentalization has been clearly demonstrated. These compartmentalized cAMP signals have differential effects in maintaining the pulmonary microvascular endothelial cell (PMVEC) barrier integrity. Several studies suggest that phosphodiesterases (PDEs) are key enzymes in regulating the spatial spread of cAMP signaling. PDE4 is primarily responsible for cAMP - PDE activity in PMVECS. However, the distribution of different PDE4 isoforms in PMVECS and their contribution cAMP compartmentalization is not well understood. This lack of knowledge is due in part to the dearth of studies that measured the localized cAMP signals and altered PDE localization and activity. State of the art probes for measuring cAMP signals in cells are based upon Förster resonance energy transfer (FRET). However, FRET signals are difficult to interpret due to weak signal strength and limited dynamic range. In this present study, we have used hyperspectral and analysis approaches to quantify multi-label FRET data with increased signal-to-noise ratios. To assess cAMP localization, we used soluble and plasma membrane targeted cAMP biosensors expressed in PMVECS isolated from wild type and PDE4A, B, and D knockout mice. This study provides preliminary information indicating the role of PDE4 isoforms in regulating the complex and spatially-distributed cAMP signaling in PMVECS. In future work, we plan to assess the spatial distribution of different PDE4 isoforms using isoform-specific antibodies. We will also investigate the role of different PDE4 isoforms in regulating the pulmonary endothelial barrier integrity.

TRANSVERSE RELAXATIONS OF SELECTIVELY EXCITED METABOLITES IN STROKE AT 21.1 T

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High magnetic fields can enhance the spectral sensitivity of Magnetic Resonance Spectroscopy. In this study, we used a 21.1-T magnet to investigate the apparent transverse relaxation (T_2) of metabolites under ischemic stroke. We utilize the Longitudinal Relaxation Enhancement (LRE) phenomena to measure T_2 -relaxation of selectively excited metabolites relevant to stroke to investigate their potential as stroke biomarkers. Spectra from the T_2 modified LRE sequence was of high fidelity, and importantly, no water contamination was observed. T_2 relaxation times were extractable, and variations in both T_2 and signal-to-noise ratio are seen. The apparent T_2 relaxation times of metabolites proved to be longer than expected, ranging from 101 ms (lactate) to 198 ms (N-acetylaspartate, NAA). At the investigated time point (24-h post occlusion), no statistically significant difference was seen for each respective metabolic T_2 when comparing the ipsilateral and the contralateral side. At only 16 averages, SNR for the shortest TE ranged from 11 (lactate on contralateral side) to 97 (choline on contralateral side) showing the increased sensitivity of using this sequence at ultra-high field. SNR measurements show significant difference between the ipsilateral and contralateral side for creatine (Cre) and NAA. These long T_2 s are interestingly accompanied by rather short T_1 s (~0.8 – 1.8 seconds). SNR measurements show significant difference between the ipsilateral and contralateral side for Cre and NAA. These findings suggest that the modified LRE sequence at high field increases MRS sensitivity and can potentially be used as biomarkers for stroke recovery.

FRACTAL DIMENSION BASED DETECTION OF ARCHITECTURAL DISTORTION ANOMALIES IN MAMMOGRAPHY

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Breast cancer is one of the devastating, deadly diseases for women nowadays. Computer-aided detection (CAD) can assist radiologists in improving the mammographic screening process by suggesting mammographic regions with suspicion of malignancy. Architectural distortion (AD) is one of three common mammographic signs of breast cancer. The mammographic signs of AD can be easily confused due to the limitations of 2-D mammography and/or the effect of the superimposed tissues. As a result, AD is often missed in screening mammography by both radiologists and commercial CAD system. Although architectural distortion is such an important anomaly in breast cancer detection, very few detection algorithms have been developed in the literature. Fractal dimension based methods presents promising alternative to tackle problems in biomedical image processing field. The implemented algorithm analyzes and detects architectural distortion anomalies by utilizing fractal theory. Fractal analysis is a popular technique in biomedicine as increasingly more studies are being done to analyze many complex physical phenomena. The fractal dimension represents the rate of additional structural detail as the measurement scale changes. In mammography, normal breast parenchyma behaves as a fractal object. If any anomaly exist in breast parenchyma structure, that self-similarity behavior is disrupted and indication of anomaly. Therefore, the calculated fractal dimension for an image with architectural distortion should be lower than the fractal dimension of normal image. This algorithm has been developed to evaluate if fractal dimension can be applied effectively to indicate the presence of architectural distortion in screening mammograms. This paper presents the results in detail using publicly available DDSM mammography dataset.

SMALL CLINIC DATA MANAGEMENT SYSTEM

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Clinic Management systems are essential for tracking patient information, billing and scheduling appointments. Healthcare software systems are created to computerize manual operations in clinics. This Clinic Data Management system is tailored to manage day-to-day operations within a small clinic. It is a simple and cheap Desktop software solution that can be easily deployed and used. It identifies key information system characteristics and uses the software development life cycle to guide the implementation of the system as a proof-of-concept. Java Swing and MS Access technologies are used to create the software.

SESSION V (CVD/HEALTH CARE)

Special Presentation

STRESS-STRAIN ALTERATIONS IN THE MYOCARDIUM INDUCED BY MICROGRAVITY: A FINITE ELEMENT MODEL OF THE HEART

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Previous studies during have demonstrated a loss of ventricular mass after prolonged exposure to microgravity that is associated with changes in cardiac function. By Laplace's law, the geometry of the ventricle is important in determining the segmental wall stress. If microgravity exposure results in variations in the ventricular geometry then these changes could cause adjustments in the normal myocardial stress/strain patterns that might induce cardiac remodeling during extended spaceflights. This study analyzes the theoretical impact of microgravity on changes in the geometric conformation and stress strain patterns of a finite element mesh model (FEM) created from the 3-dimensional geometry of the left ventricle (LV) and attributed with material properties consistent with myocardial tissue. The Geometric Aspect Ratios (GAR, length to width quotient) of the LV were compared during simulations of the upright diastolic position in Earth's gravity and in microgravity. The application of microgravity conditions to the FEM model resulted in a 3.65% lower GAR of the LV as compared to that calculated for Earth's gravity. The stress and strain patterns of the myocardial wall were also modified especially around the base of the heart. This finding suggests that microgravity exposure could potentially result in changes in the ventricular radius of curvature and alter the segmental myocardial wall stress.

DEVELOPMENT OF A NOVEL BENCH-TOP MODEL TO MIMIC THE LOWER EXTREMITY ARTERIES AND STENT MECHANICS

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Atherosclerosis is the leading cause of heart attacks and strokes in the U.S., accounting for up to 800,000 deaths annually. Metallic stents are the number one choice to re-open clogged arteries but problems caused by stent fracturing are hindering their effectiveness. This is especially common in the superficial femoral artery and is reported to be more widespread of a problem in this area of the body than others. This high rate of fracturing is believed to be caused by the unique combination of biomechanical forces that the artery experiences in day to day activities. Although standalone failure tests are performed quite regularly on stents, the problem still continues. A different approach is needed to identify the specific cause of failure in these stents and its impact on the biological performance. Therefore, the purpose of this project was to design and build a medical testing device that can subject a stent to the axial and torsional biomechanical forces experienced by stents deployed in femoral arteries. The system was developed by utilizing a linear actuator to mimic the axial forces, and a servo motor to mimic torsional forces. All of these components were controlled using a custom LABVIEW© interface. The system is capable of linear movement at a rate of one inch per second and can deliver torsional force at any angle between zero and ninety degrees. The developed novel system is thus capable of mimicking a wide range of motion to better elucidate the relationship between biomechanical factors and device durability.

TARGETED THERAPY TO TREAT CARDIOVASCULAR CALCIFICATION IN ESRD PATIENTS

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Vascular disease is the leading cause of death in populations suffering from advanced stages of chronic kidney disease (CKD). Cardiovascular calcification increases the risk of cardiac morbidity and mortality in sixty to eighty percent of

dialysis patients with end-stage-renal-disease (ESRD). This paper will focus on developing a drug delivery system to de-mineralize calcified regions of the artery wall that cause arteriosclerosis in ESRD patients and provide preventative therapy to dialysis patients with early stages of CKD.

We are proposing a targeted drug therapy to reverse vascular calcification in patients with ESRD. A pH responsive polymersome will be developed for intravenous administration to carry, and release Fetuin-A to sites of calcification by binding to matrix (Gla) proteins (MGPs) when blood pH drops below 7.4. Fetuin-A, an inhibitor of extra-skeletal calcification, is made to solubilize calcium-phosphate minerals. MGPs inhibit soft-tissue mineralization and are up-regulated when pH falls below 7.4. Recruited to sites of calcification MGPs accumulate in the calcified lesions. Surface receptors on the polymersome will bind to MGPs present in calcified regions causing the targeted release of the drug Fetuin-A.

Our drug delivery system aims to improve the life expectancy of dialysis patients, especially non-transplant candidates and those on a transplant waiting list. Re-establishing physiological levels of Fetuin-A with targeted drug-delivery should reverse the pathological calcification in ESRD patients. In addition to providing a therapy for arteriosclerosis we aim to actively reduce the risk of cardiac morbidity and mortality associated with vascular calcification in dialysis patients with early stages of CKD.

CARDIOVASCULAR RESPONSE TO TWO AND FOUR MINUTES WALK USING A STANDARD WALKER AND/OR PLATFORM WALKER WITH WHEELS IN ONE FOOT NON-WEIGHT BEARING INDIVIDUALS

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This study examined cardiovascular responses to different times of walk (two and four minutes), using standard walker and/or platform walker with wheels in one foot non-weight bearing individuals. Few studies have explored the physiological impact of various walkers and different walk times on the cardiovascular system. Male and female physical therapy students, (n=18, ages from 22 to 32 years) were studied at two different time periods. In Phase I, participants ambulated with a standard walker (SW) and a platform walker with wheels (RW) for 2 minutes. The heart rate (HR), respiratory rate (RR), and blood pressure (systolic blood pressure (SBP) and diastolic blood (DBP)) before and after walk were recorded. Phase II consisted of the same participants and the same vital sign measures but they ambulated for 4 minutes. Participants ambulated at a self-selected pace. ANOVA was used to determine statistical significance and a confidence interval of 95% or a p value <0.05 was considered significant. Results indicated that ambulation for 2 or 4 minutes produced a statistically significant difference ($p < 0.05$) between before and after measurements of HR, SBP, and RR for SW, RW and DBP (for four minute walk using RW only). Remaining DBP differences were not significant ($p > 0.05$). When all groups in each of the vital signs studied were compared, there was no statistical significant difference. Our study suggests that ambulation using any of the gait devices in 2 or 4 minutes walks significantly increased the vital signs of HR, PR, SBP and DBP (in only four minute walk using a platform rolling walker). It is highly suggested that extra precaution be taken when initiating ambulation especially in elderly patients after trauma and with other co-morbidities.

OSTEOCLAST-MEDIATED DEMINERALIZING OF MEDIAL VASCULAR CALCIFICATION

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Vascular calcification is a cardiovascular disease divided into two distinct areas: intimal and medial. Intimal calcification involves plaque build-up in the arteries, which in turn leads to heart attack and stroke. Medial calcification is result of mineral deposition in the interior walls of the arteries. This results in complications including hypertension, heart attack, and stroke. Interestingly, research has shown that medial vascular calcification is physiologically similar to bone development in the body. Bone remodeling is a process that occurs continually in the body. This process keeps bone mass consistent through the continual resorbing of bone by osteoclasts and deposition of bone by osteoblasts. Smooth muscle cells in the artery walls are differentiating into osteoblast-like cells and

depositing mineral inside the artery walls. Evidence has shown that osteoclast cell therapy is a potential pathway for treatment of vascular calcification. In this therapy, osteoclasts would resorb mineral the same way bone remodeling is done *in vivo*.

By introducing osteoclasts to sites of calcification, it is hypothesized that mineralization can be resorbed. To introduce osteoclast-like cells to sites of calcification, monocyte differentiation is a potential option. Monocytes are mobile inflammatory response cells normally found in bone and are also commonly found at sites of high calcification. Additionally, monocytes have the capacity to differentiate into osteoclast-like cells under the right conditions. Our objective is to take advantage of this by demineralizing vascular calcification through differentiation of monocytes to osteoclast-like cells *in vitro*.

FINITE ELEMENT ANALYSIS OF ARTERIAL VESSEL WALL STIFFNESS

Angel Huot, Saami K. Yazdani

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Department of Mechanical Engineering

Coronary artery disease (CAD), which is the most common type of heart disease, accounts for nearly 400,000 annual deaths. In the coronary arteries, it is well established that plaque development correlates to endothelial cell (EC) dysfunction. ECs, which are strategically located at the interface of circulating blood and the vascular wall, sense and respond to their local mechanical environment. In addition to wall shear stress and cyclic strain, EC coronaries are exposed to varying wall stiffness values due to the cardiac contraction (motion of the heart). According to the wall strain-stiffening phenomenon, high stress sites correspond to stiffer sites in the arterial wall. The purpose of this investigation was to therefore compute stress and strain values with varying modulus values within an arterial vessel. A vessel with an inner radius of 2.9 mm and wall thickness of 0.6 mm was modeled as a linear elastic material. The modulus ranged from 0.02 MPa to 0.80 MPa. The vessel was then pressurized 80 and 120 mmHg and the peak stiffness compared.

Results indicated that higher stresses occurred at the transition of change in modulus. As the model became stiffer, the stress was increased to values up to 152% of baseline levels. These results demonstrate the significance of increased wall stiffness in vessels with varying modulus and the potential adverse impact on endothelial cell function due to these increased wall stress values.

SPECTRAL- AND TIME-DOMAIN ANALYSIS OF HEART RATE VARIABILITY SIGNALS FROM MULTIPLE PHOTOPLETHYSMOGRAPHIC (PPG) SENSORS

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Spectral and Time domain analysis of Heart Rate Variability (HRV) signals is widely used as a quantitative marker of the Autonomic Nervous System (ANS) activity. A robust algorithm was developed to derive HRV from photoplethysmographic (PPG) signals, compute FFT- and AR-based spectra of these signals, and determine their time- and frequency-domain features. This algorithm has detrending, sample-rate reductions, false-peak removal, automatic peak detection, peak-to-peak (PP) interval detection and correction, HRV signal generation, and spectral- and time-domain feature extraction from the HRV signal. Adapting to the very low spectral contents of the input PPG signal is very helpful in reducing the processing/computational effort. Standard spectrum estimation and measurements on the HRV signals were performed to generate spectral features, such as the LF/HF ratio, to quantify parasympathetic influences and sympathovagal balance. To validate the efficacy of the algorithm, PPG signals were recorded under different conditions such as stimulating an acupuncture point using a nanoscale patch, measuring relaxation after exercising, and others which are known to elicit changes in the ANS activity. Significant differences in LF/HF were observed due to these effects. The pNN50, a time domain measure of PP interval variability, was also considered for quantifying ANS activity and exploring its correlation with spectral features. Finally we used multiple sensors placed on different fingers to record PPG signals and to confirm that their respective spectral analysis was almost identical. We observed that a multiple sensor approach could be used to effectively reduce the impact of motion artifacts and of deterioration of signal quality due to loss of good PPG sensor contact.

INTELLIGENT MEDICATION DISPENSER

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This paper describes a system that utilizes smart devices to alert the user when medications (Pills or Tablets) are not taken on time. The system comprises a multi compartment box in which medications are stored. Each compartment houses the medications to be taken at a particular time. All compartments are equipped with a transmitter detector pair that can detect the existence of medication in that compartment. A microcontroller system attached to the compartment box checks for the existence of medications at a user programmed time and at subsequent user determined intervals. This microcontroller communicates via WiFi or Bluetooth with a smart device application. The smart device application will then alert the user if medication is not taken on time. This alert can be done through SMS, Voice or any variety of other alarm stimuli. The system will also alert the user to refill compartments at the end of the week. The system can also be connected to the user's pharmacy system to request refills at the appropriate time. All system's records are stored and made accessible to the user to share with his or her health providers. It is anticipated that this system will improve compliance with medication orders as well as allow the health providers track such compliance.

SESSION VI (TRAUMA, BONE, CARTILAGE)

DESIGN OF SCAFFOLDS OF ALGINATE/B-TRICALCIUM PHOSPHATE FOR THE LOADING AND DELIVERY OF VANCOMYCIN

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Osteomyelitis remains a major complication of open fractures. Local vancomycin delivery is considered to provide better methods of treatment for cases in which avascular zones prevent the delivery of drugs from conventional routes of administration. Development of scaffolds to load and deliver vancomycin greatly enhances the eradication of the bacteria and bone tissue regeneration. Here, we report a novel design of scaffolds made of alginate and β -tricalcium phosphate (Alg/ β -TCP) for in situ vancomycin loading and controllable delivery. Direct deposition of Alg/ β -TCP solution through designed nozzle (27G) in calcium D-gluconate solution bath allowed the generation of spherical scaffolds. Through the process, in situ vancomycin loading was possible. Feasibility of the designed scaffolds in loading and release of vancomycin (Vanco) was investigated. Scaffolding formed in calcium D-gluconate solution led to a considerable loss of vancomycin in a crosslinking time-dependent manner, and the change in hardening conditions, such as Alg concentration (2 and 5%), calcium D-gluconate concentration (150mM and 1M), and Alg/ β -TCP ratio (1:1, 1:2, and 1:3), was not as effective in reducing the vanco loss. Subsequent release of Vanco from Alg scaffolds displayed a marked initial burst depending on crosslinking conditions, and shortening crosslinking time and decreasing calcium D-gluconate concentration lowered the initial burst. The β -TCP addition resulted in more continual and sustainable release patterns for up to 6 weeks, suggesting better performance of delivering antibiotics. Additionally, the β -TCP incorporation significantly increased the mechanical stiffness to values much closer to those of hard tissues. Results indicate that deposited Alg/ β -TCP spherical scaffolds may be useful for designing proper vancomycin delivery systems in hard tissue infection and regeneration.

AMINO ACID COATED UHMW-PE IMPLANTS MODIFY NEOVASCULARIZATION IN THE TISSUE-IMPLANT RESPONSE

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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 to further study neovascularization associated with these devices in vivo to adequately elucidate methods to modulate the tissue-implant response. The purpose of this investigation was to determine differences in neovascularization 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 intraperitoneally (I/P). 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 blood vessel counts were highest in the PLL coated group (19 ± 3.27 cells/high power field). There was a decreased mean number of blood vessels per high power field for saline (17.23 ± 4.57), RGE (2.81 ± 1.50), and RGD (2.56 ± 1.55). Analyses revealed blood vessel counts were significantly higher in saline and PLL treated group compared to RGD and RGE groups (ANOVA, $p < 0.05$). These findings indicate neovascularization in the fibrous tissue surrounding UHMW-PE can be reduced using amino acid combination coatings. In addition, these results provide evidence that the neovascularization can be modulated to some extent using amino acid coatings in soft tissue applications.

ELECTRICAL AND MAGNETIC PARAMETERS AS A PREDICTOR OF RUST SCORE FOR FRACTURE UNION

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Clinical practice lacks a Gold Standard method for early diagnosis of union, delayed and non unions of fractures. We studied electrical and electro-magnetic parameters for predicting Radiographic Union Scale for Tibial fractures (RUST) at week 20 for diagnostic assessment of fracture healing. Thirty patients with compound fracture of tibia (Gustillo Grade I&II), treated by insulated external fixators of class VI standard biomaterial, permitted measurements of electrical and electro-magnetic properties of bone excluding soft tissue. At week 20, normal union had RUST Score ≥ 9 and delayed union < 9 . Capacitance, Conductance, Impedance at week 8 and inductance at week 4 correctly predicted union in 70%, 75%, 92%, 58% patients respectively and in delayed union 94%, 61%, 76%, 69% patients respectively; precision rate for positive test (normal union) was 94%, 61% 76%, 69% respectively and precision of negative test result (delayed union) was 88%, 94%, 90%, 56% respectively; positive likelihood ratio were 14.8, 1.95, 4, 1.91 respectively; negative likelihood ratios were 0.13, 0.40, 0.1, 0.59 respectively. Impedance at week 8 is the best indicator (OR=63.09, $p=0.0013$) in prediction model for rust score 9 or above as compared to conductance (OR=0.12, $p=0.17$). Capacitance was complicated by unstable readings, inductance showed least sensitivity and specificity, therefore were excluded from prediction model. Electrical and electro-magnetic parameters of bone are measurable and could predict union (RUST Scores). This study outlined the baseline methodology and data for further research. Impedance was found to be the best predictor of union but other parameters require investigation with larger sample size.

A COMPARISON OF DECELLULARIZATION METHODS APPLIED TO PORCINE OSTEOCHONDRAL XENOGRAFTS FOR ARTICULAR CARTILAGE REPAIR

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The objective of this research was to compare decellularization methods for porcine osteochondral xenografts, which may have potential application in articular cartilage repair. Ø5.0 mm porcine osteochondral dowels were obtained from adult pig knee joints. Method 1 was a technique that had been developed for osteochondral xenografts. Method 2 had been used to decellularize xenogenic myocardium for cardiac tissue engineering. Method 3 was designed to partially demineralize and deproteinize xenogenic bone for bone defect filling. Evaluations of the osteochondral xenografts biochemistry, biomechanics, and histology were performed. In addition, they were assessed for their ability to resurface the trochlear groove of adult New Zealand white rabbits in vivo for up to 8 weeks. Method 1 removed almost all of the glycosaminoglycans and DNA, but this severely compromised the compressive stiffness. Methods 2 and 3 both extracted about half the glycosaminoglycan, and Method 3 was more effective than Method 2 at removing DNA (roughly 75% vs. 50% removed). Both methods reduced the compressive stiffness by 50% or more. The rabbit experiment showed that none of the methods caused severe adverse immune response, and by 8 weeks the bone phase was gradually integrating into the native bone. The joint resurfacing was acceptable in some cases. The results suggest Method 1 is too destructive to the extra cellular matrix. However, it is believed that Methods 2 and 3 could be refined to provide an optimal balance between DNA removal and retention of biomechanical properties.

EFFECTS OF GENIPIN ON DECELLULARIZED PORCINE CARTILAGE

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This research aims to develop an alternative method to osteochondral articular transfer using decellularized, crosslinked porcine osteochondral xenografts (OCXGs). Crosslinking collagenous tissue results in greater mechanical strength, more resistance to enzymatic degradation, and reduced immunogenicity. This study used genipin, a chemical substance from the *Gardenia jasminoides* Ellis fruit. Genipin is inexpensive and simple to use. In this study, porcine articular cartilage disks were decellularized via a previously published method for porcine nasal septal cartilage decellularization. The process extracts glycosaminoglycan to allow for greater infiltration of nutrients and host cells. The disks were then crosslinked with 0.01% and 0.1% aqueous genipin for 3 days at room temperature with agitation. Prior to decellularization, the cartilage disks' biphasic properties were determined by confined compression testing. The test was repeated after decellularization and after crosslinking. The aggregate modulus was notably lessened after decellularization but returned to, and in most cases, exceeded that of the fresh disks after crosslinking. Genipin fixation also tended to lower the hydraulic permeability. In a separate experiment, genipin fixation of fresh cartilage was shown to slow the rate of tissue destruction by collagenase. This study demonstrates that genipin seems to be a viable alternative for crosslinking OCXGs.

SESSION VII (MODELING)

DESIGN AND IMPLEMENTATION OF EMG/EEG FINITE STATE MACHINE FOR PROSTHETIC HAND CONTROLLING

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In this work a finite state machine is designed to combine both Surface Electromyography (SEMG) and Electroencephalography (EEG) signals in actuating a prosthetic hand. Also single electrode EEG and two electrodes EMG Wireless data acquisition circuits are designed and implemented to reduce the communication complexity of the system and to have more freedom in allocate the electrodes. The system was tested successfully by five healthy subjects. The results using combination of SEMG and EEG showed more sustainability in doing tasks than using either SEMG or EEG signals.

OCT IMAGING FOR SMALL ANIMALS – A SWEEP SOURCE PLATFORM

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Optical Coherence Tomography (OCT) has been recognised as a very powerful tool for ophthalmologic diagnosis. Based on the optical interference phenomenon, it is capable of producing high-resolution cross-sectional images of non-homogeneous ocular structures such as the retina.

OCT application on small animal studies with enough accuracy and resolution is a fundamental issue they are often used as physiological models to test and develop new medical techniques and therapies. Therefore, it is our main goal to develop a dedicated OCT platform for small animal ocular image acquisition using most recent technological advances, mainly in laser sources. Laser swept-source (1060nm, 110 nm bandwidth and sweep frequency of 100 kHz), InGaAs balanced detector and a fast multi I/O 400 MSPS data acquisition board installed on a personal computer (PC) are the main structural parts. Digitized data undergoes Fourier analysis to produce the final OCT image, a task performed with a dedicated acquisition/control software which has been developed to show real-time OCT images with different angle spans, B-scan pixels, scanning speed and other image features.

So far, preliminary results let us conclude that system demonstrates performance parameters that meet the final goal. Axial resolution (8 μm) and imaging speed (175 ms/image for B-scans) are comparable to other described OCT systems. Sensitivity, sensitivity roll-off, dynamic range and lateral resolution are being improved to meet the needs for biomedical OCT applications, namely imaging rats' retinas.

DEVELOPMENT OF A THREE-DIMENSIONAL DIGITAL IMAGE CORRELATION FOR DISPLACEMENT AND STRAIN MEASUREMENT OF SEEDED ENDOTHELIAL CELLS

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Atherosclerosis, a progressive disease of the large arteries, is the primary cause of heart disease, and stroke. Endothelial cell (EC) dysfunction precedes the development of atherosclerosis. ECs are mainly affected by three mechanical factors; pressure from pulse, shear stress from blood flow, and strain due to the elasticity of the blood vessel. ECs require these mechanical factors to function at optimal levels. Deviation from these levels can result in damage to ECs and lead to disease initiation. An additional factor for EC dysfunction is increased wall stiffness due to

the non-linear mechanical properties of the arterial wall. As the main coronaries are located on the epicardium, these vessels stretch and twist with each heartbeat, resulting in a non-uniform spatial distribution in strain and thus in wall stiffness. Therefore, the purpose of this investigation was to develop a non-invasive method to characterize local strain stiffness responsible for changes in EC function. To this end, a commercially available digital image correlation (DIC) was used to characterize local strain measurements under physiological conditions. Sylgard 184 was used to create synthetic models with varying elastic modulus that mimic arterial geometry. The models were then coated with micron size particles and local strain measurements could then be estimated on a Sylgard tube to an approximate accuracy of 2.1%. These preliminary results demonstrate the potential of such a system to characterize local strain undergoing arterial hemodynamics.

DEVELOPMENT OF SILICONE CORONARY BIFURCATION MODELS FOR *IN VITRO* FLOW EVALUATION

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Bifurcations throughout the vascular system are among the most common locations that atherosclerosis may form. Within the span of an arterial bifurcation, uniform flow is disrupted and more complex mechanical situations exist. Analysis of a flow path complicated by a change in direction is much more complex than studying flow patterns through a single channel. For this purpose, modeling an arterial bifurcation with sylgard 184 may allow for extensive analysis of the system. Therefore, the purpose of this study is to develop a rapid and inexpensive method to develop consistent bifurcation models. In order to model an arterial bifurcation with precise dimensions, a two-stage mold design has been strategized. The initial mold is injected with a material to form the inner cast, which is then placed into the secondary mold. Sylgard is injected into the secondary mold to cover the inner cast. Once the sylgard cures, the coated inner cast is removed from the secondary mold and then melted out of the sylgard, leaving a bifurcation shaped tube behind. Three types of materials, molding wax, polymers, and low-temp melting metals, were tested as the inner mold. Results demonstrated that the low-temp melting metal possesses the best properties for our application. Upcoming challenges will focus on the injection procedures and the manufacture of the mold. With a repeatable process for modeling bifurcations, these studies will potentially lead to more accurate testing of cardiovascular devices, such as stents, in a laboratory setting.

HIGHLY SENSITIVE CONTINUOUS FLOW MICROFLUIDIC CHIP SENSOR WITH INTEGRATED BI/SB THERMOPILE FOR BIOCHEMICAL APPLICATIONS

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Chip calorimetry offers a power tool for fast and high throughput analysis of biochemical process. However, it is challenging to realize an inexpensive, easy to fabricate microfluidic chip based calorimeter with high sensitivity. This study describes the design of a novel, highly sensitive, continuous flow microfluidic chip sensor with an integrated Sb-Bi thin-film thermopile heat detection element. The geometry and the design of the microfluidic device facilitate hydrodynamic flow focusing, and the integration and design of the thermopile sensor into the microfluidic device eliminates the need for reference temperature control. The microfluidic device is fabricated using an inexpensive fabrication method, Xurography. The device contains a single flow channel that is 120 μm high and 10 mm wide with two fluid inlets and one fluid outlet. An Sb-Bi thin film thermopile is fabricated on the inner surface of the bottom channel wall using thermal evaporation and was passivized with a 3 μm SU-8 photoresist layer. The device has been successfully used to measure the dynamic temperature changes resulting from heat generation following the mixing of glycerol and water. The effect of flow rates on the sensor's response was measured. The sensor was capable of detecting dynamic temperature changes in the order of 10^{-6} K. The limit of detection of heat power of the device was calculated to be 8.8 pW. With the obtained remarkable sensitivity and heat power detection limit, the microfluidic chip sensor can be used to investigate biochemical processes such as enzyme-catalyzed reactions, and metabolic activity of cells.

SESSION VIII (CANCER)

MULTIFUNCTIONAL NANOPLATFORMS FOR TARGETED MDRB AND CANCER THERANOSTIC APPLICATIONS

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The emergence of multi-drug resistant bacteria (MDRB) infection and multi-chemo drug resistant cancer pose a major burden to modern healthcare. Early detection in the blood stream and development of new approach for the treatment without antibiotics is clinically significant for safe million lives every year. Here we will discuss our recent report on the development of “multifunctional *nanoplatfoms*” consist of magnetic core-plasmonic shell nanoparticle, methylene blue (MB)-bound aptamer which is capable for targeted separation from blood sample, sensing and multimodal therapeutic killing of MDRB and Cancer. We will discuss the possible mechanisms and operating principle for the targeted separation, imaging and combined therapeutic actions. Our developed “multifunctional *nanoplatfoms*” have a great potential for imaging and combined therapy of MDRB and cancer in clinical settings.

PROBING G-PROTEIN COUPLED RECEPTOR CONFORMATIONAL DYNAMICS USING HUMAN COMPUTER INTERFACES

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G-protein coupled receptors (GPCR) are attractive targets for ligand discovery, however the lack of high resolution structural information combined with inadequate models in vivo model systems presents a major bottleneck in moving the compound pipeline. At the same time, the reports of highly conserved binding mode of human β 2-adrenergic receptor inverse agonists and antagonists based on x-ray cocrystal structures strongly suggests that x-ray crystallography alone may not be sufficient to capture dynamic receptor conformations induced by pharmacologically distinct ligands. 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 GPCR models and access to predictive models discriminating aspects of ligand binding to accelerate the hit-to-lead optimization of compounds. 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

INHIBITION OF CYTOMEGALOVIRUS INFECTION AND PHOTOTHERMAL LYSIS OF INFECTED CELLS USING BIOCONJUGATED GOLD NANOPARTICLES

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Human cytomegalovirus (HCMV) is a herpesvirus that causes major health problems in neonates as well as in immunocompromised individuals¹. At present, a vaccine is not available for HCMV infection and available antiviral drugs suffer from toxicity, poor efficacy and resistance^{1,2}. Here, we chemically conjugated a monoclonal antibody raised against HCMV surface glycoprotein (gB) with gold nanoparticles (GNP) and characterized the potential of this gB-GNP conjugate for antiviral activity against HCMV. The gB-GNP blocks viral replication, virus-induced cytopathogenic effects and virus spread in cell culture without inducing cytotoxicity. High concentrations of gB-GNP, that coat the surface of virus particles, block virus entry, whereas lower concentrations block a later stage of virus life cycle. Also, cells treated with gB-GNP gain resistance to HCMV infection. In addition, infected cells when bound to

gB-GNP can be selectively lysed after exposing them to specific wavelength of laser (nanophotothermolysis). Thus, we have not only designed a potential antiviral strategy that specifically blocks HCMV infection at multiple stages of virus life cycle, but we have also characterized a technique that can potentially be useful in eliminating HCMV infected cells from donor tissue during transplant or transfusion. Similar approaches can be used for tackling a wide range of microbial pathogens and cancers with known biomarkers.

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THE ROLE OF RESVERATROL IN PREVENTION AND THERAPY OF HORMONE-DEPENDENT CANCERS: IN SILICO STUDIES

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Nutritional chemoprevention is a promising approach for breast and prostate cancer. Dietary resveratrol has antioxidant, anti-inflammatory, cardioprotective and anticancer properties. Although the exact molecular mechanisms of chemoprevention and anticancer effects are not clear, resveratrol causes cell cycle arrest and apoptosis, and inhibits angiogenesis. Since estrogen receptor (ER) and androgen receptor (AR) play major roles in breast and prostate cancer etiology and progression, respectively, agents with the ability to inhibit receptor signaling are of great interest. Resveratrol binds to both ER α and β in breast cancer; however whether resveratrol-occupied ER has agonist or antagonist activity remains controversial. It is known that the tissue selective agonism/antagonism of phytoestrogens is the result of numerous factors, including receptor overexpression, structure of the ligand, and balance of co-activators and co-repressors. In prostate cancer, the anti-androgenic role of resveratrol is more accepted although AR activation mechanisms are uncertain from molecular biology and biochemical studies.

In addition to biological assays, we utilized *in silico* techniques to examine the structural details and binding affinities of resveratrol and its structural analogues with ER and AR. We performed molecular dynamic simulation on ligand (s) bound ER or AR, and clarified the roles of parameters such as interaction changes, movement of the binding pocket residues, regions of high fluctuations in conformational stability and plasticity of the complex.

The knowledge on mixed estrogenic/antiestrogenic nature of resveratrol bound to ER may provide insight into its beneficial/carcinogenic potential important for practical use in healthy postmenopausal women and/or women with breast cancer. Insights into the relationship between resveratrol and AR may facilitate the development of dietary stilbenes as therapeutics in the prevention and treatment of prostate cancer.

HORMONE-INDEPENDENT DRUG DESIGNING FOR BREAST CANCERS TARGETING RECEPTOR DIMERIZATION INTERFACE

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Among major breast cancer treatment, hormone therapy plays a major role as about 75% of breast tumors are Estrogen Receptor alpha (ER α) positive and responds to targeted hormone therapy. However, targeted hormone therapies face two major challenges: de-novo and acquired drug-resistance. If no major changes occur in prevention or treatment, it is estimated that about 747,802 women will die from breast cancer worldwide in 2030 (IARC 2010). Current hormone therapies either target binding a selective estrogen receptor modulator (SERM) at the hormone binding interface of the receptor, or use aromatase inhibitors to prevent transformations of other hormones to estrogens. However, about 30% of ER α positive breast tumors develop 'resistance' to SERM and resume progression of the tumor and aromatase inhibitors leads to strong side effects like osteoporosis. On the other hand, SERM-resistant breast tumors are reported to have an over expression of co-activator calmodulin (CaM) and CaM binding to ER which leads to the speculation of possible ligand-independent expression of ER. Accordingly, hormone-independent inhibition ER could be a suitable alternate if there exists a suitable hormone-independent target. As ER α and ER β dimerize only among themselves as homo and hetero dimers, they must possess a unique dimerization recognition surface. And as protein-protein dimerization interaction of ER is an essential step for ER-mediated transcription, this dimerization recognition surfaces, could provide us an unique target to inhibit the progression of ER-positive breast tumors. Elucidating the homo dimerization interface of ER α ligand binding domain (LBD) in molecular details, we have identified [Mol. Div. **16**, 441 (2012)] three sequence motifs responsible for dimerization – DXXTD (480-484), LQXXHQXXAQ (497-506), LSXXRHXXNK (511-520) – and used these sequences to develop peptidic and peptidomimetic inhibitors. Two of our designed peptides have exhibited strong inhibition of ER expression in in-vitro testing with MCF-7 cell lines. Details of these studies will be discussed in the meeting.