SOUTHERN BIOMEDICAL ENGINEERING CONFERENCE

39th Annual Meeting

September 7-10, 2023

Hilton New Orleans Airport,

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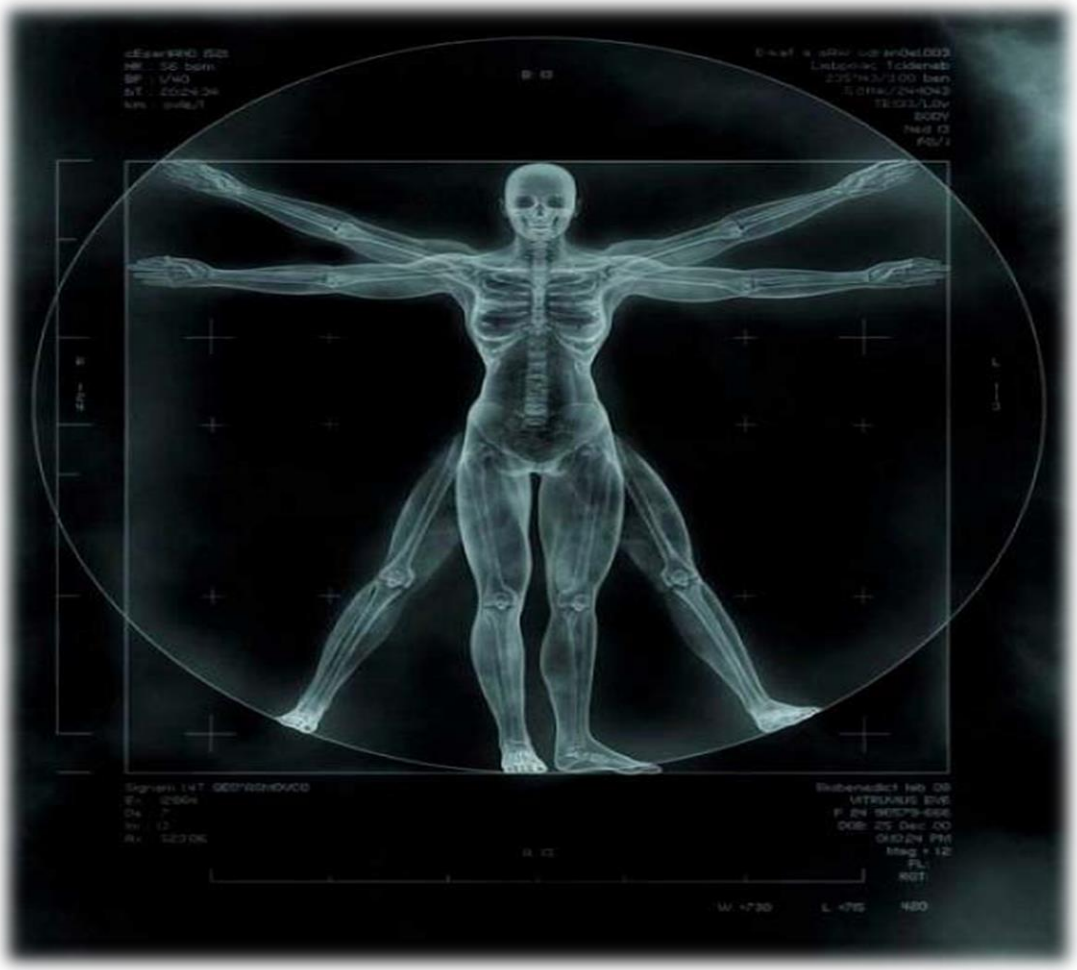
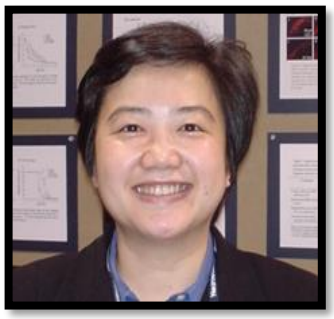
Telephone: 1 504 465 1153

http://sbeconference.org



Program



Program Chair: Dr. Lir-Wan Fan, University of Mississippi Medical Center (lwfan@umc.edu)

Dr. Lir-Wan Fan received her PhD (2002) in Pharmacology and Toxicology from the University of Mississippi Medical Center (UMMC). She was trained as a postdoctoral research fellow at Mayo Clinic Jacksonville, Jacksonville, FL (2002-2003) and the Department of Pediatrics (Neonatology Division), UMMC, Jackson, MS (2003-2004). Her academic training and research experience has provided her with an excellent background in pharmacology, toxicology, molecular biology, biochemistry, developmental neuroscience and behavioral neuroscience. She is currently a Professor in the Department of Pediatrics (Neonatology Division), UMMC. Her research investigates the mechanisms involved in the long-term adverse effects of perinatal brain inflammation on hypoxia-ischemia, intrauterine growth restriction, Attention-deficit/hyperactivity disorder (ADHD), Autism spectrum disorder, white matter disease, sleep disorders and late-onset neurodegenerative diseases, such as idiopathic Parkinson's disease, and provide valuable information for developing strategies in prevention and therapeutic treatments of neurodegenerative diseases. Her work has been well-supported by a variety of funding agencies including the NIH and Michael J. Fox Foundation, and her work has been published in leading journals in neuroscience and pediatric fields. She was selected as the Grant Reviewer for several study sections in the National Institutes such as NIH and USDA. In addition, she serves as a Director for Mississippi Academy of Sciences (MAS) Council, Editorial Review Board Member for several scientific journals, and as a reviewer of many international journal articles.

Program Co-Chair: Dr. Giovanni Solitro, Louisiana State *University Health Shreveport* (giovanni.solitro@lshhs.edu.edu)

Dr. Giovanni Solitro is Associate Professor and Director of the Biomechanics Research and Education at Louisiana State University Health in Shreveport. Following graduation in 2010 with a PhD in Mechanical Engineering with a dissertation on the patient-specific modeling of the human spine, he completed his postdoctoral training at the University of Illinois at Chicago in 2015. He continued his work at the UIC Department of Orthopedics as Senior Research Specialist, and pursued a second PhD with a dissertation on intraoperative assistance in pedicle screws placement. His research efforts aim the development of orthopaedic implants, novel surgical approaches, and training methods. He is author of several peer-reviewed manuscripts in orthopedics and biomedical engineering, and his work has been internationally recognized with distinguished awards from academic institutions and scientific associations that include the 2015 Hand and Wrist Biomechanics International Triennial Symposium Award. In his current position, he is contributing to improve the lives of patients by providing deeper insight into the mechanical workings of the body. The primary area of expertise is the advanced modeling of joints to enhance the precision of orthopedic surgery. His interests include, surgical skill training, knowledge base orthopaedics, total hip replacement, biomechanics of the spine, hand, and intra-operative navigation.

Program Co-Chair: Dr. Santosh Aryal, Universty of Texas at Tyler (santosharyal@uttyler.edu)

Dr. Santosh Aryal received his Ph. D. in Bionanosystem Engineering from Chonbuk National University, the Republic of Korea in 2007. He was a postdoctoral associate in the Department of Mechanical Engineering, University of Wisconsin, Milwaukee, and at the Department of Nanoengineering and the Moores Cancer Center, University of California, San Diego. After completing four years at Moores Cancer Center, he moved to the Department of Translation Imaging, Houston Methodist Research Institute, Houston, Texas, where he was working in the broad spectrum of Nanomedicine for the diagnosis and treatment of cancer and vascular diseases. He holds B.S. and M.S. degrees in Chemistry from Tribhuvan University, Kathmandu, Nepal. After completing six years of independent research as an Assistant Professor at the Department of Chemistry and the Nanotechnology Innovation Center of Kansas State (NICKS), Dr. Aryal joined the University of Texas at Tyler (UT-Tyler) as an Associate Professor of the Department of Pharmaceutical Sciences and Health Outcomes. At UT-Tyler, his research group is continuously working to address a fundamental question in drug delivery: how medicine is robustly tuned to

communicate with the immune system for cooperative treatment. Research activities in Aryal Lab are supported by the University of Texas, the National Science Foundation (NSF), and the National Institute of Health (NIH).

Conference-Co-Chair: Dr. Michelle Tucci, University of Mississippi Medical Center (mtucci@umc.edu)

Dr. Tucci is a Professor of Anesthesiology at the University of Mississippi Medical Center in Jackson, MS. Dr. Tucci has been involved in a leadership role for various state, national and international organizations. After completing her undergraduate training at Seton Hill University, in Pennsylvania she completed a Master's degree in Biology at the University of Dayton in Ohio. Following her move to Mississippi, she completed her PhD in Pharmacology and Toxicology in 2000. Aside from her work supervising and overseeing resident's basic science research, she has also mentored and supervised a number of undergraduate and graduate students from diverse disciplines. She has served on over 80 doctoral dissertation committees, has published over 300 full journals. Her leadership role in various societies includes Director and program chair at the Rocky Mountain Biomedical Engineering Society; Program Chair at the Academy of Surgical Research, Program and conference organizer at the Southern Biomedical Engineering meetings, Chair of Pathology Implant SIG at the Society for Biomaterials, to name a few. She served/serving in editorial boards for several and she is serving as Chief Editor of the Biomed Science Instrumentation and Chief Editor for Journal of the Mississippi Academy of Sciences. Previously, she has been recognized for her work and service by the Academy of Surgical Research, the Mississippi Academy of Sciences Outstanding Contribution to Science, Peeler Dudley Outstanding Service Award, Douglas Walker Award and recently was inducted as fellow in American Institute of the Biomedical and Biological Engineering.

Conference-Co-Chair: Dr. Ham Benghuzzi, Mississippi Academy of Sciences and JSU, Hamed.A.Benghuzzi@jsums.edu

Dr. Benghuzzi is the executive director of Mississippi Academy of Sciences and Engineering and Distinguished lecturer at Jackson State University and Consultant in the effectiveness of Biomedical. devices. Prior to that he was a Professor at the University of MS Medical Center and chaired three departments as well as directing the PhD program during his tenure. He is known nationally and internationally as a pioneer in Ceramic Drug Delivery Systems. He has over 350 PubMed indexed articles and over 800 abstracts detailing the release characteristics of various biologicals from the bioceramic carriers. He has trained (major advisor) to 44 PhD students and served as a member for over 100 PhD committees. He has mentored students at all levels (from high school, undergrad, grad, post doc and faculty). He has served as a mentor for residents and faculty on more than 10 funded grants. He has been in research leadership roles in many organizations such President of the Academy of Surgical Research, President of International Society of Ceramics in Medicine (ISCM), President of Mississippi Academy of Sciences and Engineering, currently serving as a President of the International Biomedical Sciences Instrumentation Symposium (IBSIS)/Rocky Mountain Bioengineering Symposium, and also organized and chaired several regional, national and international society programs. He has also served on numerous NIH special emphasis panels including R-25, K01, KO8, T-35, and the P-60 center grants. In addition, he has received numerous awards from various organizations during his career. He was listed as Most Cited Scientist in Stanford University's Study of top 2% Most Cited Scientists in Biomedical Engineering worldwide. A few of his awards included: (1) The Presidential Award from the RMBS, (2) Presidential Award from SEM International, (3) the Endocrine's Society Outstanding Investigator Award, (4) MAS Contribution to Science Award, (5) The MAS Dudley Peeler Award, and (6) HEADWAE Award, (7) C. Hall Award, Outstanding Contribution to Biomedical Engineering (32nd SBEC), and (8) ISCM Excellence Award from the International Society for Ceramics in Medicine. He was invited as a keynote/plenary to speak at state, national and international levels including recent invitations in Japan, France, Italy, Spain, Greece, China, Poland, Dubai and Canada. He is a fellow of the American Institute for Medical and Biological Engineering (AIMBE) as well as an International Fellow of Biomaterials Science and Engineering (FBSE).

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ROCKY MOUNTAIN BIOENGINEERING SYMPOSIUM

Program and Organizing Committee

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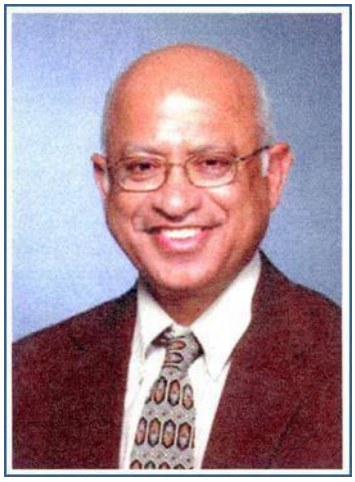
39th SOUTHERN BIOMEDICAL ENGINEERING CONFERENCE

Chairs

Time	Session	Chair	Co-Chair
Friday 8:00 am	**Session 1: Lessons Learned with Animals and 3D Cell Models**	**Carla Prado, Ph.D.** Federal University of São Paulo	**Roberta Stilhano, Ph.D.** Santa Casa de Sao Paulo School of Medical Sciences
Friday 8:00 am	**Session 2: Neural Interfaces**	**Elisa Castagnola, Ph.D.** Louisiana Tech University	**Melanie Ecker, Ph.D.** University of North Texas
Friday 10:30 am	**Session 3: Nanotechnology**	**Olga McDaniel, Ph.D.** University of Mississippi Medical Center	**Tristan Clemons, Ph.D.** University of Southern Mississippi
Friday 10:30 am	**Session 4: Biomaterials**	**Amol Janorkar, Ph.D.** University of Mississippi Medical Center	**Joel D. Bumgardner, PhD.** University of Memphis
Friday 2:00 pm	**Session 5: Neuroscience**	**Lir-Wan Fan, Ph.D.** University of Mississippi Medical Center	**Yi Pang, Ph.D.** University of Mississippi Medical Center **Nilesh Dankhara, M.D.** University of Mississippi Medical Center
Friday 2:00 pm	**Session 6: Nanomaterials and Nanomedicine**	**Eunsoo Yoo, Ph.D.** North Carolina A&T State University	**Narayan Bhattarai, Ph.D.** North Carolina A&T State University
Friday 4:00 pm	**Session 7: Clinical Rehab**	**Felix Adah, Ph.D.** University of Mississippi Medical Center	**Kenneth Butler, Ph.D.** University of Mississippi Medical Center
Friday 4:00 pm	**Session 8: Education**	**Joseph A. Cameron, Ph.D.** Jackson State University	**Judy Gordy, Ph.D.** University of Mississippi Medical Center
Saturday 7:30 pm	**Session 9: Biomechanics**	**Subrata Saha, Ph.D.** University of Washington	**Giovanni Solitro, Ph.D.** LSUHS -Shreveport **Denis DiAngelo, Ph.D.** UTHSC
Saturday 7:30 am	**Poster Session**	**Ham Benghuzzi, Ph.D.** Jackson State University	**Kenneth Butler, Ph.D.** University of Mississippi Medical Center **Michelle Tucci, Ph.D.** University of Mississippi Medical Center
Saturday 9:15 am	**Session 10: Medical Devices and Implants I**	**Christina Salas, PhD.** University of New Mexico	**Elisa Castagnola, Ph.D.** Louisiana Tech University
Saturday 9:15 am	**Session 11: Biomedical Imaging and Advancements in Precision Medicine**	**David Gordy, Ph.D.** University of Mississippi Medical Center	**Ayman Hamouda, Ph.D.** University of Texas at Tyler
Saturday 10:30 am	**Session 12: Medical Devices and Implants II**	**Brad Chauvin, M.D.** Louisiana State University Health Shreveport	**Tanvir Faisal, Ph.D.** University of Louisiana at Lafayette
Saturday 10:30 am	**Session 13: Biomaterial/Imaging 2**	**Vladimir Reukov, Ph.D.** University of Georgia	**Maricica Pacurari, Ph.D.** Jackson State University
Saturday 1:30 pm	**Session 14: Orthopaedics**	**Tanvir Faisal, Ph.D.** University of Louisiana at Layfette	**Christiana Salas, Ph.D.** University of New Mexico
Saturday 1:30 pm	**Session 15: Advances in Biomedical Informatics**	**Haifeng Wang, Ph.D.** Mississippi State University	**Olga McDaniel, Ph.D.** University of Mississippi Medical Center
Saturday 3:15 pm	**Session 16: Computer Assisted Surgery and Training**	**Giovanni Solitro, Ph.D.** Louisiana State University Health Shreveport	**Christina Salas, PhD.** University of New Mexico
Saturday 3:15 pm	**Session 17: Cell Mechanics and Disease**	**Larry McDaniel, Ph.D.** University of Mississippi Medical Center	**William Pruett, Ph.D.** University of Mississippi Medical Center
Sunday 7:30 am	**Session 18: Nanomedicine/Drug Delivery**	**Santosh Aryal, Ph.D.** University of Texas at Tyler	**Shoukath Sulthana, Ph.D.** University of Texas at Tyler
Sunday 7:30 am	**Session 19: Bioethics**	**Subrata Saha, Ph.D.** University of Washington	**Babu Patlolla, Ph.D.** Alcorn State University
Sunday 9:30 am	**Session 20: Kinesiology and Health**	**Andrew Zhang, M.D.** Louisiana State University Health Shreveport	**Eddie Austin Jr, Ph.D.** Ochsner Therapy and Wellness, Baton Rouge, LA

39th SOUTHERN BIOMEDICAL ENGINEERING CONFERENCE

SBEC HISTORY



The Southern Biomedical Engineering Conference (SBEC) series was conceived by bioengineering professionals from academia and industry located primarily in the South of the United States in 1982. The first Southern Biomedical Engineering Conference was held at the LSU Medical Center, Shreveport, Louisiana, in 1982 organized by the founder and chair of steering committee of SBEC Dr. Subrata Saha (photo). 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 single session, with each presentation limited to 15 minutes (12-minute presentation and 3minute discussions). Room assignments for each session will be posted at the conference.

Poster presentations will be held in Foyer area. The poster display dimensions are: 48" wide x 36" length. Push pins and tapes will be provided (poster format should include: Title, Authors, Affiliations, Introduction or background, Methods, Results, Discussion and summaries, References and Acknowledgments.

The Conference will be held at the Hilton New Orleans Airport, 901 Airline Drive Kenner, LA 70062, Telephone: 1 504 465 1153

All the accepted abstracts/papers will be published in an archival proceeding program book entitled **BIOMEDICAL ENGINEERING: RECENT DEVELOPMENTS**.

The program review committee will select limited number of abstracts to be invited to submit full-length manuscripts (optional to authors) to be published in the peer-review prestigious journal: Biomedical Science Instrumentations (IAE Publisher). Manuscripts are subject of Publication fee of $90.

Student Awards: Top undergraduate and graduate students for podium and poster presentations will be recognized at the awards ceremony on Sunday.

39th SOUTHERN BIOMEDICAL ENGINEERING CONFERENCE

Registration

Registration* Fee includes access to all conference events, program copy, lunches, coffee breaks and snacks. On-site registration will continue all day Friday, Saturday, and Sunday morning. More information in how to register can be found at: http://sbeconference.org.

**PayPal with credit card option*

Registration Fees (http://sbeconference.org)	Before July 20, 2023	After/Onsite July 20, 2023
Investigators registration fee for SBEC	$375	$475
Student registration fee for SBEC	$225	$325
Companion Fee	$150	$180
Publication Fee	$90	$90

Hotel Information: (During booking, Mention SBEC Group to receive Rate and comps listed below) HILTON NEW ORLEANS AIRPORT, 901 AIRLINE DRIVE KENNER, LA 70062 Rate: $119 +TAX, includes complimentary continental breakfast for up to two (2) guests in the sleeping room, Complimentary Parking, Complimentary WIFI in Meeting Room and Guest Rooms Deadline to book your room: August 10, 2023 through either://www.hilton.com/GroupPage or by contacting the hotel at: t: +1 504 465 1153

39th Annual Meeting

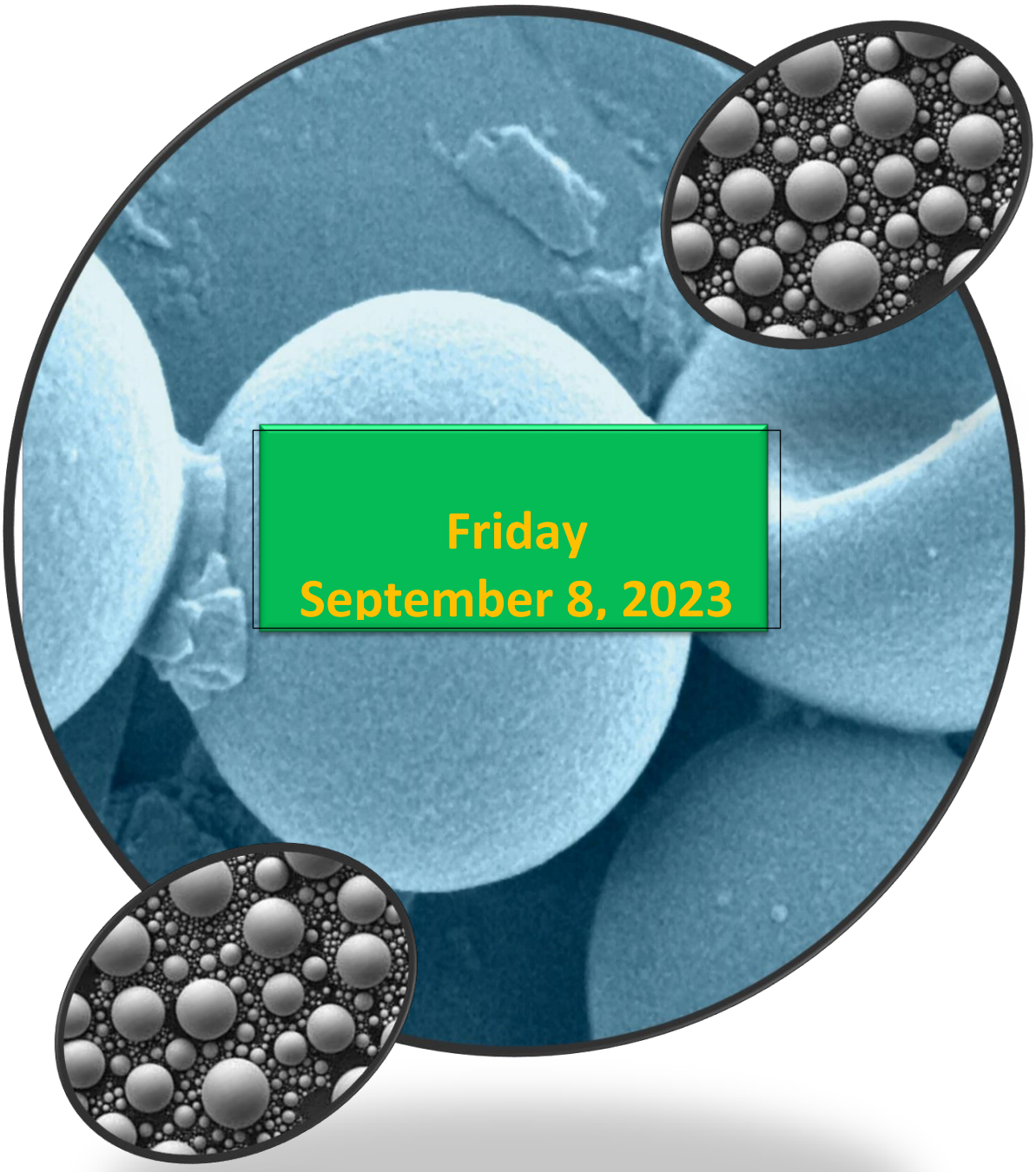
Program

Thursday, September 7, 2023

4:00 PM-6:00 PM: Registration

***H*ilton *H*otel, *N*ew *O*rleans *A*irport**

39th SOUTHERN BIOMEDICAL ENGINEERING CONFERENCE



Friday, September 8, 2023

7:00 am – 6:00 pm **Registration**

7:45 am **Opening of the Meeting**

Program Chair: *Lir-Wan Fan, Ph.D.*

Program Vice Chairs: *Giovanni Solitro, Ph.D. and Dr.* Santosh Aryal, Ph.D.

Conference Co-Chairs: *Michelle Tucci, Ph.D. and Ham Benghuzzi, Ph.D.*

Major Sponsor Remarks: *Babu Patlolla, Ph.D. President MAS*

Chairman of Steering Committee Remarks: *Subrata Saha, Ph.D.*

Scientific Sessions

Keynote Speakers

Session 1: Lessons Learned with Animals and 3D Cell Models

Fernanda Degobbi Tenorio Quirono Dos Santos Lopes

Professor and Senior Researcher

University of São Paulo

São Paulo, Brazil

Fernanda Degobbi T. Q. S. Lopes is senior researcher in the Institute of Clinical Investigations of Hospital das Clínicas of University of Sao Paulo and Professor of Medicine Department of School of Medicine of University of Sao Paulo. Her studies have elucidated the deleterious effects of smoking on health with emphasis on chronic obstructive pulmonary disease (COPD) development and progression as well as on the skeletal muscle system injuries.

Session name: "Lessons Learned with Animals and 3D Cell Models."
Chairs: Carla Máximo Prado and Roberta Sessa Stilhano

Carla Máximo Prado –
Department of Bioscience – Federal University of São Paulo, Brazil

Dr. Prado received her undergraduate degree in Physiotherapy from Universidade Metodista de Piracicaba in 1998. She received her PhD at School of Medicine at University of São Paulo (2005). She was trained as a postdoctoral research fellow at School of Medicine at University of Sao Paulo (2006-2008) in pulmonary physiopathology.

Her academic and research experience have provided her with a strong knowledge in Respiratory physiology and physiopathology and lung diseases. Currently, Dr. Prado serves as an Associate Professor in the Department of Bioscience at Society and Health Institute at Federal University of Sao Paulo, Santos, Brazil and is head of Laboratory of Studies in Pulmonary Inflammation. She was coordinator of the Posgraduate Program in Chemical biology from 2012-2015.

Her research interests primarily focus on experimental models in vivo and in vitro to study lung diseases and inflammatory mechanisms involved in lung physiopathology. Her current emphasis is on understanding the role of cholinergic system, especially nicotine receptors on lung inflammation. Moreover, Dr Prado studies phytochemicals with anti-inflammatory potential to experimental lung diseases. During the pandemic, Dr Prado contribute to the COVID-19 studies in cell models focusing on the relationship between nicotine and ACE2.

Dr. Prado 's studies has received support from the Sao Paulo Research Foundation (FAPESP) as a principal investigator and is fellow of Brazilian National Council for Technologic and Scientific Development (CNPq).

Roberta Stilhano, PhD
Santa Casa de São Paulo School of Medical Sciences, Brazil

Dr. Stilhano received her undergraduate degree in Biomedicine from Federal University of São Paulo (UNIFESP)(2008). She received her master's and doctorate degrees in Molecular Biology, also from UNIFESP (2015). She was trained as a postdoctoral research fellow at Biomedical Engineering Department, University of California, Davis (UC Davis) (2016-2018) and Pharmacology at UNIFESP (2018). Her extensive academic training and research experience have provided her with a strong foundation in gene and cell therapy, pharmacology, molecular biology, biochemistry, and biomaterials.
Currently, Dr. Stilhano serves as an Assistant Professor in the Department of Physiological Sciences at Santa Casa de Sao Paulo School of Medical Sciences, Brazil. Her research interests primarily focus on gene and cell therapy for musculoskeletal diseases. Her current emphasis is on developing formulations of alginate hydrogels for cell and vector delivery. Additionally, during the pandemic, she made contributions to the field of COVID-19 by studying the viral kinetics of SARS-CoV-2 and developing 3D models to investigate virus replication. Dr. Stilhano's work has received support from the Sao Paulo Research Foundation (FAPESP) as a young investigator.

Friday Morning	**Presentation #**	
Time		**Session 1: Lessons Learned with Animals and 3D Cell Models** **Session Chair:** Carla Prado**,** Federal University of São Paulo **Co-Chair:** Roberta Stilhano**,** Santa Casa de Sao Paulo School of Medical Sciences
8:00	**Keynote**	**IN VIVO AND IN VITRO MODELS TO STUDY THE EFFECTS OF TOBACCO IN HEALTH** *Fernanda D. T. Q S. Lopes* *Hospital das Clínicas of University of* São Paulo*, Brazil*
8:30	**1-1**	**CHOLINERGIC PATHWAY IN LUNG DISEASES: WHAT WE HAVE LEARNED WITH CHOLINERGIC DEFICIENCY MICE** *Carla Prado* Federal University of São Paulo, *Brazil*
8:45	**1-2**	**ACTIVATION OF A7 NICOTINIC RECEPTORS BY THE AGONIST PNU-282987 MODULATES OXIDATIVE STRESS PATHWAYS IN A MODEL OF ACUTE LUNG INJURY** *Mariana Santos[1], Luana Cristina Cavallini[2], Roberta Stilhano [3], Ayman Hamouda[4], Carla Prado[1], Nathalia Pinheiro[1]* *[1]Federal University of Sao Paulo, [2]University City of São Paulo, [3]Faculty of Medical Sciences of*
9:00	**1-3**	**LESSON LEARNED FROM USING HUMAN LUNG CELL LINES TO STUDY INFLAMMATION, INFECTION, AND DRUG EFFECTS** *Robert Beaudoin* *University of Texas Tyler, Tyler, TX*
9:15	**1-4**	**ADVANCING MUSCLE REGENERATION: EXPLORING THE POTENTIAL OF ALGINATE HYDROGELS** *Roberta Stilhano* *Santa Casa de Sao Paulo School of Medical Sciences, Brazil*
9:30	**1-5**	**ANTIVIRAL EFFECTS OF CURCUMIN IN 2D AND 3D CULTURE OF SH-SY5Y INFECTED WITH SARS-COV-2** *Tiago Nicoliche[1], Tamires Alves[2], Robertha Lemes[2], Carla Máximo Prado[2], Rodrigo Portes Ureshino[3], Mirela Inês de Sairre[4], Roberta S. Stilhano[1]* *[1] Faculdade de Ciências Médicas da Santa Casa de São Paulo - FCMSCSP - Departamento de Ciências Fisiologicas – Brasil, [2] Universidade Federal de São Paulo – UNIFESP-Santos - Departamento de Biociência – Brasil, [3] Universidade Federal de São Paulo – UNIFESP-Diadema - Departamento de Ciências Biológicas – Brasil, [4] Universidade Federal do ABC - UFABC - Centro de Ciências Naturais e Humanas – Brasil*

9:45	**1-6**	**REDEFINING CELL THERAPY: DEVELOPING A COST-EFFECTIVE MICROENCAPSULATION TECHNIQUE FOR GLOBAL IMPACT** *Vinicius M Peres[1], Nelson Correa[2], Roberta Stilhano[1]* *[1]Department of Physiological Sciences, Santa Casa de Sao Paulo School of Medical Sciences, São Paulo, São Paulo, Brazil,and [2]Research Center of the Sao Paulo Cancer Institute, São Paulo, Brazil*
10:00-10:30		**BREAK**

Keynote Speaker
Session 2: Neural Interfaces

Xinyan Tracy Cui, PhD

Swanson School of Engineering,

University of Pittsburgh

Pittsburgh, PA

Dr. Tracy Cui is William Kepler Whiteford Professor of Bioengineering at the University of Pittsburgh. Dr. Cui is the Director of the Neural Tissue/Electrode Interface and Neural Tissue Engineering Lab. She is also the Neural Engineering Track Coordinator for the Department of Bioengineering Graduate Committee. Prior to this she was a Research Scientist at Unilever Research US in Edgewater, New Jersey. Dr. Cui earned her BE in Polymer Materials and Chemical Engineering and her MS in Biophysics at Tsinghua University in Beijing, China. She went on to earn her PhD in Macromolecular Science and Engineering at the University of Michigan, Ann Arbor, Michigan. In the Dr. Cui's lab, the primary research focus is on the interactions between neural tissue and smart biomaterials. This field of study is applied toward the better understanding of the neural tissue/material interface and neural tissue engineering. Dr Cui's research interests lie in neural engineering with special focuses on neural electrode-tissue interface, neural tissue engineering, central nervous system drug delivery, and biosensors. She serves as a grant agency reviewer for the National Institute of Health, National Science Foundation, National Research Agency of France, Science Foundation of Ireland, European Research Council and the American Institute of Biological Sciences. Dr. Cui holds 6 granted U.S. patents, and she is a reviewer for many prestigious journals

For her work, Dr. Cui has won numerous awards, Including: 2017 Fellow of Royal Society of Chemistry in 2017, 2016 Fellow of American Institute of Medical and Biological Engineering, 2013 and 2014 Peking University Engineering Globex Fellow, 2013 Carnegie Science Emerging Female Scientist Award, 2009, 2011 and 2015 Pitt Innovator Award, 2008 National Science Foundation Career Award, 2005 Wallace Coulter Foundation Translational Early Career Award

Time		Session 2: Neural Interfaces **Session Chair**: Elisa Castagnola, Louisiana Tech University **Co-Chair**: Melanie Ecker, University of North Texas
8:00	**Keynote**	**BIOENGINEERING STRATEGIES TOWARDS MULTIELECTRODE ARRAYS FOR CHRONIC IN VIVO NEURAL RECORDING AND CHEMICAL SENSING** *Xinyan Tracy Cui* *University of Pittsburgh, Pittsburgh PA*
8:30	**2-1**	**DOPAMINE SENSING WITH ROBUST CARBON NANOTUBE IMPLANTED POLYMER MICROPILLAR ARRAY ELECTRODES FABRICATED BY COUPLING MICROMOLDING AND INFILTRATION COATING PROCESSES** *An-Yi Chang, Xuan Liu, Prabhu U Arumugam, and Shengnian Wang* *Institute for Micromanufacturing, Center for Biomedical Engineering and Rehabilitations, Louisiana Tech University, Ruston, LA*
8:45	**2-2**	**NOVEL MICROFABRICATION OF GLASSY CARBON MICROELECTRODE ARRAYS FOR NEURAL APPLICATIONS** *Austin Broussard[1], Daniel Rivera[1], Qun Cao[2], Bingchen Wu[2,4], Davis Bailey[5,] X. Tracy Cui[2,3,4] Elisa Castagnola[1]* *[1]Department of Biomedical Engineering, Louisiana Tech University, Ruston, LA, [2]Department of Bioengineering, University of Pittsburgh, Pittsburgh, PA, [3]McGowan Institute for Regenerative Med University of Pittsburgh, Pittsburgh, PA, [4]Center for Neural Basis of Cognition, University of Pittsburgh, [5]Institute for Micro manufacturing, Louisiana Tech University, Ruston, LA*
9:00	**2-3**	**DOUBLE PATTERN-TRANSFER PHOTOLITHOGRAPHIC FABRICATION OF FLEXIBLE IMPLANTABLE GLASSY CARBON MICROELECTRODES ARRAYS FOR NEUROCHEMICAL SENSING** *Emma-Bernadette A. Faul[1], Kolby L. Gary[1], Qun Cao[2], Bingchen Wu[2,4], Davis Bailey[5,] X. Tracy Cui[2,3,4], Elisa Castagnola[1] **]* *[1]Department of Biomedical Engineering, Louisiana Tech University, Ruston, LA, [2]Department of Bioengineering, University of Pittsburgh, Pittsburgh, PA, [3]McGowan Institute for Regenerative Medicine, University of Pittsburgh, Pittsburgh, PA, [4]Center for Neural Basis of Cognition, University of Pittsburgh, Pittsburgh, PA, [5]Institute for Micromanufacturing, Louisiana Tech University, Ruston, LA*
9:15	**2-4**	**UNVEILING NEUROTRANSMITTER DYNAMICS: DUAL DETECTION OF SEROTONIN AND DOPAMINE ON A SINGLE MICROELECTRODE ARRAY AT DIFFERENT BRAIN LOCATIONS** *Rabia Fatima[1], Christi Kruger[1], Elaine M. Robbins[2], Bingchen Wu[2,4], Davis Bailey[5], X. Tracy Cui[2,3,4], Elisa Castagnola[1,2]**]* *[1]Department of Biomedical Engineering, Louisiana Tech University, Ruston, LA, [2]Department of Bioengineering, University of Pittsburgh, Pittsburgh, PA, [3]McGowan Institute for Regenerative Medicine, University of Pittsburgh, Pittsburgh, PA, [4]Center for Neural Basis of Cognition, University of Pittsburgh, Pittsburgh, PA, [5]Institute for Micromanufacturing, Louisiana Tech University, Ruston, LA*
9:30	**2-5**	**STUDYING THE EFFECTS OF COMBINATIONAL DRUG TREATMENT IN REDUCTION OF BRAIN INFLAMMATION AFTER TRAUMATIC BRAIN INJURY** *Ritika Roy[1], Pragya Dhungel[1], Geetika Sruti Vutukuri Amarnath[1], Yaswanthi Yanamadala[1], Afrika Williams[1], Claire Jones[2], Jeoung Soo Lee[2], Xiao-Hong Liu[3], Teresa Murray[1*]* *[1] Louisiana Tech University, Ruston, LA, [2] Clemson University, Clemson, SC, [3] Louisiana State University Health Sciences Center-Shreveport, LA*
		BREAK

10:00- 10:30 **Coffee Break Visit the Posters**

39th SOUTHERN BIOMEDICAL ENGINEERING CONFERENCE

Friday Morning	Presentation #	
Time		**Session 3: Nanotechnology** **Session Chair:** Olga McDaniel, University of Mississippi Medical Center **Co-Chair:** Tristan Clemons, University of Southern Mississippi
10:30	**3-1**	**ENHANCING DRUG CONJUGATION AND RESPONSIVE RELEASE THROUGH POST-POLYMERIZATION MODIFICATION OF POLY (2-VINYL-4,4-DIMETHYL AZLACTONE)** *Sk Arif Mohammad[1], Alex Fortenberry[2], Adam E. Smith[1,2] and Thomas A. Werfel*[1, 2, 3, 4]* *[1]Biomedical Engineering, [2]Chemical Engineering, and [3]BioMolecular Sciences, University of Mississippi, University, MS, USA* *[4]Cancer Center and Research Institute, University of Mississippi Medical Center, Jackson, MS, USA*
10:50	**3-2**	**IDENTIFICATION OF POTENTIAL ANXIOLYTICS IN COMPLEX MIXTURE: A CASE STUDY WITH OXIDATIVE METABOLITES OF LAVENDER ESSENTIAL OIL** *William M. Neal[1], Pankaj Pandey[2], Shamba Chatterjee[2], Ikhlas A. Khan[1, 2], Amar G. Chittiboyina[1, 2]* *[1]Division of Pharmacognosy, Department of BioMolecular Sciences, School of Pharmacy, The University of Mississippi, University, MS,, [2]National Center for Natural Products Research, Research Institute of Pharmaceutical Sciences, School of Pharmacy, The University of Mississippi, University, MS*
11:05	**3-3**	**CHARACTERIZATION OF PROTEIN CORONA FORMATION ON BIOMIMETIC GLYCOPOLYMER NANOPARTICLES** *Kenneth R. Hulugalla[1], Oluwaseyi Shofolawe-Bakare[3], Claylee Chism[4], Veeresh Toragall[2], Sandeep K. Misra[1], Joshua S. Sharp[1], Eden E. L. Tanner[4], and Thomas A. Werfel*[*,1, 2, 3] *[1]BioMolecular Sciences, [2]Biomedical Engineering, [3]Chemical Engineering and [4]Chemistry and Biochemistry, University of Mississippi, University, MS*
11:20	**3-4**	**VINDICATION OF A VILLAIN: HELICOBACTER PYLORI AS AN ANTICANCER BACTERIAL VECTOR?** *Selina Zhang, Jake Y. Chen* *AI.MED Lab, Informatics Institute, School of Medicine, University of Alabama at Birmingham, AL*
11:35	**3-5**	**APPLICATIONS OF POLYMERS, FOR THE TREATMENT OF DISEASE AND INJURY** *Tristan Clemons* *School of Polymer Science and Engineering, University of Southern Mississippi, Hattiesburg, MS*
12:00-1:50		**LUNCH, PANEL, PLENARY**

Friday Morning	Presentation #	
Time		**Session 4: Biomaterials** **Session Chair:** Amol Janorkar, University of Mississippi Medical Center **Co-Chair**: Joel D. Bumgardner, University of Memphis
10:30	**4-1**	**EXPLORING THE IMPACT OF PORE SIZE AND DRYING METHODS ON THE MECHANICAL PROPERTIES OF 3D-PRINTED CHITOSAN SCAFFOLDS FOR CARTILAGE TISSUE ENGINEERING** *Ali Sadeghianmaryan[1], Joel D. Bumgardner[1], Saman Naghieh[2], Hamed Alizadeh Sardroud[3], Zahra Yazdanpanah[3], Xiongbiao Chen[2]* *[1]Department of Biomedical Engineering, University of Memphis, Memphis, TN, USA [2]Division of Biomedical Engineering, University of Saskatchewan, Saskatoon, SK, Canada*

10:45	**4-2**	**SYNTHESIS OF PROGRAMABLE HYDROGEL AT ROOM TEMPERATURE WITH TUNEABLE RELEASE FOR VARIOUS DELIVERY APPLICATIONS** *Emily Rasmussen[1], Sk Arif Mohammad[2], Adam E. Smith[2,3] and Thomas A. Werfel[1, 2, 3, 4]* *[1]BioMolecular Sciences, [2]Biomedical Engineering, [3]Chemical Engineering, and University of Mississippi, University, MS,* ***[4]Cancer Center and Research Institute, University of Mississippi Medical Center, Jackson, MS***
11:00	**4-3**	***OPTIMIZATION OF 3D BIOPRINTING PROCESS PARAMETERS OF COMPOSITE BONE SCAFFOLD FOR TISSUE ENGINEERING*** *Mahathir Mohammad Bappy[1], Emma Van Epps[2], Lauren B. Priddy [2], Wenmeng Tian [1]* *[1]Department of Industrial and Systems Engineering, Mississippi State University, Mississippi State, MS, [2]Department of Agricultural and Biological Engineering, Mississippi State University, Mississippi State, MS*
11:15	**4-4**	**DETERMINING THE SYNERGISTIC EFFECTS OF ECM COATING ON AXONAL GROWTH IN COLLAGEN GEL 3D-MODEL** *Peter Kutuzov, Jonathan Grasman, Jarin Tusnim* *New Jersey Institute of Technology*
		LUNCH, PANEL, PLENARY

The Effects of COVID on Biomedical Education

September 8, 2023
12:00-12:45 PM

Moderator: Joseph A. Cameron, Ph.D.

Panel: Julie Pigza, Ph.D., Barbara Graham, Ph.D., and Shamonica King, Ph.D.

Dr. Julie A. Pigza is an Associate Professor of Chemistry at the University of Southern Mississippi in Hattiesburg, MS. She received her B.S. from Allegheny College in Meadville, PA in Chemistry in 2002 with her thesis focusing on the synthesis of substituted furans under the advisorship of Dr. S. Shaun Murphree. She obtained her PhD in 2008 and her interests in NMR spectroscopy under the tutelage of Dr. Jeffrey N. Johnston at Indiana University (currently at Vanderbilt University) while on a total synthesis project of the biologically relevant alkaloid serratezomine A. In 2009, she completed a postdoc with Dr. Tadeusz S. Molinski at the University of California, San Diego where she focused on methodology development of non-natural amino acids. Her independent career began as an Assistant Professor at Queensborough Community College in Bayside, NY from 2010-2013 before her final move to USM (2013-current). Dr. Pigza's research group is interested in using small, chiral molecules as organocatalysts to facilitate new bond forming strategies. While at USM, Dr. Pigza has mentored students at all levels in the research lab, including 4 graduate, 29 undergraduate, and 6 high school students. Students have been awarded with funding at all levels, including graduate student stipend support through the National Science Foundation (NSF NRT), undergraduate support through research internships (St. Jude's Pediatric Oncology Program, NSF REU) and internal research funding (Drapeau Summer grant, Eagle Wings, and Eagle SPUR). High school support has been received through the American Chemical Society Project SEED. Students have given a total of 98 presentations at various conferences, 26 of those earning awards in their respective categories.

Barbara Graham is director of the Environmental Science Ph.D. Program at Jackson State University. She is a recognized leader in higher education, working to ensure that all have an equal opportunity to improve their lives through education.
Graham knows first-hand the power of a college credential, and she has made it part of her life's mission to help others, especially minorities achieve prosperity through a hearty education.

She has taught Chemistry, Biology and a variety of Environmental Science graduate courses. Graham has researched, taught and consulted in areas of environmental science, student success, first-year student retention, and STEM retention. She has worked in collaborative projects with non-STEM faculty to diversify STEM by introducing students from other disciplines with opportunities to participate in various STEM led programs. Graham has over 30 years' experience in education. She has also served as Associate Director for Environmental Science Instructional Division, Assistant Chairperson Department of Biology and Institutional Review Board member.
She has authored or co-authored several peer-reviewed publications on environmental toxicology, metal ions, among other topics.
Graham holds a bachelor's degree in Biology, a master's degree in Genetics and a doctorate in Environmental Science (Toxicology) from the Jackson State University.
She is a graduate of Houston High School (Houston, MS).

Dr. Shamonica King is a Clinical Assistant Professor at Xavier University of Louisiana and serves the Program Director of Medical Laboratory Sciences in the Department of Biology and Medical Laboratory Sciences. She earned her Ph.D. in Clinical Health Sciences from the University of Mississippi Medical Center. In addition to her Ph.D., Dr. King also received her Bachelor of Science degree in Biology from Jackson State University and a second Bachelor of Science degree from the University of Mississippi in Clinical laboratory Sciences and her Masters of Art Degree in Higher Education from the University of Mississippi. She is an ASCP board certified medical technologist in the areas of hematology, urinalysis, and coagulation. She has served as clinical instructor and clinical laboratory liaison since 2007. She guest lectured at the University of Mississippi Medical Center and Mississippi College while working in a clinical lab for Mississippi State University in the areas of serology and molecular diagnostics. Since 2020 she has been with Xavier University in her current position.

PLENARY LECTURE

September 8, 2023

12:50-1:45 PM

DEVELOPING NOVEL BIOLOGICS USING A PROTEIN-BASED DRUG DELIVERY SYSTEM

by

Dr. Gene "Lee" Bidwell

Professor of Neurology

Associate Vice Chancellor for Research

University of Mississippi Medical Center

Gene "Lee" Bidwell, PhD is currently Professor of Neurology, Chief of the Neurology Basic Science Research Division, and Associate Vice Chancellor for Research at the University of Mississippi Medical Center (UMMC). Dr. Bidwell is originally from Greenwood, MS, and he completed his undergraduate degree from the University of Mississippi in Oxford in 2002. He completed the Ph.D. program and a postdoctoral fellowship in Biochemistry at UMMC. In October 2011, Dr. Bidwell joined the faculty as Assistant Professor in the Department of Neurology. He was promoted to Associate Professor of Neurology in 2016, awarded tenure in 2018, promoted to Professor in 2021, and named Division Chief in 2022. His research interests include targeted drug delivery and development of therapeutic proteins. Current areas of focus in Dr. Bidwell's lab include drug delivery during pregnancy, delivery of neurotrophic or anti-inflammatory agents to the brain for therapy of neurological disorders or ischemic stroke, and therapeutic angiogenesis for kidney disease. His lab is developing carriers that can be fused to therapeutic agents to target them to specific organs in the body, including the brain and the kidney, or to prevent them from crossing the placenta and reaching the baby during pregnancy. Dr. Bidwell is an author on 59 scientific manuscripts and an inventor on 7 issued patents and 4 pending patent applications. Dr. Bidwell is currently the Principal Investigator on 2 NIH R01 grants and an NIH Phase II Small Business grant, and his research has been continually funded by NIH since 2014. His research program has also been supported by the American Heart Association, the Department of Defense, and industry sponsors. Dr. Bidwell has served as a grant reviewer on multiple NIH and DoD study sections and has twice served as Chair of the DoD Sustained Release Drug Delivery study section. Dr. Bidwell is currently the Chair of the American Physiological Society's (APS) Central Nervous System Section Steering Committee and a former member of the APS Animal Care and Experimentation Committee.

Scientific Sessions

Keynote Speaker : Session 5: Neuroscience

Norma B. Ojeda, MD
Department of Advanced Biomedical Education.
University of Mississippi Medical Center , Jackson, MS

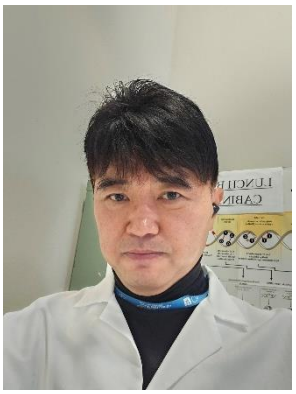
The utilization of immersive technologies in biomedical education is spearheading the changes in biomedical education to increase engagement and learning effectiveness. The most utilized methods of immersive technologies in biomedical education includes virtual reality, augmented reality and mixed reality. Virtual reality utilizes a collection of hardware, and tracking sensors to create a simulated reality. This simulation of a three-dimensional environment generates a seemingly real or physical experience for the learner to explore and interact with models and systems. Augmented Reality overlays digital content onto the real world to create interactive learning experiences, allowing students to explore and interact with 3D models in a more immersive way. Mixed reality utilizes virtual reality and augmented reality technologies to create immersive learning experiences. It allows students to interact with 3D models practice procedures in a safe and realistic environment. The interaction with learners using mixed reality allows changes in the scenarios according to the input received from learners as they complete tasks or answer questions. More than 50% of educators in the biomedical fields are using virtual reality in the learning process. Early reports suggest that learners using immersive technologies showed higher grades better performance on tests, and greater.

Friday Afternoon	**Presentation #**	
Time		**Session 5: Neuroscience** **Session Chair:** Lir-Wan Fan, University of Mississippi Medical Center **Co-Chair**: Yi Pang, University of Mississippi Medical Center **Co-Chair**: Nilesh Dankhara, University of Mississippi Medical Center
2:00	**Keynote**	**IMMERSIVE TECHNOLOGIES IN BIOMEDICAL EDUCATION** *Norma B. Ojeda* *University of Mississippi Medical Center*
2:30	**5-1**	**PLACENTAL MECHANISMS OF NEURODEVELOPMENTAL IMPAIRMENTS** *Yi Pang[1], Shuying Lin, Kathleen Carter, Lir-Wan Fan* *University of Mississippi Medical Center*
2:45	**5-2**	**BOTH MATERNAL INFLAMMATION AND INTRAUTERINE GROWTH RESTRICTION ENHANCE SUSCEPTIBILITY TO ISCHEMIC STROKE-INDUCED BRAIN INJURY AND NEUROBEHAVIORAL DYSFUNCTION IN RATS** *Valerie V Quach[1], Jonathan W Lee[2], Aswin I Arunachalam[2], Madeline C. Herris[2], Adrianna N Cooper[2], Emily C Turbeville[2], Nathaniel Lee[2], Irene Arguello[3], Nilesh Dankhara[2], Lu-Tai Tien[4], Lir-Wan Fan[2], Norma B Ojeda[5]* *[1]John Sealy School of Medicine, University of Texas Medical Branch, Galveston, TX , [2]Department of Pediatrics, Division of Newborn Medicine, University of Mississippi Medical Center, Jackson, MS, [3]Department of Pediatrics, University of Mississippi Medical Center, Jackson, MS, [4]School of Medicine, Fu Jen Catholic University, Xinzhuang Dist, New Taipei City 24205, Taiwan, [5]Department of Advanced Biomedical Education, University of Mississippi Medical Center, Jackson, MS*

3:00	**5-3**	**NEONATAL LIPOPOLYSACCHARIDE EXPOSURE EFFECTS ON METHAMPHETAMINE-INDUCED ALTERATIONS IN DOPAMINE TRANSPORTER AND ASSESSMENT OF REINSTATED BEHAVIORAL SENSITIZATION IN ADULT RATS WITH MACHINE LEARNING-BASED ANALYSIS** *Jonathan W Lee[1], Kuo-Ching Wang[2], Norma B Ojeda[3], Haifeng Wang[4], Han-Sun Chiang[5], Michelle A Tucci[6], Han-Chi Wei[5], Asuka Kaizaki-Mitsumoto[7], Sachiko Tanaka[8], Nilesh Dankhara[1], Lu-Tai Tien[5], Lir-Wan Fan[1]* *[1]Department of Pediatrics, Division of Newborn Medicine, University of Mississippi Medical Center, Jackson, MS 39216, USA, [2]Department of Anesthesiology, Shin Kong Wu Ho-Su Memorial Hospital, Taipei City, Taiwan, [3]Department of Advanced Biomedical Education, University of Mississippi Medical Center, Jackson, MS 39216, USA, [4]Department of Industrial and Systems Engineering, Mississippi State University, Mississippi State, MS 39762, USA, [5]School of Medicine, Fu Jen Catholic University, Xinzhuang Dist, New Taipei City 24205, Taiwan, [6]Department of Anesthesiology, University of Mississippi Medical Center, Jackson, MS 39216, USA, [7]Department of Pharmacology, Toxicology & Therapeutics, Division of Toxicology, School of Pharmacy, Showa University, Shingawa-ku, Tokyo 142-8555, Japan, [8]School of Pharmacy, Nihon University, Funabashi, Chiba 274-8555, Japan*
3:15	**5-4**	**MULTI-MATERIAL 3D NANOPRINTED PEGDA SCAFFOLD FOR SPINAL CORD REGENERATION** *Nathaniel Harris[1], Krishna Sharma[2], Min Zou[1], Jennifer Xie[3]* *[1]College of Mechanical Engineering, University of Arkansas, [2]Arkansas Biosciences Institute, Arkansas State University, [3]New York Institute of Technology College of Osteopathic Medicine at Arkansas State*
3:30	**5-5**	**HYDROGEL COMPOSITES FOR THE TREATMENT OF CRANIOFACIAL DEFECTS** *Lir-Wan Fan[1], Jonathan W Lee[1], Amol V Janorkar[2], Sheetal Chowdhury[2], Chipo Chapusha[2], David P. Gordy[3], Bernadette E Grayson[4], Michelle A Tucci[5]* *[1]Department of Pediatrics, Division of Newborn Medicine, University of Mississippi Medical Center, Jackson, MS 39216, USA, [2]Department of Biomedical Materials Science, University of Mississippi Medical Center, Jackson, MS 39216, USA, [3]Department of Radiology, University of Mississippi Medical Center, Jackson, MS 39216, USA, [4]Department of Neurology, University of Mississippi Medical Center, Jackson, MS 39216, USA, [5]Department of Anesthesiology, University of Mississippi Medical Center, Jackson, MS 39216, USA*
		BREAK

Keynote Speaker
Session 6: Nanomaterials and Nanomedicine

Unlocking the Potential of Cell-Free Therapeutics: Advancing with High-Quality Exosome Manufacturing



Dongki Kim, Ph.D., CEO
ExoTop Theragnostics, Inc.
Pasadena Bio Collaborative Incubator
2265 E Foothill Blvd, Pasadena, CA, 91107

Dr. Dongki Kim is a visionary leader serving as the CEO and Co-founder of ExoTop Theragnostics, a groundbreaking biotech company specializing in nanomedicine based on extracellular vesicles (EVs). These nano-sized particles, secreted by various cells ranging from prokaryotes to eukaryotes, hold immense potential for revolutionizing medical treatment. After completing his undergraduate studies in South Korea, Dr. Dongki Kim pursued his passion for biochemistry, obtaining an MS degree from Waseda University in Japan. He further expanded his expertise by earning a Ph.D. in biomedical science from the prestigious Tokyo Institute of Technology. Driven by a desire to develop more effective drugs for brain diseases, Dr. Kim relocated to the United States to join the esteemed research team led by Dr. Dawin J. Prockop in Texas.

Years of dedicated research in Texas led Dr. Kim to a remarkable breakthrough: the development of a novel protocol for isolating EVs with exceptional purity and abundance from adult stem cells. This pioneering achievement has significant implications for the treatment of brain diseases, particularly traumatic brain injury. Through independent and collaborative studies, Dr. Kim has discovered that EVs derived from adult stem cells possess remarkable anti-inflammatory properties and the ability to modulate immune responses. These findings highlight their potential in addressing both acute and chronic diseases, including autoimmune conditions. Dr. Kim proposes that their efficacy may stem from their capacity to inhibit macrophages and antigen-presenting cells, representing a promising mechanism of action.

ExoTop Theragnostics has recently elevated its nanoparticle purification methodology to not only isolate EVs from stem cells but also from diverse immune cells such as T-cells and NK cells, as well as biofluids like blood and urine. Building upon this advancement, the company has set its sights on two critical areas: Cell-free EV (exosome) therapeutics: Leveraging the power of EVs, ExoTop Theragnostics aims to develop innovative treatments that do not rely on live cells, unlocking the potential of exosomes as therapeutic agents.

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39th SOUTHERN BIOMEDICAL ENGINEERING CONFERENCE

Friday Afternoon	Presentation #	
Time		**Session 6: Nanomaterials and Nanomedicine** **Session Chair:** Eunsoo Yoo, North Carolina A&T State University **Co-Chair**: Narayan Bhattarai, North Carolina A&T State University
2:00	**Keynote**	**UNLOCKING THE POTENTIAL OF CELL-FREE THERAPEUTICS: ADVANCING WITH HIGH-QUALITY EXOSOME MANUFACTURING** *Dong-Ki Kim* *ExoTop Theragnostics, Inc, Pasadena, CA.*
2:30	**6-1**	**NANOFIBER ENABLED HYDROGEL SPHEROIDS FOR 3D CELL CULTURE PLATFORM** *Thakur Sapkota[1], Sita Shrestha[1], Bishnu Shrestha[1], Narayan Bhattarai[1]* *[1]Department of Chemical, Biological and Bioengineering, North Carolina A&T State University, Greensboro, NC 27411, USA*
2:45	**6-2**	**THERAPEUTIC POTENTIAL OF MESENCHYMAL STEM CELL-DERIVED EXTRACELLULAR VESICLES (MSC-EVS) IN THE PREVENTION OF CISPLATIN-INDUCED HEARING LOSS** *Joshua Worsham[1], Rohith Arunachalam[1], Rosie Park[1], Dong-Ki Kim[2], Rui Ma[3], Eunsoo Yoo[1]* *[1]North Carolina A&T State University, [2]ExoTop Theragnostics, Inc., [3]Eye & ENT Hospital, Fudan University*
3:00	**6-3**	**ZINC NANOPARTICLES INCORPORATED 2D NANOFIBROUS SCAFFOLDS ENHANCE FIBROBLASTS RESPONSE TO PROMOTE CELL PROLIFERATION** *Felix Tettey[1,2], Sita Shrestha[1], Salil Desai[2], Narayan Bhattarai[1]* *[1]Department of Chemical, Biological and Bioengineering & [2]Department of Industrial Syst. Engineering, North Carolina A&T State University, Greensboro, NC 27411, USA*
3:15	**6-4**	**OTOPROTECTIVE EFFECTS OF MESENCHYMAL STEM CELL-DERIVED EXTRACELLULAR VESICLES (MSC-EVS) FOR PREVENTING NOISE-INDUCED HEARING LOSS** *Kainaza Carzo[1], Rosie Park[1], Dong-Ki Kim[2], Rui Ma[3], Eunsoo Yoo[1]* *[1]North Carolina A&T State University, [2]ExoTop Theragnostics, Inc., [3]Eye & ENT Hospital, Fudan University*
3:30	**6-5**	**CHEMICALLY ENGINEERED EXTRACELLULAR VESICLES AS AN IMMUNOMODULATION FOR EXPERIMENTAL AUTOIMMUNE UVEITIS** *Gagandeep Kaur and Krushi Suresh* *Howard University*
		BREAK

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39th SOUTHERN BIOMEDICAL ENGINEERING CONFERENCE

Friday Afternoon	Presentation #	
Time		**Session 7: Clinical Rehab** **Session Chair:** Felix Adah, University of Mississippi Medical Center **Co-Chair**: Kenneth Butler, University of Mississippi Medical Center
4:00	**7-1**	**THE EFFECTS OF STANDING DESKS ON COGNITIVE PERFORMANCE IN THE CLASSROOM: A SYSTEMATIC REVIEW** *Joy Kuebler, Amanda Y. Kim, Michael S. Childers, Robert E. Lee, Tatjana C. Olinyk* *[1]Department of Physical Therapy, School of Health Related Professions, University of Mississippi Medical Center, Jackson, MS*
4:15	**7-2**	**THE EFFECT OF YOGA ON ANXIETY LEVELS IN PREGNANT WOMEN: A SYSTEMATIC REVIEW** *Katherine Annaleigh Buckley, Kimberly R. Willis* *Department of Physical Therapy, School of Health Related Professions, University of Mississippi Medical Center, Jackson, MS*
4:30	**7-3**	**EFFECTIVENESS OF VIRTUAL REALITY ON PHYSICAL AND COGNITIVE PERFORMANCES IN THE CONTEXT OF FALL PREVENTION AMONG OLDER ADULTS: A SYSTEMATIC REVIEW** *Lisa Barnes-Foster and Subhasree Sridhar* *University of North Georgia, Dahlonega, Georgia*
4:45	**7-4**	**EFFECTS OF EXERCISE ON QUALITY OF LIFE IN PEOPLE WITH LONG COVID-19: A SYSTEMATIC REVIEW** *Abigail H. Thiessen[1], Katelyn O. May[1], Julia H. McCarty[1] , Coleman S. Suber[1], Melanie Lauderdale[1]* *[1]Department of Physical Therapy, School of Health Related Professions, University of Mississippi Medical Center, Jackson, MS*
5:00	**7-5**	**THE FEASIBILITY OF SMART DEVICES TO INCREASE PHYSICAL ACTIVITY IN OLDER ADULTS: A SYSTEMATIC REVIEW** *Hatten Livingston, Erin Carpenter, Tyler Barnes, Jay Johnston, Sherry Colson* *Department of Physical Therapy, School of Health Related Professions, University of Mississippi Medical Center, Jackson, MS*
5:15	**7-6**	**EFFICACY OF NON-INVASIVE ELECTRICAL STIMULATION ON MIGRAINE HEADACHE PREVENTION** *Ameze Ero* *University of Mississippi Medical Center, Jackson, MS*
5:30	**7-7**	**SECONDARY INTRACRANIAL HYPERTENSION FROM RAPID CORRECTION OF PROFOUND HYPOTHYROIDISM WITH IV LEVOTHYROXINE: A CASE REPORT** *Ameze Ero* *University of Mississippi Medical Center, Jackson, MS*
5:45	**7-8**	**PHYSICAL THERAPY FOR A CHILD POST COVID-19 WITH MULTIPLE AMPUTATIONS** *Carol D. Parker, Corinne A. Sampson, Anna P. Scruggs, Janet P. Slaughter, Shuying Lin* *University of Mississippi Medical Center, Jackson, MS*
6:00	**7-9**	**THE EFFECTS OF TRANSCRANIAL DIRECT CURRENT STIMULATION ON DUAL-TASK COSTS IN OLDER ADULTS: A SYSTEMATIC REVIEW** *Felix Adah* *University of Mississippi Medical Center*
		END OF DAY

Keynote Speaker
Session 8: Biomedical Education

IT TAKES A VILLAGE TO BE SUCCESSFUL IN ACADEMIA

K. Raja Reddy
William Giles Distinguished Professor
Mississippi State University, Mississippi State, MS

Dr. Reddy is William L. Giles Distinguished Professor at Mississippi State University. He received his BS, MS, and Ph.D. degrees from Sri Venkateswara University, Tirupati, India, in 1975, 1977, and 1984. He joined the Plant and Soil Sciences Department at Mississippi State in 1988 and became Research Professor in 1992.

Dr. Reddy's research interests include the impact of anthropogenic climate change, remote sensing, and crop modeling applications on agricultural resource management through the lens of environmental plant physiology. He has over 35 years of research experience at Mississippi State and manages the state-of-the-art sunlit plant growth chambers known as Soil-Plant-Atmosphere-Research (SPAR, https://www.spar.msstate.edu/). He is responsible for and credited with many critical discoveries across multiple facets of agriculture. His research includes the impact of climate change on crop physiology, growth, and development of several outstanding foods, fiber, and native grassland and forages crops of global importance - cotton, soybean, rice, corn, sorghum, sweet potato, switchgrass, Bahiagrass, many horticultural crops, and domain expertise areas of remote sensing and stress physiology; and crop model applications.

Dr. Reddy has over 300 publications, including two books written, four edited volumes, and over 30 book chapters. In addition to his research obligations, he developed a capstone graduate-level course, environmental plant physiology, that interfaces research, teaching, and learning based on research he conducted using state-of-the-art SPAR facilities at Mississippi State. He received external funding from federal and state commodities boards and private industry to support his research and training program.

Dr. Reddy has received several recognitions and awards: The L.R. Ahuja Ag. Systems and Modeling Award from the Soil Science Society of America (2023), the SEC Faculty Achievement Award (2019), MSU's Ralph E. Powe Award (2012), ICAC Cotton Researcher of the Year Award (2020), the Outstanding Research Award in Cotton Physiology (2010) by the National Cotton Council of America, the Mississippi Academy of Sciences Outstanding Contributions Science Award (2020), the DAFV's Superior Faculty Research Award (2018) and International Service Award (2016), the MAFES's Excellence in Research Awards (2006, 2018), and six-times MAFES's Outstanding Publication Awards for seven times. In addition, he became elected Fellow of the American Society of Agronomy (2005), the Crop Science Society of America (2006), the American Association for the Advancement of Science, AAAS (2020), and the Mississippi Academy of Sciences (2021). In 2021, Stanford University in Biology listed him as one of the World's Top 2% Scientists. He served as the Mississippi Academy of Sciences president for two terms.

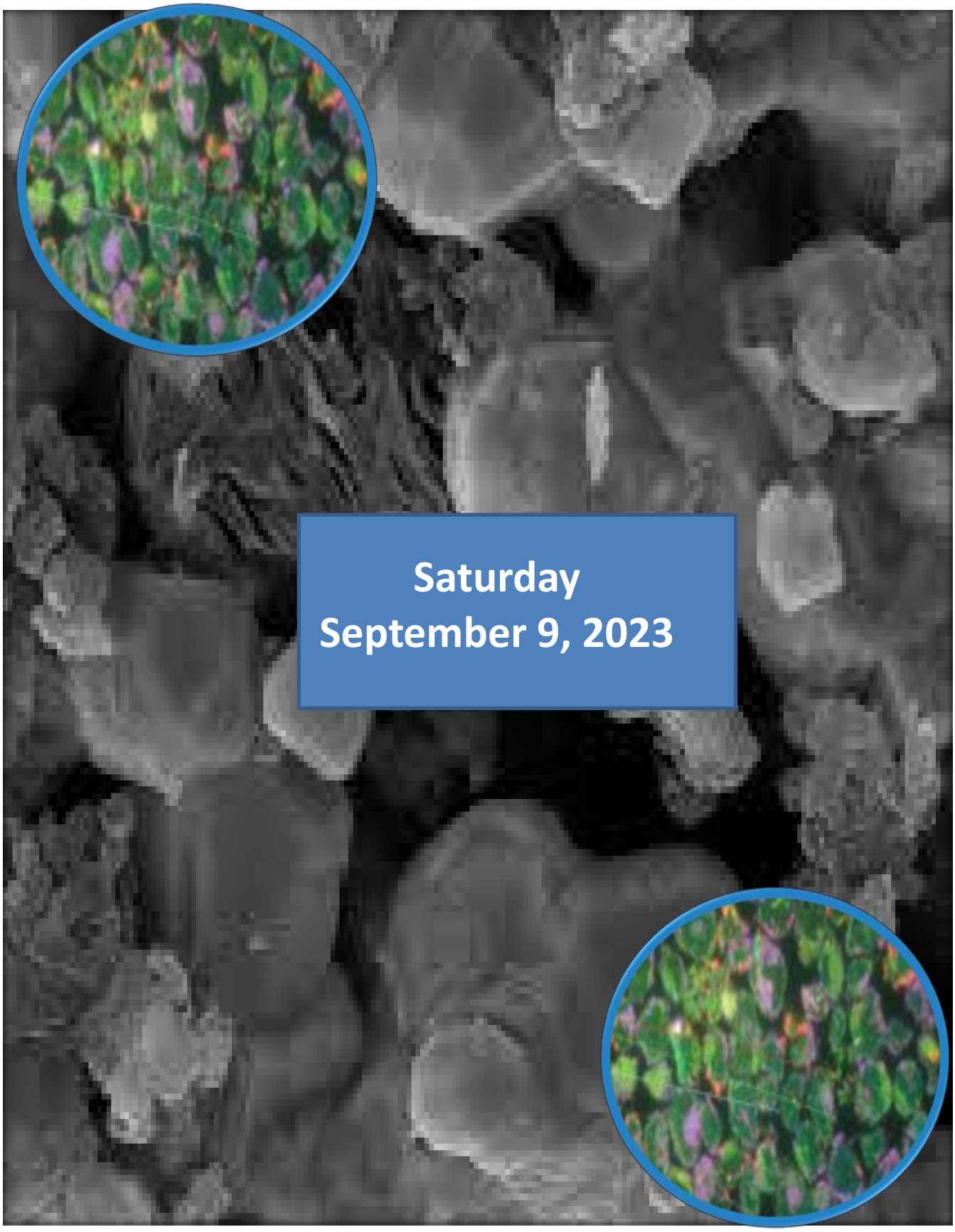
He has trained over 40 visiting and 16 postdoctoral scientists, 28 graduate students (16 Ph.D. and 12 MS), and eight undergraduate research scholars worldwide in multiple areas such as crop stress physiology, climate change, crop modeling, remote sensing, and global food security.

Outside of his numerous academic and research obligations, Dr. Reddy serves as faculty advisor of the Indian Student Association on campus. In the Starkville community, he is actively involved with the Kiwanis Club. Dr. Reddy has extended his leadership skills to the organization by chairing numerous committees and the Kiwanis Board and serving as chapter President. Dr. Reddy is also actively nurturing and engaging local High School Key Club students in developing service-leadership skills and 4-H students by providing global mindedness and citizenship through various campus programs.

39th SOUTHERN BIOMEDICAL ENGINEERING CONFERENCE

Friday Afternoon	presentation #	
Time		**Session 8: Education** **Session Chair:** Joseph A. Cameron, Jackson State *University* **Co-Chair**: Judy Gordy, University of Mississippi Medical Center
4:00	**Keynote**	**IT TAKES A VILLAGE TO BE SUCCESSFUL IN ACADEMIA** *K. Raja Reddy* *Mississippi State University, Mississippi State, MS*
4:30	**8-1**	**A MIXED-METHODS STUDY OF FACULTY DISTANCE EDUCATION EXPERIENCE DURING THE COVID-19 PANDEMIC** *Driscoll DeVaul[1], Angela Burrell[2], Kendria Lyles[2], Britney Reulet[1], Kristy Cole[3], Celia Lea A. Reulet[4], Carley Dear[5], Xiaoshan Gordy[1*]* *[1] Department of Health Sciences, School of Health Related Professions, University of Mississippi Medical Center, Jackson MS,* *[2] Department of Health Administration, School of Health Related Professions, University of Mississippi Medical Center, Jackson MS* *[3] Department of Occupational Therapy, School of Health Related Professions, University of Mississippi Medical Center, Jackson MS* *[4] Department of Medical Laboratory Science, School of Health Related Professions, University of Mississippi Medical Center, Jackson MS* *[5] School of Nursing, University of Mississippi Medical Center, Jackson MS*
4:45	**8-2**	**COVID'S LINGERING EFFECTS ON FACE-TO-FACE INSTRUCTION: OUR PATH FORWARD** *Gloria Miller, Ph.D* *Department of Biology, Jackson State University, Jackson, MS*
5:00	**8-3**	**MENTAL HEALTH STATUS AMONG STUDENTS ON DILLARD UNIVERSITY CAMPUS: THE UNCF, STEVE FUND & HEALTHY MINDS SURVEY 2023 INITIATIVE** *Lashanda Brumfield[1], Mickel Sandifer[2], Jamar Simmons[1]* *[1]Dillard University and [2]Emory University*
5:15	**8-4**	**EFFECTIVE METHODS FOR K – 12 TEACHERS TO ENSURE STUDENT ACQUISITION OF ACADEMIC MATERIAL IN VIRTUAL CLASSES** *Kesia Jones* *School of Education, William Carey University, Hattiesburg, MS*
5:30	**8-5**	**FOSTERING DIVERSITY, EQUITY, AND INCLUSION IN THE CLASSROOM** *Gloria Miller* *Department of Biology, Jackson State University, Jackson, MS*
5:45	**8-6**	**A BRIEF REVIEW OF THE PATHOPHYSIOLOGY, CLINICAL PRESENTATION, DIAGNOSIS, AND TREATMENT OF HASHIMOTO'S THYROIDITIS WITH A FOCUS ON 10 YEARS OF UMMC DATA** Lillion Hamil[1], Lamar Hamil[2], Kenneth Butler[3], Hamed Benghuzzi[4], Michelle Tucci[3] *[1]Mendenhall High School, [2]Belhaven University, [3]University of Mississippi Medical Center, [4]Jackson State University*
6:00	**8-7**	**EXPLORING MORAL AND ETHICAL PREDICAMENTS UTILIZING ARTIFICIAL INTELLIGENCE IN HEALTHCARE DECISIONS** *Kenneth Butler[1] and Lamar Hamil[2]* *[1]Mind Center University of Mississippi Medical Center, Jackson, MS and [2]Belhaven University, Jackson, MS*
		End of Day

39th SOUTHERN BIOMEDICAL ENGINEERING CONFERENCE



Saturday, September 9, 2021

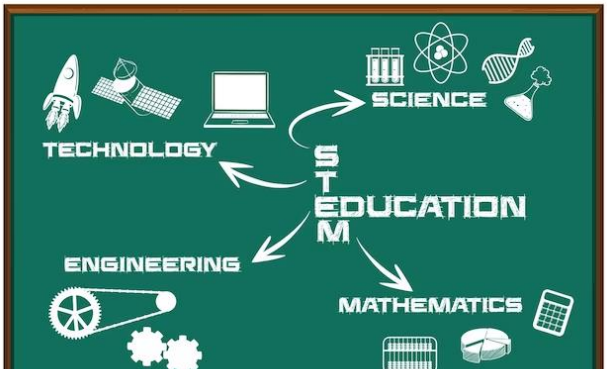
7:00 am-5:00 pm **Registration**

Scientific Session

POSTER SESSION 7:30-9:30

Saturday Morning	Presentation #	
Time		**Session 9: Biomechanics** **Session Chair:** Subrata Saha, *University of Washington* **Co-Chair**: Giovanni Solitro, *Louisiana State University Health-Shreveport* **Co-Chair**: Denis DiAnglo, University of Tennessee Health Science Center
7:30	**9-1**	**BONE PERMEABILITY CORRELATION TO CT ATTENUATION: EXPERIMENTAL STUDY ON TIBIAL TRABECULAR BONE** *Adrian Alepuz[1], Francesco Travascio[2,3], R Shane Barton[4], Steven Kautz[4], Nicholas McGee[4], Loren Latta[2], Abeer Albarghouthi[2], Giovanni F Solitro[4]* *[1]Nova Southeastern University, Fort Lauderdale, FL, [2]Max Biedermann Institute for Biomechanics, Miami Beach, FL, [3]University of Miami, Miami, FL,[4]Louisiana State University Health-Shreveport, Shreveport, LA*
7:45	**9-2**	**ASSESSMENT OF FRACTURE RISK INDEX AND FRACTURE LOCATION AT DIFFERENT LOADING DIRECTIONS VIA QCT-FE ANALYSIS** *Rabina Awal[1], Tanvir Faisal[1]* *[1]Department of Mechanical Engineering, University of Louisiana at Lafayette, LA*
8:00	**9-3**	**A MULTI-STRUCTURAL FIBRIL-REINFORCED PORO-HYPERELASTIC (MSFPH) FINITE ELEMENT MODEL TO UNDERSTAND THE PATHOMECHANICS OF ARTICULAR CARTILAGE** *Md Saiful Islam and Tanvir Faisal* *University of Louisiana at Lafayette, Lafayette, LA*
8:15	**9-4**	**HYPERELASTIC MATERIAL MODELS FOR COMPUTATIONALLY INVESTIGATING ENZYME-MEDIATED CARTILAGE MECHANICS** *Asif Istiak[1], Tanvir Faisal[1]* *[1]Department of Mechanical Engineering, University of Louisiana at Lafayette, Lafayette, LA*
8:30	**9-5**	**PEAK FORCES ACROSS THE ACL DURING THE PHANTOM FOOT LIMB INJURY: ASSESSING KNEE FLEXION ANGLE** *Adam Magana, Natalia McIver, Christopher Kurnik, Dustin Richter, Christina Salas* *University of New Mexico, Albuquerque, NM*
8:45	**9-6**	**TOTAL KNEE ARTHROPLASTY WITH MEDIAL COLLATERAL LIGAMENT REPAIR: A BIOMECHANICAL STUDY** *Leilani Baker, Natalia McIver, Jacob Sanchez, Adam Magana, Nick Brady, Michael Decker, Christina Salas* *University of New Mexico, Albuquerque, NM*
		BREAK

Saturday Morning	Presentation#	
Time		**Session 10: Medical Devices and Implants I** **Session Chair:** Christina Salas, University of New Mexico **Co-Chair**: Elisa Castagnola, Louisiana Tech University
9:15	**10-1**	**A CLINICAL TRIAL FOR FACIAL PROSTHETICS** *Lawrence Gettleman[1] and Sudarat Kiat-Amnuay[2]* *[1]University of Louisville, School of Dentistry, Louisville, KY and [2]University of Texas Health Science Center, Houston, School of Dentistry, Houston, TX*
9:30	**10-2**	**FLEXIBLE LEG-WORN DEVICE FOR TRANSCUTANEOUS NEUROMODULATION TO TREAT NEUROGENIC BOWEL DISORDER (NBD) IN SPINAL CORD INJURY (SCI) PATIENTS** *Chandani Chitrakar1, Pedro Emanuel Rocha Flores2, Eric Kildebeck2, Melanie Ecker1, Walter Voit3, Victor Pikov4* *1 Department of Biomedical Engineering, University of North Texas, Denton, TX, USA* *2 Department of Biomedical Engineering, The University of Texas at Dallas, Richardson, TX,* *3 Department of Material Science and Engineering, The University of Texas at Dallas, Richardson, TX*
10:30	**10-3**	**LOWER EXTREMITY GUIDED AND ASSISTED REHABILITATION DEVICE (LEGARD) FOR HIP SURGERY PREOPERATIVE STRENGTHENING AND REHABILITATION** *Elias Rosales Zaragoza, Rebekah Gridley, Bryan Medina De La Paz, Adam Magana, Christina Salas* *University of New Mexico, Albuquerque, NM*
10:45	**10-4**	**PROTEIN-MODULATED 3D PRINTING POLYMERIC NANOARCHITECTURE-ARBITRATED TITANIUM NANOTUBES FOR IMPLANT-TO-BONE OSTEOINTEGRATION** *Rupesh Kandel [1,4], Upasana Ghimire [1], Juyeon Kim[1], Jun Hee Song [4,*], Chan Hee Park [1,2,3,*], and Cheol Sang Kim[1,2,3,*]* *[1]Department of Bionanotechnology and Bioconvergence Engineering, Graduate School, Jeonbuk National University, Jeonju 561-756, Republic of Korea* *[2]Division of Mechanical Design Engineering, Jeonbuk National University, Jeonju 561-756,* *[3]Eco-friendly Machine Parts Design Research Center, Jeonbuk National University, Jeonju 561756, Republic of Korea* *[4]Department of IT Convergence Mechatronics Engineering, Jeonbuk National University, 567 Baekje-Daero, Deokjin-Gu, Jeonju-si 54896, Jeollabuk-do, Republic of Korea*
11:00-11:15		**Visit Posters**



39th SOUTHERN BIOMEDICAL ENGINEERING CONFERENCE

Keynote Speaker

Session 11: BIOMEDICAL IMAGING AND ADVANCEMENTS IN PRECISION MEDICINE

Candace M. Howard, M.D. Ph.D.

Associate Professor in Radiology
Chief of Cardiothoracic and Body Imaging Divisions
Vice Chair and Director of Radiology Research
Director of Biomedical Imaging Graduate Track
Director The MIND Center Imaging Core,
2500 N. State St., Department of Radiology,
University of Mississippi Medical Center, Jackson

Candace M. Howard, M.D. Ph.D. is currently an Associate Professor in Radiology, section chief of the Cardiothoracic and Body Imaging Divisions, Vice-Chair and Director of Radiology Research, a member of the Cancer Institute Research Advisory Committee, Faculty Senate, and Medical Executive Committee, among other departmental and institutional committees in the School of Medicine at the University of Mississippi Medical Center (UMMC) in Jackson, MS. She is also Associate Professor in the Graduate School of Biomedical Sciences and the founder and director of a new graduate study track offering a doctorate degree in Biomedical Imaging & Engineering and member of the SGSHS-Graduate Council. This is one of only two such programs in the nation that offer a combined residency in radiology and graduate doctoral work for select candidates.
Dr. Howard completed a M.D. and Ph.D. in molecular genetics at Thomas Jefferson University & Jefferson Medical College in 2000 where she was awarded the William J. Bodine, Jr. Research Award, for an outstanding contribution to cancer research. Dr. Howard completed a clinical diagnostic radiology residency at Thomas Jefferson University & Jefferson Medical College in 2005 where her research efforts continued to be recognized by an RSNA Roentgen Resident/Fellow Research Award, along with industry sponsored educational/research grants that allowed her to initiate her studies in image guided gene therapy.

Saturday Morning	**Presentation #**	
Time		**Session 11: Biomedical Imaging and Advancements in Precision Medicine** **Session Chair:** David Gordy, *University of Mississippi Medical Center* **Co-Chair**: Ayman Hamouda, University of Texas at Tyler
9:15	**Keynote**	**IMAGING'S ROLE IN PRECISION MEDICINE** *Candace Howard* *University of Mississippi Medical Center, Jackson, MS*
9:30	**11-1**	**MULTISCALE AND MULTIMODAL IMAGING OF THE PREECLAMPTIC PLACENTA** *Lili Shi[1], Andrew Markel[1], Allan Kardec Nogueira de Alencar[1], Kenneth F. Swan[2], Smruti Mahapatra[1], Gabriella Pridjian[2], Carolyn L. Bayer[1]*
10:30	**11-2**	**ADVANCED DIAGNOSTIC ASSESSMENT STRATEGIES FOR THE SPECTRUM OF CHRONIC LIVER DISEASE** *Elliot Varney and Candace Howard* *University of Mississippi Medical Center, Jackson, MS*
10:45	**11-3**	**AN IMAGE PROCESSING PIPELINE FOR LUNG REGION DETECTION IN CHEST RADIOGRAPHS WITH SHAPE SIMILARITY MATCHING** *Basavarajaiah Totada, Sergio Cabrera, Md Fashiar Rahman, Michael Pokojovy, Tzu-Liang (Bill) Tseng* *University of Texas at El Paso, El Paso, TX*

Saturday Morning	Presentation #	
Time		**Session 12: Medical Devices and Implants II** **Session Chair:** Brad Chauvin, Louisiana State University Health Shreveport **Co-Chair**: Tanvir Faisal, University of Louisiana at Lafayette
10:30	**12-1**	**NOVEL INTESTINAL EXPANSION SLEEVE (IES): PROMOTING DISTRACTION ENTEROGENESIS IN A LIVE ANIMAL MODEL** *Joshua C Colvin, Collyn O'Quin[1], Sean D Clayton, MD[1], Lexus Trosclair, MD[1], Hannah Meyer[1], Luke White, PhD[2], Valerie Welch, MD/MBA, FCAP[4], Giovanni F Solitro, PhD[3], J Steven Alexander, PhD[2], Donald Sorrells, MD, FACS[1].* *[1]Department of Surgery, [2]Department of Molecular and Cellular Physiology,[3]Department of Orthopedic Surgery, [4] Department of Pathology, Louisiana State University Health Shreveport, Shreveport, LA*
10:45	**12-2**	**THE HISTORY OF ARTIFICIAL TEMPOROMANDIBULAR JOINT (TMJ): EARLY FAILURES AND NEW DEVELOPMENTS** *Megha Rao, MDS, and Subrata Saha* *University of Washington, Seattle, WA 4 Transtimulation Research Inc, Pasadena, CA,*
11:00	**12-3**	**A NOVEL IMPLANT FOR TREATMENT OF TRAPEZIOMETACARPAL OSTEOARTHRITIS** *Dimitri Madden[1], Nathan Morrell[1], Ethan Darwin[2], Lauren Ostermann[1], Diego Rodriguez[1], Christina Salas[1]* *[1]The University of New Mexico, [2]Stanford University*
11:15	**12-4**	**CHALLENGES IN THE DEVELOPMENT OF ANIMAL MODELS FOR IN VIVO TESTING: INSIGHTS FROM THE EXPERIENCE WITH VAGINAL EXPANSION SLEEVES** *Hannah Meyer[1], Lexus Trosclair[1], Sean Clayton[1], Collyn O'Quin[1], Carol Crochet[1],Nhi Dao[2], Valarie Welch[3], Luke White[2], Giovanni Solitro[4], Mila Shah-Bruce[5], Stephanie Villaba[6], Jonathan S. Alexander[2], Donald Sorrells[1]* *[1] Dept of Surgery LSU Health Shreveport, [2] Dept of Molecular and Cellular Physiology LSU Health Shreveport, [3] Dept of Pathology LSU Health Shreveport, [4] Dept of Orthopaedics LSU Health Shreveport, [5] Dept of ON GYN LSU Health Shreveport, [6] Dept of Biology LSU Shreveport*
11:30	**12-5**	**BIOMECHANICAL INVESTIGATION OF LUMBAR INTERBODY CAGE CONFIGURATIONS IN OBLIQUE PROCEDURES** *John Preston Wilson Jr[1], Deepak Kumbhare, , Stanley Hoang, , and Giovanni F. Solitro[2],* *[1]Department of Neurosurgery, Louisiana State University Health Shreveport* *[2]Department of Orthopedic Surgery, Louisiana State University Health Shreveport*
		BREAK

Saturday Morning	Presentation #	
Time		**Session 13: Biomaterial/Imaging** **Session Chair:** Vladimir Reukov, University of Georgia **Co-Chair**: Maricica Pacurari, Jackson State University
10:30	**13-1**	**TOUCH SPUN FIBERS FOR TISSUE ENGINEERING APPLICATION** *Polina Vertegel, Kristina Peranidze, Sergiy Minko, Vladimir Reukov* *University of Georgia*
10:45	**13-2**	**HISTOLOGICAL ASSESSMENT OF THE REPRODUCTIVE TRACT AND NPY ANTAGONIST** *Kenneth Butler[1], Hamed Benghuzzi[2], and Michelle Tucci[1]* *[1]University of Mississippi Medical Center and [2]Jackson State University*

11:00	**13-3**	**COMPUTER-ASSISTED MICROSCOPY FOR THE CREATION OF REAL-TIME WHOLE SLIDE IMAGES** *Max S. Cooper* *Tulane University, New Orlens, LA*
11:15	**13-4**	**CORRELATION OF HISTOLOGICAL BONE FORMATION WITH MICRO CT AND DEXA** *David Gordy, Lir-Wan Fan, Amol Janorkar, Susana Salazar, and Michelle Tucci* *University of Mississippi Medical Center, Jackson, MS*
		BREAK

Panel 2 Bioethics Lunch 12:00-1:00

Panel Discussion on Diversity, Equity, and Inclusion:

An Ethical Imperative at the 39th Southern Biomedical Engineering Conference

Moderator

Subrata Saha

Panel

Pamela Saha

Richard Watkins

Joseph Cameron

Hamed Benghuzzi

Narayan Bhattarai

Dr. Pamela Saha, *Pan Psychiatry Health* (Pamsaha2@gmail.com)
Pamela Saha MD, is an African American Psychiatrist. She received her medical degree from Louisiana State Medical Center in Shreveport. She completed her training in Psychiatry at the Martin Luther King Jr./Drew Medical Center in South Central Los Angeles, California. She has been Board Certified in General Psychiatry for 28 years and Consultation-Liaison Psychiatry for 18 years by the American Board of Medical Specialties. She believes strongly that a patient's overall psychiatric health is impacted by social, environmental, biological, and psychological factors. She has worked in various settings throughout her career, including inpatient and outpatient Psychiatry, emergency rooms, shelters for the homeless, homes for the disabled, nursing facilities, and residences for the mentally ill. For eleven years, she worked at SUNY Downstate Medical Center as an Assistant Clinical Professor in the Department of Psychiatry, teaching medical students and residents. In addition, she was an Associate Clinical Professor at the University of Washington, Seattle, WA. She currently works part-time with Pan Psychiatry Health and is the Vice President at Biomedical Research and Services, Inc, started by her husband, Subrata Saha, Ph.D. who is the President of the Company.

Dr. Richard Watkins SPAN *(*richardwatkins@span-inc.org)

Richard Watkins, Ph.D., a native of North Carolina, is a distinguished scientist specializing in Virology, with a Ph.D. in Microbiology and Immunology from the University of North Carolina at Chapel Hill (UNC). His research focused on understanding disease progression towards AIDS in HIV-infected patients. Prior to UNC, Richard earned a B.S. in Psychology with a minor in Sociology from Fayetteville State University, where he excelled both academically and as a varsity football player.
Driven by his passion for bridging the gap between scientific advancements and stakeholders, Richard founded The Science Policy Action Network, Inc. (SPAN) in 2014. SPAN aims to address critical gaps between scientific progress and societal impact, envisioning a scientific enterprise that fosters opportunities for societal prosperity.
As the President of the UNC Chapter of Sigma Xi, the Scientific Research Honor Society, Richard Watkins plays a pivotal role in actively promoting scientific knowledge and nurturing a diverse and inclusive scientific community. Sigma Xi, being one of the world's oldest and most prestigious scientific organizations, is dedicated to enhancing the health of the research enterprise, fostering integrity in science and engineering, and advancing the public's understanding of science to improve the human condition. Richard Watkins, in his capacity as the Director of Membership and Chapters for Sigma Xi, not only supports the organization's mission but also actively works to facilitate the sustained growth and support of its ever-expanding membership base.
Richard previously played a pivotal role in developing and leading the Chancellor's Science Scholars Program at UNC. This program encourages talented students to explore their STEM interests at a renowned research university, fostering collaboration and inspiration within a small community.
Richard Watkins' distinguished career, dedication to scientific advancement, and commitment to fostering collaborations make him a respected figure in the scientific community. His multifaceted contributions continue to shape the future of science and inspire the next generation of scientific leaders

Dr. Joseph A. Cameron, ***Jackson State University(retired) (jcbbdp@gmail.com)***

Joseph A. Cameron, Ph.D, is a Retired Professor and Coordinator of Graduate Programs in the Department of Biology at Jackson State University. He also served as the interim Dean of the College of Science, Engineering and Technology and Co-Director of the Research and Engineering Apprenticeship Program at Jackson State University. Dr. Cameron is currently a Board Member of the Rocky Mountain Bioengineering Symposium (RMBS), the Mississippi Academy of Sciences (MAS) and the Southern Biomedical Engineering Conference (SBEC). He has acquired and directed or co-directed, intra and inter-institutional biomedical research and training grants from the National Institutes of Health (NIH), ie., NIGMS, NHLBI, NIMHD, the National Science Foundation (NSF), the Department of Education and the U. S. ARMY that resulted in the mentoring and training of hundreds of students, particularly minority, at the pre-college, bachelors, masters and doctoral levels. He has served for many years in faculty and/or administrative roles at Grambling State University, Jackson State University and Michigan State University. Dr. Cameron has also been active in extracurricular activities including serving as President of the Mississippi Academy of Science, founding member and Director of Community Mobilization for the NIH funded Jackson Heart Study, Member, Board of Examiners, Doctoral Degree Program, SRI Venkateswara University, Tirupati, India, Chair and/or member of NIH review panels for various grants including K01, K08, R-25, T-25, etc., served as an active member of research societies, e.g., endocrine society, society of experimental biology and medicine, etc. He has received many awards and recognition for his achievements, including the Sigma Xi award for "Meritorious Research", Outstanding Contributions to the MAS and inclusion in a “USA Scientific Delegation to Europe”, "Personalities of the South", and "Who's Who Among Black Americans". In addition, he has published extensively and presented research findings nationally and internationally. Dr. Cameron is a native of Birmingham, AL with BS, MS, and PhD degrees from Tennessee State University, Texas Southern University, and Michigan State University, respectively.

Dr. Narayan Bhattarai, ***North Carolina A&T State University*** *(*nbhattar@ncat.edu)

Narayan Bhattarai, Ph.D. is a Professor of Bioengineering in the department of Chemical, Biological and Bioengineering at North Carolina A&T State University (NC A&T SU), where he directs the Biomaterials and Tissue Engineering Laboratory. He is also Director of Undergraduate Bioengineering Program. He received his M.S. degree in Chemistry from Tribhuvan University in 1997, and a Ph.D. in Materials Engineering from Jeonbuk National University, in 2003. Before his academic appointment at the NC A&T SU in 2010, he worked for seven years as a postdoctoral researcher and instructor at University of Washington, Seattle, WA. His research expertise are in the areas of bio-nanomaterials, biodegradable polymers, tissue engineering, nanomedicine. In his current research, he is developing innovative methodologies to design composite scaffolds for wound healing and drug delivery funded by NSF, and cell spheroids for high through put toxicity study and tissue engineering funded by DOD. Dr. Bhattarai has supervised over 50 graduate and undergraduate researchers, and he has published over 100 peer reviewed articles with good track records of citations, 5 book chapters, four U.S. patents, and over 90 conference abstracts. Dr. Bhattarai has given several invited talks. He was listed as *Most Cited Scientist 2020* in Stanford University’s Study of top 2% Most Cited Scientists in Biomedical Engineering. His research group received Biomaterials Education Challenge Award and Biomaterials Day Award Sponsored by the Society of Biomaterials. He is recipient of Most Cited Paper Award from Elsevier, Journal of Controlled Release.

Dr. Hamed A. Benghuzzi, *Jackson State University* benghuzzi@bellsouth.net **(For Bio see information listed in the front of the program)**

Keynote Speaker

Session 14: Orthopaedics

Yufeng Dong, M.D., Ph.D.

LSU Health-Shreveport

Dr. Yufeng Dong, MD & PhD, a tenured Associate professor, is the Principal Investigator and the Director of Translational Research in the Department of Orthopaedic Surgery. Dr. Dong received his PhD degree from Shanghai Jiaotong University and finished his postdoctoral training in University of Rochester. He has more than 40 peer-reviewed publications and received a significant funding from the NIH, Orthopaedic Research and Education foundation, Airlift Research Foundation and Lonza research Foundation to study the critical effects of stem cells on cartilage and bone regeneration. Specifically, his laboratory has focused on studying cellular and molecular mechanisms underlying skeletal tissue repair and investigating cell-cell cross talk mechanisms among different cell populations under aging conditions.

Scientific Session

Saturday Afternoon	Presentation #	
Time		**Session 14: Orthopaedics** **Session Co-Chair:** Tanvir Faisal, University of Louisiana at Layfette **Co-Chair**: Christiana Salas, University of New Mexico
1:30	**Keynote**	**TARGETING TWIST1 TO PROMOTE STROMAL CELL-BASED CARTILAGE REPAIR** *Qinqin Xu[1], Yuping Wang[2], Patrick Massey[1], Shane Barton[1], Yufeng Dong[1]* *[1] Department of Orthopedics, LSU Health-Shreveport, LA and [2] Department of Obstetrics and Gynecology, LSU Health-Shreveport, LA*
2:00	**14-1**	**EVALUATING THE EFFECT OF MEDIAL TRANSMALLEOLAR DRILLING ON POSTOPERATIVE FRACTURE RISK: A CADAVERIC BIOMECHANICAL STUDY** *Mason Favre, Patrick Massey, Carver Montgomery, Rashiqa Abdeljabbar, Giovanni Solitro* *School of Medicine, LSU Health Shreveport, Shreveport, LA*
2:15	**14-2**	**REAMING INDUCED REDUCTION IN ACETABULAR STRENGTH: EXPERIMENTAL EVIDENCE ON BONE SURROGATES** *Madeline Gautreaux, Steven Kautz, Zashiana Martin, Edward Morgan, R. Shane Barton, Matthew Dubose, Hayden McBride and Giovanni F. Solitro* *Department of Orthopedic Surgery, LSU Health Shreveport, Shreveport, LA*

2:30	**14-3**	**EVALUATION ON BONE SURROGATES OF EPIPHYSIAL RIM CONTACT INFLUENCE ON CONSTRUCT STIFFNESS IN ANTERIOR LUMBAR INTERBODY FUSION** *Jay Manuel, Caroline Hannigan, Andrew Zhang, Milan Mody, Tunde Abubakar, James Robinson, and Giovanni F Solitro* *Louisiana State University Health - Shreveport, Shreveport, LA*
2:45	**14-4**	**LISFRANC INJURIES: INTERNAL BRACE VS. SCREW FIXATION, A BIOMECHANICAL STUDY** *Natalia D. McIver, Aamir Ahmad, Jessica Nelson, Tyler Chavez, Katherine Gavin, Christina Salas* *University of New Mexico, Albuquerque, NM*

Saturday Afternoon	**Presentation #**	
Time		**Session 15: Advances in Biomedical Informatics** **Session Chair:** Haifeng Wang, Mississippi State University **Co-Chair**: Olga McDaniel, University of Mississippi Medical Center
1:30	**15-1**	**GENOMIC TECHNOLOGY: REVIEW OF NGS, SINGLE CELL SEQUENCING STUDIES ASSOCIATED WITH DISEASE GENE IDENTIFICATION AND GENOME VARIANTS, ETC.** *Lavanya Challagundla* *University of Mississippi Medical Center*
1:50	**15-2**	**ACCURATE IDENTIFICATION OF HUMAN EMOTIONAL STATES FROM IMAGES USING DEEP LEARNING** *Emmy Yang, Jake Y. Chen* *The AI MED Lab, Informatics Institute, School of Medicine; The University of Alabama at Birmingham, AL 35294; The informatics Institute, UAB Heersink School of Medicine*
2:05	**15-3**	**RELATIONSHIPS BETWEEN PRIMARY LANGUAGE AND INTERPRETER USE ON LENGTH OF STAY AT HOSPITAL SYSTEM IN THE DEEP SOUTH** *Khushbu Park[1], Abdulaziz Ahmed[1], Mohammed Ali Al-Garadi[2], Mohammed Alzeen[1], Bunyamin Ozaydin[1]* *[1]Department of Health Services Administration, School of Health Professions, University of Alabama at Birmingham, [2]Department of Biomedical Informatics, School of Medicine, Vanderbilt University*
2:30	**15-4**	**MACHINE LEARNING-BASED FEATURE EXTRACTION FOR POLYSOMNOGRAPHY SIGNALS** *Jolly Ehiabhi[1], Haifeng Wang[1], Norma B. Ojeda[2], Lir-Wan Fan[2]* *[1]Mississippi State University, [2]University of Mississippi Medical Center*
2:35	**15-5**	**ASSESSING AND REPRIORITIZING PANCREATIC CANCER DRUG TARGETS** Adrian Gu and Jake Chen *AI.MED Lab, Informatics Institute, School of Medicine,*
2:50	**15-6**	**IDENTIFICATION OF GENE SIGNATURES AS A PREDICTIVE TOOL** *Maricica Pacurari* *Jackson State University*

Keynote Speaker
Session 16: Computer Assisted Surgery and Training

Karen J Dickinson MBBS, MD, BSc, MEd, CHSE, FRCS

Assistant Professor of Surgery
Director of IPE Simulation and Clinical Skills Training
University of Arkansas Medical Center

Simulation education is an important adjunct to clinical experience. Technological advances have impacted the tools available to deliver this education and, as learners and educators it is important to understand the most appropriate application of technology enhanced simulation education.

"Technology" refers to "materials and devices created or adapted to solve practical problems" and "Simulation technologies" can include a wide range of products such as virtual reality simulators, models including 3D printed models, high fidelity mannikins, animal models or animal tissue and cadavers.

This keynote address provides an overview of technology enhanced simulation education in healthcare and summarizes current evidence for efficacy and recommendations for application as part of an educator's toolkit.

Scientific Session

Saturday Afternoon	Presentation #	
Time		**Session 16: Computer Assisted Surgery and Training** **Session Chair:** Giovanni Solitro, LSU Health Shreveport **Co-Chair**: Christina Salas, University of New Mexico
3:15	**Keynote**	**TECHNOLOGY ENHANCED SIMULATION EDUCATION** *Karen J Dickinson* *University of Arkansas Medical Center*
3:45	**16-1**	**FEASIBILITY OF FABRICATING A PATIENT-SPECIFIC CEREBROVASCULAR ENDOVASCULAR SIMULATOR USING ADVANCED MANUFACTURING TECHNIQUES** *Vishal N. Bhimarasetty, Colin N. Curtis, Kimberley Hughes, Matthew Hales, Korkar Sarkar* *Ochsner Neuroscience BioDesign lab, LSU Health Shreveport, Shreveport, LA*
4:00	**16-2**	**ROBOT-ASSISTED THYMECTOMY IN JUVENILE MYASTHENIA GRAVIS** *Carol Crochet, BS[1], Sean Clayton, MD[1], Rosario Riel-Romero, MD[2], Aristoteles Pena-Miches, MD[3] and Donald Sorrells, MD, FACS[1]* *[1]Department of Surgery, LSU Health Shreveport, Shreveport, LA, [2]Department of Neurology, LSU Health Shreveport, Shreveport, LA , [3]Pediatric Neurology, St Francis Medical Center, Monroe, LA*
4:15	**16-3**	**DESIGN AND FABRICATION OF A LOW-COST, ANATOMICALLY ACCURATE 3D PRINTED KIDNEY TRANSPLANT ANASTOMOSIS SIMULATOR** *Bryan Chen* *LSU Health Shreveport, Shreveport, LA*

4:30	**16-4**	**EVALUATING THE EFFECTIVENESS OF VIDEO GAME-BASED TRAINING PLATFORM SUPPORTING EMG CONTROLLED HANDS-FREE WHEELCHAIR NAVIGATION** *Calvin MacDonald[1], Courtney Williams, Devon Lynn, Peter Smith*, Matt Dombrowski, John Sparkman, Albert Manero** *Limbitless Solutions, University of Central Florida, Orlando, Florida, United States*
4:45	**16-5**	**STANDARDIZATION OF HOW BONE SCREW CORRIDORS ARE EVALUATED: AN EXAMPLE ON PELVIC SCREWS** *Camryn Keller, Drayton Daily, Brad Chauvin, Kevin Perry, Shane Barton, and Giovanni F Solitro* *Louisiana State University Health Shreveport, Shreveport, LA*
5:00	**16-6**	**PILOT STUDY ASSESSING THE FEASIBILITY AND UTILITY OF A 3D PRINTED BIOMIMETIC TEMPORAL BONE MODEL FOR MASTOIDECTOMY SIMULATION** *Kaitlyn Tholen[1], Mohammad Alfrad Nobel Bhuiyan[3], Korak[2], Gauri Mankekar[4]* *[1]School of Medicine, Louisiana State University Health Sciences Center at Shreveport, Shreveport, LA, [2]Ochsner BioDesign Lab, Ochsner Health, New Orleans, LA, [3]Department of Internal Medicine, Louisiana State University Health Sciences Center at Shreveport, Shreveport, LA, [4]Department of Otolaryngology/Head and Neck Surgery, Louisiana State University Health Sciences Center at Shreveport, Shreveport, LA*
		End of Day

Saturday Afternoon	**Presentation #**	
Time		**Session 17: Cell Mechanics and Disease** **Session Chair:** Larry McDaniel, University of MS Med Center **Co-Chair**: William Pruett, University of Mississippi Medical Center
3:15	**17-1**	**NONSTANDARD MODELS FOR DISEASE DIAGNOSTICS** *Courtney Thompson, Larry McDaniel, and Lance Keller* *University of Mississippi Medical Center, Jackson, MS*
3:45	**17-2**	**CELLULAR MECHANICS IN POST TRAUMA-INJURY INDUCED COMPLICATIONS** *Sara B. Robertson[1,2], Benita Williams[3], John DePaula[4], Gregory Timberlake[1,3] D. O. McDaniel[1,3]* *[1]School of Medicine, [2]Anesthesiology, [3]Surgery, [4]Medicine, Division of Infectious Disease., University of Mississippi Medical Center, Jackson MS*
4:00	**17-3**	**HIGH RISK HEAD AND NECK CANCER EVALUATION WITH ARTIFICIAL INTELLIGENCE** *Yibin Wang[1], Abdur Rahman[1], William Duggar[2], Toms Thomas[2], Paul Roberts[2], Srinivasan Vijayakumar[2], Zhicheng Jiao[3], Linkan Bian[1], Haifeng Wang[1, 2]* *[1]Mississippi State University, [2]University of Mississippi Medical Center, [3]Brown University*
4:15	**17-4**	**MICROBIAL MODELS OF TRAUMA INDUCED INFECTION** *Larry S. McDaniel* *Center for Immunology and Microbial Research, Cell and Molecular Biology, University of Mississippi Medical Center, Jackson, MS*
4:30	**17-5**	**MEDICAL TECHNOLOGY IN DIABETES CARE** *Shumei Meng* *Baylor University Medical Center, Dallas, TX*

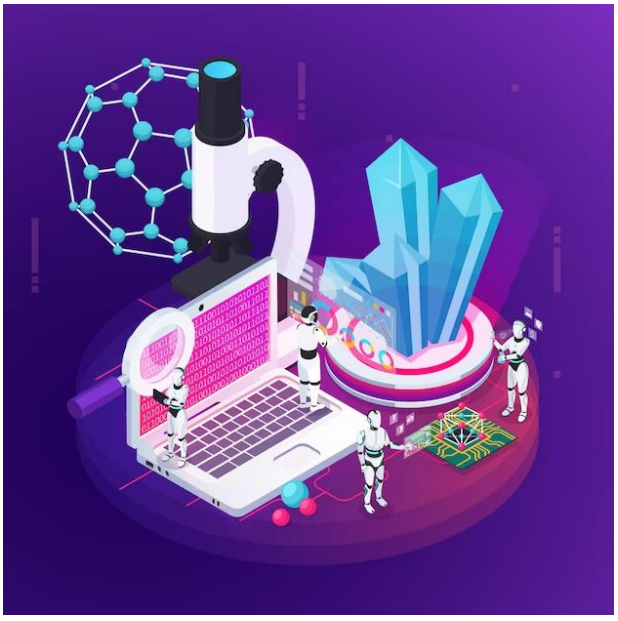
4:45	**17-6**	**WNK SIGNALING IN THE ALDO-SENSITIVE DISTAL TUBULE: WHOLE BODY PHYSIOLOGICAL SIMULATION** *W Andrew Pruett, John S Clemmer, Robert L Hester* *University of Mississippi Medical Center, Jackson, MS, USA*

Posters

Poster Session: **Session Chair:** Ham Benghuzzi, Jackson State University **Co-Chair:** Kenneth Butler University of Mississippi Medical Center, Michelle Tucci, University of Mississippi Medical Center	
INTRANASAL INSULIN AND SEX-SPECIFIC EFFECTS ON HIPPOCAMPAL INJURY AND LONG-TERM COGNITIVE DEFICITS FOLLOWING HYPOXIC-ISCHEMIC BRAIN INJURY IN NEONATAL RATS *Nilesh Dankhara, Jonathan W Lee, Norma B Ojeda, Silu Lu, Elizabeth L White, Sharon Xu, Carolyn K Glendye, Rachel T Palmer, Yi Pang, Abhay J Bhatt, Lir-Wan Fan* *University of Mississippi Medical Center*	1
AGOMELATINE REDUCES LIPOPOLYSACCHARIDE-INDUCED PRE-SOCIAL INTERACTION IMPAIRMENTS, BRAIN INFLAMMATION AND LIPID PEROXIDATION IN NEONATAL RATS *Rachel Palmer[1], Jonathan Lee[1], Selby A Ireland[1], Nilesh Dankhara[1], Michelle Tucci[1], Norma Ojeda[1], Shuying Lin[1], Lu-Tai Tien[2], Lir-Wan Fan[1]*	2
THE Effect of Nicotinic Receptor Potentiators on Human Lung Cell Viability *Robert Beaudoin [1], Marianna Pineda[1], Medhat El-Halawany[1], Carla Prado[2], Ayman Hamouda[1]* *[1]Ben and Maytee Fisch College of Pharmacy at the University of Texas at Tyler, [2]Department of Bioscience, Federal University of Sao Paulo, Santos, Brazil.*	3
ISOLATION AND INVESTIGATION OF DRUG DELIVERY POTENTIALS OF EXTRACELLULAR VESICLES DERIVED FROM NATURAL KILLER CELL *Hadeeqah Quazi,¶ Israel Joshua Santhosh,¶ Shoukath Sulthana, Santosh Aryal** *Department of Pharmaceutical Sciences and Health Outcomes, The Ben and Maytee Fisch College of Pharmacy, The University of Texas at Tyler*	4
OPTIMIZATION OF LOCALIZED PHOTOTHERMAL CANCER THERAPY UTILIZING LIPOSOMAL INDOCYANINE GREEN PHOTOACTIVE DYE *Dinesh Shrestha,[1,3] Danyel Manteufel,[1,2] Shelby Metcalf,[1,3] Anna Montero,[1,2] Shoukath Sulthana,[1] Santosh Aryal[1*]* *[1]Department of Pharmaceutical Sciences and Health Outcomes, The Ben and Maytee Fisch College of Pharmacy, University of Texas at Tyler, Tyler 75799* *[2]Department of Chemistry and Biochemistry, College of Arts and Sciences, University of Texas at Tyler, Tyler 75799* *[3]Department of Biology, College of Arts and Sciences, University of Texas at Tyler, Tyler 75799*	5
MICROSCOPIC EVALUATION OF WOUND HEALING IN THE PRESENCE AND ABSENCE OF ALBUMIN *Ashir Aryal,[1,2] Dinesh Shrestha,[1] Isreal Joshua Santhosh,[1] Farah Deba[1*]* *[1]Department of Pharmaceutical Sciences, The Ben and Maytee Fisch College of Pharmacy, the University of Texas at Tyler. Tyler, TX, [2]Whitehouse High School, Whitehouse, TX*	6
SYNTHESIS AND CHARACTERIZATION OF PLGA NANOPARTICLES WITH VARYING WEIGHTS TO STUDY THE WEIGHT EFFECT ON CELLULAR UPTAKE *Anthony Vega,[1,2] Dinesh Shrestha,[1] Isreal Joshua Santhosh,[1] Santosh Aryal[1*]* *[1] Department of Pharmaceutical Sciences and Health Outcomes, The Ben and Maytee Fisch College of Pharmacy, The University of Texas at Tyler, Tyler, TX, and [2] All Saints Episcopal School, Tyler, TX*	7
MONITORING BLEOMYCIN EFFECT ON MOUSE BODY WEIGHT *Obriana Davis[1], Kiara Davidson[1], Maricica Pacurari[1]* *[1]Jackson State University, Jackson, MS*	8

DETERMINATION OF CYTOTOXICITY OF VIT D3 ON COLON CANCER CELLS *Kiara Davison, Maricica Pacurari, Obriana Davis* *Jackson State University, Jackson, MS*	9
OPTIMIZING 3D BIOPRINTING OF HYDROGEL-BASED BIOMATERIALS WITH PLURONIC F127 AND SODIUM ALGINATE FOR TISSUE ENGINEERING APPLICATIONS *Minchan Shim, Arina Chernikova, Ruchi Borole, Jessica Patel, Vladimir Reukov* *University of Georgia, Athens, GA*	10
CREATION OF AN IN VITRO PSORIASIS MODEL *Yanin Reinholz, Anya Shroff, Arina Chernikova, Vladmir Reukov* *University of Georgia, Athens, GA*	11
EVALUATION OF NICOTINIC RECEPTOR EXPRESSION IN AN IN VITRO MODEL OF ECA+ OVEREXPRESSED CELLS INFECTED WITH SARS-COV-2. *Tamires Alves Nunes[1], Cinthia Bartholomeo[1], Tiago Nicoliche[2], Robertha Lemes[1], Nathalia Pinheiro[1], Wothan Tavares de Lima[3], Iolanda Tibério[3], Ayman Hamouda[4], Liria Okuda[5], Kil Lee[1], Rodrigo Ureshino[1], Roberta Stilhano[2], Carla Prado[1]* *[1]Universidade Federal de São Paulo, [2]Faculdade de Ciências Médicas da Santa Casa, [3]Universidade de São Paulo, [4]University of Texas at Tyler, [5]Instituto Biológico do Estado de Sao Paulo*	12
BIOINFORMATIC ANALYSIS OF RESEARCH INFORMATION RESOURCES USED TO ANSWER CLINICAL QUESTIONS FROM MORNING REPORT FOLLOW-UP *Julia M. Esparza[1], David C. Duggar[1], Taylor Gaston[2], Gunjan Kahlon[3]* *[1]LSU Health Shreveport, LSUHS Library, Shreveport, LA, [2]LSU Health Shreveport, School of Medicine, Shreveport, LA, [3] Thomas Jefferson University and Einstein Healthcare Network, Department of Internal Medicine, Hospital Medicine, Philadelphia, PA*	13
POTTING MEDIA SELECTION FOR BIOMECHANICAL TESTING *Simone Carter, Hudson Roberts, Alan Ogden, Steven Kautz, and Giovanni F Solitro,* *Louisiana State University Health Sciences Center - Shreveport, LA*	14
UPREGULATION OF α4β2 NICOTINIC ACETYLCHOLINE RECEPTORS BY POSITIVE ALLOSTERIC MODULATORS *Medhat S. El-Halawany, Ayman K. Hamouda* *Department of Pharmaceutical Sciences and Health Outcomes, Fisch College of Pharmacy, The University of Texas at Tyler, Tyler, TX*	15
THE EFFECT OF CANNABIDIOL (CBD) ON LIVER AND LUNG CELL VIABILITY *Michal Stout, A. Kologey, R. Beaudoin, A. Hamouda* *Ben and Maytee Fisch College of Pharmacy University of Texas at Tyler*	16
INVESTIGATING THE POTENTIAL OF NANOCERIA IN A CELLULAR MODEL OF FIBROSIS Helly (Krishna) Patel, Anya Shroff, and Hayley Cotton, Vladimir Reukov University of Georgia, Athens, GA	17
THE RELATIONSHIP BETWEEN SKIN TEMPERATURE AND CORE TEMPERATURE DURING RAPID HEAT STRESS *Kylie Dufrene* *Louisiana State University Health Shreveport, Shreveport, LA*	18
HIGH WAVENUMBER RAMAN ANALYSIS OF HUMAN DENTAL ENAMEL Shan Yang and Fang Chen Jackson State University, Jackson, MS	19

EVALUATING A MACROPHAGE INFLAMMATORY PROFILE IN RESPONSE TO RASPBERRY KETONE *IN VITRO* FOR GUIDED BONE REGENERATION *Samantha Hall, Joel D. Bumgardner* *Biomedical Engineering Department, The University of Memphis, Memphis TN*	20
ANALYSIS OF GBR MEMBRANE WOUND HEALING IN A CRITICAL SIZE RAT SKULL DEFECT MODEL *Andrew Watson, Matthew Atwill, Ali Sadeghianmaryan, Alex Bryan[1], Joel Bumgardner* *Biomedical Engineering Department, The University of Memphis, Memphis TN*	21
A BIOMECHANICAL STUDY OF SHAPE MEMORY STAPLE CONFIGURATIONS IN A SIMULATED FIRST TMT ARTHRODESIS *Perri Johnson, Lyndsey Bouve, Clayton Bettin, Denis DiAngelo* *The University of Tennessee Health Science Center, Memphis TN*	22
A BIOMECHANICAL STUDY OF SHAPE MEMORY STAPLE CONFIGURATIONS *Perri Johnson, Lyndsey Bouve, Clayton Bettin, Denis DiAngelo* *The University of Tennessee Health Science Center, Memphis TN*	23
A NOVEL OFFLOADING SPINAL ORTHOSIS TO REDUCE LOW BACK INJURIES DURING LIFTING EXERCISES *Lyndsey Bouve[1], Alexis Nelson[1], Douglas Powell[2], Denis DiAngelo[1]* *[1]The University of Tennessee Health Science Center, Memphis TN [2] The University of Memphis, Memphis TN*	24
NOVEL MICROFABRICATION OF GLASSY CARBON MICROELECTRODE ARRAYS FOR NEURAL APPLICATIONS *Daniel Rivera[1], Austin Broussard[1],Qun Cao[2], Bingchen Wu[2,4], Davis Bailey[5], X. Tracy Cui[2,3,4] Elisa Castagnola[1]* *[1]Department of Biomedical Engineering, Louisiana Tech University, Ruston, LA, [2]Department of Bioengineering, University of Pittsburgh, Pittsburgh, PA, [3]McGowan Institute for Regenerative Med University of Pittsburgh, Pittsburgh, PA, 4Center for Neural Basis of Cognition, University of Pittsburgh, [5]Institute for Micro manufacturing, Louisiana Tech University, Ruston, LA*	25



https://www.freepik.com/free-photos-vectors/biomedical-engineering

Sunday

September 10, 2023

Sunday, September 10, 2023

7:00 am-11:00 pm **Registration (Hotel Lobby)**

Keynote Speaker
Session 18: Nanomedicine/Drug Delivery

APPLICATIONS OF NANOMEDICINE IN WOMEN'S HEALTH

Bina Godin, Ph.D.

Department of Nanomedicine and Department of Obstetrics and Gynecology in the Institute of Academic Medicine, Houston Methodist Research Institute

Prof. Biana Godin earned her Ph.D. in Pharmaceutical Sciences from the School of Pharmacy, The Hebrew University of Jerusalem, Jerusalem, Israel. During her Ph.D. studies, Dr. Godin focused on designing a non-invasive treatment for the hard-to-treat deep skin infections and on nasal delivery of proteins. She completed postdoctoral fellowship in Cancer Nanotechnology at the Institute of Molecular Medicine, University of Texas Health Sciences Center in Houston. Her postdoctoral research focused on design and evaluation of injectable nanotherapies for cancer treatment and imaging. Dr. Godin is a Scientist in the Department of Nanomedicine at Houston Methodist Research Institute. Current research in Dr. Godin's lab, funded by federal, state and foundation grants, focuses on developing physiologically relevant in vitro and in vivo disease models and exploiting physical and biological mechanisms to improve currently available therapeutic options in oncology, infectious diseases and obstetrics. Dr. Godin is a translational scientist on the interception of biological and physical sciences, with the ultimate goal of bringing advanced and safe therapies and therapy personalization methods into the clinic to benefit patients. Dr. Godin has > 200 scientific publications, received multiple federal and foundation-based grants and participates in national and international grant review panels. She holds academic positions at the Department of Nanomedicine and Department of Obstetrics and Gynecology in the Institute of Academic Medicine, Houston Methodist Research Institute, Department of Obstetrics and Gynecology, Weill Cornell Medicine College, New York, Cancer Center Houston Methodist Hospital, as well as Adjunct Faculty positions at the Department of Obstetrics, Gynecology and Reproductive Sciences, University of Texas Health Science Center School of Medicine and Department of Biomedical Engineering, Texas A&M.

Scientific Session

Sunday	Presentation #	
Time		**Session 18: Nanomedicine/Drug Delivery** **Session Chair:** Santosh Aryal, University of Texas at Tyler **Co-Chair:** Shoukath Sulthana, University of Texas at Tyler
7:30	Keynote	**APPLICATIONS OF NANOMEDICINE IN WOMEN'S HEALTH** *Bina Godin* *Department of Nanomedicine and Department of Obstetrics and Gynecology in the Institute of Academic Medicine, Houston Methodist Research Institute*
8:00	18-1	**BIOGENIC MODIFICATION OF FUNCTIONAL PROPERTIES OF MOUSE MACROPHAGE-DERIVED EXTRACELLULAR VESICLES BY BACTERIAL VESICLES TO ENHANCE CANCER TARGETING** *Israel Joshua Santhosh, Ayan Khan, Shoukath Sulthana, Farah Deba*, Santosh Aryal** *Department of Pharmaceutical Sciences and Health Outcomes, The University of Texas at Tyler, Tyler, TX,*

8:15	18-2	**HIGH-THROUGHPUT *IN VIVO* SCREENING OF NON-VIRAL GENE DELIVERY VECTORS FOR BIODISTRIBUTION AND TRANSFECTION** *Jayoung Kim* *University of North Texas Health Science Center, Fort Worth. TX*
8:30	18-3	**INSIGHTS INTO THE UPTAKE KINETIC AND MRNA EXPRESSION OF MRNA LIPID NANOPARTICLES DELIVERY TO VARIOUS CELLS** *Karem A. Court*[1], Rhonda Holgate[2], David F. Chang[2], Elizabeth Olmsted-Davis[2], John Cooke[2], Biana Godin[1]* *[1]Department of Nanomedicine, Houston Methodist Research Institute and [2]Center for RNA Therapeutics, Houston Methodist Research Institute*
8:45	18-4	**ROLE OF TUMOR-DERIVED EXOSOMES IN TUMOR TARGETING** *Shoukath Sulthana, Dinesh Shrestha, and Santosh Aryal** *Fisch College of Pharmacy, The University of Texas at Tyler, Tyler, TX*
9:00	18-5	**DEVELOPMENT OF BIODEGRADABLE *IN SITU* IMPLANT AND MICROPARTICLE INJECTABLE FORMULATIONS FOR SUSTAINED DELIVERY OF CURCUMIN** *Sohel. H. Quazi, Ph.D.* *Texas College, Tyler, Texas*
		BREAK

Sunday	**Presentation #**	
Time		**Session 19: Bioethics** **Session Chair:** Subrata Saha, University of Washington **Co-Chair:** Babu Patlolla, Alcorn State University
7:30	19-1	**REQUIREMENTS FOR AUTHORSHIP: ETHICAL CHALLENGES** *Subrata Saha and Pamela Saha* *University of Washington, Seattle, WA*
7:45	19-2	**THE INFLUENCE OF DEVELOPMENTAL NEUROBIOLOGY ON MORALITY AND ETHICAL BEHAVIOR** *Victoria M. Morceri* *University of Washington, Seattle, WA*
8:00	19-3	**INTRODUCTION TO ANTICIPATORY ETHICS FOR BIOMECHANICAL ENGINEERING** *Michael Nestor[1], and Richard Wilson[2]* *[1]National Science Foundation, [2]Towson University*
8:15	19-4	**NAVIGATING ETHICAL CONCERNS IN THE FUTURE OF PROSTHESIS DEVICE DEVELOPMENT AND TRAINING** *Viviana Rivera, Samantha Migliore, Courtney Williams, John Sparkman, Matt Dombrowski, Peter Smith, Albert Manero* *Limbitless Solutions, University of Central Florida, Orlando, FL*
8:30	19-5	NANOTECHNOLOGY, 3D PRINTING AND SKIN : AN ETHICAL AND ANTICIPATORY ETHICAL ANALYSIS *Michael Nestor1, and Richard Wilson2* *[1]National Science Foundation, [2]Towson University*
8:45	19-6	**ETHICS, E-LEARNING, AND TELEMEDICINE IN THE COVID-19 ERA** *Fred Xavier* *Medical Affairs Consultant - Biotech Industry*

9:00	19-7	**ORGAN-ON-A-CHIP: DEVELOPMENTS AND FUTURE POSSIBILITIES: AN ETHICAL AND ANTICIPATORY ETHICAL ANALYSIS** *Richard Wilson* *Townson University*
9:15	19-8	**WHAT IS TRUTH IN MEDICINE?** *David Dinhofer* *Cooperman-St. Barnabas Medical Center. Livingston, NJ*
9:30	19-9	**ETHICAL AND ANTICIPATED ISSUES OF BRAIN COMPUTER INTERFACES** *Richard Wilson* *Townson University*
9:45		**End of Sessions**

Keynote Speaker
Session 20: Kinesiology and Health

Corey J. Coehoorn, Ph.D.

Louisiana State University Health Shreveport

Dr. Coehoorn is the Director of the Ph.D. in Rehabilitation Sciences for the School of Allied Health Professions and an Associate Professor in the Department of Rehabilitation Sciences and Family Medicine. He earned his BS in Kinesiology from the University of Calgary, his MSc in Kinesiology & Health Science from Louisiana State University – Shreveport, and his Ph.D. in Exercise and Occupational Physiology from the University of Victoria. He is originally from Redcliff, Alberta, Canada.

Dr. Coehoorn's research is focused on the impact of heat stress on various occupational groups, including firefighters and the military. He analyzes the effects of heat stress on neural function, stress, inflammation, tissue oxygenation, and hemodynamics. His research group uses electroencephalography, salivary analysis, and near-infrared spectroscopy, among many other techniques. His research has appeared in many journals and has been presented throughout the United States and Canada.

Time		Session 20: Kinesiology and Health **Session Chair:** Andrew Zhang, Louisiana State University Health Shreveport **Co-Chair:** Eddie Austin, Jr. Ochsner Therapy and Wellness, Baton Rouge, LA
9:30	**Keynote**	**RAPID HEAT STRESS CAUSES INCREASED DELTA SPECTRAL POWER 24 HOURS POST-EXPOSURE IN FIREFIGHTERS BY ITS DYNAMIC ABILITY TO GENERATE HEAT STORAGE** *Cory J. Coehoorn* *Louisiana State University Health Shreveport, Shreveport, LA*
10:00	20-1	**AN INTENSE BOUT OF RAPID HEAT STRESS DOES NOT CAUSE PROLONGED INCREASES IN SALIVARY CORTISOL AND DOES NOT ALTER C-REACTIVE PROTEIN PRODUCTION IN FIREFIGHTERS** *Aaron Adams, Diana Cruz, Schaefer Mueller, Lilly Anne D. Kamberov, Jillian N. Danzy, Naina Lal, Daniel Poole, Cory J. Coehoorn* *Louisiana State University Health Shreveport*
10:15	20-2	**ASSESSING MANUAL DEXTERITY AND STRENGTH TO INFORM PROSTHESIS DESIGN** *Samantha Migliore, Courtney Williams, Calvin MacDonald, Peter Smith, John Sparkman, Albert Manero* *Limbitless Solutions, University of Central Florida, Orlando, FL*
10:30	20-3	**DESIGN AND ASSESSMENT OF BIRD CLAW BIOMIMICRY-INSPIRED UPPER LIMB PROSTHESIS** *Pavan Senthil, Om Vishanagra, John Sparkman, Peter Smith, Albert Manero* *Limbitless Solutions, University of Central Florida, Orlando, Florida, United States*
10:45	20-4	**THE RELATIONSHIP BETWEEN RATE OF THERMAL ACQUISITION DURING RAPID HEAT STRESS AND PRE-TESTING HYDRATION STATUS** *Jillian N. Danzy, Aaron Adams, Naina Lal, Daniel Poole, Cory J. Coehoorn* *Louisiana State University Health Shreveport, Shreveport, LA*
11:00	20-5	**EQUINUS ANKLE CHARACTERIZATION THROUGH MOTION CAPTURE: A CASE STUDY** *Eddie Austin, Jr.* *Ochsner Therapy and Wellness, Baton Rouge, LA*
		End of Sessions

11:30-12:00 **General Assembly**
Student Award Presentations

ABSTRACTS

Session 1: Lessons Learned -Animals and 3D Cell Models

ACTIVATION OF A7 NICOTINIC RECEPTORS BY THE AGONIST PNU-282987 MODULATES OXIDATIVE STRESS PATHWAYS IN A MODEL OF ACUTE LUNG INJURY

Mariana Santos[1], Luana Cristina Cavallini[2], Roberta Stilhano [3], Ayman Hamouda[4], Carla Prado[1], Nathalia Pinheiro[1]

[1]Federal University of Sao Paulo, [2]University City of São Paulo, [3]Faculty of Medical Sciences of Santa Casa, [4]University of Texas at Tyler

It is known that stimulation of nicotinic receptors reduces inflammation, but there is no evidence of the effects on oxidative stress. Oxidative stress plays an important role in acute lung injury (ALI). Aim: To evaluate the potential reduction of oxidative stress by PNU, an α7nAChR agonist, in an ALI model in C57BL/6 mice. Methods: Male mice received PNU-282,987 (specific α7nAChR agonist) 30 minutes before (10mg/kg, ip) or 6 hours after (10mg/kg) the LPS administration (5mg/kg, intratracheal). We evaluated lung inflammation in BALF and oxidative stress (iNOS, nNOS, SOD-1, NFr2, and isoprostane) in lung tissue by immunohistochemistry 24 hours after LPS instillation. Results: Pre- and post-treatment with PNU-282,987 reduced the number of positive cells for iNOS, nNOS, and the positive area for isoprostane. Additionally, our results showed that pre- and post-treatment with PNU-282,987 increased the number of positive cells for NrF2 and SOD-1, anti-oxidant markers. Moreover, PNU reduced lung inflammation. Conclusion: α7 nAChR stimulation prevents and reduces oxidative stress in a model of ALI. Our data reinforce the idea that α7 nAChR is an important pathway to be further explored in the treatment of acute respiratory distress syndrome.

ANTIVIRAL EFFECTS OF CURCUMIN IN 2D AND 3D CULTURE OF SH-SY5Y INFECTED WITH SARS-COV-2

Tiago Nicoliche[1], Tamires Alves[2], Robertha Lemes[2], Carla Máximo Prado[2], Rodrigo Portes Ureshino[3], Mirela Inês de Sairre[4], Roberta S. Stilhano[1]

[1] Faculdade de Ciências Médicas da Santa Casa de São Paulo - FCMSCSP - Departamento de Ciências Fisiologicas - Brasil

[2] Universidade Federal de São Paulo – UNIFESP-Santos - Departamento de Biociência - Brasil

[3] Universidade Federal de São Paulo – UNIFESP-Diadema - Departamento de Ciências Biológicas - Brasil

[4] Universidade Federal do ABC - UFABC - Centro de Ciências Naturais e Humanas – Brasil

SARS-CoV-2 has the ability to infect neuronal cells, leading to various symptoms such as memory loss, anosmia, and brain inflammation. Curcuminoids (Me08 and Me23) and Curcumin are derived from *Curcuma longa* and possess anti-inflammatory, antioxidant, and antiviral properties. The objective of this study was to investigate the antiviral effects of curcuminoids and curcumin in both 2D and 3D models of neuronal cells infected with SARS-CoV-2. Methods: SH-SY5Y, SH-ACE2 (SH-SY5Y overexpressing ACE2 – angiotensin converting enzyme) and astrocytes cells were used. ACE2 and TMPRSS2 (transmembrane serine protease) gene expression levels and SARS-CoV-2 replication were evaluated by RT-qPCR after treatment with Curcumin extract (EXT), Me08, Me23. Inflammatory cytokines were quantified by ELISA. SH-SY5Y and SH-ACE2 neuroespheres were produced and their viability was assessed by flow cytometry over of 28 days. Results: EXT and Me08 reduced TMPRSS2 expression in SH-SY5Y, but there was no significant change in ACE2 expression upon treatment. Me08 and Me23 decreased SARS-CoV-2 replication in SH-ACE2 ($p<0.05$). Me08 also decreased the expression of cytokines (IL-6, IL-17, IFN-γ, and TNF-α) in SH-ACE2 cells, while specifically reducing IL-17 in Vero-E6 cells. Additionally, EXT decreased IL-17 and TNF-α expression in Vero-E6 and SH-ACE2 cells, respectively. Me23, on the other hand, increased IL-6 and IL-17 expression in Astrocytes. Both SH-SY5Y and SH-ACE2 neurospheres increased cell viability on days 14 and 21. Conclusion: our findings suggest that Me08 and Me23 exhibit potential as agents that can reduce SARS-CoV-2 replication in SH-ACE2 cells, while also displaying anti-inflammatory effects.

REDEFINING CELL THERAPY: DEVELOPING A COST-EFFECTIVE MICROENCAPSULATION TECHNIQUE FOR GLOBAL IMPACT

Vinicius M Peres[1], Nelson Correa[2], Roberta Stilhano[1]

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Introduction: Cell therapy has demonstrated promising results in treating diseases and injuries, yet faces effectiveness challenges due to immunological clearance and cell survival. Incorporating encapsulation techniques using alginate hydrogel provides mechanical protection and a stable environment for cells. Additionally, microfluidic systems offer precise control over capsule shape and size, making it a promising approach for cell encapsulation. Objective: Develop the microencapsulation technique using a low-cost Air-Jet system to improve cell therapy, enabling cost-effective replication in laboratories worldwide. Methodology: Twelve variations of 2% (w/v) Low Molecular Weight, non-oxidized alginate hydrogel microcapsules were produced (2 levels of gas pressure; 2 of syringe pump speed; and 3 of needle diameter). Statistical analysis showed the most uniform combination to work with. C2C12 (myoblasts) were microencapsulated inside the hydrogel and the viability was evaluated by Calcein/7AAD tests over 21 days. Results: the group using a needle diameter of 21G, a syringe pump speed of 400µL/min and a N2 Pressure of 50kPa presented the least mean Z-score modulus values for perimeter ($p<0.01$), sphericity ($p<0.001$), area ($p<0.01$) and diameter ($p<0.01$). These parameters were employed to encapsulate C2C12 and its viability over time was 99.22% (day 1), 85.64% (day 7), 59.42% (day 14), 53.98% (day 21). Conclusion: Many parameters combinations regarding microcapsules production were tested and the best one was: 21G - 400µL/min - 50kPa. Also, the encapsulated cell's survival evidenced a great cell response. Thus, microencapsulation has shown great potential in improving cell therapy.

Session 2: Neural Interfaces

BIOENGINEERING STRATEGIES TOWARDS MULTIELECTRODE ARRAYS FOR CHRONIC IN VIVO NEURAL RECORDING AND CHEMICAL SENSING

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Microelectrode array (MEA) devices, placed in the nervous system to record and modulate neuroactivity have demonstrated success in neuroscience research and neural prosthesis applications. Functionalizing the microelectrode sites on MEAs to enable electrochemical sensing adds additional dimensions of information, and such multimodal MEAs present tremendous potential for understanding neural circuits and treating neurological diseases. In this talk, I will introduce the methods by which we enable chemical sensing from MEAs. By incorporating nanocarbon into the conducting polymer electrode coating, we achieved direct detection of electroactive species such as dopamine, melatonin, and serotonin. By immobilizing enzymes or aptamers on nanostructured electrodes, we achieved multisite detection of glutamate, GABA, and cocaine. Multisite and multiple analyte detection along with neural recording have been demonstrated with these MEAs. Currently, the chronic recording and sensing performance of implantable MEAs is sub-optimum due to material limitations and undesired host tissue responses. Quantitative histology, explant analysis, and 2-photon imaging revealed biofouling, neuronal damage, inflammation, and oxidative stress at the site of implants. Meanwhile, material degradation also contributes to device failure. We use several bioengineering strategies to minimize these failure modes. First, materials and devices that mimic the mechanical properties of the neural tissue have been developed and shown to significantly improve device-tissue integration. Secondly, biomimetic coatings and drug delivery have been applied to reduce biofouling and inflammatory responses. These approaches may be combined to achieve long-term and high-fidelity neural recording and chemical sensing.

DOPAMINE SENSING WITH ROBUST CARBON NANOTUBE IMPLANTED POLYMER MICROPILLAR ARRAY ELECTRODES FABRICATED BY COUPLING MICROMOLDING AND INFILTRATION COATING PROCESSES

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Flexible electrochemical sensors are preferred to monitor the levels of neurotransmitters which are important to understand human central nervous system and diagnose/treat many brain-related diseases. Robust conductive coating is essential for these neural sensors to promote their sensitivity and selectivity. By coupling micropattern molding and infiltration coating processes, we successfully fabricated composite electrodes with part of carbon nanotubes (CNT) exposed to the sample while the rest of it embedded in polymer micropillars and the sensor base. Together with the micropillar array pattern, the partial implantation configuration provides the electrodes a stable coating with minimal conductivity loss in a 7-day impedance test. Cyclic voltammetric studies indicate a quasi-reversible behavior of dopamine and a retention of 93% signal after a two-hour fouling experiment. When detecting dopamine via differential pulse voltammetry (DPV), it exhibits a detection limit of 0.77 nM, quantification limit of 2.34 nM, and sensitivity of 0.453 nA/nM. Well separated DPV peaks were observed when sensing dopamine without and with excess uric acid, ascorbic acid, and glucose, common interfering bioactive compounds. Given successful demonstration on both rigid and soft substrate surfaces, this new fabrication method and its sensor products could help advance important *in vivo* neurotransmitter sensing and other electrochemical applications.

NOVEL MICROFABRICATION OF GLASSY CARBON MICROELECTRODE ARRAYS FOR NEURAL APPLICATIONS

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Flexible glassy carbon multielectrode arrays (GC-MEAs) have shown promising performance in neural applications. The main concern faced with the GC-MEAs fabrication is the adhesion of the metal traces with the GC electrodes, as prolonged use of electrical and mechanical stimulation can cause the adhesion to fail, leading to signal discontinuities. Using GC as a homogenous material for both electrodes and interconnects eliminates this concern. Devices with GC electrodes and interconnects ("all" GC-MEAs) have been previously fabricated and have shown outstanding electrochemical stability. However, their fabrication required a complex double-pattern lithography process that is a potential limitation for device miniaturization.

Here, we propose an alternative microfabrication method that does not require a double pattern-transfer technique to develop "all" GC-MEAs with miniaturized features. First, we pattern the SU-8 precursor on the SiO_2 wafer followed by pyrolysis (1000°C in an inert atmosphere) to obtain GC electrodes and interconnections. Dimensions of trace width (5µm) and thickness (2-3µm) are optimized to ensure practical conductivity. Second, we lithography pattern the SU-8 insulation of the device and we protect its features with a sacrificial hard mask. Then, we etch the 1µm SiO_2 layer (reactive ion etching with CF4), where not protected, leaving the Si exposed. Finally, we use a purely chemical XeF_2 etching, taking advantage of the 50:1 Si versus SiO_2 selectivity, to release the SiO_2 insulated MEA from the Si wafer. The microfabrication process and the electrochemical and

mechanical characterization of the devices will be detailed and discussed.

DOUBLE PATTERN-TRANSFER PHOTO-LITHO GRAPHIC FABRICATION OF FLEXIBLE IMPLANTABLE GLASSY CARBON MICROELECTRODE ARRAYS FOR NEUROCHEMICAL SENSING.

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The real-time multi-site measurements of *in vivo* serotonin (5-HT) dynamics are fundamental in the further understanding of its role in brain functions and disfunctions.

Fast scan cyclic voltammetry (FSCV) can provide real-time 5-HT detection with sub-second resolution. However, FSCV is typically performed on carbon fiber microelectrodes which are susceptible to electrochemical fouling and are often limited to only one active site per penetrating electrode. Glassy carbon (GC) microelectrodes arrays (MEAs) have only recently been developed for implantable neural interfaces due to innovative pattern transfer technology that allows the integration of GC electrodes into flexible circuits. GC microelectrodes have demonstrated highly sensitive FSCV 5-HT measurements while minimizing electrochemical fouling.

Additionally, flexible MEA implants have shown minimal inflammatory response and seamless tissue integration. To respond to the double need of multi-site FSCV electrochemical detection and implant stability, we report here a double pattern-transfer photolithographic process to develop implantable MEAs. The MEAs incorporates highly graphitized GC microelectrodes and interconnections on thin flexible SU-8 substrate (GC-MEA) with miniaturized features to promote tissue integration. This process avoids the use of metal interconnections and allows the fabrication of 3µm GC traces with a conductivity that enables FSCV measurements. The fabrication steps, the optimization of the transfer-bonded temporary polymeric support, and the FSCV electrochemical sensing performance of the GC-MEAs will be detailed and discussed.

UNVEILING NEUROTRANSMITTER DYNAMICS: DUAL DETECTION OF SEROTONIN AND DOPAMINE ON A SINGLE MICROELECTRODE ARRAY AT DIFFERENT BRAIN LOCATIONS

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Serotonin (5-HT) and dopamine (DA) play crucial roles in brain functions, and there is an increasing interest in understanding their interplay in in the progression of neurological and psychiatric disorders, such as Parkinson's disease, schizophrenia, and depression.

PEDOT/CNT-coated glassy carbon microelectrode arrays (GC-MEAs) have previously shown highly sensitive *in vivo* detection of tonic DA and 5-HT concentrations, using optimized square wave voltammetry (SWV) waveforms.

This study aims to advance the PEDOT/CNT-coated GC-MEAs capability by integrating the simultaneous detection of 5-HT and DA on a single device across different brain dept, building upon previous successes in individual neurotransmitter detection. First, GC-MEAs are developed using a high-resolution pattern-transfer photolithography process. Then, the GC microelectrodes are electrochemically coated with PEDOT/CNT nanocomposite. The application of two different SWV waveforms, optimized for 5-HT and DA respectively, enable dual detection of basal 5-HT and DA concentrations using alternatively PEDOT/CNT-coated GC microelectrodes of the same MEA across different layers of the striatum of anesthetized mice.

This innovative MEA platform holds great potential for elucidating the interplay between 5-HT and DA in the brain and paves the way for further advancements in the field of neuroscience.

STUDYING THE EFFECTS OF COMBINATIONAL DRUG TREATMENT IN REDUCTION OF BRAIN INFLAMMATION AFTER TRAUMATIC BRAIN INJURY

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As per CDC, in the US alone, 22% patients died and 30% became worse after the initial (primary) injury due to traumatic brain injury (TBI) associated with moderate and severe injuries. Secondary injuries in TBI patients, as a result of the initial insult, can result in mortality and impairments, due to inflammatory responses, excitotoxicity, and neuronal apoptosis, leading to neurological deficits. Currently, no drugs exist to mitigate secondary injury; instead, medication is used to treat its effects, like depression. We hypothesize that administering minocycline (Min) in combination with rolipram (Rm), a medication with a rapid onset of action, could effectively mitigate and ultimately inhibit the secondary injury cascade. To test this hypothesis, we used five treatment groups having 19 mice/group. Groups included positive (TBI-vehicle) and negative (Sham TBI-vehicle) control groups and three experimental groups, including mice treated with Rm alone, Min alone, and a combination of the two, MinRm. During the study, behavioral tests were conducted, and then immunohistochemistry was performed to determine if

activation levels of astrocytes (GFAP) and microglia (Iba-1) were reduced after drug treatment at 7- and 14-days post-injury. Our results indicate that a combination of MinRm decreased motor coordination deficits vs TBI-Vehicle treatment, and mean performance was comparable to Sham-Vehicle. Our preliminary IHC results show a trend towards effectiveness of MinRm. It appears that the MinRm combination therapy could reduce inflammation and thus the secondary neurodegenerative effects of TBI. However, further experiments are required to strongly support our preliminary observations.

Session 3: Nanotechnology

ENHANCING DRUG CONJUGATION AND RESPONSIVE RELEASE THROUGH POST-POLYMERIZATION MODIFICATION OF POLY (2-VINYL-4,4-DIMETHYL AZLACTONE)

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Post-polymerization modification of highly-defined "scaffold" polymers is a promising approach for overcoming the existing limitations of controlled radical polymerization, such as batch-to-batch inconsistencies, accessibility to different types of monomers, and compatibility with harsh synthesis conditions. Poly(2-vinyl-4,4-dimethyl azlactone) is an efficient reactive tool for post-polymerization modification with various small molecule drugs and biologics. We demonstrate the versatile nature of PVDMA scaffolds by modifying them with a coumarin-derivative (DBAC), doxorubicin, camptothecin, and 2-Dimethyl aminoethanol (DMAE). In addition, we depicted controlled DBAC drug release from the PVDMA backbone. Moreover, we have shown the modification of PVDMA scaffolds with tertiary amine-containing alcohols for making charge-reversing nucleic acid delivery platforms and demonstrate the controlled DNA release from polyplexes. For synthesized PVDMA scaffolds, we polymerized VDMA monomer via reversible addition−fragmentation chain-transfer (RAFT) polymerization and introduced ester moieties on the side chain of the PVDMA scaffold by post polymerization modification of PVDMA with DMAE and DBAC, respectively. We checked the ^{1}H NMR, FTIR spectroscopy for structural characterization of PVDMA, and modified PVDMA polymers to confirm structure. Next, we monitored the drug release from PVDMA at multiple pHs, monitored the intracellular trafficking of PVDMA-drug conjugates, and quantified the pharmacokinetics and biodistribution of PVDMA *in vivo* for the first time. Our results highlight the utility of PVDMA for its broad use as a stimuli-responsive drug delivery scaffold polymer.

IDENTIFICATION OF POTENTIAL ANXIOLYTICS IN A COMPLEX MIXTURE: A CASE STUDY WITH OXIDATIVE METABOLITES OF LAVENDER ESSENTIAL OIL

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Lavender (*Lavandula angustifolia*) essential oil (EO), prepared from harvested flowering tops, has been traditionally utilized for centuries to treat an array of human psychiatric imbalances. Intranasal administration of lavender EO by aromatherapy is touted to induce a calming and relaxing sensation by promoting sleep and easing generalized anxiety disorders. Following inhalation of lavender EO, Phase I metabolism of the EO volatile organic compounds (VOCs), such as monoterpenes, sesquiterpenes, and their oxygenated counterparts, begins through induction of cytochrome P450s, leading to increased functionalization that can produce diverse VOC metabolites and result in a postulated exaggerated target promiscuity. Computational identification of potential targets for functionalized lavender EO VOC metabolites may reveal new or amplified VOC-target associations while mitigating laborious animal toxicological studies. Constituents of lavender EO were subjected to *in silico* prediction of downstream Phase I metabolites by ADMET Predictor 10.0. Resulting functionalized metabolites were docked in Schrödinger Maestro 12.8 to selected G-protein-coupled receptor (GPCR) targets involved in central nervous system (CNS) effects associated with lavender, e.g., cannabinoid, serotonin, dopamine, melatonin, opioid, and gamma-aminobutyric acid (GABA). Using GlideScore and the interaction profile, 20 metabolites of lavender EO were prioritized for target correlation with SwissTargetPred and Super-PRED to confer the accuracy of docking results. These *in silico* efforts have discovered that functionalized VOC metabolites of lavender EO possess a greater predicted affinity to bind to human receptors involved in anxiolytic activity than parent lavender EO VOCs. Furthermore, synthesis and *in vitro* testing of predicted lavender EO metabolite VOCs are in progress

CHARACTERIZATION OF PROTEIN CORONA FORMATION ON BIOMIMETIC GLYCOPOLYMER NANOPARTICLES

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This study investigates the potential of using glycopolymer-based poly[2(diisopropylamino)ethyl methacrylate-*b*-poly(methacryl amidoglucopyranose) (PDPA-*b*-PMAG) nanoparticles as an alternative for conventional PEGylated nanoparticles. We aim to

address the existing limitations in controlling immune interactions through protein corona formation which is an ongoing challenge in drug delivery systems. We synthesized and characterized PDPA-*b*-PMAG, PDPA-*b*-PEGMA (poly[2(diisopropyl amino)ethyl methacrylate-*b*-poly(ethylene glycol) methacrylate), and PLGA (poly(lactic-co-glycolic acid)) nanoparticles for analysis. Among these, PDPA-*b*-PMAG nanoparticles exhibited promising properties - they were monodispersed, smaller than 100 nm, and maintained a near-neutral surface charge at physiological pH. Notably, PDPA-*b*-PMAG demonstrated a marked reduction in protein adsorption compared to PDPA-*b*-PEGMA and PLGA, which was verified by results of a BCA assay and SDS-PAGE gel studies. Additionally, PDPA-*b*-PMAG exhibited lower percentages of immunogenic proteins, which could potentially decrease nanoparticle clearance by the mononuclear phagocyte system. These promising findings highlight the potential of PDPA-*b*-PMAG nanoparticles in modulating protein corona and immune interactions in cancer drug delivery systems. The results present a promising avenue for future studies, where we aim to delve deeper into establishing structure-property relationships to elucidate the impact of material properties and protein corona dynamics on nano-immuno interactions, paving the way for predictive computational models.

VINDICATION OF A VILLAIN: HELICOBACTER PYLORI AS AN ANTICANCER BACTERIAL VECTOR?

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Background: Bacteria have been recently considered as an unconventional vehicle to introduce anticancer therapy, thanks to their ability to bypass biophysical barriers such as ADME and tumor microenvironment inherent in conventional cancer treatments. Pathogenic bacteria like S. typhimurium have been used to treat cancer in cell and animal models. This research explores Helicobacter pylori, a microaerophile that colonizes the hostile human gastric glands, as a bacterial-mediated cancer therapy(BMCT) vector. Current research focuses on eliminating H. pylori as gastroenterological disease prevention, overlooking the bacterium's potential in targeting gastroenterological cancers.

Method: The H. pylori strain 26695 is selected for its extensive genetic documentation and transformability. Of H. pylori's 1632 genes (consisting of 3241 regions) from Tomb et. al.'s sequencing, we filtered out speculative coding regions, then manually assessed gene relevance to toxicity and colonization, yielding a candidate list. Additionally, we consider non-native bacterial augmentations, such as the extracellular contractile system(eCIS).

Results: Our research suggests engineering the 26695 strain of H. pylori as a tumor-infiltrating bacteria to deliver cancer drugs. We would need to delete 50 potentially pathogenic genes such as cag PAIs, VacA, and IceA, examine 43 genetic mobility elements, consider modification to proteins in a list of 209 candidates, such as TlpD, SabA(HopP), and LabA, for improved BMCT effect, and introduce eCIS, infrared-light lifestyle control, RGD peptide, and/or appropriate protein payloads through genetically modified plasmids.

Discussion: Our work indicates a new direction of BMCT, which may lead to precision targeting of selected gastroenterological cancers.

APPLICATIONS OF POLYMERS, FOR THE TREATMENT OF DISEASE AND INJURY

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Reversible hierarchical self-assembly of molecules, have been harnessed by living systems to control the formation of structures such as protein assemblies, cellular membranes, cytoskeletal filaments along with many others. By controlling multiple orthogonal interactions between molecules, we can design supramolecular polymeric systems that mimic these reversible hierarchical processes. A key advantage of supramolecular polymers is they are designed for directed self-assembly, making them highly amenable to spray delivery. In my presentation today I will provide an introduction into peptide amphiphile based supramolecular polymers as an exciting platform for biomaterial development, and provide examples of the utilization of these systems in the treatment of disease and injury from the recently established Clemons Lab

Session 4: Nanomaterials and Implants

EXPLORING THE IMPACT OF PORE SIZE AND DRYING METHODS ON THE MECHANICAL PROPERTIES OF 3D-PRINTED CHITOSAN SCAFFOLDS FOR CARTILAGE TISSUE ENGINEERING

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This study investigated the effects of different drying methods and pore sizes on the mechanical properties of chitosan-based scaffolds for cartilage tissue engineering. Chitosan was dissolved in acetic acid solution and ten-layer cubic scaffolds with pore sizes of 2, 3, and 4 mm were printed using a 3DBioplotterTM. The printed scaffolds were then dried using air drying, warm drying, or vacuum drying. The dried scaffolds were crosslinked with sodium hydroxide and assayed with the ATDC5 cell line for 24 hours to determine cell attachment and viability.

The results showed that air-dried scaffolds had a higher elastic modulus compared to warm-dried and vacuum-dried scaffolds. Scaffolds with a pore size of 2 mm exhibited a higher density, resulting in a greater elastic modulus. SEM images revealed that air-dried and warm-dried scaffolds had more porous and interconnecting structures, while vacuum-dried scaffolds had a rigid structure with tiny pores. Smaller pore sizes in the scaffolds led to higher cell attachment percentages, with statistical analysis showing that pore size had a significant impact on cell attachment.

The study concluded that air-dried scaffolds had a higher elastic modulus and were potentially suitable for cartilage tissue engineering applications. In vitro cell viability tests showed proper

cell attachment and chitosan's biocompatibility with the cells. These findings provide insights into the effects of drying methods and pore sizes on chitosan-based scaffolds' mechanical properties and suggest potential applications in cartilage tissue engineering.

SYNTHESIS OF PROGRAMABLE HYDROGEL AT ROOM TEMPERATURE WITH TUNEABLE RELEASE FOR VARIOUS DELIVERY APPLICATIONS

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Programmable hydrogels with tuneable release profiles have garnered significant interest in recent years due to their versatile applications in drug delivery and tissue engineering. Hydrogels can be designed to encapsulate the range of drug classes with different release profiles dependent on the crosslinking composition. In this study, we report a novel method for synthesizing a programmable hydrogel with tuneable degradability and release using poly(2-vinyl-4,4-dimethyl azlactone) (PVDMA) combined with diamine and diol-functionalized polyethylene glycol (PEG) crosslinkers sensitive to pH mediated cleavage. The VDMA monomer was polymerized via reversible addition fragmentation chain transfer (RAFT) polymerization to yield a well-defined, mono dispersed polymer. The PVDMA scaffold was constructed by mixing PVDMA with PEG diamine and diol crosslinkers without stirring or heating. The hydrogels were incubated in buffer solution and their weight routinely measured to construct degradation profiles. Hydrogels with 50% crosslinking exhibited faster degradation than the 100% crosslinked polymers for each crosslinking ratio. The hydrogels with greater diamine crosslinker ratio exhibited slower degradation. In some cases, model therapeutics tagged with fluorophores were loaded into the hydrogels during mixing. The loaded PVDMA hydrogels were incubated in buffer solution, and the release profiles of the tagged model therapeutics were determined for different PVDMA hydrogel compositions. These findings demonstrate the potential of the synthesized programmable hydrogel for efficient and controlled delivery of various therapeutic agents and provides a promising platform for the development of advanced materials with tuneable degradability and controlled release capability for various biomedical applications.

OPTIMIZATION OF 3D BIOPRINTING PROCESS PARAMETERS OF COMPOSITE BONE SCAFFOLD FOR TISSUE ENGINEERING

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Critically-sized bone defects present a significant challenge to orthopedic surgeons due to the limited availability of autograft bone tissue, the current gold-standard treatment. As an alternative, 3D bioprinted porous scaffolds can be designed to mimic native bone's mechanical and biochemical properties to support tissue regeneration. Achieving high geometric accuracy and repeatability of these scaffolds can be challenging, especially when printing novel composite materials and geometries. Therefore, as a significant factor, optimizing the 3D bioprinting process parameters is the primary goal of this study. Bone scaffolds composed of a polylactic-co-glycolic acid (PLGA) and 5% nano-hydroxyapatite (nHA) composite were printed and analyzed to evaluate their dimensional accuracy, which is primarily influenced by the bioprinting process parameters. This empirical study investigates the effects of different process parameters, particularly, nozzle temperature, pressure, and printing speed, on the geometric accuracy of the printed scaffold in terms of strut thickness. Starting with a full factorial design of experiments, *in-situ* layer-wise optical images are captured, which are then leveraged through image processing for strut thickness characterization. Subsequently, a new iterative process optimization method is proposed that involves regression modeling and bound constraints-based minimization. A case study on printing a two-layer scaffold was used to demonstrate the effectiveness of the proposed method. Overall, the geometric accuracy of the printed scaffolds improved significantly as new iterative experiments were conducted, which demonstrates the great potential of the proposed method in extrusion-based bioprinting process parameter optimization.

DETERMINING THE SYNERGISTIC EFFECTS OF ECM COATING ON AXONAL GROWTH IN COLLAGEN GEL 3D-MODEL

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Peripheral nerve injuries (PNIs) can have detrimental effects on the lifestyle and quality of life of patients. While microsurgery and nerve autografts are currently the standards of care, results from clinical trials have shown limited recovery of full motor or sensory function in patients. Recently, there has been a rise in the development of new potential treatments for peripheral nerve repair due to promising research in studying biomolecular approaches for promoting peripheral nerve regeneration. This research project proposes a novel biometric model aimed to mimic the extracellular matrix (ECM) environment which can be utilized to study peripheral nerve repair. Most existing models employed to study peripheral nerve regeneration are limited in their ability to capture the full range of biological complexities associated with the ECM. This project investigates the interactions of ECM molecules (collagen, laminin, and fibronectin) in a facile 2D system followed by a 3D collagen model with dorsal root ganglion (DRG). We hypothesize that a collagen gel with hollow channels coated with laminin and fibronectin would be more efficient at peripheral nerve repair than individual ECM coatings with laminin and fibronectin. The average axonal length was determined through immunostaining of the DRG culture with antibodies against β-tubulin III and DAPI and used to gauge the extent of peripheral nerve regeneration. The development of a more realistic

in vitro model will allow for more efficient screening of potential drug treatments for various neurodegenerative diseases and the construction of more effective tissue grafts, resulting in improved clinical outcomes and overall prognosis of PNIs.

Session 5: Neuroscience

IMMERSIVE TECHNOLOGIES IN BIOMEDICAL EDUCATION

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The utilization of immersive technologies in biomedical education is spearheading the changes in biomedical education to increase engagement and learning effectiveness. The most utilized methods of immersive technologies in biomedical education includes virtual reality, augmented reality and mixed reality. Virtual reality utilizes a collection of hardware, and tracking sensors to create a simulated reality. This simulation of a three-dimensional environment generates a seemingly real or physical experience for the learner to explore and interact with models and systems. Augmented Reality overlays digital content onto the real world to create interactive learning experiences, allowing students to explore and interact with 3D models in a more immersive way. Mixed reality utilizes virtual reality and augmented reality technologies to create immersive learning experiences. It allows students to interact with 3D models practice procedures in a safe and realistic environment. The interaction with learners using mixed reality allows changes in the scenarios according to the input received from learners as they complete tasks or answer questions. More than 50% of educators in the biomedical fields are using virtual reality in the learning process. Early reports suggest that learners using immersive technologies showed higher grades better performance on tests, and greater engagement when compared to students not exposed to immersive technologies. However, further research will clarify whether immersive technologies can affect long-term knowledge retention and lifelong learning.

PLACENTAL MECHANISMS OF NEURODEVELOPMENTAL IMPAIRMENTS

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Maternal immune activation by bacterial or viral pathogens is a well-recognized risk factor for neurodevelopmental disorders such as autism. The placenta plays a crucial role in early brain development by supplying neurotrophic and patterning molecules. During infection, however, the placenta produces a host of inflammatory mediators that may harm the fetal brain. The aim of this study was to test the hypothesis that the inflamed placenta not only produces a plethora of inflammatory mediators but also exhibits impaired endocrine functions. Time-pregnant mice at gestational (G) day 12 were exposed to double strand RNA poly (I:C). Ninety-seven cytokines in the placenta and amniotic fluid were profiled by cytokine array, and immune cells involved in innate immune response in the placenta and offspring mice brain were examined by immunofluorescence. We found that 16 cytokines were significantly upregulated and 2 were downregulated in the placenta, while 35 cytokines were significantly increased in the amniotic fluid, 72 h following poly (I:C) challenge. We also detected a robust infiltration of macrophages and neutrophils in the labyrinth of placenta. In contrast, the expression of nerve growth factor (NGF) was significantly decreased in the placenta. The brain of postnatal (P) day 6 offspring showed a wide-spread activation of microglia and a significant change in the growth pattern of cortical immature neurons. In conclusion, our study indicate that the inflamed placenta may contribute to abnormal development of cortical neurons by not only supplying harmful inflammatory mediators but also reducing expression of neurotrophic factors.

BOTH MATERNAL INFLAMMATION AND INTRAUTERINE GROWTH RESTRICTION ENHANCE SUSCEPTIBILITY TO ISCHEMIC STROKE-INDUCED BRAIN INJURY AND NEUROBEHAVIORAL DYSFUNCTION IN RATS

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Epidemiological and experimental studies suggest a link between both maternal inflammation and intrauterine growth restriction (IUGR), and increased risk to develop diseases later in life. However, susceptibility to ischemic brain injury in maternal inflammation or IUGR individuals is poorly understood. This study tested whether maternal inflammation or IUGR rats have greater ischemic brain injury compared to control rats. Maternal inflammation or IUGR was induced in rat offspring using lipopolysaccharide (LPS, 100 ug/kg)) intraperitoneal injection or reduced uterine perfusion (RUP) procedure during late gestation, respectively. At 5 months, maternal inflammation, IUGR and control animals were exposed to middle cerebral artery occlusion (MCAO) to induce stroke. Motor skills and sensory tests were assessed 24 hours post-stroke followed by euthanasia to collect brain tissue for assessment of ischemic damage. Our results show that offspring from dams exposed to LPS or RUP showed significant hypomotor activity, hyperalgesia, allodynia, and reduced brain volume compared to control offspring. Maternal inflammation and IUGR rats showed greater motor and sensory deficits compared to control rats as assessed with the modified neurological severity score after MCAO procedure. Both LPS-induced maternal inflammation and RUP-induced IUGR enhanced adult susceptibility to MCAO-induced ischemic brain injury in adult rats, including increases in total brain and damage volume as indicated by Nissl staining. These results suggest that both maternal LPS-induced and RUP-induced brain dysfunction in rats may enhance adult susceptibility to ischemic brain injury. Our model may be useful for studying mechanisms involved in

ischemic brain injury and the development of potential therapeutic strategies.

NEONATAL LIPOPOLYSACCHARIDE EXPOSURE EFFECTS ON METHAMPHETAMINE-INDUCED ALTERATIONS IN DOPAMINE TRANSPORTER AND ASSESSMENT OF REINSTATED BEHAVIORAL SENSITIZATION IN ADULT RATS WITH MACHINE LEARNING-BASED ANALYSIS

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To investigate the effect of neonatal systemic LPS exposure-induced dopaminergic injury, we used our neonatal rat model of systemic lipopolysaccharide (LPS) exposure (1 or 2 mg/kg, intraperitoneal injection in postnatal day 5 male rats) to examine methamphetamine (METH) sensitization as an indicator of drug addiction in adult rats. On P70, animals began a treatment schedule of 5 daily subcutaneous (s.c.) administrations of METH (0.5 mg/kg) (P70-P74) to induce behavioral sensitization. Ninety-six hours after the 5th treatment with METH (P78), animals received 0.5 mg/kg METH (s.c.) to reintroduce behavioral sensitization. A random forest model was used as the detector to extract the feature interaction patterns among the collected high-dimensional locomotor data. Our approaches identified neonatal systemic LPS exposure dose and METH-treated dates as features significantly associated with methamphetamine-induced behavioral sensitization, reinstated behavioral sensitization and perinatal inflammation in this experimental model of drug addiction. Neonatal LPS exposure also enhanced METH-induced reduction of dopamine transporter (DAT) expression, decrease in mitochondrial complex I activity, and increases in the interleukin-1β concentration in the P78 rat striatum. These results indicate that neonatal systemic LPS exposure produces a persistent lesion in the dopaminergic system which leads to a long-lasting change in the brain reward system as indicated by enhanced METH-induced behavioral sensitization and reinstated behavioral sensitization later in life. These findings show that early-life brain inflammation may enhance susceptibility to the development of drug addiction later in life, which may be associated with chronic inflammation-induced striatal mitochondrial dysfunction and alterations in striatal DAT expression.

MULTI-MATERIAL 3D NANOPRINTED PEGDA SCAFFOLD FOR SPINAL CORD REGENERATION

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Spinal cord injury (SCI) is debilitating, life-threatening, and imposes great physical and financial burden on an estimated 20 million patients. Medical research such as stem cell implantation and growth factor application has failed to overcome challenges in repairing long-term sensory and motor functions after injury due to the limited regeneration capacity of the central nervous system. We designed, fabricated, and *in-vivo* tested polyethylene glycol diacrylate (PEGDA) scaffolds with features to mimic native rat spinal cord physiology. Scaffolds were designed to mimic the T10 spinal cord cross-sectional shape while providing solid-walled grooved channels for guiding long-distance nerve regeneration present in the white matter (WM) and membrane-lined porous-walled channels for maintaining interconnectivity in the grey matter (GM) spinal cord regions. PEGDA scaffolds nanoprinted via two-photon lithography using two polymer molecular weights (700 kDa and 250 kDa) established softer and harder mechanical moduli to recreate physiological trends in WM and GM regions, respectively. *In vitro* studies using stem cell culture and *in-vivo* studies using a rat model of SCI confirmed the biocompatibility of the scaffold. Animals experienced sensory and motor deficits following complete transection of the T10 spinal cord. Implantation of the scaffolds with or without neural stem cells produced partial improvement of the lost functions and significantly higher body weight increase compared to the control animals. In summary, the newly designed biomimetic 3D scaffold holds great potential to provide matrix support to the *in vivo* implantation of stem cells. Future studies are needed to identify the axon regeneration and host-implant interactions

COLLAGEN-ELASTIN-LIKE POLYPEPTIDE COMPOSITES FOR THE TREATMENT OF CRANIOFACIAL DEFECTS

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Head injury in pediatric trauma is associated with deleterious consequences, and is often associated with the need for cranioplasty to relieve brain swelling. High impact force to the head is also positively associated with long-term inflammation which is associated with progressive loss of learning and memory. The objective of the current study was to determine the healing and resorption rates of cranial defects with resorbable biopolymer

composites in adolescent animals, along with evaluating the potential for inflammation-mediated changes in behavior and healing. Four experimental groups were included using a 5-mm central critical-sized cranial defect model in adolescent Sprague-Dawley rats (P49): (1) sham operated, (2) empty defect, (3) placement of autologous bone, (4) composite with hydrogel composite (collagen-elastin-like polypeptide (ELP)). Behavioral tests were determined biweekly and characterization of composite performance were determined at the 8-weeks-endpoint. Our data have shown that both empty defect group and bone placement group decreased short-term memory in male rats two and four weeks after surgery, but not in the composite with hydrogel group. In female animals, both bone placement group and composite with hydrogel group reduced bone defect-induced reduction in short-tern memory two and four weeks after surgery. The composite with hydrogel group achieved the most enhanced bone growth compared to composites lacking hydrogel eight weeks after surgery in both male and female rats. Our results suggest that the hydrogel composite-enhanced bone repair is superior to the autograft in our adolescent defect model, without inducing neurobehavioral dysfunction.

Session 6: Nanomaterials and Nanomedicine

NANOFIBER ENABLED HYDROGEL SPHEROIDS FOR 3D CELL CULTURE PLATFORM

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Engineered 3D architectural network of polymer hydrogel can mimic the native cell environment that enables enhanced cell infiltration and growth. Among several bio-fabrication techniques, core-shell microcapsules inherit the potential of cell encapsulation to ensure direct interaction with ingredients. Herein, a co-axial electrohydrodynamic atomization strategy has been proposed to encapsulate nanofiber-enabled hydrogel spheroids. The chitin nanofibril integrated alginate is used to design core-shell structured hydrogel spheroids. The physicochemical characterization that includes size, shape, and stability of the core-shell microcapsules was analyzed by scanning electron microscope, Fourier transforms infrared microscopy, fluorescence inverted microscopy, and compression test. The biocompatibility of the core-shell microcapsule was evaluated by encapsulating fibroblasts NIH3T3 cells. Notably, these microcapsule spheroids showed excellent cell viability for more than two weeks. Thus, our results showed a promising approach for the design of a fibrous hydrogel framework that is suitable for 3D cell culture sites and several other biomedical applications including wound repairs and tissue engineering.

THERAPEUTIC POTENTIAL OF MESENCHYMAL STEM CELL-DERIVED EXTRACELLULAR VESICLES (MSC-EVS) IN THE PREVENTION OF CISPLATIN-INDUCED HEARING LOSS

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Cisplatin, a widely used chemotherapeutic agent, has shown remarkable efficacy in the treatment of various cancers. However, its clinical use is hampered by the development of ototoxicity, particularly cisplatin-induced hearing loss (CIHL). CIHL is a serious adverse effect that significantly impacts the quality of life for cancer survivors. In recent years, there has been growing interest in the potential use of mesenchymal stem cell-derived extracellular vesicles (MSC-EVs) as a novel therapeutic approach for CIHL.

This study aims to investigate the therapeutic potential of MSC-EVs in preventing cisplatin-induced hearing loss. MSC-EVs were isolated from human umbilical cords and collected by using chemically defined protein-free media. Then, it is characterized for their size, surface markers, and cargo content. In vitro studies were conducted using auditory hair cell (HEI-OC1; The House Ear Institute-Organ of Corti 1) cultures to evaluate the protective effects of MSC-EVs against cisplatin-induced cytotoxicity and apoptosis.

Results from the in vitro studies demonstrated that MSC-EVs effectively mitigated cisplatin-induced cytotoxicity and apoptosis in auditory hair cell (HEI-OC1) cultures. These findings suggest that MSC-EVs hold great promise as a potential therapeutic intervention for the prevention of cisplatin-induced hearing loss. MSC-EVs may offer a novel strategy to alleviate the ototoxicity effects of cisplatin, thus improving the quality of life for cancer patients undergoing chemotherapy. Further research is necessary to advance the understanding of the underlying mechanisms and optimize the therapeutic application of MSC-EVs for CIHL prevention.

ZINC NANOPARTICLES INCORPORATED 2D NANOFIBROUS SCAFFOLDS ENHANCE FIBROBLASTS RESPONSE TO PROMOTE CELL PROLIFERATION

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Zinc metal and its alloys have received potential interest in biomedical applications due to their biodegradability, biocompatibility, antimicrobial activity, and ability to stimulate tissue regeneration. Zinc-based materials have been successfully utilized in a variety of implant applications, most notably as bioabsorbable cardiac stents and orthopedic fixation devices, where it provides adequate mechanical properties while also releasing zinc ions (Zn^{2+}) during degradation. Such beneficial ions are dose-dependent, and when released in excess, can induce cellular toxicity. In this study, we developed 2D nanofibrous scaffold by embedding Zn particulates into a fiber matrix. We expect that the nanofibrous matrix will enable control degradation and timely release of the Zn^{2+}. We fabricated Zn nourish polycaprolactone-chitosan (PCL-CH) fibrous mesh by using an electrospinning technique. The physicochemical properties of the meshes were characterized using various techniques. The biological properties of the meshes were evaluated by utilizing in vitro direct and indirect cytotoxicity assays and cell viability. All

the data showed that the addition of Zn changed various aspects of fibrous meshes, except for the chemical structure of the fibers. Further investigation reveals that the PCL-CH polymer mesh degrades the Zn particles quicker than the PCL because the presence of the hydrophilic CH influences the faster release of Zn^{2+} in cell culture conditions as compared to the PCL fibers. The combined advantages of CH and Zn in the meshes enriched 3T3 fibroblast cells survival and proliferation except for the one with the higher concentration of Zn particles. This new composite nanofiber meshes are promising and can be considered further for tissue healing and regeneration applications.

OTOPROTECTIVE EFFECTS OF MESENCHYMAL STEM CELL-DERIVED EXTRACELLULAR VESICLES (MSC-EVS) FOR PREVENTING NOISE-INDUCED HEARING LOSS

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Noise-induced hearing loss (NIHL) is a prevalent and irreversible form of sensorineural hearing loss that affects millions of individuals worldwide. Currently, there are limited treatments available for preventing or reversing NIHL. Recent advancements in regenerative medicine have highlighted the therapeutic potential of mesenchymal stem cell-derived extracellular vesicles (MSC-EVs) in various diseases and injuries, including hearing loss. This study aims to explore the therapeutic potential of MSC-EVs in the prevention of noise-induced hearing loss. MSC-EVs were obtained from human umbilical cords and isolated using chemically defined protein-free media. Subsequently, MSC-EVs were thoroughly characterized to determine their size, surface markers, and cargo composition. In vitro studies were carried out using auditory hair cells (HEI-OC1; The House Ear Institute-Organ of Corti 1), which were exposed to damaging levels of reactive oxygen species (ROS), mimicking the effects of noise exposure. The objective was to evaluate the protective effects of MSC-EVs on auditory hair cells, assessing their ability to counteract noise-induced cytotoxicity and apoptosis.

The results of the in vitro studies demonstrated that MSC-EVs effectively attenuated noise-induced cytotoxicity and apoptosis in HEI-OC1 cells. Additionally, molecular analyses indicated the involvement of MSC-EVs in modulating inflammation and oxidative stress pathways, which are crucial in the pathogenesis of NIHL.

These findings highlight the potential of MSC-EVs as a promising therapeutic approach for the prevention of noise-induced hearing loss. MSC-EVs may offer a novel strategy to mitigate the detrimental effects of noise exposure on the auditory system. Further research of MSC-EVs into clinical applications holds significant promise for the development of effective interventions for individuals at risk or experiencing noise-induced hearing loss.

CHEMICALLY ENGINEERED EXTRACELLULAR VESICLES AS AN IMMUNOMODULATION FOR EXPERIMENTAL AUTOIMMUNE UVEITIS.

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Howard University

Accumulating evidence indicates that mesenchymal stem/stromal cell-derived extracellular vesicles (MSC-EVs) exhibit immunomodulatory effects by delivering therapeutic RNAs and proteins; however, the molecular mechanism underlying the EV-mediated immunomodulation is not fully understood. In this study we designed and synthesized novel chemically engineered extracellular vesicles (EVs) derived from mesenchymal stem cells using L-azidohomoalanine (AHA) and dibenzocyclooctyne (DBCO) click chemistry. These novel chemically engineered EVs were of 100-200 nm in size and spherical shape. We investigated the therapeutic potential of these chemically engineered EVs using our established mouse model for experimental autoimmune uveitis (EAU), an autoimmune disease. The data suggested that TGF-b1 and let-7b-5p are the vital molecules mediating the therapeutic effects of these chemically engineered-EVs and these EVs can suppress autoreactive T cell infiltration in the diseased mice. These results would help understand molecular mechanism of immunomodulation of these EVs and advance the prospect for development of novel and robust EV-based therapies for treatment of autoimmune diseases.

Session 7: Clinical Rehab

THE EFFECTS OF STANDING DESKS ON COGNITIVE PERFORMANCE IN THE CLASSROOM: A SYSTEMATIC REVIEW

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Background: Evidence suggests there are strong correlations between sedentary behavior and poor health outcomes. Standing desks have shown to reduce sedentary behavior in students. If there are multiple benefits associated with standing desks, such as improved cognitive performance, individuals may utilize them more frequently to reduce sedentary behavior.

Objective: The purpose of this systematic review was to explore the effects of standing desks on student cognition in classroom settings.

Methods: Searches were conducted in PubMed and Embase databases on November 30, 2022, with search terms relevant to students, standing desks, and cognition. Inclusion criteria were published articles since 2021 in the English language and occurring in a traditional classroom setting. JBI appraisal tools were used to assess the risk of bias of the studies. PRISMA guidelines were utilized.

Results: A total of 298 participants with mean ages ranging from 10-20 were evaluated by either post-intervention exam grades or the Flanker Test (FT). All findings revealed that there was no significant difference in cognition between students utilizing standing desks compared to those who did not utilize standing desks. Studies found no adverse effects with usage of standing desks. The studies included had an average JBI score of 82.8%, indicating a high-quality score.

Conclusion: Overall, while studies do not show significant improvements in cognitive functions, and the use of standing desks did not negatively affect students' cognitive performance. Thus, standing desks may serve to decrease sedentary behavior in students without compromising their learning abilities and performance. Further research is recommended due to the lack of uniformity in measuring cognition.

THE EFFECT OF YOGA ON ANXIETY LEVELS IN PREGNANT WOMEN: A SYSTEMATIC REVIEW

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Background: Women have been reported to exhibit increased levels of anxiety during the prenatal period of pregnancy. Yoga benefits help decrease the rate of anxiety as a low-impact form of exercise in the general population. Recent research has served to explore yoga's effect on anxiety in pregnant women.

Objective: The aim of this systematic review was to explore the effect of yoga on anxiety levels

in pregnant women during the prenatal period.

Methods: A search of PubMED and Embase was performed in November 2022 using search terms related to yoga, anxiety, and the prenatal period of pregnancy. Inclusion criteria included pregnant women, multiple yoga sessions during the prenatal period, specific outcome measures for anxiety levels, and articles published in the past 10 years. Exclusion criteria included outcome measures related to stress or depression, anxiety during labor, and articles published before 2012. Mean, standard deviations, and outcomes of interest for intervention and control groups were extracted.

Results: The search generated 223 articles with five articles selected for inclusion. Data was analyzed with a total of 249 pregnant women included from the five articles. The intervention groups participated in yoga during the 2nd and 3rd trimesters for at least 8 weeks of their pregnancy. Anxiety was measured pre and post treatment with self-reported outcome measures. Findings in all included articles demonstrated significant results in favor of yoga's ability to decrease anxiety levels in the prenatal population.

Conclusion: The implementation of yoga in prenatal care yielded positive results with an overall decrease in anxiety among pregnant women. Higher quality studies with well-defined parameters should be conducted in the future on this topic.

EFFECTIVENESS OF VIRTUAL REALITY ON PHYSICAL AND COGNITIVE PERFORMANCES IN THE CONTEXT OF FALL PREVENTION AMOzaNG OLDER ADULTS: A SYSTEMATIC REVIEW

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Background: In the United States, falls in older adults result in 3 million emergency hospital visits per year with many leading to serious injuries and even death, as reported by the Centers for Disease Control and Prevention. Impaired cognition and physical function are strong fall predictors affecting the functional independence of older adults. Virtual reality has been shown to enhance physical and cognitive conditioning. This systematic review seeks to analyze the effectiveness of virtual reality on the physical and cognitive performances of older adults with reference to minimizing falls. **Methods:** This systematic review was reported according to the PRISMA guidelines. An electronic search across four databases was conducted: PubMed, MEDLINE, CINAHL, and ProQuest. The inclusion criteria were older adults, healthy or mild cognitive impairment, English language articles published from 2016-2022, and physical and cognitive outcome measures. The exclusion criteria included case studies, lack of desired outcome measures, severe cognitive impairment, and neurological disorders. **Results:** Across the articles included in this review, virtual reality interventions resulted in significant improvement in balance, gait, upper extremity function, and various aspects of cognition when compared to more traditional interventions. **Conclusion:** Based on the study findings, virtual reality may be a viable treatment option to improve physical function and cognition which are important aspects for the prevention of falls among older adults.

EFFECTS OF EXERCISE ON QUALITY OF LIFE IN PEOPLE WITH LONG COVID-19: A SYSTEMATIC REVIEW

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Background: For some, the coronavirus (COVID-19) is a debilitating and life altering disease. Symptoms of COVID-19 could be persistent after the acute phase of illness which is known as long COVID. Common symptoms of long COVID include extreme fatigue and shortness of breath which impact quality of life (QOL). Resistance training and aerobic exercise could improve functional living in people with long COVID-19.

Objective: The purpose of this systematic review was to investigate the effects of exercise in improving QOL in adults with long COVID-19.

Methods: PubMed and Embase were searched in November 2022 using terms associated with long COVID, exercise, and QOL. Studies were divided evenly among group members to be screened by at least two authors. Exclusion criteria included editorials, opinion articles, interventions of solely pulmonary rehab, non-English articles, and subjects less than 18 years old. The Mixed Method Appraisal Tool (MMAT) was scored by the authors to assess the methodological quality of the studies.

Results: A total of 201 articles were screened. Six studies with a total of 239 participants met the criteria. Based on the MMAT, the articles had an average quality score of 80%. The results showed that exercise improved QOL in all studies, with 15 out of 19 QOL measures showing statistically significant improvement from baseline.

Conclusion: Overall, the evidence demonstrates that exercise may improve QOL in adults with long COVID. The QOL outcome measures improved in all studies, but the quality of the articles is limited. Due to the novelty of this disease, more high level

research is needed to verify the effects of exercise in improving QOL for those with long COVID-19.

THE FEASIBILITY OF SMART DEVICES TO INCREASE PHYSICAL ACTIVITY IN OLDER ADULTS: A SYSTEMATIC REVIEW

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Background: Physical activity (PA) is a vital component to maintaining health especially as one ages. Eighty five percent of Americans own a smartphone with capabilities of utilizing fitness apps, videos, and social media to aid in improving PA. However, the ability of older adults to utilize technology for PA may be limited. Utilization of this technology to facilitate an exercise program could be a valuable resource to older adults and physical therapists in improving PA.

Objective: Determine if utilization of smart device technology can improve physical activity in older adults.

Methods: PubMed and Embase were searched in November 2022 using search terms related to smart devices, PA, and older adults. Inclusion criteria: participants 50 years and older, smart device intervention, PA outcome measure, and English studies within the past 5 years. Participants with dementia or inability to engage in PA were excluded. McGill Mixed Methods Appraisal Tool 2018 was used to assess quality of the studies.

Results: The search generated 1,542 articles. Following title, abstract and full text screening, six studies were included. 2/6 studies showed significant statistical gains in PA. 2/6 showed initial statistically significant improvements in PA, but participants did not maintain improvement. 2/6 studies showed no significant statistical gains in PA with use of technology. 6/6 studies indicated participant compliance with use of smart device technology > 70%. Risk of bias indicated high quality studies. Statistical significance interpreted with a p-value < 0.05.

Conclusion: The results indicate the use of smart devices to promote activity does not increase PA in older adults. However, older adults are willing and able to utilize this technology. Further research would be beneficial to determine clinical significance and effectiveness.

EFFICACY OF NON-INVASIVE ELECTRICAL STIMULATION ON MIGRAINE HEADACHE PREVENTION

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Background: Migraine headache is a disabling disorder characterized by headaches of varying intensity that may last for 4 to 72 hours at a time. Literature states that migraine is the third most common disease and the sixth leading cause of disability worldwide. There is an inconclusive report in the literature that electrical nerve stimulation could be effective in managing or preventing migraine headaches. Therefore, this systematic review aimed to investigate the efficacy of non-invasive electrical stimulation on migraine headache prevention**. Method:** Medline database using PubMed was searched. Search terms included migraine headache with or without aura, patients with migraines treated with electrical Nerve stimulation, occipital nerve stimulation, transcutaneous electrical nerve stimulation, vagus nerve stimulation, trigeminal nerve stimulation, and percutaneous electrical stimulation. With the appropriate application of inclusive and exclusive criteria for non-invasive electrical stimulation, seven articles met the requirement of the study. The PEDro scale was used to assess the risk of bias in each study included in this systematic review. **Results**: The electronic search yielded 255 potential articles, with seven meeting the criteria. Six of the seven studies showed that electrical nerve stimulation provides positive outcomes for reducing the number of headache days or reducing migraine attacks post-treatment using non-invasive electrical stimulation compared to the control or sham groups with significant p-values between 0.05 - 0.00002. Risk of bias using PEDro scale determined six articles to be high-quality (≥9/10), and one moderate quality (6/10). **Conclusion**: Six out of the seven studies showed positive efficacy or potential of non-invasive electrical stimulation for migraine headache prevention; one of the studies was not different from the sham. It is suggested that in the management of migraine, non-invasive electrical stimulation be considered as a sole option or be considered in the arrays of other therapeutic interventions. The authors suggest that clinical trials at a larger scale be conducted to validate the efficacy of neuromodulation for migraine headache management.

SECONDARY INTRACRANIAL HYPERTENSION FROM RAPID CORRECTION OF PROFOUND HYPOTHYROIDISM WITH IV LEVOTHYROXINE: A CASE REPORT

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Headache resulting from intracranial hypertension amongst pediatric patients is rare. In the pediatric setting, the presentation can be unusual or may lack set criteria for making the correct diagnosis. Untreated intracranial hypertension could lead to worsening visual disturbance and ultimately vision loss. Secondary intracranial hypertension is attributed to certain medications or certain disease processes. Working to find the offending agent takes adequate history taking, detailed physical exam, and a high index of suspicion. Here, we report the case of a 9 y.o. patient who presented with severe thyroiditis with an initial serum thyroid stimulating hormone (TSH) of 1,030 mclU/mL who was treated with IV levothyroxine resulting in rapid correction of thyroid hormone levels. She presented only with headache after five days of initial treatment. Treatment with Acetazolamide and reduction of Levothyroxine dosing resulted in a significant reduction of headache symptoms and reversal of papilledema. This report serves to increase awareness of this rare clinical scenario, encourage a multidisciplinary approach with care plans and contribute to the identification of possible risk factors which could raise clinical suspicion and allow for timely management. Mode of administration of levothyroxine, rate of correction of thyroid levels, severity of the presentation (high levels of TSH) and pediatric population may all be associated with a high risk of developing IIH with treatment. The authors suggest that further clinical trials to standardize treatment plans for the management of IIH in the setting of autoimmune thyroiditis.

PHYSICAL THERAPY FOR A CHILD POST COVID-19 WITH MULTIPLE AMPUTATIONS FOLLOWING ECMO

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Introduction: COVID-19-related complications research for effective treatment interventions is emerging. In the case presented, the effects of physical therapy intervention in a complex pediatric patient with amputations due to complications of extracorporeal membrane oxygenation (ECMO) from COVID-19 are presented. **Case Description:** The patient is a 19-month-old female who was born at 37.1 weeks gestational age. Following delivery, the patient had a two-week neonatal intensive care unit stay with diagnoses of bilateral cleft lip and palate, nutritional deficiency, atrial septal defect, patent foramen ovale, small for gestational age, and intestinal failure. The patient also failed the newborn hearing screening. After discharge from the NICU, additional diagnoses of chronic serous otitis media and exotropia were added. At three months of age, the patient was admitted from an outside hospital with diagnoses of COVID-19 and acute respiratory failure. Complications during hospital stay included chest tube placement, ECMO, amputation of the left upper extremity and bilateral lower extremities, tracheostomy/ventilation dependent, and gastrostomy tube dependent. **Discussion:** Outpatient physical therapy was provided following discharge to promote the achievement of motor milestones. During play, interventions focusing on functional strength training, functional mobility, and balance were delivered while promoting cognitive development. The Pediatric Evaluation of Disability Inventory was used to show improvement in functional abilities.

THE EFFECTS OF TRANSCRANIAL DIRECT CURRENT STIMULATION ON DUAL-TASK COSTS IN OLDER ADULTS: A SYSTEMATIC REVIEW

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Background: As older adults see decreases in motor and cognitive performance, this can affect their ability to perform multiple tasks at once (dual-tasks). This can make day-to-day activities more difficult and could potentially lead to an injury or fall. In this systematic review, we examined the potential treatment option of using transcranial direct current stimulation (tDCS) to combat the rise of dual-task costs in the elderly. **Objective:** The objective of this review was to determine the effectiveness of using tDCS to reduce dual-task costs in older adults.

Methods: An article search was performed in PubMed and Embase databases using search terms related to tDCS, dual-task costs, and older adults. The articles were then screened according to title, abstract and duplication. This resulted in a total of 6 articles to be used in our review after following our inclusion/exclusion criteria. Inclusion criteria: studies needed to be original research and involve the effects of transcranial direct current stimulation on dual-tasking in older individuals that do not have comorbidities. Exclusion criteria: articles published before the last decade, systematic reviews, editorials, perspectives, and studies involving e-stim that was not tDCS. These 6 articles were then reviewed for data extraction.

Results: The six articles retrieved during our search included a total of 145 participants that performed a dual-task after receiving a session of tDCS. Each study we reviewed yielded significant results in dual-task performances with p-values (< .05). These results point towards tDCS having a significant effect on dual-task costs, such as walking and mental task, in older adults.

Conclusion: The evidence from this systematic review suggests that transcranial direct current stimulation is a beneficial, noninvasive intervention that decreases dual-task costs, and therefore, increases the ability for older adults to perform multiple tasks, such as walking and performing arithmetic subtraction at the same time. The additional effect of improved cognition in this cohort could be seen as a huge benefit of tDCS. Further study is suggested to elucidate the mechanism by which tDCS decrease dual-task cost but not necessarily so in a single task. Also, study is suggested to compare the use of medications and tDCS.

Session 8: Biomedical Education

A MIXED-METHODS STUDY OF FACULTY DISTANCE EDUCATION EXPERIENCE DURING THE COVID-19 PANDEMIC

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The COVID-19 pandemic forced institutions of higher education into an emergency remote teaching practice. In this study, the researchers utilized a sequential explanatory mixed-methods study design to investigate technological obstacles and growth faculty experienced in the seven schools at the University of Mississippi Medical Center as a result of the transition to emergency remote teaching during the COVID-19 pandemic. Quantitative data were collected first through an anonymous online survey that asked faculty to rate their competency in each of the 14 technology-related tasks twice – once for the pre-pandemic period and once for the current period. Qualitative data were collected through semi-structured interviews conducted virtually or in person. Priority was given to qualitative data in this study as the interviewee sample size was more adequate for qualitative research than the survey respondent sample size for quantitative research. One hundred faculty participated in the quantitative survey. Most survey items demonstrated significant differences between faculty self-rated competency levels in the pre-pandemic period and the current period, suggesting technology knowledge growth from the forced transition. Qualitative interviews of 19 faculty revealed four overarching themes: Inconsistency in

instructional support, pandemic-induced technological growth, power of togetherness, maintaining continuity through flexibility, and resilience against adversity. This study provided faculty with the experience to perform effective self-reflection and gain insights into their pedagogical practices. Future research should focus on professional development that can help faculty remain up-to-date on technology utilization and establish a contingency plan to better prepare for the unknown.

COVID'S LINGERING EFFECTS ON FACE-TO-FACE INSTRUCTION: OUR PATH FORWARD

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During the recent COVID -19 pandemic, many universities were forced to convert face-to-face (F2F) courses into online formats. We have observed at several universities that one of the lingering effects of the pandemic is the hesitancy of students to return to traditional F2F classroom instruction. Online lectures are convenient, popular, and seem to be growing in demand, and we recognize that online laboratories (labs) are gaining in popularity as well. While online labs may be effective preparation tools for many disciplines, we believe that online labs that are associated with life sciences lack the inherent characteristics and tactile information that physical experiences offer. For example, during F2F hands-on life science lab activities, students directly and safely investigate chemical properties and reactions, they perform and investigate the activities of cell culturing, and have the opportunity to experience the various features associated with dissecting. Students also gain valuable training and experience in using equipment such as fume hoods, autoclaves, and cryogenic devices. Most of us can agree that students remember approximately 30% of what they see and 90% of what they do. Our aim, therefore in this discussion is to share ideas and best practices designed to help encourage students to return to F2F instruction; especially hands on F2F labs that are associated with the life sciences.

MENTAL HEALTH STATUS AMONG STUDENTS ON DILLARD UNIVERSITY CAMPUS: THE UNCF, STEVE FUND & HEALHTY MINDS SURVEY 2023 INITIATIVE

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The Dillard University 2023 Healthy Minds survey results support the need for future campus funding for mental health-based programming, to better serve the disparities faced by the students on HBUC & PBI campuses. Dillard University committed to participating in the UNCF's HBCU Mental Health Initiative Spring of 2023, as a cohort HBCU campus. With IRB approval, the survey was released on the Dillard University campus from April 11th to May 8th. The Healthy Minds Survey was selected as a component of the 2022-2023 United Negro College Fund Healthy HBCU Mental Health Initiative, in partnership with the Steve Fund. Over 32% (N=348) of the Dillard University student body participated in the survey. When focusing on the mental health status of the current study body; data from the survey revealed that 15% of the survey participants reported seriously thinking about committing suicide within the past year and 41% reported having a previous diagnosis of mental illness, with only 8% of that 41% reporting utilization of services offered thru the Office of Disability Services. This study's results support the need for future campus-wide programming to better serve mental health disparities faced by students on HBCU & PBI campuses.

EFFECTIVE METHODS FOR K – 12 TEACHERS TO ENSURE STUDENT ACQUISITION OF ACADEMIC MATERIAL IN VIRTUAL CLASSES

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The Covid – 19 pandemic expedited the infusion of virtual learning at every instructional level. Virtual learning experiences proved convenient, but the intensity of student engagement is the question. Academic engagement occurs when pupils are attentive, committed, and persistent towards the learning task. Teachers are challenged when delivering face-to-face instruction; thus, confirmation of academic engagement during online learning sessions is compounded. The goal of this discussion is to expose effective methods for K – 12 teachers to ensure student acquisition of academic material in virtual classes. Providing teacher training embedded with the use of technological tools is a proper means to enhance teachers' ability to positively impact student achievement in distance learning environments. Teachers capitalize upon professional development and incorporate said strategies into their distance learning agendas. Student outcomes are at stake and the effectiveness of teaching methods on virtual learning is exponentially worthy of investigation as 21st century learners proceed towards standardized testing which measures performance as determined by the Kindergarten Readiness Assessment, Mississippi Academic Assessment Program, American College Test (ACT), Scholastic Aptitude Test (SAT),

and WorkKeys.

FOSTERING DIVERSITY, EQUITY, AND INCLUSION IN THE CLASSROOM

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Diversity, Equity, and Inclusion (DEI) seem to be the new buzzwords in education, and rightfully so. Teaching for diversity refers to acknowledging a range of differences in the classroom. Teaching for equity allows the differences to transform the way we think, teach, learn, and act such that all experiences and ways of being are handled with fairness and justice. Moreover, e*ducational equity allows for us to discover and cultivate the unique gifts, talents, and interests that our learners possess.* Teaching for inclusion signifies embracing differences so that all students feel validated. The idea of diversity, equity, and inclusion complement each other and enhances educational opportunities for all students when simultaneously engaged. The goal of this discussion is to help educators discover that teaching to engage diversity, to seek equity, and to include all learners is essential for creating a campus and society that recognizes the contributions of all people. From creating more positive learning environments, to generating fresh insights, and preparing open-minded citizens, there are several reasons why investing in intentional diversity, equity, and inclusive practices is an essential move for each of us.

A BRIEF REVIEW OF THE PATHOPHYSIOLOGY, CLINICAL PRESENTATION, DIAGNOSIS, AND TREATMENT OF HASHIMOTO'S THYROIDITIS WITH A FOCUS ON 10 YEARS OF UMMC DATA

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The purpose of this project is to review the current body of knowledge on the pathophysiology, diagnosis, treatment, outcomes, and future considerations for research on Hashimoto's thyroiditis. Hashimoto's thyroiditis is an autoimmune disorder where the immune system makes antibodies that attack the thyroid gland. Hashimoto's thyroiditis (aka Hashimoto's disease) occurs in 5 out of 100 Americans and is the most common cause of hypothyroidism in the US. Many people with Hashimoto's disease have no symptoms until the disease progresses into later stages. Early in the disease, the thyroid may enlarge and release higher levels of thyroid hormone resulting in hyperthyroidism. As the disease progresses, hypothyroidism ensues as more damage to the thyroid occurs. The most common signs and symptoms include fatigue, weight gain, cold intolerance, joint and muscle pain, constipation, dry skin, dry thinning hair, heavy or irregular menstrual periods, infertility, and slow heart rate. Risk factors include female sex, family history, other autoimmune diseases, history of certain viral infections, pregnancy, excessive iodine intake, poor psychological well-being, and radiation exposure. The diagnostic workup for Hashimoto's thyroiditis includes thyroid function tests (TSH, free thyroxine (fT4)) to confirm a hypothyroid state. Coupled with thyroid peroxidase antibodies (TPO), the diagnosis of Hashimoto's thyroiditis can be confirmed. Thyroid ultrasound is often used to detect a goiter or nodules. Treatment includes pharmacologic therapy with levothyroxine (standard dose = 1.6-1.8 mcg/kg/day) to restore the euthyroid state. Patients >50 years of age are treated with 25 mcg/day with reevaluation in 6-8 weeks. Patients undergo thyroidectomy in the later stages of the disease because of higher cancer risk. Current clinical trials are exploring dietary supplementation, laser light therapy, Identity Oriented Psychotrauma Therapy (IOPT), and Eye Movement Desensitization and Reprocessing (EMDR). Future research should include therapies targeted at the pathophysiological autoimmune mechanisms causing the disease.

EXPLORING MORAL AND ETHICAL PREDICAMENTS UTILZING ARTIFICIAL INTELLIGENCE IN HEALTHCARE DECISIONS

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Artificial intelligence (AI) strives to mirror human cognitive functions. The use of AI in healthcare decision-making is a current example of the periodic paradigm shift that Thomas Kuhn described as an extreme change in a well-accepted model or assessment of events. The shift toward dependency and reliability of AI to diagnose and treat patients may have the power to interfere with or alter the judgment of healthcare providers caring for individual patients. Numerous ethical issues confront society due to the use of AI in healthcare decision-making. These issues include privacy, possible discrimination, and the philosophical challenges in the role of human judgment. In addition, there are several concerns regarding AI resources becoming a new source of inaccuracy and data breaches. Most healthcare datasets are incomplete and may not account for all patient variability. Mistakes in a procedure, diagnosis, treatment protocol, or judgment in clinical decision-making when using AI technologies by healthcare team members can have severe adverse consequences for the patient. Currently, there are no well-defined regulations or ethical guidelines to address such issues that often arise due to the use of AI in healthcare settings for making medical decisions. In this project, we aim to address these critical issues focusing on the need for transparency in the development of algorithms, the use of personal data and privacy, and the protection of all the beneficiaries involved in using AI in healthcare decision-making.

Saturday

Session 9: Biomechanics

BONE PERMEABILITY CORRELATION TO CT ATTENUATION: EXPERIMENTAL STUDY ON TIBIAL TRABECULAR BONE

Adrian Alepuz[1], Francesco Travascio[2,3], R Shane Barton[4], Steven Kautz[4], Nicholas McGee[4], Loren Latta[2], Abeer Albarghouthi[2], , Giovanni F Solitro[4],

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INTRODUCTION: Bone mechanical behavior is well described by the Theory of poroelasticity. More specifically the hierarchical structure of bone is responsible for the direct translation of interstitial fluid flow in the osteocyte shear stresses with resultant bone remodeling. Bone permeability estimation is essential to properly characterize structural behavior, fracture mechanism, and also for surgical interventions involving cement infusion. Therefore the identification of a relationship between trabecular bone permeability and attenuation coefficients obtained through Computer Tomography has the potential to allow CT based poroelastic modeling of bone structures. We hypothesized that for samples belonging to the proximal tibial region a relationship exists and can be drawn.

METHODS: Trabecular bone slices in thickness of 10mm harvested perpendicularly to the anatomical axis were obtained from cadavers with age of 64.2±8.2. An experimental apparatus was used to convert the axial motion of an Instron mechanical testing system in an axial flow infusing the bone specimens at a rate of 22.98 ml/sec (Ochia and Ching 2002). Darcy Law law was used to extrapolate the permeability from the measure fluid pressure.

Imaging of the specimens was then performed using a GE LightSpeed VCT at a slice thickness of 0.625mm to calculate average attenuation coefficient. While BoneJ v1.4.3 on µCT scans of the specimens (SkyScan1176; Bruker BioSpine Corp) was used to identify bone volume fraction (BV/TV), mean trabecular thickness (Tb.Th); connectivity density (Conn), and degree of anisotropy (DA). The correlation between CT attenuation coefficients and hydraulic permeability was performed trough linear correlation.

RESULTS SECTION: The bone morphology was found to be characterized by a BV/TV of 0.04±0.02 and a connectivity of 3092±3544. The fluid pressure measured in 13.03±9.48 kPa resulted in a permeability of 25560±26824 mm^4/Ns. The attenuation coefficient correlated with the permeability with a coefficient of determination of ~0.90.

DISCUSSION and CONCLUSION: While the investigated relationship between these two quantities is dependent on the site

object of study, the high correlation found reveal the opportunity to include poroelasticity characterization in most of the FE based studies currently limited to linear elasticity. Further experiments are needed to account for different morphologies and other anatomical regions.

ASSESSMENT OF FRACTURE RISK INDEX AND FRACTURE LOCATION AT DIFFERENT LOADING DIRECTIONS VIA QCT-FE ANALYSIS

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Hip fracture is a traumatic injury that often affects older individuals with low bone mineral density (BMD). Although it is known to have a higher correlation with BMD, age, and sex, the majority of hip fractures are caused by simple sideways fall from a standing height, highlighting the role of loading in hip fracture. However, only a small percentage of falls, around 1-5%, result in hip fractures, indicating that not all loading directions are equally significant. Prior research showed that a change in loading direction from 0º to 30º, measured from the femoral neck axis only on the transverse plane, led to a 24% decrease in failure load, which is comparable to 25 years of age-related bone loss. The objective of the current study was to investigate the effect of loading directions both on a coronal plane and transverse plane to better predict the fracture location and fracture risk index. Nine different sideways fall conditions varying from 0º to 30º at 15º intervals and varying from -15º to 15º at 15º intervals were considered. Results show that the fracture risk primarily increases due to the increase of loading direction angle on the transverse plane, indicating the posterolateral loading direction is more critical than the anterolateral loading direction. Additionally, the posterolateral loading direction is associated with the femoral neck fracture whereas the anterolateral loading direction is associated with an increased risk of fracture at the femoral neck and subtrochanteric regions.

A MULTI-STRUCTURAL FIBRIL-REINFORCED PORO-HYPERELASTIC (MSFPH) FINITE ELEMENT MODEL TO UNDERSTAND THE PATHOMECHNAINCS OF ARTICULAR CARTILAGE

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Osteoarthritis (OA) is a prevalent, debilitating joint disease affecting millions globally. Despite significant research, our understanding of cartilage mechanics in the process of OA development and progression remains limited. A major challenge is characterizing the mechanical environment of individual articular cartilage properties during daily activities using current techniques. Although computational multiscale modeling offers potential solutions, existing models are limited in scope, focusing only on single components without considering combined interactions. This study adopted a physics-based approach, where a novel multi-structural fibril reinforced poro-hyperelastic (MSFPH) model has been developed to investigate the deformation behavior of dominant parameters in healthy and osteoarthritic cartilage during indentation test. Using an axisymmetric finite element model, we incorporated the Extracellular Matrix (ECM), Pericellular Matrix (PCM), Cells, and Collagen fibers type (II and VI), accounting for their varying orientations across different zones. This comprehensive approach enables more accurate representation of cartilage mechanics at the tissue level. In addition, our findings offer insights into the mechanics of individual cartilage ECM macromolecules and chondrocytes subjected to physiological loading conditions. This research emphasizes multiscale modeling's potential to deepen complex biological systems understanding and promote new treatments for degenerating diseases like OA.

HYPERELASTIC MATERIAL MODELS FOR COMPUTATIONALLY INVESTIGATING ENZYME-MEDIATED CARTILAGE MECHANICS

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Osteoarthritis (OA) and the associated degradation of cartilage is a growing concern worldwide, particularly for aging population. The pathophysiological mechanisms of OA are challenging to comprehend because of the complexity of the disease. While the use of modelling and simulation for explorations of cartilage mechanics is appealing, routine investigations are hampered by many technical challenges associated with the need to accommodate the nonlinear and multiscale nature of this tissue. Finite element analysis (FEA) can be used to evaluate the mechanics of articular cartilage associated with hyperelastic materials models. The prior work of our research group experimentally investigated the role of enzyme-mediated cartilage degradation and its associated mechanical properties. In this work, we utilized a curve fitting approach to test different hyperelastic materials models to computationally understand the mechanics of healthy and degraded cartilage. We used several hyperelastic models including neo-Hookean, Mooney-Rivlin, Yeoh, Ogden, Polynomial, VanderWaals in PolyUMod, MCalibration software to evaluate the fitting parameters of each model based on our prior experimental data. The models with the best fitted parameters were then used in the FEA. Among all the tested hyperelastic models, the Ogden, VanderWaal, Polynomials yielded the best and optimized outcomes. This work demonstrates the potential of hyperelastic models in developing realistic and accurate multiscale FEA models for understanding the pathomechanics of cartilage.

PEAK FORCES ACROSS THE ACL DURING THE PHANTOM FOOT LIMB INJURY: ASSESSING KNEE FLEXION ANGLE

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The phantom foot injury is believed to be the most common mechanism of anterior cruciate ligament (ACL) injury in skiers. It is a complex series of simultaneous motions characterized by: a skier falling backwards while going downhill, the body is positioned with the hips below the knees, the torso facing the downhill ski, the uphill ski unweighted, and all of their weight on the inside edge of the back of the downhill ski. This injury mechanism produces excessive internal rotation and valgus moment on the knee coupled with a high anterior tibial load. The skiers body position during the phantom foot injury mechanism prevents boot release. While this injury mechanism has been simulated using finite element modeling (FEM), it has not been

consistently experimentally reproduced using cadaveric tissue. Our lab developed a methodology for experimental reproduction of this injury following input parameters defined in the published FEM study. We have found that this injury is difficult to consistently reproduce with the specified parameters, thus we have begun to assess which variables need to be modified to consistently achieve the desired injury mechanism. We present results of a feasibility model to directly measure loads along the ACL while the knee is subject to the complex series of forces simulating the phantom foot limb injury. We vary the knee flexion angle from 90 to 150 degrees to ascertain the knee flexion angle at which peak forces occur.

TOTAL KNEE ARTHROPLASTY WITH MEDIAL COLLATERAL LIGAMENT REPAIR: A BIOMECHANICAL STUDY

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During total knee arthroplasty (TKA), the medial collateral ligament (MCL) is sometimes inadvertently injured. Because the MCL is essential to knee stability, the surgeon repairs the ligament via direct repair. Alternatively, Internal Brace Fixation (IBF) may result in greater stability and reduce reoperation rate. This study compares knee stability following TKA, post-MCL repair via direct repair or IBF. Five fresh-frozen pairs of legs, mid-femur to distal tibia, were mounted in a custom fixture that secured the femur and allowed for the knee to be locked at 10° increments of flexion from 0° to 90°. Using 6 Optitrack motion tracking cameras, rotation and angular displacement were measured at 0°, 10°, 40°, and 90° of knee flexion under fixed loads: internal and external rotation (5N-m) and valgus load (10N-m). Intact specimen stability was first assessed. A fellowship trained orthopaedic surgeon performed a TKA using hardware and trials fit specifically to each specimen; stability was again quantified. The MCL was subsequently severed simulating injury and stability was again recorded. One specimen from each pair was randomly assigned to receive IBF for MCL repair; the contralateral limb was treated with a direct repair. Stability was again quantified. All stability measures were obtained 3 times at each knee flexion angle for each condition. A multivariate analysis of variance (MANOVA) with repeated measures was used to compare stability across all conditions, relative to the intact state and to the TKA treatment condition with intact MCL.

Session 10: Medical Devices and Implants 1

A CLINICAL TRIAL FOR FACIAL PROSTHETICS

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A randomized, controlled, double-blind, single-crossover, multi-center, Phase III, NIH-supported $2.8M clinical trial was carried out at M.D. Anderson Cancer Center and Toronto Sunnybrook Cancer Centre in 2003-09, to evaluate a thermoplastic chlorinated polyethylene from Dow Chemical for extraoral maxillofacial prosthetics (EMFP). The material is inexpensive and processed for 30 minutes in gypsum molds in a domestic pressure cooker. The translucent material is layered in the mold simulating color-at-depth, accepts intrinsic and extrinsic pigments, textured using rayon flock, threads to simulate facial hair, and final lamination under a clear sheet of unpigmented material. It is repairable with a hot instrument, or recycling in the mold. A MEK varnish was developed for extrinsic coloration. The control material was medical-grade Silastic® 4210A/Adhesive A. Originally developed at Gulf South Research Institute in New Orleans and at Charity Hospital (LSU), with help from Dow Chemical, the CPE material is available for free from the presenter. Emphasis will be on the virtues and subtleties of human clinical trial design for EMFP materials, and the management of working with colleagues and staff. The experimental design can be used for other clinical trials of prosthetic materials.

FLEXIBLE LEG-WORN DEVICE FOR TRANS-CUTANEOUS NEUROMODULATION TO TREAT NEUROGENIC BOWEL DISORDER (NBD) IN SPINAL CORD INJURY (SCI) PATIENTS.

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Neurogenic Bowel Disorder (NBD) is an impairment of gastrointestinal (GI) function manifested by slow colonic transit and rectal hyposensitivity resulting in constipation, fecal incontinence, and other GI symptoms. It is seen in over 95% of patients with Spinal Cord Injury (SCI)1,2. Direct stimulation of the ST36 acupuncture point has improved NBD in SCI patients in clinical studies3–5. We hypothesize that Transcutaneous Neuromodulation (TNM) on ST36 can also alleviate the symptoms of NBD in SCI patients. As proof of concept, a 2 x 2 electrode array was developed on a thin and flexible thiol-ene acrylate polymer substrate using photolithography, sputtering of metals, reactive ion etching, and wet etching. Gold was used for conductive traces and connection pads, whereas TiN was used as electrode material for stimulation. Dynamic mechanical analysis was performed to assess the softening behavior of the polymer. The functionality of the device was tested by carrying out electrochemical impedance spectroscopy, cyclic voltammetry, and voltage transient tests. Softening of polymer at body temperature, demonstrated by the reduction in the storage modulus at 37 °C vs 23 °C, provides a reliable conformal interface with the leg skin. The impedance of (101± 9.78) Ω at 1 kHz, charge storage capacity of (2.51 ± 0.26) mC/cm2, and charge injection capacity of 41.73 µC/cm2 provide an adequate amount of electrical stimulation to the targeted area for neuromodulation. TENS device with TiN electrodes demonstrated the capability of charge storage and charge injection for transcutaneous neuromodulation.

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LOWER EXTREMITY GUIDED AND ASSISTED REHABILITATION DEVICE (LEGARD) FOR HIP SURGERY PREOPERATIVE STRENGTHENING AND REHABILITATION

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Rehabilitation following musculoskeletal injury is important not only to improve functional recovery and satisfaction of the patient, but to prevent costly hospital readmissions and further disability. Hip injury, specifically, can result in altered gait and increased likelihood of falls if strength is not recovered. Despite this, few lower extremity exercise devices are designed to target hip rehabilitation. Given the importance of hip strength in preventing further injury, new technology to recover hip strength, range of motion, and neuromuscular control is needed. The Lower Extremity Guided and Assisted Rehabilitation Device (LEGARD) aims to provide more effective rehabilitative care for patients experiencing hip injury or loss of function. This is accomplished through the implementation of a biofeedback system that improves the patient's exercise quality and provides ease to the physical therapist's assessment of patient progress. Presently, the LEGARD prototype measures velocity and range of motion achieved during exercise in real time and displays relevant data to the user, which will undergo internal validation testing in the next stage of development. Future iterations of the LEGARAD will be useful in multiple rehabilitative settings where hip range of motion, muscular strength, and/or neuromuscular control is affected, including for injured athletes, stroke patients, hip arthroplasty patients, and more.

PROTEIN-MODULATED 3D PRINTING POLYMERIC NANOARCHITECTURE-ARBITRATED TITANIUM NANOTUBES FOR IMPLANT-TO-BONE OSTEOINTEGRATION

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Artificial bone grafts are one of the most transplanted tissues linked with therapeutic strategies that offer promising advantages over autologous grafts and are most likely the most effective way to improve patients' health and quality of life. Currently, surface-mediated titanium nanotube-based implants are used to hasten bone fracture healing and tissue repair. Various bio-ceramic components, metal-based bioactive glasses, and polymeric solutions are utilized for the surface treatment of titanium implants. The implant's weak shape ability and limited mechanical properties can be improved by extrusion-assisted three-dimensional (3D) printing of ceramics, which allows the generation of engineered bone scaffolds from a computer-aided design (CAD) model. Here, we designed the protein-modulated implants with 3D printed polymeric nanoarchitecture i.e., nanocrystalline apatite titanium implants (NCATIs), which could conjugate with anabolic factors and bone-forming potential that could serve as a therapeutic target for osteoporosis. The synthesized implants can be produced in low-cost, and eco-friendly techniques, that are affordable for osteoporotic patients with modest incomes. More importantly, the NCATIs could be used in osteo-immunomodulated bone graft materials, which provide an advanced platform for treating bone disorders, voids, and dental implant materials. These NCATIs could mimic various spatial confinements to the cells that retain mechanical support through load-bearing qualities and antibacterial properties to reduce inflammation near the wounded site and vicinity of a dental implant, which mitigates the demand for grafting, and significantly lowers healthcare expenses.

Session 11: BIOMEDICAL IMAGING AND ADVANCEMENTS IN PRECISION MEDICINE

MULTISCALE AND MULTIMODAL IMAGING OF THE PREECLAMPTIC PLACENTA

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Inadequate placental development is believed to be the initiating pathology of preeclampsia, or new onset hypertension during pregnancy. Existing ultrasound imaging methods assess gross placental anatomy, but provide limited information about multiscale functional and anatomical information. Our research develops multimodal ultrasound-based imaging methods to characterize progression and treatment of placental-related diseases, including photoacoustic imaging, contrast-enhanced ultrasound, and quantitative ultrasound. In photoacoustic imaging, a nanosecond pulsed laser generates information about tissue oxygenation. Photoacoustic imaging has been performed of the placenta of the reduced uterine perfusion pressure (RUPP) rat, and demonstrating that this model of preeclampsia has an ischemic placenta. With treatment with sildenafil, the placental oxygenation returns to normal pregnant levels. Complementary contrast enhanced ultrasound imaging provides information about vascular perfusion. In the RUPP rat, the placental perfusion is reduced in comparison to normal pregnant. Quantitative ultrasound then provides information about the microstructure of the placenta. The placental microstructure becomes more complex in normal pregnancy, potentially due to villi branching and maturation, but does not increase in the RUPP rat. Together, these methods are

being combined to generate multiscale information about the preeclamptic placenta to identify new therapeutic pathways.

AN IMAGE PROCESSING PIPELINE FOR LUNG REGION DETECTION IN CHEST RADIOGRAPHS WITH SHAPE SIMILARITY MATCHING

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Accurate and reliable identification and segmentation of the lung region in digital chest X-ray images plays a critical role in computer-aided diagnosis, especially in the early detection of lung disorders. In this paper, we propose a new approach to lung segmentation of chest radiographs. Our fully automated, unsupervised method consists of three stages. First, for an image of interest, the five most similar X-rays are selected from a set of healthy images using partial Radon transform and Bhattacharyya shape similarity measures. Second, the identified healthy chest X-rays are segmented by a) detecting the Region of Interest (ROI) using Euler's number, b) performing gray-level Otsu thresholding using histogram of Canny edges within the ROI, c) improving initial segmentation by merging the ROI gradient magnitude with the threshold image, d) adjusting the boundaries (interpolated using Bezier curves) by detecting salient points using the Gateaux derivative of the total variation, e) using morphological filtering for shape adjustments and f) producing final masks using the Graph Cut algorithm. Third, for the original image of interest, a patient-specific lung mask is obtained using patient-specific masks from the closest five healthy patient images via a SIFT-flow process and averaging the masks obtained in the previous step.

Our method was applied to a database of 150 clinical posteroanterior (PA) and anteroposterior (AP) chest radiographs from healthy and COVID-19 adult patients provided by The University of Texas Medical Branch (UTMB) at Galveston. Using manually segmented images as ground truth, our method produced very convincing results for most images considered.

Session 12: Medical Devices and Implants 2

NOVEL INTESTINAL EXPANSION SLEEVE (IES): PROMOTING DISTRACTION ENTEROGENESIS IN A LIVE ANIMAL MODEL

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Introduction: Short bowel syndrome (SBS) occurs with inadequate intestinal mass to support complete enteral nutrition. Intestinal adaptation in SBS is a lengthy process requiring parenteral nutrition, central lines, and even surgical lengthening procedures. Recently, distraction enterogenesis has been postulated as a treatment modality to lengthen intestine in SBS patients. Our novel intestinal expansion sleeve (IES) should promote distraction enterogenesis. We hypothesize that the IES device can achieve significant bowel lengthening *in vivo* by promoting distraction enterogenesis.

Methods: A Roux-en-Y in the jejunum of 6 rats was performed. The IES was precontracted over a Bucatini noodle and inserted into the isolated roux limb . After 4 weeks, the rats were sacrificed and the intestines were examined. A paired t-test was performed to compared initial and final roux limb lengths. Intestinal tissue was sampled for histological examination.

Results: Intestinal distraction was evaluated at 4 weeks post deployment of the IES, resulting in a significant increase in roux limb length from an average of 42.5± 15mm to 54.2±21.8 mm ($p=.043$, $n=6$).

Discussion: Distraction enterogenesis with significant intestinal lengthening *in vivo* has been achieved with the IES. Increasing intestinal mass with these devices may change the treatment paradigm for SBS. Histology does demonstrate a degree of expected inflammation. Future constucts of the IES may benefit from the addition of immunomodulators.

THE HISTORY OF ARTIFICIAL TEMPEROMANDIBULAR JOINT (TMJ): EARLY FAILURES AND NEW DEVELOPMENTS

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Temporomandibular joint (TMJ) disorders affect millions of individuals worldwide, leading to significant pain, dysfunction, and impaired quality of life. TMJ prostheses have emerged as a promising treatment modality for patients with severe TMJ pathology who have not responded to conservative therapies. The evolution of these TMJ prostheses in terms of design, materials and clinical techniques over the years, resulted in the betterment of replacement options including those like Christensen's device and Proplast joint by Dr. Jack Kent. However, the success rates of TMJ prostheses may sometimes become questionable, often presenting with early signs of failure such as - facial edema and facial nerve palsy, anomalous deposition of bone (heterotopic bone formation), the development of neuromas characterized by aberrant nerve tissue growth, auditory complications, joint dislocation, and the possibility of adverse repercussions on the contralateral joint subsequent to unilateral joint replacement. This could be attributed to an improper case- prosthesis selection process. The need for standardized protocols for prostheses selection based on the clinical scenario could entail better clinical success and predictability. This paper aims to provide an overview of the success rates of TMJ prostheses and highlight the importance of developing comprehensive clinical guidelines for TMJ replacement procedures.

A NOVEL IMPLANT FOR TREATMENT OF TRAPEZIOMETACARPAL OSTEOARTHRITIS

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INTRODUCTION: An effective treatment for osteoarthritis is carpometacarpal joint arthrodesis (fusion). This procedure alleviates thumb discomfort and restores partial grip strength, but thumb movement limitations are unavoidable. A novel implant was designed to improve upon current treatments. The CMC

joint's range of motion was tested in bio-implantation studies and compared to that of the novel device and other treatments.

METHODS: Eleven fresh-frozen specimens mid-humerus to fingertip were tested. All procedures were performed by a fellowship-trained hand and wrist surgeon. Specimens were placed in a custom testing apparatus that simulated thumb circumduction. Each specimen was tested in six conditions: intact, fusion, fusion with partial resection, fusion with ligament transection, full trapeziectomy, and novel implant. Positional and rotational data were collected using Optitrack cameras and Motive Body motion capture software.

RESULTS SECTION: Mean, standard deviation, and 95% confidence intervals were quantified. Figure 1 shows of angular and rotational ranges of motion.

DISCUSSION: CMC fusion decreased the range of motion for both angular and rotational thumb circumduction. Subsequent techniques increased thumb range of motion. The novel implant provided a greater range of angle motion than the fusion techniques while maintaining similar rotational motion range.

SIGNIFICANCE/ CLINICAL RELEVANCE: Existing procedures have many shortcomings: reduced grip strength, thumb shortening, and reduced range of motion. The novel implant mimics fusion surgery that solves most failures by other procedures. The implant is an alternative option that may provide improved range of motion while maintaining thumb length without the potential limitations of grip strength as seen in CMC arthrodesis.

CHALLENGES IN THE DEVELOPMENT OF ANIMAL MODELS FOR IN VIVO TESTING: INSIGHTS FROM THE EXPERIENCE WITH VAGINAL EXPANSION SLEEVES

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In vivo vaginal studies involving the rat model have proven to be quite a challenge. Our vaginal expansion sleeve (VES) was created as an alternative treatment for vaginal atresia. The greatest task to overcome in testing VES was preventing the rats from removing the device before the end of the trial. Several procedural variations in maintaining VES placement were tested to find a suitable, reproducible method.

We began testing with only 2 rats. Prior to recognizing the need for preventative measures, the rats had chewed out the device within the first day after placement. Subsequently, cardboard E-collars that extended out just past their noses were applied. These collars had been chewed down enough after 3 days for the rats to reach their vaginas and begin removing VES. The idea to limit the rats' ability to flex their bodies led to wrapping their torsos with Coban. Moreover, surgical pledgets were used to further protect the sutures. Although the rats still managed to chew their wrapping to bend, we discovered it took about 4 days to chew enough to reach the vaginal area. With this knowledge, we decided to re-wrap their torsos every 3 days. Of note, the rats' ability to access food and water was maintained throughout each variation.

It is possible to limit rats' access to their vaginas when conducting studies involving this area. With the flexion-limiting torso wrapping and surgical pledgets combination, we were able to successfully keep VES devices in place in 6 rats over the course of about 1 week. Plans to extend the study over multiple weeks will further evaluate the precision of this method.

BIOMECHANICAL INVESTIGATION OF LUMBAR INTERBODY CAGE CONFIGURATIONS IN OBLIQUE PROCEDURES

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Introduction: Oblique lumbar interbody fusion (OLIF) is an operative treatment to relieve compressive symptoms due to degenerative disc pathology. Minimally invasive techniques are often utilized when approaching these procedures, this allows for greater preservation of nearby anatomy while maintaining multilevel vertebral body access. However, in interbody spinal cage placement (ISC), proper alignment to an orthogonal configuration is challenging. Related complications can include injuries to vasculature, nervous system, and musculoskeletal structures. Due to the nature of an oblique approach in these procedures, ISC rotation within the disc space to orthogonal alignments is often required. Therefore, this study aims to evaluate the influence of ISC configuration in determining the subsidence load of the construct. We hypothesized that while the footprint of the implant increases the subsidence load, there are no differences generated by the orientation of the implant.

Methods: Lumbar bone surrogate models were made from CT scans of 9 cadaveric specimens with age of 81±7 yo. Compression testing was performed using mockup steel cages resembling a Medtronic lumbar cage. ISCs were tested in compression using an Instron mechanical testing system (Instron 8872, Norwood, MA) with placements in orthogonal or oblique orientation (15˚). The subsidence load was defined as the peak load's exhibited within the first two millimeters of compression. Differences were evaluated using a two-sample t-test with a level of significance of 0.05.

Results: The average subsidence load in the orthogonal ISC configuration was 4349N±576 (N = 13) while the average within the oblique configuration test group was of 4429N±533 (N = 13) p=0.716.

Conclusions: This study informs that oblique ISC alignment at 15° maintains similar biomechanical properties when compared to traditional orthogonal alignment. While this finding has the potential to provide valuable insight for surgeons, future research is needed using cadaveric specimens to translate this finding to procedural protocol.

Acknowledgements: We would like to thank Mr. Alan Ogden for the assistance given in performing the experiments.

Session 13: Biomaterials/Imaging

TOUCH-SPUN FIBERS FOR TISSUE ENGINEERING APPLICATIONS

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Tissue engineering is a growing field that seeks to create cell-culture substrates that mimic the extracellular matrix (ECM) of biological tissues. One material that holds promise for this purpose is polycaprolactone, a biocompatible and biodegradable polymer. The traditional method of producing ECM-analogous scaffolds is electrospinning, but this method lacks precision in controlling fiber orientation, diameter, and spacing. More recently, touch-spinning has been used as the preferred approach because it allows for greater control over fiber formation. This study evaluates the suitability of dry-spun polycaprolactone fibers for use in 3D cell culturing. The touch-spun nanofiber layers were analyzed using optical and scanning electron microscopy, and their biocompatibility was assessed by culturing NIH3T3/GFP fibroblasts on the fibers for up to seven days. The results of optical microscopy showed that the fibroblasts attached to the fibers and proliferated on the denser regions of the scaffold. These findings indicate that the touch-spun polycaprolactone scaffolds support continuous cell growth. Future work will explore the creation of tissue constructs using human umbilical vein endothelial cells (HUVECs) and smooth muscle cells (SMCs) as a model for vascularization.

Session 14: Orthopaedics

TARGETING TWIST1 TO PROMOTE STROMAL CELL-BASED CARTILAGE REPAIR

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Placenta-derived Mesenchymal stromal cells (PMSCs) have been widely explored for tissue engineering applications and have demonstrated high capacity for variety of tissue repair *in vitro*. However, rapid chondrogenic induction of PMSC during therapeutic transplantation remains extremely challenging. Here we undertook a study to determine if Twist1 inhibition by shRNA could be utilized to accelerate PMSC-mediated cartilage repair in a mouse cartilage defect model. PMSCs were isolated from human placenta delivered from normal term. Lentivirus-mediated gene silence was used to generate Twist1 deficient PMSCs. A mouse knee joint cartilage defect model was used for *in vivo* study. Wild type control and Twist1 deficient PMSC pellets were generated and inserted to fill the cartilage defects. After 4 weeks postoperatively, knee joints were harvested for analysis. The flow cytometry results indicated that human stromal cell markers CD29, CD73, CD90 and proliferation marker Ki-67 were highly expressed in the 3rd generation PMSCs, and these cells could be induced into osteoblastic cells, adipocytes and chondrocytes when cultured in specific conditional media. Particularly, silencing Twist1 significantly enhanced chondrogenesis in cell pellet cultures when compared to control PMSCs. Importantly, the *in vivo* transplantation of Twist1 deficient PMSCs into knee joint cartilage defects had a significantly enhanced cartilage formation by showing stronger Alcian blue and Col-II staining in cartilage defect area. Collectively, these findings demonstrate that 1) PMSCs are a favorable cell source for cartilage repair. 2) Silencing transcription factor Twist1 could accelerate PMSC differentiation into chondrocyte under the cartilage microenvironment *in vivo*.

EVALUATING THE EFFECT OF MEDIAL TRANSMALLEOLAR DRILLING ON POSTOPERATIVE FRACTURE RISK: A CADAVERIC BIOMECHANICAL STUDY

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The medial transmalleolar portal (MTP) for the ankle is used to mend osteochondritis dissecans (OCD) lesions of the medial talar dome. OCD is characterized by cartilaginous/osseous cell death due to inadequate blood flow to the area commonly secondary to repetitive microtrauma. This paper describes the postoperative fracture risk of MTP drilling at the tibiotalar joint when compared to intact ankles, utilizing a cadaveric model. The primary aim of the study is to determine if the MTP is a safe option for accessing the medial talar dome for osteochondral graft implantation. Twenty-four matched ankles were cut mid-tibia and dissected down to the bone, sparing the tibiotalar joint capsule. The specimens were divided into 2 groups; Intact control ankles (N=12), and ankles with an MTP (N=12) created by a senior orthopedic surgeon. Each specimen was then secured against a steel baseplate and compressed until gross failure was indicated by a sharp drop in resistance. The mean failure loads were 8473.1 N ± 5141.8 and 7404.6 N ± 4295.8 for the control and MTP (transmalleolar portal) groups respectively. The difference between groups was deemed insignificant by paired samples T-test yielding a p-value of 0.123. Our results point toward the potential post-operative safety of the MTP, although more study is warranted.

REAMING INDUCED REDUCTION IN ACETABULAR STRENGTH: EXPERIMENTAL EVIDENCE ON BONE SURROGATES

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Total hip arthroplasty is a widely performed operation and continues to grow each year as the population continues to age. THA allows disabled patients to improve their quality of life to a degree greater than any other elective procedure. In order to plan for THA, adequate patient assessment and preoperative characterizations of acetabular bone loss via radiographs and specific classification schemes is required. Some surgeons may be inclined to ream at a larger diameter thinking it would lead to a more stable press-fit, but this could be detrimental to the acetabular wall, inducing thinning, resulting in an increased susceptibility to intraoperative fracture. In the attempt to reduce the incidence of intraoperative complications, the current study aims to identify how increased reaming diameter degrades and weakens the acetabular rim strength. We hypothesized that there is proportionality between the reaming diameter and the reduction in acetabular strength. To test this hypothesis, this study used bone surrogates, templated from CT scans of cadaveric pelvis which were reamed at different diameters. The obtained bone surrogate

models were then tested using an Intron 8874 mechanical testing machine (Instron, Norwood, MA) equipped with a custom-made fixture. Analysis of variance (ANOVA) was used to identify differences among reamed diameters while linear regression was used to identify the relationship between reamed diameters and acetabular strength. We found a moderate correlation between increasing reaming diameter that induced thinning of the acetabular wall and radial load damage. For the simplified acetabular model used in this study, it supported our hypothesis and is a promising first attempt in providing quantitative data for acetabular weakening induced by reaming which can assist orthopaedic surgeons in the future with preoperative planning.

EVALUATION ON BONE SURROGATES OF EPIPHYSIAL RIM CONTACT INFLUENCE ON CONSTRUCT STIFFNESS IN ANTERIOR LUMBAR INTERBODY FUSION

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Anterior lumbar interbody fusions (ALIFs) have increased over the past 2 decades by over 24% annually. ALIF subsidence has an incidence ranging from 6% to 23%. Common risk factors for subsidence include old age, osteoporosis, and higher BMI.

The objective of this study was to quantify ALIF construct strength from positioning of the implant along the epiphyseal rim. We hypothesized that cage positioning along the epiphyseal rim results in increased construct strength and that the subsidence load can be estimated through the measurement of the rim dimensions.

Methods: The L3 and L4 bone surrogates were machined in 40 PCF density for the peripheral shell to represent cortical bone of the epiphyseal ring, and an inner 15 PCF to represent the cancellous central vertebral body. A representative ALIF cage with a footprint of 36x30mm was then placed on the bone surrogates in various positions according to their contact with the epiphyseal rim, and then tested under compression from an Instron 8874. Subsidence load was defined as the peak load measured within the 2mm displacement.

Results: A total of 24 experiments were performed. Cage position significantly correlated to subsidence loads ($p=0.02$). Cages with maximal epiphyseal contact demonstrated significantly higher subsidence loads ($3779N\pm1091$, $p=0.01$) compared to those with partial contact ($2891N\pm608$, $p=0.08$).

Conclusions: Deliberate placement of ALIF cages along the anterior epiphyseal rim decreases subsidence in this biomechanical study. Additionally, an inverse relationship exists between thickness of the epiphyseal rim and cage subsidence.

LISFRANC INJURIES: INTERNAL BRACE VS. SCREW FIXATION, A BIOMECHANICAL STUDY

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INTRODUCTION: Standard operative fixation of LisFranc injuries requires an open reduction with internal fixation by inter-fragmentary screws. Suture button fixation is advantageous because it maintains physiologic motions and eliminates future screw removal. The InternalBrace (IBF) is a suture button alternative designed for augmentation of primary fixation but is sometimes used as a primary treatment. Using IBF as definitive treatment for LisFranc injuries, this study characterizes diastasis against standard screw fixation in a cadaver study.

METHODS: 10 pairs of fresh-frozen feet (male, 43.7y/o), talus to toe, were pinned at 30° plantarflexion. Weight bearing was limited to the first and second metatarsals. An 8-camera Optitrack motion tracking system quantified diastasis between the medial cuneiform and the 2nd metatarsal under weight-bearing (5N, 69N, 138N, and 207N- preload, light weight-bearing, normal walk, and jog, respectively) and abduction (50N) conditions. LisFranc ligaments were sectioned. Diastasis was quantified again at each load bearing state. One specimen from each pair was randomly assigned to receive screw fixation, the contralateral limb IBF. Specimens underwent cyclic loading (10,000 cycles) at 69N, 138N, and 207N with diastasis quantified under loads at 10,000 cycle increments.

RESULTS: Post-treatment diastasis was not significantly different between IBF and screw fixation. Both maintained diastasis similar to the intact state.

DISCUSSION: A non-significant difference in relative diastasis between screw fixation and IBF, coupled with the qualitative advantages that IBF offers over screw fixation, suggests IBF is a viable option for primary fixation of LisFranc injuries.

Session 15: Advances in Biomedical Informatics

ADVANCES IN GENOMIC TECHNOLOGY: OVERVIEW OF NEXTGEN AND SINGLE CELL RNA SEQUENCING STUDIES IN THE CONTEXT OF BIOMEDICAL INFORMATICS

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Recent advances in genomic technology have made significant strides in the field of biomedical informatics particularly with the use of next-generation sequencing (NGS) and single-cell RNA sequencing (scRNA-seq). These technologies have enabled the identification of genetic variations and gene expression patterns that provide detailed mechanistic insights into diseases from large scale genomic datasets in a cell type specific manner. We will discuss the applications of NGS and scRNA-seq in a couple of different areas of research, highlighting computational approaches for the analysis and interpretation of these large-scale genomic datasets. We will also discuss the challenges and limitations of these technologies, as well as potential areas for further development and improvement. For example, in the context of SARS-CoV-2, NGS has allowed for rapid and accurate sequencing of the virus's genome, facilitating the development of effective diagnostic tools and therapies. It has played a critical role in tracking the emergence and spread of new viral variants, their geographic distribution and transmission dynamics within Mississippi. scRNA-seq on the other hand, provides a powerful tool to characterize individual cells within complex Tissues and organs, allowing for the identification of cell type-specific gene expression patterns and the discovery of previously unknown cell types. We present data to depict the heterogeneity of cell types within at least 2 different organs, including kidney and placenta.

RELATIONSHIPS BETWEEN PRIMARY LANGUAGE AND INTERPRETER USE ON LENGTH OF STAY AT A HOSPITAL SYSTEM IN THE DEEP SOUTH

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Objective: To evaluate the associations between primary language and interpreter use on length of stay (LOS) at a large university medical system in Alabama.

Methods: We conducted a retrospective cohort study of all patient encounters from February 1, 2021 and February 15, 2023. We evaluated the relationship between self-reported primary language and LOS. We also examined the use of interpreters during the encounter, the mode of service and how long after admission these services were provided.

Results: Of the 14,611 patient encounters, 49.04% reported primary language as Spanish, and while English as a primary language was reported in only 22.49% of encounters. About 9% of the encounters were emergent or urgent, 10% were inpatient encounters, and 81% were outpatient encounters. Controlling for service location, insurance type and age, primary language was not significantly associated with LOS. The use of an interpreter was associated with shorter LOS (p<0.0001). Moreover, time until interpretation services after admission had a positive association with LOS (p<0.0001). The mode of interpretation showed variation in its impact, with interpreters through remote video services being associated with longer LOS compared to in-person interpreters (p=0.003).

Conclusions: In this large medical system, patients are more likely to report their primary language as one other than English. Because of this, it is vital to address communication barriers that may lead to longer LOS. Utilization of interpretation services, and using them soon after admission, can reduce LOS and have positive impacts on in facilitating communication and expediting patient care.

MACHINE LEARNING-BASED FEATURE EXTRACTION FOR POLYSOMNOGRAPHY SIGNALS

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Recently, there has been a substantial amount of machine learning-based sleep research. Time and frequency have been commonly considered for sleep stage classification and prediction. This study utilized sensor data from various bioelectrical devices that output polysomnography (PSG) records. These time series datasets contain various human body signals, including electroencephalogram (EEG), electrooculogram (EOG), electromyography (EMG), and electrocardiogram (ECG) signals. These signals are multichannel and utilize various modulation schemes. Welch Power Spectral Density (PSD) techniques were used to classify the recommended sleep stages: Rapid Eye Movement and Non-Rapid Eye Movement. The objective is to analyze the patterns in the EEG waveform frequency, which is performed in six frequency bands: Delta ($\boldsymbol{\delta}$), Theta ($\boldsymbol{\theta}$), Alpha ($\propto$), Beta ($\boldsymbol{\beta}$), Sigma (Σ), and Gamma ($\boldsymbol{\gamma}$). Changes in model performance were determined by analyzing the model's accuracy, sensitivity, precision, and F1 Score following each frequency band modification. The modification was discovered to affect model performance.

ASSESSING AND REPRIORITIZING PANCREATIC CANCER DRUG TARGETS

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Background: Target identification and prioritization methods are well-established in cancer treatment. Gene prioritization is commonly used to create shortlists of relevant genes, and is a commonly used method in finding and prioritizing drug targets in pancreatic cancer. However, current gene prioritization methods are not comprehensive enough in their assessments, leading to many overlooked drug targets.

Methods: We performed modern gene prioritization techniques, compiling an initial gene list using CbioPortal, PAGER, and COSMIC. The BEERE software was used to rank the initial gene list, creating a short list of the most relevant genes. We then used functional, frequency, and network-based criteria, such as mutation frequency, RNA expression differences, clinical trial significance, and pathways affected by the gene to rank each gene on the list. In addition, we used PAGER to identify linked pathways and metastasized genes not included in the prioritized gene list, prioritizing them based on similarity analysis.

Conclusion: The effectiveness of our developed method in identifying and prioritizing targets for pancreatic cancer was demonstrated. The top-ranking pathway consisted of protein-protein interactors of the gene PAK6, which is heavily under researched in the context of pancreatic cancer. Therefore, we recommend using this prioritization technique to rank pathways and genes to research which have been previously overlooked and underreported in the context of cancer.

IDENTIFICATION OF GENE SIGNATURES AS A PREDICTIVE TOOL

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Introduction. gene expression signatures are developed to be used in numerous ways including disease prognosis or guidance for clinical treatment decisions. The present study sought to identify gene signatures in the mouse lungs associated with lung pathological responses. The gene signatures were guided by previously identified genes in human lung cancer samples.

Materials and Methods. Mice (C57BL/6J males) were instilled with multi-walled carbon nanotubes and after 7 and 56 d post instillation, the lungs were collected and used for microarrays analysis. Real-time qPCR was performed using TaqMan microfluidic low density arrays (LDA) with custom designed genes on an ABI 7900HT Fast RT-PCR instrument (Applied Biosystems). Gene expression analysis was done using SDS2.3 software (Applied Biosystems) based on the number of cycles required to reach threshold fluorescence (*Ct*). 18S was used as an endogenous control gene. **Results.** Two sets of gene signatures were identified at 7 and 56d in the mouse lungs exposed to multi-

walled carbon nanotubes vs control. At 7d a signature of 7-genes whereas at 56d a signature of 11-genes were identified. Additionally, 4 genes from these two sets of significant genes, coiled-coil domain containing-99 (Ccdc99), muscle segment homeobox gene-2 (Msx2), nitric oxide synthase-2 (Nos2), and wingless-type inhibitory factor-1 (Wif1) showed significant mRNA expression perturbations at both time points. Using Ingenuity Pathway Analysis (IPA) several carcinogenic-related and carcinogenesis signaling pathways correlated with both the 7- and 11- gene signatures. **In conclusion**, this study suggests that gene signatures from a mouse-model of lung pathology may provide biomarkers associated with human lung cancer.

Session 16: Computer assisted surgery training

ADVANCED MANUFACTURING TECHNIQUES

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Objective: Fabricating a patient-specific cerebrovascular endovascular simulator using three-dimensional printing (3DP).

Background: Patient-specific simulation based on 3DP models are being used more frequently in clinical training and hold promise in procedural simulation. This study aimed to develop a fabrication approach for a patient-specific endovascular simulator for cerebrovascular disease.

Methods: Digital Imaging and Communications in Medicine (DICOM) files were obtained from the Ochsner Radiology Department and segmented to create Stereolithography (STL) files of intracranial vascular anatomy. A STL file 3DP using Acrylonitrile Butadiene Styrene (ABS) with polyvinyl alcohol (PVA) supports on an Ultimaker S5 printer. The print was rotated while it was coated with multiple layers of silicone. The ABS was later dissolved, leaving a hollow silicone vascular model, which was then connected to the simulator platform. The platform used an Arduino-controlled peristaltic pump to propel fluid through the circuit composed of silicone tubes, 3DP vasculature, and a port for catheter access.

Results: Development for the simulator required 30 hours of bioengineering design effort and $113 in materials. Creating the 3DP required 3.5 hours of digital processing, 1 hour of manual post-processing, and $2.50 of material. This proof of-concept study established the feasibility of constructing a low-cost patient-specific endovascular simulation platform with fluid flow.

Future Direction: Future iterations of patient-specific endovascular simulators will more accurately replicate *in vivo* procedural experiences by incorporating additional anatomical structures, biomimetic materials, and physiological fluid flow. Future studies will investigate the authenticity, effectiveness, and scalability of 3DP-based patient-specific simulation endovascular procedural training.

ROBOT-ASSISTED THYMECTOMY IN JUVENILE MYASTHENIA GRAVIS

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Purpose: Juvenile myasthenia gravis (JMG) is an autoimmune neuromuscular disorder characterized by exertional muscular weakness alleviated by rest. The treatment paradigm has shifted toward early thymectomy to improve neurological outcomes and decrease medication needs. This study aims to quantify the variation in neurological function that results from robot-assisted thymectomy. We hypothesized that the robot assisted procedure results in improved outcomes.

Methods: Following IRB approval, chart review was performed on pediatric patients (ages 4-18) who had a robot-assisted thymectomy by a single surgeon. Data were assessed for demographics, operative time, length of hospital stay, postoperative complications, preoperative versus postoperative medication use, and preoperative versus postoperative neurological function as determined by the MGFA classification score.

Results: Of all the patients, within the selection criteria used, nine were included in the study. Intraoperative complications were not noted and the operative time was of 153±9 min. The average length of stay was 1.7±0.4 days while the surgery improved the MGFA score from 2.4±0.4 preoperative to 1.4±0.3 postoperative ($p = 0.008$).

DESIGN AND FABRICATION OF A LOW-COST, ANATOMICALLY ACCURATE 3D PRINTED KIDNEY TRANSPLANT ANASTOMOSIS SIMULATOR

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Background: Kidney transplant vascular anastomosis time and quality are critical to the outcomes of renal transplantation. Surgical simulation has previously demonstrated benefits with kidney transplant anastomosis performance in trainees. Previous simulators have been split between low-fidelity low-cost models requiring significant crafting time to recreate, or high-fidelity, high-cost models requiring industrial grade manufacturing which are inaccessible to surgical trainees. Consumer grade 3d printers are now widely accessible and affordable. We designed and fabricated a low-cost, modular kidney transplant simulator with biomimetic features which can be reproduced on a consumer grade 3d printer.

Method: Using a de-identified CT scan, we segmented the iliac fossa to create stereolithography (STL) files. Using fusion360 we modeled an anatomically accurate 3d printable simulator for kidney transplant vascular anastomosis. Multiple models were printed in PLA on various consumer grade printers and assembled with basic office supplies. Surgical trainees were taught to perform the vascular anastomosis.

Results: Each simulator cost ~$30 to print and can be assembled in 10 minutes. Various materials were used to simulate the vasculature including Penrose drains, latex balloons and cadaveric vessels. Modular design allows for variation of the surgical field. The simulator is intuitive to setup and trainees were able to quickly reset without instruction.

Conclusion: We designed and fabricated a 3d printed kidney transplant anastomosis simulator that was successfully used by medical students and general surgery residents. It is an affordable,

accessible, and easily reproducible teaching tool. We plan to assess the simulator's impact on vascular anastomosis skill acquisition in surgical trainees.

EVALUATING THE EFFECTIVENESS OF VIDEO GAME-BASED TRAINING PLATFORM SUPPORTING EMG CONTROLLED HANDS-FREE WHEELCHAIR NAVIGATION

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Amyotrophic Lateral Sclerosis (ALS) is a debilitating neurodegenerative disorder denoted by diffuse muscle weakness and associated speech and swallowing difficulties[4]. The degeneration of motor neurons in ALS patients leads to muscle weakness and eventually total loss of voluntary motor control and independent mobility [5]. The factors have been shown to negatively impact mood and psychosocial functioning, as well as overall quality of life[1,2]. One proposed solution utilizes surface electromyography (EMG) located on the facial muscles to provide independent control of a powered wheelchair[4]. To provide users with training in a low stress, virtual environment, a serious training game that incorporates identical EMG controlled movements was developed [6]. The system integrates eye tracking technology for menu control and calibration [6].

To evaluate the novel training environment, a qualitative talk aloud study was designed for able bodied participants aged 18-64. While engaged with *Limbitless Journey*, participants provided feedback to evaluate the usability of the system. All participants played through four levels of Limbitless Journey with EMG leads placed on their preferred temporalis muscle. Participants were split into 3 cohorts to evaluate varying modalities of calibration and menu selection: mouse control by the participant, mouse control by a researcher, and eye tracking. Quantitative surveys were then completed including the Game User Experience Satisfaction Scale (GUESS) and the System Usability Scale (SUS). These surveys, as well as transcribed recordings, will be analyzed to provide data for improving user satisfaction, optimizing human-machine interfaces, and evaluating the effectiveness of early training.

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STANDARDIZATION OF HOW BONE SCREW CORRIDORS ARE EVALUATED: AN EXAMPLE ON PELVIC SCREWS

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Introduction: In orthopaedic surgery, intraosseous screw insertion trajectories are described in multiple ways without use of conventions. Some authors, describe safe screw insertions trough minimal and maximal values for transverse and sagittal inclinations in relation to the anatomical planes. Very often, screw safe trajectories are indicated as the direction of the largest cylinder that could host the screw within a considered bone corridor. Some other author, instead, indicated to the surgeons the dimensions of the smallest bone section along the screw path and its depth. More importantly, in bone screw placement, for manual or most of the navigated surgical approaches, insertion angular error is not direction dependent. Given the heterogeneity in description of bone corridors and the need to compare different insertions sites in terms of safe angular ranges we aim to introduce a novel metric that measures amplitude of the safe bone corridors without reference to a cartesian coordinate system neither using linear length measures. We applied this novel metric to compare the safe corridors of two locations used for the fixation of the pelvis. We hypothesized that this metric could further highlight differences among screw insertion sites.

Methods: In the anatomical reference planes, the safe insertion range of a given screw, can be indicated for any plane π_i rotated in the sagittal plane (π_S) at angle α_i with respect to the transverse plane (π_t), with the angles β_i and a γ_i delimiting initial and final transverse screw inclinations for which the screw can safely inserted at that sagittal inclination (see Figure 1). The transverse safe range identified for the plane π_i is therefore identified by the difference between these two angles $\delta_i = \gamma_i - \beta_i$ and it is zero for planes in which a given screw is not feasible $\gamma_j = \beta_j \rightarrow \delta_j = 0$. The novel metric here proposed is indicated as Safe Angular Region (SAR) and is calculated as the area between the profiles traced by β_i and γ_i for $\alpha_i = [-\pi/2, \pi/2]$ as shown in the graph with abscissa and ordinate respectively indicating transverse and sagittal screw inclinations (see Figure 2). From data acquired on CT scans of human pelvises, using a previously developed protocol, we extracted the relationships γj and βi for the insertion points in the supracetabular and subcristal locations at sagittal inclinations spaced of 5 deg. We calculated the SARs values and compared them to the safe insertion ranges expressed in cartesian coordinates.

Results: A total of 56 pelvises were used for the purpose of this study. Considering an intraosseous screw length of 60mm, the 3d CT analysis revealed, sagittal ranges of 57.6°±6.71 and

46.9°±22.3 respectively for the supracetabular and subcristal locations (p>0.05). While differences were noted for the transverse ranges measured to be 17.53°±3.62, and 9.97°±2.47 respectively for supracetabular and subcristal (p<0.05). The supraacetabular location had a SAR of 1008.04°2±214.15 that was higher than the SAR of 449.00°2±231.93 found for the subcristal (p<0.05, see Figure 3).

Discussion: For the two entry points considered for pelvic fixation we have found a superiority of the acetabulum in the sagittal range that is not found in the transverse ranges. The discrepancy between the two directions creates uncertain in the selection of the entry point. The adoption of the SAR allowed to uniquely identify the supracetabular location as location with greater discretion in pin-screw insertions. The use of this novel metric allows easy comparison between entry points. Its use is limited by the fact that to be calculated, safe screw ranges must be measured in both planes. While the authors have previously developed algorithms for the automatic evaluation of screw insertion ranges in sagittal and transverse directions, most of the studies use data manually extracted from CT scans. The metric can be particularly useful for comparison between entry points that require different screws orientations.

Significance/Clinical Relevance: In conclusion, the proposed metric is a novel approach to standardize comparisons among bone corridors. Considering the developments of surgical navigation technologies, CT based surgical planning, and more recently surgical training in virtual reality environments. The proposed metric can be used to compare alternative insertion points and easy describe challenging instrumentations.

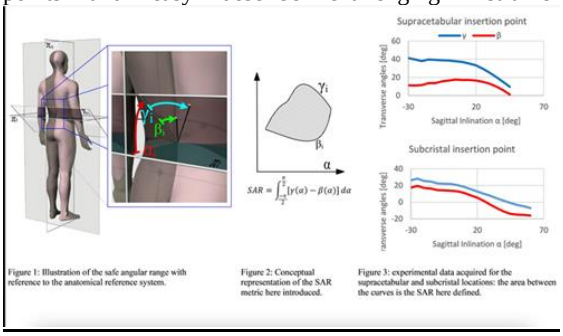

Figure 1: Illustration of the safe angular range with reference to the anatomical reference system.

Figure 2: Conceptual representation of the SAR metric here introduced.

Figure 3: experimental data acquired for the supracetabular and subcristal locations: the area between the curves is the SAR here defined.

PILOT STUDY ASSESSING THE FEASIBILITY AND UTILITY OF A 3D PRINTED BIOMIMETIC TEMPORAL BONE MODEL FOR MASTOIDECTOMY SIMULATION

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Objectives: To establish feasibility of 3D printing a patient-specific temporal bone and to evaluate its utility in mastoidectomy training in otolaryngology trainees

Methods: Eight temporal bone models were 3D-printed from patients' computed tomography (CT) scans with acrylonitrile butadiene styrene plastic filament (ABS), polylactic acid filament (PLA), high impact polystyrene (HIPS), and Formlabs white resin. Eight otolaryngology residents performed a mastoidectomy on the models and completed a Likert scale questionnaire, with a score of "1" meaning the models are unlike cadaveric bones and "5" meaning they are identical.

Results: The mean (*M)* rating for overall value of drilling the 3D printed bones was 2.94. The 3D printed models were highly rated for their ease of use (*M*=4.31) and their safety (*M*=4.19). The bones were rated as "similar" to cadaver bone for their value in surgical experience (*M*=3.25); however, the bones were rated as less "similar" in their bony anatomy compared to cadaver bones (*M*=2.63). Junior residents had statistically higher average ratings for the 3D printed temporal bone models than senior residents (p=0.03). The total cost of the raw materials for all eight models was $36.48.

Conclusions: The 3D printed temporal bones were rated poorly for their bony anatomy and overall value in surgical training; however, junior residents found the models more practical in surgical training compared to senior residents. Our future study will continue our investigation into low-cost biomimetic fabrication approaches that replicate an authentic and useful temporal bone drilling experience for all training levels.

Session 17: Cell Mechanics and Disease

NONSTANDARD MODELS FOR DISEASE DIAGNOSTICS

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Use of disease models are a vital aspect of drug development. This holds true for testing efficacy of new antimicrobials in the treatment of infectious diseases. There are numerous animal models for testing infectious disease and effectiveness of treatment. While mouse models of infection have provided great insight into infections and treatment, maintenance and cost can be prohibitive for drug screening. To overcome these limitations, new models for testing drug effectiveness for infectious disease have been developed. Cell culture systems offer a cost-effective and easy-to-manipulate alternative to animal models, allowing for high-throughput screening of potential therapies. Zebrafish have also emerged as a valuable model organism for studying infectious diseases due to their transparent embryos and well-characterized immune system. Additionally, *Galleria mellonella* (waxworm) larvae have been used as a model system for studying bacterial infections, as they are inexpensive and can be easily maintained. Here we describe the use of these models in studying infectious disease and treatment with an emphasis on use of the waxworm model. We demonstrate that the waxworm model can be used to identify novel virulence genes and as a model for testing effectiveness of antimicrobials. While traditional animal models have provided valuable insights into infectious disease and treatment, alternative models offer a range of benefits, including cost-effectiveness and ethical considerations. The continued development of these new models is essential for advancing our understanding of infectious diseases and accelerating the discovery of new therapies.

CELLULAR MECHANIC IN POST TRAUMA-INJURY INDUCED COMPLICATIONS

Sara B. Robertson[1,2], Benita Williams[3], John DePaula[4], Gregory Timberlake[1,3] D. O. McDaniel[1,3]

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An assessment of applying transcript level of genes with influential variability and differential expression analysis are powerful tools for determination of biomarkers during post trauma injury complications. Many traumatically injured patients have demonstrated varying degrees of systemic inflammatory response syndrome (SIRS), leading to clinical complications such as sepsis. Clinical characteristics associated with sepsis in combination with molecular markers are study tools to derive informative gene subsets for early determination of disease. Sepsis is a life-threatening response of the immune system to trauma induced complications which can potentially lead to tissue damage, organ failure, and death. Numerous risk factors in the context of inflammatory parameters such as cytokines and Toll-like receptor genes contribute to an early inflammatory response to the pathogen or damage associated molecular patterns (DAMPs) associated with trauma injury. A panel of candidate risk factors associated with the innate immune response genes were evaluated using blood from trauma patients within the first 72 hours upon the admission to SICU. Leukocytes including monocytes/macrophages and neutrophils for mRNA transcript analysis of cytokines, and the TLR-signaling pathway genes (GEARAY protocol) were tested. The expression was confirmed by quantitative PCR and plasma specimen from patients by ELISA. The study confirms an early upregulation of the innate immune response through monocytes/macrophages, extends to neutrophil functional dynamics. TLR-2 and TLR-4 transcripts were significantly increased comparing day 1 vs. day 3 in patients who later developed sepsis. The IRAK-1, a major mediator of the TLR-signaling pathway was reversibility increased (2.0- fold) in patients with sepsis vs. no sepsis. TOLIP gene, a Toll-like receptor inhibitory protein, also known as Cox-2 gene was increased 4-fold in patients with no sepsis. The CD86 an HLA-Class II receptor molecule on monocytes and macrophages significantly increased in patients who later developed sepsis. Conclusions: Trauma causes changes in macrophage/monocyte activations. The data support correlation between TLR-2 and TLR-4 signaling molecules with the expression of pro-inflammatory cytokines in trauma induced sepsis. The performance of gene selection model is likely to be improved by extending to a broader dataset.

HIGH RISK HEAD AND NECK CANCER EVALUATION WITH ARTIFICIAL INTELLIGENCE

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Background: Diagnosis and treatment management for head and neck squamous cell carcinoma (HNSCC) is guided by routine diagnostic head and neck computed tomography (CT) scans to identify tumor and lymph node features. The extracapsular extension (ECE) is a strong predictor of patients' survival outcomes with HNSCC. It is essential to detect the occurrence of ECE as it changes staging and management for the patients. Current clinical ECE detection relies on visual identification and pathologic confirmation conducted by radiologists. However, manual annotation of lymph node regions is a required data preprocessing step in most of the current machine learning-based diagnosis studies. An automated ECE detection algorithm is presented in this study.

Purpose: In this paper, we propose a Gradient Mapping Guided Explainable Network (GMGENet) framework to perform ECE identification automatically without requiring annotated lymph node region information.

Methods: The gradient-weighted class activation mapping (Grad-CAM) technique is proposed to guide the deep learning algorithm to focus on the regions that are highly related to ECE. The proposed framework includes an extractor and a classifier. In the joint training process, informative volumes of interest (VOIs) are extracted by the extractor without labeled lymph node region information, and the classifier learns the pattern to classify the extracted VOIs into ECE positive and negative.

Results: In evaluation, the proposed methods are well-trained and tested using cross-validation. GMGENet achieved test accuracy and AUC of 92.2% and 89.3%, respectively. GMGENetV2 achieved 90.3% accuracy and 91.7% AUC in the test. The results were compared with different existing models and further confirmed and explained by generating ECE probability heatmaps via the Grad-CAM technique. The presence or absence of ECE has been analyzed and correlated with ground truth histopathological findings.

Conclusions: The proposed deep network could learn meaningful patterns to identify ECE without providing lymph node contour. The introduced ECE heatmaps will contribute to the clinical implementation of the proposed model and reveal the unknown features to radiologists. The outcome of this study is expected to promote the implementation of explainable artificial intelligence-assist ECE detection.

MICROBIAL MODELS OF TRAUMA INDUCED INFECTION

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Inflammation insult of the human immune response after traumatic injury introduces various microbial organisms to the immune system which in some patients leads to in-hospital death. There has been a rapid increase of sepsis due to multidrug resistant organisms (MDROs). Trauma patients who survive an initial injury can develop infections with MDROs. Comorbidities, previous infections, lack of intestinal barriers, impaired immune defenses predispose trauma patients to sepsis. Damage control procedures for trauma patients may lack antiseptic measures. This can expose the patient to many different microbes. Trauma can suppress humoral and cell-mediated immune responses. Following major trauma, lymphocyte function can be depressed, neutrophil chemotaxis decreased, monocyte antigen presenting capacity impaired, and complement activity impacted. Thus, trauma patients have to be closely monitored to diagnose early

infection which can lead to sepsis. There is a trimodal distribution in trauma death. There can be immediate death from injury, early death from complications from injuries, or late death from microbial infections and sepsis. Prompt and appropriate treatment save lives reducing trauma mortality. In addition to sepsis, pneumonia is a common cause of infections in trauma patients. Injuries to the chest and neck significantly increase the risk of pneumonia because of changes in respiratory mechanisms. Prolonged use of mechanical ventilators can lead to hospital-acquired pneumonias. Bacteria such as *Pseudomonas aeruginosa*, coagulase-negative staphylococci, and Enterococcus can be difficult to treat in trauma patients due to increasing resistance to antimicrobial therapy. Unfortunately, infection after trauma can have a poor prognosis.

MEDICAL TECHNOLOGY IN DIABETES CARE

Shumei Meng

Baylor University Medical Center

The WHO estimated about 422 million people worldwide currently have diabetes. The prevalence of diabetes has been steadily increasing despite the fact that general technology has advanced over the past 40 years. Less physical activity has been blamed as one of the causes that has contributed to the epidemic rising of obesity and diabetes over the past several decades. While general technology might adversely decrease people's physical activity, medical technology surely has provided new means of diabetes care in an unimaginable way. This review will discuss the historical development of medical technology in diabetes care, the current most commonly used diabetic devices and their features and the future direction of medical technology in diabetes care. This review will specifically focus on the glucose monitoring and insulin pump systems. This knowledge will not only significantly increase the awareness of the availability of those technologies but also greatly enhance the full utilization of medical technology in diabetic care and other medical field. Furthermore, it will inspire more research scientists, medical doctors and industrial companies to develop more advanced and practical medical technology, which will boost medical care and thus prolong people's life span and enhance their quality of life.

WNK SIGNALING IN THE ALDO-SENSITIVE DISTAL TUBULE: WHOLE BODY PHYSIOLOGICAL SIMULATION

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University of Mississippi Medical Center, Jackson, MS

Intracellular signaling motifs determine the response of cells to external conditions. In the aldosterone sensitive distal tubule (ASDN), these motifs are fundamental for determining the expression and activity of transporters that affect serum sodium, potassium, and chloride. In recent years, WNK (with-no-lysine) kinases have been shown to be powerful regulators of sodium and potassium transport, coordinating proteins in the sodium chloride cotransporter and inwardly rectified potassium channel families. Identified by genomic investigation of familial hyperkalemic hypertension (FHHT), early studies in transfected oocytes and isolated distal tubule cell lines had contradictory conclusions that are still not resolved. Moreover, while Berk's hypothesis potentially explains how hyperkalemia induces changes in intracellular chloride to drive the ASDN into potassium secretion mode, it remains unproven.

In this study, we built a model of WNK signaling in the ASDN using simulations of isolated cells in controlled media to replicate experimental studies. The tuned cells were then implemented in HumMod, an integrative model of human physiology, to recapitulate the phenotype of FHHT and to test the effect of potassium intake on ASDN sodium, chloride, and potassium transport. The model determined that hyperkalemia was a sufficient signal to induce increased apical expression of sodium chloride transporters through WNK4 and WNK1 dependent processes, confirming Berk's hypothesis. Implementation of intracellular WNK kinase signaling models in the thick ascending limb and connecting tubule are necessary for full realization of FHHT.

SUNDAY

Session 18: Nanomedicine/Drug Delivery

BIOGENIC MODIFICATION OF FUNCTIONAL PROPERTIES OF MOUSE MACROPHAGE-DERIVED EXTRACELLULAR VESICLES BY BACTERIAL VESICLES TO ENHANCE CANCER TARGETING

Israel Joshua Santhosh, Ayan Khan, Shoukath Sulthana, Farah Deba, Santosh Aryal

Department of Pharmaceutical Sciences and Health Outcomes, The University of Texas at Tyler, Tyler, TX

In this project, we studied the interaction of extracellular vesicles (EVs) derived from highly abundant and well-studied Escherichia coli (E. coli, DH5α) with mouse macrophage (J774.1A) to illustrate a realistic scenario of activated macrophage acquiring bacterial properties that could synergistically act to target and arrest cancer. In these endeavors, EVs were collected from the activated J774.1A and labeled with fluorescent dye to track its targeting properties to mouse breast cancer (4T1) and routinely compared with mouse fibroblast (NIH-3T3) cells. The resultant EVs from the macrophages were characterized using multi-angle dynamic light scattering for their colloidal properties such as size and surface charge, which are essential for cellular internalization. The hydrodynamic size of EVs derived from macrophages and activated macrophages ranges from 60 to 130 nm. More interestingly, the concentration of EVs derived from activated macrophages was higher than that of macrophages at normal conditions. This higher concentration of EVs was further confirmed by the production of a significantly higher concentration of CD-63, a molecular marker for EVs. Triggered inflammatory responses were observed with elevated production of IL-6, IL-2, and TNF-α. Finally, cellular internalization was studied using flow cytometry and found a differential uptake behavior with cancer and noncancerous cells. Considering the rapidly growing use of NPs delivery systems, this bioengineering protocol would hold promise in developing efficient anticancer nanomedicines.

HIGH-THROUGHPUT *IN VIVO* SCREENING OF NON-VIRAL GENE DELIVERY VECTORS FOR BIODISTRIBUTION AND TRANSFECTION

Jayoung Kim, Ph.D.

University of North Texas Health Science Center, Fort Worth. TX
Presentation Type: Invited Talk

Gene therapy utilizes transgene intervention to potentially cure monogenic diseases. The therapeutic nucleic acid is complexed

with a delivery vector to maximize its therapeutic efficacy and minimize toxicity. A library of new material compositions and their structural derivatives are continuously being developed as non-viral vectors. Top-down approach requires them to be individually screened *in vivo*, often by labeled fluorescence, to identify an optimal, tissue-targeted delivery vector. However, this low-throughput process not only exhausts through a vast amount of resources, animals, time, cost, and effort, but more critically introduces biological differences between animals as a confounding factor. Hence, an enabling technology that facilitates an accurate and efficient high-throughput method to assess targeted biodistribution of multiple vectors simultaneously in a single animal would provide a significant advancement in the biomedical research towards effective gene therapy. I will present a work on the development of DNA barcodes a novel high-throughput, *in vivo* screening tool for polymeric gene delivery vectors with the objective of 1) minimizing any potential effect on the NP or its pharmacokinetics and 2) detecting both biodistribution and transfection. Each DNA barcode is a unique oligonucleotide sequence that can be incorporated into an NP formulation to serve as its identifier and be quantified through polymerase chain reaction. The presentation will end with a brief description on the future research direction of personalized drug delivery vehicle that can be facilitated with the high-throughput *in vivo* screening method

INSIGHTS INTO THE UPTAKE KINETIC AND MRNA EXPRESSION OF MRNA LIPID NANOPARTICLES DELIVERY TO VARIOUS CELLS

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[1]Department of Nanomedicine, Houston Methodist Research Institute, and [2]Center for RNA Therapeutics, Houston Methodist Research Institute

(Invited-Presentation)

The COVID-19 pandemics has demonstrated the clinical importance of mRNA as current vaccines and future therapeutics. The administration of mRNA requires lipid nanoparticles (LNP) to protect the cargo from degradation and overcome biological barriers. The mRNA molecules have a strong negative charge and to be efficiently encapsulated, the carrier should contain positively charged lipids. These can be either ionizable at certain pH or constantly cationic. There is very limited information on their specificity in terms of mRNA delivery and protein expression in various cell populations. The objective of this study was to evaluate the kinetics of LNP cellular uptake and mRNA expression in cells from different origins, while understanding the mechanisms involved in the behaviors of LNP formulated with cationic and ionizable lipids. For this purpose, cationic and ionizable LNP were formulated and tested in human fibroblasts, endothelial cells, primary keratinocytes, breast and colon cancer cells, as well as skin cell suspension derived from human skin donors. We found differential LNP uptake and mRNA expression kinetics between various cells. While LNP with cationic lipids performed significantly better in terms of uptake and mRNA expression in endothelial cells, keratinocytes and fibroblasts as well as in cell suspension extracted from human skin, ionizable LNP demonstrated better performance in breast and colon cancer cells. Furthermore, our data show that there are differences in mechanisms that govern the uptake of mRNA LNP. The finding of this work are important in understainding the design parameters of various mRNA LNP systems for tailoring potential clinical applications.

ROLE OF TUMOR-DERIVED EXOSOMES IN TUMOR TARGETING

*Shoukath Sulthana, Dinesh Shrestha, and Santosh Aryal**

Fisch College of Pharmacy, The University of Texas at Tyler, Tyler, TX

The tumor microenvironment (TME) is rich in exosomes which play a vital role in the development and spread of cancer because it facilitates the growth, angiogenesis, and distant metastasis of tumor cells. Exosomes are extremely tiny extracellular vesicles that are widely distributed in a variety of bodily fluids and are released by numerous cell types. Owing to their role in cancer, exosomes have come to attention in the search for a new cancer therapy strategy to minimize off-target effects as they are naturally designed to localize at their respective targets. Herein, we reviewed the role of exosomes in drug delivery applications with the specific example of tumor-derived exosomes in targeting cancer in vivo. We highlighted properties such as differential targeting, tissue distribution, and cancer imaging. In our study, exosomes were isolated from 4T1 mouse breast cancer cells and re-engineered with synthetic liposomes. Thus, engineered exosomes are found to be monodispersed with a hydrodynamic size of 130±5 nm and a zeta potential of -50±5 as characterized by using multi-angle dynamic light scattering. These engineered exosomes were rapidly taken up by cancer cells thereby confirming their targeting properties, which we have exploited to maximize tumor delivery in this study. As expected, we observed that a large number of engineered exosomes are taken up by tumors when compared to that of a synthetic liposome. We anticipate that this study can picture future opportunities for drug delivery solutions that are superior in target recognition.

DEVELOPMENT OF BIODEGRADABLE *IN SITU* IMPLANT AND MICROPARTICLE INJECTABLE FORMULATIONS FOR SUSTAINED DELIVERY OF CURCUMIN

Sohel. H. Quazi

Texas College, Tyler, TX

The Objective of this study is to develop injectable sustained release biodegradable polymeric *in situ* implant (ISI) and *in situ* microparticle (ISM) injectable formulations of curcumin, a natural polyphenol exhibiting anticancer, antineoplastic, anti-inflammatory, and antioxidant activities. The low water solubility and poor oral bioavailability of curcumin hinder its clinical trial.

The ISI formulations of curcumin (10%, w/w) were prepared by homogeneous mixing of poly (lactide-co-glycolide) (PLGA, 50:50, intrinsic viscosity 0.3 and 0.4 dL/g, 20-30% w/w), Pluronic F127 (2.5%, w/w), and N-methyl pyrrolidone as a solvent. *In vitro* release of the prepared formulations was performed in phosphate buffer saline (PBS, pH 7.4) with Tween 80 (0.5-1.0%, w/v) at 37ºC. The amount of drug released from the implant formed in the release media was analyzed by using UV spectroscopy at 423 nm. The stability of a selected ISI formulation was performed at different temperatures.

The concentration of the polymer (PLGA) in the ISI formulation and surfactant in PBS has great influence on *in vitro* drug release from the implants. The percentages of *in vitro* drug release in PBS

with 0.5% Tween 80 after 24hr at 20% and 30% PLGA 4A formulations were found to be 26.52 % and 13.25%, respectively, while at 20% and 30% PLGA 3A formulations, the drug release was 24.07% and 15.84% respectively. The drug release observed on day 28 was 34.61% and 22.56% for 20% and 30% PLGA 4A formulations, respectively, while on day 28, at 20% and 30% PLGA 3A formulations, the drug release was 34% and 24.1% respectively. 20% PLGA (3A or 4A) containing formulations are suitable for injecting either intramuscularly or subcutaneously as their viscosity is considerably low and the drug release is sustained. Based on stability data at 4ºC, curcumin is stable in formulation for more than a year. Curcumin can be used in a sustained release ISI formulation.

Session 19: Bioethics

NAVIGATING ETHICAL CONCERNS IN THE FUTURE OF PROSTHESIS DEVICE DEVELOPMENT AND TRAINING

Viviana Rivera, Samantha Migliore, Courtney Williams, John Sparkman, Matt Dombrowski, Peter Smith, Albert Manero

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As both rehabilitative and augmentative medical devices[1] become more readily available, a variety of ethical considerations are of important discussion. Recent advances in biomedical engineering have produced innovations including custom bionic limbs[2], ocular restoration devices[3], and prototype organs[4] specialized for the recipient. While access to the devices will most certainly grow, questions regarding the right to repair, software updates and maintenance lifecycles, and patients' rights and expectations abound.

This research team is focused on advancing electromyographic actuated prosthetic limbs [2], with video game training software that augments device training. Considerations for predicted device downtime due to maintenance or updating and software availability are critical for discussion for the future implementation as the technology projects to transcend the research domain to the commercially accessible. While all medical devices need to be maintained and repaired in a timely manner, software is often distributed by third party platforms using publicly available digital store fronts. There is a need to maintain quality standards both for patient care and patient data, but also for the accessible software repositories. Rules for commercial distribution need to be followed, while at the same time privacy and patient data privacy must be observed.

A comparison of the right to repair authority and controversy from industries including: electronics, software, farming equipment, and medical devices will be discussed. Guidelines for device manufacturers and practitioners for communicating transparently with patients regarding use cases, lifecycle, repair, and upgradability will be proposed.

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NANOTECHNOLOGY, 3D PRINTING AND SKIN: AN ETHICAL AND ANTICIPATORY ETHICAL ANALYSIS

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Human skin is the largest organ covering the entire human body with a surface area of approximately 1.522 M squared with a weight of 3 to 10 kilograms. Due to it's position and structure on the human body, human skin represents a barrier between an individual's body and the external environment. The skin protects the inside of a person's body which, as a result, protects a person from environmental harm including protection from chemicals, mechanical and thermal injuries, as well as from radiation and pathogens.

The skin serves a protective function against external influences and helps maintain temperature and provide a water balance homeostasis helping the body avoid problems such as dehydration and hypothermia. As the result of large burns, the barrier function of the skin is destroyed and when this is combined with liquid and protein loss, burns may lead to two life-threatening conditions. The traditional method used in treating burns involves removing the damaged tissue and replacing it with healthy skin from another part of the body. However, this method also known as "graft," isn't a viable option when it comes to severe burns that affect the inner tissues of the body. The new possibility of employing 3D printing used in conjunction with bioengineered artificial skin, would potentially eliminate the need for grafts altogether, by depositing strips of a special bioink on burns. The bioink would contain living cells and as a result would assist healing proteins that would support the body's immune system and encourage new cell growth. As a result, patients could recover from what were previously life-threatening injuries.

To develop an artificial skin would require moving from harvesting cells from patients, to isolating these cells, while maintaining their biological properties, and then getting all of these components to grow to a large number of cells and cell density to make up the new components of an artificial skin. What would be needed for this to occur would be 3D printing of skin, keeping the graft alive, making sure it is sterile, while eventually suturing it on the wound of a patient.

This analysis will focus on the challenges and ethical issues related to nanotechnology and the creation and 3D bioprinting of skin. In addition, an anticipatory ethical analysis will focus on anticipated problems with the development needed to engage in 3D bioprinting of skin. Practical ethicists attempt to identify and address social and ethical issues that arise in the world around us. It is an assumption in practical ethics that knowing what to do and knowing how to act requires that we understand general ethical principles. When practical ethicists attempt to identify ethical problems that may develop in the future, these problems are often identified based upon these general ethical principles. When

professional and practical ethics, in any area of professional existence, attempt to identify ethical problems before they arise, we take a proactive approach to ethics. Anticipatory ethics has emerged and begun to gain attention in the area of information technology ethics. Anticipatory ethics can be characterized as focusing on the problems that can be anticipated as potentially arising because of emerging technologies. In this analysis anticipatory ethics will be employed to discuss current and potential future issues with nanotechnology as it relates to the development of nanotechnology and 3D printing and how these developments can lead to the development of 3D printed skin.

ETHICS, E-LEARNING, AND TELEMEDICINE IN THE COVID-19 ERA

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Telemedicine usage has increased exponentially in the last few years with the arrival of SARS-CoV-2, reaching worldwide acceptance and implementation for patient care and medical education.

Advantages include: greater penetration in rural and remote areas; increased access to specialists; cost-efficiency; improved quality; increased patient satisfaction; and continuous medical education. However, telemedicine carries noticeable limitations due to the lack of in-person physical examinations and ethical issues with privacy, informed consent, and medical liabilities.

Caution must therefore be exerted for several reasons: limited data on the validity of its usage in acute care settings; user error among non-tech savvy individuals and elderly populations; and the reliability of communication between patients and healthcare providers in a virtual physical examination context. Until further studies establish the clear indications and contraindications of telemedicine, there is a need for comprehensive regulations and control systems for safe practice and to protect patients' rights.

INTRODUCTION TO ANTICIPATORY ETHICS FOR BIOMECHANICAL ENGINEERING

Michael Nestor[1] *and Richard Wilson*[2]

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Biomedical engineering is the application of the principles and problem-solving techniques of engineering to biology and medicine. This is evident throughout healthcare, from diagnosis and analysis to treatment and recovery, and has entered the public conscience though the proliferation of implantable medical devices, such as pacemakers and artificial hips, to more futuristic technologies such as stem cell engineering and the 3-D printing of biological organs.

Engineering itself is an innovative field, the origin of ideas leading to everything from automobiles to aerospace, skyscrapers to sonar. **Biomedical engineering** focuses on the advances that improve human health and health care at all levels.

Biomedical engineers differ from other engineering disciplines that have an influence on human health in that biomedical engineers use and apply an intimate knowledge of modern biological principles in their engineering design process. Aspects of mechanical engineering, electrical engineering, chemical engineering, materials science, chemistry, mathematics, and computer science and engineering are all integrated with human biology in biomedical engineering to improve human health, whether it be an advanced prosthetic limb or a breakthrough in identifying proteins within cells.

There are many subdisciplines within biomedical engineering, including the design and development of active and passive medical devices, orthopedic implants, medical imaging, biomedical signal processing, tissue and stem cell engineering, and clinical engineering, just to name only a few.

This analysis will examine how anticipatory ethics can be deployed in biomechanical engineering and technology in medical contexts and will conclude with an Ethical and Anticipatory Ethical analysis of the issues related to the future development of biomechanical engineering technology in the medical domain.

Organ-on-a-chip: Developments and Future Possibilities: An Ethical and Anticipatory Ethical Analysis

Richard Wilson[1]

[1]Towson University

Organ-on-a-chip (OOAC) technology is in the list of top 10 emerging technologies and refers to a physiological organ biomimetic system built on a microfluidic chip. Through a combination of cell biology, engineering, and biomaterial technology, the microenvironment of the chip simulates that of the organ in terms of tissue interfaces and mechanical stimulation. This reflects the structural and functional characteristics of human tissue and can predict response to an array of stimuli including drug responses and environmental effects. OOAC has broad applications in precision medicine and biological defense strategies. Here, the concepts of OOAC are introduced and a review of its application to the construction of physiological models, drug development, and toxicology from the perspective of different organs is undertaken. There is a further discussion of existing challenges and charts future perspectives for the application OOAC technology.

This analysis will examine the design, development of OOAC technology in medical contexts and conclude with an Ethical and Anticipatory Ethical analysis of the issues related to the future development of OOAC technology in the medical domain.

WHAT IS TRUTH IN MEDICINE?

David Dinhofer

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Politicians and all members of society are fed falsehoods, repeat them and call them truth. It has become hard to tell what is truth. Medical ethical principle of respect for autonomy is the foundation of truth telling to patients and colleagues supported by the beneficence of truth. This presentation reviews the meaning of truth for scientists and by extension, health professionals. In addition, this presentation will discuss the key attributes of good science and how these attributes are related to healthcare with the hope that seeking the highest level of these attributes will promote and maintain trust of the individuals that healthcare professionals server.

ETHICAL AND ANTICIPATED ISSUES OF BRAIN COMPUTER INTERFACES

Richard Wilson[1]

[1]*Towson University*

Brain Computer Interface (BCI) technology is a powerful and rapidly developing form of technology which has a variety of potential applications for future development. BCI is any form of technology where a machine is connected to or directly controlled by the activity of the human brain. By its very nature BCI technology is suited for use both as a treatment for human's who have physical limitations resulting from an injury or illness and for the enhancement of the capabilities of humans who have relatively normal physical capabilities. This paper will examine the ethical and anticipated implications of applying BCI technology both for therapeutic and enhancement uses. The ethical and technical issues presented by these two types of BCI use will be examined, and ethical principles will be employed to make recommendations about how best to approach the ethical and technical problems posed by therapeutic and enhancement uses of BCI technologies.

THE INFLUENCE OF DEVELOPMENTAL NEUROBIOLOGY ON MORALITY AND ETHICAL BEHAVIOR

Victoria M Moceri

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Growth and development are a timed and ordered process. Not all areas of the brain grow and reach maturation at the same time and pace. Growth and maturation proceed earliest in the brain stem, then to the mid-brain/limbic system, and lastly to the cortex. Throughout this process, all cortical fields generate rich pathways to and from the subcortical regions. The frontal lobe, and especially the prefrontal cortex (and all its connection to other brain areas), is the last to complete growth and reach maturation.

The prefrontal cortex is associated with greater executive function, problem-solving, complex cognitive abilities, flexibility in behavior, self-control, and moral reasoning. The cognitive abilities reach maturation prior to psychosocial and moral reasoning.

This is particularly important for medical and health researchers who are highly intelligent. A highly intelligent person may not ever reach full moral maturity and, therefore, will be lacking in full fortitude and regulation of ethical behavior.

Session 20: Kinesiology and Health

RAPID HEAT STRESS AND FIREFIGHTERS: THE PROBLEM AND SOLUTION

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Occupational workers, such as firefighters, who perform in emergencies while wearing protective equipment (PPE), lend themselves to the potential for heat-related health complications. These thermal complications can lead to significant challenges, such as increased stress, increased inflammation, and increased risk of brain dysfunction, at a time when decision-making and concentration are critical. Additionally, increased stress and inflammation are known contributors to the development of cardiovascular disease, the current leading killer of firefighters.

Firefighters are exposed explicitly to a unique phenomenon known as rapid heat stress (RHS) during a live fire. RHS is an acute type of heat stress where the individual stores heat at the double the rate of a normothermic condition. Our previous research [Coehoorn et al., 2020] revealed that RHS causes a core temperature increase of 0.04°C/min, while normothermic conditions resulted in 0.02°C/min. Furthermore, our previous research [Coehoorn et al., 2020; Coehoorn et al., 2022, Coehoorn et al., 2023] found that RHS resulted in a decreased neural response (theta power), increased decision-making errors, altered cerebral oxygenation, and increased stress response immediately following exposure to RHS.

A critical question remains: What are the effects of multiple exposures? For example, if a bout of RHS leads to perturbations 24 – 48 hours post-exposure, then numerous episodes of RHS may lead to a chronic response. Our lab is currently analyzing the impact of multiple bouts of RHS.

Our lab is additionally working to create a cooling system for occupational workers who wear PPE and are exposed to RHS. Our current project is working to create a thermal map of the body during RHS. This will provide the necessary insight to develop a cooling system to optimize neurocognition during RHS. This innovative technology will help save lives lost to decision-making errors and alleviate the loss of life due to cardiovascular disease.

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AN INTENSE BOUT OF RAPID HEAT STRESS DOES NOT CAUSE PROLONGED INCREASES IN SALIVARY CORTISOL AND DOES NOT ALTER C-REACTIVE PROTEIN PRODUCTION IN FIREFIGHTERS

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PURPOSE: In the present experiment, we evaluated the impact of rapid heat stress (RHS) on salivary cortisol and C-reactive protein production pre-RHS, post-RHS, and 24 – 48 hours post-RHS exposure among firefighters. Previous research has demonstrated that RHS increases salivary cortisol during RHS and immediately post-RHS exposure. However, no studies have analyzed the impact of RHS on inflammatory markers, such as C-reactive protein. Additionally, no research has discovered the duration necessary to return to baseline cortisol levels following a bout of RHS. In this study, we hypothesized that salivary cortisol and c-reactive protein levels would increase following RHS and then return to pre-RHS levels within the 24 hours post-exposure. **METHODS:** Twenty-four participants performed a steady-state treadmill protocol in an environmental chamber (35°C; 45% humidity) in full firefighter personal protective equipment until reaching either a core temperature (Tc) of 39°C or a volitional maximum. The subjects had their saliva collected via the passive

drool protocol pre-RHS, post-RHS, 24 hours post-RHS, and 48 hours post-RHS. **RESULTS:** An analysis of the pre-RHS and post-RHS values revealed increased salivary cortisol ($p \leq 0.01$). This finding supports previous literature demonstrating the immediate impact of RHS. There were no changes in C-reactive protein at any data collection point. The novel finding of this study is that salivary cortisol levels return to baseline in the 24 hours post-RHS exposure. **CONCLUSIONS:** This data indicates that 24 hours is recommended to recover from an RHS bout and should be applied to prevent the chronic stress response linked to cardiovascular disease.

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ASSESSING MANUAL DEXTERITY AND STRENGTH TO INFORM PROSTHESIS DESIGN

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Hand dexterity is a fundamental part of daily function, expression of creativity, and precision. The Box and Block Test (BBT) of manual dexterity is a commonly used research and rehabilitation tool to establish a baseline for dexterity comparison (Zapata-Figueroa, et.al. 2022). The test has also proven valuable to assess generalizability for individuals with congenital limb differences (Martin, 2015; Soysal, 2021). While the assessment is widely employed, generalizability is sometimes limited due to reported confounding factors (Barut, et.al. 2014; Martin, 2015).

This research is designed to collect a baseline dataset for participants with full control of upper extremities performing dexterity assessments, including variations of BBT and physical grip strength. A comparison of handedness via the Edinburgh Handedness Inventory (Oldfield 1971), which describes how a participant scores on the right- versus left-handed spectrum, will provide context for lateral variations in performance. These baseline benchmarks will be used for direct comparison to future prosthesis patients training with our research's in-house developed prosthesis.

Use of upper limb prosthesis requires significant training, which can result in patients becoming discouraged or even lead to device rejection (Biddiss, et al. 2007). This preliminary study aims to understand how dexterity, strength, and anthropometric measurements correlate, while establishing baseline comparisons for future design iterations. The results will be used to better assess the device for both performance and design considerations, along with providing context for assessment of a patient's training plan.

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DESIGN AND ASSESSMENT OF BIRD CLAW BIOMIMICRY-INSPIRED UPPER LIMB PROSTHESIS

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Biomimicry for mechanical design refers to incorporating either the form or function of existing processes in nature into design elements [1,2]. Adapting biomechanical principles from natural structures specialized for grasping into current research with 3D-printed bionic hand designs may improve robotic dexterity in picking up a wider variety of objects [3,4]. Species of birds' claw variations lend biomechanical advantages for grasping motions related to perching, climbing, and hunting, and may provide mechanical advantages beyond a human-inspired structure for specific grasping applications.

When creating robotic grasping mechanisms, limiting degrees of freedom and actuators can streamline mechanical design. Bird claws are an ideal inspiration for robotics because of their limited joints, reduced number of actuators, and smaller palm size [3]. Different bird species' unique toe configurations offer different prehensile movements, which are specialized for their environments and lifestyles [5]. Recent literature has developed flying drone landing mechanisms inspired by bird claws [6,7], which this work builds upon.

This research designed and manufactured two robotic devices with different toe arrangements: anisodactyl (3 forward x 1 backward) and zygodactyl (2x2). Our research team reports the design and evaluation methods of novel 3D-printed mechanized grasping claws, demonstrating the capabilities of different claw configurations as a comparison against a traditional five-finger prosthetic hand. Evaluation methods included a qualitative variable-object grasp assessment and a quantitative grip force test. The designs and comparisons offer insights into how biomimicry can be harnessed to optimize the grasping capabilities of upper-limb prosthetics.

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THE RELATIONSHIP BETWEEN RATE OF THERMAL ACQUISITION DURING RAPID HEAT STRESS AND PRE-TESTING HYDRATION STATUS

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Previous research has found optimal hydration to be one of the best thermoregulation defense mechanisms for heat stress**.** However, no research to date has evaluated the correlation between the rate of thermal acquisition (core temperature increase per minute) during rapid heat stress (RHS) and pre-testing hydration status. RHS is an uncompensable form of heat stress that occurs while wearing firefighter personal protective equipment (PPE) in the heat and results in double the heat stress load per minute compared to normothermic conditions. **PURPOSE:** The study objective was to determine whether there is a relationship between pre-testing hydration status and core temperature acquisition during RHS. **METHODS:** The experimental study design utilized a steady-state exercise test while wearing firefighter PPE. Thirteen participants (age 35 ± 10 years) were selected from the firefighter population in northwest Louisiana and analyzed for this study. A urine sample was provided before each exercise test and analyzed for urine specific gravity (USG) via refractometry. To ensure euhydration (USG ≤ 1.020), participants were asked to drink 3.7 L of water and refrain from physical activity or alcohol consumption in the 24 hours prior and abstain from caffeine consumption for 48 hours before the exercise trial. Core body temperature was monitored during exercise using an integrated physiological monitoring system and core temperature capsules. **RESULTS:** A Pearson's product-moment correlation was used to assess the relationship between hydration status and core temperature during RHS. There was a statistically significant, strong positive correlation between the variables, $r(11) = .71$, $p = .006$, with the hydration level explaining 50% of the variation in RHS. **CONCLUSIONS:** Hydration status is strongly correlated with RHS in firefighters. Firefighters may be able to delay heat exhaustion by ensuring optimal hydration.

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EQUINUS ANKLE CHARACTERIZATION THROUGH MOTION CAPTURE: A CASE STUDY

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BACKGROUND: Motion capture (MC) dates to the late 1800s when horse racing fans wished to investigate the presence of "float phase" in a gallop. From there, MC has been used in various fields from computer-generated-imagery in movies to healthcare. In particular, MC is integral to determine appropriate treatment for ambulatory patients with cerebral palsy (CP).

METHODS: Two participants completed a gait assessment with Vicon MC and AMTI force plate technologies. An adolescent with CP and left equinus (EQ) ankle participated in a gait analysis. EQ is a condition where an ankle (AN) has a plantarflexion (PF) contracture and is unable to achieve a neutral dorsiflexion (DF) position. This gait analysis was compared to a female of similar height/weight, no neuromusculoskeletal deficits, and a "normal" gait.

RESULTS: Physical exam of the EQ participant revealed ROM deficits in left ankle DF and strength deficits at the left hip and AN musculature. The observed EQ gait demonstrated a swing phase of PF that resulted in forefoot strike (instead of normal heel strike) during initial contact. As a result, there is a large knee flexion moment that causes rapid knee flexion (buckling). Also observed were decreased knee extension and hip extension ROM compared to normal gait as a compensation for decreased AN DF. To compensate for strength/balance deficits, spatiotemporal variables of walking velocity, cadence, and step length were decreased and step width was increased.

CONCLUSION: A typical intervention for decreased DF strength would involve ankle foot orthosis (AFO) prescription. However, this patient is unable to achieve neutral ankle DF. Therefore, this patient will undergo a gastrocnemius lengthening to allow for greater ankle DF, proper fitting of an AFO and training of proper gait.

Posters

INTRANASAL INSULIN AND SEX-SPECIFIC EFFECTS ON HIPPOCAMPAL INJURY AND LONG-TERM COGNITIVE DEFICITS FOLLOWING HYPOXIC-ISCHEMIC BRAIN INJURY IN NEONATAL RATS

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Hypoxic-ischemic (HI) encephalopathy (HIE) remains a significant cause of morbidity and mortality in neonates. Our objective was to test whether InInsulin provides long-term neuroprotection against neonatal HI-induced hippocampal damage and cognitive disturbances in juvenile rats at postnatal days 21-25 (P21-P25). On postnatal day 10 (P10), pups were randomized into four groups: HI+Insulin; HI+Vehicle; Sham+Insulin; Sham+Vehicle with equal male and female ratios. Pups had either the HI by permanent ligation of right carotid artery or Sham surgery followed by 90 min of hypoxia or room air exposure, respectively. Immediately after procedures, rat pups received InInsulin (25 μg) or an equivalent volume of the vehicle in each nare. Depending on the group, two more doses of InInsulin/Vehicle were repeated every 24 h after HI or Sham. Neuro-behavior outcomes show that InInsulin protects both male and female pups against HI induced abnormal sensorimotor disturbances (P20) and abnormal long-term memory (P23). Only male pups had abnormal short-term memory following HI (P21); the findings were improved in HI+Insulin pups. InInsulin reduced HI-induced long-term hippocampal injury, as evidenced by increases in the numbers of mature neurons (NeuN+) in hippocampal CA3 and immature neurons (DCX+) in dentate gyrus regions and reduction in the numbers of degenerated neurons (FluoroJade C+) in CA3 regions. Our findings suggest that InInsulin provides long-lasting protective effects against neonatal (P10) HI-induced hippocampal neuronal injury and cognitive disturbances in juvenile rats, which supports InInsulin as a promising non-invasive therapy to improve outcomes of newborns with HIE.

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AGOMELATINE REDUCES LIPOPOLYSACCHARIDE-INDUCED PRE-SOCIAL INTERACTION IMPAIRMENTS, BRAIN INFLAMMATION AND LIPID PEROXIDATION IN NEONATAL RATS

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Inflammation and oxidative stress play important roles in brain injury in neonatal human and animal models. Our previous studies showed that systemic administration of endotoxin lipopolysaccharide (LPS) induces brain damage and neurobehavioral dysfunction in neonatal rats, which is associated with the production of pro-inflammatory cytokines and oxidative stress. Recent studies suggest that agomelatine treatment which could affect inflammation and microglia polarization could be a neuroprotective agent in adult animals. The objective of the current study was to determine whether agomelatine, a melatonergic agonist with anti-inflammatory and antioxidative effects, ameliorates LPS-induced brain inflammation and neurobehavioral dysfunction in neonatal rats. Intraperitoneal (i.p.) injections of LPS (2 mg/kg) were performed in P5 Sprague Dawley rat pups and agomelatine (20 mg/kg) or vehicle was administered (i.p.) 5 min after LPS injection. Control rats were injected (i.p.) with sterile saline. Neurobehavioral tests were performed and brain inflammation was examined on P6, 24 hours after LPS exposure. Our results showed that agomelatine reduced LPS-induced sensorimotor disturbances and reduction in pre-social interaction (ultrasonic vocalization) at P6. Agomelatine also reduced LPS-induced increase in levels of IL-1β and thiobarbituric acid reactive substances (TBARS) contents, suggesting anti-inflammatory and antioxidative effects. These results suggest that agomelatine may provide protection against systemic LPS exposure-induced brain inflammation, lipid peroxidation and neurobehavioral disturbances, and that the protective effects are associated with its ability to attenuate LPS-induced inflammation and oxidative stress.

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THE EFFECT OF NICOTINIC RECEPTOR POTENTIATORS ON HUMAN LUNG CELL VIABILITY

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The anti-inflammatory effects of the lung cholinergic system involve increased expression of nicotinic receptors (nAChRs). Our goal is to determine the Maximum Tolerable Concentration (MTC) for a series of nAChRs positive allosteric modulators (PAMs) on bronchial epithelial cells . **Method:** Human bronchial epithelial cell line (BEAS-2B; CRL-9609™) was maintained at 37ºC/95%air/5%CO_2 in RPMI1640 medium with 10% FBS/1% penicillin-streptomycin solution. For MTC determination, cells were seeded in 96-well plates (6 wells per drug concentration), treated 24 hours before confluency with nAChR PAMs at a concentration ranging from 1-100 μM. CyQUANT MTT Cell Viability Assay was used, according to the manufacturer's protocol, to determine BEAS-2B cell viability that was normalized to non-treated cells cultured within the same 96-well plate. Each drug was tested in triplicate. Reduced cell viability >25% is considered cytotoxic. **Results:** PNU282987 and methyllycaconitine exhibited minimal cytotoxicity up to 100 μM (maximum concentration tested). MTCs for desformylflustrabromine, LY2078101, PNU129596, sazetidine, GAT1712, and CMPI were 30, 30, 10, 10, 10 and 3 μM, respectively. **Conclusion:** Our results provide concentration ranges at which nAChR ligands enhance nicotinic receptor function without cytotoxicity and are suitable for elucidating their anti-inflammatory potential *in vitro*. The role of nAChRs as a pharmacological target for inflammation is emerging considering that inflammation is a feature of several pulmonary diseases.

ISOLATION AND INVESTIGATION OF DRUG DELIVERY POTENTIALS OF EXTRACELLULAR VESICLES DERIVED FROM NATURAL KILLER CELL

Hadeeqah Quazi, Israel Joshua Santhosh, Shoukath Sulthana, Santosh Aryal

Background-Natural Killer (NK) cells are large granular lymphocytes that belong to the innate immune system. Their major function is to provide host defense against microbial infections and tumors by immune surveillance to find the abnormal expression of MHC-I molecules and cell stress markers. Lesson learned from these properties of NK cells, we herein hypothesized that the extracellular vesicles (EVs) derived from NK cells carry the mother's nature to seek abnormally expressed receptor proteins, which can be taken as an advantage to maximize delivering cytotoxic agents to target cells. EVs are nanosized membranous sacs released by cells that are used for intercellular communication and interaction. To evaluate our hypothesis, we started our experiment with the NK-92 cell line. NK-92 cells were cultured as recommended and their targeting properties were evaluated using human breast adenocarcinoma (MDA-MB-231). NK-92 cells were found targeting and attacking the cancer cells and destroying cancer cells. An experiment was designed to evaluate NK cell attacking, cells were labeled with rhodamine dye, and their action against cancer was monitored via a live cell imaging system, which shows the transfer of dye and destruction of cancer cells. With cellular targeting confirmations, we evaluated NK-92-derived EVs as a potential cytotoxic agent delivery vehicle because cells are not compatible with cytotoxic agents. First, extracted EVs were characterized with multiangle dynamic light scattering for their colloidal properties suggesting hydrodynamic size ranges from 50-200 nm, a characteristic size of EVs originating from endosomal origin also called exosomes. Along with colloidal properties, characteristic proteins such as CD-81, CD-63, CD56, and NKG-2D were characterized using dot blot, Bradford, and ELISA assays. Cancer cell targeting properties of EVs were studied using flow cytometry of rhodamine as model drug loaded EVs and routinely compared with the nontargeted liposomal system, which shows NK-EVs were associated with cancer cells to a higher extent as compared to that of the liposome. While more study is required to understand the underlying mechanism of NK-EVs targeting cancer cells, we are optimistic with the results obtained that the system could hold promise drug delivery application.

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OPTIMIZATION OF LOCALIZED PHOTOTHERMAL CANCER THERAPY UTILIZING LIPOSOMAL INDOCYANINE GREEN PHOTOACTIVE DYE

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Current phototherapeutic approaches in cancer treatment include photothermal (PTT) and photodynamic (PDT) therapy, which harness light energy for the activation of a photoactive molecule, resulting in the destruction of cancer cells. In PTT, the local heat generated kills abnormal cells; whereas, in PDT, a series of biochemical reactions generating reactive oxygen species is responsible for cellular damage. However, a major challenge arises in the cellular delivery of an optimal amount of a photoactive molecule required for the desired effect. In this work, we employed indocyanine green (ICG) ($\lambda_{ex}/\lambda_{em}$ =700/820 nm) in a liposomal formulation to maximize its delivery to cancer cells while minimizing its adverse side effects for localized PTT. The synthesized liposomes were monodispersed and highly stable with a hydrodynamic size of 120 ± 5 nm and a narrow polydispersity index of 0.15 ± 0.02. The optimization of IR-820 loading showed a loading efficiency of 85 ± 3.2% and these liposomes exhibited biocompatibility when treated with normal and cancerous cells. Irradiation of free IR-820 and liposomal IR-820 aqueous solutions using 808 nm near-infrared laser resulted in a rapid rise in temperature up to 60° C within 60 seconds, as captured in FLIR infrared camera. Such an order of magnitude of temperature rise was observed effectively killing more than 50% of human breast cancer cells (MCF-7) within 30 seconds of NIR laser irradiation. Considering the ease of liposome fabrication and obtained preliminary results, this pilot study could have great potential and hold promise in the photothermal therapy of cancer.

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MICROSCOPIC EVALUATION OF WOUND HEALING IN THE PRESENCE AND ABSENCE OF ALBUMIN

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Albumin is the most prominent protein in the blood. Albumin infusion and dietary proteins play a vital role in wound healing by correcting the hypoalbuminemic state which in turn enhances adhesion and absorption properties to accelerate the healing process. In this summer pilot project, we evaluated the effect of fetal bovine serum (FBS), a major albumin source used in the *in-vitro* cell culture system, in the wound healing process. For this purpose, NIH-3T3 murine fibroblast cells were used as a model cells to create a scratch would model in a six-well plate. Cells were cultured in full confluency and a vertical line of scratch was developed using the tip of the pipette tips under aseptic conditions. The healing process was monitored under a live cell imaging system (CytoSMART Lux3 FL) in the presence of various FBS concentrations. Time-lapse images were recorded at 10 min intervals for 48 hours. All images were saved in Joint Photographic Experts Group (JPEG) image file format. Using the National Institutes of Health-ImageJ image analysis software, all micrograph's healing areas were calculated and recorded as a numerical value to evaluate the decrease in the scratch areas, which corresponds to the healing process. Our results showed the acceleration in wound healing in the presence of FBS whereas the decrease or absence of FBS decelerates the wound healing

process. In the future, our focus will be to understand the stress biomarker that influences the healing process in varying mineral contents such as calcium, magnesium, zinc, and iron in the medium.

Authors Contribution: Presenting author Ashir Aryal is a High School Student presenting his summer research under the leadership of senior student Dinesh Shrestha and Isreal Joshua Santhosh. Ashir contributed his effort to computation image analysis to evaluate the wound healing process.

SYNTHESIS AND CHARACTERIZATION OF PLGA NANOPARTICLES WITH VARYING WEIGHTS TO STUDY THE WEIGHT EFFECT ON CELLULAR UPTAKE

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Biodegradable and biocompatible polymeric nanoparticles (NPs) stand out as a key tool for improving drug bioavailability, reducing inherent toxicity, and targeting the intended site. Most importantly, the ease of polymer synthesis and its derivatization to add functional properties makes them potentially ideal to fulfill the requirements for intended therapeutic applications. Among many polymers, US-FDA-approved poly(l-lactic-co-glycolic) acid (PLGA) is widely used biocompatible and biodegradable co-polymers in drug delivery and in implantable biomaterials. While many studies have been conducted using PLGA NPs as a drug delivery system, less attention has been given to understanding the effect of NP weight on cellular behaviors such as uptake. Here we discuss the synthesis of PLGA NPs with varying NPs weights and their colloidal and biological properties. Following nanoprecipitation, we have synthesized ten different PLGA NPs of varying gravimetric weight. Hydrodynamic sizes of these NPs were ranging from 60 to 150 nm all having negative zeta potential. These NPs were differentially uptaken by human breast cancer cells (MCF-7), which are greatly influenced by NP's weight. For the uptake study, NPs were labeled with rhodamine dye to track NPs under a fluorescent microscope. All micrographs were saved in Joint Photographic Experts Group (JPEG) image file format. Using the National Institutes of Health-ImageJ image analysis software, channels were separated to quantify the total red intensity associated with cells. Results showed that lighter particles are uptake to a greater extent as compared to that of heavier particles. Considering the significance of PLGA-based NP drug delivery systems, we anticipate that this study will contribute to the establishment of design considerations and guidelines for the therapeutic applications of NPs.

Authors Contribution: Presenting author Anthony Vega is a High School Student presenting his summer research under the leadership of senior students Dinesh Shrestha and Isreal Joshua Santhosh. Anthony contributed his effort to computation image analysis to evaluate the NP uptake.

MONITORING BLEOMYCIN EFFECT ON MOUSE BODY WEIGHT

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Background: Pulmonary fibrosis (PF) is a progressive and deadly disease without an effective treatment except lung transplant. After diagnosis, the survival average is ~3-5 yrs which is close to many cancer types. PF pathological mechanisms are complex and studies have shown that TGFbeta signaling plays a key role in fibrosis development within the lungs such as collagen deposition that leads to stiffness of lungs. TGFbeta signaling has been a target for therapeutic development.

Hypothesis: In the present study we investigated the effect of bleomycin (BLM) on mouse body weight. Bleomycin is a chemodrug used to treat several cancer types and also an inducer of PF.

Materials and Methods: C57BL6J male mice of 10 weeks old were purchased (Jackson Laboratories) and housed in the animal vivarium at Jackson State University (IACUC Protocol 2003) and maintained at 25°C and 55%± % humidity with a 12-hr light-dark cycle with ad libitum access to water and standard feed. The mice were acclimatized for 1 week before any treatments. The mice were grouped into 3 groups and each group was treated ip with PBS (control), BLM (BLM), and BLM + Pirfenidone (BLM+PFD). BLM was prepared in PBS and administered to animals at 1.5U/kg bwt every other day for a total of 4 administrations thus receiving a total of 1.5U/kg bwt BLM. PFD was administered at 200 mg/kg bwt every other day for a total of 14 days. All animals were ip. Body weights were measured every week for a total of 4 wks.

Results: Over the course of 4 wks BLM decreased body weight whereas the group receiving the treatment with PFD body weight initially decreased after BLM treatment at week one but after a week of PFD treatment body weight slowly increased from week one until week 4 at which point all mice were sacrificed. In conclusion BLM decreased body weight whereas treatment with PFD stabilized body weight loss. PFD is used to treat PF in humans.

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DETERMINATION OF CYTOTOXICITY OF VIT D3 ON COLON CANCER CELLS

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Background: Colon cancer is the second- and third-most common cancer in women and men. Although some progress have been made in therapeutic targeting of colon cancer, resistance to treatment still remains a major challenge. Vitamin D3 (1,25-dihydroxyvitamin D3) or calcitriol has been suggested to benefit colon cancer survival and to lower the risk of colon cancer. **Hypothesis:** In the present study we investigate whether calcitriol which is the physiologically active form of Vit. D3 is cytotoxic to colon cells.

Materials and Methods: The SW480 cells (ATCC) were cultured in RPMI-1640 medium supplemented with 10% FBS and 1% penicillin-streptomycin until reached a 90% confluency. The cells were then seeded in 96- or 6-well plates in growth media overnight and then treated with different doses of Vit. D3 (0.1-8 µM). Cell viability and migration were measured after 24h of treatment using MTS and wound scratch assays according to manufactured protocols (Promega). **Results:** Cell viability after 24h of Vit. D treatment was significantly decreased only by concentrations of 5 and 8 µM. Vit. D3 at 5 and 8 µM produced a cell viability of 50 % and 10% respectively. No cell migration was found at 5 and 8 µM of Vit. D3. These results suggest that Vit. D3 decreases colon cancer cells viability and migration and warrants further investigation into its antitumorigenic mechanism alone or in combination with other chemotherapeutic drugs.

Acknowledgement

This work was supported by the National Institute of Minority Health Department Grant no. U54MD015929 Research Project 6611 (MP) through RCMI Center for Health Disparities Research at Jackson State University.

OPTIMIZING 3D BIOPRINTING OF HYDROGEL-BASED BIOMATERIALS WITH PLURONIC F127 AND SODIUM ALGINATE FOR TISSUE ENGINEERING APPLICATIONS

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Three-dimensional (3D) bioprinting technology has significant potential for creating functional tissues and organs for transplantation and medication testing. This study aimed to optimize the 3D bioprinting settings for the construction of stable hydrogels utilizing Pluronic F127 and sodium alginate as bioink. We started by making stock solutions of 40% Pluronic F127 and 10% sodium alginate, which we then mixed with low glucose DMEM to form a 6 wt% F127-13 wt% alginate gel. The gel was either filled with cells or left cell-free before being transferred to a sterile syringe and bioprinted with an Allevi 3D bioprinter. We investigated the impact of various bioprinting settings on creating hydrogel-based structures utilizing two gauge tips (25 gauge and 30 gauge). The 30 gauge tip with a pressure of 100 psi and a speed of 6 was the best combination for high-precision bioprinting with Pluronic F127-sodium alginate hydrogels. The 30 gauge tip allowed for high-resolution printing of complicated designs, but the 25 gauge tip had superior flowability but needed more precision. Our findings imply that Pluronic F127-sodium alginate hydrogels can be employed as a stable and biocompatible bioink for 3D bioprinting applications, and the optimal bioprinting parameters we determined can help tissue engineering research progress.

CREATION OF AN IN VITRO PSORIASIS MODEL

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This research project aimed to develop an in vitro model of psoriasis - a debilitating skin disease associated with forming inflammatory skin plaques. The two most significant characteristics of psoriasis are the hyperproliferation of keratinocytes and an abundance of activated T-cells attacking keratinocytes. Another cell type responding to inflammatory changes in psoriasis is fibroblasts; therefore, we used a specialized version of fluorescent fibroblasts (3T3GFP) to mimic psoriatic cell response. During psoriasis, activated T cells further interact with macrophages, creating a pro-inflammatory response. In our project, we planned to use a co-culture of the 3T3GFP fibroblasts with RAW264.7 macrophages. The culture was exposed to the TLR ligand lipopolysaccharide (LPS) which was known to induce reactive oxygen species (ROS) in macrophages, simulating the activation of macrophages from T cells. To estimate the cell's viability after adding LPS and the consequent macrophage inflammatory response, we ran the Alamar Blue assay. With this experiment, we hope to create an in vitro model that will effectively encompass psoriasis-related processes and can be easily utilized.

EVALUATION OF NICOTINIC RECEPTOR EXPRESSION IN AN IN VITRO MODEL OF ECA+ OVEREXPRESSED CELLS INFECTED WITH SARS-COV-2.

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Introduction: SARS-CoV-2 is the virus that causes COVID-19 and the entry of the virus into the host cell occurs after binding of the Spike protein to ACE2. It is believed that nicotinic acetylcholine receptors (nAChRs) may be associated with COVID-19, as they have the potential to modulate ACE2 levels. **Aim:** To evaluate a possible interaction of ACE2 and nAChRs and whether the activation of these receptors modulates SARS-CoV-2 infection. **Material and Methods:** BEAS-2B cells were modified to overexpress ACE2 ($ACE2^+$) by lentivirus and the gene expression of α3, α7 e β2nAChR was evaluated by RT-qPCR. ACE2+ and wild-type (WT) cells were infected with SARS-CoV-2 (MOI 0.2) and treated with nicotine (10µM and 100µM) or PNU-282987 (3µM, 10µM e 20µM). The viral entry was evaluated by RT-qPCR. **Results:** Downregulation of α7nAChR, α3nAChR and β2nAChR was observed in ACE2+ cells ($P<0.05$). The nicotine treatment (10µM) reduced the viral load in WT, but not in $ACE2^+$ cells. PNU, a selective agonist of α7nAChR, did not have any effect. SARS-CoV-2 exposure increased α7nAChR ($p<0.05$) in WT, but not in ACE2+ cells. **Conclusion**: These data suggest that nAChRs may play a role in COVID-19 since nAChR stimulation reduces viral load in infected cells. Increased ACE2 reduced nAChRs expression, confirmed by the absence of the effect of nicotine in reducing the viral load in these cells. Considering that the increase in ACE2 is related to severe infection, it suggests that reduced nAChR may corroborate to the increased infection.

BIOINFORMATIC ANALYSIS OF RESEARCH INFORMATION RESOURCES USED TO ANSWER CLINICAL QUESTIONS FROM MORNING REPORT FOLLOW-UP

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OBJECTIVES: What information resources are used by LSUHS library faculty for Internal Medicine Morning Report follow up to answer Internal Medicine Morning Report questions?

METHODS: Morning Report Topics, Basic Resources (Textbook, Web Documents), and Journal Titles were analyzed. Basic Resources and Journal Titles were totaled for the two academic years of 2013-2014 and 2014-2015, for each date and for each question. Journal sub-analysis was completed by: Bradford's law of scattering and National Library of Medicine Medline Core Clinical Journal list.

RESULTS/CONCLUSION: To answer clinical information needs 1579 resources were referenced. After deleting the duplicate entries for the same day of the same question 469 individual question entries remained. Questions were classified into 20 broad sub-specialty categories. Textbooks were used 657 times to answer clinical questions with a mean of 6 ±12 of usage and 919 journal articles were used. Of those used during the time, 65% had only one citation from a journal, 18% had two citations and 17% provided at least 3 citations to answer clinical questions. When comparing the Core Clinical Journal list, 44% of the top 25 journals were used. The great variety of journals with one citation means a variety of journals are needed for residents in IM to answer clinical questions.

POTTING MEDIA SELECTION FOR BIOMECHANICAL TESTING

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Introduction: Potting is used to stabilize specimens during biomechanical testing and has been instrumental in gaining accurate and effective results for many years. This method allows for bones of distinctive shapes to be used for testing because the media can mold to the shape of any bone. Potting media that are easily attainable include polyester resins, polyepoxides resins, and polyurethane elastomers and these have been used in a plethora of experimental procedures. For instance, polyester resin has been used to stabilize femoral bones for comparing different reconstruction techniques for medial patellofemoral ligament injuries (Johnston et al., 2020). While polyepoxide resin has been used in experiments aimed to compare the mechanical stability of a fixed-angle blade plate to a locking plate on proximal humerus fracture-fixation (Siffri et al. 2006). Further applications include polyurethane elastomers being used to pot humerus sawbones subjected to a bending load for fixation construct characterization (Scolaro et. Al., 2014). In these types of experiments, peak loads can reach 3000 N (Amirouche et al. 2016) and can induce bending (Massey et al. 2019), especially if a long bone is involved (Arnander et al. 2008). In light of the heterogeneity of the potting media used, comparison among studies of the measured variables is limited by the differences in potting media used with resultant impact on the experimental results. Therefore, the main goal of this study is to determine, among the most common media commercially available, which media results in the highest construct stiffness in the execution of mechanical testing of long bones. We hypothesize that the configurations potted with polyepoxide resin will result in the highest stiffness because characterized by the highest tensile modulus as declared by the manufacturers.

Method: For the purpose of the experiment, we considered constructs mimicking the testing of long bones subject to bending and tension loads. The bone surrogate was composed by a square aluminum tube 5in long with 1in side dimension and a wall thickness of 0.25in. The surrogate was potted into a 3x3x3in aluminum box and stabilized with a 0.125in rod at a depth of 1.5in in the potting media. The media considered in the study were Bondo Body Filler (3M Company), Bondo Fiberglass (3M Company), and Smooth-Cast 300 (Smooth-On Company) respectively representing polyester resins, polyepoxide resins, and polyurethane elastomers. Each medium was tested in bending and tension with an execution of three repetitions for a total of 18 experiments (see Figure 1). Previously designed in Fusion360 (Autodesk, Software Corporation), plate fixtures were used to ensure centering of the bone surrogate in the potting and for interfacing the surrogate to the Instron 8872 Servohydraulic Testing System (Instron Corporation). Tensioning was performed by rigidly connecting the bone surrogate to the actuator of the mechanical testing system (see Figure 1a) while bending was performed by displacing the Instron actuator down against a rounded attachment centered at a distance of 4in from the aluminum box (see Figure 1a). Instron displacement was imposed at a rate of 0.8 in/min to a limit of 1in displacement while recording load-displacement data at a frequency of 100 Hz. Each specimens' peak load and construct stiffness, evaluated from the linear regression, were used to characterize the biomechanical performances. Differences among the groups were evaluated using Analysis of Variance (ANOVA) while specific differences were evaluated using T-test with a level of significance set at 5%.

Results: Judging from the bending tests' results, all the specimens were able to withstand the 1in displacement with exemption of one specimen potted with polyepoxide resin that exhibited a fracture in the potting at 10mm of imposed displacement corresponding to a load of 3098N. In the first 10mm of displacement, the construct potted with polyester resin was less stiff than both the polyester resin ($p=0.01$) and polyurethane ($p<0.01$, see Figure 2a). In tension, the stiffer construct was the polyepoxide (3141N/mm±594) which was not much different from the value found for the polyurethane ($p=0.248$) but superior to the value found for the polyester potting ($p=0.01$, see Figure 2b).

Discussion: The results we have found in both tests indicate a strong influence of the potting media on the construct stiffness. Although the polyepoxide resin has shown high stiffness as hypothesized, it exhibited a fracture within the first 10mm of imposed displacement in bending. The polyester resin has resulted to be the less suitable for biomechanical testing. While the testing conditions here were particularly designed for long bones, the results can be broadly applied to other types of bones. The main limitation of the study is given by the fact that temperatures were not reported while suitability of the media should also account for the soft tissue damage resultant from the thermal stress induced by the exothermic reaction of the chosen media. In conclusion, the polyurethane exhibited high stiffness without showing signs of fractures within the range of imposed displacements considered in the study.

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THE RELATIONSHIP BETWEEN SKIN TEMPERATURE AND CORE TEMPERATURE DURING RAPID HEAT STRESS

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Previous research has evaluated the association between skin temperature (Tsk) and core temperature (Tc) during various types of heat stress. However, there is no research to date evaluating skin temperature (Tsk) and core temperature (Tc) differences during rapid heat stress (RHS). RHS is an uncompensable form of heat stress that occurs while wearing firefighter personal protective equipment (PPE) in the heat and results in double the heat stress load per minute compared to normothermic conditions. **PURPOSE:** To assess the differences between Tsk and Tc during RHS. **METHODS:** 12 subjects (mean 34.62 ± 10.26 years) performed a steady state exercise protocol to the termination point of Tc 39°C while in firefighter PPE in an environmental chamber. Tsk was recorded at the time points at which the subjects reached Tc 37.5°C, Tc 38°C, Tc 38.5°C, and Tc 39°C. Tsk and Tc values were compared at each point to determine if differences existed. **RESULTS:** There was no difference between Tsk and Tc at the time points associated with Tc 37.5°C and Tc 39°C. There were differences between Tsk and Tc at the time points associated with Tc 38°C (Tsk mean: 38.34 $\pm$ 0.50 °C, $p \leq 0.05$) and Tc 38.5°C (Tsk mean: 38.89 $\pm$ 0.55 °C, $p \leq 0.05$). **CONCLUSION:** Although speculative, these results suggest that early in the RHS bout, the body has the ability to move heat effectively to the periphery to expel heat into the microclimate between the subject at the PPE. At this point, the microclimate is relatively low in humidity and temperature. This results in the maintenance of Tsk and Tc values. As RHS continues, the core continues to move heat to the periphery resulting in an excessively humid and hyperthermic microclimate due to the lack of permeability in the PPE. This creates higher Tsk values in comparison to Tc values at the time points associated with Tc 38°C and 38.5°C. Finally, at the termination of the RHS bout (Tc 39°C), Tsk and Tc equate due to a non-optimal temperature and humidity gradient between the core and microclimate within the PPE. This creates an uncompensable heat stress environment where the microclimate can no longer support thermoregulation.

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UPREGULATION OF α4β2 NICOTINIC ACETYLCHOLINE RECEPTORS BY POSITIVE ALLOSTERIC MODULATORS

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Upregulation (increased density) of brain nicotinic acetylcholine receptors (nAChRs), especially of the α4β2 subtype, has been documented in human smokers and in animals chronically treated with nicotine or other nAChR agonists. This phenomenon plays a role in nicotine-associated behaviors including rewards and dependence. As nAChR positive allosteric modulators (compounds that enhance agonist-induced receptor function) represent a promising strategy for treatment of nicotine dependence, it is important to evaluate their effects on upregulation of nAChRs. Here, we examine the effect of a series of potent nAChR PAMs (CMPI, dFBr, LY2087101) on the α4β2 nAChR density in HEK293 cell line stably expressing the human α4β2 nAChR (HEK-hα4β2). HEK-hα4β2 were treated with vehicle (control) or increased concentrations nicotine or PAMs, alone or in combination, for 24-48 hours. Following the treatment, the membrane fractions of the cells were isolated, and α4β2 nAChR density was determined using [^{3}H]epibatidine equilibrium binding and western blot analyses. Among PAMs tested so far, we found that the treatment with dFBr at 30 μM resulted in α4β2 nAChR upregulation that is comparable to that with nicotine. However, dFBr did not enhance nicotine-induced α4β2 nAChR upregulation and the observed upregulation with combined nicotine and dFBr treatment can be accounted by their individual effect on α4β2 nAChR density. Experiments are ongoing to elucidate if the effect of dFBr on receptor density correlates with dFBr enhancement of agonist-induced receptor function or it is due to a nAChR-independent mechanism.

THE EFFECT OF CANNABIDIOL (CBD) ON LIVER AND LUNG CELL VIABILITY

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Cannabidiol (CBD) has recently been approved by the FDA for the treatment of certain types of seizures and is widely used as a recreational treatment for a host of conditions ranging from anxiety and depression to pain. However, the hepatotoxicity of CBD has been documented in clinical trials. The exact mechanism(s) that contributes to CBD hepatotoxicity is not clearly understood nor is it known how this compares to CBD potential toxicity to other cell types. The objective of this experiment is to determine the toxic concentrations of CBD for liver cells in comparison to lung epithelia cells, which highly susceptible to CBD introduced via vaping. For CBD toxicity determination, human hepatic cells **(**HepG2; HB-8065™) and lung cells (BEAS-2B; CRL-9609™ and A549; CCL-185 ™) were seeded in 96-well plates and treated for 24 and 48 hours with increasing concentrations of CBD then cell viability was determined using CyQUANT MTT Cell Viability Assay according to the manufacturer's protocol. Each experiment is done in 3 independent plates each containing 4-6 wells per treatment condition. Our preliminary results demonstrate that CBD at concentration as low as 10 μg/mL substantially decrease (>50%) HEPG2 cell viability in a concentration dependent manner. Experiments are ongoing to determine CBD toxicity at lung epithelial cells, the time course of CBD cellular toxicity, and subcellular alterations leading to CBD-induced cellular toxicity.

INVESTIGATING THE POTENTIAL OF NANOCERIA IN A CELLULAR MODEL OF FIBROSIS

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Excess reactive oxygen species (ROS) negatively influence the wound healing process damaging surrounding healthy tissues, causing cell apoptosis and among other things, might result in fibrosis. ROS is involved both directly and indirectly in the development of hypertrophic scarring upon injury. Thus, the modulation of the tissue microenvironment is necessary to prevent further oxidative stress. Cerium oxide nanoparticles (nanoceria) scavenge and inactivate ROS and can potentially be used as a therapeutic to reduce fibrosis. An MTT assay was performed to determine fibroblast cell metabolic activity with the addition of different concentrations of nanoceria solution. In this experiment, the increased concentration of nanoceria solution decreased fibroblast and macrophage cell metabolic activity. This data makes a foundation for what concentration of nanoceria can be used for further research when studying fibrotic conditions.

THE RELATIONSHIP BETWEEN SKIN TEMPERATURE AND CORE TEMPERATURE DURING RAPID HEAT STRESS

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Previous research has evaluated the association between skin temperature (Tsk) and core temperature (Tc) during various types of heat stress. However, there is no research to date evaluating skin temperature (Tsk) and core temperature (Tc) differences during rapid heat stress (RHS). RHS is an uncompensable form of heat stress that occurs while wearing firefighter personal protective equipment (PPE) in the heat and results in double the heat stress load per minute compared to normothermic conditions. **PURPOSE:** To assess the differences between Tsk and Tc during RHS. **METHODS:** 12 subjects (mean 34.62 ± 10.26 years) performed a steady state exercise protocol to the termination point of Tc 39°C while in firefighter PPE in an environmental chamber. Tsk was recorded at the time points at which the subjects reached Tc 37.5°C, Tc 38°C, Tc 38.5°C, and Tc 39°C. Tsk and Tc values were compared at each point to determine if differences existed. **RESULTS:** There was no difference between Tsk and Tc at the time points associated with Tc 37.5°C and Tc 39°C. There were differences between Tsk and Tc at the time points associated with Tc 38°C (Tsk mean: 38.34 $\pm$ 0.50 °C, $p \leq 0.05$) and Tc 38.5°C (Tsk mean: 38.89 $\pm$ 0.55 °C, $p \leq 0.05$). **CONCLUSION:** Although speculative, these results suggest that early in the RHS bout, the body has the ability to move heat effectively to the periphery to expel heat into the microclimate between the subject at the PPE. At this point, the microclimate is relatively low in humidity and temperature. This results in the maintenance of Tsk and Tc values. As RHS continues, the core continues to move heat to the periphery resulting in an excessively humid and hyperthermic microclimate due to the lack of permeability in the PPE. This creates higher Tsk values in comparison to Tc values at the time points associated with Tc 38°C and 38.5°C. Finally, at the termination of the RHS bout (Tc 39°C), Tsk and Tc equate due to a non-optimal temperature and humidity gradient between the core and microclimate within the PPE. This creates an uncompensable heat stress environment where the microclimate can no longer support thermoregulation.

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HIGH WAVENUMBER RAMAN ANALYSIS OF HUMAN DENTAL ENAMEL

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Water is a critical component of dental tissues, impacting their structure and properties. Although nuclear magnetic resonance (NMR) techniques have traditionally been utilized to investigate water in dental tissues, Raman spectroscopy offers valuable insights into material structure analysis. In this study, we present a research endeavor employing a customized dual-wavelength excitation Raman spectrometer for high wavenumber Raman analysis in dental tissues.

Disidentified teeth, extracted for routine clinical purposes, were collected from local oral and maxillofacial surgery clinics. The teeth underwent sterilization with a 10% formalin solution, followed by rinsing with distilled water and storage in simulated saliva. Over 30 healthy premolars and molars were embedded and sectioned using a low-speed diamond saw cooled with distilled water, resulting in more than 60 sample beams categorized into enamel, dentin, and dentin-enamel junction groups. The sample beams were stored in refrigerated simulated saliva and equilibrated to room temperature by overnight incubation in simulated saliva prior to experimentation.

Raman spectra were acquired from multiple marked locations on each sample, capturing variations before and after demineralization. Eight random spots, slightly spaced (~20 μm) apart, were selected at each location, and the average spectrum represented that specific location. Additional investigations involved analyzing residual teeth pieces resulting from cutting to explore water variations within individual tissues and across different tissue interfaces, encompassing enamel, dentin, cementum, and dentin tubules.

This study aims to provide insights into water distribution and characteristics in dental tissues through high wavenumber Raman analysis. The findings will enhance our understanding of water's role in dental health, facilitating the development of improved diagnostic and treatment strategies.

EVALUATING A MACROPHAGE INFLAMMATORY PROFILE IN RESPONSE TO RASPBERRY KETONE *IN VITRO* FOR GUIDED BONE REGENERATION

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Guided bone regeneration is a method of treating oral bone defects that utilizes resorbable membranes to prevent soft tissue infiltration. To enhance healing, strategies to influence the bioactivity of barrier membranes are being investigated, including the local delivery of active compounds. Macrophage polarization is another strategy that can be implemented to facilitate the healing process. During healing, macrophages polarize from a pro-inflammatory phenotype (M1) to a pro-healing phenotype (M2). Raspberry Ketone (RK) is a phenolic compound of red raspberry that has shown significant potential in the promotion of macrophage polarization toward the M2, pro-healing, phenotype.

This study evaluated the immunomodulatory effects of RK on RAW 264.7 cells (ATCC-TIB-71) through in vitro microarray analysis. Cells were seeded in 24 well plates at 100,00 cell/ml and incubated in DMEM supplemented with 10% FBS and 1% penicillin, streptomycin, and neomycin for 24 hours. After 24 hours, M1 polarization was induced by incubating with medium containing 1 µg/mL lipopolysaccharide. After 24 hours of LPS incubation, medium was replaced with DMEM, DMEM containing 300 ng/ml Prostaglandin E2 or DMEM containing 60 µg/ml RK. On days 1, 2, and 3 after initial LPS stimulation, groups (n=1) were assayed for nitrite concentration, and a microarray (RayBiotech Mouse Cytokine Array Q1, GA) evaluated 20 inflammatory cytokines associated with macrophage polarization. RK treated groups saw a decrease in pro-inflammatory cytokines and an increase in pro-healing cytokines. Additionally, microarray results confirmed prior single cytokine assays for IL-1β and TNF-α, indicating that RK has a positive effect on polarizing macrophages.

ANALYSIS OF GBR MEMBRANE WOUND HEALING IN A CRITICAL SIZE RAT SKULL DEFECT MODEL

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This study investigates the potential of hexanoic-modified electrospun chitosan membranes (ESCM) loaded with raspberry ketone (RK) and simvastatin (SMV) for enhancing bone regeneration in rat calvarial defects. Guided bone regeneration (GBR) membranes, combining barrier function and biological activity, hold promise for improved healing. Chitosan's biocompatibility and cost-effectiveness, alongside RK's immunomodulatory effects and SMV's osteogenic properties, contribute to their attractiveness.

We compared the healing efficiency of RK-SMV-loaded ESCM with a collagen membrane containing BMP-2. ESCMs were gas-sterilized and loaded with varying RK-SMV concentrations. Rats underwent calvarial defect surgery, and implants were placed. MicroCT scans and histological evaluations were performed at 2, 4, and 8 weeks, with statistical analyses and inflammatory scores computed.

MicroCT results demonstrated progressive bone fill across all groups. Collagen-BMP-2 consistently outperformed dual loaded ESCM in bone fill. At 8 weeks, collagen-BMP-2 achieved 71±15% bone fill, while ESCM-1 and ESCM-2 reached 40±13% and 45±15%, respectively. Collagen-BMP-2 induced ectopic bone formation.

Histological assessments involved scoring H&E-stained samples on a 0-4 inflammation scale, with lower scores indicating reduced inflammation. All groups exhibited declining inflammation over time, with no significant difference between ESCM groups. By 8 weeks, collagen-BMP-2 scored 1.41, and ESCM-1 and ESCM-2 scored 2.00 each.

In conclusion, RK-SMV-loaded hexanoic-modified ESCM exhibit potential for bone regeneration. While collagen-BMP-2 excels in bone fill, ESCM groups hold promise. Future research could optimize RK-SMV concentrations to enhance regenerative effects and mitigate ectopic bone formation. This contributes to advancing GBR membranes with augmented biological activity, offering prospects for enhancing bone healing and regeneration.

A BIOMECHANICAL STUDY OF SHAPE MEMORY STAPLE CONFIGURATIONS IN A SIMULATED FIRST TMT ARTHRODESIS

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Stand-alone single 2-legged shape memory staples are routinely used in foot and ankle arthrodesis surgery to promote fusion by maintaining a compressive force across the fixation site. Multiple staple constructs or staples with more than two legs are available to increase stiffness. However, the comparative biomechanical properties of these various constructs are unknown. Four staple constructs were compared under cyclic 4-point bending and torsional loading conditions. METHODS: Anatomic composite Sawbones models of the medial cuneiform and first metatarsal were used to simulate a tarsometatarsal (TMT) arthrodesis. Four staple constructs were tested: two different 4-legged single staple constructs and two 2-legged staples constructs placed in parallel or orthogonally. Each staple configuration underwent 50 cycles of 4-point bending followed by 50 cycles of torsional loading. Measurements included axial stiffness (to characterize bending properties), torsional stiffness, and compressive force across the fracture site. A Shapiro-Wilks test assessed normality, a Kruskal Wallis test determined differences between staple configuration, and a Student-Newman-Keuls (SNK) test was used to test the rank difference between each staple configuration. RESULTS: For the 4-legged staple configurations, increasing bridge length caused a significant increase in applied axial stiffness and a significant decrease in torsional stiffness. An orthogonal staple configuration significantly increased torsional stiffness compared to the parallel configuration as well as both single 4-legged staple constructs. CONCLUSION: For the 4-legged staples, even though increasing bridge length increased axial stiffness, a drop in torsional stiffness occurred. Orthogonal staple configuration provided greater axial and torsional stiffnesses compared to parallel staple configuration.

A BIOMECHANICAL STUDY OF SHAPE MEMORY STAPLE CONFIGURATIONS

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Various nitinol shape memory staples are commercially available for foot and ankle surgery, but minimal information of their comparative biomechanical properties exist. A biomechanical testing protocol was developed to analyze nitinol staples under cyclic 4-point bending and torsional loading conditions. The protocol was repeated for varying bridge and leg length staples, simulating unicortical and bicortical fixation. The objective was to compare staple design parameters of leg length and bridge length. METHODS: Rectangular sawbones were used to create two unicortical constructs (15mm leg length with 15mm or 20mm bridge length) and two bicortical constructs (20mm leg length with 20mm or 25mm bridge length). Each construct underwent 50 cycles of 4-point bending followed by 50 cycles of torsional loading. Measurements included axial stiffness (to characterize bending properties), torsional stiffness, and compressive force across the fracture site. A Shapiro-Wilks test assessed normality, a Kruskal Wallis test determined differences between staple configuration, and a Student-Newman-Keuls (SNK) test was used to test the rank difference between each staple configuration. CONCLUDING DISCUSSION: Axial stiffness significantly

increased for staples with increased leg length and bridge length. Staples with leg lengths sufficient to achieve bicortical fixation had an increased axial stiffness compared to unicortical fixation for staples with similar bridge lengths. For unicortical staple constructs, increased bridge length reduced torsional stiffness. For bicortical staple constructs, increased bridge length increased torsional stiffness, but reduced axial stiffness. Overall, bicortically placed staples maintained significantly more compression across the fracture staples as well as increased axial stiffness compared to unicortically placed staples.

A NOVEL OFFLOADING SPINAL ORTHOSIS TO REDUCE LOW BACK INJURIES DURING LIFTING EXERCISES

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A Distractive and Mobility-Enabling Orthosis (DMO) was designed to alleviate the recurring problem of mechanical lumbar strain during lifting sports. The objective was to determine the effects of the DMO on muscle activity during a dead-lift exercise. METHODS: Motion capture and wireless EMG systems were used to measure kinematics and paraspinal muscle responses, respectively, during three lifting tasks (0kg, 8kg, and 16kg) while wearing no DMO, activated DMO (80N distractive force), and non-activated DMO. Ten participants completed 5 Russian dead lifts holding each external weight for each brace condition. Muscle force was estimated as a single paraspinal muscle group using a static equilibrium moment balance. Any effect of the DMO on EMG response or calculated muscle force was determined by a 1x3 repeated measures ANOVA and post-hoc paired samples t-tests. RESULTS: Peak EMG values of the paraspinal muscle group did not differ across the brace conditions during each lifting task ($p<0.05$), confirming addition of the DMO did not affect muscle activity. The muscle force calculations also revealed there was no difference in the muscle force produced between the brace conditions during each lifting task ($p<0.05$). CONCLUSION: This study provided evidence that the DMO can offload the lumbar spine during a lifting exercise without compromising muscle involvement as the EMG responses and estimated muscle force from the paraspinals remained consistent between the brace conditions, even as external weight increased. Moreover, these results revealed that the use of the DMO during exercises could possibly minimize the risk of low back injuries.