SOUTHERN BIOMEDICAL ENGINEERING CONFERENCE

40th Annual Meeting

September 13-15, 2024

Louisiana State University Health Shreveport

http://sbeconference.org

Program

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

Dr. Giovanni F. Solitro is an Associate Professor and the Director of Biomechanics Research and Education at Louisiana State University Health in Shreveport. He earned his first PhD in Mechanical Engineering in 2010, focusing his dissertation on patient-specific modeling of the human spine. In 2015, he completed postdoctoral training at the University of Illinois at Chicago (UIC), where he continued as a Senior Research Specialist in the Department of Orthopedics. During his tenure at UIC, he pursued a second PhD, with his dissertation centered on intraoperative assistance in pedicle screw placement. He serves on the editorial boards of leading journals in bioengineering and orthopedics and is a voting member of the ASTM Medical and Surgical Materials and Devices Committee. He has authored numerous peer-reviewed publications in orthopedics and biomedical engineering, with his work earning international recognition and prestigious awards from academic institutions and scientific organizations. In his current role, Dr. Solitro is committed to improving patient outcomes by advancing the understanding of the body's mechanical systems. His primary expertise lies in the advanced modeling of joints to enhance the precision of orthopedic surgery. His research interests encompass surgical skill training, knowledge-based orthopedics, total hip replacement, and biomechanics of the spine, and intraoperative navigation.

Program Vice-Chair: Dr. Santosh Aryal, University 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 in the Dept. 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).

Program Vice-Chair: Dr. Amol Janorkar , University of Mississippi Medical Center, Jackson, MS, USA, ajanorkar@umc.edu

Amol V. Janorkar received his B.S. in chemical engineering from University of Mumbai Department of Chemical Technology (UDCT) in 2000 and his Ph.D. in chemical engineering from Clemson University in 2005. Subsequently, he did a two-year postdoctoral research fellowship at the Center for Engineering in Medicine with a joint appointment at the Harvard Medical School, Massachusetts General Hospital, and Shriners Hospital for Children. He joined the faculty of the Department of Biomedical Materials Science, School of Dentistry at the University of Mississippi Medical Center (UMMC) in August 2007 as an Assistant Professor. Dr. Janorkar was promoted to the rank of Associate Professor (with tenure) in July 2013 and then to the rank of Professor in July 2017. Beginning in July 2020, Dr. Janorkar was entrusted with the responsibility of being the Chairperson for the Department of Biomedical Materials Science. In his other administrative service roles, Dr. Janorkar is serving as the Professional Development Liaison for the School of Dentistry, the Chair of the UMMC Intellectual Property Committee, and the Co-Director of the NIH-funded Mississippi Center for Clinical and Translational Research (MCCTR) Mentoring Academy. With his training and experience in the field of biomaterials and tissue engineering over the past 23 years, Dr. Janorkar leads a research group that focuses on cell-biomaterial interactions to direct cell morphology and ultimate cell function. The Janorkar Lab uses chemical and physical modification of biopolymer substrates to create three-dimensional in vitro tissue models that achieve enhanced survival and biological function versus conventional cultures for liver, adipose, and bone tissue engineering. His research has been funded by the National Science

Foundation (NSF), the National Institutes of Health (NIDCR and NIBIB), and the United States Department of Agriculture (USDA). Dr. Janorkar has published over 70 journal articles and 50 conference proceedings. Dr. Janorkar and his students have made over 100 conference presentations. Recognizing these research accomplishments, the University of Mississippi Medical Center has awarded Dr. Janorkar the Gold, Silver, and Bronze Medallions for Research Excellence. Dr. Janorkar served as the founding Director of the summer research program that has trained over 250 dental and undergraduate students over past 15 years. Recognizing his contributions to dental research, he has been inducted into the Omicron Kappa Upsilon National Dental Honor Society, which rarely inducts non-dentist faculty members. Dr. Janorkar also served as the Director of the Ph.D. graduate program with focus on Biomedical Materials Science from 2016-2020. He continues to serve as the director and course faculty for dental and graduate courses. Dr. Janorkar has mentored over 80 graduate, undergraduate, dental, and medical students and post-docs. His students have won 44 awards for outstanding research at local and national levels. Recognizing his teaching and mentoring, Dr. Janorkar was awarded the TEACH (Toward Educational Advancement in Care and Health) Prize, the highest award given to an educator by the University of Mississippi Medical Center. He has also been inducted into the Nelson Order of Teaching Excellence and the UMMC Academy for Excellence in Education (AEE). Dr. Janorkar currently serves as the President of the AEE. Dr. Janorkar is a senior member of the American Institute of Chemical Engineers (AIChE) and an active member of the Society for Biomaterials (SFB).

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).

40th SOUTHERN BIOMEDICAL ENGINEERING CONFERENCE

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FIU Engineering & Computing Biomedical Engineering

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Endorsement

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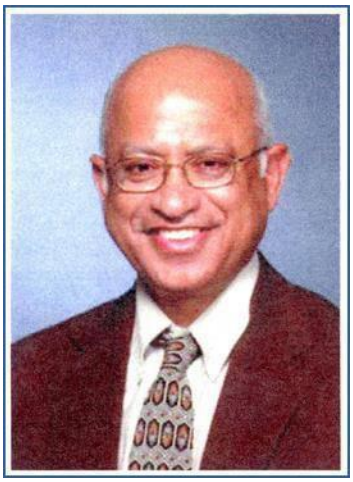
40th SOUTHERN BIOMEDICAL ENGINEERING CONFERENCE

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 in Shreveport, LA, at the LSU Health formerly LSU Medical Center, 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 the best paper and presentation awards to undergraduate, graduate, and professional students.

Conference Information

The format of the conference is to have two concurrent sessions, with each presentation limited to 15 minutes (12-minute presentation and 3-minute discussions). Room assignments for each session is posted at the sessions below and entire program can be accessed at the conference website.
Poster presentations will be held on the second floor around the auditorium Room 2315. 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 **LSU HEALTH SHREVEPORT (LSUHS) Center for Medical Education (CME) Building, Rooms: 1304, 1307, Plenary presentation will be held in auditorium: 2315 and Banquet will be conducted at the CME Gym))**

All the accepted abstracts/papers will be published in an archival proceeding program book entitled **BIOMEDICAL ENGINEERING: RECENT DEVELOPMENTS**. The program review committee selected limited number of abstracts 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 at noon. Winners must be present for cash prizes of the awards.

40th SOUTHERN BIOMEDICAL ENGINEERING CONFERENCE

Registration

Registration* Fee includes access to all conference events, program copy, lunches, banquet, 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*

Category	Before July 12	After July 12
Investigators/Staff	**$375**	**$475**
Students	**$225**	**$375**
Companion*	**$150**	**$180**
Publication Fee	**$90**	**$90**

- **Companion fee includes access to event functions and excludes attending or presenting in the scientific sessions.**
- **Registrations after July 12, 2024 is nonrefundable due to placing orders for event functions.**
- **Failure to register or no show will result in removal of abstract from program post meeting.**

Hotel Information: Detailed information for each hotel can be found on fourwaves:
Hilton Shreveport– 104 Market Street- Booking Website: https://book.passkey.com/e/50843403
Holiday INN Express -201 Lake Street- Booking Link https://www.hiexpress.com/redirect?path=hd&brandCode=EX&localeCode=en®ionCode=1&hotelCode=SHVLK&_PMID=99801505&GPC=SBE&cn=no&viewfullsite=true
Horseshoe Casino– Booking link https://www.caesars.com/book/?propCode=UBC&action=FindRooms&groupcode=S09SBE4

https://www.explorelouisiana.com/articles/top-things-do-shreveport

https://www.visitshreveportbossier.org/events/events-this-weekend/

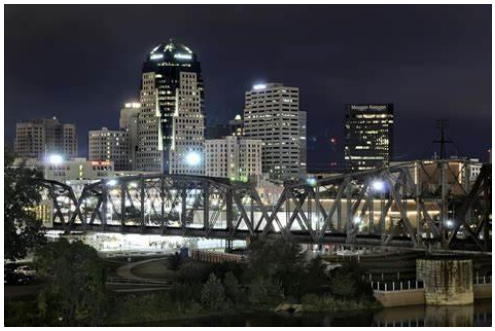
40th SOUTHERN BIOMEDICAL ENGINEERING CONFERENCE

40th Annual Meeting

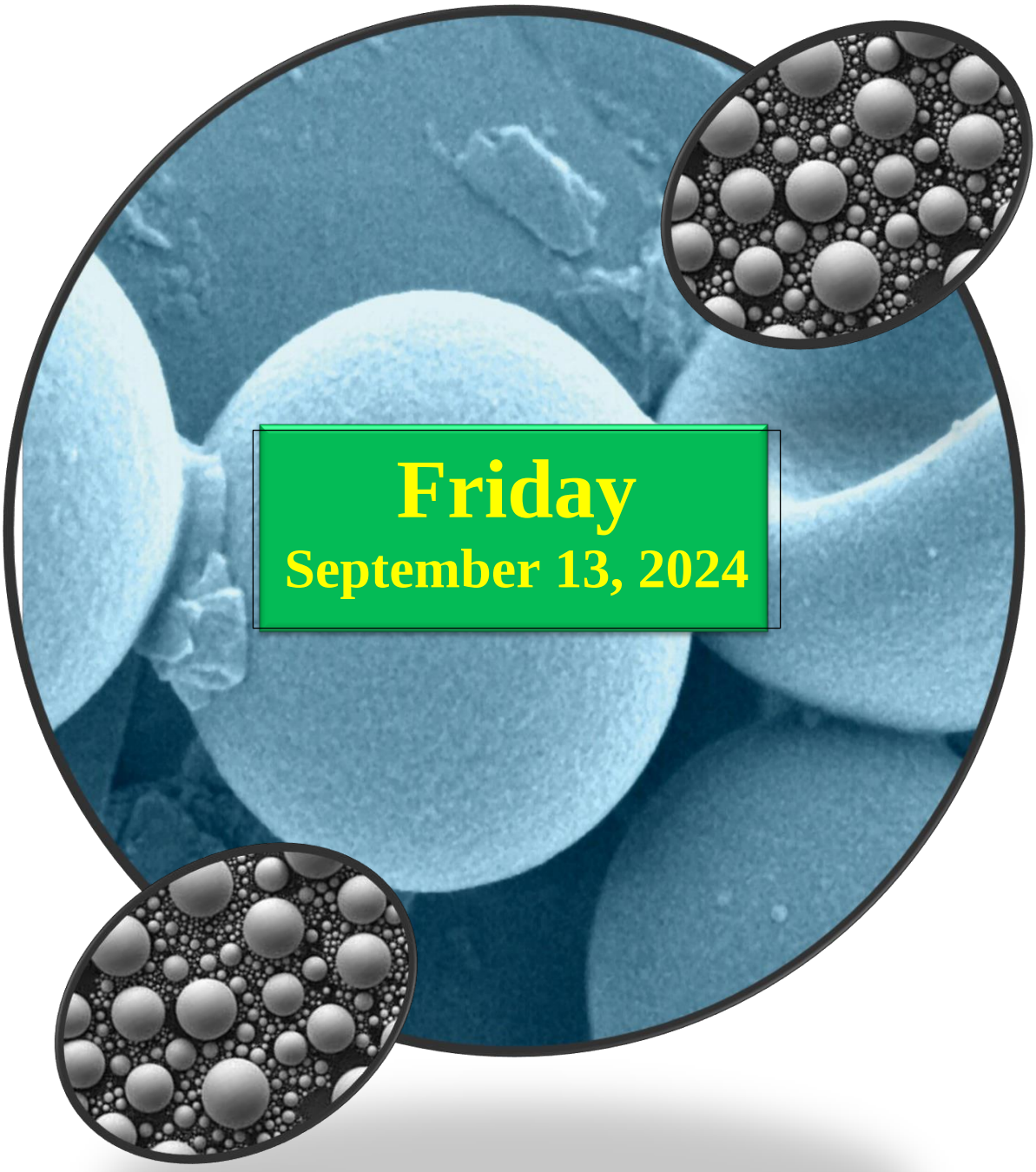
Program

Thursday, September 12, 2024

4:00 PM-6:00 PM: Registration at LSUHS, Center for Medical Education



40th SOUTHERN BIOMEDICAL ENGINEERING CONFERENCE



Friday
September 13, 2024

40th SOUTHERN BIOMEDICAL ENGINEERING CONFERENCE

Friday, September 13, 2024

7:00 am – 6:00 pm **Registration**

7:15 am **Welcoming Remarks, Room# 1307**

Program Chair

Giovanni Solitro, Ph.D

Program Vice-Chairs

Santosh Aryal, PhD and Amol Janorkar, PhD

Conference Co-Chairs

Michelle Tucci, PhD and Ham Benghuzzi, PhD

Chairman of Steering Committee Remarks

Subrata Saha, PhD (Virtual)

Scientific Sessions (all odd number sessions will be held in Room 1307 and all even number sessions will be held in Room 1304)

Friday Morning	Presentation#	CME Room# 1307
Time (am)		**Session 1: Ethics in Education** **Session Chair:** Kenneth Butler, PhD, University of Mississippi Medical Center **Co-Chair:** Larry McDaniel, PhD, University of Mississippi Medical Center
7:30	**1-1**	**VACCINATION ETHICS AND CONCERNS IN HUMAN POPULATIONS** *Larry McDaniel and D. Olga McDaniel* *University of Mississippi Medical Center, Jackson, MS*
7:45	**1-2**	**ETHICS OF GENOME RESEACH** *D. Olga McDaniel, Larry McDaniel, Charles Moore* *University of Mississippi Medical Center, Jackson, MS*
8:00	**1-3**	**ETHICAL CONCERNS IN BIOMEDICAL PUBLISHING I** *Gary Hamil[1], Hamed Benghuzzi[2], Michelle Tucci[3], Kenneth Butler[3]* *[1]Belhaven University, [2]Jackson State University, [3]University of Mississippi Medical*
8:15	**1-4**	**ETHICAL CONCERNS IN BIOMEDICAL PUBLISHING II** *Kenneth Butler[1], Hamed Benghuzzi[2], Michelle Tucci[1], Gary Hamil[3]* *[1]University of Mississippi Medical Center, [2]Jackson State University, [3]Belhaven University*
8:30		**BREAK**

8:30- 8:45 Coffee Break Visit the Posters

Friday Morning	Presentation #	Concurrent CME Room# 1304
Time		**Session 2: Ergonomics and Prosthetics I** **Session Chair**: Albert Manero, PhD, Limbitless Solutions **Co-Chair**: Denis J. DiAngelo, PhD, The University of Tennessee Health
7:30	2-1	**PRELIMINARY INSIGHTS FROM A MULTIYEAR 3D-PRINTED PROSTHESIS CLINICAL TRIAL** *Viviana Rivera[1], Calvin MacDonald[1], Elizabeth Barnum[1], Peter Smith[2], Matt Dombrowski[2], John Sparkman[1], Kelly Dunbar[3], Albert Chi[3], Rosanne Yee[3], Albert Manero[1]* *[1]Limbitless Solutions, University of Central Florida, [2]University of Central Florida, [3]Oregon Health Science University*
7:45	2-2	**THE ROLE OF OBESITY IN PHYSIOLOGICAL STRESS AND PROPRIOCEPTION DURING REPETITIVE MANUAL MATERIAL HANDLING TASKS** *Sergio Lemus[1], Jaron Mohammed[1], Eduard Tiozzo[2], Francesco Travascio[1, 3, 4]* *[1]Department of Mechanical and Aerospace Engineering, University of Miami, [2]Department of Physical Medicine and Rehabilitation, University of Miami, Coral Gables, FL, [3]Department of Orthopaedics, University of Miami, [4]Max Biedermann Institute for Biomechanics at Mount Sinai Medical Center*
8:00	2-3	**DESIGN AND VALIDATION OF A NOVEL ERGONOMIC BACKPACK** *Denis DiAngelo[1], Lyndsey Bouve[1]* *The University of Tennessee Health Science Center*
8:15	2-4	**DYNAMIC PROSTHETIC INTERFACE FOR COMPETITIVE CYCLISTS: A STABILITY TEST** *Natalia McIver[1], Brandon Doehne[2], Leilani Baker[1], Evan Long[3], Christina Salas[1]* *[1]Department of Orthopaedics & Rehabilitation, The University of New Mexico, [2]Department of Mechanical Engineering, The University of New Mexico, [3]Orthotics & Prosthetics, Carrie Tingley Children's Hospital*
8:30		**BREAK**

8:30- 8:45 Coffee Break Visit the Posters

Friday Morning	Presentation	CME Room# 1307
Time		**Session 3: Artificial Intelligence and Health Care** **Session Chair:** Mohammad A Nobel Bhuiyan, PhD, LSU Health Shreveport **Co-Chair:** Steven Conrad, PhD,MD LSU Health Shreveport
8:45	3-1	**R-BASED MULTI-OMICS INTEGRATION PIPELINE FOR COMPREHENSIVE METABOLOMIC ANALYSIS** *Mohammad Alfrad Nobel Bhuiyan, Md Ismail Hossain* *Louisiana State University Health Shreveport, Shreveport, LA*
9:00	3-2	**Ejection fraction prediction from echocardiogram videos using AI** *Taymaz Akan, Mohammad Alfrad Nobel Bhuiyan* *Louisiana State University Health Shreveport, Shreveport, LA*
9:15	3-3	**PREDICTIVE MACHINE LEARNING MODELS FOR THE PROGRESSION OF ALZHEIMER'S DISEASE IN PATIENTS WITH MILD COGNITIVE IMPAIRMENT** *Fatih Gelir, Steven Conrad, Mohammad Alfrad Nobel Bhuiyan* *Louisiana State University Health Shreveport, Shreveport, LA*

9:30	**3-4**	**ADDRESSING DATA SCARCITY IN MEDICAL IMAGING: SYNTHETIC DATA GENERATION AND SELF-SUPERVISED LEARNING** *Scott Chase Waggener[1], Timothy Cogan[1], Lakshman Tamil[2]* *[1]MedCognetics, Inc., [2]University of Texas at Dallas*
9:45	**3-5**	**PULMONARY ARTERIAL HYPERTENSION WITH METHAMPHETAMINE USE: DECADE LONG DEMOGRAPHIC AND TREND ANALYSIS FROM 2008-2020** *Amanda Husein, Jolie Bouillon, Diensn Xing, Md Ismail Hossain, Mohammad Alfrad Nobel Bhuiyan* *Louisiana State University Health Shreveport, Shreveport, LA*
10:00	**3-6**	**ARTIFICIAL INTELLIGENCE AND IN VITRO FERTILIZATION:AN ETHICAL AND ANTICIPATORY ETHICAL ANALYSIS** *Richard Wilson* *Towson University Philosophy/Computer and Information Sciences*
10:15		**BREAK**

10:15- 10:30 Coffee Break Visit the Posters

Friday Morning	**Presentation #**	**CME Room# 1304**
Time		**Session 4: Medical Device and Implants I** **Session Chair:** Denis J. DiAngelo, PhD, University of Tennessee Health Science Center **Co-Chair**: Mila Shah-Bruce, Louisiana State University Health -Shreveport
8:45	**4-1**	**IMPLANT CUSTOMIZATION TO INCREASE IMPLANT EFFECTIVENESS IN ALIF** *Andrew Zhang[1], Mason Favre[1], Landyn Froberg[1], Giovanni Solitro[1]*
9:00	**4-2**	**DESIGN OF A DYNAMIC SCOLIOSIS BRACE FOR TREATING ADOLESCENT IDIOPATHIC SCOLIOSIS** *Clayton Rudolph[1], Derek Kelly[2], Denis DiAngelo[1]* *[1]University of Tennessee Health Science Center, Memphis, TN, USA, [2]Le Bonheur Children's Hospital, Memphis, TN, USA*
9:15	**4-3**	**DOES TKA ALTER SYNOVIAL FLUID PROPERTIES? A COMPARISON OF NECROPSY TKA AND CONTRALATERAL KNEE SPECIMENS** *Bailey Bond[1], Michael Kurtz[2], Shabnam Aslani[2], Madison Brown[1], Steven Kurtz[2], Jeremy Gilbert[3], William Mihalko[1]* *[1]University of Tennessee Health Science Center, [2]Drexel University, [3]Clemson University*
9:30	**4-4**	**IMBALANCE LOAD DETECTION IN KNEE IMPLANTS UTILIZING TRIBOELECTRIC ENERGY HARVESTING** *Mohammad Alghamaz[1], Alwathiqbellah Ibrahim[1]* *[1]University Of Texas at Tyler, Tyler Texas*
9:45	**4-5**	***USE OF MANIFOLD DEVICE TO PREVENT POST-OPERATIVE GASTROSTOMY LEAKAGE*** *Jensen (Alex) Crifasi[1]* *[1]Louisiana State University Health Shreveport School of Medicine, Shreveport, LA*
10:00	**4-6**	**A NOVEL PELTIER-CONTROLLED PHASE-CHANGE SOFT ACTUATOR FOR BIOMEDICAL APPLICATIONS** *Daniel Johnson [1], Trevor Exley [1], Rashmi Wijesundara[1], Amir Jafari[1]* *[1]University of North Texas*
10:15		**BREAK**

10:15- 10:30 Coffee Break Visit the Posters

Friday Morning	Presentation #	CME Room# 1307
Time		**Session 5: Nanomedicine and Drug Delivery** **Session Chair:** Santosh Aryal, PhD, University of Texas Tyler **Co-Chair**: Farah Deba, PhD, University of Texas Tyler
10:45	**5-1**	**NEUROPEPTIDE Y1 ANTAGONIST AMELIORATES WEIGHT GAIN IN POSTMENOPAUSAL ANIMAL MODELS** *Kenneth Butler[1], Michelle Tucci[1], Hamed Benghuzzi[2], Lamar Hamil[3]* *1University of Mississippi Medical Center, [2]Jackson State University, 3Belhaven University*
11:00	**5-2**	**CHARACTERIZATION OF INSULIN-SECRETING ARIP CELL LINE TREATED WITH GLUCAGON-LIKE PEPTIDE-1 TO EVALUATE THEIR SUITABILITY IN SUSTAINED-RELEASE DRUG DELIVERY FOR DIABETES TREATMENT** *Gary Hamil[1], Hamed Benghuzzi[2], Michelle Tucci[3], Kenneth Butler[3]* *[1]Belhaven University, [2]Jackson State University, [3]University of Mississippi Medical Center*
11:15	**5-3**	**OPTIMIZING PEGYLATED LIPOSOMAL DOXORUBICIN NANOPARTICLES FOR ENHANCED ANTICANCER EFFECT** *Troy Dane, Israel Joshua Santhosh, Viswanathan Sundaram, Shoukath Sulthana, Santosh Aryal* *University of Texas at Tyler*
11:30	**5-4**	**ENGINEERING OF NATURAL KILLER CELL-DERIVED EXTRACELLULAR VESICLES WITH LIPOSOMES FOR TARGETED CANCER THERAPY AND DIAGNOSIS** *Viswanathan Sundaram, Sriyam Joshi, Dinesh Shrestha, Israel Joshua Santhosh, Shoukath Sulthana, Santosh Aryal* *University of Texas at Tyler*
11:45	**5-5**	***EVALUATING CELLULAR-BASED DRUG DELIVERY THROUGH IMMUNE AND CANCER CELL INTERACTION*** *Israel Joshua Santhosh, Macie Kirby, Shoukath Sulthana, Dinesh Shrestha, Santosh Aryal* *University of Texas at Tyler*
12:00		**LUNCH**

Concurrent Session

Friday Morning	Presentation #	CME Room# 1304
Time		**Session 6: Kinesiology and Rehabilitation** **Session Chair:** Cory Coehoorn, PhD, Louisiana State University Health Shreveport **Co-Chair**: Christinie Walck, PhD, Embry-Riddle Aeronautical University
10:45	**6-1**	**IMPACT OF DIFFERENT BIOMECHANICAL MODELS ON KNEE KINEMATICS, RELIABILITY AND BICYCLE FIT RECOMMENDATIONS** *Erin McCallister, Nicholas Russell* *Louisiana State University Health Shreveport*
11:00	**6-2**	**COMPARISON OF SELECTED GAIT PARAMETERS IN NULLIPAROUS FEMALES WITH AND WITHOUT URINARY INCONTINENCE** *Amanda Mahoney, Erin McCallister, Clifton Frilot, Alexander Gomelsky, Daniel Flowers* *Louisiana State University Health Shreveport*

11:15	**6-3**	**COMPARISON OF A DYNAMIC ANKLE ORTHOSIS WITH A CLINICAL WALKING BOOT ON TIBIAL COMPRESSIVE FORCE REDUCTION DURING TREADMILL WALKING** *Perri Johnson, Denis DiAngelo* *University of Tennessee Health Science Center*
11:30	**6-4**	**ASYMMETRY IN KINEMATICS OF DOMINANT/NONDOMINANT LOWER LIMBS IN CENTRAL AND LATERAL POSITIONED COLLEGE AND SUB-ELITE SOCCER PLAYERS** *Francisco Beron-Vera[1], Sergio Lemus[1], Bryan Mann[2], Francesco Travascio[1, 3, 4]* *[1]Department of Mechanical and Aerospace Engineering, University of Miami, [2]Department of Kinesiology and Sport Management, Texas A&M University, College Station, TX, [3]Department of Orthopaedics, University of Miami, [4]Max Biedermann Institute for Biomechanics at Mount Sinai Medical Center, Miami Beach, FL*
11:45	**6-5**	**TEMPORALIS MUSCLE TRAINING THROUGH SERIOUS GAMES FOR AUTONOMOUS WHEELCHAIR USERS** *Maanya Pradeep, Calvin MacDonald, Viviana Rivera, Peter Smith, Matt Dombrowski, John Sparkman, Albert Manero* *University of Central Florida*
12:00	**6-6**	***COMPARISON OF MEASURED VS. PREDICTED GROUND REACTION FORCES IN FULL BODY MUSCULOSKELETAL MODELING: A STUDY USING MARKER-BASED AND IMU-BASED KINEMATIC SYSTEMS*** *Maria Prado, Sakiko Oyama, Hugo Giambini* *The University of Texas at San Antonio*
12:15		**LUNCH Auditorium Room # 2315**

RW Norton Art Gallery
Thursday through Sunday, 1:00PM to 5:00PM
There is no admission charge

40th SOUTHERN BIOMEDICAL ENGINEERING CONFERENCE

General Event and Lunch

12:25-12:35 PM, Conference Opening

Auditorium Room # 1307

PLENARY LECTURE I

September 13, 2024

12:35-1:15 PM, Room # 1307

Introduction by Dr. Giovanni Solitro

"Pathways in Human Cancer"

Antonio Giordano, MD, PhD

Director & Professor, Sbarro Institute, Temple University ; University of Siena

Dr. Antonio Giordano is the President and Founder of the Sbarro Health Research Organization (SHRO), which conducts research to diagnose, treat and cure cancer, cardiovascular disease, diabetes, and other chronic illnesses.

Born in Naples, Italy October 11, 1962, Dr. Antonio Giordano is a Professor of Molecular Biology at Temple University in Philadelphia and a 'Chiara fama' Professor in the Department of Pathology & Oncology at the University of Siena, in Siena, Italy. Dr. Antonio Giordano is also the Director of the Sbarro Institute for Cancer Research and Molecular Medicine and the Center for Biotechnology at Temple's College of Science & Technology. In his research throughout the years, Dr. Antonio Giordano identified a tumor suppressor gene, Rb2/p130, that has been found to be active in the lung, endometrial, brain, breast, liver, and ovarian cancers. Dr. Antonio Giordano also found that if doses of gamma radiation are combined with this gene, it accelerates the death of tumor cells. Dr. Antonio Giordano went on to discover Cyclin A, Cdk9, and Cdk10. Cdk9 is known to play critical roles in HIV transcriptions, the inception of tumors, and cell differentiation. They also play a part in muscle differentiation and have been linked to various genetic muscular disorders. Dr. Antonio Giordano has also developed patented technologies for diagnosing cancer.

Dr. Antonio Giordano has published over 600 papers on gene therapy, cell cycle, genetics of cancer, and epidemiology. In 2011, Dr. Antonio Giordano and his team uncovered anti-tumor agents that might be effective in the treatment of mesothelioma, cancer caused by prolonged asbestos exposure. Dr. Antonio Giordano and his team discovered they could induce cell death without harming healthy cells.

Innovative research led by Dr. Antonio Giordano at the Sbarro Health Research Organization (SHRO), Temple College of Science and Technology's Sbarro Institute for Cancer Research and Molecular Medicine revealed that interventions using virtual reality (VR) during chemotherapy have significant potential to improve the quality of life—and possibly survival chances, by increasing adherence to therapy—in breast cancer patients. The study found that women undergoing chemotherapy who received a VR intervention during treatment had improvements in anxiety levels and mood when compared with women who did not receive the VR intervention.

In recent years, Dr. Antonio Giordano has also focused efforts on studying the relationship between cancer and environmental pollution in the Italian region of Campania. He was among the first to report an increased incidence of various types of cancer in populations near illegal toxic waste sites and published numerous findings including the link between cancer and multiple types of toxins attributed to the landfill wastes, such as reporting high levels of the cancer-causing dioxins in surrounding wildlife and high levels of heavy metals in cancer patients from the region. Dr. Antonio Giordano's work on the environmental disaster in this region was highlighted through two books on the subject, respectively "Campania, terra di veleni" (translated Campania; Land of Fires) and "Monnezza di stato", edited by Denaro Libri and one of these books was eventually produced as a movie. The publications also launched a petition to protect the environment, signed by over 500 researchers and people from various professional sectors.

Scientific Sessions

Friday Afternoon	Presentation#	CME Room# 1307
Time		**Session 7: Biomedical Education I** **Session Chair:** Joseph A. Cameron, PhD, Jackson State University, Emeritus **Co-Chair:** Judy Gordy, PhD, University of Mississippi Medical Center
1:15	**7-1**	**MECHANISMS FOR MOTIVATING HIGH SCHOOL SENIORS TO APPLY AND EARN SCHOLARSHIP FUNDS** *Joseph A. Cameron, Kesia Jones* *Jackson State University, Jackson, MS*
1:30	**7-2**	**COLLABORATIVE E-LEARNING PLATFORM FOR HEALTH PROFESSION STUDENTS WITH APPLICATION TO UNDERSTANDING SOCIAL DETERMINANTS IN OBGYN** *Urska Cvek[1], Sudeep Paudel[1], Aleksandra Ristic[1], Mila Shah-Bruce[2], Marjan Trutschl[1], Qingsong Zhao[1]* *[1]LSU Shreveport, [2]LSU Health Shreveport*
1:45	**7-3**	**THE PERCEPTIONS OF FACULTY AND STUDENTS REGARDING ARTIFICIAL INTELLIGENCE USAGE IN EDUCATION AT AN ACADEMIC MEDICAL CENTER** *Xiaoshan Gordy, Jacob Daniels, Britney Reulet, Robin Thompson, Driscoll DeVaul, Kristy Cole, John Garner, Angela Burrell* *University of Mississippi Medical Center, Jackson, MS*
2:00	**7-4**	**EPIDURAL EDUCATION FOR LABOR AND DELIVERY USING TELEMEDICINE** *Nicky Rugnath, Michelle Tucci* *University of Mississippi Medical Center, Jackson, MS*
2:15		**Break**

1:15 pm Keynote Speaker Session 8: Advanced Molecular and Cellular Technologies

Alex Sutton Flynt, PhD

Associate Professor
Cellular and Molecular Biology
University of Southern Mississippi

Following a childhood in southeast Kansas, Dr Flynt finished high school in Clarksville Tennessee. After that, he attended Austin Peay State University, earning a BS in biology in 2001. After an internship at the Mote Marine Laboratory, Dr Flynt undertook graduate studies at Vanderbilt University in the lab of James Patton. There he began working on RNAi biology in 2002 using the zebrafish model system. That work pioneered strategies to modulate expression of miRNAs in zebrafish using antisense oligonucleotides. In 2007 Dr Flynt completed his PhD and moved to New York City for postdoctoral studies at the Sloan Kettering Cancer Center in the lab of Eric Lai. The focus of his postdoctoral studies was using high-throughput sequencing datasets to identify novel miRNA and siRNA biogenesis pathways in *Drosophila*. In 2013 Dr Flynt joined the faculty at the University of Southern Mississippi where he built a flourishing research program funded by NIH, NSF, and private industry. Research in his lab broadly investigates the role of RNA biology in post-transcriptional gene regulation. Projects are focused on the biogenesis and function of non-coding, small regulatory RNAs. These molecules are most famously known as the effectors of RNAi and fall into distinct classes that vary by maturation pathway and function. To study these molecules Dr Flynt's lab takes a multidisciplinary approach that combines genetics, biochemistry, and bioinformatics. The major emphasis in the Flynt lab's approach is using transcriptiomics to gain insights for to developing novel approaches to inducing gene silencing. In addition to a sustained interest in small RNAs, Dr Flynt has collaborated heavily with material scientists, organic chemists, and biomedical engineers through EPSCoR consortia. Beyond research activities, Dr Flynt also serves as the PI/PD of the Mississippi INBRE program where he works with academic partners across the state of Mississippi to promote biomedical research capacity and enhance workforce development in related occupations.

Friday Afternoon	Presentation#	CME Room# 1304
Time		**Session 8: Advanced Molecular and Cellular Technologies** **Session Chair:** Amol Janorkar, PhD, University of Mississippi Medical Center **Co-Chair:** Karen Stokes, PhD Louisiana State University Health Shreveport
1:15	**Keynote**	**MODULAR RNA ENGINEERING TO POTENTIATE GENE SILENCING** *Alex Flynt* *University of Southern Mississippi, Hattiesburg, MS*
1:45	**8-1**	**DECIPHERING THE ROLE OF THE GENOME IN MASH USING MATURE IPSC-DERIVED HEPATOCYTES** *Tasneem Abdulrahman* *Louisiana State University Health Shreveport, Shreveport, LA*
1:45	**8-2**	**QUANTIFYING CELL-CELL ADHESION DYNAMICS: ATOMIC FORCE MICROSCOPY INVESTIGATION** *Sheetal Chowdhury[1], Dutton D. Day[1], Keri Donohue[2], Anne Mayo[2], Kevin Pilkiewicz[2], Jared Cobb[2], Michael Mayo[2], Amol V. Janorkar[1]* *[1]Department of Biomedical Materials Science, School of Dentistry, University of Mississippi Medical Center, Jackson, MS, [2]U.S. Army Engineer Research and Development Center (ERDC), Vicksburg, MS*
2:15		**Break**

2:15- 2:30 Coffee Break Visit the Posters

Friday Afternoon	Presentation #	CME Room# 1307
Time		**Session 9: Cardiovascular** **Session Chair:** Maricicia Pacurari, PhD, Jackson State University **Co-Chair:** Tarek Magdy Mohamed, PhD, Louisiana State University Health Shreveport
2:30	9-1	**DEMOGRAPHIC AND RISK FACTOR ANALYSIS OF STIMULANT INDUCED HEART FAILURE** *Akshat Agrawal* *Louisiana State University Shreveport, Shreveport, LA*
2:45	9-2	**PLANT-DERIVED XANTHOHUMOL TO TARGET LEUKEMIA CELLS** *Maricica Pacurari* *Jackson State University, Jackson, MS*
3:00	9-3	**A COST-EFFECTIVE BIAXIAL MECHANICAL TESTING SYSTEM FOR VASCULAR SPECIMENS** *Victoria Sartin[1], Maximilien Caffery[1], Ashleigh Phillips[1], Hobbs McAllister[1], Anna Claire Ricks-Boyd[1], Bruno Rego[2]* *Louisiana State University Health Shreveport*
3:15	9-4	**ROLE OF NCK1 SH2 AND SH3.1 DOMAINS IN ENDOTHELIAL ACTIVATION.** *Gerardo Cruz-Marquez[1], Cyrine Ben Dhaou[2], A. Wayne Orr[1, 2]* *[1]Department of Molecular and Cellular Physiology and [2] Department of Pathology Louisiana State University Health Shreveport*
3:30		**Break**

3:30-3:45 Coffee Break Visit the Posters

Friday Afternoon	Presentation#	CME Room# 1304
Time		**Session 10: Cartilage and Ligaments I** **Session Chair:** Tanvir Faisal, PhD, University of Louisiana at Lafayette, Lafayette, LA **Co-Chair:** Francesco Travascio, PhD, University of Miami, Miami, FL
2:30	10-1	**AN INVERSE FINITE ELEMENT APPROACH TO CHARACTERIZE MENISCUS MECHANICS AND COLLAGEN FIBER DAMAGE MECHANISMS** *Raul Santamaria[1], Gabi Schwartz[2], Thomas Best[2, 3], Alicia Jackson[2], Francesco Travascio[1, 3, 4]* *[1]Department of Mechanical Engineering, [2]Department of Biomedical Engineering, [3]Department of Orthopaedics, [4]Max Biedermann Institute for Biomechanics at Mount Sinai Medical Center*
2:45	10-2	**CREEP AND STRESS RELAXATION OF THE SCAPHOLUNATE INTEROSSEOUS LIGAMENT: A BIOMECHANICAL STUDY** *Natalia McIver[1], Mahmoud Reda Taha[2], Christina Salas[1]* *[1]Department of Orthopaedics & Rehabilitation, The University of New Mexico* *[2]Department of Civil Engineering, The University of New Mexico*
3:00	10-3	**EXTERNAL FIXATION V BRACING IN INITIAL TREATMENT OF MULTILIGAMENT TEARS OF THE KNEE** *Abigail Fruge, Patrick Massey, Hayden McBride, Brad Chauvin* *[1]Louisiana State University Health Shreveport*

3:15	**10-4**	**IN VITRO FORCE MEASUREMENTS ACROSS THE ANTERIOR CRUCIATE LIGAMENT BY PASSIVE FLEXION-EXTENSION OF THE KNEE** *Bryan Medina De La Paz, Natalia McIver, Leilani Baker, Tyag Patel, Christina Salas* *Department of Orthopaedics & Rehabilitation, The University of New Mexico*
3:30		**Break**

3:30-3:45 Coffee Break Visit the Posters

Friday Afternoon	**Presentation#**	**CME Room# 1307**
Time		**Session 11: Biomaterials I** **Session Chair:** Narayan Bhattarai, PhD, North Carolina A&T State University **Co-Chair:** Vladimir Reukov, PhD, University of Georgia
3:45	**11-1**	**CUSTOMIZABLE THIOL-CLICKABLE HYDROGELS FOR 3D CELL CULTURES** *Marc Torres, Veda Kolipakula, Praises Ogunbanwo, Melanie Ecker* *University of North Texas*
4:00	**11-2**	**MOLECULAR SIGNATURE DIFFERENCES BETWEEN PLACENTAL TROPHOBLASTS FROM NORMOTENSIVE AND PREECLAMPTIC PREGNANCIES IN RESPONSE TO VITAMIN D - A PROTEOMICS ANALYSIS** *Jie Xu[1], Yang Gu, Xinggui Shen, David Lewis, Dani Zoorob, Yuping Wang* *Louisiana State University Health Shreveport, Shreveport, LA*
4:15	**11-3**	**EXPLORING SHAPE MEMORY POLYMERS FOR BIOMEDICAL APPLICATIONS** *Raj Kumar Pittala, Jack Slayton, Melanie Ecker* *University of North Texas*
4:30	**11-4**	**CHARACTERIZATION OF INSULIN-SECRETING ARIP CELL LINE TREATED WITH GLUCAGON-LIKE PEPTIDE-1 TO EVALUATE THEIR SUITABILITY IN SUSTAINED-RELEASE DRUG DELIVERY FOR DIABETES TREATMENT** *Gary Hamil[1], Hamed Benghuzzi[2], Michelle Tucci[3], Kenneth Butler[3]* *[1]Belhaven University, Jackson, MS, [2]Jackson State University, Jackson, MS [3]University of Mississippi Medical Center, Jackson, MS*
4:45		**Break**

Concurrent Session

Friday Afternoon	**Presentation #**	**CME Room# 1304**
Time		**Session 12: Cartilage and Ligaments II** **Session Chair:** Francesco Travascio, PhD, University of Miami, Miami, FL **Co-Chair:** Yufeng Dong, PhD, Louisiana State University Health, Shreveport, LA
3:45	**12-1**	**ADVANCED MULTISCALE MODELING OF CARTILAGE: ASSESSING THE MECHANICAL INFLUENCE OF ZONAL AND RADIAL CELL VARIABILITY** *Md Saiful Islam[1], Tanvir Faisal[1]* *[1]Dept. of Mechanical Engineering, University of Louisiana at Lafayette, Lafayette, LA*
4:00	**12-2**	**MECHANICS OF AN INDIVIDUAL COLLAGEN FIBER: A FINITE ELEMENT ANALYSIS** *Md Imrul Kayes[1], Tanvir Faisal[1]* *[1]University of Louisiana at Lafayette, Lafayette, LA*

4:15	**12-3**	**EFFECTS OF INTEROSSEOUS MEMBRANE INJURY ON FOREARM AND HAND ROTATIONAL MOBILITY** *Nikalus Skipp, Ann Laurie Wells, Deana Mercer, Christina Salas* *Department of Orthopaedics & Rehabilitation, The University of New Mexico*
4:30	**12-4**	**HUMAN MESENCHYMAL STEM/STROMAL CELL-DERIVED EXOSOMES DIFFUSIVITY IN MENISCUS** *Gabi Schwartz[1], Samir Rana[2], Alicia Jackson[1], Thomas Best[1, 3], Dimitrios Kouroupis[4], Francesco Travascio[3, 5, 6]* *[1]Department of Biomedical Engineering, [2]Department of Kinesiology and Sports Sciences, [3]Department of Orthopaedics, [4]Diabetes Research Institute and Cell Transplant Center, [5]Department of Mechanical Engineering, [6]Max Biedermann Institute for Biomechanics at Mount Sinai Medical Center*
4:45		**Break**

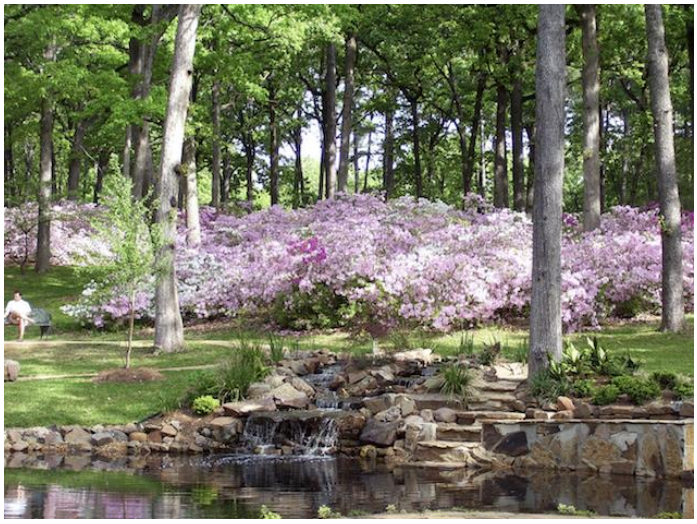
4:45-5:00 Coffee Break Visit the Posters

Friday Afternoon	**Presentation#**	**CME Room# 1307**
Time		**Session 13: AI Concepts, Machine Learning and Predictive Modeling In Health and Disease** **Session Chair:** Olga McDaniel, PhD, University of Mississippi Medical Center, Emeritus **Co-Chair:** Haifeng Wang, PhD, Mississippi State University, Mississippi State, MS
5:00	**13-1**	**Patient Privacy-Preserving Machine Learning and Application in ECG Signals** *Wesley Chorney, Haifeng Wang* *Mississippi State University, Mississippi State, MS*
5:15	**13-2**	**ARTIFICIAL INTELLIGENCE LEADS TO A VACCINE REVOLUTION** *Larry McDaniel* *University of Mississippi Medical Center, Jackson, MS*
5:30	**13-3**	**GENETIC ALGORITHM FOR DESIGN OPTIMIZATION OF DENTAL IMPLANTS** *Jason Griggs[1], Hakan Yasarer[2], Yacoub Najjar[2]* *[1]University of Mississippi Medical Center, Jackson, MS [2]University of Mississippi, Oxford, MS*
5:45	**13-4**	**ENHANCING DIAGNOSTIC ACCURACY THROUGH DOMAIN ADAPTATION: AUTOMATED DETECTION OF EXTRACAPSULAR EXTENSION IN HEAD AND NECK CANCER CT IMAGES** *Amirhossein Eskorouchi[1], Haifeng Wang[1, 2], W. Neil. Duggar[2]* *[1]Mississippi State University, [2]University of Mississippi Medical Center*
6:00	**13-5**	**IN SILICO CANDIDATE GENE PERTURBATIONS: CHARACTERIZATION ARRHYTHMIA POTENTIALS OF DRUG TARGETS OF IPSC-DERIVED CARDIOMYOCYTE THERAPIES** *Sophia Zhang[1], Jake Chen[1, 2]* *[1]AlphaMind Club, [2]Systems Pharmacology AI Research Center, School of Medicine, the University of Alabama at Birmingham, AL*
6:15	**13-6**	**IMPACT OF AI AND ORGAN MATCHING IN KIDNEY TRANSPLANTATION** *D. Olga McDaniel[1] and Alan Hawxby[2],* *[1]University of Mississippi Medical Center, Jackson MS, and [2]University of Oklahoma Health Science Center, Oklahoma, OK.*
6:30		**END OF DAY**

Concurrent Session

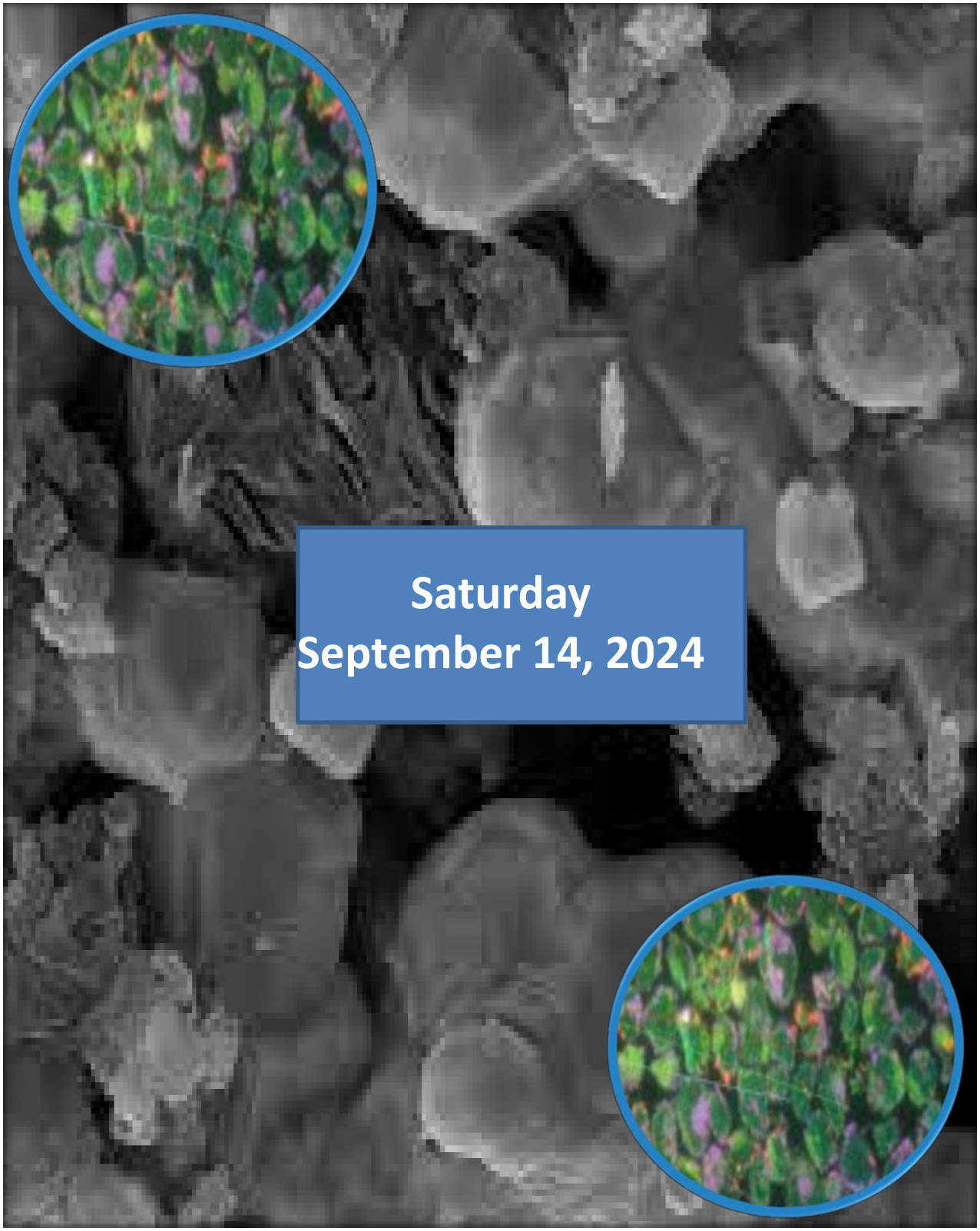
Friday Afternoon	Presentation #	CME Room# 1304
Time		**Session 14: Orthopaedics I** **Session Chair:** Francesco Travascio, PhD, University of Miami, Miami, FL **Co-Chair:** Ham Benghuzzi, PhD, Mississippi Academy of Sciences
5:00	**14-1**	**A THREE-DIMENSIONAL APPROACH TO DETERMINE THE INTER-RATER AND INTRA-RATER RELIABILITY OF HIP JOINT CENTER LOCATION IN THE INFANT HIP** *Ignacio Moyano[1], Victor Huayamave[2], Tamara Chambers[2], Victoria Melendez[2], Jack Jordan[2], Dannielle Charpentier[2]* *[1]Virginia Commonwealth University, [2]Embry-Riddle Aeronautical University*
5:15	**14-2**	**THERAPEUTIC POTENTIAL OF RUNX1-ENGINEERED MESENCHYMAL STEM CELLS FOR CARTILAGE REPAIR** *Qinqin Xu, Yuping Wang, Patrick Massey, Shane Barton, Yufeng Dong* *Louisiana State University Health Shreveport, Shreveport, LA*
5:30	**14-3**	**MACROPHAGE INDUCED SENESCENCE IN OSTEOPROGENITOR CELLS: PRO- AND ANTI-INFLAMMATORY EFFECTS ON BONE REGENERATION** *Sylvia Culpepper* *[1]Louisiana State University Health Science Center, New Orleans, LA*
5:45	**14-4**	**LIMB SURVIVAL OF GRADE III OPEN TIBIA FRACTURES AFTER CREATION OF AN ORAL MAXILLOFACIAL SOFT TISSUE FLAP TEAM** *Sarah Walker* *Louisiana State University Health Shreveport, Shreveport, LA*
6:00		**END of DAY 1**

End of Friday Event



Norton Botanical Gardens
open Wednesday - Sunday from sunrise to sunset
There is no admission charge

40th SOUTHERN BIOMEDICAL ENGINEERING CONFERENCE



Saturday, September 14, 2024

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

Scientific Sessions

Saturday Morning	Presentation #	CME Room# 1307
Time		**Session 15: Nanotechnology Cancer Drug Delivery** **Session Chair:** Qi Cai, PhD, Louisiana State University **Co-Chair**: Yongsheng Gao, PhD, The University of Texas at Dallas
7:30	**15-1**	**THE HK97 VIRUS-LIKE PARTICLE: A VERSATILE NANO-SCAFFOLD VEHICLE FOR TARGETED DELIVERY** *Dustin Patterson* *University of Texas at Tyler, Tyler, TX*
7:45	**15-2**	**OPTICAL BLOOD-BRAIN-TUMOR BARRIER MODULATION ENHANCES DRUG PENETRATION AND THERAPEUTIC OUTCOME IN CLINICALLY RELEVANT GLIOBLASTOMA MODELS** *Qi Cai* *Louisiana State University, Baton Rouge, LA*
8:00	**15-3**	**INJECTABLE HYALURONIC ACID HYDROGELS ENCAPSULATING DRUG NANOCRYSTALS FOR LONG-TERM TREATMENT OF INFLAMMATORY ARTHRITIS** *Yongsheng Gao* *The University of Texas at Dallas*
8:15		**BREAK**

Concurrent Session

Saturday Morning	Abstract #	CME Room# 1304
Time		**Session 16: Neuroscience I** **Session Chair:** Lir-Wan Fan, University of Mississippi Medical Center **Co-Chair**: Rachel Palmer, MD, University of Mississippi Medical Center
7:30	**16-1**	**EFFECTS OF COMBINATIONAL DRUG TREATMENT TO REDUCE INFLAMMATION AFTER TRAUMATIC BRAIN INJURY** *Geetika Sruti Vutukuri Amarnath, Ritika Roy, Pragya Dhungel, Yaswanthi Yanamadala, Afrika Williams[1], Claire Jones[1], Jeoung Soo Lee[2], Xiao-Hong Liu[3], Teresa Murray[1]* *[1]Louisiana Tech University, [2]Clemson University, [3]Louisiana State University Health Shreveport*

7:45	**16-2**	**MELATONIN AGONIST AGOMELATINE PROTECTS AGAINST NEONATAL LIPOPOLYSACCHARIDE-INDUCED ATTENTION-DEFICIT/HYPERACTIVITY DISORDER (ADHD)-LIKE BEHAVIOR IN JUVENILE RATS** *Rachel Palmer[1], Jonathan Lee[1], Selby Ireland[1], Madison Klim[1], Mabry Temple[1], Charles Matheny[1], Michelle Tucci[2], Norma Ojeda[3], Mary Kosek[1], Shuying Lin[4], 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, [2]Department of Anesthesiology, University of Mississippi Medical Center, Jackson, MS, [3]Department of Advanced Biomedical Education, University of Mississippi Medical Center, Jackson, MS, [4]Department of Physical Therapy, University of Mississippi Medical Center, Jackson, MS, [5]School of Medicine, Fu Jen Catholic University, Xinzhuang Dist, New Taipei City, Taiwan*
8:00	**16-3**	**AGE-RELATED NEUROIMMUNE SIGNALING HAS OPPOSING EFFECTS ON NEURONAL REPOPULATION AND STROKE-INDUCED BEHAVIORAL OUTCOMES** *Bilkis Akhter, Nibedita Aich, Ricaurte Marquez-Ortiz, Krista Rodgers* *LSU Health Sciences Center, Shreveport, LA*
8:15	**16-4**	**THE EFFECTS OF MICROGRAVITY ON SEROTONIN IN THE BRAIN** *Carl Jimmy Robbins, Elisa Castagnola* *Louisiana Tech University, Rushton, LA*
8:30		**Break**

8:30-8:45 Coffee Break Visit the Posters

Saturday Morning	**Abstract #**	**CME Room# 1307**
Time		**Session 17: Orthopedics II** **Session Chair:** Christina Salas, PhD, University of New Mexico **Co-Chair**: Hugo Giambini, University of Texas at San Antonio
8:45	**17-1**	**IS CONSIDERATION OF FREE TORQUE IMPORTANT IN TREATING FEMORAL NECK FRACTURE? -A FINITE ELEMENT ANALYSIS-** *Sakura Kuniyoshi, Satohi Nakasone, Kotaro Nishida* *Department of orthopedic surgery, Graduate School of Medicine, University of the Ryukyus*
9:00	**17-2**	**SCREW STRIPPING TORQUE IN BONE SURROGATES USED FOR SURGICAL TRAINING: COMPARATIVE STUDY BETWEEN 3D PRINTED AND ASTM F1839 REGULATED POLYURETHANE FOAMS BLOCKS** *Austin Thomassen, Mason Granger, Landon Tujague, Benjamin Lee, Patrick Massey, Shane Barton, Giovanni Solitro* *Louisiana State University Health Shreveport, Shreveport, LA*
9:15	**17-3**	**THE POST-TRAUMATIC MECHANICS OF ARTICULAR CARTILAGE UNDER DYNAMIC LOADING** *Asif Istiak, Tanvir Faisal* *University of Louisiana at Lafayette, Lafayette, LA*
9:30	**17-4**	**COMPARISON AMONG PIN INSERTION SITES FOR PELVIC FIXATION** *Drayton Daily, Benjamin Young, Andre Mira, Brad Chauvin, Richard Barton, Giovanni Solitro* *Louisiana State University Health Shreveport, Shreveport, LA*
9:45	**17-5**	**TOTAL KNEE ARTHROPLASTY WITH MEDIAL COLLATERAL LIGMENT REPAIR: A BIOMECHANICAL STUDY** *Leilani Baker[1], Natalia McIver[1], Nicholas Brady[1], Samer Kakish[1], Michael Decker[2], Christina Salas[1]* *[1]Department of Orthopaedics & Rehabilitation, The University of New Mexico, [2]Department of Orthopaedics, Medical College of Wisconsin*

10:00	**17-6**	**ACROMIOCLAVICULAR JOINT RECONSTRUCTION: A BIOMECHANICAL COMPARISON OF A NEW HYBRID TECHNIQUE** *Benjamin Chanes, Patrick Massey, James Robinson, Cameron Vauclin, Giovanni Solitro* *Louisiana State University Health Shreveport , Shreveport, LA*
10:15		**Break**

Keynote Speaker for Session 18: ELECTROPHYSIOLOGY AND NEUROMODULATION

Ravi L. Hadimani, PhD
Visiting Associate Professor, Harvard Medical School
Associate Professor and Director, Biomagnetics Laboratory
Department of Mechanical and Nuclear Engineering,
Virginia Commonwealth University
Richmond, Virginia USA

Dr. Hadimani is an associate professor and the director of the Biomagnetics Laboratory at the Department of Mechanical and Nuclear Engineering of Virginia Commonwealth University. He is currently on sabbatical as a **Visiting Associate Professor at Harvard Medical School, Harvard** University. He founded the IEEE Joint Magnetics and Engineering in Medicine and Biology Society's Richmond Chapter, and he is the current vice chair of the chapter. He is an associate editor of the Frontiers of Neuroscience and American Institute of Physics (AIP) Advances journals. He is a member of the US National Academy of Inventors. Dr. Hadimani's research focuses on biomagnetic materials and devices for biomedical applications, magnetocaloric heating/cooling, and energy harvesting. He has developed a first-of-a-kind anatomically accurate brain phantom for validating neuromodulation procedures that are commercialized through the university spin-off company RAM Phantoms LLC. Dr. Hadimani has received several international awards, including the UK Energy Innovation Award and the International Young Scientist Fellowship from the National Natural Science Foundation of China (NSFC). He also received the Engineer of the Year award from the Richmond Joint Engineers' Council in 2021. He has authored more than 110 peer-reviewed original research journal papers, more than 225 international conference papers, 15 current and pending patents, several invited trade magazine articles, a book, and 3 book chapters to date. Dr. Hadimani has a 'first class' honors degree in Mechanical Engineering from Kuvempu University, India, an MS in Mechatronics from the University of Newcastle, UK, and a PhD in Electrical Engineering from Cardiff University, UK. He has served as a Project Scientist at the Institute of Materials Research and Innovation of the University of Bolton, UK. He was an Adjunct Assistant Professor and Associate Scientist at Iowa State University and was also an Associate at Ames Laboratory, US Dept. of Energy.

Transcranial Magnetic Stimulation: Novel Coils, Techniques, and the Use of Machine Learning.

Abstract: Transcranial Magnetic Stimulation (TMS) can tune brain functions non-invasively, safely, and effectively without the need for surgery or drugs. Thus, it can enable the treatment of several debilitating neurological and psychiatric disorders and enhance cognitive capabilities. Several groups have reported developments on novel hardware associated with generating current pulses that can stimulate deeper regions of the brain and novel TMS coils that can stimulate focal regions of the brain. My lab has designed and fabricated novel focal stimulation coils based on novel soft ferromagnetic materials that can stimulate focal regions of the primary motor cortex and subcortical structures. We are currently working to experimentally verify the results from coil design in rats in collaboration with the Dept. of Neurology at VCU and Richmond Veteran Hospital. We have also developed an anatomically accurate human brain phantom that can be used to test the feasibility and safety of several TMS protocols. My team has also designed a TMS coil configuration that can stimulate multiple sites simultaneously and vary sites of stimulation without moving the coils physically. These new TMS techniques will enable the future development of effective TMS protocols for the diagnosis and treatment of several neurological and psychiatric disorders. We have investigated a feasibility study of combined TMS and DBS using brain phantom in collaboration with the VCU Department of Neurosurgery. We are currently working to ***predict TMS responses in humans by using deep machine learning algorithms considering anatomical and functional variables using MRI, fMRI, DTI and EEG***. These new machine-learning algorithms will enable to prediction of the TMS outcome of patients before the treatment begins in the future.

Saturday Morning	Abstract #	CME Room# 1304
Time		**Session 18: Electrophysiology and Neuromodulation** **Session Chair:** Deepak Kumbhare, PhD, Louisiana State University Health Shreveport **Co-Chair**: Elisa Castagnola, PhD, Louisiana Tech University
8:45	**Keynote**	**TRANSCRANIAL MAGNETIC STIMULATION: NOVEL COILS, TECHNIQUES, AND THE USE OF MACHINE LEARNING** *Ravi L. Hadimani* *Virginia Commonwealth University*
9:15	**18-1**	**NEUROMODULATION OF BASAL NUCLEUS OF MEYNERT: EFFECT OF ACTIVATION PATTERNS ON THE NETWORK COUPLING WITH CORTEX** *John Wilson, Greyson Jadwin, Jamie Toms, Kathryn Holloway, Deepak Kumbhare* *Louisiana State University Health Shreveport – Shreveport, Shreveport, LA*
9:30	**18-2**	**UNRAVELING NEUROMODULATION BY PSYCHEDELICS IN THE TREATMENT OF ADDICTION: INTEGRATING INSIGHTS FROM BEHAVIOR, GENE EXPRESSION, AND IN VIVO ELECTROPHYSIOLOGY** *Bo Jarrett Wood[1,2], Nicholas McComb[3], Greyson Jadwin[4], Deepak Kumbhare[3,5], Kevin Murnane[1,2,4]* *[1]Department of Pharmacology, Toxicology & Neuroscience, [2]Louisiana Addiction Research Center, [3]School of Medicine , [4]Department of Psychiatry and Behaviroal Medicine, [5]Department of Neurosurgery*
9:45	**18-3**	**AUTOMATED RODENT SLEEP SPINDLE DETECTOR: MATLAB APP USING TWO COMPLEMENTARY SEARCH ALGORITHMS.** *Kevin Holly[1,2], Pragya Dhungel [2], Sadie Villarrubia[2], Allison Kumler[2], Sai Rudrashetty[2], John Merten[3], Aaron Kemp[4], Linda Larson-Prior[4,5], Teresa Murray[2]* *[1]MathWorks, Chevy Chase, MD USA, [2]Biomedical Engineering, Louisiana Tech University, Ruston, LA USA, [3] Baptist Health UAMS GME, North Little Rock, AR USA, [4]Departments of Psychiatry and Biomedical Informatics, UAMS, Little Rock, AR USA, [5]Departments of Neurobiology & Developmental Sciences, Neurology, Pediatrics, UAMS, Little Rock, AR USA*
10:00	**18-4**	**DEEP BRAIN STIMULATION IN MOVEMENT DISORDERS** *Jamie Toms, Deepak Kumbhare* *Louisiana State University Health Shreveport , Shreveport, LA*

Saturday	Abstract #	CME Room# 1307
Time		**Session 19: Ergonomics and Prosthetics I** **Session Chair:** Albert Manero, PhD, University of Central Florida **Co-Chair**: Denis DiAngelo, PhD, University of Tennessee Health Science Center
10:45	**19-1**	**SHORT DURATION TRAINING FOR MULTI-GESTURE PROSTHESIS CONTROL** *Samantha Migliore[1,2], Annelisa Swiersz[1,2], Crystal Paver[1,2], Peace Akinkunmi[1,2], Viviana Rivera[1,2], Peter Smith[1,2], John Sparkman[1,2], Matt Dombrowski[1,2], Albert Manero[1,2]* *[1]University of Central Florida, [2]Limbitless Solutions*
11:00	**19-2**	**FUNCTIONAL ASSESSMENT OF AN ERGONOMIC BACKPACK COMPARED TO A TRADITIONAL BACKPACK DURING WALKING** *Denis DiAngelo[1], Lyndsey Bouve[1], Doug Powell[2]* *[1]The University of Tennessee Health Science Center, Memphis, TN [2]The University of Memphis, Memphis, TN*
11:15	**19-3**	**REDUCING REPETITIVE STRESS INJURIES DURING RUCK MARCHING IN WARFIGHTERS** *Matthew Grosman[1], Shelby Peel[2], Max Paquette[2], Denis DiAngelo[1]* *[1]Department of Orthopaedic Surgery and Biomedical Engineering, College of Medicine, University of Tennessee Health Science, Memphis, TN, [2]College of Health Sciences, University of Memphis, Memphis, TN*

11:30	**19-4**	**DESIGN AND ASSESSMENT OF BIRD-INSPIRED 3D-PRINTED MODELS TO EVALUATE GRASP MECHANICS** *Pavan Senthil[1], Om Vishanagra[1], John Sparkman[1], Peter Smith[1], Albert Manero[1,2]* *[1]University of Central Florida, [2]Limbitless Solutions*
11:45	**19-5**	**3D-PRINTED TRANSRADIAL PROSTHESIS: A PRELIMINARY PROPOSAL OF METHOD FOR EVALUATION OF GRASPING PERFORMANCE** *Erica Tobaro[1], Om Vishanagra[2], John Sparkman[2], Albert Manero[2], Fausto Medola[1]* *[1]São Paulo State University (UNESP), [2]Limbitless Solutions, University Central Florida (UCF)*
12:00	**19-6**	**BIO-INSPIRED FLEXIBLE HUMIDITY-AWARE SOFT EFFECTORS IN HEALTHCARE APPLICATIONS** *Maliha Kabir, Aryan Anan[1], Akhil Naik Banothu, Vinay Budhraja, Prabha Sundaravadivel* *Center for Robotics and Intelligent Systems, Dept. of Electrical and Computer Engineering, The University of Texas at Tyler, Tyler, Texas, USA 75013*
		LUNCH

Keynote Speaker
Session 20: Neural Interface

NEW TWISTS ON OLD TECH FOR A DEEPER LOOK AT SEIZURES AND SLEEP IN A RAT MODEL OF EPILEPSY

Teresa Murray, PhD

Interim Academic Director for Chemical and Biomedical Engineering
Professor of Biomedical Engineering
Louisiana Tech University in Ruston, Louisiana

Dr. Murray is the Director of the Integrated Neuroscience and Imaging Laboratory at Louisiana Tech University in Ruston, Louisiana, the Rhodes Eminent Scholar Chair in Engineering, Professor of Biomedical Engineering, and the Academic Director for Biomedical and Chemical Engineering. Her lab develops research tools for neuroscience research and conducts longitudinal studies on traumatic brain injury, stroke, epilepsy, and Alzheimer's disease using these tools. The lab also evaluates peptides and drugs to treat brain injuries. Dr. Murray received a BS and a PhD in Bioengineering from Arizona State University and was an NSF Graduate Research Fellow and NSF IGERT Fellow from 2003 - 2008. Her graduate work focused on engineering neural receptor proteins to study subunit co-assembly, trafficking and function which led to the characterization of a new type of nicotinic acetylcholine receptor in the mammalian brain. During her postdoctoral fellowship at Yale University, she developed implantable microlens systems for high resolution, acute imaging in deep brain regions of mice. At Louisiana Tech, her lab developed permanently implantable micro-lens systems for longitudinal studies of injury and disease and the effects of therapeutic interventions. She has also co-developed novel geometries for biosensors to record neurotransmitter dynamics in models ranging from cultured cells to rats with temporal lobe epilepsy. She is also the Principal Investigator of the NSF-funded, multistate FUTURE Sensors project to develop printed ink sensors to detect environmental pollutants in water supplies and in the human body. Her research is funded by the National Science Foundation, the National Institutes of Health, the Louisiana Board of Regents, and private foundations.

NEW TWISTS ON OLD TECH FOR A DEEPER LOOK AT SEIZURES AND SLEEP IN A RAT MODEL OF EPILEPSY

Phillip T Doughty[1, 2], Imran Hossain[1, 2], Chenggong Gong[2, 3], Kayla A. Ponder[1, 2], Pragya Dhungel[1, 2], Sadie Villarrubia-Hearn [1, 2], Allison Kumler[1, 2], Shabnam Siddiqui[1, 2], Kevin Holly[1, 2], Linda Larson-Prior[4], Prabhu Arumugam[1, 2, 3], Teresa A. Murray[1, 2]

[1]Center for Biomedical Engineering and Rehabilitation Science, [2]Louisiana Tech University, [3]Institute of Micromanufacturing, [4]Dept. of Neurobiology and Developmental Sciences, University of Arkansas for Medical Sciences

Epilepsy has been a mysterious and troubling disease with accounts as old as written history. It not only causes life-disrupting seizures, it also causes memory dysfunction due to sleep disturbances. Scientists have shed light on how it alters the electrical activity of the brain and have developed drug therapies and surgeries to treat it. Yet, we do not know enough to predict and rationally design a neuromodulation system that can intercept and diffuse an impending seizure or to reestablish normal sleep to restore memory. To

reach this level of understanding, our group has transformed existing technologies to provide unprecedented temporal resolution of electrical and neurochemical signals from the brain using a rat model of temporal lobe epilepsy. To study electrical activity, we took a radical approach to standard intracortical electroencephalography (iEEG) by creating a system to record from rats 24 hr/day for 3 mo. Technical challenges were overcome and software was created to study targeted iEEG features. We posited that the aberrant iEEG signals associated with epileptogenesis and seizures was due to an imbalance in levels of the major excitatory neurochemical, glutamate (GLU) and the primary inhibitory neurochemical, gamma-aminobutyric acid (GABA). Biosensors for in vivo recording were available for GLU but not for GABA; this study overcame that limitation. Additionally, a new type of biosensor system was created to facilitate repeated recordings for this unprecedented study. Together, these technologies produced the first in vivo recordings of GLU and GABA dynamics during an epileptic seizure and during sleep which surprisingly revealed that low GABA levels led to both.

Funding: NSF Award OIA 1632891 and NINDS Grant R21NS114723

Saturday Morning	Abstract #	CME Room# 1304
Time		**Session 20: Neural Interface** **Session Chair:** Elisa Castagnola, PhD, Louisiana Tech University **Co-Chair**: Deepak Kumbhare, PhD, Louisiana State University Health Shreveport
10:45	**Keynote**	**NEW TWISTS ON OLD TECH FOR A DEEPER LOOK AT SEIZURES AND SLEEP IN A RAT MODEL OF EPILEPSY** *Phillip T Doughty[1,2], Imran Hossain[1,2], Chenggong Gong[2,3], Kayla A. Ponder[1,2], Pragya Dhungel[1,2], Sadie Villarrubia-Hearn[1,2], Allison Kumler[1,2], Shabnam Siddiqui[1,2], Kevin Holly[1,2], Linda Larson-Prior[4], Prabhu Arumugam[1,2,3], Teresa A. Murray[1,2]* *[1]Center for Biomedical Engineering and Rehabilitation Science, [2]Louisiana Tech University, [3]Institute of Micromanufacturing, [4]Dept. of Neurobiology and Developmental Sciences, University of Arkansas for Medical Sciences*
11:15	**20-1**	**BATCH-FABRICATED GLASSY CARBON LIKE FIBERS FOR REAL-TIME DOPAMINE DETECTION** Umisha Siwakoti[1], Austin M. Broussard[1], Emma-Bernadette A. Faul[1], Daniel R. Rivera[1], Bingchen Wu[2], May Yoon Pwint[2], Davis Bailey[1], Xinyan Tracy Cui[2], Elisa Castagnola[1] [1]Louisiana Tech University, [2]University of Pittsburgh
11:30	**20-2**	**TOWARD THE OPTIMIZATION OF BATCH FABRICATION OF MICROELECTRODE ARRAYS WITH GLASSY CARBON MICROELECTRODES AND INTERCONNECTIONS FOR NEURAL APPLICATIONS** *Alexia Josefina Romero[1], Emma-Bernadette Faul[1], Austin Broussard[1], Daniel Rivera[1], Bingchen Wu[2], May Yoon Pwint[2], Davis Bailey[1], X. Tracy Cui[2], Elisa Castagnola[1]* *[1]Louisiana Tech University, [2]Univesrsity of Pittsburgh*
11:45	**20-3**	**INFLUENCE OF ELECTRODE CONTACT AREA ON S1 PROJECTION FIELDS FROM INTRATHALAMIC MICROSTIMULATION** *Bret A. See[1], Logan M. Dickey[1], William A. Walker[1], Joseph T. Francis[1]* *[1]University of Houston*
		LUNCH

40th SOUTHERN BIOMEDICAL ENGINEERING CONFERENCE

General Event and Lunch

PLENARY LECTURE II

September 14, 2024

12:30-1:10 PM, Auditorium Room # 2315

Introduction by Dr. R Shane Barton

"Leadership: Guidance, Alignment, and Impact"

Sharon Dunn, PT, PhD
Vice Chancellor for Academic Administration,
Dean, School of Allied Health Professions,
Professor of Physical Therapy, Board Certified Specialist in Orthopaedic Physical Therapy
Louisiana State University Health Shreveport

Sharon Dunn, PT, PhD, is the Dean of the School of Allied Health Professions, Professor of Physical Therapy, and Vice Chancellor of Academic Administration at LSU Health Shreveport. She graduated in 1987 with a BS in PT from LSU, a MHS in 1996, and she earned her PhD in Cellular Biology and Anatomy in 2006, also from LSU Health Shreveport. Sharon's research interests include conservative clinical approaches to the management of common musculoskeletal conditions and translational research of applied mechanical loading to healing tissue to determine dosing effects the ultimate functional and biomechanical tissue integrity. Dr. Dunn previously served on the PT faculty and as program director, teaching professional issues, anatomy, biomechanics, and orthopaedic PT. Her clinical practice and board specialty is in the area of orthopaedics. Throughout her career, Dr. Dunn has been professionally engaged in efforts to promote public policies to enhance the public's access to high quality health services and excellence in practice delivery. She is a past president of the American Physical Therapy Association and has significant experience in health policy and collaborative approaches to health delivery. She advocates for a team-based approach and patient-centered management for better health outcomes in our communities.

Concurrent Scientifics Sessions

1:15 PM, Keynote Speaker

Session 21: Biomedical Education II

Kelly Pagidas, MD, MA, FACOG, FRCSC

Senior Associate Dean for Medical Education

Louisiana State University Health Shreveport

Dr. Pagidas earned her medical degree at McGill University in Montreal, Canada followed by residencies in surgery at Montreal General Hospital and in obstetrics and gynecology at the Royal Victoria Hospital, McGill University. She completed a fellowship in reproductive endocrinology and infertility, also at Royal Victoria Hospital. Dr. Pagidas also received an honorary Master of Arts Degree at the Warren Alpert Medical School of Brown University in Providence, Rhode Island.

Dr. Pagidas brings extensive knowledge and experience in medical education, especially in the areas of active learning and contemporary medical education curricula. She previously served as the Chair of Medical Education and Interim Associate Dean of Education Affairs at Burnette School of

Medicine, Texas Christian University (TCU). As Chair of Medical Education, she built a dynamic and diverse learning community by leading a team comprised of basic science, clinical and educational faculty. In her role of Interim Associate Dean of Educational Affairs, Dr. Pagidas leads the administrative and education arm of the office of student affairs, curriculum development, assessment, and evaluation.

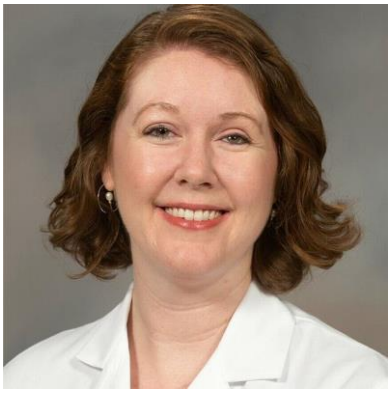
Dr. Pagidas has been actively engaged in graduate medical education and clinical, translational, and basic science research for over two decades. She has served as Professor and Division Director, Reproductive Endocrinology and Infertility at the University of Louisville School of Medicine, Professor and Division Chief, Reproductive Endocrinology and Infertility at University of Massachusetts Medical School, and Professor and Division Director, Reproductive Endocrinology and Infertility at University of Alabama Birmingham School of Medicine.

Scientific Sessions

Saturday Afternoon	Presentation #	CME Room# 1307
Time		**Session 21: Biomedical Sciences II** **Session Chair:** Patrick Massey, M.D., Louisiana State University Health Shreveport **Co-Chair**: Peter Smith, Ph.D., University of Central Florida
1:15	**Keynote**	**BIOMEDICAL EDUCATION** *Kelly Pagidas* *LSU HealthShreveport, LA*
1:45	**21-1**	**CONSTRUCT AND TRANSFER VALIDITY OF 3D PRINTED SIMULATORS FOR MEDICAL EDUCATION** *Patrick Massey* *LSU Health Shreveport, Shreveport, LA*
2:00	**21-2**	**THE USE OF COMPUTER SIMULATION IN ANESTHESIOLOGY RESIDENT TRAINING** *Nicky Rugnath, Michelle Tucci* *University of Mississippi Medical Center, Jackson, MS*
		BREAK

1:15 PM, Keynote Speaker

Session 22: Neuroscience II



Cynthia Karlson, PhD
Professor
SOM-Peds-Hematology/Oncology
University of Mississippi Medical Center, Jackson, MS

Dr. Karlson received her undergraduate degree in psychology from the University of Florida and completed her PhD in clinical health psychology from the University of Kansas. She completed her pre-doctoral internship and post-doctoral fellowship at the University of Mississippi Medical Center (UMMC) in Jackson, MS. Dr. Karlson's clinical interests include psychosocial adjustment and neurocognitive concerns of children with cancer and sickle cell disease. Dr. Karlson has been PI and Co-I on funded NCI, NIMHD, HRSA, foundation, and intramural grant projects. Her research focuses on chronic pain and sleep disturbance in children with chronic medical conditions. Other research projects include examining brief neurocognitive screening tools in children with cancer and examining the longitudinal trajectory of psychosocial adjustment in families of children with cancer and sickle cell disease.

40th SOUTHERN BIOMEDICAL ENGINEERING CONFERENCE

Advancing Biomarkers of Chronic Pain in Pediatric Sickle Cell Disease: Temporal Summation of Pain

Cynthia W. Karlson, PhD[1,2], Harrison Dickens, BS[3], Wynette Williams-Kirkwood, PhD,[4] Megan Mascaro, BS[2], Erin Jackson, MD[2], Veronica Carullo, MD[2], Melissa McNaull, MD[2], and Matthew C. Morris, PhD[1,5]

[1]Department of Psychiatry and Human Behavior, University of Mississippi Medical Center, Jackson, MS, USA
[2]Department of Hematology and Oncology, University of Mississippi Medical Center, Jackson, MS, USA
[3]Department of Psychological Science, University of Arkansas, Fayetteville, AR, USA
[4]Department of Pediatrics, University of Arkansas Medical Center, Little Rock, AR USA
[5]Department of Anesthesiology, Vanderbilt University Medical Center, Nashville, TN, USA

Translational research seeks to bridge the gap between basic research and clinical care. The field of biomedical engineering often provides the ingenuity and technology that bridges these gaps and advances health care. The current T1 translational study examines the role of central sensitization in the experience of chronic pain in youth with the most severe genotypes of sickle cell disease (SCD). We utilized biomedical quantitative sensory testing to measure central sensitization and hypothesized that youth with chronic SCD pain would demonstrate a significantly higher perceived pain response to repeated stimulation of identical intensity (i.e., temporal summation of pain, TSP) compared to youth with infrequent pain. Youth ages 12 to 21 years, diagnosed with SCD type Hb SS or Hb S Beta0Thalasemia, who reported infrequent pain (≤2 pain days/month; n=25) or met AAPT criteria for chronic SCD pain (n=25) were enrolled. Youth completed static quantitative sensory testing and dynamic TSP testing to assess pain sensitivity, along with psychological questionnaires. Heat TSP responses differed significantly between frequent and infrequent pain groups. Simple slope analysis revealed elevated TSP among youth with chronic SCD pain (b=3.14, p=.002); however, youth with infrequent pain did not exhibit TSP (b=0.45, p=.61). Faster habituation was observed for youth with chronic pain. Youth with chronic pain reported more frequent anxiety but psychological symptoms were not associated with TSP (p's >.17). Current results may indicate that TSP response, a well-established biomarker of pain sensitivity, distinguishes chronic from infrequent pain subgroups in youth with SCD.

Saturday Afternoon	Presentation #	CME Room# 1304
Time		**Session 22: Neuroscience 2** **Session Chair:** Lir-Wan Fan, PhD, University of Mississippi Medical Center **Co-Chair:** Cynthia Karlson, PhD, University of Mississippi Medical Center **Co-Chair**: Rachael Palmer, MD, University of Mississippi Medical Center
1:15	**Keynote**	**ADVANCING BIOMARKERS OF CHRONIC PAIN IN PEDIATRIC SICKLE CELL DISEASE: TEMPORAL SUMMATION OF PAIN** *Cynthia Karlson* *University of Mississippi Medical Center, Jackson, MS*
1:45	**22-1**	**INVESTIGATION OF BDNF-TRKB SIGNALING IN NEURAL REGENERATION AND NEUROPLASTICITY FOLLOWING ISCHEMIC STROKE** *Nibedita Aich[1], Bilkis Akhter[1], Alejandro Marquez[1], Morgan Bradford[1], Krista Rodgers [1]* *LSU Health Shreveport, Shreveport, LA*
2:00	**22-2**	**MOLECULAR SIGNATURE DIFFERENCES BETWEEN PLACENTAL TROPHOBLASTS FROM NORMOTENSIVE AND PREECLAMPTIC PREGNANCIES IN RESPONSE TO VITAMIN D - A PROTEOMICS ANALYSIS** *Jie Xu[1], Yang Gu[1], Xinggui Shen[1], David Lewis[1], Dani Zoorob[1], Yuping Wang[1]* *LSU Health Shreveport, Shreveport, LA*
		BREAK

2:30 PM, Keynote Speaker
Session 23: Ethics

Dan Godbee, M.D.
EMS Medical Director East Baton Rouge Parish EMS in Louisiana
Louisiana State University

Dr. Dan Godbee is an emergency physician and the director of East Baton Rouge Parish EMS. He grew up in Oak Ridge, TN and attended Georgia Tech where he received a Bachelor of Mechanical Engineering. Dr. Godbee then joined the U.S. Army and served six years on active duty in the 5th Special Forces Group as a Special Forces Explosives and Demolition Sergeant, Combat Diver, Special Forces Medic, Dive Medical Technician, and Arabic Linguist. He was on the first U.S. battalion to open the Sinai Peacekeeping Force with the 82nd Airborne Division. After his active-duty years, Dan returned to Georgia Tech for graduate school and earned Master Degree in both Mechanical Engineering and Industrial and Systems Engineering. During and after graduate school he worked as a private engineering consultant in and around Atlanta, GA. Dr. Godbee remained in the Army Reserve after active duty and also was a volunteer Paramedic with the Fayette County Fire and Emergency Services. In the Army Reserve Dr. Godbee continued to serve as a Special Forces Medic, Explosives & Demolition Sergeant, and Operations & Intelligence Sergeant. After almost a decade working as an engineer, Dan's medical background and experience motivated him to attend medical school. He graduated from Mercer University School of Medicine in Macon, GA and completed emergency medicine residency at LSU Medical Center – Earl K. Long Hospital in Baton Rouge. During residency, he was a Chief Resident and the recipient of the resident research award from the Louisiana Chapter of the American College of Emergency Physicians. Dr. Godbee was an emergency medicine faculty member at the Emergency Medicine Residency Program in Baton Rouge for 12 years. He was a Battalion doctor and a Group doctor in the 20th Special Forces Group in the Army National Guard and has two combat tours in Iraq and one combat tour in Afghanistan. Dr. Godbee served 47 consecutive years in the Army on active duty, Army Reserve, and National Guard. Twenty-four years as an enlisted person and 23 years as a commissioned officer; and retired as a Colonel last year. He is both a Flight Physician and a Dive Medical Officer. Dr. Godbee received the 2022 Award of Excellence for Medical Director of the Year from the National Association of EMTs, and the 2024 President's Award from the Louisiana Chapter of the National Association of EMTs. He is the current president of the Louisiana Chapter of the National Association of EMS Physicians. In his EMS Medical Director job, Dan serves on the Special Response Team and Hazardous Materials Team. He medically directs all 11 fire departments in East Baton Rouge Parish, the Baton Rouge Police Department, and the East Baton Rouge Parish Sheriff's Office Dive Team. He was the Parish-wide medical director during the COVID-19 Pandemic. Dr. Godbee is the Medical Editor of the Journal of Special Operations Medicine. Dan is married and has two adult children.

Ethics Classes Don't Make Us Ethical

An overview of the philosophical basis of ethics. Topics included are what it means to be a "professional", the Doctrine of Double Effect, and the "Georgetown Mantra" of ethical principles and how to order them.

Saturday Afternoon	Presentation #	CME Room# 1307
Time		**Sessions 23 and 25: Ethics** **Session Chair:** R. Shane Barton, Louisiana State University Health Shreveport **Co-Chair**: Richard Wilson, Towson University **Co-Chair**: Subrata Saha, PhD, University of Washington
2:30	**Keynote**	**DOCTRINE OF DOUBLE EFFECT AND GEORGETOWN MANTRA** *Dan Godbee* *East Baton Rouge Parish EMS*
3:00	**23-1**	**NAVIGATING ETHICAL CONCERNS IN THE FUTURE OF PROSTHESIS DEVICE DEVELOPMENT AND TRAINING** *Viviana Rivera[1,2], Samantha Migliore[1,2], Courtney Williams[1,2], John Sparkman[1,2], Matt Dombrowski[1,2], Peter Smith[1,2], Albert Manero[1,2]* *[1]UCF, [2]Limbitless*

3:15	**23-2**	**INCORPORATING AI INTO MEDICAL EDUCATION: AN ANTICIPATORY ETHICAL ANALYSIS** *Richard Wilson* *Towson University*
3:30-3:45		**BREAK**
3:45	**25-1**	**CLINICAL RESEARCH ETHICS: LEARNING FROM HISTORY** John Vanchiere *Louisiana State University Health Shreveport*
4:00	**25-2**	**ETHICS OF ANIMAL USE IN RESEARCH** *V. Hugh Price, Jr.* *Louisiana State University Health Shreveport*
4:15	**25-3**	**ARTIFICAL WOMBS: AN ETHICAL AND NTICIPATORY ETHICAL ANALYSIS** *Richard Wilson* *Towson University*
4:30	**25-4**	**ETHICAL CHALLENGES IN HEALTHCARE LEADERSHIP: BEDSIDE TO BOARDROOM** *R. Shane Barton,* *Department of Orthopaedic Surgery, Louisiana State University Health Shreveport*
		BREAK

Concurrent Session

Saturday Afternoon	**Presentation #**	**CME Room# 1304**
Time		**Session 24 Health Technology in Medicine I** **Session Chair:** Prabha Sundaravadivel, PhD, University of Texas-Tyler **Co-Chair**: Sagnik Dakshit, PhD, University of Texas-Tyler
2:30	**24-1**	**INTERROGATING CELL MECHANOBIOLOGY IN AN ELASTIC DOME MICRO-DEVICE** *Gideon Nyarko, Carla Lacerda* *University of Texas at Tyler*
3:00	**24-2**	**GENE SAMPLING TECHNOLOGY FOR RAPID MICROBIAL LYSIS AND GENOTYPING IN MICROFLUIDIC DEVICE** *Md Aminul Islam, Matthew Franklin, Cassidy Husson, Rebecca Giorno, Gergana Nestorova* *Louisiana Tech University, Ruston, LA*
3:15	**24-3**	**FUNCTIONAL MOVEMENT (FMOVE) TELE-SCREENING APPLICATION** *Antonio Morelos, Matthew Castillo, Benjamin Baber, Carina Gallegos, Sagnik Dakshit* *The University of Texas at Tyler*
3:30	**24-4**	**AI-DRIVEN REHABILITATION ROBOTICS FOR GAIT TRAINING EXERCISES** *Jacob Anthony, Chung Hyun Goh, Jacob Carr, Woohyoung Jeon* *University of Texas at Tyler*
		BREAK

3:45- 4:00 Coffee Break Visit the Posters

40th SOUTHERN BIOMEDICAL ENGINEERING CONFERENCE

Saturday Afternoon	Presentation #	CME Room# 1304
Time		**Session 26 Clinical Rehabilitation** **Session Chair:** Felix Adah, PhD, University of Mississippi Medical Center **Co-Chair**: Kenneth Butler, PhD, University of Mississippi Medical Center
3:45	**26-1**	**EFFICACY OF BACKWARDS WALKING ACROSS THE CONTINUUM OF CARE POST-STROKE: A SYSTEMATIC REVIEW** *Melissa Knight, Jacob Long* *University of Mississippi Medical Center, Jackson, MS*
4:00	**26-2**	**AN EVALUATION OF THE EFFECTS OF PHYSICAL ACTIVITY BREAKS DURING WORK ON THE INCIDENCE AND PREVALENCE OF NECK PAIN: A SYSTEMATIC REVIEW** *Joy Kuebler, Sarah Whitt, Kennedy Williams, Slater Richardson, Walker Hardin* *University of Mississippi Medical Center, Jackson, MS*
4:15	**26-3**	**EFFECTS OF DUAL TASK INTERVENTION ON FALL RISK IN OLDER ADULTS: A SYSTEMATIC REVIEW** *Sherry Colson, Nyah Tate, Bradley Lewis, Chase Pennington, Haley Puckett* *University of Mississippi Medical Center, Jackson, MS*
4:30	**26-4**	**THE EFFECTS OF TRANSCRANIAL DIRECT CURRENT STIMULATION ON DUAL-TASK COSTS IN HEALTHY YOUNG ADULTS: A SYSTEMATIC REVIEW** *Felix Adah, Geoffrey Reliquias, William Meyers, Braxton Wells, Clark Beard, Ameze Ero* *University of Mississippi Medical Center, Jackson, MS*
		BREAK

4:45- 5:00 **Coffee Break Visit the Posters**

Saturday Afternoon	Presentation #	CME Room# 1307
Time		**Session 27 Career Development** **Session Chair:** May Abdelaziz, PhD, University of Texas-Tyler **Co-Chair**: Alwathiqbellah Ibrahim, PhD, University of Texas-Tyler
5:00	**27-1**	**A CAREER IN RESEARCH FOR WOMEN STUDENTS AND UNDERREPRESENTED MINORITIES** *May Abdelaziz* *The University of Texas at Tyler*
5:15	**27-2**	**CAREER DEVELOPMENT FOR BIOENGINEERING TRAINEES** *Alwathiqbellah Ibrahim* *The University of Texas at Tyler*
5:30	**27-3**	**ENTREPRENEURSHIP IN BIOMEDICAL ENGINEERING** *Matthew Lucci* *Runatek*
		BREAK

40th SOUTHERN BIOMEDICAL ENGINEERING CONFERENCE

Concurrent Session

Saturday Afternoon	Presentation #	CME Room# 1304
Time		**Session 28 Health Technology in Medicine II** **Session Chair:** Prabha Sundaravadivel, PhD, University of Texas-Tyler **Co-Chair**: Sagnik Dakshit, PhD, University of Texas-Tyler
5:00	**28-1**	**A SMART SYSTEM FOR MONITORING AND ALERTING INADEQUATE PATIENT MOVEMENT IN BED-BOUND INDIVIDUALS** *Laavanya Rachakonda, Elysia Marie Ramsey* *University of North Carolina Wilmington*
5:15	**28-2**	**AN INNOVATIVE SMART FOOT-ANKLE BRACE FOR TELE-REHABILITATION OF PARALYZED PATIENTS** *Oluwaseyi Oyetunji, Austin Rain, William Feris, Abolghassem Zabihollah, Haitham Abu-Ghazaleh, Joe Priest, Seyed Ghorshi [1]Tarleton State University, [2]University of Texas at Tyler*
5:30	**28-3**	**DEVELOP A GROUNDBREAKING SHAPE MEMORY ALLOY STENT AIMED AT ENHANCING BLOOD FLOW IN OBSTRUCTED VEINS.** *Oluwaseyi Oyetunji, Abolghassem Zabihollah* *Tarleton State University*
5:45	**28-4**	**3D PRINTED SKIN AND ETHICS: AN ANTICIPATORY ETHICAL ANALYSIS** *Ian Holmes* *Towson University*
6:00	**28-5**	**CONCEPTUAL ENGINEERING, TECHNOLOGICAL CONFLUENCE AND ANTICIPATORY ETHICS** *Richard Wilson* *Towson University*
		BREAK

Posters, 6:00-7:00 pm, CME Auditorium Lobby

Poster Session: **Session Chair:** Ham Benghuzzi, Jackson State University **Co-Chair:** Lamar Hamil, University of Mississippi Medical Center	**P #**
MEASURING THE ANTIMICROBIAL PROPERTIES OF BIOACTIVE GLASSES. *Chloe Nguyen, Alessandra Palladino, Melanie Ecker* *University of North Texas*	1
UTILIZATION OF ETOMIDATE AND SEVOFLURANE AS THE PRIMARY ANESTHETIC DRUGS IN MANAGEMENT OF CARDIOVASCULAR SURGERY IN AORTIC STENOSIS PATIENTS *Kareem Abdelhamid, Ishrar Shaid, Malvina Kartamyshev, Zakaria Elmageed* *Edward Via College of Osteopathic Medicine, Monroe, LA*	2
CYTOTOXICITY EVALUATION OF A NOVEL CATHEPSIN L INHIBITOR ON HUMAN COLON CARCINOMA SW620 CELLS *Kayode Komolafe, Felicite Noubissi, Barbara Graham* *Jackson State University, Jackson, MS*	3
METHANOL-AQUEOUS EXTRACT OF *Agelaea obliqua (AO)* ACTIVATES APOPTOSIS IN A549 CELLS *Omowumi Koledoye, Maricica Pacurari* *Jackson State University, Jackson, MS*	4

40th SOUTHERN BIOMEDICAL ENGINEERING CONFERENCE

Banquet 7:00 pm CME Gym

SUBRATA SAHA OUTSTANDING SPEAKER AWARDEE

7:30 pm

Adventures in Dental/Craniofacial Biomaterials Research & Innovation

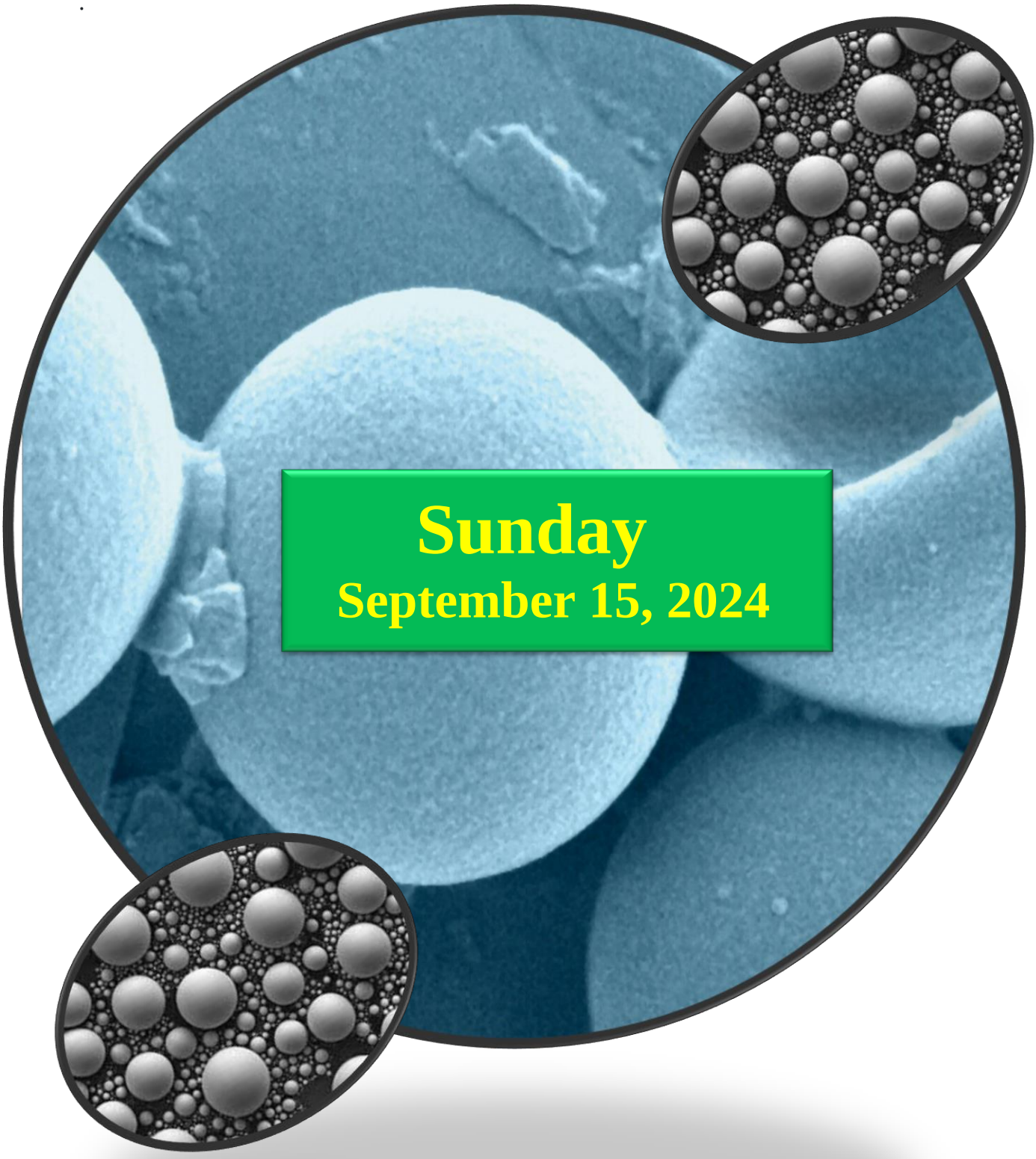
Joel D. Bumgardner, PhD, FBSE, FAIMBE
Chair and Professor
Biomedical Engineering Department
University of Memphis

Joel D. Bumgardner, PhD obtained his BS Degree with Honors in Biology from Florida State University, and his BS in Materials Science, and MS and PhD in Biomedical Engineering all from the University of Alabama at Birmingham.

Dr. Bumgardner was a faculty member in the Department of Agricultural and Biological Engineering at Mississippi State University (1994-2004) and professor and co-Director of academic programs in the Biomedical Engineering Department at The University of Memphis and in the University of Memphis-University of Tennessee Health Science Center-Memphis Joint Graduate Biomedical Engineering Program (2004-2019).

He currently serves as Chair of the Biomedical Engineering Department at The University of Memphis (2019-present). His area of research is in the dental/craniofacial and orthopaedic alloys and corrosion and in chitosan-based materials for implant coatings, bone tissue engineering and drug delivery. He has over 105 journal articles, 17 book chapters, 6 patent disclosures (2 licensed for infection abatement therapies using chitosan materials) and 215+ presentations and invited lectures. He is a co-editor of a two volume book series on chitosan-based materials. He has mentored over 80 students; 10 of which have received NSF and or Whitaker graduate fellowships, 5 Fulbright Fellowships, and more than 22 students accepted to medical, dental or law school. He has received numerous awards for his research and instruction including the 2012 Outstanding Instructor Award in the Herff College of Engineering University of Memphis, Outstanding Professor (2001 & 2002) Awards in the Bagley College of Engineering, Mississippi State University, and the University of Alabama Engineering School Alumni recognition award as one of the '40 Engineers Making a Difference' 2011. He is an elected Fellow (2011) of American Institute of Medical & Biological Engineering, an elected Fellow (2016) Biomaterials Science & Engineering, and a JW Fulbright Scholar (1994), Umeå University, Umeå Sweden. He is active in several professional organizations such as American Association for Dental Research, the Society for Biomaterials (SFB) and American Institute of Medical & Biological Engineering (AIMBE). He has held numerous leadership positions in SFB including founding member and first president of the National Student Section, Program chair of the 2005 Annual Meeting, and President (2012-2013). He also has held leadership positions in AIMBE including serving as Chair of the AIMBE Bylaws committee (2011-2015) and Chair of the Council of Societies (2016-2018). He was the 1997 Southern Biomedical Engineering Conference Program Chair and served on the Conference Steering Committee from 1996-2002. He is a regular reviewer for the NIH, NSF and DoD and many biomaterials related journals and serves as an Associate Editor of the Journal of Biomaterial Materials Research: Part B.

40th SOUTHERN BIOMEDICAL ENGINEERING CONFERENCE



Sunday
September 15, 2024

Sunday, September 15, 2024

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

Sunday Morning	Presentation #	CME Room# 1307
Time		**Session 29 Medical Imaging** **Session Chair:** David Gordy, PhD, University of Mississippi Med Center **Co-Chair**: Giovani Solitro, PhD, Louisiana State University Health Shreveport
7:30	**29-1**	**NON-INVASIVE ASSESSMENT OF MYOTOXIN-INDUCED SKELETAL MUSCLE DAMAGE OF MDX MICE.** *Ravneet Vohra[1,2], Joshua Park[2], Feng Zhang[2], Jeffrey Chamberlain[3,4,5,6], Donghoon Lee[2]* *[1]Department of Physical Therapy, Louisiana State University Health Science, LA, USA., [2]Department of Radiology, University of Washington, Seattle, WA, USA., [3]Department of Neurology, University of Washington, Seattle, WA, USA., [4]Senator Paul D. Wellstone Muscular Dystrophy Cooperative Research Center, University of Washington, Seattle, WA, USA., [5]Department of Biochemistry, University of Washington, Seattle, WA, USA., [6]Department of Medicine, University of Washington, Seattle, WA, USA.*
7:45	**29-2**	**VALIDATION OF FREEHAND 3D TOMOGRAPHIC ULTRASOUND AND TI-RADS-GENERATING MACHINE LEARNING ALGORITHM TO EVALUATE THYROID NODULES** *Benjamin Lee* Louisiana State University Health Shreveport
8:00	**29-3**	**ULTRASOUND ASSESSMENT DETERMINES THAT THE 90° OPEN-CHAIN POSITION IN THE CLINICAL SETTING OPTIMIZES KNEE JOINT SPACE: POSSIBLE IMPLICATIONS FOR INTRA-ARTICULAR KNEE JOINT INJECTIONS** *Naina Bouchereau-Lal, Cory Coehoorn, Daniel Poole, Andrew Wilkinson, Dakota Ellison, E.J. Mayeaux, Peter Seidenberg* Louisiana State University Health Shreveport
8:15	**29-4**	**SENSITIVITY OF CT SCANNING DIRECTION IN FE EVALUATION OF VERTEBRAL STRENGTH AND STIFFNESS** *Camryn Keller, Ross Dies, Andrew Zhang, Alberto Simoncini, Milan Mody, Anton Pelto, Giovanni Solitro* Louisiana State University Health Shreveport
		BREAK

8:30-8:45 Coffee Break Visit the Posters

Concurrent Sessions

Sunday Morning	Presentation #	CME Room# 1304
Time		**Session 30 Nanomedicine and Drug Delivery II** **Session Chair:** Santosh Aryal, PhD, University of Texas-Tyler **Co-Chair**: Farah Deba, PhD, University of Texas-Tyler
7:30	**30-1**	**MACROPHAGE DERIVED EXTRACELLULAR VESICLES COATED GOLD NANORODS FOR PHOTOTHERMAL CANCER THERAPY** *Anavya Jernigan[1], Israel Joshua Santosh, Shoukath Sulthana, Santosh Aryal* *University of Texas-Tyler*
7:45	**30-2**	**THE EFFECT OF NANOPARTICLE SIZE ON CELLULAR UPTAKE KINETICS IN BREAST CANCER MODEL** *Hadeeqah Quazi, Viswanathan Sundaram Sundaram, Shoukath Sulthana, Santosh Aryal* *University of Texas-Tyler*
8:00	**30-3**	**LIVER FUNCTION AND ANTIOXIDANT POTENCY OF SILVER NANOPARTICLE MODIFIED CORCHORUS OLITORIUS (JUTE) LEAF EXTRACT ON DIABETIC WISTAR RATS** *Chioma Onyeugo* The University of New Mexico
8:15	**30-4**	**OPTIMIZING PRODUCTION, CHARACTERIZATION, AND IN-VITRO BEHAVIOR OF POLYPHENOL- 5-AMINOSALICYLIC ACID EUDRAGIT CO-AXIAL ELECTROSPRAYED FIBER FOR ANTI-INFLAMMATORY EFFECTS** *Foram Madiyar[1], Takara O'Brien[1], Kaitlyn Daugherty[1], Liam J Suskavcevic[1], Lasya Namilae[1]* Embry Riddle Aeronautical University
		BREAK

8:30-8:45 Coffee Break Visit the Posters

Concurrent Scientific Sessions

Keynote Speaker

Session 31: Target Signaling Pathway CD

Hamed I. Ali, PhD
Associate Professor of Pharmaceutical Sciences
Texas A&M University
Irma Lerma Rangel School of Pharmacy

Education & Training: Dr. Hamed Ali graduated as "The Valedictorian" from the College of Pharmacy and was awarded a full Governmental Scholarship to pursue a PhD degree in Japan in 2007. He completed his postdoctoral training at TAMU-Rangel School of Pharmacy (RSOP), then was promoted, within 2 years, to Instructor, Lecturer, Instructional Assistant Professor, Assistant Professor, and then Associate Professor (Tenured) in 2024.

Teaching: Dr. Ali has demonstrated excellence in teaching Medicinal Chemistry/Pharmacology for Pharm-D and graduate students, being recognized as "Teacher of the Year" in 2017 and 2021 and "Teaching Team of the Year" for 10 consecutive years at RSOP. He received the "*Texas A&M University-Distinguished Achievement Award*" in 2019.

Research: Dr. Ali has several years of expertise in designing, synthesizing, and biologically screening selective tyrosine kinase inhibitors (TKIs) for targeting aggressive metastatic HER2+ breast cancer. Through his successful scholarly activity, he garnered

substantial extramural/intramural funding and received several research grants. He has mentored more than 30 undergraduate, graduate, and Pharm-D students, exposing them to meritorious research opportunities. He has published more than 65 peer-reviewed articles, served as an Ad hoc grants/journal's reviewer for several national and international organizations, and has been invited as a speaker at many national and international conferences. Accordingly, he received the "*Early Career Faculty Research Award*" in 2023, for demonstrating sustained and impactful scholarship at RSOP.

Service: Dr. Ali has extensive experience in Pharm-D and graduate curricula, AACP accreditation Assessment, OSCE, and student advising/mentoring. He has served as Caucus Leader, Senator at the Texas A&M Faculty Senate, and on various University/College-level committees. He has acquired substantial leadership capacity, serving as Chair of the Admission Committee for more than 8 years.

Sunday Morning	Presentation #	CME Room# 1307
Time		**Session 31: Target Signaling Pathway CD** **Session Chair:** Ayman Hamouda, University of Texas at Tyler **Co-Chair:** Zakaria Elmageed, VCOM-LA
8:45	**Keynote**	**REVOLUTIONIZING BREAST CANCER THERAPY: PRECLINICAL EXPLORATION OF A NOVEL QUINAZOLINE SCAFFOLDS AS DUAL HER2/ VEGFR2 KINASE INHIBITORS** *Mariam El Ganiany[1], Ishaq Khan[2], Zakaria Abd Elmageed[3], Constantinos Mikelis[4], Hamed Ali[1]*
9:15	**31-1**	**CAMBINOL DECREASES CELL PROLIFERATION AND MIGRATION OF METASTATIC CASTRATION RESISTANT PROSTATE CANCER CELLS** *Malvina Kartamyshev[1], Dalal Dawud[1], Roopin Singh[1], Abir Islam[1], Yao Liang[1], Murtaza Khambhati[1], Kareem Abdulhamid[1], Hasan Khanani[1], Wasifuddin Syed[1], Tanya Kumar[1], Zakaria Elmageed[1]* *[1]VCOM-LA*
9:30	**31-2**	**CHLORPROMAZINE AUGMENTS THE EFFECT OF ANTI-ANDROGEN THERAPY THROUGH THE INDUCTION OF HEME OXYGENASE 1-FERROPTOSIS AXIS IN METASTATIC CASTRATION-RESISTANT PROSTATE CANCER CELLS** *Dalal Dawud[1], Zakaria Abd El-Mageed[2], Khalid Elsayed[1], Mourad Zerfaoui[3]* *[1]ULM, [2]VCOM, [3]Tulane*
9:45	**31-3**	**PATIENT-SPECIFIC MODELING FOR PARATHYROID ADENOMAS USING 3D PRINTING** Sylvia Mullen, Steve Alexander, Giovanni Solitro, Wendy Chriss, Rajini Kanth Yatavelli,, Terry Lairmore Louisiana State University Health Shreveport
10:00	**31-4**	**In Vitro and In Vivo MODELING OF ASTHMA-CHRONIC OBSTRUCTIVE PULMONARY DISEASE OVERLAP** *Vitoria Caroline Queiroz [1], Iolanda de Fátima Lopes Calvo Tibério[2], Carla Maximo Prado[3], Ayman Hamouda[1]* *[1]University of Texas at Tyler, [2]University of Sao Paulo, [3]Federal University of Sao Paulo*
10:15	**31-5**	**IN VIVO IMMUNE-COMPETENT MODEL TO EXAMINE HEPATOCELLULAR CARCINOMA DEVELOPMENT IN LIVER SPECIFIC KNOCKOUT MICE** *Shaimaa Gad[1], Xianzhong Ding[1], Wei Qiu[1]* *[1]Loyola University Chicago*
		BREAK

Keynote Speaker

Session 32: BIOMEDICAL IMAGING AND ADVANCEMENTS IN PRECISION MEDICINE

ENZYME INDUCED SELF-ASSEMBLY OF SMALL MOLECULES CELL FATE

Neda Habibi, PhD

Assistant Professor
Department of Biomedical Engineering
University of North Texas

Dr. Habibi has a PhD in Nano-biotechnology specializing in Bionanomaterials and drug delivery. She received her PhD degree from the University of Genova, Italy in 2012. From 2012 to 2016, she was Assistant Professor with Nanotechnology and Advanced Materials Institute at Isfahan University of Technology, Iran.

She is an alumna of the Division of Engineering in Medicine and Renal Division of Medicine at Brigham and Women's Hospital at Harvard University where she was visiting Assistant Professor at Dr. Shafiee's Laboratory. From 2016, she has been a research assistance professor with Biomedical Engineering Department at the University of Texas at San Antonio (UTSA). Prior to join UNT, she was coordinating a Nano-engineering program at Northwest Vista College in San Antonio.

Her works have been published in prestigious journals such as NanoToday, Advanced Functional Materials, Journal of Biomedical Materials Research and Collides and Surfaces. As a program coordinator, she has been involved in couple of grants from National Science Foundation NSF as both PI and Co-PI with more than $9.3M in total, towards variety of different academic activities such as interacting with graduate and undergraduate students, establishing her research area, collaboration with other faculty members as well as industrial partners

Abstract:
Enzyme induced self-assembly of ultra-short peptides is a new approach to control cell fate. (EISA) is a molecular nanotechnology targeting technique that relies on local enzymatic
activity to deliver drugs effectively. Enzymes initiate self-assembly by converting a non-self-assembling precursor into a self-assembling molecule via bond cleavage, bond formation, or dephosphorylation. Self-assembled peptides have the potential to overcome drug resistance due to their ability to bypass cell receptors, form self-assembling nanostructures within cells to entrap drugs and prevent drug efflux, and target tumor cells' mitochondria to overcome DNA repair. Research on EISA therapeutic has led to the discovery of hundreds of new EISA compounds with promising efficacy in cancer therapy, molecular imaging, tissue engineering, and antibacterial therapy. EISA compounds have shown significant potential in improving the efficiency of IC90 values of drugs against cancer cells, targeting mitochondria, accumulating drugs inside targeted cells, and minimizing multidrug resistance caused by efflux pumps. The EISA precursors are induced by enzymes such as alkaline phosphatase (ALP), and Metalloproteinase (MMP) that are expressed in diseased cells. These enzymes are critical for normal physiological functions such as the nervous system and liver and therefore an obstacle in clinical translation of EISA's is their effect on tissues with high enzymatic activity. Successful clinical translation depends on designing selective EISA molecules and characterizing their fate in various tissues.

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Sunday Morning	Presentation #	CME Room# 1304
Time		**Session 32: Biomaterials II** **Session Chair: Melanie Ecker, PhD, University of North Texas** **Co-Chair: Narayan Bhattarai North Carolina A&T State University**
8:45	**Keynote**	**ENZYME INDUCED SELF-ASSEMBLY OF SMALL MOLECULES CELL FATE** *Neda Habibi* *University of North Texas*
9:15	**32-1**	**K-CO-MO-SX CHALCOGEL SORPTION OF URANIUM AND OTHER POTENTIAL APPLICATIONS** *Jing Nie* *Jackson State University, Jackson, MS*
9:30	**32-2**	**EVALUATION OF BIOCOMPATIBILITY AND ANTIBACTERIAL ACTIVITY OF THIOL-ENE MICROPARTICLES** *Chipo Chapusha, Mary Carr, Mary Marquart, Amol Janorkar* *University of Mississippi Medical Center, Jackson, MS*
9:45	**32-3**	**POLYMER-METAL COMPOSITE NANOFIBERS FOR WOUND HEALING APPLICATIONS** *Narayan Bhattarai* *North Carolina A&T State University*
10:00	**32-4**	**VALIDATION OF THERAPEUTIC AGENT CONJUGATION TO POLYVINYL ALCOHOL COATED MEDICAL DEVICES** *Joshua Colvin , Donald Sorrells, Jonathan Alexander* *Louisiana State University Health Shreveport*
		BREAK

Sunday Morning	Presentation #	CME Room# 1307
Time		**Session 33: Bioinformatics and Health** **Session Chair:** Haifeng Wang, Ph.D, Mississippi State University **Co-Chair:** Olga McDaniel, PhD, University of Mississippi Medical Center
10:30	**33-1**	**UTILIZING GRAPH THEORY AND MACHINE LEARNING TO ANALYZE POLYSOMNOGRAPHY DATA FOR ADHD DIAGNOSIS: A FOCUS ON SLEEP STAGE-BASED BIOMARKERS** *Amirhossein Eskorouchi, Haifeng Wang, Junfeng Ma* *Mississippi State University*
10:45	**33-2**	**PREDICTION OF HERG INHIBITION BY CHEMICAL LARGE LANGUAGE MODEL** *Ronni Chang[1], Md Delower Hossain Jake Chen[2]* *[1]Brookline High School, [2]University of Alabama at Birmingham*
11:00	**33-3**	**LEVERAGING GRAPH NEURAL NETWORKS FOR MIC PREDICTION IN ANTIMICROBIAL RESISTANCE STUDIES** *Zhiqian Chen* *Mississippi State University*
11:15	**33-4**	**COMPARATIVE ANALYSIS OF SLEEP PATTERNS IN ADHD AND NON-ADHD GROUPS** *Niraj Ghimire[1], Jonathan Lee[2], Vignesh H. Nayak[2], Norma B. Ojeda[2], Lir-Wan Fan[2], Zhiqian Chen[1], Michael Nadorff[1], Haifeng Wang[1]* *[1]Mississippi State University, [2]University of Mississippi Medical Center*
		END OF SESSION

Concurrent Session

Sunday Morning	Presentation #	CME Room# 1304
Time		**Session 34: Medical Device Implants II** **Session Chair:** Giovanni Solitro, Ph.D, Louisiana State University Health Shreveport **Co-Chair:** Donald Sorrells, MD, Louisiana State University Health Shreveport
10:30	**34-1**	**IMPROVED TIBIAL BONE STRAIN REDUCTION WITH A DYNAMIC ANKLE ORTHOSIS COMPARED TO A CLINICAL WALKING BOOT** *Denis J. DiAngelo, and Perri A. Johnson* *University of Tennessee Health Science Center, Memphis, TN*
10:45	**34-2**	**USE OF RFID TECHNOLOGY FOR MEDICAL DEVICE POSITION TRACKING** *Dominic Lincoln, Payton Hollenshead,Giovanni Solitro, Jonathan Alexander, Donald Sorrells* *Louisiana State University Health Shreveport*
11:00	**34-3**	**PATIENT-SPECIFIC MODELING FOR PARATHYROID ADENOMAS USING 3D PRINTING** *Sylvia Mullen, Steve Alexander, Giovanni Solitro, Wendy Chriss, Rajini Kanth Yatavelli,, Terry Lairmore* *Louisiana State University Health Shreveport*
11:15	**34-4**	**COMMUNITY-BASED RECRUITMENT USING A MOBILE SCREENING DEVICE FOR INVESTIGATING HEARING LOSS AND COGNITIVE DECLINE IN OLDER ADULTS** *Stacee Naylor, Kenneth Butler, Sarah Faucette, Laree Hiser* *University of Mississippi Medical Center, Jackson, MS*
11:30	**34-5**	**GLP-2-COATED VAGINAL EXPANSION SLEEVES SIGNIFICANTLY EXPAND THE RAT VAGINAL CANAL** *Donald Sorrells, Rachel Cline, Hannah Meyer, Mila Shah-Bruce , Menchu Ong, Joshua Colvin* *Louisiana State University Health Shreveport*
		END OF SESSION

11:45-12:00 General Assembly
Student Award Presentation

Abstracts

Abstracts presented at the 40th SBEC, 9/12-9/15/2024

Ethics in Education

VACCINATION ETHICS AND CONCERNS IN HUMAN POPULATIONS

Larry McDaniel, D. Olga McDaniel

University of Mississippi Medical Center, Jackson, MS

Population dynamics and vaccination strategies are closely linked. High population density can accelerate the transmission of infectious diseases and the need for vaccines. Often such populations have health disparities due to a lack of access to health care. For such populations having time-off from work and even transportation can be challenges. These logistical challenges can hinder immunization efforts. The ethics of vaccination has several concerns. The pandemic highlighted ethical problems with vaccines. First, wealthy countries secured large quantities of vaccines which left poorer regions under-vaccinated. Second, mandatory vaccine policies must respect personal freedoms and address vaccine hesitancy with informed consent and transparency being important to maintain public trust in vaccine programs. Third, the balance between individual autonomy and public health should be considered. Four, misinformation can create skepticism and resistance which impacts public health goals. Ethical vaccine development and testing requires adherence to safety standards to ensure that vulnerable populations are not exploited in clinical trials. Addressing population issues and vaccine ethics requires an approach that integrates public health strategies with ethical principles. This includes ensuring equitable access, respecting individual rights, fostering informed consent, and maintaining transparency to have successful vaccine programs. Such an approach is essential for population health. The scientific community must collaborate to overcome challenges to achieve a fair and ethical response to infectious diseases through ethical vaccination practices.

ETHICS OF GENOME RESEACH

D. Olga McDaniel[1], Larry McDaniel[1], Charles Moore[1]

[1]University of Mississippi Medical Center

The rise of genome-wide association studies (GWAS) in medical research and the possibility of data-sharing and advances in science and technology such as NextGen and single cell RNA sequencing presents new challenges. In the context of biomedical informatics, a continuum of new ethical issues associated with genomic disparities among population and across international borders are generated with special policy requirements. Organ transplantation and rejection testing has been revolutionized using gene expression profiling biomarkers and donor-derived cell-free DNA testing for identification of allograft dysfunction/rejection without invasive endomyocardial biopsies (EMB). This work presented molecular-re-classification of intra-graft myocyte injury including acute cellular and antibody-mediated rejection. Gene therapy has historically been defined as the addition of new genes to human cells, in which exogenous good DNA is used to replace the defective DNA in a disease gene. Genome editing of human cells provides a useful tool which may help to repair a mutation that could cause a deadly disease, or to produce healthy organoids for organ repair. CRISPR is a more recent genome editing tool which is simpler and more accurate than the older editing methods. This presentation includes some aspects of genome editing approaches in somatic cells, as well as in diseases where application is available. A demo of sickle cell disease-story of a young Mississippi woman will be presented. Genome editing of disease affected human cells have been subject to FDA regulations and many other regulatory bases. Many concerns about misusage of gene-editing between medical applications and human enhancements may lead to misunderstanding within non-scientific communities of the life-threatening and life-altering conditions.

ETHICAL CONCERNS IN BIOMEDICAL PUBLISHING

Gary Hamil[1], Hamed Benghuzzi[2], Michelle Tucci[3], Kenneth Butler[3]

[1]Belhaven University, [2]Jackson State University, [3]University of Mississippi Medical Center

This exploration delves into the multifaceted concept of harm within medical practice, examining scenarios where the pursuit of preserving life can inadvertently expose patients to additional harm. Harm, encompassing physical, psychological, and socio-economic consequences, challenges the ethical foundation of healthcare interventions aimed at alleviating suffering. Despite intentions to mitigate harm, certain treatments carry inherent risks that may introduce unforeseen adverse effects. Ethical dilemmas in end-of-life care further complicate decision-making, as life-sustaining treatments can prolong suffering and diminish quality of life. Moreover, disparities in healthcare access underscore systemic injustices, exacerbating harm among marginalized communities. Recognizing this, the ethical imperative to preserve life must be contextualized within a broader social justice framework, considering structural determinants of health. Medical professionals often encounter ethical dilemmas were preserving life conflicts with the potential for causing harm. Informed consent and shared decision-making emerge as crucial principles for navigating these complexities, empowering patients to make autonomous choices aligned with their values. In conclusion, while preserving human life remains paramount in medical ethics, prioritizing patient-centered care requires critical evaluation of intervention risks and benefits to minimize harm and uphold principles of beneficence and non-maleficence.

ETHICAL CONCERNS IN BIOMEDICAL PUBLISHING

Kenneth Butler[1], Hamed Benghuzzi[2], Michelle Tucci[1], Gary Hamil[3]

[1]University of Mississippi Medical Center, [2]Jackson State University, [3]Belhaven University

Ethical issues pervade the landscape of medical and scientific publishing, posing significant challenges to the integrity and credibility of scholarly literature. This exploration provides an overview of various ethical concerns within the realm of publishing. The unethical practice of buying and selling author and reviewer slots on papers undermines the meritocracy of scholarly publishing, compromising the quality and integrity of peer review. Falsified data and plagiarism represent egregious violations of research integrity, eroding public trust and threatening the foundation of scientific inquiry. The proliferation of low-quality papers inundates journals, diluting the credibility of published literature and impeding scientific progress. Financial inducements offered to journal editors and bribery of editorial staff undermine the editorial independence and impartiality essential for maintaining the integrity of scholarly publishing. Embedding third-party agents on editorial boards introduces conflicts of interest and compromises editorial autonomy, raising concerns about undue influence on editorial decision-making. Vulnerable editors face ethical dilemmas, balancing professional integrity with pressures from stakeholders and institutions. Guest editors of supplemental or special journal issues confront ethical challenges related to conflicts of interest, transparency, and equitable representation. Addressing these ethical issues requires a multifaceted approach, including robust editorial policies, transparent peer review processes, and stringent measures to prevent misconduct.

Ergonomics and Prosthetics I

PRELIMINARY INSIGHTS FROM A MULTIYEAR 3D-PRINTED PROSTHESIS CLINICAL TRIAL

Viviana Rivera[1], Calvin MacDonald[1], Elizabeth Barnum[1], Peter Smith[2], Matt Dombrowski[2], John Sparkman[1], Kelly Dunbar[3], Albert Chi[3], Rosanne Yee[3], Albert Manero[1]

[1]Limbitless Solutions, University of Central Florida, [2]University of Central Florida, [3]Oregon Health Science University

The CDC estimates that in every 10,000 live births, 4 children are born with congenital upper limb deficiency (Canfield, 2006). Degree of physical limitation varies depending on the child and level of amputation, with many eventually relying on the use of prostheses or the residual portion of their limb to accomplish daily tasks. Use of a prosthesis has been proven to encourage the development of symmetrical functional development and enhance their self-esteem (Peterson & Prigge, 2020); however, prosthetic device use is limited due to the associated cost of replacement as the child grows (Blough, 2010). Additive manufacturing techniques may play an influential role in eliminating barriers to prosthesis. A collaborative, multi-visit study was conducted between the Limbitless Solutions research facility at the University of Central Florida and the Oregon Health & Science University to examine the impact of a novel 3D-printed myoelectric device in children with congenital limb deficiency. Though intended to last 1 year with clinical evaluations at 0, 3, 6, and 12 months, the COVID-19 pandemic extended Visit 4 to 36 months. Each visit involved the completion of functionality assessments, musculoskeletal questionnaires, and parent-child-reported quality of life. To aid in the participants' acclimation to the prosthesis, occupational therapists and a serious training video game were additionally incorporated into the study. Comparative and paired hypothesis tests were conducted, with data analysis showing that usage of the prosthesis by patients improved over time.

THE ROLE OF OBESITY IN PHYSIOLOGICAL STRESS AND PROPRIOCEPTION DURING REPETITIVE MANUAL MATERIAL HANDLING TASKS

Sergio Lemus[1], Jaron Mohammed[1], Eduard Tiozzo[2], Francesco Travascio[1, 3, 4]

[1]Department of Mechanical and Aerospace Engineering, University of Miami, [2]Department of Physical Medicine and Rehabilitation, University of Miami, Coral Gables, FL, [3]Department of Orthopaedics, University of Miami, [4]Max Biedermann Institute for Biomechanics at Mount Sinai Medical Center

Obesity negatively impacts human performance, altering motion patterns and decreasing endurance. However, ergonomists still design manual handling tasks based on normal weight individuals. This may expose obese to higher risk of injury: our preliminary work showed that obese exceed the physiological safety limits (4.7 kcal/min) during repetitive lifting tasks designed according to current ergonomic standards. We hypothesized that increased levels of physiological stress may lead to decrease of proprioception, a biomechanics parameter associated to balance. The goal of this study was to investigate the relationship between physiological stress and proprioception in obese individuals to infer their risk of injury in the workplace. Participants completed two manual handling tasks: (1) carried a 27.5-pound box (2) pushed and pulled a 19-pound sled. Each task was performed for 25 feet and repeated every 15 seconds for a total of 15 minutes. Metabolic parameters were monitored via a metabolic cart and energy expenditure rate was calculated according to the stablished Weir equation. Obese participants surpassed the energy consumption threshold for carrying while both obese and overweight participants surpassed it for pushing and pulling. Proprioception showed a significant decrease in the Sharpened Romberg Test and Functional Reach for carrying and pushing/pulling respectively. Overall, these findings can serve as empirical data to introduce adjustments to workplace guidelines, specifically accounting for the interactions of body composition and task design. Furthermore, evaluating the body's response to unsafe physiological stress helps quantify and categorize the increased risk of injury of obese people in the workplace.

DESIGN AND VALIDATION OF A NOVEL ERGONOMIC BACKPACK

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The use of backpacks continues to increase and has brought about an influx of new health-related problems. Of particular interest are musculoskeletal injuries at the shoulder and lower back resulting

from carrying heavy loads over extended periods of time. **PURPOSE**: The purpose of this study was to design and validate a novel offloading ergonomic backpack (EBP) that transferred a portion of the shoulder and spine loads to the pelvic region. A traditional two strap backpack (T2SBP) was used as the control device. It was hypothesized that the EBP would significantly reduce strap tension and shoulder loads compared to the T2SBP. **METHODS**: Five participants wore the EBP and T2SBP under quiet (vertical) stance conditions. Strap tension and shoulder loads were measured twice for six bag weight conditions (0,2,5,7,9,11kg). Portable luggage scales were attached directly to the shoulder straps and configured to measure strap tension. Load sensors (loadsol, Novel Inc.) placed underneath the shoulder straps provided an estimate of the total force acting on the shoulders and transferred to the spine. One-way repeated measures ANOVA and Cohen's d effect size were analyzed to determine differences between backpack designs for the different bag weight conditions. **RESULTS**: The EBP had a large effect size and significant reduction ($p<0.05$) in shoulder loads compared to a T2SBP for all bag weight conditions. Similarly, the EBP had a large effect size in reducing strap tension compared to the T2SBP. **CONCLUSIONS**: A newly designed EBP was effective at transferring a significantly large portion of the shoulder and spine loads to the pelvic region, which could reduce the risk of injury.

DYNAMIC PROSTHETIC INTERFACE FOR COMPETITIVE CYCLISTS: A STABILITY TEST

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There is a trend among professional cyclists with unilateral transfemoral amputations to have their residual limb attached directly to either their seat post or the bike frame rather than wear their prosthetic limb while cycling. This allows the cyclist to create greater force with their unaffected limb and is more efficient. A Paralympic triathlete residing in Albuquerque, NM uses a customized carbon fiber construct that was fitted by a UNM orthotist. This has been a good solution. However, once the mount has been set, it cannot be moved to a different bike or adjusted in any way without cutting the construct off and starting again from scratch. There is a need for a mount that permits rotational and translational adjustment to allow the athlete to finetune the position of the socket and use it on multiple bikes without needing to create a new set up each time. A semi-universal design would allow this system to be used by any cyclist with a unilateral transfemoral amputation, from a novice to Olympian. The co-authors, working with a team of undergraduate mechanical engineering students, addressed this problem by creating a simple design that adapts to prosthetic socket components readily available to orthotists. The team designed and fabricated a mounting system that allows for easy translational adjustments along two axes and rotational adjustments around two axes. The system can then be locked in place using bolts. Finite element analysis simulations ensured the mount could withstand the stresses placed on it during riding. The mount was cyclically tested using a Mini Bionix 858 MTS load frame for 12,000 cycles between 533.8N (120 lbs) and 311.4N (70 lbs) at 1.5Hz to simulate completion of approximately 5 competitive races at a range from body weight to half weight. The device was tested at two bolt torque values (5 N-m and 3 N-m), to ensure that the device would maintain stability even if the system was slightly under-constrained. Feedback from the cyclist and outcome measures from this pilot study are being used to develop version 2 of the system which will be used by the triathlete at a World Championship.

Artificial Intelligence in Healthcare

R-BASED MULTI-OMICS INTEGRATION PIPELINE FOR COMPREHENSIVE METABOLOMIC ANALYSIS

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Louisiana State University Health Shreveport

Advancements in metabolomics research have underscored the importance of integrating multi-omics data to gain a deeper understanding of complex biological processes. In this abstract, we introduce an open-source pipeline developed in the R software environment to facilitate comprehensive metabolomic analyses within the context of multi-omics integration. The pipeline encompasses various stages of metabolomics research, offering a systematic and user-friendly framework for researchers to analyze, visualize, and interpret data across different omics layers. Leveraging the capabilities of R, specialized statistical and bioinformatics tools are seamlessly integrated, allowing for a holistic examination of metabolites, transcripts, and proteins. Key components of the pipeline include data preprocessing, feature selection, statistical analysis, and visualization techniques tailored for multi-omics datasets. By adopting a modular and extensible design, the pipeline accommodates diverse experimental designs and platforms, ensuring flexibility for researchers across different domains. We outlined the steps involved in developing the R-based pipeline. We also provide a comprehensive overview of the main tools and packages crucial for metabolomic analyses in an integrated multi-omics framework. Additionally, practical applications of the pipeline are demonstrated through case studies involving identifying abnormal metabolic pathways in various cancers and diseases. The presented R-based pipeline is a valuable resource for researchers seeking an efficient and customizable solution for multi-omics integration in metabolomics research. By promoting transparency, reproducibility, and collaboration, this open-source tool contributes to the ongoing advancements in the field and encourages the adoption of standardized approaches for multi-omics analyses.

PREDICTIVE MACHINE LEARNING MODELS FOR THE PROGRESSION OF ALZHEIMER'S DISEASE IN PATIENTS WITH MILD COGNITIVE IMPAIRMENT

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This study uses machine learning to predict whether mild cognitive impairment (MCI) subjects will develop Alzheimer's disease (AD), a neurodegenerative disorder that impairs cognition, memory, and behavior. The study uses longitudinal data from the Alzheimer's Disease Neuroimaging Initiative (ADNI) database to predict disease progression. The Shapley value explanation (SHAP) technique was used to identify common biomarkers for predicting progression from MCI to AD. Four fundamental data sampling approaches were compared to balance the dataset and reduce overfitting. Eight classification methods were examined for analyzing neuroimaging data to predict progression from MCI to AD. The Shapley Additive Explanations (SHAP) technique was found to be the most effective in identifying critical biomarkers and enhancing disease progression predictions. Random Over Sampling was found to be the most advantageous in sampling methods. Artificial Neural Networks (ANN) was found to be the superior approach in classification, offering enhanced accuracy and predictive power over alternative strategies.

ADDRESSING DATA SCARCITY IN MEDICAL IMAGING: SYNTHETIC DATA GENERATION AND SELF-SUPERVISED LEARNING

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The scarcity of required medical imaging data for building AI models presents significant challenges for researchers, attributed to stringent government regulations, high acquisition costs, licensing issues, and the labor-intensive process of data annotation. This presentation explores innovative approaches to address these limitations, focusing on practical solutions that meet the pressing needs of the research community. One promising avenue is the utilization of synthetic data, which can bypass many barriers associated with real medical data. We will showcase VICTRE as a tool enabling the creation of realistic synthetic X-ray datasets, particularly valuable for tasks like breast cancer diagnosis. We discuss the application of VICTRE simulations in generating synthetic datasets for breast cancer images, showcasing their effectiveness in tasks such as estimating the percent fibroglandular composition of the breast—a particularly challenging task with real-world data. Additionally, we will present recent advancements in self-supervised learning methods, specifically the implementation of Joint Embedding Predictive Architecture (JEPA) style pre-training with a novel vision transformer model. We will discuss its application to breast cancer prediction, including evaluations of linear probing performance on small, labeled datasets, demonstrating the efficacy of these approaches in overcoming data scarcity challenges.

PULMONARY ARTERIAL HYPERTENSION WITH METHAMPHETAMINE USE: DECADE LONG DEMOGRAPHIC AND TREND ANALYSIS FROM 2008-2020

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Pulmonary arterial hypertension (PAH) is a rare, chronic, progressive form of pulmonary hypertension in which increased arterial pressure causes remodeling of the arterial system. PAH is specifically defined as increased mean arterial pressure (MAP) in the lungs by greater than 20mmHg, in the absence of cardiac disease, abnormal lung pathology, and thromboembolic causes. PAH may be idiopathic with common risk factors such as hypertension or arterial disease, or it may be drug induced. Methamphetamine is a stimulant that has recently become a focus in PAH research and is now being labeled in the “definite” category as a causative agent of PAH. The focus of this study is to analyze the overall trends and demographics of PAH alone in comparison to the trends and demographics of PAH with concurrent methamphetamine usage. This study utilized the National Inpatient Sample, Healthcare Cost and Utilization Project, and Agency for Healthcare Research and Quality from 2008 to 2020 to calculate nationally weighted estimates for both conditions. The results revealed an overall significant increase in methamphetamine-associated PAH hospitalizations (9.2-fold). In terms of demographics, the highest prevalence of methamphetamine-associated PAH hospitalizations was seen in patients defined as White, male, older than age 64, living in the Southern US, Medicare users, and those with a salary of less than $25,000. The results reveal a national trend of increasing PAH with concurrent methamphetamine usage, demonstrating the need for further PAH education and public health outreach, specifically for susceptible methamphetamine users.

ARTIFICIAL INTELLIGENCE AND IN VITRO FERTILIZATION:AN ETHICAL AND ANTICIPATORY ETHICAL ANALYSIS

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Introduction: the birth of the first baby conceived through the use of in vitro fertilization (ivf) happened over four decades ago when Louise brown was born on July 25, 1978. Since that time there have been a variety of developments and advances with ivf related to technological developments. These developments, related to technological improvements include personalized ovarian stimulation, extended embryo culture at physiological oxygen level improvements and a move to single embryo transfer. However, the success of ivf has remained level (stagnant) for the last decade. The focus of a great deal of research on ivf related to ai has been on the effort to improve upon the 30% success rate of in vitro fertilization. The use of artificial intelligence has been deployed to improve fertility outcomes within fertility clinics. This use of ai has focused on the potential for adopting ai techniques as a way to develop improvements for issues related to ivf cycle, egg/sperm and embryo selection, as well as developing ways for improving and developing ivf treatment techniques. In addition to discussing these issues this analysis will discuss the ethical and the anticipated ethical issues with the application of ai

technics as they are being applied to ivf technology. **Methods:** The method used in this analysis will be a standard conceptual analysis and definition of the key terms related to AI and in vitro fertilization techniques as well as concepts related to ethic AI and anticipatory ethical analysis. **Results:** The results of the conceptual analysis will identify ethical and anticipated ethical problems with the use of ai as applied to ivf to improve in vitro fertilization and will discuss ethical and an anticipatory ethical analysis of AI applied to IVF technology. **Conclusion:** The pros and cons of artificial intelligence and ivf will be identified in order to identify ethical and anticipated ethical issues with ai applied in vitro fertilization.

Medical Device Implants I

IMPLANT CUSTOMIZATION TO INCREASE IMPLANT EFFECTIVENESS IN ALIF

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Disc degeneration is a normal part of the aging process that occurs from gradual degradation of the spinal discs. This process occurs on the spectrum in almost all individuals over the age of 35, and in severe cases, can lead to sharp and chronic back and neck pain. Anterior lumbar interbody fusion (ALIF) is a surgical procedure that involves fusion of two or more vertebrae in the lower back to stabilize the spine and relieve pain related to disc degeneration. A potential complication of the ALIF procedure, however, includes progressive implant subsidence that can result from an error in the positioning and/or sizing of the implanted cage. Hence, the current study aims to evaluate how implants tailored to the endplate impact resistance to subsidence. We reconstructed cadaveric spines using CT scans of L5 vertebrae and isolated endplates and cortical shell from the inner trabecular core. The novel implant was positioned on each bone surrogate in the unexpanded (control) or expanded (tailored) configuration and compressed at a rate of 5 mm/min. The subsidence load and construct stiffness were evaluated for each group. The subsidence load of the tailored implants was significantly higher than that of the control group ($p < 0.05$), although the construct stiffness did not result in significant improvement ($p > 0.05$). A positive correlation was found between the subsidence load and cortical bone surface in the tailored implants group only. There was no correlation seen between the stiffness and cortical surface in the control group or the tailored group. Based on our findings, the use of endplate tailored ALIF implants has the potential to decrease subsidence and increase effectiveness compared to regular implants.

DESIGN OF A DYNAMIC SCOLIOSIS BRACE FOR TREATING ADOLESCENT IDIOPATHIC SCOLIOSIS

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Adolescent idiopathic scoliosis (AIS) is an irregular curvature of the spine in children that develops during early adolescence. An estimated 30,000 children per year are prescribed a brace for curve progression prevention. The prescribed brace wear time of 18 hours is uncomfortable for children leading to non-compliance. With proper compliance the brace is 72% effective in preventing progression, but lack of compliance reduces brace effectiveness. Velcro fastening straps are tightened to apply corrective forces to the spine, however, tension is lost over time. These limitations with current bracing technology provide the need for a more comfortable brace that will increase compliance as well as provide active force correction to not only maintain the spinal curve but reduce it. Our Biorobotics and Rehabilitation Lab has developed a modified brace fastening system that replaces the Velcro fastening strap fasteners with constant tension units (CTUs). The CTU fasteners allowed the brace to expand and contract during daily living activities (DLA). A pilot study (n=15 scoliosis patients) comparing Velcro fastener brace to CTU fastener brace while performing 11 DLAs found the CTU brace-maintained force correction while improving comfort. An IRB-approved imaging study is currently underway to validate the claims that the CTU brace improves spinal curve correction without compromising user comfort compared to the Velcro brace. Moving forward, the goal of this project will be to use tools and methods in additive manufacturing technology to design a modular and compliant scoliosis brace that provides active force correction by strategically integrating the CTU devices into the brace.

DOES TKA ALTER SYNOVIAL FLUID PROPERTIES? A COMPARISON OF NECROPSY TKA AND CONTRALATERAL KNEE SPECIMENS

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In vivo, synovial fluid contacts cobalt-chromium-molybdenum (CoCrMo) implants and may transfer metal ions into the periprosthetic tissue. Previous studies identified both variable synovial fluid electrochemical properties and metal ion levels in necropsy total knee arthroplasty (TKA) specimens [1]. This study compared synovial fluid's physical, chemical, and electrochemical properties in necropsy TKA and contralateral (native) knees. Synovial fluid was collected from ten deidentified pairs of necropsy TKA and native knees following an IRB-approved protocol (22-09069-XP). For each knee, synovial fluid volume was recorded, and pH was measured using a compact pH meter. To assess electrochemical properties, synovial fluid was placed in an electrochemical cell. Open-circuit potential (OCP) was monitored for 60 minutes followed by electrochemical impedance spectroscopy (EIS). The resulting spectra were fit with a Randles-CPE model. Oxide polarization resistance (R_p) values were area-adjusted, and the inverse was taken to calculate the instantaneous corrosion rates. Synovial fluid volume from TKA specimens (5.6±2.5 mL) was significantly higher than the contralateral knees (1.6±0.50 mL, p=0.000). We did not identify significant differences in pH (p=0.07). The open circuit potential values for the specimens with total knee replacements and the contralateral specimens ranged from -0.15 to -0.35 V and -0.03 to -0.33 V,

respectively. The instantaneous corrosion rates ($1/R_p$) for TKA specimens (1.804E-7±7.49E-8 $\Omega^{-1}cm^{-2}$) were significantly higher than the corrosion rates of the contralateral knees (9.035E-8±5.58E-8 $\Omega^{-1}cm^{-2}$). Future work will investigate a larger sample size and explore alternative circuit model fits for the EIS data. **References:** [1] Brown et al, ISTA Proceedings #8628, 2023. **FDA Disclaimer:** The findings and conclusions in this abstract have not been formally disseminated by the Food and Drug Administration (USFDA) and should not be construed to represent any agency determination/policy. The mention of commercial products their sources, or their use in connection with material reported herein is not to be construed as either an actual or implied endorsement.

FLAT-FEET HEALTH MONITORING SYSTEM UTILIZING TRIBOELECTRIC ENERGY HARVESTING

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A self-powering triboelectric-based smart insole for flat-foot continuous health monitoring is proposed. The smart sensor that also serves as a triboelectric energy harvester can be developed and embedded in a show so that data can be continuously collected and analyzed to detect any earlier signs of flat-foot problems that may occur. Through strategically placed triboelectric sensors along the transverse arch, medial longitudinal arch, and lateral longitudinal arch of the foot, a normally arched foot will generate a continuous voltage from each of the sensors except the one located at the lateral longitudinal arch because of the nature of the arched foot at this location. However, for those with flatfoot, voltage is generated from all sensors, including the sensor located along the lateral longitudinal arch, as the layers are continuously in contact. The self-sustainability of the system makes it particularly suitable for continuous, long-term monitoring, with potential applications in healthcare, rehabilitation, and sports medicine.

USE OF MANIFOLD DEVICE TO PREVENT POST-*OPERATIVE GASTROSTOMY LEAKAGE*

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Gastrostomy tubes (“G-tubes”) play an important role in nutrition for those who cannot orally ingest food for a variety of reasons. A common complication that occurs with G-tubes is leakage. D50 injection around the gastrostomy tract is proposed to stiffen and decrease the diameter of the tract sufficient to decrease leakage onto the outside skin. To minimize inaccurate D50 injection, we created a fully external injection guide which produces a highly reproducible pattern for D50 injection. The original design included a central guide piece that would temporarily enter the gastrostomy tract. This central piece posed a risk of breaking in the body, calling for the change to a completely external device. The new design includes six evenly distributed guide sites for D50 injections, and externally secures the injection sites around the G-tube without the need to remove the gastrostomy tract during the procedure. FDA approval of D50 usage for this procedure has recently been granted and data collection on this procedure is forthcoming. Preliminary testing of our device will include injecting boluses of a visible tracer into porcine skin to record accuracy and reproducibility using this injection guide. Because of the external nature of this device, our approach is being fast-tracked for use by local IRB, and we anticipate gastrostomy tube leakage patients to be enrolled shortly. By utilizing this accurate injection approach, we anticipate that G-tube patients will experience less leakage and resolution of any skin breakdown or irritation.

A NOVEL PELTIER-CONTROLLED PHASE-CHANGE SOFT ACTUATOR FOR BIOMEDICAL APPLICATIONS

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In this work, we present an advanced thermo-active variable impedance module, enhancing our previous innovations in thermal-based impedance adjustment for actuation systems. Our initial design utilized the temperature-responsive, viscoelastic properties of Polycaprolactone (PCL) to modulate stiffness and damping via integrated flexible Peltier elements. While effective, the reliance on compression and the stress relaxation characteristics of PCL resulted in suboptimal response times for impedance adjustments. To address these limitations, our current module adopts a novel 'shear-mode' operation. Comprehensive shear rheology analyses of PCL have identified a configuration that eliminates viscoelastic delay, providing a faster response and improved heat transfer efficiency. A significant advantage of our module is its scalability and the elimination of additional mechanical actuators for impedance adjustment. The compactness and efficiency of thermal actuation through Peltier elements allow for significant downsizing, making these modules exceptionally well-suited for applications where space constraints and actuator weight are critical. This development represents a major advancement in the design of variable impedance actuators, offering a more versatile, responsive, and compact solution for a wide range of robotic and biomechanical applications.

Nanomedicine and Drug Delivery I

NEUROPEPTIDE Y1 ANTAGONIST AMELIORATES WEIGHT GAIN IN POSTMENOPAUSAL ANIMAL MODELS

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Studies have documented that sustained estrogen delivery can modulate or sustain normal female reproductive structure and function. However, the literature lacks scientific evidence regarding the mechanism of estrogen and a neuropeptide Y (NPY) antagonist effect on weight gain in post-menopausal females. This

study explored the role of sustained estrogen delivery and its effects on weight gain compared to an NPY antagonist in post-menopausal animal models. There were 75 adult female rats divided into five groups (n=15/group), including the intact control, ovariectomized, ovariectomized-sham, ovariectomized + estrogen, and ovariectomized + NPY antagonist). Animals in four groups were surgically sterilized, and three groups were implanted with a TCP delivery device loaded with no drug or biological (sham), estrogen, or an NPY antagonist. At the end of each study phase, animals were euthanized and weighed. Vital organs were evaluated at 2, 4, and 8 weeks post-implantation. Samples of organ tissues were submitted for histological evaluation. The results of this study revealed statistically significant differences in the body weight and wet organ weights of the ovariectomized + estrogen and ovariectomized + NPY antagonist groups compared to the control groups at endpoints ($p<0.05$). This analysis indicated that the ovariectomized estrogen-treated animals and NPY antagonist-treated animals maintained weight comparable to the intact control group. Overall, this study demonstrated that the release of estrogen and an NPY antagonist at sustained levels results in an observable reduction in weight gain compared to ovariectomized and sham control groups.

NEUROPEPTIDE Y1 ANTAGONIST PRESERVES REPRODUCTIVE ORGAN MORPHOLOGY IN POSTMENOPAUSAL ANIMAL MODELS

Gary Hamil[1], Michelle Tucci[2], Hamed Benghuzzi[3], Kenneth Butler[2]

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Previous studies have demonstrated that sustained estrogen or neuropeptide Y (NPY) delivery can modulate normal female reproductive organ structure and function. However, the literature lacks scientific evidence regarding the mechanism of estrogen or an NPY antagonist effect in preserving reproductive tract morphology. This study explored the role of sustained estrogen delivery and its effects on female reproductive organs compared to an NPY antagonist. There were 75 adult female rats divided into five groups (n=15/group), including the intact control, ovariectomized, ovariectomized-sham, ovariectomized + estrogen, and ovariectomized + NPY antagonist. Animals in four groups were surgically sterilized, and three groups were implanted with a TCP delivery device loaded with no drug or biological (sham), estrogen, or an NPY antagonist. Animals were euthanized, and samples of reproductive organs were evaluated at 2, 4, and 8 weeks post-implantation by histological evaluation. Statistically significant differences were demonstrated in all ovariectomized+estrogen and ovariectomized+NPY antagonist reproductive organ morphology compared to the ovariectomized and sham control groups at endpoints ($p<0.05$). These findings indicate that the ovariectomized estrogen-treated animals and NPY antagonist-treated animals demonstrated tissue thickness and morphology similar to ovariectomized controls. Overall, this study demonstrated that the release of estrogen or an NPY antagonist at sustained levels resulted in observable morphologic preservation of female reproductive organs and tissues comparable to the intact control group.

OPTIMIZING PEGYLATED LIPOSOMAL DOXORUBICIN NANOPARTICLES FOR ENHANCED ANTICANCER EFFECT

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In the clinic, normally the drugs are given with frequent dosages to reintroduce the compound regularly to maintain systemic drug concentration in the therapeutic window. Towards this endeavor, liposome-based drug delivery systems are acquiring considerable attention because of their potential to enhance the effectiveness of cancer treatments by improving the solubility of drugs, lowering toxicity throughout the body, and increasing the uptake of drugs by cells. However, these lipid nanoparticles (NPs) evoke an immune response that results in their removal from the body. To counteract this response, the NPs may be formulated with polyethylene glycol (PEG) chains on the surface of the liposome. These chains help to prevent immunogenicity. This study focused on the synthesis of an anticancer drug doxorubicin-loaded lipid NPs with varying PEG chain lengths and compared it to determine the optimal formulation to maintain a steady-state drug concentration and cellular uptake kinetics *in vitro* experimental settings. Once drug-loaded into the NPs, the characterization was done through a dynamic light scattering to assess its size and charge to determine the stability of these NPs. In addition, drug loading studies were performed using clinically used anticancer doxorubicin (DOX). The data from these experiments allowed the optimal DOX-liposome formulation to be taken for further studies and the effect of PEG chain length in cellular interaction. Drug release studies were carried out in different pH environments to simulate the environments within the body where the liposomes are intended to be used, which showed a sustained release profile. Finally, the therapeutic potential of pegylated DOX-liposome was studied in human breast cancer cells. The results from this study demonstrate the potential therapeutic efficacy for pharmacological applications of proposed lipid NPs systems.

ENGINEERING OF NATURAL KILLER CELL-DERIVED EXTRACELLULAR VESICLES WITH LIPOSOMES FOR TARGETED CANCER THERAPY AND DIAGNOSIS

Viswanathan Sundaram, Sriyam Joshi, Dinesh Shrestha, Israel Joshua Santhosh, Shoukath Sulthana, Santosh Aryal

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Currently, nanodrug technology has revolutionized the pharmaceutical sciences by providing substantial advancements compared to traditional drug delivery methods. The nano drug systems utilize nanoparticles to improve the transportation, effectiveness, and precision of therapeutic and diagnostic substances. The optimal usage of nanoparticles is limited by factors such as nanotoxicity, heterogeneity in biodistribution and accumulation, and the clearance of nanoparticles by the human

body. The development of biomimetic biogenic nanoparticles using cellular products is rising as an emerging nano drug delivery system due to their ability to target cell communication. Among various cellular products, a high-yield cellular product such as extracellular vesicles (EVs) are of great interest because a single cell produces thousands of EVs equipped with parent cell-specific cargos of proteins, lipids, and genetic materials, which can be selectively taken up by neighboring or distant target cells. Within this background, we herein propose to engineer EVs derived from NK cells which are recognized as innovative drug delivery systems due to their biological source and compatibility with living organisms. For this purpose, EVs isolated from the NK92 cell, one of the emerging and highly studied cells in immunotherapy that naturally seek tumors, were re-engineered with synthetic liposomes and studied its tumor-targeting properties on *in vitro* and *in vivo* experimental models. EVs were isolated from cell supernatant using sequential centrifugation, then filtered and assessed for their physical (Size, charge, polydispersity, and stability), biological (protein markers) properties, and tumor targeting efficacy using *in vitro* and *in vivo* models. These EVs were nano entities with size ranges from 30 to 170 nm with negative zeta potential of -19±5mV, which were re-engineered with pre-synthesized 150±5 nm liposome by using mechanical extrusion resulting in the formation of monodispersed hybrid liposomal EVs (HLEVs) with a hydrodynamic diameter of 160±2 nm and zeta potential of -41±1.5 mV. These EVs and HLEVs were found to be reached in protein biomarkers present in NK cells such as CD-56, NKG-2D, NKp-30, and a marker for EVs, CD-63. *In vitro* and *in vivo* studies revealed that these biomimetic HLEVs system efficiently targets and distribute in the targeted cancer cells Considering the importance of proteins in target recognition and mother nature acquired from NK cells, we are highly optimistic that the proposed construct holds promise in targeting tumors to minimize off-target effects in cancer therapy.

EVALUATING CELLULAR-BASED DRUG DELIVERY THROUGH IMMUNE AND CANCER CELL INTERACTION

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Cells have been proposed as a potential drug delivery vehicle that has wide application in medicine. A cellular-based drug delivery system could be used within oncology, cardiology, or immunology. In this project, THP-1 cells (a human monocyte) were used as the model drug delivery cell and their interaction with MCF-7 (a human breast cancer) was studied, specifically with regard to their ability to deliver a drug payload to the cell. THP-1 cells were coincubated with MCF-7 and imaged using a live-imaging system that would allow for monitoring of the cells as immune cell action proceeded. Images were studied to gain a better understanding of the interaction between the cells. THP-1 cells recognized the target cancer cells and were seen attaching to and inducing lysis of the MCF-7 cells, proving their effective targeting. THP-1 cells were then loaded with a fluorescent (the model drug). Post-loading, cells were imaged to evaluate loading efficiency, then incubated with MCF-7 cells to establish drug delivery to target. Transfer of fluorescence was observed which proved proper delivery of the model drug. Additionally, protein assays were run on the lysate of THP-1 and MCF-7 to characterize pre-interaction state, and MCF-7 post-treatment. A Fluorescence-Activated Cell Sorting study was also run on MCF7 treated with dye-loaded THP-1 to quantify the delivery of the drug model to the cancer cells, which shows rapid interaction and transfer of payload to cancer cell. With the increase in use of personalized therapies in the treatment plans of many pathologies, there is potential in using immune cells as a cellular-based drug delivery vehicle for treatment.

Kinesiology and Rehabilitation

IMPACT OF DIFFERENT BIOMECHANICAL MODELS ON KNEE KINEMATICS, RELIABILITY AND BICYCLE FIT RECOMMENDATIONS

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Introduction: The aims were to compare the kinematic outputs of Plug-in-Gait (PiG) and Conventional Gait Model 2 (CGM2) biomechanical models, assess the reliability of the two models for cycling motions, and compare each model's classification of saddle height. **Methods:** Healthy, adult, recreational cyclists participated in two data collection sessions. Kinematic data was collected via an 11-camera motion capture lab. Ten pedal cycles were processed using the two biomechanical models. Knee extension, total frontal plane knee motion, and total transverse plane knee motion were compared using repeated-measures t-tests ($p < .0167$). Two-way mixed-model intraclass correlation coefficients (ICC) analyzed test-retest reliability of each model for each plane of knee motion. Cohen's kappa assessed agreement of the two models on saddle height classification. **Results**: 35 recreational cyclists were included. CGM2 calculated a larger sagittal angle than PiG by 1.82° ($p = .014$, $d = 0.438$) and 10.8° less frontal plane motion than PiG ($p < .001$, $d = 1.123$). No significant effect on transverse plane knee motion ($p = .280$) was found. ICC's for CGM2 were excellent for sagittal (.919), good for transverse (.861), and moderate for frontal plane motions (.740). ICC's for PiG were good for sagittal (.853), and moderate for frontal (.603) and transverse planes (.578). The agreement between models on saddle height was moderate ($k = 0.461$). **Conclusions**: CGM2 has better test-retest reliability in all planes. Small differences in kinematic outputs of each model may influence the bicycle fit decisions. Further studies should determine which model's kinematics are more correct.

COMPARISON OF SELECTED GAIT PARAMETERS IN NULLIPAROUS FEMALES WITH AND WITHOUT URINARY INCONTINENCE

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Young, nulliparous women can experience problems urinary urgency (UU) or urgency urinary incontinence (UUI). This is the first study looking at specific gait parameters nulliparous college-aged women with UU or UUI to age-matched women without any urinary symptoms. Participants were screened and consented. Reflective markers were placed on each participant according to the Plug-in Gait Model on the Vicon Motion Analysis System. Spatiotemporal, kinetic, and kinematic data were collected and were processed using the Plug-in Gait Model within the Nexus processing system. Ten participants had complaints of UU or UUI and ten participants without complaints were age-matched to those with UUI. Means and standard deviations for selected parameters were analyzed with independent sample t-tests. A paired t-test was used for between-limb comparisons between the right and left lower extremities for step width in the urinary urgency group. Data were analyzed with IBM SPSS. Eighteen female participants completed gait analysis with nine of these being participants with symptoms of urgency or UUI and nine without. There were no significant differences for the comparisons between groups for cadence ($p = 0.981$), step width ($p = 0.211$), gait speed ($p = 0.470$), mean hip abduction moment at weight acceptance ($p = 0.101$), and hip external rotation angle at weight acceptance ($p = 0.072$). There was no significant difference in the between limb comparison for step width ($p = 0.150$) for those with urgency. This is the first study to observe gait in nulliparous women with urgency and UUI. Though there were no significant findings between the two groups, this was a small sample size, and the parameters were not exhaustive. Biomechanics of nulliparous females requires further study.

COMPARISON OF A DYNAMIC ANKLE ORTHOSIS WITH A CLINICAL WALKING BOOT ON TIBIAL COMPRESSIVE FORCE REDUCTION DURING TREADMILL WALKING

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Tibial bone stress injuries (TBSI) are the most prevalent overuse injuries in military cadets (29-74%) and recreational runners (22%). Treatment for TBSI involves wearing a walking boot (WB) for three to twenty-six weeks, which reduces ankle mobility and muscle activity, causing significant muscle atrophy within four days of boot wear that delays recovery. The Dynamic Ankle Orthosis (DAO) is an alternative option to a WB that applies a distractive offloading force across the lower limb while maintaining ankle mobility. The objective of the study was to determine the effects of the DAO and WB on tibial compressive force and ankle motion during walking. Twenty healthy young adults walked on a split-belt instrumented treadmill (1200Hz, Bertec) at 1.0 m/s in two brace conditions: DAO and WB (Össur FormFit Walker Air). A 3D motion capture system (240Hz, Qualisys) recorded kinematic data, force treadmill recorded ground reaction forces, and force sensing insoles (100Hz, loadsol, Novel) measured in-shoe vertical reaction force. The difference in the peak tibial compressive force (10.9%; $p = 0.03$; $d = 0.5$) and Achilles' tendon force (12%; $p = 0.021$; $d = 0.5$) were moderately lower in the DAO compared to the WB. Sagittal plane ankle motion from peak plantarflexion to peak dorsiflexion during stance phase was 54.9% lower in the WB compared to the DAO ($p < 0.001$; $d = 3.2$). The improved walking dynamics provided by the DAO (i.e., reduced tibial compression force, decreased Achilles' tendon force, and increased sagittal ankle motion) compared to a clinical WB support its consideration as an alternative rehabilitation method for treating TBSI.

ASYMMETRY IN KINEMATICS OF DOMINANT/NONDOMINANT LOWER LIMBS IN CENTRAL AND LATERAL POSITIONED COLLEGE AND SUB-ELITE SOCCER PLAYERS

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Change of direction, stops, and pivots are among the most common non-contact movements associated with anterior cruciate ligament (ACL) injuries in soccer. By observing these dynamic movements, clinicians recognize abnormal kinematic patterns that contribute to ACL tears such as increased knee valgus or reduced knee flexion. Different motions and physical demands are observed across playing positions, which may result in varied lower limb kinematic patterns. In the present study, 28 college and sub-elite soccer players performed four dynamic motions (change of direction with and without ball, header, and instep kick) with the goal of examining the effect of on-field positioning, leg dominance, and gender in lower body kinematics. Motion capture software monitored joint angles in the knee, hip, and ankle. A three-way ANOVA showed significant differences in each category. Remarkably, centrally positioned players displayed significantly greater knee adduction (5° difference, p=0.013), hip flexion (9° difference, p=0.034), hip adduction (7° difference, p = 0.016), and dorsiflexion (12°difference, p=0.022) when performing the instep kick in comparison to their laterally positioned counterparts. These findings suggest that central players tend to exhibit a greater range of motion when performing an instep kicking task compared to laterally positioned players. At a competitive level, this discrepancy could potentially lead to differences in lower limb muscle development among on-field positions. Accordingly, it is suggested to implement position-specific prevention programs to address these asymmetries in lower limb kinematics, which can help mitigate dangerous kinematic patterns and consequently reduce the risk of ACL injury in soccer players.

TEMPORALIS MUSCLE TRAINING THROUGH SERIOUS GAMES FOR AUTONOMOUS WHEELCHAIR USERS

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Amyotrophic lateral sclerosis (ALS) is characterized by a significant decrease in mobility due to its neurodegenerative etiology (1). The development of electromyography (EMG) interfaces for wheelchair control can restore some autonomy (2). This work explores two different electromyographic training games to support learning hands-free control via the temporalis muscles. Data collected across two studies evaluate the efficacy of training and usability. *Limbitless Journey* is a simulation game patients play prior to real-world wheelchair usage. *Limbitless Runner* (3), adapted from bionic arm training, was implemented for temporalis muscle training via muscle contraction controlled jump height. To evaluate the efficacy of *Limbitless Journey*, a qualitative Think-Aloud study with able-bodied participants was conducted. Participants were placed into 1 of 3 cohorts that differed in control interface: participant controlled mouse, researcher controlled mouse, and participant controlled eye-tracking. Participants voiced their feedback while playing through the game and completed the Game User Experience Satisfaction Scale (GUESS) and the System Usability Scale (SUS). More participants were given *Limbitless Runner's* quantifiable, structured training mode, the "ring challenge" for use as a scored pre-test, then assigned to one of three cohorts for training: *Limbitless Journey, Limbitless Runner's* "free play mode", or "ring challenge" before the final post-test. This research revealed that the temporalis muscles were able to be trained for isolation and discretization, enabling the control of gamified simulation characters and events. It also demonstrated where usability successes and areas for improvement exist, which will enable improvements prior to exposure for ALS patients. All cohorts showed an improvement.

COMPARISON OF MEASURED VS. PREDICTED GROUND REACTION FORCES IN FULL BODY MUSCULOSKELETAL MODELING: A STUDY USING MARKER-BASED AND IMU-BASED KINEMATIC SYSTEMS

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Assessment of subject-specific kinematics and ground reaction forces (GRF) is crucial for the evaluation of vertebral joint contact forces and estimations of spine biomechanics [1 2]. Traditionally, GRF measurements have relied on gold standard laboratory-based force plates synchronized with marker-based systems [3 4]. Alternatively, inertial measurement unit (IMU) systems allow for kinematics to be obtained without the need for camera, eventually mimicking real-life environments [4 5]. The AnyBody modeling software implements a full-body musculoskeletal (MSK) model that allows for predictions of GRF through inverse dynamic analysis [6]. Predicted GRFs from IMU-based kinematic input in the modeling process could be useful in translating the process to an outside environment, although its accuracy has not been extensively validated. Five dynamics tasks and three static postures were captured on eleven healthy subjects using both camera-based and IMU-based, kinematic systems simultaneously. MSK modeling was then implemented to obtain GRFs using the marker-based kinematics and force plate data (measured), and to obtain the IMU-based kinematics and predicted GRFs [3 7]. The average GRF, analyzed vertically, for all tasks showed a Pearson correlation of 0.99 between systems, highlighting the predictive model's high accuracy. Paired t-tests showed no significant differences between systems, except when evaluating walking with weights (p=0.02). The predicted GRF demonstrated high agreement with the gold standard of force plates, offering a viable alternative for assessing joint contact forces for diverse populations and pathologies without laboratory constraints.

Biomedical Education I

MECHANISMS FOR MOTIVATING HIGH SCHOOL SENIORSTO APPLY AND EARN SCHOLARSHIP FUNDS

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College education is expensive, and costs continually escalate. Parents and families establish and utilize savings plans and college funds, but various fees attached to higher learning cost scratch pupils and their parents off guard. Nothing in life is free; therefore, scholarships that are awarded to students to support their matriculation at institutions of higher learning require training and extensive efforts by students and parents. High school students do not have specific courses geared to teach them about the cost of college or about earning scholarships; thus, there is a need to empower high school Seniors with informative facts regarding college options and opportunities to earn scholarships. The goal of this project was to expose mechanisms for motivating high school Seniors to apply for scholarships and earn funds to offset the cost of out-of-pocket payments and/or the need for student loans. Class meetings facilitated to focus on college admission and scholarship earnings is a proper means to stimulate Seniors to select potential colleges and begin to investigate criteria for earning scholarships. Seniors were allotted time during each school day to complete and submit applications. Their earnings were announced on the public address system, posted on the bulletin board, listed in the commencement program, and shared on the local television news. The number of scholarships Seniors received over a five-year period increased exponentially. The quality of life of students and their future families are at stake, and this study demonstrates that the motivation and encouragement of 21st century learners to exploit scholarship opportunities is beneficial and essential.

COLLABORATIVE E-LEARNING PLATFORM FOR HEALTH PROFESSION STUDENTS WITH APPLICATION TO UNDERSTANDING SOCIAL DETERMINANTS IN OBGYN

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Background: While online platforms have proven effective in enhancing healthcare education by offering flexible learning schedules, there is a notable lack of e-learning platforms specifically designed to improve knowledge and clinical reasoning regarding health disparities in the OBGYN setting. Social determinants of health (SDoH) encompass the conditions in which people are born, live, learn, work, play, worship, and age. These factors are particularly relevant in obstetrics and gynecology, where health disparities are linked to worse outcomes for disadvantaged populations. Non-Hispanic Black patients, for example, are three times more likely to die from pregnancy-related complications compared to White patients. We developed an e-learning platform and developed a study of social determinants of health in clinical reasoning as an example application. This study assessed the increased awareness and understanding of SDoH and their role in healthcare disparities through pre- and post-test case assessments. **Methods**: A repository of virtual case simulations targeting Obstetrics and Gynecology foundational knowledge, incorporating social determinants of health, was developed by our multidisciplinary team. Thirty students were recruited via email and campus instructors; however, three did not complete the modules, and one had incomplete pre/post-tests, so only twenty-six participants were included. Surveys administered before and after completing ten virtual case modules assessed students' comfort and competency regarding SDoH in OBGYN, and the post-test also assessed the usefulness and impact of the modules. **Results**: Pre-survey results indicated that 60% of participants had never heard of SDoH, 63.3% lacked confidence in listing the five SDoH domains, and nearly 65% had never received formal training on SDoH. Most participants (80%) believed interprofessional teams were better positioned to assess SDoH than single professionals, 60% acknowledged the impact of SDoH on clinicians' decision-making, and 96.7% recognized the impact on patients' decision-making. Post-survey results showed that 80% of participants felt the e-learning tool influenced their decision-making perceptions. User-friendliness was rated highly, with 48.1% giving it a 10 out of 10, and approximately 74% found the platform easy to use. Open-ended feedback praised the modules' accessibility and clarity, though suggestions included a refresher on SDoH before the modules and adding explanations for answers. The Wilcoxon Signed Ranks test analysis indicates that the e-learning platform significantly impacted students' confidence level in discussing the following domains: living situation and housing stability ($p<0.014$), food security ($p<0.007$), personal safety ($p<0.025$), financial stressors ($p<0.002$), employment ($p<0.008$), and education ($p<0.014$). The e-learning platform significantly increased participants' confidence in knowing the SDoH ($p<0.001$), listing the five domains of SDoH ($p<0.001$), and perception that they had formal training on SDoH ($p<0.001$). **Conclusions:** The e-learning platform significantly increased students' knowledge of SDoH and their confidence in applying it in an OBGYN clinical context. Initially, most participants were unfamiliar with SDoH, but post-module completion showed improved confidence in discussing all five SDoH domains with patients. These findings emphasize the importance of integrating SDoH modules into health professions curricula using e-learning platforms.

THE PERCEPTIONS OF FACULTY AND STUDENTS REGARDING ARTIFICIAL INTELLIGENCE USAGE IN EDUCATION AT AN ACADEMIC MEDICAL CENTER

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Background: Artificial intelligence has taken center stage in the education sector, particularly following the emergence of OpenAI. It is essential for educators to recognize that AI tools are becoming an integral part of education, akin to the transformative inventions of the past century like computers and the Internet. **Objective:** The current study aimed to gain insights into how faculty and students at the University of Mississippi Medical Center perceive AI usage in education. **Methods:** This study utilized a sequential exploratory mixed-methods design. Quantitative data were collected first through a cross-sectional survey and analyzed with descriptive statistics using SPSS 28. Qualitative data were collected through semi-structured interviews and analyzed with constant comparative methods. **Results:** A total of 169 faculty (36%) and students (64%) responded to the survey. 74% of respondents reported that they were aware of AI tools and 45% reported that they had personally used AI for academic activities. In addition, 67% of the respondents believed that AI tools could potentially have a positive impact on learning. However, they were concerned about the reliability and accuracy of AI-generated content. The interviews indicated that faculty were open to utilizing AI tools but were uncertain about how to proceed. Students stated that they were actively using AI to assist with assignments but were concerned about potential penalties. **Conclusion:** The study revealed that AI tools have not been widely used by faculty and students. However, the inevitability of AI tools becoming integral to education should motivate educators to proactively leverage AI's potential and turn challenges into opportunities.

EPIDURAL EDUCATION FOR LABOR AND DELIVERY USING TELEMEDICINE

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Advanced Molecular and Cellular Technologies

MODULAR RNA ENGINEERING TO POTENTIATE GENE SILENCING

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Gene silencing through RNA interference (RNAi) offers an opportunity for single gene manipulation without permanent changes to genomes. Gene silencing is induced through

introduction of an exogenous RNA molecule that is processed into small RNA (20-30nt) effectors that guide regulatory complexes to target transcripts. Successful RNAi-based pharmaceuticals and agriproducts share a common feature in that they have been developed around an effective delivery method. Commercialization in other settings will likewise need to be delivered reliably. Invertebrate animals have more complex RNAi biology, relative to humans, with many expressing a distinct class of RNAi effectors, called piwi-interacting RNAs (piRNAs) in their somatic cells. This includes many parasites and disease vectors. piRNA are distinct in their biogenesis is not dependent on precursor structures such as double-stranded RNA, which is required for generation of other RNAi effectors (ie small-interfering RNAs and microRNAs). This provides an opportunity for engineering RNAs that elicit RNAi through piRNA production by inclusion of additional elements that can drive internalization and trafficking. Here we present results from using engineered RNAs that include aptamers and motifs that affect localization to elicit gene silencing in refractory cell lines animals.

DECIPHERING THE ROLE OF THE GENOME IN MASH USING MATURE IPSC-DERIVED HEPATOCYTES

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Metabolic dysfunction-associated steatotic liver disease (MASLD) affects ~100 million people in the US, with no curative treatments identified yet. The lack of human models has contributed to the failure of clinical trials of drugs tested solely in animal models. Importantly, genome-wide association studies have identified hundreds of single nucleotide polymorphisms (SNPs) associated with MASLD predisposition and progression, but the mechanistic implications of these SNPs remain unknown. Human-induced pluripotent stem cells offer a unique platform to differentiate hepatocytes and develop liver organoids. We have established an optimized differentiation protocol for mature and functional iPSC-derived hepatocytes. We demonstrated that iPSC-hepatocytes express hepatocyte-specific markers, and recapitulate primary human hepatocytes functions, including albumin secretion, glycogen storage, and CYP3A4 activity. Using a CRISPR-Cas9 based approach, we generated a pure population of iPSC-hepatocytes with > 90% ALB^+ hepatocytes. MASH (metabolic-associated steatohepatitis) is the more advanced form of MASLD. The main pathogenic driver of MASH occurs when energy intake exceeds metabolic needs due to excess fat in diet. We used our mature iPSC-hepatocytes to model MASH by treating the cells with multiple lipid treatment modalities. We found that a three-day combinatorial treatment of 400 µM palmitic acid and 400 µM oleic acid was optimal to induce MASH phenotypes, including significant lipid accumulation and expression of key MASH-specific markers of inflammation and steatosis (SREBP1c, PPARα, ALT, AST, and more). Next, we plan to develop this model in liver organoids, and utilize it to explore the functional role of MASH-associated SNPs.

QUANTIFYING CELL-CELL ADHESION DYNAMICS: ATOMIC FORCE MICROSCOPY INVESTIGATION

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Objective: Cellular functionality relies on intricate cell-cell binding interactions, principally mediated by a class of transmembrane proteins called cadherins. Various methods exist to quantify cell-cell adhesion, yet few measure adhesive force between individual cells. One method that *can* measure adhesion at the single-cell level is atomic force microscopy (AFM). In this study, we investigated the effect of the retraction delay, defined as the time between cell-cell contacts. The retraction delay is significant because it allows the cells to recover from prior cadherin-mediated cell-cell. **Methods:** In fluid, cell-surface adhesion was quantified using a Bruker Bioscope Catalyst atomic force microscope (AFM). Cantilevers were coated with 2 mg/mL Concavalin A and calibrated for spring constant and deflection sensitivity. Human cells were allowed to attach to the Concavalin A coated cantilever over a 1 h period. The cell-attached cantilever was then approached to cell monolayer, and cell-cell binding was allowed for 45 seconds. The cantilever was then retracted, breaking the cell-cell binding, and reapproached to the cell monolayer after retraction delays of 60, 120, and 300 seconds. This procedure was repeated thrice on three different cells, resulting in 9 force-distance curves. **Results:** The adhesive forces between cells, with cell-cell contact time of 45 seconds and retraction delays of 60, 120, and 300 seconds, were observed to be 1.2 ± 0.4, 1.5 ± 0.4, and 1.9 ± 0.4 nN, respectively. Statistical analysis revealed no significant difference in adhesion forces across varying retraction delays ($p > 0.05$). This suggests that retraction delay does not substantially affect cell-cell adhesion strength within the tested time frames. **Conclusion:** Using AFM, we successfully measured cell-cell adhesive forces. Despite varying retraction delays, the adhesive force between cells remained consistent. Our results indicate that retraction delay had no significant impact, and the cells recovered from prior cadherin-mediated cell-cell binding within 60 seconds. In the future, we will analyze the effect of cell-cell contact time on the adhesive forces between the cells.

Cardiovascular

DEMOGRAPHIC AND RISK FACTOR ANALYSIS OF STIMULANT INDUCED HEART FAILURE

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Heart failure occurs when the heart is not able to pump enough blood to meet the demands of the body. It can be divided into heart failure with preserved ejection fraction (HFpEF) caused by decreased systolic function with ejection fraction (EF) less than <40% or heart failure with reduced ejection fraction (HFrEF) due

to diastolic dysfunction with EF ≥50%. Stimulant use like cocaine and methamphetamine causes heart failure and etiology is multifactorial with excess sympathetic stimulation and direct myocardial toxicity being prominent. Literature review has shown that stimulant use is more common in the young, male, African American population, while methamphetamine use was more prominent among Hispanics and Pacific Islanders, with increasing use among Whites and decreasing use among African-Americans. Users also had fewer comorbidities, reduced left ventricular EF, were more likely to leave against medical advice, more in Medicaid patients, more readmission rates, and lower mortality. Heart failure due to methamphetamine is more common on the West Coast and no similar data is available for cocaine users. Most cases were of HFrEF although, few report HFpEF among methamphetamine users. Continued methamphetamine use can cause HFpEF to progress to HFrEF, but the same is unknown for cocaine users. Most data available compares heart failure in stimulant users to non-stimulant users without distinction between HFrEF and HFpEF. Therefore, a study must be designed with clear definitions of HFpEF and HFrEF with matched controls to identify the demographics and risk factors among stimulant induced heart failure patients.

PLANT-DERIVED XANTHOHUMOL TO TARGET LEUKEMIA CELLS

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Background. Leukemia a cancer of the white blood cells can also affect erythrocyte (red blood cells), lymphocytes (white blood cells) and platelets. There are four types of leukemia: acute myeloid leukemia (AML), chronic myeloid leukemia (CML), acute lymphocytic leukemia (ALL), and chronic lymphocytic leukemia (CLL). AML occurs when the bone marrow begins to make blast cells that have not completely matured and most widely used treatment is chemotherapy. AML affect both kids and adults, but is more common in adults and affects males at higher rates than females. Although 2 out of 3 patients that receive chemotherapy go into remission, leukemia causes yearly approximately 250,000 deaths, and is associated with resistance to chemotherapy. In order to overcome chemoresistance, novel therapeutic approaches, particularly, phytochemicals, are currently being considered. Xanthohumol (XN) is a natural polyphenol in plant hop (*Humulus lupulus* L) which is used in beer making. **Hypothesis:** In this study, we examined antileukemic effects of natural phytochemical XN on HL-60 leukemia cells, a model to study AML. XN is a natural polyphenol found in plant hops. We tested the hypothesis that XN inhibits HL-60 growth through apoptosis. **Materials and Methods.** HL-60 cells were purchased from ATCC and grown according to manufacturer's recommendations. HL-60 cells were exposed to different concentrations of XN (μM) for 24 h. Cell viability, cell morphology, the expression of $p21^{WAF1/Cip1}$ and CYP24A were and apoptosis were analyzed. **Results.** XN reduced HL-60 cell viability in a dose-dependent manner. At 5, 12.5, and 25 μM, cell viability was reduced to 98, 84, and 83 % vs control. At 50 μM cell viability was reduce to 53%. XN induced a dose-dependent profound morphological changes including cell size change from large in size and clustered to smaller in size and less clustered and with blebbings at 12.5 and 25 μM. XN induced the expression of $p21^{WAF/CIP}$ and Cyp24A1. These data indicates that XN induces HL-60 cells death by regulating cell cycle progression and apoptosis. This study also suggests that dietary supplements with XN may have antileukemic preventive effects. **Acknowledgements:** Research reported in this publication was supported by NIH/RCMI U54MD015929 grant for research project to MP. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institute of Health

A COST-EFFECTIVE BIAXIAL MECHANICAL TESTING SYSTEM FOR VASCULAR SPECIMENS

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Mechanical characterization of blood vessels is pivotal for understanding how the vasculature (mal)adapts to various pathologies. Commercial mechanical testing devices pose significant cost barriers, warranting the development of affordable alternatives. Toward this end, we have designed a device to characterize the circumferential and longitudinal (thus biaxial) mechanical properties of small blood vessels using cost-effective and open-source hardware and software for approximately 10% of the cost of commercial systems. Circumferential distension is measured continuously via live tracking of the vessel's inner and outer diameters using a microscope camera, while intraluminal pressure is controlled automatically using a syringe pump. Each end of the specimen is attached to a parallel beam load cell to enable continuous measurement of longitudinal force, while longitudinal stretch is prescribed with automated translation stages. All electronic components, including pressure transducers, load cells, and stepper motors, interface with custom open-source software through a microcontroller board. Our experimental setup allows live visualization and real-time analysis of inner/outer diameters, pressure, and longitudinal force/stretch as the software compiles data from the pressure transducers, load cells, and microscope camera. Validation studies using hydrogel conduits of known mechanical properties and murine arteries are ongoing. This device overcomes limitations of current open-source pressure myography systems, which do not measure longitudinal force or automatically control circumferential/longitudinal loads, while avoiding the prohibitive cost of current biaxial systems.

ROLE OF NCK1 SH2 AND SH3.1 DOMAINS IN ENDOTHELIAL ACTIVATION

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The non-catalytic region of tyrosine kinase adaptor protein 1 (Nck1) has been identified as a key regulator in the progression of atherosclerosis through the regulation of endothelial activation. Endothelial activation increases the adhesion and migration of

cells and molecules into the intima of arteries, promoting the formation of plaque. This event has been localized to the areas of the vascular tree with oscillatory blood flow, where it increases the expression of inflammatory molecules. Previous studies have shown that the global inhibition of Nck1 in atheroprone mice has a protective effect in the development of the disease, and oscillatory flow induces Nck1 interaction with IRAK-1. To gain insight as to how Nck1 mediates the inflammation through IRAK-1's upstream receptors (IL1R1 and TLR4) we employed treatment with the receptors ligands after in vitro Nck1 selective small peptide inhibition and Nck1 siRNA knockdown. These results will help elucidate the mechanisms of flow-induced plaque formation and serve for the development of more effective domain-targeted drugs that should be useful for the treatment of the disease.

Cartilage and Ligaments I

AN INVERSE FINITE ELEMENT APPROACH TO CHARACTERIZE MENISCUS MECHANICS AND COLLAGEN FIBER DAMAGE MECHANISMS

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Damage to the meniscus, particularly to its collagen fibers, can lead to compromised joint function and osteoarthritis. Understanding the mechanical properties and damage mechanisms of the meniscus is essential for developing effective treatments and preventive strategies. ~0.5mm thick tissue samples of lateral porcine menisci were prepared via freezing stage microtome either in the circumferential direction (circumferential fibers parallel to the direction of stretch) or in the radial direction (circumferential fibers orthogonal to the direction of stretch. Slices were trimmed into rectangles (circumferential samples ~10 x 6mm; radial samples 4 x 5mm). Experiments were conducted on a uniaxial, displacement-controlled apparatus with high resolution imaging and samples were stretched to 400% of their initial length at a rate of 0.1s-1. Stress-strain curves were developed. The meniscus was modeled as a biphasic coupled transversely isotropic Veronda-Westmann model. The model was curve fit to the experimental data, therefore optimizing the fiber coefficients. Model verification was accomplished via custom image processing to identify transition point (transition between compression-dominated and shear-dominated failure), yield strength, ultimate tensile strength, and complete rupture. The computational model curve fit to the experimental data at R^2>0.95 for radial samples. The optimized fiber coefficients in the biphasic coupled transversely isotropic Veronda-Westmann model were in agreement with circumferential experimental results. In conclusion, our adapted computational model for meniscus mechanics can be deployed as a tool to further characterize meniscus pathophysiology and guide the development of tissue engineered constructs aiding novel treatment approaches.

CREEP AND STRESS RELAXATION OF THE SCAPHOLUNATE INTEROSSEOUS LIGAMENT: A BIOMECHANICAL STUDY

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Few studies have reported stress relaxation data of the scapholunate interosseous ligament (SLIL) and even fewer have explored creep[1]. This information is essential as tissue engineering scaffolds have been targeted to aid in regeneration of this unique ligament complex. Matching the viscoelastic properties of the native tissue will ensure adequate repair of the joint at time zero (just after implantation) and will provide the appropriate mechanical cues for tissue regeneration. 10 matched pairs of fresh frozen cadaveric male SLIL's (average age 56.1yrs) were dissected en bloc. The scaphoid was potted in urethane casting resin and inserted into a custom fixture that allowed for natural alignment of the ligament along the axis of loading. The lunate was attached to the actuator of an MTS 858 Mini Bionix servohydraulic load frame equipped with a 1kN axial load cell using a pin inserted through the bone. Cross sectional area (A_0) of the dorsal portion of the SLIL was calculated and initial length (L_0) was measured. All specimen were preconditioned for 25 cycles at 1Hz to 50% of the specimen's targeted L_T. L_T was calculated for each specimen based on their L_0 and the target strain, ε_T, calculated in a previous experiment as the start of the linear region of the stress strain curve for SLILs. One limb from each pair was randomized to stress relaxation testing while the contralateral limb received creep testing. Specimen were cyclically loading for 1,000 cycles, n=5, or 10,000 cycles, n=5, at 1Hz from L_0 (~3N) to either L_T for stress relaxation or F_T for creep testing. F_T was calculated for each specimen based on their A_0 and the target stress, σ_T, calculated in a previous experiment mentioned above. After 1,000 cycles (n=10), the average stress relaxation was 1.28(0.79)MPa and the average creep was 0.44(0.66)%. After 10,000 cycles (n=5), the average stress relaxation was 3.28(2.06)MPa and the average creep was 0.45(0.51)%. SLILs exhibit additional stress relaxation after 1,000 cycles while creep is more stable. Work modeling the relationship between creep and stress relaxation is underway.

CREEP AND STRESS RELAXATION OF THE SCAPHOLUNATE INTEROSSEOUS LIGAMENT: A BIOMECHANICAL STUDY

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Few studies have reported stress relaxation data of the scapholunate interosseous ligament (SLIL) and even fewer have explored creep[1]. This information is essential as tissue engineering scaffolds have been targeted to aid in regeneration of this unique ligament complex. Matching the viscoelastic properties of the native tissue will ensure adequate repair of the joint at time zero

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EXTERNAL FIXATION V BRACING IN INITIAL TREATMENT OF MULTILIGAMENT TEARS OF THE KNEE

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While there are indications on when and how bracing versus external fixation should be used during the pre-operative portion of multiligament knee injury treatment, there isn't a concise doctrine on which results in superior post-operative patient recovery. The purpose of this study is to compare two modes of pre-operative treatment based on patient outcomes following definitive surgical reconstruction. This is a retrospective case control study of 33 patients identified within the EPIC database with multiligament knee injuries treated within the LSU Ochsner Health System by a single board-certified sports medicine surgeon since 2019. Any pre-operative use of an external fixator qualified patients for the experiment group, while those whose care comprised solely of a hinged knee brace formed the control group. Following descriptive analysis to characterize patient comorbidities, associated injuries, and perioperative factors, sole pre-operative use of a hinged knee brace demonstrated statistically significant improvements in patient outcomes compared to pre-operative external fixation ($p=0.048$). Our study found significant differences in patient outcomes based on pre-operative modes of treatment. this supports the sole use of hinged knee bracing, which provides a less expensive and less invasive option for patients whose multiligament knee injuries do not include neurovascular compromise.

IN VITRO FORCE MEASUREMENTS ACROSS THE ANTERIOR CRUCIATE LIGAMENT BY PASSIVE FLEXION-EXTENSION OF THE KNEE

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Current tensioning methods for anterior cruciate ligament (ACL) reconstruction surgeries are variable based on the operating surgeon. A tendon autograft is inserted in the knee joint, through a bone tunnel. One end of the graft is secured using a bone screw, then the practitioner pulls taut until it feels the tendon is "tensioned enough" to provide knee stability, at which time the other end is secured via bone screw. This method produces a high-tension inconsistency depending on the technique, choice of knee flexion, and strength used by the surgeon. Failure to appropriately tension grafts may lead to over-constraint (stiffness) or under-constraint (laxity) of the knee - both situations having been attributed to post-surgical osteoarthritis of the joint.[1] This is exacerbated by the fact that tensioning is further reduced after pre-conditioning, and may lead to increased postoperative joint laxity.[2] We present a pilot study to evaluate the effects that the surgeon's applied force during reconstruction has on the measured force across the ACL in a passive flexion-extension scenario. A custom device was developed to measure forces across the reconstructed ACLs, in a controlled series of passive flexion-extension tests from five cadaveric knees. The experiment involved four trials per specimen to assess repeatability between trials. The limb was set at full extension (0 degrees) for ACL tensioning by the surgeon. A custom mounting fixture allowed for passive flexion at 10-degree increments up to 150 degrees. Four specimens reached their max force at 150 degrees, 60N(SD$\pm$13) (Threefold the initial tension), while the highest force for the fifth specimen occurred at 70 degrees, 90N(SD$\pm$60) (Twofold the initial tension). While bending the knee from full extension to 90-100 degrees, the ACL loses tension; nonetheless, by increasing flexion, the ACL regains tension. The results show that the initial tensioning of the tendon by the surgeon has a direct impact on the stress experienced across the ACL when flexing the knee over 100 degrees.

Biomaterials I

Customizable Thiol-Clickable Hydrogels for 3D Cell Cultures

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The objective of this research is to create modifiable hydrogels serving as matrix 3D cell structures for a specific tissue environment. This will be done by combining thiol-click chemistry with allylated gelatin (GelAGE), following the method of introducing alkene groups to the gelatin backbone, then

crosslinking with di-thiol crosslinkers to the gel. Pursuing this approach allows customization of the gelatin-based hydrogels, specifically, manipulation of stiffness, nutrient transport capabilities, and network structure. Moreover, customization is significant because it allows the GelAGE hydrogel to mimic the extracellular matrix of cartilage, for example, knee cartilage. Exploring the mechanical and thermomechanical characteristics, alongside the integration of chondrocyte cells into hydrogel matrices, presents valuable avenues for examining biological distinctions across diverse 3D culture setups. Additonally, this investigation stands as a pivotal platform for pioneering drug delivery initiatives. This study aims to propel the evolution of 3D cell culture systems that mimic in vivo tissue environments. Emphasis lies in highlighting the most optimal hydrogel composition mimicking human cartilage, thus replicating its extracellular matrix (ECM) and facilitating chondrocyte proliferation. Clearly, the developed thiol-clickable hydrogels present promising applications in drug discovery and tissue engineering, providing researchers with a comprehensive gradient of hydrogel stiffnesses.

MOLECULAR SIGNATURE DIFFERENCES BETWEEN PLACENTAL TROPHOBLASTS FROM NORMOTENSIVE AND PREECLAMPTIC PREGNANCIES IN RESPONSE TO VITAMIN D - A PROTEOMICS ANALYSIS

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Placental trophoblast (TC) dysfunction plays a vital role in pathogenesis of preeclampsia (PE), a hypertensive disorder in human pregnancy. Vitamin D deficiency/insufficiency in pregnancy is considered a risk factor for PE development. Our study aims to determine beneficial effects of vitamin D in pregnancy and identify molecular signature of placental TCs in response to vitamin D. TCs were isolated from normotensive (Nor) and PE placentas and treated with or without bioactive $1,25(OH)_2D_3$ in culture. Total cellular protein was collected, and Label-free quantification Gel-Based proteomic assay was then performed. A total of 4213 peptides were identified across all TC samples. PCA analysis showed that proteomic profiles are significantly different between Nor-TCs and PE-TCs in response to vitamin D. Bioinformatic analysis revealed that protein profiles upregulated by vitamin D significantly enriched in endoplasmic reticulum (ER) to Golgi transport vesicle in Nor-TCs, whereas protein profiles upregulated by vitamin D showed significant enrichment in cytosol and organelle in PE-TCs. Moreover, a total of 77 proteins that were significantly reduced in PE-TCs were upregulated by vitamin D stimulation. KEGG analysis highlighted pathways enriched by these proteins, including protein processing in ER, lysosome, and metabolic pathways, etc. STRING analysis further discovered networks of proteins in ER and mitochondria, including SEC61A1, SEC63, YME1L1, and MT-ATP6, etc. These data identified vitamin D-mediated molecular signature profiles in placental TCs and demonstrated beneficial effects of vitamin D on improvement of TC function in PE.

EXPLORING SHAPE MEMORY POLYMERS FOR BIOMEDICAL APPLICATIONS

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Shape memory polymers are next-generation biomaterials, and these materials have an excellent capability to undergo self-softening after implantation in the body. Our ultimate goal is to develop a biomedical version of the heat shrink tubing to seal body parts and organs after surgery or injury. These polymers have combined self-softening technology, enhanced flexibility with shape memory properties. Using 1,3,5-triallyl-1,3,5-triazine-2,4,6(1H,3H,5H)-trione (TATATO), Trimethylolpropane tris (3-mercaptopropionate)(TMTMP), and Polyethylene Glycol Diacrylate (PEGDA) with different molecular weights (Mn 250 and Mn 575), thiol-ene/acrylate polymers were produced. Thiol-ene polymers exhibit softening properties under bodily conditions, the addition of polyethylene glycol diacrylate enhances the stretchability of the polymer system. Dynamic mechanical characterization of thiol-ene acrylate polymer showed shifts in glass transition temperature (Tg) with the addition of the PEGDA. The shifts in the Tg are due to the presence of water molecules in the polymer acting as plasticizers. The water-induced plasticization in the polymer system leads to the free volume in between the polymeric chains, allowing the molecular chains of the polymer to move freely in the system, lowering the Tg of the polymer in soaked condition. The analysis of shape memory behavior using DMA showed a consistent pattern in the material's shape recovery and fixity. The addition of varying weight % of PEGDA corresponds with the enhanced shape recovery properties of material. Our studies indicate that our material possesses shape memory properties, and having a heat shrink tube that responds to bodily conditions would enable various applications.

CHARACTERIZATION OF INSULIN-SECRETING ARIP CELL LINE TREATED WITH GLUCAGON-LIKE PEPTIDE-1 TO EVALUATE THEIR SUITABILITY IN SUSTAINED-RELEASE DRUG DELIVERY FOR DIABETES TREATMENT

Gary Hamil[1], Hamed Benghuzzi[2], Michelle Tucci[3], Kenneth Butler[3]

[1]Belhaven University, [2]Jackson State University, [3]University of Mississippi Medical Center

Diabetes is a prevalent, progressive disease with multiple complications. Unsatisfactory treatment modalities have led to new investigations on the viability and suitability of targeted and sustained-release drug delivery approaches to diabetes treatment. This investigation characterized the ARIP pancreatic cancer cell line for future suitability in tricalcium phosphate lysine (TCPL) reservoirs as insulin-producing cells. ARIP cells were treated with 10nM (Glucagon-like peptide-1) GLP-1. Their viability, proliferation rate, morphology, MDA, glutathione, glucose levels, and insulin immunohistochemistry were assessed at 24, 48, and 72 hours. GLP-1 did not affect the viability of ARIP cells. Glutathione levels rose initially, then sharply declined at 72 hours ($p<0.05$).

Over time, ARIP cells became increasingly positive for insulin. Glucose levels dropped significantly after 48 hours of exposure to GLP-1 ($p<0.05$). Treating with 10nM GLP-1 did not alter cellular viability, proliferation, or morphology. Also, GLP-1 does not cause free radical formation in this cell line demonstrated by consistent cell counts and insignificant levels of MDA. Cells grew into monolayers of cobblestone-patterned cells that were translucent. Treatment groups showed increasing insulin levels over time. ARIP cells were found suitable for placement in TCPL drug delivery systems. This study provides the first-ever positive findings of the insulin-secreting ARIP cell line treated with GLP-1 for future hosting in TCPL drug delivery systems.

Cartilage and Ligaments II

ADVANCED MULTISCALE MODELING OF CARTILAGE: ASSESSING THE MECHANICAL INFLUENCE OF ZONAL AND RADIAL CELL VARIABILITY

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Understanding the mechanical environment of cells within collagenous biological tissues during various daily activities is crucial for elucidating the role of mechanics in cell biosynthesis and tissue health. However, current imaging techniques fall short in capturing the rapid deformation of cells. Computational multiscale modeling offers a potential solution, yet existing models incorporating collagen fibril networks and poroelastic ground matrices have typically included only single cells or a few randomly distributed cells without accounting for location-specific size and orientation. In this study, we developed a workflow to generate a multiscale fibril-reinforced finite element model with zone-wise cell distributions and their micro-environments, encompassing both the pericellular matrix and the extracellular matrix. Our observations indicate that cells experience significantly different deformations depending on their zonal and radial positions within the cartilage. Utilizing an axisymmetric finite element model, we conducted both unconfined compression and indentation tests. This comprehensive approach revealed that cells undergo markedly different deformations based on their specific locations within the cartilage. Furthermore, our findings provide insights into the mechanics of individual cartilage extracellular matrix (ECM) macromolecules and their influence on chondrocyte mechanics under physiological loading conditions. These results suggest that the morphological properties of cells are affected by variations in their locations, local structures, and composition. Thus, it is essential to consider the zonal and radial distribution of cells, including their orientation, composition, and size, along with their microenvironment and fibril networks, to fully understand cartilage mechanics.

MECHANICS OF AN INDIVIDUAL COLLAGEN FIBER: A FINITE ELEMENT ANALYSIS

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Collagen fibers serve as crucial structural components in vertebrate animals, providing a framework that gives mechanical support to load-bearing tissues such as cartilage, meniscus, ligament, tendon, etc. A significant amount of research over the past several decades has concentrated on unraveling how these fibrils contribute to the mechanical properties of tissues either computationally, primarily via an atomistic modeling approach, or experimentally, which is challenging for an isolated fiber. In this work, we adopted a continuum approach to investigate the mechanical behavior and associated deformation of an individual collagen fiber under tension, which is the primary type of load experienced by most collagen-rich tissues. The collagen fiber comprises collagen fibrils embedded in a matrix, with the fibrils naturally forming a three-dimensional crimped shape within the soft matrix. We model the fiber crimp as a sinusoidal wave as $Y = A\sin(X)$, where (A) is the amplitude of the crimped fiber. The fiber is modeled as a fiber-reinforced composite, with the volume fraction (v_f) of fiber varying between 50-75%. In the developed finite element (FE) model, no relative sliding between the fibril and the matrix was implemented. The obtained results reveal that parameters such as crimp amplitude A, v_f and the number of fibrils are the primary factors influencing the non-linear mechanics and mechanical properties of the fiber. In contrast to previous studies, which were primarily focused on only the elastic behavior, this study will consider the elastoplastic behavior of the fiber. The incorporation of strain-dependent elasticity and plastic failure introduces a great deal of sophistication into the modeling of collagen fiber mechanics. The constitutive model proposed here accurately captures the stress-strain behavior observed in fibrous soft tissues and serves to validate the soundness of our approach. We have investigated native collagen fibrils in the present preliminary study; however, in the future, simulation of biochemically degenerated collagen fibers will be conducted to understand the mechanical integrity of collagen fibers in disease states. Overall, our study contributes to an enhanced understanding of collagen fiber mechanics and lays the groundwork for further study into the mechanical behavior of collagen-rich tissues.

EFFECTS OF INTEROSSEOUS MEMBRANE INJURY ON FOREARM AND HAND ROTATIONAL MOBILITY

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The interosseous membrane (IOM) is a complex structure and key stabilizer of the forearm. We are unaware of any biomechanical studies that have assessed how the rotational stability of the radial head is affected by injury to the annular ligament (AL) and the IOM. The objective of this study was to quantify how high-impact injury, simulated by sectioning of essential ligamentous structures of the elbow and forearm, changes the native radial head rotational stability and affects the hand's range of rotation during pronation

and supination activities. 14 cadaveric arms were biomechanically tested in active supination and pronation motions in an intact state and following simulated injury to the AL, proximal band (PB), central band (CB), and distal band (DB) of the IOM, respectively. Rotational stability of the radial head and rotational mobility of the hand were assessed using a 12-camera Optitrack motion capture system. Relative measurements to the intact state were assessed via one-way analysis of variance. Tukey's post hoc analysis assessed differences between sectioning states. Simulated AL, PB, CB, or DB injury had no effect on radial head rotational stability or hand rotational mobility during pronation motion. Simulated injury to the AL and PB slightly increased the range of rotation of the radial head and hand. Subsequent sectioning of the CB and DB, significantly reduced the range of rotation of the radial head and resulted in a 60% decrease in rotational mobility of the hand. Understanding the effects of injury to the AL and IOM on hand rotational mobility can aid in determination of surgical intervention.

HUMAN MESENCHYMAL STEM/STROMAL CELL-DERIVED EXOSOMES DIFFUSIVITY IN MENISCUS

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The knee meniscus tissue, partly vascularized, relies on transport properties for therapeutic agent delivery. MSC-derived exosomes, known for their immunomodulatory and reparative properties, are under investigation for their diffusivity and partitioning within the meniscus, considering its structural regions. Exosomes (sEVs) were isolated from Crude and CD146+ eMSC cultures. CD9 validation and CD63 markers confirmed exosome presence. NTA determined the size (<200 nm) and quantity, with PKH67 green fluorescence labeling the exosomes. Porcine meniscus samples from femoral, tibial, and core regions were used. Cylindrical specimens (5 mm diameter, 0.5 mm height) were immersed overnight in a solution containing Crude or CD146+ sEVs. Diffusion coefficient was measured using a custom FRAP technique, and light spectrometry determined the partitioning coefficient. A two-way ANOVA assessed the effects of tissue region and probe type on transport properties. High purity (>90%) of CD9 was observed in both Crude and CD146+ eMSC sEVs. Diffusivity ranged 4-30 mm/s^2. No significant interactions between probes and tissue regions were found ($p > 0.05$). Crude eMSC sEVs showed higher diffusion coefficients than CD146+ eMSC sEVs ($p = 0.025$). Partitioning data is forthcoming. In conclusion, both Crude and CD146+ eMSC sEVs effectively traversed all meniscus regions, highlighting their potential in cartilaginous tissue diffusion. These findings support using CD146+ sEVs to enhance the delivery of orthobiologics and cell-derived therapies for cartilaginous tissue healing.

Artificial Intelligence Concepts

PATIENT PRIVACY-PRESERVING MACHINE LEARNING AND APPLICATION IN ECG SIGNALS

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Modern methods in artificial intelligence perform very well on many healthcare datasets, at times outperforming trained doctors. However, many assumptions made in model training are not justifiable in clinical settings. In this work, we propose a method to train classifiers for electrocardiograms, able to deal with data of disparate input dimensions, distributed across different institutions, and able to protect patient privacy. In addition, we propose a simple method for creating federated datasets from any centralized dataset. We use autoencoders in conjunction with federated learning to model a highly heterogeneous modeling problem using the Massachusetts Institute of Technology Beth Israel Hospital Arrhythmia dataset, the Computing in Cardiology 2017 challenge dataset, and the PTB-XL dataset. For an encoding dimension of 1000, our federated classifier achieves an accuracy, precision, recall, and F1 score of 73.0%, 66.6%, 73.0%, and 69.7%, respectively. Our results suggest that dropping commonly made assumptions significantly complicates training and that as a result, estimates of the performance of many machine learning models may overestimate performance when adopted for clinical settings.

ARTIFICIAL INTELLIGENCE LEADS TO A VACCINE REVOLUTION

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Infectious diseases have shaped human and societal development. Infectious diseases cause about a quarter of all deaths worldwide each year. These diseases also result in many days of lost work and education. The pandemic clearly demonstrated that vaccines are effective in combating infectious diseases. Smallpox was the first human disease eradicated by the use of vaccines. Vaccines not only save lives, but vaccines can also reduce increases in antimicrobial resistance which has been termed the silent pandemic. Artificial intelligence (AI) has revolutionized traditional approaches in many areas including vaccine development. AI is being used to simulate the immune system and create models to identify novel targets for vaccines against bacterial and viral diseases. Vaccine development has involved inactivating a pathogen or identifying a component of a pathogen that elicits a protective immune response against infection in humans. This can be time consuming and requires a lot of resources. AI can use large-scale genomic and proteomic data to predict antigenicity, immunogenicity, and cross-reactivity of potential vaccine candidates greatly reducing vaccine development time. Also, AI can design novel adjuvants and delivery systems to increase efficacy and safety profiles. AI can aid in preclinical and clinical trials by analyzing vast datasets. AI can also monitor vaccine safety following approval of a vaccine

for human use. AI can potentially enhance public confidence in vaccines and help rapidly respond to emerging threats.

GENETIC ALGORITHM FOR DESIGN OPTIMIZATION OF DENTAL IMPLANTS

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Objectives: We previously reported on training an artificial neural network (ANN) to predict the fatigue limits of implants (Satpathy *et al.,* 2022). The current study was aimed at more efficient design optimization by using genetic algorithms and ANN in tandem. **Methods:** The 16 design parameters of implant designs were coded as genes in a virtual genome. Successive generations of designs were created by random crossover between the parent genomes with 125 offspring per generation, mutation rates ranging from 1-20%, and 2-10 parents per generation. The previously trained ANN was queried regarding the fitness (fatigue limit) of each offspring, and the fittest offspring were chosen to be parents of the next generation. Design parameters were constrained to be within either 20% or 40% of the commercially available implant (Biomet 3i external hex). **Results:** Regardless of the genetic algorithm parameters chosen, the implant designs rapidly evolved with the fatigue limit reaching 264 N, which is 128% higher than the best of the commercially available products that we have tested (116 N). This also exceeded the performance of designs found by Latin hypercube (228 N) and manual search (254 N). The speed of convergence on the optimal design was directly related to the point mutation rate and was independent of the number of parents per generation. **Conclusions:** Genetic algorithms are more efficient than Latin hypercube and manual search in optimizing the fatigue limit of reduced-diameter dental implants. However, these results still need to be validated by cyclic loading of physical prototypes.

ENHANCING DIAGNOSTIC ACCURACY THROUGH DOMAIN ADAPTATION: AUTOMATED DETECTION OF EXTRACAPSULAR EXTENSION IN HEAD AND NECK CANCER CT IMAGES

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Background: Domain adaptation in medical imaging allows models trained on specific datasets to be effectively applied to different, yet related, datasets. This capability is essential in clinical settings where data diversity can impact model performance. A Gradient Mapping Guided Explainable Network V2 (GMGENetV2) model effectively demonstrates this by identifying extracapsular extension (ECE) in head and neck cancer from CT scans, without the need for manual lymph node annotations. **Methods:** GMGENetV2 enhances its predecessor by integrating gradient-weighted class activation mapping (Grad-CAM), which highlights significant regions affecting the model's predictions, facilitating domain adaptation. This model employs a 3D DenseNet architecture that extracts significant volumes of interest (VOIs) from CT images autonomously, which simplifies the overall diagnostic process. Through domain adaptation techniques, the model generalizes effectively across diverse datasets, enhancing robustness and applicability in varied clinical environments. **Results:** GMGENetV2 achieves an accuracy of 71.6% and an area under the curve (AUC) of 78.1%. These results demonstrate GMGENetV2's robust performance across different imaging domains and streamline the data preparation process. **Conclusions:** GMGENetV2 demonstrates the potential of domain adaptation in improving the accuracy and reliability of medical diagnostics. By utilizing domain adaptation strategies, the model shows robust performance across varying imaging conditions, thus streamlining the transition from model development to clinical application. In addition, by leveraging deep learning and explainable AI, the model enhances the interpretability of ECE detection in CT scans. This advancement significantly reduces the need for detailed radiological input, facilitating quicker and more accurate clinical decision-making.

IN SILICO CANDIDATE GENE PERTURBATIONS: CHARACTERIZATION ARRHYTHMIA POTENTIALS OF DRUG TARGETS OF IPSC-DERIVED CARDIOMYOCYTE THERAPIES

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Human induced pluripotent stem cells (iPSCs) as a future treatment of heart failure have been complicated by cardiac arrhythmia. The arrhythmia can be attributed to immature cardiomyocytes after iPSC differentiation, such as gap-junction imperfection, different electrophysiological properties, and ineffective autonomic regulation, which may disrupt the synchronized contraction of the heart and lead to irregular electrical activity. To study the molecular mechanism of iPSC differentiation leading to possible arrhythmia, we first compiled candidate genes implicated in these biological processes from iPSC data sets that are publicly available on the CM4AI website. We hypothesize the use of drugs targeting genes that lower the probability of arrhythmia occurrence after iPSC transplantation in the heart may improve the therapeutic intervention success rate. Therefore, we conducted a systematic simulation experiment using a deep-learning-based software tool called GEARS. We experimented with each candidate gene involved in cardiomyocyte maturation and evaluated their impact on arrhythmogenic potential. Currently, we have identified KCND3 as a possible treatment target, showing promising results in reducing arrhythmogenic potential in our simulations. Further validation and refinement of these findings through experimental studies should be pursued to advance the development of effective therapeutic interventions for heart failure using iPSC-derived cardiomyocytes.

IMPACT OF AI AND ORGAN MATCHING IN KIDNEY TRANSPLANTATION

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Kidney transplantation is a treatment of choice for individuals with end stage renal disease (ESRD). Nationally, there are more than 100,000 individuals on the waiting list of which the majority are in need for kidney. Matching appropriate donor-recipient pairs includes many difficulties. The United Network for Organ Sharing (UNOS), uses complex computerized programs to identify the best match recipient for the available donor organ. Risk factors linked with 1-year graft loss are associated with genetics mismatch between recipient and donor leukocyte antigen (HLA). In addition, recipient and donor age, living vs. deceased donor, and recipient pre-existing health such as diabetes, hypertension, BMI, cardiovascular disease, all have impact on the clinical outcomes particularly organ survival. Recently, artificial intelligence (AI) and machine learning (ML) have provided a significant contribution in kidney match and availability of appropriate unrelated donors. AI algorithms have provided most fitting match between donor and recipients across the country. The AI uses matching algorithms based on extensive database of registered donor and recipient's profiles in the kidney exchange program. Demographic and biological data of patients willing to donate a kidney but are incompatible are submitted to the UNOS registry. Biological factors such as blood type, tissue compatibility (HLA match) and other relevant markers are used to identify an optimal match. The data are used for identification of multiple exchange combination. In addition, by predictive modeling based on patient health status, donor organ characteristics, surgical procedure (cold/warm ischemia time, etc.), the AI estimates postoperative complications. Thus, in turn reduces post-transplantation complication leading to greater organ survival. In conclusion, the AI algorithms used from a donor-recipient registry empowers identification of compatible donor for a suitable recipient. However, the management of such a computerized system will need cooperation of an ethical institute for patient and donor protection.

Orthopaedics I

A THREE-DIMENSIONAL APPROACH TO DETERMINE THE INTER-RATER AND INTRA-RATER RELIABILITY OF HIP JOINT CENTER LOCATION IN THE INFANT HIP

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Estimating the hip joint center (HJC) location in infants allows for biomechanical analysis of the lower limb and it can also be used to assess and diagnose developmental conditions. Early diagnosis of conditions such as cerebral palsy, developmental dysplasia of the hip, and other musculoskeletal disorders rely on precise HJC location. It is becoming more popular to use 3D models to determine the HJC and its derivatives. The efficacy of this method has begun to be studied in adult cases, but the reliability and repeatability are not well documented for infant models. We hypothesize that using 3D analysis methods will have a high inter-rater and intra-rater repeatability in infant cases when determining the HJC through the femoral head. We will use a sample of femurs from the Ortolani collection from the University of Padua, with the ages ranging from 0 - 6 months. Three to five researchers will segment 8 femurs using a threshold-based segmentation technique in 3D Slicer, an open-source software. In 3D Slicer, a best-fit method will be used to fit a sphere around the femoral head to calculate its geometric center, indicating the HJC. This will be repeated several times by each researcher. These values will then be analyzed to determine the inter-rater and intra-rater reliability of the 3D-based estimation method. Our study has the potential to provide further evidence for radiologists to make 3D analysis a standard in musculoskeletal examination, as we hypothesize high repeatability will be seen. If the hypothesis is proven, it could potentially increase long-term health outcomes by advancing accurate and early diagnostics.

THERAPEUTIC POTENTIAL OF RUNX1-ENGINEERED MESENCHYMAL STEM CELLS FOR CARTILAGE REPAIR

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Introduction: Placenta-derived Mesenchymal stromal cells (PMSCs) have been widely explored for tissue engineering applications and have demonstrated high proliferation and capacity for chondrogenic differentiation *in vitro*. However, rapid induction of PMSC chondrogenic differentiation during therapeutic transplantation remains extremely challenging. Our previous studies discovered that transcription factor Runx1 plays a crucial role in stem cell chondrogenic differentiation. Particularly, gene silencing Runx1 completely blunted PTH induced formation of chondrogenic nodules and expression of chondrogenic markers in micromass culture of murine limb bud mesenchymal cells [1]. Here we undertook a study to determine if Runx1 overexpression by adenovirus could be utilized to accelerate human PMSC-mediated cartilage repair in a mouse cartilage defect model. **Methods:** In this study, PMSCs were isolated from human placenta delivered from normal term. PMSC stemness phenotype was evaluated by colony formation and flow cytometry. *In vitro* osteogenic, chondrogenic and adipogenic differentiation assays were performed to determine the multipotency. Adenovirus-mediated gene expression was used to test whether Runx1 overexpression could enhance chondrogenesis in PMSC pellet culture. A mouse knee joint cartilage defect model was used for *in vivo* study. Wild type and Runx1 overexpression PMSC pellets were generated and inserted to fill the cartilage defects. After 4 weeks postoperatively, animals were euthanized and osteochondral units containing the defects were harvested. Alcian Blue/Orange G staining, Immunohistochemical staining (IHC) and RT-PCR analysis for Sox9, type II collagen (Col-II), and Aggrecan was performed to analyze *in vitro* and *in vivo* chondrogenesis. All experiments were repeated at least three times independently and data were presented as mean ± standard deviation (s.d.). Statistical significance among the groups was assessed with one-way ANOVA. The level of significance was

P<0.05. **Results**: 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, in PMSC chondrogenic cell pellet cultures, overexpression of Runx1 significantly enhanced chondrogenesis by showing increased Alcian blue staining, enhanced Col-II expression when compared to control wild type PMSCs (Fig. 1A). PCR data further showed an increased expression of chondrogenic markers Sox9, Col-II and aggrecan in pellet cultures of Runx1 expressing PMSCs when compared with wild type PMSCs (Fig. B, C, D). Importantly, the *in vivo* transplantation of Runx1 expressing 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 when compared with wild type PMSCs at 4 weeks after operation (Fig. 2). **Discussion**: In this study, PMSCs were observed to have high proliferation and chondrogenic ability, especially when pro-chondrogenic gene Runx1 was overexpressed. This result is also in agreement with our published studies that Runx1 is induced in the initial steps of chondrocyte maturation and differentially regulated by BMP and TGF signaling [2]. **Significance:** Collectively, these findings demonstrate that 1) PMSCs are a favorable cell source for cartilage repair. 2) Overexpressing transcript factor Runx1 could accelerate PMSC differentiation into chondrocyte under the cartilage microenviroment *in vivo*. Our results strongly suggest that overexpress Runx1 in stromal cells may be a promising strategy to enhance stem cell-based cartilage regeneration.

MACROPHAGE INDUCED SENESCENCE IN OSTEOPROGENITOR CELLS: PRO- AND ANTI-INFLAMMATORY EFFECTS ON BONE REGENERATION

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INTRODUCTION: Macrophages are essential to coordinating mammalian tissue regeneration. In the dynamic bone microenvironment, macrophages exist as dual-natured entities, adopting pro-inflammatory (M1) or anti-inflammatory (M2) phenotypes in response to specific conditions. M1 macrophages, activated by IFNγ and LPS, release cytokines and ROS that induce cellular senescence, hindering the regenerative function of osteoprogenitor cells (OPs). In contrast, macrophages, induced by IL-13, can play a reparative role, suggesting their protective effect against tissue damage due to inflammation. The distinction between these phenotypes is crucial in the context of healing and regeneration across the entire human body. Mice, mirroring human regenerative abilities, offer an applicable model to study these effects and are able to regenerate the distal half of the digit tip, known as the third phalangeal element (P3). This regenerative capability contrasts with the response to amputations proximal to this point (P2), where regeneration fails, resulting in a cartilaginous callus without bone growth beyond the amputation plane and subsequent dermal scar formation. The underlying reasons for this disparity in healing outcomes between amputations mice, or union or non-union fractures in humans, raise questions about whether the differences are attributable to intrinsic qualities of OPs or to the environmental factors influencing the healing process. This study aims to explore how OPs respond to the senescence-inducing effects of macrophage-derived factors, considering the potential influence of macrophage phenotypes on the regenerative process. If differences in P2 and P3 cell regeneration capabilities are caused by their intrinsic characteristics, we hypothesize that P2 cells will demonstrate increased senescence in response to stimulation with macrophage-conditioned media. **METHODS:** OPs were isolated from P2 and P3 mouse digits and cultured. To measure stress resistance, P3 and P2 cells were placed in 24 well plates with different variations of macrophage-conditioned media. To make macrophage conditioned media bone marrow macrophages are treated with different stimulants, IFN/LPS (M1), IL-13 (M2), or no treatment (M0) for 24 hours. The media was washed off and OPs were collected 24 hours later for SA-βGal senescent staining. **RESULTS:** P3 OPs exhibited significantly increased senescence when exposed to the untreated macrophages (M0) and IFN/LPS treated (M1) conditions, compared to P2 cells, which showed no significant change in senescence levels. M2-conditioned media exerted a seemingly protective effect, with no observed difference in senescence between P2 and P3 cells. **DISCUSSION**: Our findings contradict our hypothesis and suggest that extrinsic factors are what affect the regenerative properties of P2 and P3 cells. P3 cells showing increased senescence convey the complexity of the bone microenvironment, particularly in how macrophage-derived factors modulate cellular senescence differently in OPs derived from different locations of mouse digits. Overall, these findings indicate that certain OPs exhibit resistance or vulnerability to inflammatory environments. Furthermore, they suggest that in vivo injuries capable of regenerating these inflammatory conditions may vary across different regions, potentially due to differences in secretory factors and other regional characteristics.

LIMB SURVIVAL OF GRADE III OPEN TIBIA FRACTURES AFTER CREATION OF AN ORAL MAXILLOFACIAL SOFT TISSUE FLAP TEAM

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INTRODUCTION: High grade open tibial fractures are some of the most common injuries encountered by orthopedic surgeons. Chances of complication increase 13% with each day of delayed wound coverage and 87% of complications require operative intervention. A modified orthoplastic approach was used in the treatment of open tibial fractures involving both orthopedic and oral/maxillofacial surgeons. The purpose of this paper is to assess the limb salvage rate of high-grade open tibial fractures after establishment of a limb salvage team with OMFS. **METHODS:** From charts that met inclusion criteria, we collected relevant data. Our cohort consisted of 34 patients ranging from 2020-2023. We compared numerical data using a T-test and categorical data using a Chi square test. **RESULTS:** Implementation of OMFS limb

salvage team for the treatment of high-grade open tibial fractures from 2020-2023 lead to a limb salvage rate of 91.2%. There was a higher rate of limb survival, and no difference in wound complication and osteomyelitis rates in non-DM versus DM as well as in non-smoking versus smoking patient groups. **DISCUSSION & CONCLUSION**: Limb salvage rate using ortho-OMFS approach is similar to orthoplastic approach, and much higher than ortho-only approach. Non-diabetic patients and non-smoking patients have better limb survival outcomes than diabetic and smoking patients. Creation of an OMFS limb salvage team is beneficial in the treatment of grade III open tibial fractures.

Saturday, September 14, 2024

Nano Technology Cancer Drug Delivery

The HK97 VIRUS-LIKE PARTICLE: A VERSATILE NANO-SCAFFOLD VEHICLE FOR TARGETED DELIVERY

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Nanomaterials hold great promise as vehicles for transporting therapeutic and diagnostic agents in the treatment of disease. Virus-like particles (VLPs) are non-pathogenic protein cage structures derived from viruses that hold promise as therapeutic delivery vehicles. While a library of various VLPs exist, the VLP derived from the bacteriophage HK97 is a particularly promising scaffold for biomaterials construction and use in therapeutic delivery strategies. The HK97 VLP is comprised of single coat protein, GP5, that spontaneously self-assembles into a 56 nm porous nanoparticle with a hollow interior surrounded by protein shell (capsid). Investigations in our lab have led to the development of the HK97 VLP as a platform that allows covalent localization of small molecules on the interior, external modification and chemical programming through genetic display of peptides on the VLP surface, and directed encapsulation of macromolecular cargoes on the interior. Our investigations also show the ability to disassemble and reassembly the HK97 VLP *in vitro*. Here we present our findings for modifying the HK97 VLP to produce an adaptable nanoplatform and initial investigations toward utilizing it toward applications in diagnostic and therapeutic delivery.

OPTICAL BLOOD-BRAIN-TUMOR BARRIER MODULATION ENHANCES DRUG PENETRATION AND THERAPEUTIC OUTCOME IN CLINICALLY RELEVANT GLIOBLASTOMA MODELS

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The development of effective therapies for brain tumors has been challenging in part due to the presence of the highly selective blood-brain barrier (BBB). Although the BBB breakdown is common in high-grade gliomas and brain metastases, the blood-brain tumor barrier (BBTB) shows heterogeneous permeability, which limits the delivery efficiency of systematically administrated drugs. In the current work, we demonstrated that the optical modulation of blood-brain tumor barrier permeability (optoBBTB) allows paclitaxel penetration into tumor and exhibited powerful anti-tumor efficacy. We first analyzed the intratumoral blood-brain-tumor barrier heterogeneity in human glioblastoma and characterized two genetically engineered mouse models that recapitulate two important glioma phenotypes, including the diffusely infiltrative tumor margin and angiogenic core. Next, we showed that picosecond laser stimulation of tight junction targeting gold nanoparticles (optoBBTB) enhances the delivery of paclitaxel in these two models. The treatment reduces the tumor volume by 6 and 2.4-fold and prolongs the survival by 50% and 33%, respectively. Since paclitaxel does not penetrate the BBB and is abandoned for glioblastoma treatment following its failure in early-phase clinical trials, our results raise the possibility of reevaluating a number of potent anticancer drugs by combining them with strategies to increase BBTB permeability. Our results establish a solid basis for further translational work to deliver therapeutics for a range of central nervous system diseases.

INJECTABLE HYALURONIC ACID HYDROGELS ENCAPSULATING DRUG NANOCRYSTALS FOR LONG-TERM TREATMENT OF INFLAMMATORY ARTHRITIS

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Antiproliferative chemotherapeutic agents offer a potentially effective treatment for inflammatory arthritis. However, their clinical application is limited by high systemic toxicity, low joint bioavailability as well as formulation challenges. Here, we report an intra-articular drug delivery system combining hyaluronic acid hydrogels and drug nanocrystals to achieve localized and sustained delivery of antiproliferative chemotherapeutic agent camptothecin for long-term treatment of inflammatory arthritis. We synthesized a biocompatible, in situ-forming injectable hyaluronic acid hydrogel using a naturally occurring click chemistry: cyanobenzothiazole/cysteine reaction, which is the last step reaction in synthesizing D-luciferin in fireflies. This hydrogel was used to encapsulate camptothecin nanocrystals (size of 160-560 nm) which released free camptothecin in a sustained manner for 4 weeks. In vivo studies confirmed that the hydrogel remained in the joint over 4 weeks. By using the collagen-induced arthritis rat model, we demonstrate that the hydrogel-camptothecin formulation could alleviate arthritis severity as indicated by the joint size and interleukin-1β level in the harvested joints, as well as from histological and microcomputed tomography evaluation of joints. The hydrogel-nanocrystal formulation strategy described here offers a potential solution for intra-articular therapy for inflammatory arthritis.

Neuroscience I

EFFECTS OF COMBINATIONAL DRUG TREATMENT TO REDUCE INFLAMMATION AFTER TRAUMATIC BRAIN INJURY

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According to the CDC, in the United States alone, 22% of patients die and 30% encounter deterioration in brain function due to moderate and severe traumatic brain injury (TBI). Secondary injuries are known to cause inflammation leading to mortality and to long-term neurological deficits due to neuronal apoptosis, inflammatory responses, and excitotoxicity. The current interventions target symptoms such as depression; however, no drugs are available to treat secondary injury at the cellular level. We hypothesize that administering minocycline (Min) along with rolipram complexed with PgP nanoparticles (Rm-PgP), a medication with a rapid onset of action and sustained release, could effectively attenuate and finally inhibit the secondary injury cascade. To test our hypothesis, we considered five treatment groups, consisting of 19 mice/group. Our control groups were sham injured mice, treated with vehicle and TBI mice, treated with vehicle. We had three experimental groups, including mice treated with Rm alone, Min alone, and a combination of the two, MinRm. Behavioral tests, such as rotarod, and immunohistochemistry were performed to evaluate the effects of treatment. In addition, activation levels of astrocytes and microglia to evaluate the drug's anti-inflammatory effects were conducted at 7- and 14-days post-injury by comparing levels of GFAP and Iba-1, respectively. Our findings indicate that the MinRm combination drug helps restore motor coordination to levels resembling those of Sham-Vehicle treated mice. Immunohistochemistry results showed lower levels of inflammation when mice were treated with the MinRm combination drug. Together, these results suggest that MinRm combination therapy may help reduce inflammation and mitigate the effects of secondary neurodegeneration due to moderate TBI. However, further experiments are necessary to firmly substantiate our preliminary observations and to evaluate the effects with sex as a biological variable.

MELATONIN AGONIST AGOMELATINE PROTECTS AGAINST NEONATAL LIPOPOLYSACCHARIDE-INDUCED ATTENTION-DEFICIT/HYPERACTIVITY DISORDER (ADHD)-LIKE BEHAVIOR IN JUVENILE RATS

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Neonatal lipopolysaccharide (LPS) exposure-induced brain inflammation plays an important role in brain injury and increases the risks of attention-deficit/hyperactivity disorder (ADHD)-like behavior in juvenile and adolescent human and animal models. Recent studies suggest that agomelatine treatment could be a neuroprotective agent in adult animals by reducing inflammation and microglia polarization. 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 ADHD-like behavior in neonatal and juvenile rats. Intraperitoneal (i.p.) injections of LPS (2 mg/kg) were administered in postnatal day 5 (P5) Sprague-Dawley rat pups, and agomelatine (20 mg/kg) or vehicle was administered (i.p.) 5 min after LPS injection and/or then every 24 hr for 3 days. Control rats were injected (i.p.) with sterile saline. Neurobehavioral tests were performed, and brain inflammation and injury were examined in P6 and P25 rats. Our results showed that agomelatine reduced LPS-induced reduction in pre-social interaction (ultrasonic vocalization) and LPS-induced brain injury, including a reduction in white matter oligodendrocyte numbers, increases in microglia numbers, and an increase in IL-1β and TBARS contents at P6, suggesting anti-inflammatory and antioxidative effects. Agomelatine also reduced neonatal LPS-induced brain injury and inflammation in P25 rats and ADHD-like behaviors, including hyperlocomotion activity, social interaction disturbances, and learning and memory deficits (P21-P25). These results indicate that agomelatine may protect against LPS exposure-induced brain injury, inflammation, lipid peroxidation, and ADHD-like behaviors and that the protective effects are associated with its ability to attenuate LPS-induced inflammation and oxidative stress.

AGE-RELATED NEUROIMMUNE SIGNALING HAS OPPOSING EFFECTS ON NEURONAL REPOPULATION AND STROKE-INDUCED BEHAVIORAL OUTCOMES

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Ischemic damage to the brain contributes to functional disabilities in many stroke survivors. Recovery of behavioral function is critical for improved quality of life in millions of stroke survivors living with chronic disabilities. Stroke and neurologic deficits occur in both adults and children, and yet it is well-known that the developing brain has remarkable plasticity that promotes increased post ischemic functional recovery compared with adults. However, the mechanisms underlying post-stroke recovery in the young brain have not been fully explored. We examined neurogenesis and inflammatory markers with flow cytometry, immunohistochemistry, ELISA, and assessed post-ischemic motor function. We observed opposing responses to experimental cerebral ischemia in juvenile and adult mice, with substantial neuronal repopulation detected in juvenile brain that was not found

in adults, along with improved functional outcomes. Microglia are one of the primary cells involved in the immune response to stroke, and our findings indicate that early microglial responses are key to the survival of newborn neurons in juveniles. Following microglia attenuation with Ibudilast (10 mg/kg), a glial cell activation inhibitor, we demonstrated strikingly different stroke-induced neuroimmune responses that are deleterious in adults and protective in juveniles, supporting neural regeneration and functional recovery. Understanding these age-related differences in neuronal repair/regeneration, restoration of motor function, and neuroimmune signaling in the stroke-injured brain may offer new insights for the development of novel therapeutic strategies for stroke rehabilitation in adults *and children.*

THE EFFECTS OF MICROGRAVITY ON SEROTONIN IN THE BRAIN

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Human space exploration demands a deeper understanding of the health risks posed by the spaceflight environment. Microgravity presents a challenge that can disrupt human physiology during space missions, necessitating adaptive responses from the body to maintain brain homeostasis. Astronauts exposed to spaceflight conditions often experience alterations in behavior and cognitive functions, including changes in spatial orientation, sensory processing, social interactions, learning, memory, and mood regulation. Serotonin (5-hydroxytryptamine, 5-HT), a key neurotransmitter in the central nervous system, plays a pivotal role in regulating various physiological functions crucial for astronaut well-being, from mood and cognition to appetite and sleep. This project aims to use a previously developed key technology to investigate how gravity impacts serotonin levels in the mouse brain. This technology consists of poly(3,4-ethylenedioxythiophene)/carbon nanotube (PEDOT/CNT) coated glassy carbon (GC) microelectrode arrays (MEAs), that has been shown to enable selective 5-HT measurement in combination with an optimized square wave voltammetry (SWV) electrochemical technique. In this study, we will present the potential of our technology in enhancing our understanding of 5-HT levels under microgravity, which is not only pivotal for safeguarding astronaut mental health but also holds implications for developing countermeasures.

Orthopaedics II

IS CONSIDERATION OF FREE TORQUE IMPORTANT IN TREATING FEMORAL NECK FRACTURE? -A FINITE ELEMENT ANALYSIS-

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INTRODUCTION: Pauwels classification is a classification for femoral neck fracture (FNF) based on the Pauwels angle. Evaluation of this classification is important when treating FNF, since shearing force applied to the fracture surface is reported to vary depending on the angle. However, it has recently been reported that presence of free torque at the fracture surface is as equally important, and should be considered preoperatively. METHODS: Study was conducted using a finite element analysis software, Mechanical Finder ver.12, and the CT data of 81 years old male with history of FNF was used for solving. FNF models with different fracture line: with and without free torque were created, and were fixed with a fixed angle device. Referring to the original literature, a vector with an angle of 16° was projected from the center of the femoral head onto the level of fracture. If the vector intersects the fracture surface, free torque was considered absent, and vice versa. Fracture surface and screw/ bone were set to friction. Single leg standing position was simulated. Von mises stress (VMS) of the implant, relative displacement (RD) of the fracture segment and compression force (CF) of the fracture surface were the outcome measures of this study. RESULTS/ DISCUSSION: VMS of the implant was 53 MPa and 34 MPa, RD was 0.7mm and 0.4mm, and CF was 274N and 604 N, for the free torque present and absent model, respectively. The presence of tree torque had a definite influence on the mechanical stability of the fracture. Thus, the presence of free torque should be considered when choosing the treatment for FNF.

SCREW STRIPPING TORQUE IN BONE SURROGATES USED FOR SURGICAL TRAINING: COMPARATIVE STUDY BETWEEN 3D PRINTED AND ASTM F1839 REGULATED POLYURETHANE FOAMS BLOCKS

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INTRODUCTION: This study aims to assess the correlation between stripping torque (ST) and infill value in 3D printed surrogates, we hypothesize no influence of the screw insertion angle on stripping torque for inclination up to 45 degrees. **METHODS:** 3D printed surrogates were instrumented at various angles and infill densities. Instrumentation was performed measuring stripping torque (ST). Paired T-test was used to identify differences between the two infill patterns. **RESULTS:** The 3D Honeycomb infill ST ranged from 0.23Nm±0.02 for 5% density to 3.89Nm±0.14 for 27% density infill. The ST values found for the Gyroid infill ranged from 0.32Nm±0.06 to 3.68Nm±0.46 for 5% and 27% infill respectively. Linear correlation was found ($R^2>0.76$) between infill density and stripping torque. No significant differences were found among insertion angles. **DISCUSSION**: The study is limited in that only PLA materials with 2 infill patterns at a limited number of angles was considered. Experiments involving other materials, infill pattern, and angles are still needed to generalize the use of 3D-printed surrogates for screw insertion training. However, our results suggest it is feasible to use 3D printed surrogates in training of screw insertion. While bone surrogates are limited in number of available configurations, our results create opportunities for unlimited training scenarios created using 3D printed surrogates.

THE POST-TRAUMATIC MECHANICS OF ARTICULAR CARTILAGE UNDER DYNAMIC LOADING

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Mechanical trauma in cartilage may trigger the initiation of knee osteoarthritis (KOA), where chondrocyte death due to mechanical loading affect the tissue homeostasis. Mechanical insults to articular cartilage due to non-physiological, injurious loading, or crack initiation during knee arthroplasty may lead to progressive cartilage damage even with regular physiological activities, leading to post-traumatic OA (PTOA). Additionally, obesity, a frequently modifiable risk factor, can significantly increase stress on the knee joint and is a common factor contributing to the development of KOA. Hence, investigating the mechanics of structurally compromised cartilage of high body mass index (BMI) at different walking speeds will provide insights into the pathomechanics of cartilage damage. In this study, 5 mm diameter cartilage explants were extracted from bovine stifle joints collected from local slaughterhouse for conducting dynamic mechanical analysis (DMA). Before initiating a crack, each samples underwent dynamic loading to establish a control baseline. A single crack was initiated at the center using 0.3 mm diameter spherical indenter with variable depths to simulate injury in different layers—superficial (10-20%), middle (40-60%), and deep layers (30%). After that, DMA mimicking different walking speeds was conducted to investigate post-traumatic mechanics of articular cartilage. Two walking speeds, namely slow and fast were simulated via unconfined compression set-up, where the explants were subjected to sinusoidal loading with frequencies at 1 Hz (slow) and 2 Hz (fast) for 1 hour, and an amplitude of 40% strain of the thickness, mimicking high BMI. All tests were performed in Mach-I (Biomomentum Inc) multiscale tester with the samples submerged in phosphate-buffered saline (PBS) medium. The mechanistic changes of cartilage between healthy (before crack initiation) and damaged (after crack initiation) states were elucidated by the viscoelastic properties—storage (E') and loss modulus (E"), whereas the morphological changes were attributed via histologic assessment. All the results presented as the mean ± std. dev. One way ANOVA was conducted to determine the statistical differences followed by Dunnett's multiple comparisons test. A significance level of 0.05 was used for all statistical analyses. The results provide an in-depth understanding of the correlation of crack depth and progressive cartilage damage.

COMPARISON AMONG PIN INSERTION SITES FOR PELVIC FIXATION

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External pelvic fixators provide a reliable method for treatment of anteriorly unstable pelvic injuries. Considerations for anterior fixation rely on variations in frame construct and location for pin insertion. Proper insertion trajectories and pin containment are essential to reduce complications during fixation. This study compares three surgically relevant pin insertion locations (supraacetabular, iliac crest, and subcristal) and determines the ranges of safe insertion for bone containment. Using CT-generated pelvis models, the study analyzes pin containment at different transverse and sagittal inclinations within the boney corridors. Intraosseous screw depths of 60, 75, and 90mm with a core diameter of 5mm were considered at each angle. At each inclination, the sagittal range, average transverse range, average bisecting angle, and safe angular region (SAR) were calculated. Based on the results, supraacetabular pins offer the largest range of insertion with the mean SAR being $1008.04^{\circ 2}\pm214.15$ in the 60mm screw depth, while iliac crest pins provided a SAR of $498.15^{\circ 2}\pm271.95$ Additionally, the subcristal pin location with the 60mm screw depth yielded a SAR of $449.00^{\circ 2}\pm231.93$. Upon comparing the regions for the 60mm depth, the supraacetabular was found to be non-similar to the iliac crest and subcristal ($p<0.01$), while the iliac crest and subcristal were found to be similar ($p=0.147$) The study suggests the supraacetabular pins are the most reproducible and result in less complications related to screw breaching or loosening. Overall, this study provides valuable insight to surgeons in selecting pin insertion sites for external pelvic fixation to enhance patient outcomes.

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

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Upon completion of a Total Knee Arthroplasty (TKA), the cruciate ligaments are completely removed, and the main stabilizing ligament of the knee is the medial collateral ligament (MCL). During a standard TKA the MCL can accidentally become injured. Should this occur, the most popular surgical repair technique is Direct Repair (DR) which consists of suturing together the opposing ends of the damaged ligament. More recently, an alternative repair technique, DR augmented with Internal Brace Fixation (IBF), has been used. This technique begins with a direct repair of the ligament, but is reinforced with a thick suture tape to augment the repair. The latter technique has been suggested to enable greater stability of the knee joint following TKA. The purpose of this study is to compare a TKA with the MCL repaired via DR vs. IBF and observe which best restores stability of the TKA under multiaxial loading. For this study, ten fresh frozen mid femur to mid tibia were used. Each specimen was mounted in a custom-made test fixture that enabled movement of the knee from full extension to 90 degrees of flexion, in 10 degree increments. Each specimen underwent five test states: Intact, TKA, TKA with MCL injured, TKA with MCL repaired via either DR or IBF techniques. At each state, the specimens were tested at 0, 10, 40, and 90 degrees of flexion at 3 applied loads: 5 N-m internal rotation (IR), 5 N-m external rotation (ER), and 10 N-m valgus angulation (V). Rotation and displacement of the tibia was recorded at each knee flexion angle, under each loading condition,

using retroreflective marker triads and 8 high-speed Optitrack Motion Capture cameras. We previously reported pilot data on ER and IR of four matched pairs at SBEC 2023, with one specimen from each pair receiving DR while the contralateral limb received IBF. Conclusions from the current study suggest that TKA may over constrain the knee an average of 48% externally, 33% internally and 26% in valgus. IBF and DR demonstrated similar rotations (less than 2 degrees difference) and similar laxity (less than 1 degree difference). But IBF may provide clinical benefits by reducing the TKA failure rate due to early mobilization in cases where the MCL is damaged.

ACROMIOCLAVICULAR JOINT RECONSTRUCTION: A BIOMECHANICAL COMPARISON OF A NEW HYBRID TECHNIQUE

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In surgery, various methods have been developed to treat AC joint injuries, particularly a Continuous Suture and Static Suture Tape configuration. However, both techniques have shown various post-operative problems, namely with hardware complications (e.g., loss of reduction) in addition to symptomatic challenges (e.g., instability and persistent pain). As a result, the purpose of this study was to introduce a new Hybrid Suture configuration that reduces post-operative difficulties while still demonstrating similar or greater biomechanical properties as compared to the current techniques for AC repair. 12 freshly frozen cadaveric specimens were dissected leaving solely the AC joint. For implantation, the Continuous Suture utilized a 2.4 mm guide pin and a 4.5 mm cannulated drill. The Static Suture Tape utilized only the guide pin. Lastly, the Hybrid Suture utilized the guide pin, the cannulated drill, one Continuous Suture, and one Static Suture Tape. Shoulder testing involved sinusoidal cyclic loading at 20 and 70 N for 1,000 cycles at 1 Hz; in addition, peak failure load was measured at a static increasing axial load rate of 25 mm/min. The Continuous Suture (n = 4) measured an average peak failure load = 388.78 N (SD = 129.27), the Static Suture Tape (n = 4) = 302.78 N (SD = 96.44), and the Hybrid Suture (n = 4) = 411.29 N (SD = 212.75). When comparing the three groups, there were no significant differences between the peak failure loads (p-value = 0.59), proving that the Hybrid Suture is a biomechanically acceptable technique for AC repair.

Electrophysiology and Neuromodulation

NEUROMODULATION OF BASAL NUCLEUS OF MEYNERT: EFFECT OF ACTIVATION PATTERNS ON THE NETWORK COUPLING WITH CORTEX

John Wilson[1], Greyson Jadwin[1], Jamie Toms[1], Kathryn Holloway[1], Deepak Kumbhare[1]

*[1]LSU Health Shreveport****Background.*** The nucleus basalis of Meynert (NBM) plays a critical role in attention, learning, and memory. Its widespread cholinergic projections are the primary source of acetylcholine (ACh) to the entire neocortex and amygdala. The progressive loss of NBM is a crucial hallmark of Alzheimer's and Parkinson's disease dementia. NBM has been shown to facilitate learning by altering ACh release, which in turn modulates the neuro-excitability and spectral topography in the neocortex. In addition, the GABAergic and glutamatergic projections from the basal forebrain also have a pivotal effect on intra-cortical signaling/ oscillations. NBM neurons have also been reported to alter their firing patterns under different cognitive processes. This study assesses the impact of different NBM stimulation patterns on the coupling strength of the NBM-cortical network. ***Methods. (i)*** Various NBM stimulation parameters were tested in anesthetized adult rats. Default DBS parameters were cathodic monopolar pulse with phasic patterns, ten pulses per train with 100ms train duration, train frequency of 100 Hz (intra-burst or inter-pulse frequency, IPF), and train repetition rate of 4 Hz (inter burst frequency, IBF). Refer to Fig 3c for a description of DBS patterns. ***(ii)*** In a separate experiment, the NBM-local field potential (LFP) and EEG from the auditory cortex (A1) were recorded from tethered normal, demented, and stimulated demented rats during the presentation of audio tons. ***Results. (i)*** When *different IBFs* were tested, we saw a peak in the theta power at the 4-6 Hz range with the corresponding decrease in delta (fig 3a). The drastic reduction at 2 and 6 Hz indicates the circuitry's resonance sensitivity. Similarly, for *different IPFs*, the same pattern of a peak in theta and reduction in the delta was found at an IPF of 50-60 Hz (fig 3b). *The pulse-width* response was maximized at 6-8 ms. ***(ii)*** The different activation levels of NBM regulate the cross-frequency coupling strength of the NBM-cortical network. ***Conclusion.*** Our findings suggest a phasic stimulation of *5 Hz IBF-60Hz IPF* represents the innate pattern for communication during attention tasks. Testing of additional parameters is underway.

UNRAVELING NEUROMODULATION BY PSYCHEDELICS IN THE TREATMENT OF ADDICTION: INTEGRATING INSIGHTS FROM BEHAVIOR, GENE EXPRESSION, AND IN VIVO ELECTROPHYSIOLOGY

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Psychedelics, acting primarily on the serotonin 2A receptor, have garnered significant attention for their potential in treating psychiatric disorders, particularly addiction, anxiety, and depression. These compounds induce enduring changes in behavior and neuronal function beyond their acute effects. In our study, we investigate the neuromodulatory effects of psychedelics in addiction treatment using three complementary approaches: 1) rodent behavior, 2) gene expression analysis, and 3) in vivo electrophysiology. Firstly, we demonstrate that two distinct

psychedelics, 2,5-dimethoxy-4-iodoamphetamine (DOI) and psilocybin, effectively attenuate methamphetamine-taking behavior in a rodent model of addiction using operant self-administration paradigms. Secondly, we uncover robust alterations in gene expression within the prefrontal cortex following a single administration of DOI and psilocybin, indicating widespread molecular changes underlying their therapeutic effects. Lastly, our in vivo electrophysiology findings reveal transient as well as long-term DOI-induced modulations in delta band power in the frontal cortex, highlighting persistent neural alterations. Our multi-modal approach underscores the potent neuromodulatory properties of psychedelics and their potential as transformative agents in addiction therapy. By elucidating their mechanisms of action through behavior, gene expression, and electrophysiology, we aim to advance our understanding of psychedelic-assisted treatments and pave the way for novel therapeutic interventions in addiction.

AUTOMATED RODENT SLEEP SPINDLE DETECTOR: MATLAB APP USING TWO COMPLEMENTARY SEARCH ALGORITHMS.

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Sleep spindles are waveforms generated by thalamocortical circuits. They play a fundamental role in memory consolidation, sleep maintenance, and diagnosis of neurological, neuropsychiatric, and neurocognitive disorders. Rodent models are a preferred choice for neuroscience studies involving sleep. To assist researchers working with high volumes of rodent sleep data related to sleep spindles, a MATLAB based Rodent Sleep Spindle Detector application was developed. It uses two novel yet complementary methods for detecting sleep spindles' waxing and waning waveform. An EEG window displays the identified spindles and count, and the results window summarizes the statistics. For validation, 6,000 real spindles varying in amplitude and duration within the 11-17 Hz frequency range were extracted from iEEG and randomly placed in a noisy simulated prefrontal cortex iEEG without sleep spindles. When compared to the ground truth on a datapoint-by-datapoint basis, the program had an accuracy of 98.40±5.62% (mean±SD) with 95% C.I. [91.93, 100] and 96.90±4.34% (mean±SD) with 95% C.I. [91.91, 100] for the primary and secondary algorithmic approach, respectively. Evaluating total spindle count, the program had an accuracy of 93.68±13.66% (mean±SD) with 95% C.I. [81.71, 100] and 99.85±0.12% (mean ± SD) with 95% C.I. [99.71, 99.96] for the primary and secondary algorithmic approach, respectively. The robustness of the sleep spindle detection was further evaluated by embedding artificial spindles at various durations, amplitudes, and frequencies in lieu of real spindles, where detection was within the cut-off frequency for both methods.

Ergonomics and Prosthetics II

SHORT DURATION TRAINING FOR MULTI-GESTURE PROSTHESIS CONTROL

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Learning a myoelectric upper limb prosthesis is not an intuitive task. Each desired gesture, such as gross grasp and pinch grip, requires a unique neuromuscular input. First-time users require time, energy, and support devoted to device acclimation (Manero, 2018; McLinden, 2024). The significant learning investment could lead to frustration and ultimate device rejection if usability outcomes are perceived as unworthy of the training investment (Smail, 2021; Yamamoto, 2019). A major aspect of usability is incorporating the prosthesis into daily life to serve as a functional tool (Smail, 2021). Before bimanual tasks can be performed, it is first essential to master device controls (Atkins, n.d.). This initial phase may take anywhere from minutes to days depending on the user (Johnson, 2014). Thus, it is of interest to streamline this learning process.

A variety of training modalities, such as serious gaming, can be employed by a multidisciplinary team to help individuals achieve functional goals (Howard, 2017). Gamified training has demonstrated success in teaching users the general myoelectric control system and muscle discretization while providing an engaging learning environment (McLinden, 2024; Smith, 2012). To determine whether training modalities contribute to short-term transfer of basic controls, participants with full control of their upper extremity will complete myoelectric multi-gesture controls testing before and after receiving a short-targeted training intervention. Participants will either receive training that is gamified, traditional strengthening, or based on visual input. This study may demonstrate the application of myographic mini games in aiding targeted prosthesis controls training.

FUNCTIONAL ASSESSMENT OF AN ERGONOMIC BACKPACK COMPARED TO A TRADITIONAL BACKPACK DURING WALKING

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Backpacks (BP) are the most common means for carrying items by individuals of all ages. However, modern day two strap backpack create problematic loading conditions at the shoulders and lower back that increase the risk of injury due to the excessive load being carried. A prototype Ergonomic Backpack (EBP) was designed to reduce these complications and improve load carriage performance. **PURPOSE**: The purpose of this study was to determine the effects of wearing the EBP during level walking compared to a traditional two strap BP. **METHODS**: Fifteen participants walked on an instrumented treadmill wearing the EBP

and traditional BP. Body segment kinematics and ground reaction force data were used to determine trunk angle and muscle powers at each major joint. Electromyography signals were processed and used to determine the muscle activation. Indirect calorimetry measured oxygen consumption during ten-minute walking trials under two load carrying conditions (7 kg and 11 kg). **RESULTS**: The EPB maintained significantly more vertical trunk orientation, lower paraspinal muscle activity, and decreased hip muscle power with the EBP compared to the traditional backpack ($p<0.05$) for both load conditions. Additionally, comfort scores were significantly reduced while wearing the EBP compared to the traditional BP. **CONCLUSIONS**: This functional assessment provided evidence of the efficacy of the EBP to improve ergonomic performance and potentially reduce the risk of shoulder and lower back musculoskeletal injuries.

REDUCING REPETITIVE STRESS INJURIES DURING RUCK MARCHING IN WARFIGHTERS

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Musculoskeletal injuries (MSKIs) constitute 80% of all Army injuries in 2016, and lead to 2 million clinic visits and 25 million limited duty days, making them the leading cause of outpatient treatment. Rucking is a major source of these MSKIs. However, the military rucksack design has changed little over the course of the past three decades despite its implication in repetitive stress injuries in male and female warfighters. The standard issued rucksack (Modular Lightweight Load-Carrying Equipment, or MOLLE) currently used in basic training was designed as a one size fits all frame that lacks gender specific structure. The goal of the proposed project is to design an ergonomic rucksack that improves the loading mechanics compared to a standard-issued rucksack. The objectives of this project are to 1) design an ergonomic rucksack that redirects a portion of the shoulder and spine loads to the pelvic region and 2) biomechanically compare it to a standard-issue military rucksack during simulated rucking. To date, preliminary data on the standard-issue rucksack have been collected from three participants using a motion capture (OptiTrack, Qualisys) and wireless EMG system (Delsys) that tracks the movements and measures select muscle activity during a 20-minute ruck walking at 1.5 m/s. The methodology developed in this preliminary study will be used to conduct an IRB-approved study that compares the standard rucksack to the ergonomic rucksack. Furthermore, additive manufacturing technology will be used to design and fabricate prototype frame and suspension system parts of the ergonomic rucksack.

DESIGN AND ASSESSMENT OF BIRD-INSPIRED 3D-PRINTED MODELS TO EVALUATE GRASP MECHANICS

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Adapting grasp-specialized biomechanical structures into current research with 3D-printed prostheses may improve robotic dexterity in grasping a wider variety of objects. Claw variations across various bird species lend biomechanical advantages for grasping motions related to perching, climbing, and hunting. Designs inspired by bird claws provide improvements beyond a human-inspired structure for specific grasping applications to offer a solution for mitigating a cause of the high rejection rate for upper-limb prostheses. This research focuses on the design and manufacturing of two robotic test devices with different toe arrangements. The first, anisodactyl (three toes at the front, one at the back), is commonly found in birds of prey. The second, zygodactyl (two toes at the front, two at the back), is commonly found in climbing birds.

The evaluation methods for these models included a qualitative variable-object grasp assessment. The results highlighted biomechanical elements that suggest an improved grasp: a small and central palm, curved distal digit components, and a symmetrical digit arrangement. A quantitative grip force test demonstrated that the single digit, the anisodactyl claw, and the zygodactyl claw designs support loads up to 64.3 N, 86.1 N, and 74.1 N, respectively. These loads exceed the minimum mechanical testing requirements outlined by ISO and ASTM standards for prosthetic devices. The developed designs offer insights into how biomimicry can be harnessed to optimize the grasping functionality of upper-limb prostheses. Future iterations will explore a comprehensive model with easily adjustable digit angles allowing users to explore advantages from additional digit configurations.

3D-PRINTED TRANSRADIAL PROSTHESIS: A PRELIMINARY PROPOSAL OF METHOD FOR EVALUATION OF GRASPING PERFORMANCE

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3D printing has emerged as an innovative manufacturing process due to its ability to quickly manufacture products, reduce production costs, and simplify development processes. This has supported the development of assistive devices by allowing the production of customized, low-cost products that provide better user comfort, fit, functional performance, and, which together may benefit the users' satisfaction with the device. Although there is an increase in literature reporting the use of 3D printing in prosthetics due to the availability of these open-source designs resulting from global initiatives of groups promoting 3D printing, there remains a gap regarding the performance, usability and functionality aspects of the currently available models [1]. Due to the variety of designs available, a standardized evaluation is recommended. This study reports the development of a method to standardize the evaluation of the performance of 3D-printed, transradial, elbow-driven prostheses in grasping and supporting objects. The

proposed method aims to support the design process by promoting a simple means for assessing the device performance. The testing method first fixes the device to a platform, then the mechanism for finger flexion is activated by attached weights to a cord, which is fixed to the cuff of the prosthesis and passed through a pulley. This testing is performed for a variety of standardized everyday objects to evaluate the hand grip. It also enables investigation across different designs with repeatable conditions and can be conducted without the participation of a user. This method may be extended to evaluate other unique devices.

BIO-INSPIRED FLEXIBLE HUMIDITY-AWARE SOFT EFFECTORS IN HEALTHCARE APPLICATIONS

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In healthcare applications, the replication of human dexterity and sensory capabilities is crucial for tasks ranging from delicate surgeries to patient care. However, traditional robotic systems often fall short of mimicking the intricate sensitivity and adaptability of human hands. Recent breakthroughs in soft robotics, particularly in sensor technology, offer promising solutions to bridge this gap. In this research article, we draw inspiration from nature to create bio-inspired flexible humidity-aware soft effectors tailored for healthcare applications. Our primary focus lies in developing a robotic arm finger outfitted with an array of pressure and moisture sensors. These sensors, strategically positioned across each fingertip, emulate the nuanced tactile perception of human touch, thereby elevating the robot's ability to discern textures and moisture levels during manipulation tasks. The incorporation of a humidity sensor within the finger structure represents a significant leap forward, enabling real-time monitoring. This innovation not only enhances the robot's awareness of its surroundings but also unlocks a plethora of possibilities for applications within the healthcare sector. In patient care settings, such a robot could assist caregivers by delicately handling sensitive medical equipment or administering treatments with heightened sensitivity to patient comfort and safety. Beyond clinical settings, our research holds promise for applications in rehabilitation robotics, prosthetics, and telemedicine. By infusing soft robotics with advanced sensing capabilities, we pave the way for more intuitive and empathetic human-robot interactions, ultimately improving the quality of healthcare delivery.

Neural Interface

NEW TWISTS ON OLD TECH FOR A DEEPER LOOK AT *SEIZURES AND SLEEP IN A RAT MODEL OF EPILEPSY*

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Epilepsy has been a mysterious and troubling disease with accounts as old as written history. Epilepsy not only causes life-disrupting seizures it also causes memory dysfunction due to sleep disturbances. Scientists and clinicians have shed light on how it alters the electrical activity of the brain and have developed drug therapies and surgeries to treat it. Yet, we do know enough to predict and rationally design a neuromodulation system that can intercept and diffuse an impending seizure or to reestablish normal sleep to restore memory. To reach this level of understanding, our group has transformed existing technologies to provide unprecedented temporal resolution of electrical and neurochemical signals from the brain using a rat model of temporal lobe epilepsy. To study electrical activity, we took a radical approach to standard intracortical electroencephalography (iEEG) by creating a system to record from rats 24 hr/day for 3 months. Several technical challenges were overcome and novel software was created to study targeted iEEG features. We posited that the aberrant iEEG signals associated with epileptic seizures, and possibly epileptogenesis overall, was due to an imbalance in concentrations of the major excitatory neurochemical, glutamate (GLU) and the primary inhibitory neurochemical, gamma-aminobutyric acid (GABA). Biosensors for in vivo recording were available for GLU but not for GABA. This study overcame that limitation. Additionally, a new type of sensor system was created to facilitate repeated recordings for the 3-month study. Together, these technologies produced the first in vivo recordings of GLU and GABA dynamics during an epileptic seizure and during sleep. We expected to see sharp increases in GLU, instead reduced GABA levels led to both. Funding: NSF Award OIA 1632891 and NINDS Grant R21NS114723

BATCH-FABRICATED GLASSY CARBON LIKE FIBERS FOR REAL-TIME DOPAMINE DETECTION

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Real-time measurement of neurochemicals in the brain is crucial for understanding neurochemical processes and the underlying causes of neurological disorders. Carbon fiber microelectrodes (CFEs) are the gold standard for measuring rapid neurotransmitter changes due to their small size (5 - 10 µm), biocompatibility, flexibility, and excellent electrochemical properties. However, achieving consistent results and scaling up the production of CFE arrays through manual fabrication pose significant challenges. Our group previously developed flexible carbon-based microelectrode arrays (MEAs) with glassy carbon (GC) electrode and metal

interconnections. Despite their advantages, the adhesion of metal interconnects with carbon microelectrodes can lead to mechanical discontinuities and failures during large cycles of electrical stimulation and extended periods of *in-vivo* use.

To address these challenges, we present an innovative approach for fabricating *all*-glassy carbon-like fibers (GCF) made from a single homogeneous material of GC. These fibers are batch-fabricated and insulated using photolithography, eliminating the need for manual fabrication. The designed electrodes can penetrate the brain without additional support, resulting in minimal insertion damage and tissue response. The electrochemical properties of the fabricated GCF and the results of dopamine detection in both *in vivo* and *in vitro* settings will be detailed and discussed.

TOWARD THE OPTIMIZATION OF BATCH FABRICATION OF MICROELECTRODE ARRAYS WITH GLASSY CARBON MICROELECTRODES AND INTERCONNECTIONS FOR NEURAL APPLICATIONS

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Flexible multielectrode arrays with glassy carbon (GC) electrodes and metal interconnection (*hybrid* MEAs) have shown promising performance in multi-channel neurochemical sensing and electrophysiological recordings. A primary challenge faced by *hybrid* MEAs fabrication is the adhesion of the metal traces with the GC electrodes, as prolonged electrical and mechanical stimulation can lead to adhesion failure. Previous devices with GC electrodes and interconnects made of a homogeneous material (*all* GC) demonstrated exceptional electrochemical stability but required miniaturization for enhanced tissue integration and chronic sensing. In this study, we used two different methods for the fabrication of *all* GC-MEAs on thin flexible substrates with miniaturized features. The first method, involves a double pattern-transfer photolithographic process, including transfer-bonding on temporary polymeric support. The second method requires a double-etching process, which uses a 2 µm-thick low stress silicon nitride coating of the Si wafer as the bottom insulator layer for the MEAs, bypassing the pattern-transfer and demonstrating a novel technique with potential advantages. We confirmed the feasibility of the two fabrication processes by verifying the practical conductivity of 3 µm-wide 2 µm-thick GC traces, the GC microelectrode functionality, and their sensing capability for the detection of serotonin using fast scan cyclic voltammetry. Through the exchange and discussion of insights regarding the strengths and limitations of these microfabrication methods, our goal is to propel the advancement of GC-based MEAs for the next generation of neural interface devices.

INFLUENCE OF ELECTRODE CONTACT AREA ON S1 PROJECTION FIELDS FROM INTRATHALAMIC MICROSTIMULATION

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Stimulation of somatosensory brain regions can be used to evoke sensory percepts, including those lost to nerve damage or amputation. However, current stimulation techniques deliver a high proportion of paresthesias such as shocking and tingling in patients, as opposed to more useful naturalistic mechanoception or proprioception. To some extent, this can be attributed to electrically evoked activity differing from that elicited from natural stimulus. This in turn could be a result, at least in part, of the space of the neural tissue being electrically stimulated, which is itself partially a function of electrode contact area on the implanted stimulating array. Despite the importance to the development of somatosensory prostheses, there is not yet an established optimum contact area for electrodes implanted in the somatosensory area of the thalamus. In this work, we implanted Lewis rats with microwire arrays in the forelimb representation of the primary somatosensory cortex (S1) and planar silicon shank arrays in the forelimb representation of the ventral posterolateral (VPL) thalamus, ipsilateral to the cortical implant. The silicon arrays had either 703µm^2 or 177µm^2 contact sizes for each electrode site. Electrical stimulation was performed in the thalamus to show significant differences between the projection fields in response to randomized pulse stimulation and patterns modeled to result in naturalistic neural activity in S1.

MOVING TOWARD TRANSLATIONAL APPLICATION: A STRAIGHTFORWARD METHODOLOGY FOR NEUROCHEMICAL SENSING USING GC-COATED TUNGSTEN WIRE

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Deep brain stimulation (DBS) has emerged as a pivotal surgical technique for treating various neurological and psychiatric conditions by precisely implanting electrodes into deep brain regions and applying pre-determined stimulation parameters in an open-loop configuration. A significant advancement in DBS is the implementation of a closed-loop system that dynamically adjusts stimulation parameters based on real-time neurochemical feedback. The rapid changes in neurotransmitter concentrations induced by DBS can be measured using fast-scan cyclic voltammetry (FSCV) at a carbon electrode interface. Our previous research highlighted the exceptional performance of glassy carbon (GC) microelectrode arrays integrated into flexible substrate for FSCV detection of dopamine (DA). Despite their benefits, implementing these flexible, miniaturized microelectrode arrays (MEAs) in clinical settings for human deep brain surgeries presents significant challenges. In this study, we introduce a straightforward methodology to enable neurochemical sensing using GC-coated tungsten wire, offering a potential solution for integrating advanced neurochemical detection into DBS procedures. First, we dip-coated the tips of sharpened tungsten

wires with SU-8, a photosensitive epoxy-based polymer, which was subsequently cross-linked using UV light and used as a precursor for the GC synthesis through pyrolysis in controlled environments. As proof of principle, we successfully tested the electrochemical properties and durability of the GC-coated tungsten tips, and their *in vitro* sensing capability for detecting DA using FSCV. We will detail the preliminary result obtained and discuss the potential advantages of these simple electrodes for enhancing the precision and efficacy of DBS by enabling real-time neurochemical monitoring in clinical applications.

Biomedical Education II

THE USE OF COMPUTER SIMULATION IN ANESTHESIOLOGY RESIDENT TRAINING

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Neuroscience II

ADVANCING BIOMARKERS OF CHRONIC PAIN IN PEDIATRIC SICKLE CELL DISEASE: TEMPORAL SUMMATION OF PAIN

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Translational research seeks to bridge the gap between basic research and clinical care. The field of biomedical engineering often provides the ingenuity and technology that bridges these gaps and advances health care. The current T1 translational study examines the role of central sensitization in the experience of chronic pain in youth with the most severe genotypes of sickle cell disease (SCD). We utilized biomedical quantitative sensory testing to measure central sensitization and hypothesized that youth with chronic SCD pain would demonstrate a significantly higher perceived pain response to repeated stimulation of identical intensity (i.e., temporal summation of pain, TSP) compared to youth with infrequent pain. Youth ages 12 to 21 years, diagnosed with SCD type Hb SS or Hb S Beta0Thalasemia, who reported infrequent pain (≤2 pain days/month; n=25) or met AAPT criteria for chronic SCD pain (n=25) were enrolled. Youth completed static quantitative sensory testing and dynamic TSP testing to assess pain sensitivity, along with psychological questionnaires. Heat TSP responses differed significantly between frequent and infrequent pain groups. Simple slope analysis revealed elevated TSP among youth with chronic SCD pain (b=3.14, p=.002); however, youth with infrequent pain did not exhibit TSP (b=0.45, p=.61). Faster habituation was observed for youth with chronic pain. Youth with chronic pain reported more frequent anxiety but psychological symptoms were not associated with TSP (p's >.17). Current results may indicate that TSP response, a well-established biomarker of pain sensitivity, distinguishes chronic from infrequent pain subgroups in youth with SCD.

INVESTIGATION OF BDNF-TRKB SIGNALING IN NEURAL REGENERATION AND NEUROPLASTICITY FOLLOWING ISCHEMIC STROKE

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Stroke is a devastating neurological disorder that compromises local brain function, resulting in disability in millions of stroke survivors. However, stroke in the young injured brain has been reported to have a greater degree of plasticity and capacity for repair than adults. Recognizing the importance of these reports, we used a novel model of pediatric stroke (MCAO) to study brain repair and neuroplasticity in pediatric and adult mice. We discovered a remarkable neural regenerative response in pediatric compared to adult mice at 30d, along with improved post-ischemic recovery. Our findings suggest a possible mechanism is brain-derived neurotrophic factor (BDNF) signaling through its tropomyosin related kinase B (*TrkB*) receptor. BDNF is known to support neural survival, outgrowth of axons and dendrites, synaptogenesis/remodeling, and synaptic transmission. We found age-related differences in BDNF-TrkB signaling in immunofluorescence, gene expression microarrays, and *in vivo* electrophysiological recovery. We observed marked increases in BDNF expression and phosphorylated TrkB in the injured pediatric striatum compared to adult. Further, BDNF was primarily released by neurons in pediatric and by astrocytes in adult mice, which could explain age-related differences in regeneration and recovery since reports in the literature suggest astrocytic BDNF is pathological, modulating neuronal dysfunction. Our findings suggest BDNF-TrkB signaling has a powerful age-related influence on neural regeneration and recovery of neuroplasticity following stroke. Our future studies will focus on investigating age differences BDNF-TrkB mediated downstream signaling pathways.

AGE-RELATED NEUROIMMUNE SIGNALING HAS OPPOSING EFFECTS ON NEURONAL REPOPULATION AND STROKE-INDUCED BEHAVIORAL OUTCOMES

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Ischemic damage to the brain contributes to functional disabilities in many stroke survivors. Recovery of behavioral function is critical for improved quality of life in millions of stroke survivors living with chronic disabilities. Stroke and neurologic deficits occur in both adults and children, and yet it is well-known that the developing brain has remarkable plasticity that promotes increased post ischemic functional recovery compared with adults. However, the mechanisms underlying post-stroke recovery in the young brain have not been fully explored. We examined

neurogenesis and inflammatory markers with flow cytometry, immunohistochemistry, ELISA, and assessed post-ischemic motor function. We observed opposing responses to experimental cerebral ischemia in juvenile and adult mice, with substantial neuronal repopulation detected in juvenile brain that was not found in adults, along with improved functional outcomes. Microglia are one of the primary cells involved in the immune response to stroke, and our findings indicate that early microglial responses are key to the survival of newborn neurons in juveniles. Following microglia attenuation with Ibudilast (10 mg/kg), a glial cell activation inhibitor, we demonstrated strikingly different stroke-induced neuroimmune responses that are deleterious in adults and protective in juveniles, supporting neural regeneration and functional recovery. Understanding these age-related differences in neuronal repair/regeneration, restoration of motor function, and neuroimmune signaling in the stroke-injured brain may offer new insights for the development of novel therapeutic strategies for stroke rehabilitation in adults and children.

Ethics

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

Viviana Rivera[1, 2], Samantha Migliore[1, 2], Courtney Williams[1, 2], John Sparkman[1, 2], Matt Dombrowski[1, 2], Peter Smith[1, 2], Albert Manero[1, 2]

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Biomedical technology continues to develop for the augmentation of human performance and rehabilitation [1]. Devices such as upper extremity prostheses [2], retinal implants [3], and artificial organs [4] have indoctrinated new advances that contribute to the execution of daily activities. Ethical concerns subsequently arose in regards to the development of these medical devices that should be included within the dialogue. Though additional devices are certain to develop in the coming years, access to such technology in regards to repair, maintenance, and software poses many questions in relation to patient rights. The focus of this research team includes the development of accessibility technology for the disabled population using video game training software and customized hardware alike. Providing a supporting framework for users during device downtime for maintenance, updates, and potential changes in device availability is crucial when transitioning developmental research projects to consumers. The unique nature of medical devices in addressing user concerns requires that access to repair is consistent in regards to quality, time for repair, and availability. Third party platforms may further complicate access as some products are exclusively offered from such digital storefronts, while others remain entirely unsupported. Proper infrastructure for device downtime should respect the rules of product distribution and the rights of patient data.

This presentation will explore the controversy and organizational stances in relation to the right-to-repair, enabling dialogue from industries such as medical devices, video games, farming equipment, and more.

INCORPORATING AI INTO MEDICAL EDUCATION: AN ANTICIPATORY ETHICAL ANALYSIS

Richard Wilson

Towson University

The introduction of artificial intelligence (AI) into healthcare has accelerated in recent years, with promising applications across many areas of medicine. AI includes a variety of technologies that learn from data to optimize their work to achieve medical goals. In the field of radiology, deep learning has matched the performance of clinicians in the screening for and predicting the risk of lung cancer based on computed tomography (CT) scans as well as providing accurate measurements of heart structure and function based on echocardiograms. In pathology a deep learning algorithm has outperformed a panel of clinicians in the detection of cancerous metastases. During the COVID-19 pandemic, AI has been applied to the interpretation of chest CT imaging with great success, displaying rapid and accurate diagnosis and outperforming radiologists. These successes point to the potential for AI to transform medical fields such as oncology, radiology and pathology, but there are also challenges. The difficulties of implementing AI into clinical settings are driven in-part by a lack of AI education and knowledge among clinicians. Interpretability of results and incorporation into cultural constructs within the medical clinical environment are cited as key obstacles. In addition, the trust of clinicians and the general public in healthcare AI has been reduced by high-profile reports of systemic racial biases in widely-used algorithms. These issues may be exacerbated in low- and middle-income countries (LMICs) due to the concentration and development of AI in high-income countries (HICs), despite the growing applications of AI in LMICs. This raises the possibility that clinicians in LMICs will be ill-equipped to utilize and employ AI-based technology to meet the needs of their health systems. Clinicians, as end-users, are uniquely placed to ensure a patient-centered and equitable roll-out of AI. Expertise in AI among clinicians is not widespread and medical students and allied health students are not taught about AI routinely in medical curricula. There are calls for updating educational practices, with an increased focus on novel digital technologies including AI in order to better prepare medics for work in this changing field.

This analysis will focus on incorporating AI into medical education and the ethical and the Anticipated Ethical Issues that will emerge as this incorporation develops.

CLINICAL RESEARCH ETHICS: LEARNING FROM HISTORY

John Vanchiere[1]

[1]LSU Health Shreveport

This session on Clinical Research Ethics will critically review cases from medical history to reinforce the principles of Respect for Persons, Beneficence and Justice that are the foundation of clinical research.

ETHICS OF ANIMAL USE IN RESEARCH

V. Hugh Price, Jr.

LSU Health Sciences Center Shreveport

ARTIFICAL WOMBS: AN ETHICAL AND ANTICIPATORY ETHICAL ANALYSIS

Richard Wilson

Towson University Philosophy/Computer and Information Sciences

Introduction: how can ectogestation technology disrupt gender roles, parenting practices and concepts such as birth, body or parent? in this analysis we situate this emerging technology in the context of the history of reproductive technologies and analyze the potential ethical, social and conceptual disruptions to which it could contribute. the actual device and actual device better known as an artificial womb enables extra uterine gestation. for a human being or any mammal . it is currently being developed with the main goal of improving the survival chances of extremely premature neonates. This analysis argues that the use of the technology and neonate intensive care units as an alternative has a number of ethical and anticipated ethical issues that challenge concepts such as birth fetus and neonate. The futuristic scenario of the entire embryological and fetal development could occur within an artificial womb. These possibilities show that full ectogestation reveals the possibility of the disruptions of our current conceptions of mother, father, and parent. **Methods:** (The method used in this analysis will be a standard conceptual analysis and definition of the key terms related to Ectogensis and to ethics and anticipatory ethics. **Results:** The results of the conceptual analysis will identify ethical and anticipated ethical problems with artificial wombs and will be an anticipatory ethical analysis of the technology. Conclusion: (the pros and cons of artificial wombs will be identified in order to make policy recommendations about the development of artificial womb technology.

Health Technology in Medicine I

INTERROGATING CELL MECHANOBIOLOGY IN AN ELASTIC DOME MICRO-DEVICE

Gideon Nyarko, Carla Lacerda

University of Texas at Tyler, Tyler, TX, Tyler, TX

Valvular heart diseases (VHDs) are a significant health burden in developed countries, yet understanding their pathophysiology remains incomplete. Valvular interstitial cells (VICs), the primary cell population in heart valves, are pivotal in VHD development, transitioning from quiescent to activated myofibroblast-like cells in diseased valves. The crucial role of mechanobiology in valvular pathophysiology is underscored by the influence of various mechanical forces triggering phenotypical transformations in VICs, leading to the onset of valvular degeneration. Given the unique size, role, and location of heart valves within the body, there is a compelling need for in vitro systems capable of accurately recapitulating the initiation and progression of these diseases. This work presents a novel microfluidic device to mechanically stimulate cultured VICs within an elastic dome, mimicking physiological strain from blood transvalvular pressure inducing valve stretch during peak diastole. VIC responses were examined across strains from 0 to 18%, revealing myofibroblastic morphology and up-regulation of α-smooth muscle actin expression at higher strains. This links tensile stretch to cell morphology and phenotype transformation, laying groundwork for investigating stretch-induced valvular degeneration pathways and the potential for therapeutic interventions.

GENE SAMPLING TECHNOLOGY FOR RAPID MICROBIAL LYSIS AND GENOTYPING IN MICROFLUIDIC DEVICE

Md Aminul Islam, Matthew Franklin, Cassidy Husson, Rebecca Giorno, Gergana Nestorova

Louisiana Tech University, Rushton, LA

This study reports on designing and characterizing a lab-on-a-chip piezoelectric platform for purifying bacterial lysis and nucleic acid. This device platform enables the isolation of bacterial RNA for subsequent gene expression analysis. The lysis efficiency of mechanical, enzymatic, and ultrasonic methods was assessed using gram-positive (*B. cereus*) and gram-negative (*E. coli*) bacteria. Ultrasonic lysis was the most efficient method resulting in an average of 502ng of RNA from 1^10^7 *B. cereus*. Mechanical lysis provided the highest yield for gram-negative bacteria at an average of 2,438ng of RNA from 1^10^7 *E. coli*. Lysis efficiency testing was done using LIVE/DEAD™ bacterial viability fluorescence assay. The design of the microfluidic platform includes piezoelectric plates (25mm×5mm×0.3mm) for disruption of bacterial cell walls. The device was fabricated using a Form 3 printer and Formlabs clear V4 resin. The platform dimensions were 35mm×28mm×10mm. The lysis efficiency for *E. coli* ranged from 40% to 70% at 15 and 45 minutes respectively. The platform was successfully functionalized with *E. coli*-specific aptamer for selective bacterial enrichment. A gold-plated pin (200µm×25mm) was functionalized with thiol-conjugated synthetic RNA capture sequences for selective purification of bacterial 16S RNA. The nucleic acid material selectively binds to the pin after at least 2 minutes of incubation in the bacterial lysate. The RNA capture pin efficiency was 60ng of RNA per pin using *E. coli* and 28ng per pin using *B. cereus*.

FUNCTIONAL MOVEMENT (FMOVE) TELE-SCREENING APPLICATION

Antonio Morelos, Matthew Castillo, Benjamin Baber, Carina Gallegos, Sagnik Dakshit

The University of Texas at Tyler, Tyler, TX

Recently there has been renewed interest in fitness, especially with the deteriorating health conditions due to lifestyle stress and pandemics. While the requirement of functional fitness has been long prevalent in sports, there is also a need for the same for maintaining a healthy lifestyle with age and recovering from various injuries. It is more important to achieve functional fitness than spending long hours in the gym. Functional Movement

Screen (FMS) is a screening test popularly used to rate and rank movement patterns by physiotherapists, to assess compensatory movement patterns which increases chances of injury in sports. The seven primary movement patterns listed in FMS are (1) Deep Squat which evaluates flexibility, mobility, and stability in the hips, knees, and ankles, (2) Hurdle Step assessing stability and mobility in the hips and pelvis, (3) Inline Lunge which focuses on hip mobility and balance, (4) Shoulder Mobility which focuses on the flexibility and range of motion in the shoulders and thoracic spine, (5) Active Straight Leg Raise evaluating hamstring and lower back flexibility, (6) Trunk Stability Push-Up which measures core and upper body strength and stability, and (7) Rotary Stability which tests core strength and stability during rotational movements. Popularly used in sports analytics and rehabilitation, FMS finds use also in movement correction for a fit lifestyle. In this work, we develop a mobile platform "FMove" for functional fitness evaluation using any embedded device or laptop with a camera. Our novel application, FMove, designed for automated Functional Movement Screen monitoring to assess compensatory movement pattern for early assessment of risk injury uses real-time joint tracking from live video stream to calculate identified joint angles and distances for movement pattern monitoring and automated scoring of the movement form. A functionality score is automatically assigned based on the movement. This facilitates tele-assessment and early risk identification from remote settings with an expert-in-the-loop assessing and observing score improvement or degradation in physiotherapy programs. Our User Interface (UI) allows the end-users to automatically monitor their FMS score and for experts to add more exercises with the future work of selective joint tracking. The proposed system is developed in three design phases intertwined with testing phases. Furthermore, we discuss the challenges and limitations of developing such as an application with open-source packages. The successful deployment of our application will be a step towards raising awareness of functional fitness in public and making health services accessible leveraging advancement in technology.

AI-DRIVEN REHABILITATION ROBOTICS FOR GAIT TRAINING EXERCISES

Jacob Anthony, Chung Hyun Goh, Jacob Carr, Woohyoung Jeon

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As a patient gets older, their chances of sustaining a motor disability increase. Such disabilities negatively effect the patient's ability to perform daily activities. These patients require rehabilitation to regain their mobility and agency. Gait training is a commonly prescribed treatment to help patients regain muscle memory. Automated-walking training devices have been designed to aid this process. While these devices establish accurate ankle-path trajectories, the knee and hip path trajectories are inaccurate. In this work, a redesign of the leg assembly for a multi-purpose rehabilitation robotic device (RoboREHAB) was explored to improve hip- and knee-joint movement accuracy by adding an additional degree of freedom at the knee joint. In this research, motion analysis was employed to test feasibility, reinforcement learning was utilized to train the new leg assembly to walk. The joint motions achieved with the redesign were compared to motion-capture (mocap) data. The motion analysis demonstrated an improvement in the knee- and hip-path trajectories due to the added roller/joint segment. The redesigned leg assembly, under the reinforcement-learning policy, showed a X- and Y- deviation of 45.622 mm and 17.164 mm at the knee joint and maintained a similar profile to the mocap trajectory data. This is an improvement over the original two-segment design, which achieved an X- and Y- deviation of 133.333 mm and 38.832 mm at the knee joint. These results in the knee and hip-joint movements more closely reflecting the mocap and motion-analysis results, validating the redesign and opening it up to further experimentation and technical improvement.

Clinical Rehabilitation

EFFICACY OF BACKWARDS WALKING ACROSS THE CONTINUUM OF CARE POST-STROKE: A SYSTEMATIC REVIEW

Melissa Knight, Jacob Long

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Background: Backwards walking (BW) is a functional, cost-effective, and easy to implement gait training strategy that has the potential to maximize therapeutic benefit as it challenges a variety of body systems required for successful functional mobility. **Objective:** The purpose of this systematic review is to assess the effectiveness of backwards walking (BW) as an intervention for patients after a stroke through the lens of the Academy of Neurologic Physical Therapy (ANPT) Core Outcome Measures. **Methods:** PubMed, Embase, PEDro, CINAHL, and Science Direct were searched in December 2023 using terms associated with stroke and backward walking. Studies included adult subjects in randomized control trials only and used at least one of the ANPT's Core Outcome Measures. Articles excluded were published greater than 10 years ago or used an adjunct intervention. Quality was assessed with the Physiotherapy Evidence Database (PEDro) and Centre for Evidence-Based Medicine (CEBM) scales. **Results:** While the initial searches pulled 162 articles, six RCTs met the inclusion requirements. The total number of subjects across the spectrum of care was 173 of variable chronicity**.** Articles ranged from 5 to 7/10 on the PEDro scale and were all Level II according to CEBM. **Conclusion:** The majority of the outcome measures studied indicated favorable results with the use of BW training. Therefore, BW may be a more effective treatment for stroke rehab when compared with conventional PT or forwards walking training alone.

AN EVALUATION OF THE EFFECTS OF PHYSICAL ACTIVITY BREAKS DURING WORK ON THE INCIDENCE AND PREVALENCE OF NECK PAIN: A SYSTEMATIC REVIEW

Joy Kuebler, Sarah Whitt, Kennedy Williams, Slater Richardson, Walker Hardin

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Background: Neck pain is the 4th leading cause of disability worldwide and office workers have the highest reported annual incidence of neck symptoms in the working population. Research has proven that physical activity has many benefits for the musculoskeletal system. **Objective:** This systematic review aims to examine whether implementing physical activity in the workplace can decrease or prevent neck pain in office workers. **Methods:** PubMed and Embase databases were last searched on November 30, 2023. Search terms included physical activity, neck pain, and office workers. The inclusion criteria include physical activity during the work shift at the workplace, RCTs, full-text articles, articles written in English, and studies published in 2016 or after. Exclusion criteria exclude multiple items such as pain and comorbidities not related to the work place. PRISMA guidelines were utilized to report on the current systematic review. **Results:** Four articles utilized at-work physical activity programs, totaling 1674 participants. Two articles received a PEDro score in the "good" category and two in the "fair" category. Three of the four studies showed that implementing an at-work exercise program caused a statistically significant reduction in neck pain in office workers compared to a control group. **Conclusion:** Our results show that physical activity in the workplace reduces the incidence and prevalence of neck pain in office workers. Results improve with adherence to the workplace physical activity intervention.

EFFECTS OF DUAL TASK INTERVENTION ON FALL RISK IN OLDER ADULTS: A SYSTEMATIC REVIEW

Sherry Colson, Nyah Tate, Bradley Lewis, Chase Penningto, Haley Puckett

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Background: One in four older adults experience a fall each year and 37% of falls result in a severe injury. Dual-task training, defined as performing motor activity simultaneously with cognitive tasks, shows promise in improving balance in older adults. **Objective:** The purpose of this systematic review is to determine the effectiveness of Dual Task training on reducing falls risk in older adults. **Methods:** PubMed and EMBASE were searched on November 11th, 2023, using search terms: dual task, falls risk, and older adults. Inclusion criteria: older adults >65, dual task intervention, falls risk outcome. Exclusion Criteria: cognitive impairments, subjects with specific medical diagnosis. PRISMA reporting guidelines were used. Articles retrieved were screened by two authors and a third and fourth author were utilized for discrepancies. PEDro and JBI appraisal tools were used to complete the risk of bias assessment. **Results:** The search generated 347 articles. Following title, abstract, and full text screening, five studies were included resulting in four randomized controlled trials and one quasi-experimental totaling 228 participants. The JBI Appraisal score of 66.7% for the quasi experimental and the average PEDro score of 7/10 for the RCTs indicate good quality studies. Two studies indicated statistically significant improvement in favor of dual task training. Two studies showed no statistically significant improvement at end of trial. One study had mixed results. Statistical significance interpreted with a p-value < 0.05. **Conclusion:** The varied results of this review indicate dual task training has the potential to reduce falls risk in older adults.

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

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School of Health-Related Professions, University of Mississippi Medical Center, Jackson, MS

Background: A dual-task activity involves the performance of a simultaneous cognitive and motor task. There is inconclusive evidence in the literature that transcranial direct current stimulation (tDCS) has reduced dual-task cost in individuals with cognitive impairments and in the elderly. There are limited studies that have looked at the effect of tDCS in healthy young adult cohorts. **Objective**: The objective of this review is to determine if using tDCS within the healthy, young adult population will reduce dual-task costs. **Methods**: The last search for articles using search terms about tDCS, dual-task performance, and healthy young adults was on 1/16/24. The articles were screened by title, abstract, and duplication. The inclusion criteria encompass healthy young adults (18-35 years of age) and randomized control trials or randomized crossover studies. The exclusion criteria include studies before 2013, systematic reviews, studies that do not use a dual-task, and the use of transcranial magnetic stimulation (TMS). PEDro Quality Assessment was used to determine the risk of bias. **Results**: Five articles met the criteria for the study with a total of 242 participants who performed a dual-task post-tDCS session with a mean PEDro Score of 8.60. All five articles showed significant positive effects with the application of tDCS and the reduction of dual-task cost ($p < 0.05$). Outcomes such as reaction time, response accuracy, postural control, gait velocity, and variability were observed. **Conclusion**: This suggests that tDCS could enhance brain functions and optimize overall efficacy during dual-task situations, which was not observed in single-task performance with tDCS. It could be possible that young healthy adults' performance in some sports or academic activities that require multiple tasks may be enhanced. More studies are needed to validate the efficacy of tDCS in varying areas of young adults' lives and the lasting effects of the reduction of dual-task costs.

CAREER DEVELOPMENT

A CAREER IN RESEARCH FOR WOMEN STUDENTS AND UNDERREPRESENTED MINORITIES

May Abdelaziz

The University of Texas at Tyler, Tyler, TX

This abstract describes my contribution to the planned Career Development panel geared towards undergraduate and graduate students from the broader spectrum of life science and technology

at the Southern Biomedical Engineering Conference. I have a Bachelor's degree in pharmacy and a Master's in pharmaceutical chemistry from Cairo University, Egypt, and a PhD in pharmaceutical sciences. Currently, I serve as an assistant professor at The University of Texas at Tyler, where I run an externally funded lab on drug discovery and development. I want to contribute to the Career Panel by sharing my expertise in helping undergraduate students in my institution develop a successful research career. My lab aims to recruit and retain undergraduate female students and students from underrepresented minorities in STEM. I will discuss with the participants strategies that I implement to help students succeed and activities they can pursue to help them succeed in a research environment in academia. I will also share valuable life experiences, including maintaining an environment of well-being and having a healthy work-life balance. The discussion will offer opportunities for self-development and career advancement to benefit the audience.

CAREER DEVELOPMENT FOR BIOENGINEERING TRAINEES

Alwathiqbellah Ibrahim

University of Texas at Tyler, Tyler, TX

This abstract describes my contribution to the planned Career Development panel geared towards undergraduate and graduate students from the broader spectrum of life science and technology at the Southern Biomedical Engineering Conference. I have a PhD degree from The State University of New York at Binghamton. Currently, I serve as an Assistant Professor at the Department of Mechanical Engineering at the University of Texas at Tyler. I would like to contribute to the Career Panel by Co-charging the panel session and inviting some speakers to share their valuable life experiences for self-development and career advancement that would benefit the audience.

ENTREPRENEURSHIP IN BIOMEDICAL ENGINEERING

Matthew Lucci

Runatek

This abstract describes my contribution to the planned Career Development panel geared towards undergraduate and graduate students from the broader spectrum of life science and technology at the Southern Biomedical Engineering Conference. Holding a Master's degree in Mechanical Engineering from the University of Texas at Tyler and currently serving as the CEO of Runatek, a startup medical device company, I have traversed the challenging yet rewarding path of biomedical entrepreneurship. My contribution to the discussion will encompass the critical intersections of engineering principles and entrepreneurial strategies within the biomedical industry. I will delve into the transition from engineering to executive leadership, emphasizing the importance of biomedical innovation to meet market needs. Additionally, I will highlight the unique challenges faced in the medical device sector, including regulatory hurdles, funding acquisition, and market entry strategies. I aim to provide students and aspiring biomedical entrepreneurs with actionable insights and practical advice to build a business around their innovations. Attendees will gain a deeper understanding of how to leverage their technical background to identify market needs, develop viable products, and navigate the complexities of bringing medical innovations to market.

HEALTH TECHNOLOGY AND MEDICINE II

A SMART SYSTEM FOR MONITORING AND ALERTING INADEQUATE PATIENT MOVEMENT IN BED-BOUND INDIVIDUALS

Laavanya Rachakonda, Elysia Marie Ramsey

University Of North Carolina Wilmington, Wilmington, NC

Bed-bound patients often experience complications such as bedsores, muscle atrophy, and general weakening due to immobility. Addressing these challenges requires continuous monitoring and timely intervention. In response, we present a prototype for a smart fabric system designed to monitor patient movement and alert caretakers when inadequate movement is detected. When prolonged immobility is detected, the system generates alerts, notifying caretakers and medical professionals to intervene promptly.

AN INNOVATIVE SMART FOOT-ANKLE BRACE FOR TELE-REHABILITATION OF PARALYZED PATIENTS

Abolghassem Zabihollah[1], Seyed Ghorshi[2]

[1]Tarleton State University, [2]University of Texas at Tyler

Human locomotion relies heavily on the coordination of various body parts, particularly the foot and ankle. Paralysis, characterized by partial or complete loss of muscle function, can significantly impair an individual's ability to move voluntarily. Foot drop, a form of paralysis, disrupts control over the foot during walking, leading to the dragging of the foot or toes. Rehabilitation for paralysis often involves the use of assistive footwear or other devices. However, successful rehabilitation requires precise monitoring of the patient's daily activities to tailor interventions effectively. To address this need, our work introduces an innovative smart foot-ankle brace equipped with multiple sensors to monitor key parameters while walking. These sensors measure angular rotation, off-axis displacement, acceleration, and pressure. By analyzing this data, the brace can identify foot-ankle malalignment, dragging of the foot or toes, and pressure distribution. The collected data is transmitted via Bluetooth to a processing platform, such as the patient's smartphone. Utilizing signal processing techniques like Fast Fourier Transform (FFT), we can extract clear patterns of the patient's locomotion. This information empowers physicians to prescribe or adjust personalized rehabilitation procedures based on the patient's unique mobility patterns. To demonstrate the feasibility of our approach, we have developed a proof-of-concept prototype of the system, showcasing its performance and functionality in monitoring foot-ankle dynamics during walking.

DEVELOP A GROUNDBREAKING SHAPE MEMORY ALLOY STENT AIMED AT ENHANCING BLOOD FLOW IN OBSTRUCTED VEINS

Oluwaseyi Oyetunji, Abolghassem Zabihollah

Tarleton State University

The exploration of cardiovascular diseases (CVDs) caused by blood flow issues, particularly venous blockages, is a crucial area of study. Understanding blood flow dynamics is vital for developing effective treatments, given the significant number of lives claimed by CVDs each year. This research delves into the potential use of Shape Memory Alloys (SMAs) in biomedical interventions, specifically in the development of self-expandable stents to address cardiovascular diseases. The unique qualities of SMAs, such as the shape memory effect and super elasticity, could enable the creation of stent designs that dynamically adapt to vessel dimensions. The SMA is trained to function within a specific temperature range, between 35 and 37.2 degrees Celsius, to facilitate blood flow in the vein. This study outlines the modeling of a two-dimensional SMA actuator aimed at altering venous cross-sections to enhance blood flow and combat cardiovascular disease in veins. Experimental endeavors include the design of SMA actuators, measurement of strains using Fiber Bragg Grating (FBG) sensors, and prototyping of tubes. FBG sensors prove to be valuable in biomedical applications due to their high sensitivity and multiplexing capacity, particularly for monitoring strain changes. FBG sensors mounted on the prototype tube are utilized to collect temperature and strain data, which are then transmitted to the processing unit via a compact, low-powered FBG interrogator. In conclusion, this work underscores the potential of computational modeling with Ansys and SMAs to advance cardiovascular therapy. From strain measurement to stent design, this approach holds promise for improving patient outcomes and treatment effectiveness in the real world.

3D PRINTED SKIN AND ETHICS: AN ANTICIPATORY ETHICAL ANALYSIS

Ian Holmes

Towson University

Reconstructive surgery employed to correct trauma to skin due to injuries from burns disease, is often difficult, imperfect and not aesthetically pleasing. Researchers currently working on 3D printed skin seek to correct these problems by implementing 3D printing and printing full thickness skin onto a patient. 3D printed skin would be used to treat a variety of skin injuries including correcting life-threatening deep wounds and other injuries that would take a long time to heal on their own without the help of 3D printing. 3D printing applied to issues in medicine are not completely new. My research would look at types of 3D printing and in particular suspended layer additive manufacturing (SLAM) and its potential to be used in creating 3D printed skin. This will give the audience a background that will provide a foundation for analyzing the ethical and technical problems of 3D printed skin in a clinical setting. While 3D printed skin has not been fully developed for use on patients, researchers are currently developing 3D printed skin to be fully functional. To conduct my analysis of 3D printed skin, I will be employing the Belief desire Intentional model rational agency and as the basis for performing an anticipatory ethics on the possible future effects of 3D printed skin in humans. The work of bioethicists is to identify social and ethical issues in the world. When an bioethicist seeks to identify future social and ethical issues, they use anticipatory ethics. It should be noted that the basis for both current and future identification of social and ethical issues employs generally defined ethical principles. Anticipatory ethics will be used to identify the emerging social and ethical issues that arise from the potential to 3D print skin in a world where the technology has not been fully developed but where research is active and ongoing. Anticipatory Ethics attempts to project technological advances and then attempts to imagine what the ethical problems may be that accompany these technological advances.

CONCEPTUAL ENGINEERING, TECHNOLOGICAL CONFLUENCE AND ANTICIPATORY ETHICS

Richard Wilson[1], Michael Nestor[2]

[1]Towson University Philosophy/Computer and Information Sciences, [2]Autica Bio, Baltimore, MD

Introduction: Technologies have a variety of impacts on human behavior, the environment and on society as well as having an impact on what we believe and value. Some technologies are not just capable of producing powerful impacts but they are also socially disruptive. they challenge existing institutions, social practices and beliefs and conceptual categories. in this discussion we are interested in the influence of the confluence of technologies and how this confluence challenges the fundamental categories according to which analysis prior to the development of the disruptive technology has taken place. Conceptual disruption occurs when the meaning of concepts is challenged and such challenges may lead to a range of examples which require not just a reorientation of our concepts, technically called conceptual engineering but also to the potential for a reconfiguration of ethics. Ethical engineering is the idea that with the confluence of technologies we encounter problems related to how to even perform a ethical analysis. when one looks at the influence of GPT chat on medical practice the issues that occur are related to AI, voice recognition systems and issues related to the development of old medicine. the question becomes what type of ethical analysis needs to be conducted in order to legitimately examine the ethical issues that are at play with the confluence of these technologies. this analysis will explore issues related to these questions from the perspective of anticipatory ethics. Methods: the method employed in this analysis will examine the concepts related to conceptual engineering emerging technologies and anticipatory ethics. A clear identification of these concepts is critical in a time period where there is an increasing confluence of technologies which has an impact on the basic definitions of terms and concepts in biomechanical engineering. We proceed by exploring the concepts and definitions needed to carry out an anticipatory ethics involving conceptual and ethical engineering. **Results:** the results of this analysis well be to develop a method

for conducting conceptual engineering and ethical engineering based on the confluence of technologies. Our analysis we'll need to anticipate the issues arising from the ongoing development of technologies and the continuing confluence of emerging technologies. **Conclusion:** we will conclude by offering a method for developing and anticipatory ethical analysis of emerging technologies and how to confront the ongoing exponential growth of technologies. We need to develop ideas about how to conduct conceptual and ethical analysis in the face of the exponential growth of technologies and the confluence taking place between emerging technologies.

ETHICAL CHALLENGES IN HEALTHCARE LEADERSHIP: BEDSIDE TO BOARDROOM

R. Shane Barton

Department of Orthopaedic Surgery, LSU Health Shreveport

The presentation explores the complex ethical dilemmas that healthcare leaders face across different levels of the healthcare continuum. From direct patient care at the bedside to executive decision-making in the boardroom, healthcare leaders encounter diverse ethical challenges that require a delicate balance between patient advocacy, resource allocation, and organizational goals. This presentation will analyze case studies highlighting real-world ethical conflicts, discuss the role of leadership in fostering an ethical culture, and propose strategies for navigating these challenges. Attendees will gain insights into the ethical responsibilities of healthcare leaders, the impact of their decisions on patient care and staff morale, and the importance of ethical frameworks in guiding leadership practices. This discussion is essential for current and aspiring leaders committed to upholding integrity and trust in healthcare.

Sunday, September 15, 2024

Medical Imaging

NON-INVASIVE ASSESSMENT OF MYOTOXIN-INDUCED SKELETAL MUSCLE DAMAGE OF MDX MICE.

Ravneet Vohra[1, 2], Joshua Park[2], Feng Zhang[2], Jeffrey Chamberlain[3, 4, 5, 6], Donghoon Lee[2]

[1]Department of Physical Therapy, Louisiana State University Health Science, LA., [2]Department of Radiology, University of Washington, Seattle, WA[3]Department of Neurology, University of Washington, Seattle, WA, [4]Senator Paul D. Wellstone Muscular Dystrophy Cooperative Research Center, University of Washington, Seattle, WA, [5]Department of Biochemistry, University of Washington, Seattle, WA, [6]Department of Medicine, University of Washington, Seattle, WA

Introduction: Using histochemical methods, a plethora of injury models have been used to degeneration and regeneration processes in preclinical models of Duchenne muscular dystrophy (DMD). In contrast, MRI can non-invasively monitor the underlying pathological changes in the skeletal muscles. The purpose of this study was to use quantitative multiparametric MRI (mp-MRI) to evaluate the hind leg muscles with myotoxin-induced damage in dystrophic and normal C57BL/6 mice over a period of 3 weeks. **Methods:** Using mp-MRI, we monitored the effects of myotoxin injection in control (n = 5) and dystrophic (n = 10) tibialis anterior (TA) muscle. MR images were obtained for the myotoxin-injected and saline-injected leg muscles. **Results:** Mean T1 values decreased and bottomed at day 5 in control and day 3 in dystrophic muscle. Mean T2 values increased and peaked at day 3 in both control and dystrophic muscles. Mean magnetization transfer ratio (MTR) values decreased and bottomed at 5 days in control and dystrophic muscles post myotoxin injection. Diffusion weighted imaging parameters such as radial and mean diffusivity also demonstrated differences in control and dystrophic muscles post myotoxin injection. **Conclusions:** The data indicates that MRI parameters may be used as a time sensitive biomarker to detect myotoxin induced degeneration and regeneration process.

ULTRASOUND ASSESSMENT DETERMINES THAT THE 90° OPEN-CHAIN POSITION IN THE CLINICAL SETTING OPTIMIZES KNEE JOINT SPACE: POSSIBLE IMPLICATIONS FOR INTRA-ARTICULAR KNEE JOINT INJECTIONS.

Naina Bouchereau-Lal[1], Cory Coehoorn[1], Daniel Poole[1], Andrew Wilkinson[1], Dakota Ellison[1], E.J. Mayeaux[1], Peter Seidenberg[1]

LSU Health Shreveport, Shreveport, LA

Introduction: A review of previous literature demonstrates a lack of definitive data regarding optimal knee position during palpation-guided methods to maximize knee joint space for knee joint injections. **Purpose:** Therefore, it was hypothesized that a 90° open-chain position will increase knee joint space and provide an optimal space for palpation-guided intra-articular knee joint injections. **Methods:** Eighteen subjects (11 biological females and 7 biological males) between the ages of 22 and 52 (30 ± 10.6 years) were first seated on an examination table in a 90° open chain position. The knee was marked at the anterolateral position over the lateral joint line, where a palpation-guided intra-articular knee joint injection would typically occur. Next, a portable handheld ultrasound machine was placed over the marked area, measuring the widest space between the femoral head and tibial plateau in centimeters. This was repeated in a 90° closed chain position. A total of 35 non-pathological knees were examined. **Results:** The results demonstrated that knee joint space in the 90° open chain position (mean: 1.53 ± 0.29 cm) was greater compared to the 90° closed chain position (mean: 1.21 ± 0.35 cm), with $p \leq 0.00001$. **Conclusion:** This finding has potential implications for determining the optimal knee position for intra-articular knee joint injections, especially in primary care clinics lacking ultrasound machines.

SENSITIVITY OF CT SCANNING DIRECTION IN FE EVALUATION OF VERTEBRAL STRENGTH AND STIFFNESS

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Vertebral compression fractures (VCFs) are common a common vertebral pathology in postmenopausal women. The commonly used test, dual energy X-ray absorptiometry (DXA) scan, has a low sensitivity. An alternative is Finite element analysis (FEA) using quantitative computer tomography (qCT). The major drawback to using FEA is the high amount of radiation the patient is exposed to during the CT scans. This study aims to evaluate the capability of qCT based FEA limited to the midportion of the vertebral body in estimating vertebral stiffness and strength, and evaluate if vertebral inclination limits FEA in this approach to limit patient radiation exposure. The T7 to T12 vertebrae from 18 cadaveric spines were scanned using CT. Each vertebra was sectioned at 20, 25, and 30% thickness with inclinations ranging from -10 to +10 degrees in 5-degree increments. Each section went under a simulated compression at 1.9% axial deformation in FE to estimate stiffness and peak load. The cadaveric vertebrae were then compressed at a rate of 5mm/min until the displacement equivalent of 1% of vertebrae height was reached. A correlation coefficient was used to compare the estimated and experimental peak loads (20% R^2=0.9019, 25% R^2=0.9106, 30% R^2=0.9112) and stiffness (20% R^2=0.9441, 25% R^2=0.9446, 30% R^2=0.9511) of each section. There was no difference in the estimated peak load ($p>0.05$) or estimated stiffness ($p>0.05$) at 0 degrees as compared to -10, -5, 5, and 10 degrees of inclination. In conclusion, limiting CT scanning to midsection of the vertebral body and the angle of inclination of the vertebral body have minimal effect on the sensitivity of FEA. **Acknowledgement:** The study has been supported by the LSU Lift 2 fund.

Nano Medicine and Drug Delivery II

109 - MACROPHAGE DERIVED EXTRACELLULAR VESICLES COATED GOLD NANORODS FOR PHOTOTHERMAL CANCER THERAPY

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Gold nanorods (AuNRs) have been explored in photothermal therapy (PT) of cancer due to their strong surface plasmon resonance properties, which are tunable to a different spectrum of light. PT therapy is a treatment method in which a molecule or a material is activated with light and releases energy in the form of heat for therapeutic effect. However, the use of AuNRs in biomedical applications is greatly affected by their stability in biological media. Therefore, studies were focused on improving the stability of AuNRs with biocompatible surface functionalization coatings. However, the coatings on AuNRs can also affect heat conduction and alter their photothermal behavior. In the present work, we provide investigations on the effect of macrophage-derived extracellular vesicles (MEVs) coating on two different aspect ratios (5.4 and 2.6) of AuNRs on temperature distribution of suspensions under near-infrared irradiation, cell uptake *in vitro*, and hyperthermia-induced cytotoxicity. Towards this end, surfactant-coated AuNRs were synthesized and purified while exchanging surfactant with MEVs following a brief sonication resulting in the formation of MEVs-AuNRs. Spectrophotometric characterization of these AuNRs exhibited a near IR effect with maximum absorbance red-shifted to 1000 nm. Next, AuNRs and MEVs-AuNRs aqueous solutions were irradiated with 808 nm near-infrared laser and the heat evolved was captured using an infrared thermal camera. The observation showed that the suspension temperature reached 60°C (ΔT=30°C) sufficient to show a therapeutic effect. In the pilot experiment, we observed that these AuNRs are up-taken by breast cancer cells and have shown PT effect showing its potential in cancer treatment.

THE EFFECT OF NANOPARTICLE SIZE ON CELLULAR UPTAKE KINETICS IN BREAST CANCER MODEL

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Gold nanoparticles (AuNPs) have attracted considerable attention as drug delivery vehicles due to their unique physicochemical properties. However, the cellular uptake of these particles is greatly influenced by their size, shape, and surface chemistry. Particle size, in particular, plays a major role in determining how AuNPs interact with biological systems, ultimately influencing their uptake and toxicity. Toward this end, in this study, we investigated two different sizes of methyl polyethylene glycol coated-AuNPs (20 nm and 80 nm) for cellular internalization studies. The cellular internalization of these nanoparticles by breast cancer (MCF-7 and MDA-MB-231) cells were analyzed, providing a parametric evaluation of the effect of size. The in vitro cytotoxicity studies demonstrated that both 20 nm and 80 nm AuNPs have significant concentration dependent cytotoxicity. Further, the cellular uptake of different sized AuNPs in both cells was quantitatively measured by ICP-MS and the results showed noticeable disparities in the uptake behavior at different time periods of the treatment. Flow cytometric analysis with FITC/annexin V dual staining was used to determine the apoptotic or necrotic cell death induced by both sizes of AuNPs. Additionally, ELISA was used to detect the release of pro-inflammatory cytokines such as IL-6, TNF- α and IL-1β in the supernatant of both breast cancer cells after 24-hr exposure of AuNPs. The overall study concluded that both 20 nm and 80 nm AuNPs possess significant biological effect which necessitates careful consideration of nanoparticle size in biomedical applications to optimize therapeutic efficacy and minimize adverse side effects.

LIVER FUNCTION AND ANTIOXIDANT POTENCY OF SILVER NANOPARTICLE MODIFIED Corchorus olitorius (Jute) LEAF EXTRACT ON DIABETIC WISTAR RATS

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High prevalent of diabetes coupled with economic burden posed for its therapy have been an issue of concern. This study aimed at examining the liver and antioxidant potency of *Corchorus olitorius* leaf extracts (COLE) and its modification with silver nanoparticles (AgNPs-COLE) on alloxan induced diabetic wistar rats. The extracted aqueous *Cochorus olitorius* (*C. olitorius*) leaf was modified with biosynthesized silver nanoparticles in a 4:1. The acute toxicity was determined using 10, 200, 400mg/kg of wistar rats of 184-201g for 30 minutes, 1 hour, 2 hours, 4 hours, 8 hours, and 24hrs for 3 days. The liver functions of aspartate transferase (AST), alanine transferase (ALT) and alkaline phosphate (ALP) were determined using the spectrophotometric technique. Antioxidants parameters of catalase (CAT), superoxide dismutase (SOD), melondialdehyde (MDA), Glutathione peroxidase (GPx), Glutathione reductase (GSH) and GR were determined using colometric procedures. Histopathological analysis of liver and pancreas after sacrificed of Wistar rats and fixed in 10% formalin, dehydrated, embedded in paraffin wax and stained with hematoxylin and eosin. The stained slide was rinsed, mounted on DPX and photomicrograph was captured by the microscope. Induction of Wistar rats with alloxan increased AST, ALT and ALP by 161.54, 107.55 and 112.84%, but reduced to a normal range on administration of Glibenclamide, COLE and AgNPs-COLE, respectively. SOD, CAT and GPx reduced with increased MDA, GSH and GR beyond the standard limits, and vice-versa when administered with Glibenclamide, COLE and AgNPs-COLE, respectively. Histopathological studies of both the liver and pancreas showed alterations of the cellular structures in diabetic but not treated Wistar rat group. However, diabetic and treated groups showed more improvement compared to other treated groups. Extracted aqueous *C. olitorius* leaf possesses antioxidant and regeneration of liver parameters. Biosynthesized AGNPs improved antioxidant and liver regenerative potentials of aqueous extract of jute leaf.

OPTIMIZING PRODUCTION, CHARACTERIZATION, AND IN-VITRO BEHAVIOR OF POLYPHENOL- 5-AMINOSALICYLIC ACID EUDRAGIT CO-AXIAL ELECTROSPRAYED FIBER FOR ANTI-INFLAMMATORY EFFECTS

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The study addresses the challenge of treating Inflammatory Bowel Disease (IBD) by developing a novel drug-polymer complex, the SIL-ASAElectrofiber complex, using an coaxial electrospray system. Silymarin, a polyphenolic flavonoid with antioxidant and anti-inflammatory properties, 5-aminosalicylic acid (5-ASA), is primarily indicated to treat inflammatory bowel disease and is effective in inducing or maintaining remission in mild-to-moderate cases of ulcerative colitis are combined with Eudragit® S100 polymer to enhance its solubility and targeted release in the gastrointestinal tract. The optimized coaxial electrospray will be optimizing the ratio of the Silymarin, 5ASA and Eudragit polymer, producing fiber-like encapsulations with varying drug loading fiber diameters. Characterization techniques, including UV Spectrophotometry, FTIR, SEM, and DSC, confirm the complex's chemical and physical properties and dissolution tests will be conducted to understand improved drug release kinetics and stability. The study will demonstrate that the SIL-ASAElectrofiber complex potential for targeted IBD treatment and enhanced drug delivery. **Introduction:** Inflammatory Bowel Disease (IBD), encompassing ulcerative colitis and Crohn's disease, is a chronic condition marked by gastrointestinal inflammation, affecting millions and incurring high healthcare costs. Current treatments, such as salicylates and glucocorticoids, have limitations and side effects, prompting exploration of polyphenolic compounds like silymarin for their therapeutic potential. Silymarin, derived from milk thistle seeds, exhibits antioxidant and anti-inflammatory properties but suffers from poor water solubility, limiting its efficacy. 5-aminosalicylic acid (5-ASA), is primarily indicated to treat inflammatory bowel disease and is effective in inducing or maintaining remission in mild-to-moderate cases of ulcerative colitis. This study explores the fabrication employing coaxial electrospray and fiber characterization of a SIL-ASAElectrofiber complex. The aim is to improve 5-ASA, silymarin's solubility, stability, and targeted release for IBD treatment. The complex's in-vitro behavior, drug loading, and antioxidant activity are evaluated to assess its potential in enhancing drug delivery and therapeutic outcomes. **Materials and Methods:** The SIL-ASAElectrofiber complex is created using an coaxial electrospray setup, optimizing parameters like solvent type, drug to drug ratio, drug-to-polymer ratio, voltage, and flow rate. The drug-polymer complex undergoes evaluation using UV-visible spectrophotometry, FTIR, SEM, and DSC to confirm its formation and properties. Drug loading, solubility, and release kinetics are assessed in simulated gastric and intestinal fluids. **Results and Discussion:** The optimized parameters must produce fibrous strands with enhanced surface area and solubility. Characterization techniques will confirm the integrity of the 5-ASA, silymarin and polymer components. The SIL-ASAElectrofiber complex drug release will be investigated in intestinal conditions compared to gastric conditions, indicating its suitability for targeted delivery in the colon. Antioxidant assays will demonstrate the complex's potential to enhance silymarin's therapeutic effects in the gastrointestinal tract. **Conclusion:** The SIL-ASAElectrofiber complex will represent a promising advancement in IBD treatment, offering improved solubility, targeted release, and enhanced anti-inflammatory effects. This study paves the way for further research on drug-polymer complexes using electrospray methods for various biomedical applications.

Target signaling Pathway CD

CAMBINOL DECREASES CELL PROLIFERATION AND MIGRATION OF METASTATIC CASTRATION RESISTANT PROSTATE CANCER CELLS

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Introduction and objective: Metastatic castration resistant prostate cancer (mCRPC) remains a significant health challenge for treatment of American men at advanced stages. Thus, further studies are needed for exploration of novel therapeutic strategies to combat tumor progression. The current study highlights the effect of Cambinol, a specific inhibitor of neutral sphingomyelinase 2, as a promising compound with potential anticancer properties on mCRPC cells. **Methods**: mCRPC cells were treated with different concentrations of Cambinol for 72 hours. Cell viability assay was deployed to determine the IC_{50} of Cambinol. The effect of the drug on the clonogenic potential was also performed. The migratory potential of cancer cells in response to Cambinol treatment was evaluated by a scratch assay. The protein expression of NF-κB, ERK1/2 and N-SMase 2 expression was assessed using immunoblotting analysis. **Results**: Our findings demonstrate that Cambinol treatment significantly inhibited cell viability of mCRPC cells in a dose-dependent manner, highlighting its potential as an antiproliferative agent. The colony formation assay results support the hypothesis that Cambinol hinders the clonogenic potential of these cells. A substantial reduction in cell migration upon Cambinol treatment was observed, suggesting its ability to impede metastatic potential at early stage. Western blot analysis demonstrated a decreased expression in NF-κB, ERK1/2 and n-SMase 2. **Conclusion**: This study provides new insights into the multifaceted effects of Cambinol on mCRPC cells, encompassing reduced cell viability, colony-formation and cell migration. These findings warrant further investigation for the development of Cambinol individually and in combination with other standard therapeutic agents for treating the most aggressive forms of prostate cancer.

CHLORPROMAZINE AUGMENTS THE EFFECT OF ANTI-ANDROGEN THERAPY THROUGH THE INDUCTION OF HEME OXYGENASE 1-FERROPTOSIS AXIS IN METASTATIC CASTRATION-RESISTANT PROSTATE CANCER CELLS

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Background: Metastatic castration-resistant prostate cancer (mCRPC) remains a current clinical challenge, prompting the exploration of novel pharmacological interventions. Drug combinations is one of the most effective strategies to reduce metastasis in mCRPC patients. Thus, we investigated the individual and combined effects of chlorpromazine and enzalutamide on a panel of mCRPC cell lines. **Methods**: Cell toxicity, colony formation and scratch assays in addition to Western blot analysis were performed to comprehensively evaluate the therapeutic effects of individual and combined chlorpromazine and enzalutamide. The half-maximal inhibitory concentration (IC_{50}) for each treatment was determined using cell proliferation assay. The effect of individual and combined drugs on tumor size and weight was evaluated in preclinical prostate cancer mouse model. **Results**: Individual treatments demonstrated noteworthy inhibitory effects on cell viability, while the combined regimen exhibited a synergistic reduction in cell viability of mCRPC cells. Boyden chamber assay revealed a significant attenuation of cell migration, indicating a potential impairment of metastatic capabilities. Colony formation assay further supported the combination's robust anti-proliferative effect. To extend our findings using *in vivo* study, Foxn1nu/nu (nude) mice were xenografted with luciferase-tagged mCRPC cells treated with chlorpromazine, enzalutamide, or their combinations. In vivo imaging demonstrated a significant reduction in tumor bioluminescence in the combined treatment group, outperforming individual treatments. On the molecular level, Heme oxygenase 1 (HMOX-1) protein was overexpressed in the combined treatment as compared to the individual drugs. This was accompanied by induction of cell death mediated by ferroptosis. **Conclusions**: Our comprehensive approach provides an unequivocal understanding of the therapeutic potential of combining chlorpromazine with enzalutamide. The robust drug combination was associated with significant overexpression of HMOX-1 protein and inductions of ferroptosis. The observed synergistic effects underscore the promise of this dual treatment strategy for treatment of the most aggressive forms of mCRPC.

REVOLUTIONIZING BREAST CANCER THERAPY: PRECLINICAL EXPLORATION OF A NOVEL QUINAZOLINE SCAFFOLDS AS DUAL HER2/VEGFR2 KINASE INHIBITORS

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Breast cancer poses a significant global health challenge, necessitating more effective treatments. Targeting HER2 and VEGFR2 signaling pathways shows promise in inhibiting tumor progression. Tyrosine kinases (TKs) are crucial in cancer development, with quinazoline derivatives demonstrating selective TK inhibition. We focused on TKs like HER2 and VEGFR2 due to their roles in cancer and angiogenesis.
Utilizing pharmacophoric elements from anti-HER2 and anti-VEGFR2 drugs, we designed novel inhibitors targeting both pathways. Screening 40 compounds yielded 13f as a standout, inhibiting multiple kinases, particularly HER2. Compound 13i emerged as the most potent HER2 inhibitor, with 13f close behind. Both showed heightened potency against VEGFR/KDR kinase.

We investigated the mechanism of 13f compared to lapatinib, a standard HER2 inhibitor, using breast cancer models. 13f demonstrated potent antiproliferative activity against HER2 and VEGFR2-expressing cells, with IC50 values ranging from 103.2 to 251.8 nM. Additionally, 13f significantly inhibited VEGF-induced angiogenesis in HUVEC cells, reducing nodes, junctions, and total sprout length. Western blot analysis confirmed dual down regulation of HER2/VEGFR2 expression.

In vivo studies in mice confirmed 13f's efficacy in inhibiting tumor growth, comparable to lapatinib and combination therapy, without observable adverse effects. Histopathological examination indicated the safety of 13f.

These findings highlight 13f as a promising dual HER2/VEGFR2 inhibitor, offering potential for breast cancer treatment.

IN VITRO AND IN VIVO MODELING OF ASTHMA-CHRONIC OBSTRUCTIVE PULMONARY DISEASE OVERLAP

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Lung diseases have a high global burden of mortality and morbidity. Asthma-chronic obstructive pulmonary disease (COPD) overlap (ACO) is a syndrome that involves both asthma and COPD features, such as eosinophilic inflammation and non-reversible airway obstruction in the same patients. This syndrome remains a challenge to the medicine since these patients did not respond adequately to the treatments commercially available. In order to develop novel therapeutic strategies to better manage symptoms associate with ACO, we are developing *in vivo* and *in vitro* workflows to delineate signaling pathways involved in this comorbidity. For *in vivo* model, wild-type and cholinergic-deficient (vesicular acetylcholine transporter (VAChT) Knock-Down) mice received ovalbumin i.p. injection (day 1 and 14) followed by inhalations with ovalbumin (days 21, 23, 25, 27) and/or porcine pancreatic elastase (intratracheal instillation in day 21). On day 28, animals were anesthetized and mechanically ventilated to determine respiratory system mechanics, then they were euthanized and bronchoalveolar lavage fluid was collected to evaluate lung inflammation. For *in vitro* models, we treat both A549 (human lung adenocarcinoma cell line) and BEAS-2B (bronchial epithelial cell line) cells with IL-13 (to mimic asthma-related injury) and/or elastase (to mimic emphysema-relate injury). Because cholinergic anti-inflammatory system, especially by activation of nicotinic acetylcholine receptors, has been shown to modulate lung inflammation in several models of lung diseases, we are going to evaluate nicotinic receptor gene expression (specially α7 and β2) in these *in vivo* and *in vitro* models. We also investigating the merit of α7 nAChR agonist (e.g. PNU282987) and positive allosteric modulators (e.g. PNU120596) as potential pharmacological interventions for ACO.

IN VIVO IMMUNE-COMPETENT MODEL TO EXAMINE HEPATOCELLULAR CARCINOMA DEVELOPMENT IN LIVER SPECIFIC KNOCKOUT MICE

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Hepatocellular carcinoma (HCC) is the most prevalent type of liver cancer and the deadliest liver disease. It is imperative to delineate the pathophysiological processes leading to the development of HCC to identify new molecular targets for potential pharmacological interventions. In this talk, I will focus on monocarboxylate transporter-1 (MCT1), as a molecular target for HCC, using *in vivo* immune-competent HCC model. To this end, we generated MCT1 conditional knockout mice through CRISPR-Cas9 technology and crossed them with AlbminCre mice to generate liver-specific MCT1 knockout mice. Then, we utilized diethylnitrosamine/carbon tetrachloride (DEN/CCl4) to induce HCC in the liver specific MCT1 knockout mice. MCT1 is a proton- coupled protein that facilitates the bidirectional transport of monocarboxylates, such as lactate and pyruvate, across the plasma membrane to maintain the cellular metabolism and energy supply. MCT1 was reported to be upregulated in human specimens of HCC and its inhibition reduced xenograft tumor growth in immune-compromised mice. In contrast to this reported effect, we found that hepatocyte-specific deletion of MCT1 was not sufficient to reduce the size or count of liver tumors in DEN/CCl4-induced HCC in immune-competent mice. In addition, we used immunohistochemical staining to evaluate the expression of Ki67, collagen A1, and myeloperoxidase (MPO), and we found that MCT1 knockout was not able to hinder the proliferation, fibrosis, and inflammation in the DEN/CCl4-induced HCC tumors. We view the lack of effect of MCT1 in this model may be a part of the interplay between the immune system and hepatocytes in the development of liver tumor, where MCT1 oncogenicity becomes evident only under immune-compromised conditions. These results also highlight the importance of using liver-specific knockout strategy to study HCC pathophysiology.

Biomaterials II

K-CO-MO-SX CHALCOGEL SORPTION OF URANIUM AND OTHER POTENTIAL APPLICATIONS

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Chalcogel represents a unique class of meso- to macroporous nanomaterials that offer applications in energy and environmental pursuits. Here, we report the synthesis of an ion-exchangeable amorphous chalcogel using a nominal composition of

$K_2CoMo_2S_{10}$ (KCMS) at room temperature. Synchrotron X-ray PDF, XANES, and EXAFS revealed a plausible local structure of KCMS gel consisting of $Mo^{5+}{}_2$ and $Mo^{4+}{}_3$ clusters in the vicinity of di/polysulfides covalently linked by Co^{2+} ions. The ionically bound K^+ ions remain in the percolating pores of the Co-Mo-S covalent network. XANES of Co K-edge shows multiple electronic transitions, including quadruple (1s→3d), shakedown (1s→4p + MLCT), and dipole allowed 1s→4p transitions. Remarkably, despite a lack of regular channels, as in some crystalline solids, the amorphous KCMS gel shows ion-exchange properties with UO_2^{2+} ions. Additionally, it also presents surface sorption via [S····UO_2^{2+}] covalent interactions. Those features might provide potential applications in surface-enhanced Raman spectroscopy and chemical diagnostics.

EVALUATION OF BIOCOMPATIBILITY AND ANTIBACTERIAL ACTIVITY OF THIOL-ENE MICROPARTICLES

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Ensuring patient adherence is crucial for treating diseases, particularly chronic diseases. In 2018, poor medication adherence was linked to 50% of treatment failures, causing an estimated 125,000 deaths annually in the US. The rising prevalence of chronic diseases in fields like dentistry, orthopedics, and oncology underscores the need to address poor compliance. Drug delivery systems alleviate these issues by reducing dosing frequency, enhancing compliance, and improving cost-effectiveness. Thiol-ene polymerization, a reaction characteristic of click chemistry involving thiol and alkene monomers, offers advantages such as mild reaction conditions, rapid rates, high yields, and eco-friendly product formation. These properties render thiol-ene microparticles suitable for drug delivery. Our research evaluates the biocompatibility and antibacterial effects of these microparticles. Microparticles were synthesized via thiol-ene suspension polymerization. Osteoblastic 3T3-E1 cells were cultured and exposed to different volumes of thiol-ene microparticles (0, 5, 10, 25, 50, and 100 µL) for 24 hours, assessing cytotoxicity with an MTT assay. Methicillin-resistant Staphylococcus aureus (MRSA) bacteria were cultured and subjected to drug-loaded and non-drug-loaded microparticles for seven days, monitoring colony-forming units (CFU) on days 1, 3, and 7. Statistical tests were carried out using one-way ANOVA, and data was reported as mean 95% confidence intervals. Results demonstrated that microparticle volumes up to 25 µL were non-cytotoxic. Drug-loaded microparticles effectively eradicated bacteria, while bacteria proliferated in the nondrug-loaded ones. The results confirm the biocompatibility of thiol-ene microparticles and their ability to release drugs for bacterial elimination.

POLYMER-METAL COMPOSITE NANOFIBERS FOR WOUND HEALING APPLICATIONS

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Chronic wounds pose a significant challenge due to their susceptibility to infections and slow healing. It is highly desirable to employ multifunctional therapeutic strategies for promoting chronic wound healing. Nanocomposites including various metal nanoparticles have shown excellent antibacterial and tissue regenerative capacity to achieve prominent wound healing effectiveness. In our research, we developed composite nanofibers from synthetic and natural polymers containing degradable metal nanoparticles using electrospinning. These versatile scaffolds demonstrated synergy between antibacterial properties and tissue regeneration potential. We studied cellular interaction of the composites nanofibers at different weight ratios of the metal nanoparticles of zinc and magnesium with NIH/3T3 and human dermal fibroblasts (HDF). Under the cell culture conditions these fibers released metal ions and hydrogen, and were not cytotoxic for the cells. In addition, the expression of cytoskeleton filamentous proteins including α-SMA, collagen IV and vimentin reveals that the metal ions enhance cell differentiation and regeneration. This agrees with other studies showing beneficial effects of these metal particles and provides a new type of scaffold material that will be useful in wound healing applications.

VALIDATION OF THERAPEUTIC AGENT CONJUGATION TO POLYVINYL ALCOHOL COATED MEDICAL DEVICES

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Purpose: The use of protein-based therapeutics is limited by their route of administration and the inability to confine therapeutics to their site of action. One innovative approach would be to chemically bind therapeutics to medical devices, allowing localized and concentrated delivery of therapeutics to the site of action. This study aims to evaluate if GLP-2 can be covalently bound to our Vaginal Expansion Sleeve (VES) and Intestinal Expansion Sleeve (IES) in measurable quantities. **Methods**: Expansion sleeves were coated and crosslinked with polyvinyl alcohol (PVA) making a chemically reactive surface capable of binding amine-containing therapeutics such as GLP-2. A standard curve was created by adding 250ug, 100ug, 50ug, 25ug, and 0ug of GLP-2 into respective wells. A rabbit anti-GLP-2 antibody followed by a goat anti-rabbit IgG alkaline phosphatase secondary antibody was added to the wells to allow the addition of SeraCare KPL BluePhos Microwell Phosphate Substrate System. Once added, the color would change from yellow to blue depending on the concentration of GLP-2 bound antibodies, allowing the absorbance to be read at 620nm to generate the standard curve and calculate the concentration of GLP-2 on the PVA-coated sleeves. **Results:** Addition of 50ug of GLP-2, each IES and VES each device bound an average of 22.69 ± 9.32 ug/cm^2 of GLP-2 after adjustment for an external surface area of 9.425 cm^2, allowing for 44% of added GLP-2 to remain fixated to the PVA coated sleeves. **Conclusion:** Current GLP-2 dosing in humans in 0.6mg/70Kg. With an external surface area of 9.425 cm2, each sleeve is capable of giving a localized delivery of 213.85ug of GLP-2, which is 25.2x greater dose than systemic dosing. This methodology makes

it possible to add dramatically lower doses of therapeutic agents to get the same effect as systemic administration of the GLP-2 drug while also avoiding systemic effects.

Bioinformatics and Health

UTILIZING GRAPH THEORY AND MACHINE LEARNING TO ANALYZE POLYSOMNOGRAPHY DATA FOR ADHD DIAGNOSIS: A FOCUS ON SLEEP STAGE-BASED BIOMARKERS

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Background: Attention-Deficit/Hyperactivity Disorder (ADHD) significantly affects children and adults globally, presenting a major challenge in neurodevelopmental diagnostics. This study explores the potential of graph theoretical approaches to identify sleep stage-based biomarkers for ADHD, aiming to enhance diagnostic accuracy and reliability. **Methods:** We analyzed PSG recordings, including EEG, ECG, EOG, and EMG data, across five sleep stages to calculate graph theoretical metrics, focusing on the average shortest path length. This quantified the efficiency of information transfer in brain networks and other physiological signals. Networks were modeled using weighted, undirected correlation matrices as adjacency matrices, capturing the interconnections of physiological signals. These metrics were used as features in a RandomForest machine learning model. Our dataset of 240 instances from 25 children with ADHD and 23 controls was split into training and testing subsets to validate the model's accuracy. Stratified K-fold cross-validation enhanced training robustness, and GridSearchCV optimized the classifier's settings for maximum performance. **Results:** Utilizing the optimized RandomForest classifier, our model effectively distinguished ADHD from control groups. This methodology yielded an accuracy of 70% a precision of 85%, a recall of 73%, and an F1-score of 79%. **Conclusions:** These results demonstrate the model's capability in using graph theoretical metrics derived from comprehensive PSG data to accurately classify ADHD instances.

PREDICTION OF hERG INHIBITION BY CHEMICAL LARGE LANGUAGE MODEL

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Background: The human Ether-à-go-go-Related Gene (hERG) channel is pivotal in cardiac repolarization. Blockage of this channel increases the risk of arrhythmias or sudden cardiac death. During drug development, early detecting drug-induced hERG inhibition is desired. However, direct observation of hERG inhibition *in vivo* is infeasible. An alternative is to predict hERG IC50 *in silico*. Unlike existing predictive approaches using local molecular properties, this study considers a Chemical Large Language Model (ChemLLM) that can dynamically feature context-based local and global molecular properties to achieve improved predictive power. **Method:** We utilized the Karim dataset from Therapeutics Data Commons, comprising 13,445 compounds, defined by SMILES strings, and their hERG inhibition toxicity, defined by an IC50 threshold of 10 μM. Our ChemLLM approach began with generating 128-dimensional numerical representations of SMILES strings using the PubChem10M_SMILES_BPE_450k tokenizer, followed by training a ChemBERTa-based classifier for hERG inhibition prediction. The dataset was split by scaffolding into 70% training, 10% validation (for training phase evaluation and early stopping), and 20% blind test. **Result:** The proposed ChemLLM model achieved a predictive accuracy of 0.79 AUROC. The performance was benchmarked against two existing models: a random forest and a deep neural network using Morgan descriptors. To conduct fair comparisons, both models utilized Morgan features with the *same dimension* as ChemLLM. The random forest and deep network reached AUROCs of 0.75 and 0.69, respectively. The superior accuracy of ChemLLM predictor highlights its potential as a robust tool to profile pharmaceutical candidates in drug discovery and safety assessment.

THE EFFECTS OF SOCIOECONOMIC STATUS ON OUTCOMES FOLLOWING TOTAL ANKLE ARTHROPLASTY

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Background: We investigated how socioeconomic status affects patient-reported outcomes preoperatively and post-total ankle arthroplasty (TAA). **Methods:** This is a retrospective cohort study of patients who underwent primary TAA for end-stage ankle arthritis, with an average 5-year follow-up, selected from a single surgeon's Prospective Ankle Reconstruction Registry. Utilizing standard surgical techniques, Hintegra or Cadence prostheses were implanted. Data collected included patient demographics, complications, and revisions. Patient-reported outcomes included Ankle Osteoarthritis Scale (AOS) pain and disability scores and Short Form-36 (SF-36) physical and mental component summary scores (PCS, MCS, respectively). Patients' postal codes determined median household income using national 2015 census data. 594 patients were divided into quintiles by income, and outcomes were compared using analysis of covariance (ANCOVA), adjusting for confounders. Linear regression models analyzed self-reported education levels. **Results:** No significant differences in patient-reported outcome measures, complication rates, or reoperation were observed between income groups. Patients in all quintiles made similar improvements in AOS pain, AOS disability, and SF-36 PCS from pre-to post-TAA, which were statistically and clinically significant ($p<0.001$). Similar improvements in AOS Pain, AOS disability, SF-36 PCS, and SF-36MCS scores persisted across education levels. However, patients with lower education levels are associated with worse

AOS Pain and AOS Disability pre-operatively (p=0.002) and sustained poorer AOS Disability scores postoperatively (p=0.007). **Conclusion:** Patient selection for TAA remains an important consideration. However, the current study demonstrates that patients from all socioeconomic backgrounds benefit from TAA. Our findings support efforts to ensure equitable access to arthroplasty regardless of socioeconomic background.

DEEP BRAIN STIMULATION IN MOVEMENT DISORDERS

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Deep brain stimulation, in its current state, is the implantation of electrodes into the basal ganglia or thalamus in order to modulate neurological and psychiatric diseases. This treatment has revolutionized the treatment of movement disorders and will likely revolutionize the fields of psychiatry and epilepsy. The current diseases treated with DBS are Parkinson's disease, tremor, and dystonia. The therapy is very effective in reducing the motor symptoms of this disease. Modern DBS is thought to work by disrupting signaling between the nuclei. It is hypothesized that those neurons within the electric field lose their ability to transmit information to surrounding cells. In the future, more novel stimulation parameters may be able not just to disrupt signaling but truly modulate the information that the neurons are sharing.

LEVERAGING GRAPH NEURAL NETWORKS FOR MIC PREDICTION IN ANTIMICROBIAL RESISTANCE STUDIES

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Antimicrobial resistance (AMR) poses a significant challenge in healthcare and public health, with organisms such as nontyphoidal Salmonella leading the way due to their escalating resistance to antimicrobial agents. This situation severely complicates the management and containment of diseases, highlighting the urgent need for more effective techniques to assess antimicrobial susceptibility. Conventional methods, including the broth microdilution technique for determining Minimum Inhibitory Concentrations (MICs), are time-consuming and require extensive manual effort. The advent of machine learning (ML) technologies offers a revolutionary approach to predicting MICs, thereby potentially increasing the efficacy of antimicrobial therapies. This paper explores the latest advancements in ML for MIC prediction, focusing on an innovative approach using Graph Neural Networks (GNNs), which could provide a novel insight into the correlation between gene fragment similarities and MIC values. Within this paper, we introduce the K-mer GNN, a novel GNN model designed for MIC prediction. The K-mer GNN model distinctively identifies and incorporates the similarities among k-mers, integrating these insights into GNN alongside k-mer features. This approach not only elevates the precision of MIC predictions but also sheds light on the genomic factors at the k-mer level that drive antimicrobial resistance.

COMPARATIVE ANALYSIS OF SLEEP PATTERNS IN ADHD AND NON-ADHD GROUPS

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Sleep patterns play a crucial role in overall health and well-being, yet they are often disrupted in individuals with Attention Deficit Hyperactivity Disorder (ADHD). This research aims to investigate the differences in sleep patterns between ADHD and Non-ADHD groups, shedding light on potential implications for diagnosis and treatment. Using a comparative approach, we analyzed sleep data collected from participants belonging to both ADHD and Non-ADHD groups. Various parameters such as brain activity in different stages during sleep, were examined using polysomnography and self-report measures. The study utilized real clinical data involved recruiting participants from clinical settings and community samples, ensuring a diverse representation. A series of data preprocessing and cleaning approaches have been used. Statistical analyses were employed to identify significant differences in sleep patterns between the two groups.

Understanding the unique sleep patterns linked to ADHD can have a significant impact on early detection and intervention strategies. Individuals with ADHD often experience difficulties with falling asleep, staying asleep, and having good quality sleep in general. These disruptions can exacerbate symptoms of ADHD, such as impulsivity, inattention, and hyperactivity, leading to impaired daytime functioning and decreased quality of life.

By interpreting these differences, this research aims to contribute to the development of specific measures aimed at improving sleep quality and overall well-being in individuals with ADHD. Additionally, insights gained from this study may inform early detection strategies and personalized treatment approaches for individuals with ADHD, ultimately enhancing their overall health and functioning.

Medical Device Implants II

USE OF RFID TECHNOLOGY FOR MEDICAL DEVICE POSITION TRACKING

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The purpose of this presentation is to assess the use of radio-frequency identification tags for position tracking in medical devices using a novel system encompassing both hardware as well as proprietary code. Here we report preliminary testing data that assesses read accuracy, sensor detection area profiles, and fatiguability of our system using an Arduino code base with RC522 mini sensor modules. This solution shows promise in detection of unwanted motion and by triangulation of signals can

help to ensure firm connection of medical devices in a 3-dimensional space. Due to the risk of magnetic sensors in adolescent or unconscious patients, our solution provides a low cost and non-invasive method with a lower risk of adverse events if accidentally ingested. Initial testing for accuracy has shown a false negative reading in about 1 of every 2000 sensor reads with no false positive reads detected. Our results have also explored the read distance of the sensor modules, which will allow for fine-tuning of system control, and will allow for adjustment of sensitivity in applications that require delicate monitoring. Initial fatigue testing has shown no change in performance over current testing periods, indicating that our system can be used for extended monitoring in the hospital setting. Currently, our hope is to direct these promising preliminary results into targeted medical monitoring applications while also expanding current testing to additional sensor configurations.

PATIENT-SPECIFIC MODELING FOR PARATHYROID ADENOMAS USING 3D PRINTING

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3D printing in medicine is rapidly advancing, as it is used for creating affordable surgical tools, developing artificial tissues through bioprinting, and constructing patient-specific 3D anatomical models for surgical planning. This includes utilizing data from Parathyroid 4D CT scans to generate patient-specific 3D models of parathyroid adenomas for surgical planning and educational purposes, contributing to the evolution of virtual imaging technologies in intraoperative parathyroid adenoma localization. The DICOM data from a preoperative 4D CT parathyroid localization study obtained in patients with primary hyperparathyroidism as part of their standard care, were utilized to construct patient-specific models by 3D printing. We demonstrated successful 3D printing of patient-specific models for five consecutive patients with primary hyperparathyroidism and parathyroid adenoma(s). These models are currently being used routinely by the primary surgeon (TCL) as a paradigm for preoperative surgical planning and resident education. Patient-specific models of parathyroid adenomas can be printed using 3D printing technology. These models precisely depict and exemplify the unique spatial anatomic relationships of the adenoma(s) to the surrounding thyroid gland, trachea, major vessels, and other critical structures in individual patients. We plan to continue and build on these initial studies by developing augmented reality and virtual imaging technologies for utilizing a computer-generated visual overlay for application to complex or preoperative parathyroid surgical localization.

COMMUNITY-BASED RECRUITMENT USING A MOBILE SCREENING DEVICE FOR INVESTIGATING HEARING LOSS AND COGNITIVE DECLINE IN OLDER ADULTS

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The objective of this study was to elucidate the efficacy of a community outreach recruitment strategy that actively employed a mobile hearing screening (mHealth) device compared to community engagement without a mHealth device for generating interest and enrollment in a large RCT examining the relationship between a hearing loss intervention and cognitive decline among older adults. At each community event, we recorded the number of people in the audience, expressions of interest, and enrollment. On-site hearing assessments were actively conducted utilizing the SHOEBOX® Pro Manual Test. We analyzed the number and proportion of those attending events, screened on-site, and screened later at the research center for each type of community event. Statistical analysis included t-tests ($\alpha<0.05$) and Hedges' g for effect size. Six community events actively offered on-site hearing screening, engaging 398 participants, screening 127 (31.9%), screening 12 later at the research clinic (3.0%), and resulting in 11 study enrollments. Seven community events that did not utilize the screening device resulted in 11 interested participants screened at the research center (4.8%) of an estimated 227 encounters, resulting in 2 enrollments. Community events where the SHOEBOX® Pro was utilized actively increased community interest, evidenced by more screenings and randomizations ($p<0.05$). The approach of community-based recruitment coupled with accurate mobile hearing bioinstrumentation actively provides for more efficient engagement, identification, and enrollment of eligible individuals in a large-scale randomized trial investigating intervention targeting hearing loss and cognitive decline.

GLP-2-COATED VAGINAL EXPANSION SLEEVES SIGNIFICANTLY EXPAND THE RAT VAGINAL CANAL

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PURPOSE: Vaginal atresia is the congenital absence of the vaginal canal. Current treatments include at-home dilation therapy and surgical vaginoplasty. Our novel vaginal expansion sleeve (VES) aims to create a neovagina without the need for patient compliance or surgery. Glucagon-like peptide (GLP-2) is known to promote intestinal tissue proliferation. Research exploring GLP-2's role in non-intestinal tissues is sparse, including female reproductive tissue. The current study explores the effect on vaginal lengthening via our GLP-2 drug-coated VES. **METHODS:** The VES is a cylindrical, spring-like device with resin caps. Each VES was coated with 50µg GLP-2 via cross-linking with polyvinyl , inserted into the vaginal canals of 4 Sprague Dawley rats, and anchored with nonabsorbable sutures. Each week, the sleeves were removed and replaced with a serially longer VES over three weeks. Rats were monitored for another 2 weeks to assess for any decrease in vaginal length. Vaginal lengths were measured prior to initial VES insertion and weekly during the 5-week trial. **RESULTS:** The GLP-2 coated VES resulted in an average increase of 17.14% (week 1), 34.29% (week 2), 41.90% (week 3), 35.24% (week 4), and an overall 35% increase ($p<0.001$, week 5). Histologically, diffuse vaginal wall thinning with preservation of the epithelial, mucosal, and muscular layers was seen. Mild to moderate inflammation was also noted. **CONCLUSION:** The serial implantation of GLP-2 VES resulted

in significant retained expansion of the rat vagina. The GLP-2 VES suggests a minimally invasive alternative for vaginal atresia treatment.

IMPROVED TIBIAL BONE STRAIN REDUCTION WITH A DYNAMIC ANKLE ORTHOSIS COMPARED TO A CLINICAL WALKING BOOT

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Tibial bone stress injuries are common among runners and military cadets. Current treatment of wearing a walking boot (WB) for 3 to 26 weeks reduces ankle mobility and decreases muscle activity causing extensive muscle atrophy. The Dynamic Ankle Orthosis (DAO) is an alternative option to a WB that applies a distractive offloading force across the lower limb while maintaining ankle mobility. A previous treadmill walking study found the DAO (set to offload 12% body weight) significantly reduced Achilles tendon loading and axial tibial loads, while retaining sagittal ankle excursion compared to a WB. The goal of this study was to determine if comparable reduction in tibial bone strain would occur between the DAO (offloading 12% BW) and WB in a human cadaver model. Seven human cadavers (6 males, 1 female; 58±12yrs) were tested under two axial loading conditions up to 900N: stationary vertical loading and simulated dynamic stance (5° plantarflexion to 8° dorsiflexion) for the DAO and WB bracing conditions. Strain gauges at the distal and mid tibia recorded tibial bone deformation. Force sensing insoles measured in-shoe vertical reaction force. Peak strain and vertical reaction force were recorded. During stationary load testing, the DAO significantly reduced tibial bone strain at the distal (20.4%) and midshaft (41.1%) gauges compared to the WB. Likewise, during the dorsiflexion phase of the simulated dynamic testing, tibial bone strain was moderately to largely reduced at the distal (22.3%) and midshaft (46%) gauges with the DAO compared to the WB. These findings confirmed 12% offloading provided by the DAO was effective at reducing tibial bone strain compared to a WB.

Poster Abstracts

MEASURING THE ANTIMICROBIAL PROPERTIES OF BIOACTIVE GLASSES.

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Bioactive materials are at the forefront of materials science research, as they have the ability to enhance existing implants and medical devices with new properties that will improve the quality of life of patients. Being able to prevent and fight bacterial infections in implants greatly reduces the risks of complications and secondary surgeries, which is why many research groups want to produce bioactive materials with antimicrobial properties. The purpose of this study is to test the antimicrobial properties of different Zirconium bioactive glasses with a newly developed protocol. This protocol involves counting the number of colony forming units (CFUs) that are present after a diluted bacterial lawn is treated with the extract. If the number of CFUs is lower than a certain threshold, the material is effective in killing most bacteria present, which is a good indicator of antimicrobial activity.

UTILIZATION OF ETOMIDATE AND SEVOFLURANE AS THE PRIMARY ANESTHETIC DRUGS IN MANAGEMENT OF CARDIOVASCULAR SURGERY IN AORTIC STENOSIS PATIENTS

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INTRODUCTION AND OBJECTIVE: Aortic stenosis presents unique hemodynamic challenges during operative management, especially during induction, and maintenance after anesthesia. Diagnosis often stems from symptoms like syncope, angina, and dyspnea, or through preoperative auscultation findings. Central regional anesthesia, such as epidural and spinal anesthesia, is generally contraindicated in severe Aortic Stenosis due to its sympatholytic effect, which can lead to loss of vascular tone; thus general anesthesia is often given. This review study aims to provide a concise overview of aortic valve stenosis' pathophysiology, focusing on specific anesthetic considerations, and perioperative management strategies for maintaining hemodynamic stability. This review study utilizes Etomidate for induction and Sevoflurane for maintenance during anesthesia. Key cardiovascular effects were considered such as increased Left-Ventricular End Diastolic Pressure, reduced Cardiac Output, Stroke Volume, and Left Ventricular Hypertrophy in these patients. This study aims to guide anesthesiologists in navigating the complexities of anesthesia in this challenging patient population. **METHODS:** To assess the influence of Etomidate and Sevoflurane on the anesthetic management of Aortic Stenosis patients, we conducted a search on PubMed and the National Library of Medicine for relevant articles using the following medical search headings: "aortic valve stenosis," "Etomidate," "Sevoflurane," "epidural anesthesia," and "spinal anesthesia." Our search in MEDLINE in March 2024 allowed us to narrow down to "Aortic Valve Stenosis and Etomidate," "Aortic Valve Stenosis and Sevoflurane," and "Aortic Valve Stenosis and central regional anesthesia." We reviewed abstracts and full-text papers in these databases, including additional records identified through PubMed. The inclusion criteria for our study's eligibility were: 1) articles published in English until April 1st, 2024, 2) Patients with AS receiving anesthetic management with both Etomidate and Sevoflurane, excluding articles focusing solely on one of the agents. 3) Articles on AS and comorbid conditions managed with different anesthetic treatments were excluded due to their specialized nature and rare incidence in this patient group. **RESULTS:** In terms of randomized clinical trials on AS patients undergoing anesthesia with Etomidate and Sevoflurane, the data returned as limited, highlighting the need to investigate new perioperative management strategies for patients undergoing

anesthesia with AS. Regarding existing literature, more emphasis was placed on the cardioprotective effects of Sevoflurane for maintenance than on Etomidate. Approximately fifteen articles were found to be relevant to the study. These studies demonstrate how perioperative management of patients with AS can be improved with a more cardio-selective approach. Additionally, the use of post-epidural analgesia has shown better outcomes compared to conventional analgesia. **CONCLUSION:** Through our investigation, the use of Etomidate for induction and Sevoflurane for maintenance can serve as a beneficial alternative for perioperative management in patients with aortic stenosis. When combined, these anesthetics can help preserve cardiovascular stability by maintaining preload, sinus rhythm, and afterload. Aortic stenosis patients often struggle with managing their anesthetic plans, but through a collaborative understanding approach, their perioperative management can be tailored, one patient at a time.

CYTOTOXICITY EVALUATION OF A NOVEL CATHEPSIN L INHIBITOR ON HUMAN COLON CARCINOMA SW620 CELLS

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Colorectal cancer, the third most common cancer in the United States, represents around 10% of global cancer diagnoses and deaths each year. The lysosomal cysteine protease, cathepsin L (CatL), is often overexpressed in many types of human cancer, where it correlates with increased metastatic aggressiveness and poor patient prognosis. In the present study, the effects of a novel CatL inhibitor, NN9, on the proliferation and viability of human colon adenocarcinoma SW620 cells were investigated. SW620 cells (ATCC#CCL-227) grown in a complete Leibovitz`s L-15 medium were seeded (50,000 cells/well) in a 96-well plate and acclimatized (37℃, 5% CO2) for 24 h prior to drug treatment and evaluation of cell viability using the XTT kit (Thermo Fisher Scientific, Waltham, MA, USA). Also, the CatL inhibitory capacity of NN9 was validated using a fluorometric approach and the compound's impact on SW620 cellular migration was assessed using the scratch assay. NN9 exhibited significant cytotoxicity against SW620 cells with IC_{50} values of 2.54±0.38 and 2.00±0.09, respectively, following 48 h and 72 h treatments in comparison with 241±25.1 µM and 164.3±12.09 for the reference drug, oxaliplatin. Furthermore, treatment with 1 µM ($p<0.01$) and 5 µM ($p<0.001$) NN9 decreased SW620 cells' wound healing potential in a dose-dependent manner, and the compound's CatL inhibitory effect was comparable to that of E64D, with an IC_{50} of 2.74±0.057 µM. The results confirm NN9's cytotoxicity against SW620 cells, prompting further investigation into its mechanisms to better understand and utilize the protease inhibitor as an anti-tumor treatment for colorectal cancer. **Acknowledgement:** This work was supported by NIH-NIMHD funding for a pilot project study (Grant No. U54MD015929-04) for KK at the RCMI Centre for Health Disparities Research at Jackson State University, Jackson, MS, USA.

METHANOL-AQUEOUS EXTRACT OF Agelaea obliqua (AO) ACTIVATES APOPTOSIS IN A549 CELLS

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Caspases are a group of enzymes involved in programmed cell death, or apoptosis, in various organisms. Poly-(ADP-ribose) Polymerase (PARP) is involved in the apoptotic process, and the cleavage of PARP serves as a marker for cells undergoing apoptosis. Natural compounds, most especially medicinal plants, induce apoptosis in cancer cells as part of their mechanism of action. This study evaluates caspase 3 and cleaved PARP- 1 activities in Agelaea obliqua (AO) methanol-aqueous extract. Agelaea obliqua has been known for its medicinal properties and has been used traditionally in the treatment of various diseases. Lung cancer cells, A549, were treated with varying concentrations of AO. Measurement of the caspase-3 substrate Ac-DEVD-AMC (acetyl Asp-Glu-Val-Asp 7-amido-4-methylcoumarin) cleavage was performed fluorimetrically as described by the manufacturer (CASP3F, Sigma Aldrich). The immunofluorescence method was used to detect cleaved PARP (Invitrogen, USA) in accordance with the manufacturer's instructions. The results of the study revealed a significant increase in caspase activities in the cells treated with extract compared to control. This result is further corroborated with the high intensity of cleaved PARP observed in the treated cells compared to the control. This suggests the potential induction of apoptotic pathway in the plant and can be used as a biomarker to assess the anticancer potential of the extract. This may offer insightful information on the molecular mechanism that underlies its therapeutic effects. In conclusion, the present investigation indicates the presence of apoptosis-inducing qualities in AO methanol-aqueous extract by showing enhanced cleaved PARP 1 and caspase activities.

SELF-HEALING SENSORS FOR ADVANCED HEALTH MONITORING

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In the rapidly growing industry of biomedical engineering, self-healing sensors are vital to the future of biochemical and physical applications such as continuous health monitoring (blood pressure, pH, glucose, pulse, movement, and temperature), strain sensing, soft robotics, and wearable electronics. The project goal is developing an advanced sensor system applicable to human skin using a self-healing polymer fabricated using amine-terminated PDMS through a one-pot condensation method with isocyanates to create a self-healing polymer. The team plans to utilize the sensor as soft robotic flanges for gripping or for human motion monitoring activities such as nodding, frowning, speaking, drinking, and bending of fingers, wrists, arms, and knees. The limitations of the sensor will be examined through nanoindentation, optically via 3D microscope, and through tensile strain testing. The sensor will be subjected to various conditions such as temperature, humidity, and degrees of damage to simulate practical working conditions. The sensor was characterized with current-voltage curves and impedance curves to compare the most suitable electrode material for the sensor. It was observed that the fabricated strain sensor exhibited increased resistance during stretching or bending, enabling the sensing function of the device.

The position of the joint will be monitored through the use of measuring the resistance of the sensor at different angles.

ADVANCEMENTS IN DUAL-LAYER CAPACITANCE SELF-HEALING SENSORS FOR ENHANCED PRESSURE DETECTION IN BIOMEDICAL APPLICATIONS

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Capacitive sensors made of smart materials, which operate on the principle of change in capacitance proportional to change in electrode distance, offer numerous advantages such as structural simplicity, low power consumption, rapid response, and high reliability and stability. These sensors effectively convert external stimuli into capacitance signals, making them highly suitable for a range of biomedical applications. Classic flexible capacitive pressure sensors typically consist of an elastic dielectric layer sandwiched between flexible electrodes. When pressure is applied to the sensor, the distance between the electrodes changes, consequently affecting the capacitance value. In the biomedical field, these sensors can be utilized for detecting subtle pressure changes in various applications, such as monitoring blood pressure, respiratory rate, and even cardiac anomalies like arrhythmias. The versatility and sensitivity of capacitive sensors make them ideal for integrating into wearable devices, providing continuous and non-invasive monitoring of vital signs. Manufacturing a three-dimensional structure on the dielectric layer is currently the main method employed to increase the compressibility and sensitivity of pressure sensors. Structures such as micro-pyramids or cylindrical patterns have been shown to improve sensor sensitivity. However, most studies have utilized single-sided structures, which present limitations such as restricted compressibility, low durability, and increased viscoelastic behavior. This paper investigates the use of a dual-layer dielectric structure comprising an electrospun polyvinylidene fluoride (PVDF) layer and a self-healable polydimethylsiloxane (PDMS) micropillar array, exploring its feasibility for application in capacitive pressure sensors. Comprehensive testing will be conducted to evaluate the sensor's performance under static and dynamic pressure conditions. These tests assess the sensor's sensitivity, response time, and durability. The expected results aim to demonstrate that the sensor exhibits high sensitivity and rapid response across a wide range of pressure changes, with robust performance attributed to the self-healing properties of PDMS.

By leveraging the unique properties of self-healing PDMS and the electrospun PVDF layer, the proposed dual-layer capacitance sensor aims to address the limitations of traditional pressure sensors. This innovative approach offers significant potential for advancements in biomedical sensing technologies, ensuring enhanced detection capabilities and long-term reliability for various medical applications.

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ADVANCING PRESSURE INJURY PREVENTION WITH WEARABLE SENSORS AND MACHINE LEARNING

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Pressure ulcers, or pressure injuries, are localized areas of skin and/or underlying tissue necrosis that typically occur over bony prominences due to a prolonged pressure or friction. Experts estimate that 2.5 million Americans develop pressure injuries every year with essentially anyone being susceptible to them. They can lead to serious morbidity and mortality, emphasizing the need for prevention. Current prevention approaches are not economically feasible, have insufficient predictive validity and poor accuracy, or are too cumbersome and expensive to be provided to every patient.

The goal of this project was to develop a model to determine predispositions to pressure injuries and develop a wearable that would continuously monitor the patient and inform healthcare personnel of the need to move the patient to prevent injuries.

This project utilized a database of demographic and clinical features of a large patient dataset and applied machine learning to determine the patients at greatest risk of pressure injuries. The only features utilized are structured and available within the first 48 hours of admission with the goal of early prevention. The training data using 6-fold split reached 95.5% median accuracy with the logistic regression model, 93.5% accuracy with the KNN model, and 92% with the decision tree model. The test data reached 93.8% accuracy with logistic regression, 91.4% with KNN, and 87.9% with decision tree classification. When a patient arrives to the hospital, the patient's data would then be entered into this model and if they are identified to be at a higher risk, they would be equipped with a wearable device. A microcontroller-based inertial wearable tracks time and a patient's movements, providing the hospital personnel with alerts to manually turn the patient to a different position when necessary. The position data is sent from the wearable into the database wirelessly using the MAC address, accelerometer X/Y/Z values, and gyroscope X/Y/Z values. The data can infer the patient's position on the bed based on the accelerometer and gyroscope data. The combined approach is evaluated, fine-tuned, and assessed based on different performance metrics. In conclusion, this research presents a model that identifies ICU patients that are at the highest risk for formation of pressure ulcers. Using features available within 24-48 hours of their ICU arrival, we can now identify the patients that are at the highest risk of developing pressure injuries, and they are equipped with an inertial wearable that provides healthcare providers with audible alerts and notifications when these patients must be turned to prevent formation of pressure injuries.

FLAT-FEET HEALTH MONITORING SYSTEM UTILIZING TRIBOELECTRIC ENERGY HARVESTING

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A self-powering triboelectric-based smart insole for flat-foot continuous health monitoring is proposed. The smart sensor that also serves as a triboelectric energy harvester can be developed and embedded in a show so that data can be continuously collected

and analyzed to detect any earlier signs of flat-foot problems that may occur. Through strategically placed triboelectric sensors along the transverse arch, medial longitudinal arch, and lateral longitudinal arch of the foot, a normally arched foot will generate a continuous voltage from each of the sensors except the one located at the lateral longitudinal arch because of the nature of the arched foot at this location. However, for those with flatfoot, voltage is generated from all sensors, including the sensor located along the lateral longitudinal arch, as the layers are continuously in contact. The self-sustainability of the system makes it particularly suitable for continuous, long-term monitoring, with potential applications in healthcare, rehabilitation, and sports medicine.

FUNCTIONALIZED POLY-LACTIC ACID NANOPARTICLES FOR BRAIN DRUG DELIVERY

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Formed by the tight-junction (TJ) complex at the interfacial leaflets of brain endothelial cells (ECs) and the low level of transcytosis through the endothelium, the blood-brain barrier (BBB) maintains brain homeostasis and represents a formidable challenge for brain drug delivery. To combat this, we developed poly-lactic acid (PLA) nanoparticles that target the brain microvascular system for brain drug delivery. These PLA nanoparticles were functionalized with Lectin (LEL) and Albumin (Alb). PLA serves as a biodegradable, biocompatible vehicle for drug delivery that has already seen FDA approval. Lectin is used for its ability to bind to the endothelial glycocalyx, a brush-like structure comprising glycoproteins on the inner lining of the microvasculature. To demonstrate the binding efficiency, in vitro BBB models (D3 cells) were incubated with the NPs and intracellular uptake was observed compared to the control nanoparticle which did not show intracellular uptake. The cytotoxicity was determined by incubating D3 cells with NPs at various concentrations and time periods, followed by WST-1 assay to determine cell viability. The assay results indicated that PLA-LEL-Alb nanoparticles did not influence D3 cell viability. These results suggest that PLA-LEL-Alb nanoparticles may serve as an effective delivery platform for glioblastoma treatment. Future work will focus on functionalizing the NPs with an anticancer drug and testing drug delivery efficiency as well as treatment outcomes.

CAMBINOL DECREASES CELL PROLIFERATION AND MIGRATION OF METASTATIC CASTRATION RESISTANT PROSTATE CANCER CELLS

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Introduction and objective: Metastatic castration resistant prostate cancer (mCRPC) remains a significant health challenge for treatment of American men at advanced stages. Thus, further studies are needed for exploration of novel therapeutic strategies to combat tumor progression. The current study highlights the effect of Cambinol, a specific inhibitor of neutral sphingomyelinase 2, as a promising compound with potential anticancer properties on mCRPC cells. **Methods**: mCRPC cells were treated with different concentrations of Cambinol for 72 hours. Cell viability assay was deployed to determine the IC_{50} of Cambinol. The effect of the drug on the clonogenic potential was also performed. The migratory potential of cancer cells in response to Cambinol treatment was evaluated by a scratch assay. The protein expression of NF-κB, ERK1/2 and N-SMase 2 expression was assessed using immunoblotting analysis. **Results**: Our findings demonstrate that Cambinol treatment significantly inhibited cell viability of mCRPC cells in a dose-dependent manner, highlighting its potential as an antiproliferative agent. The colony formation assay results support the hypothesis that Cambinol hinders the clonogenic potential of these cells. A substantial reduction in cell migration upon Cambinol treatment was observed, suggesting its ability to impede metastatic potential at early stage. Western blot analysis demonstrated a decreased expression in NF-κB, ERK1/2 and n-SMase 2. **Conclusion**: This study provides new insights into the multifaceted effects of Cambinol on mCRPC cells, encompassing reduced cell viability, colony-formation and cell migration. These findings warrant further investigation for the development of Cambinol individually and in combination with other standard therapeutic agents for treating the most aggressive forms of prostate cancer.

NURBS-BASED DEEP LEARNING SEGMENTATION OF THE LEFT VENTRICULAR CAVITY AND MYOCARDIUM FROM APICAL 4 CHAMBER ECHOCARDIOGRAM

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Accurate and rapid cardiac function assessment is essential for diagnosing cardiac disease. Automatic segmentation of the left ventricle (LV) and myocardium from echocardiography images is crucial for evaluating left ventricle ejection fraction, heart wall thickness, and overall cardiac health. Deep learning models are commonly used for this, but their effectiveness is often compromised by the quality of the echocardiography image and the presence of artifacts. To address these limitations, we propose a novel deep learning model based on Non-Uniform Rational B-spline (NURBS) for segmenting the LV and myocardium. Our NURBS-based model offers higher spatial resolution, increased versatility, and lower computational cost while maintaining comparable segmentation accuracy to existing methods. We applied our model to 312 patients' data from the EchoDynamic dataset, creating 1248 NURBS surface/curve labels. The dataset was split into training, validation, and testing sets, and used to train both a standard UNet and our NURBS-Net (NNet) model. The NURBS-NNet achieved a Dice score of 0.939 for LV and 0.876 for myocardium segmentation, generating anatomically accurate masks in 100% of cases, with a processing time of just 1ms. This outperforms the NURBS-UNet, which, despite slightly higher Dice scores, produced anatomically inaccurate masks in 48% of cases and required 10ms per segmentation. Our NURBS-Net enables advanced features like deformable surface registration for tissue motion recovery and dynamic wall thickness calculation.

This study presents a significant improvement in echocardiogram segmentation, offering clinicians a more accurate and efficient tool for cardiac analysis.

VALIDATION OF FREEHAND 3D TOMOGRAPHIC ULTRASOUND AND TI-RADS-GENERATING MACHINE LEARNING ALGORITHM TO EVALUATE THYROID NODULES"

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The following project aimed to evaluate whether 3-dimensional (3D) tomographic ultrasound (TuS) and a machine learning (ML) algorithm, as integrated into the InfinityTM software, are able to increase interobserver agreement for measurements and classifications of thyroid nodules (TNs) in the clinical setting. Software generated lobe measurements and TI-RADS classifications were compared to those made with conventional ultrasound (US) using two physician raters, and ratings were compared between physicians. Interrater agreement (Cohen's Kappa) was found to be low for TI-RADS scores for conventional 2-dimensional (2D) scans ($\kappa = .23$, $p = .01$) and was found to be even lower ($\kappa = .15$, $p = .12$) for automated scans. Use of the InfinityTM software was found to have poor intramodality agreement for both physicians 1 ($\kappa = -0.07$, $p = .28$) and 2 ($\kappa = .19$, $p < .01$). Many differences were observed between dimensional measurements that should have been the same between raters and scan types. Most notably, measurements of length and volume were found to agree poorly with conventional scans due to artifacts from poor tracking. Despite offering advantages in flexibility and visualization, the InfinityTM system was deemed not ready for clinical use due to gross inaccuracies, particularly in length and volume measurements."

NOVEL HYDROGEL COMPOSITES FOR THE TREATMENT OF CRANIOFACIAL DEFECTS IN ADOLESCENTS

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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 and memory deficits. The objective of the current study was to determine the healing and resorption rates of cranial defects with resorbable biopolymer composites in animals, along with evaluating the potential for inflammation-mediated changes in neurobehaviors and healing. Five experimental groups using a 5-mm central critical-sized cranial defect model in Sprague-Dawley adolescent rats were included: (1) sham-operated, (2) empty defect, (3) placement of autologous bone, (4) composite with hydrogel composite, (5) placement of autologous bone and composite with hydrogel composite. Neurobehavioral assessment was determined biweekly, and characterization of bone remodeling performance was determined at the 8-week endpoint. Our data have shown that the empty defect group decreased short-term memory two, four, and six weeks after surgery, the autograft (bone placement) group only decreased short-term memory two and four weeks with recovery six weeks after surgery, but not in the hydrogel composite group and autograft plus hydrogel composite group. The bone remodeling, as determined by dual-energy X-ray absorptiometry (DEXA) scan, showed that the bone placement plus 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 and neurobehavioral performance is superior to the autograft in our rat defect model.

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