42nd Annual Meeting

September 10-13, 2026

http://sbeconference.org

Program Committee

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

Dr. Amol V. Janorkar is Professor and Chair of the Department of Biomedical Materials Science in the School of Dentistry at the University of Mississippi Medical Center (UMMC). He earned his B.S. in Chemical Engineering from the University of Mumbai Department of Chemical Technology (UDCT) and his Ph.D. in Chemical Engineering from Clemson University. He subsequently completed postdoctoral training at the Center for Engineering in Medicine through a joint appointment with Harvard Medical School, Massachusetts General Hospital, and Shriners Hospital for Children before joining the UMMC faculty in 2007.

Dr. Janorkar's research focuses on biomaterials, tissue engineering, regenerative medicine, and cell–biomaterial interactions. His laboratory develops chemically and physically engineered biomaterial platforms and three-dimensional tissue models to enhance cell survival and function for applications in liver, adipose, and bone tissue engineering. His research has been supported 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 authored 99 peer-reviewed publications and over 50 conference proceedings, with more than 200 scientific presentations delivered by his laboratory. He has mentored more than 100 graduate, undergraduate, dental, medical, and postdoctoral trainees, whose research has earned more than 50 regional and national awards. In recognition of his excellence in research, teaching, and mentorship, he has received the UMMC Gold, Silver, and Bronze Medallions for Research Excellence, the TEACH Prize - the institution's highest educational honor - and induction into both the Nelson Order of Teaching Excellence and the UMMC Academy for Excellence in Education.

Beyond his research and educational leadership, Dr. Janorkar serves as Chair of the UMMC Intellectual Property Committee and Co-Director of the NIH-funded Mississippi Center for Clinical and Translational Research (MCCTR) Mentoring Academy. He is a Senior Member of the American Institute of Chemical Engineers (AIChE), elected member of Omicron Kappa Upsilon (OKU) National Dental Honor Society and Sigma Xi National Honor Society and an active member of the Society for Biomaterials (SFB), American Association for Dental, Oral, and Craniofacial Research (AADOCR), International Association for Dental Research (IADR), and American Dental Education Association (ADEA).

Program Co-Chair: Dr. Melanie Ecker, University of North Texas, Denton, TX melanie.ecker@unt.edu. Melanie Ecker, Ph.D. is an Associate Professor of Biomedical Engineering at the University of North Texas, where she leads the Smart Polymers for Biomedical Applications Laboratory. Her research focuses on the design of advanced biomaterials, stimuli-responsive polymers, and additive manufacturing technologies for tissue engineering, regenerative medicine, and biomedical devices. Her group develops innovative hydrogel and shape-memory polymer platforms that bridge fundamental materials science with clinically relevant biomedical applications.

Dr. Ecker has established an internationally recognized research program supported by federal and state funding, including the prestigious NSF CAREER Award. She has authored numerous peer-reviewed publications and mentors undergraduate, graduate, and doctoral students in interdisciplinary biomedical engineering research.

Beyond her research, Dr. Ecker is dedicated to strengthening the biomedical engineering community through education, mentorship, and professional service. She serves as a Faculty Fellow in UNT's Office of Research and Innovation and has received multiple awards recognizing excellence in teaching and mentoring. She enjoys connecting researchers across disciplines, fostering new collaborations, and mentoring students and early-career scientists as they develop into future leaders in biomedical engineering.

42nd SOUTHERN BIOMEDICAL ENGINEERING CONFERENCE

Dr. Ecker is pleased to serve as Program Vice Chair of this year's South Biomedical Engineering Conference (SBEC), where she welcomes attendees from across the region to share ideas, build collaborations, and advance the field of biomedical engineering. She looks forward to hosting the SBEC community at the University of North Texas for next year's conference.

Immediate Past Program Chair:: **Dr. Santosh Aryal, University of Texas at Tyler (**santosharyal@uttyler.edu**)**

Dr. Santosh Aryal is Associate Professor in the Department of Pharmaceutical Sciences and Health Outcomes at The University of Texas at Tyler. He earned his Ph.D. in Bionanosystem Engineering from Chonbuk National University, Republic of Korea, following B.S. and M.S. degrees in Chemistry from Tribhuvan University in Kathmandu, Nepal. He completed postdoctoral training at the University of Wisconsin–Milwaukee and at the University of California, San Diego, where he conducted research in nanoengineering and cancer therapeutics at the Moores Cancer Center. He subsequently joined the Houston Methodist Research Institute, where he advanced translational nanomedicine for the diagnosis and treatment of cancer and vascular diseases.

Prior to joining UT Tyler, Dr. Aryal served as Assistant Professor in the Department of Chemistry and the Nanotechnology Innovation Center of Kansas State (NICKS), where he established an independent research program in nanomedicine and drug delivery. His research focuses on the development of innovative nanotechnology-based therapeutic and diagnostic platforms that enhance communication between engineered drug delivery systems and the immune system to improve treatment outcomes for cancer, inflammatory disorders, and other complex diseases. By integrating biomaterials, immunology, and pharmaceutical sciences, his laboratory seeks to advance precision medicine through next-generation targeted therapeutics.

Dr. Aryal's research has been supported by the National Institutes of Health (NIH), the National Science Foundation (NSF), and The University of Texas System. His interdisciplinary contributions to nanomedicine, biomaterials, and targeted drug delivery have established him as an internationally recognized investigator dedicated to translating fundamental discoveries into innovative therapeutic strategies that improve human health.

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

Dr. Michelle Tucci is Professor of Anesthesiology at the University of Mississippi Medical Center (UMMC) in Jackson, Mississippi. She earned her undergraduate degree from Seton Hill University in Pennsylvania, followed by a Master of Science in Biology from the University of Dayton, Ohio. She completed her Ph.D. in Pharmacology and Toxicology at the University of Mississippi Medical Center in 2000.

Dr. Tucci's research spans anesthesiology, pharmacology, biomaterials, bone biology, and translational medicine. In addition to directing and overseeing resident research, she has mentored undergraduate, graduate, medical, and postdoctoral trainees across multiple disciplines. She has served on more than 80 doctoral dissertation committees and has authored over 300 peer-reviewed scientific publications.

A recognized leader in biomedical research and scientific societies, Dr. Tucci has held numerous leadership positions at the regional, national, and international levels. She currently serves as Director and Program Chair of the Rocky Mountain Biomedical Engineering Symposium and has served as Program Chair for the Academy of Surgical Research, conference organizer for the Southern Biomedical Engineering Conference, and Chair of the Pathology and Implant Special Interest Group of the Society for Biomaterials. She also serves as **Editor-in-Chief** of *Biomedical Sciences Instrumentation* and the *Journal of the Mississippi Academy of Sciences* and has served on the editorial boards of several scientific journals.

Dr. Tucci has received numerous awards recognizing her scientific contributions and professional service, including honors from the Academy of Surgical Research, RMBS, the Mississippi Academy of Sciences, the Society for Biomaterials, and the Southern Biomedical Engineering Conference. Most recently, she was elected a **Fellow of the**

American Institute for Medical and Biological Engineering (AIMBE) in recognition of her outstanding contributions to biomedical engineering, translational research, and scientific leadership.

Conference-Co-Chair: Dr. Ham Benghuzzi, Mississippi Academy of Sciences and JSU, *msacademyofscience@gmail.com*

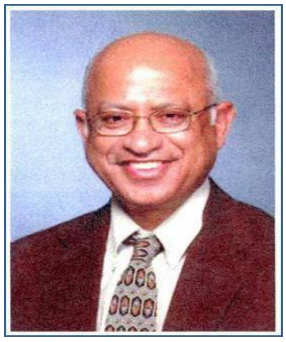
Dr. Hamed Benghuzzi is Executive Director of the Mississippi Academy of Sciences and Engineering, Distinguished Lecturer at Jackson State University, and a consultant specializing in the evaluation and effectiveness of biomedical devices. Prior to his current appointments, he served for 27 years at the University of Mississippi Medical Center as Professor, where he chaired three academic departments and directed the Ph.D. program.

An internationally recognized pioneer in ceramic drug delivery systems and biomaterials research, Dr. Benghuzzi has authored more than 350 PubMed-indexed publications and over 800 scientific abstracts investigating the controlled release of biologically active agents from bioceramic carriers. Throughout his distinguished career, he has served as the major advisor for 44 Ph.D. graduates, participated on more than 100 doctoral committees, and mentored students and investigators at every career stage, from high school through postdoctoral fellows and junior faculty. He has also mentored residents and faculty members on more than 10 successfully funded research grants.

Dr. Benghuzzi has provided leadership to numerous national and international scientific organizations, serving as President of the Academy of Surgical Research, the International Society for Ceramics in Medicine (ISCM), and the Mississippi Academy of Sciences. He currently serves as President of the International Biomedical Sciences Instrumentation Symposium/Rocky Mountain Bioengineering Symposium (IBSIS/RMBS) and has organized and chaired numerous regional, national, and international scientific conferences. He has also served on numerous NIH Special Emphasis Panels, reviewing R01, R25, K01, K08, T35, and P60 Center grant applications.

His many honors include recognition among **Stanford University's World's Top 2% Most-Cited Scientists in Biomedical Engineering**, election as a Fellow of the **American Institute for Medical and Biological Engineering (AIMBE)**, Fellow of the **Mississippi Academy of Sciences**, and International Fellow of **Biomaterials Science and Engineering (FBSE)**. A highly sought-after keynote and plenary speaker, Dr. Benghuzzi has delivered invited lectures throughout the United States and internationally, including in Japan, France, Italy, Spain, Greece, China, Poland, the United Arab Emirates, and Canada.

Legacy of Southern Bioengineering Conference



Founder Dr. Subrata Saha: The Southern Biomedical Engineering Conference (SBEC) was founded in 1982 by Dr. Subrata Saha, a pioneering biomedical engineer and visionary leader whose dedication to interdisciplinary research and education helped shape the biomedical engineering community throughout the southern United States and beyond. The inaugural conference was held at Louisiana State University Medical Center (now LSU Health Shreveport) in Shreveport, Louisiana, under Dr. Saha's leadership. Since its inception, SBEC has grown into an internationally recognized scientific meeting, bringing together researchers, clinicians, engineers, educators, and students from around the world to share advances in biomedical engineering and translational science.

A defining hallmark of SBEC is its longstanding commitment to mentoring the next generation of scientists and engineers. The conference provides undergraduate, graduate, and professional students with the unique opportunity to present their research alongside established investigators in a collegial and highly interactive environment. All submitted manuscripts undergo peer review, and accepted papers are published in the annual SBEC Proceedings. To recognize excellence in research and scientific communication, outstanding student presentations are honored with competitive awards. More than four decades after its founding, SBEC continues to uphold Dr. Saha's vision of fostering innovation, collaboration, and scientific excellence while cultivating future leaders in biomedical engineering.

Major Sponsors of 42nd SBEC

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Endorsement:

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Society For Biomaterials
Giving life to a world of materials

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

*** Registration fee is nonrefundable after July 12, 2026 due to finalizing catering and services.*

Program

Thursday, September 10, 2026

4:00PM-6:00PM: Registration

Foyer, Hilton New Orleans Airport, Kenner, LA

Friday, September 11, 2026

7:00 am-6:00 pm Registration

8:00 am Conference Opening

Program Chair
Dr. Amol Janorkar
Program Vice-Chairs
Dr. Melanie Ecker
Major Sponsor: *Dr. Raja Reddy, MAS President*
Conference Co-Chairs
Dr. Michelle Tucci, and
Dr. Ham Benghuzzi

8:15- 8:30 Coffee Break Visit the Posters

Scientific Sessions **(There will be two concurrent sessions in rooms A & B.**

42nd Southern Biomedical Engineering Conference 2026
Scientific Committee Members

Name	Affiliation	Email
Amol Janorkar	University of Mississippi Medical Center	**Ajanorkar.umc.edu**
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Urara Hasegawa	Penn State University	**Uph5002@psu.edu**

Session 1: Biomedical Engineering - I

Session Chair: Catherine Ambrose, Orthopaedic Surgery, UTHealth
Co-Chair: Neda Habibi, University of North Texas

Room#A	Session 1: Biomedical Engineering - I **Session Chair**: Catherine Ambrose **Co-Chair:** Neda Habibi			
Abstract Number	**Presentation Time**	**Presentation Number**	**Presentation Title**	**Name of the Presenting Author**
43	8:45	1-1	**Computational Modeling of Bur-Bone Interaction and Thermal Response in Sinus Surgery** Thoai Nguyen[1], Alain Kassab[1], Alexandra Schonning[2] [1]University of Central Florida, [2]University of North Florida	Thoai Nguyen
38	9:00	1-2	**Detecting and Identifying Inflammatory Biomarkers in a Female Hyperandrogenemic Rat Model of Polycystic Ovary Syndrome** Mulunji Sampson, Mohadehth Moulana Jackson State University, Jackson, MS	Mulunji Sampson
10	9:15	1-3	**Geometry Over Material: Biomimetic Inspiration and Unexpected Cross-Sectional Findings in FEA Based Structural Optimization of an Upper Limb Exoskeleton Frame** Matt Liqua, Blythe Seraphim, Garrett Murdock Murdock, Thomas Dozier, Jackson Kitchens Georgia Southern University	Matt Liqua
32	9:30	1-4	**Engineering Equity: Low-cost Development of a Female Crash Test Dummy** Ellie Lin, Ellen Zulkarnain University of California, Los Angeles	Ellie Lin, Ellen Zulkarnain
74	9:45	1-5	**Encapsulation of Bacteriophage into Biodegradable Microspheres for Treatment of Orthopaedic Infections** Cora Kosnik[1], Analisa Narro[2], Allison Zieschang[3], Raquel Luna[1], Taiwo Oso[3], Heidi Kaplan[1], Catherine Ambrose[3] [1]Microbiology and Molecular Genetics, UTHealth, [2]Orthopedic Surgery, University of Kentucky, [3]Orthopaedic Surgery, UTHealth	Catherine Ambrose
37	10:00	1-6	**Removal of Microplastics from Industrial Water Using Chitosan-Coated Textile Lint: A Sustainable Approach to Wastewater Remediation** Nishat Sarmin Rupanty, Vladimir Reukov University of Georgia	Nishat Sarmin Rupanty, Vladmir Reukov

Session 2: AI Applications in Healthcare - I

Session Chair: Subhajit Chakrabarty, Louisiana State University
Co-Chair: Eunsoo Yoo, North Carolina A&T State University

Room# B	Session 2: AI Applications in Healthcare - I **Session Chair**: Subhajit Chakrabarty **Co-Chair:** Eunsoo Yoo			
Abstract Number	**Presentation Time**	**Presentation Number**	**Presentation Title**	**Name of the Presenting Author**
122	8:45	2-1	**Machine Learning Guided Optimization of 3D Printed Tablets** Samrat Choudhury[1], Mohammed Maniruzzaman[2] [1]Department of Mechanical Engineering, University of Mississippi, [2]School of Pharmacy, University of Mississippi	Samrat Choudhury
114	9:00	2-2	**Simulated Minds: AI and the Illusion of Consciousness** Lillion Hamil[1], Kenneth Butler[2], Hamed Benghuzzi[3], Michelle Tucci[2], Gary Hamil[1, 2] [1]Belhaven University, [2]University of MS Medical Center, [3]Jackson State University	Lillion Hamil
118	9:30	2-4	**Using AI to Link Differentially Methylated Regions to Symptom Heterogeneity in Autism Spectrum Disorder** Aidan O'Maille Towson University	Aidan O'Maille
104	9:45	2-5	**Prediction of Alzheimer's Disease using Multimodal Data** Devesh Sarda, Udaysinh Rathod Louisiana State University Shreveport	Devesh Sarda, Udaysinh Rathod
57	10:00	2-6	**A Reproducible AI-Driven Framework for Multi-Group Gene Expression and Pathway Analysis** Clever Nyengerai, Maricica Pacurari Jackson State University	Clever Nyengerai

Session 3: Molecular Design of Functional Organic Biomaterials

Session Chair: Urara Hasegawa, Penn State University
Co-Chair: Rupesh Kandel, University of Mississippi

Room# A	**Session 3: Molecular Design of Functional Organic Biomaterials** **Session Chair**: Urara Hasegawa **Co-Chair:** Rupesh Kandel			
Abstract Number	**Presentation Time**	**Presentation Number**	**Presentation Title**	**Name of the Presenting Author**
94	10:30	3-1	**Developing Novel Polymeric Materials for Biomedical Applications** Sharon Hamilton Ouachita Baptist University	Sharon Hamilton
76	10:45	3-2	**Influence of Elastin-Like Polypeptide Chain Length on Environmentally Responsive QCM Sensor Interfaces** Olivia Bridges[1], Amol Janorkar[1], Anna Funderburg[1], Sheetal Chowdhury[1], Jared Cobb[2] [1]University of Mississippi Medical Center, [2]U.S. Army Engineer Research and Development Center	Olivia Bridges
120	11:00	3-3	**Elucidating versatile strategies to design synthetic lipids** Alejandro Ramirez, Titilayo Oluwole, Jimmy Lawrence Louisiana State University	Alejandro Ramirez
107	11:15	3-4	**Designer peptide-based supramolecular polymer for biomedical applications** Tristan Clemons University of Southern Mississippi	Tristan Clemons
30	11:30	3-5	**Additive Manufacturing of Multi-Stimuli Responsive Shape Memory Polymer for Biomedical Applications.** Raj Kumar Pittala[1], Sravya Pilla[2], Melanie Ecker[1], Akhila Joy[3], Neha Pramod Davange[4], Xiao Li[3], Marc Anthony Torres[1] [1]University of North Texas, Dept of Biomedical Engineering, [2]Texas Academy of Mathematics and Science, University of North Texas, [3]Materials Science and Engineering, University of North Texas, [4]Depart of Chemistry, Univ. of North Texas	Raj Kumar Pittala
14	11:45	3-6	**Ionic Liquid Coated PEG-PLGA Nanoparticles for Transporter-Independent Brain Delivery of Thyroid Hormone (Liothyronine) via Red Blood Cell Hitchhiking** Hena Gain[1] [1]University of Mississippi	Hena Gain

9	12:00	3-7	**Design of Conjugated Polymers and Molecules towards Biomedical Imaging and Sensing** Graham S. Collier University of Southern Mississippi	Graham Collier

Session 4: Neuroscience

Session Chair: Lir-Wan Fan, University of Mississippi Medical Center
Co-Chair: Yi Pang, University of Mississippi Medical Center

Room# B	**Session 4: Neuroscience** **Session Chair**: Lir-Wan Fan **Co-Chair:** Yi Pang			
Abstract Number	**Presentation Time**	**Presentation Number**	**Presentation Title**	**Name of the Presenting Author**
90	10:30	4-1	**Simulation of a Butterfly Semi-Open Shunt Tip Geometry for Ventricular Flow Optimization** Pranavi Paudel[1], Gehendra Sharma[1], Mohammed Elmellouki[2], Michael Murphy[1], Eromosle Eigbe[1], Shanti Bhushan[1], Raheleh Miralami[1] [1]Mississippi State University, [2]Mississippi Valley State University	Pranavi Paudel, Raheleh Miralami
67	10:45	4-2	**Maternal Immune Activation Alters Fetal And Neonatal Microglia Phenotypes And Disrupts Neurogenesis In Mice** Yi Pang, Shuying Lin, Kathleen Carter, Lir-Wan Fan University of Mississippi Medical Center	Yi Pang
88	11:00	4-3	**Neuropeptide Y Y1 Receptor Antagonist Reduces Maternal Inflammation and Reduced-Uterine Perfusion Pressure-Induced Placental Efficiency Reduction And Fetal Growth Restriction** Tyra Lockett, Jonathon Lee, Almia Valentine, Ashya Richardson[1], McKenzee Henson, Norma Ojeda[2], Susana Salazar Marocho, Alexandre da Silva[4], Michelle Tucci[5], Lir-Wan Fan University of Mississippi Medical Center	Tyra Lockett
93	11:15	4-4	**Explainable Machine Learning of Neonatal LPS Exposure-Enhanced Adult Methamphetamine-Induced Reinstated Behavioral Sensitization and Dopamine Transporter Changes** Jonathan W Lee[1], Kuo-Ching Wang[2], Norma B Ojeda[2], Haifeng Wang[3], Han-Sun Chiang[4],	Jonathan W Lee

			Michelle A Tucci[5], Han-Chi Wei[4], Asuka Kaizaki-Mitsumoto[6], Sachiko Tanaka[7], Nilesh Dankhara[1], Lu-Tai Tien[4], Lir-Wan Fan[8] [1]Department of Pediatrics, Division of Newborn Medicine, University of Mississippi Medical Center, [2]Department of Anesthesiology, Shin Kong Wu Ho-Su Memorial Hospital, Taipei City, Taiwan, [3]Department of Industrial & Systems Engineering, Auburn University, Auburn, AL 36849, USA, [4]School of Medicine, Fu Jen Catholic University, Xinzhuang Dist, New Taipei City 24205, [5]Department of Anesthesiology, University of Mississippi, [6]Department of Pharmacology, Toxicology & Therapeutics, Division of Toxicology, School of Pharmacy, Showa University, Shingawa-ku, Tokyo 142-8555, Japan, [7]Center for Research and Development in Pharmacy Education, School of Pharmacy, Nihon University, Funabashi, Chiba 274-8555, Japan, [8]Division of Newborn Medicine, University of Mississippi Medical Center	
92	11:30	4-5	**Neonatal Inflammation Induces ADHD-Like Behaviors And Affects Homeostatic Responses To Sleep Disruptions In Adolescent Rats With Sex-Specific Effects: Machine Learning-Based Analysis** Lir-Wan Fan[1], Jonathan Lee[1], Silu Lu[1], Joseph Crosby[1], Charles Matheny[1], James Shaffery[1], Norma Ojeda[1], Haifeng Wang[4], Md Rokibul Hasan[1], Vignesh Nayak[1], Michelle Tucci[1], Yi Pang[1], Pratim Niyogi[1], Yu-Ching Tu[3], Lu-Tai Tien[4] [1] University of Mississippi Medical Center, Jackson, MS, USA, [2]Department of Industrial & Systems Engineering, Auburn University, Auburn, AL 36849, USA, [3]Department of Long-Term Care Management, Chung Hwa University of Medical Technology, Rende Dist, Tainan City, 71703, Taiwan, [4]School of Medicine, Fu Jen Catholic University, Xinzhuang Dist, New Taipei City 24205, Taiwan	Lir-Wan Fan
124	11:45	4-6	**Improving Graphics in Scientific Communication in Neuroscience Research** Chung-Fan Chang[1], Jonathan Lee[2], Lir-Wan Fan[2] [1]Visual Arts Program, School of Arts & Humanities, Stockton University, Galloway, NJ, [2]University of Mississippi Medical Center, Jackson, MS	Chung-Fan Chang

12:30-1:20 Workshop and Lunch

TEAM SCIENCE

Tristan Clemons, PhD

University of Southern Mississippi

Hattiesburg, MS

Tristan Clemons is an Assistant Professor in the School of Polymer Science and Engineering at the University of Southern Mississippi, where he leads the Clemons Lab focused on polymeric biomaterials for tissue regeneration and drug delivery applications. Originally from Australia, Tristan completed his PhD at the University of Western Australia before undertaking research positions in both Australia and the United States, including postdoctoral training at Northwestern University. Beyond academia, he is a founder and entrepreneur working at the intersection of biomaterials innovation and translational medicine. Alongside his research team experience, Tristan has also worked in a number of different teams, including representing both Australia and the United States internationally in field hockey, and has served as an international coach and mentor within elite athlete development pathways. His multidisciplinary career reflects a unique combination of scientific innovation, leadership, entrepreneurship, high performance sport, and mentorship

Session 5: Drug Delivery at the Nanoscale - I

Session Chair: Santosh Aryal, University of Texas at Tyler
Co-Chair: Eunsoo Yoo, North Carolina Agricultural and Technical State University

Room# A	**Session 5: Drug Delivery at the Nanoscale - I** **Session Chair**: Santosh Aryal **Co-Chair:** Eunsoo Yoo			
Abstract Number	**Presentation Time**	**Presentation Number**	**Presentation Title**	**Name of the Presenting Author**
130	1:45	5-1	**Screening Self-assembling Peptides in 3D Cancer Spheroids** Robert Powell[1], Neda Habibi[1] [1]University of North Texas	Robert Powell, Neda Habibi
12	2:00	5-2	**Choline-Based LAT1 Substrate Ionic Liquids as potential Drug Delivery Enhancers** Mercedes Pride[1], Eden Tanner[1] [1]University of Mississippi	Mercedes Pride
135	2:15	5-3	**Development of Silk Protein-Based Drug Delivery System for Lung Cancer Treatment** Hyeyoun Cho[1], Jaehong Key[1] [1]Department of Biomedical Engineering, Yonsei University, Mirae Campus, Wonju, Korea	Jaehong Key

50	2:30	5-4	**Computational Chemistry - Inclusive Tools to Study Nanomaterials** Jerzy Leszczynski[1], Pabitra Samanta[1] [1]Jackson State University	Jerzy Leszczynski
20	2:45	5-5	**Repurposing Cisplatin into Pt(IV) prodrug with varied lipophilicity for targeted anticancer effect** Cesar Aparicio[1], Viswanathan Sundaram[1], Alisha Upreti[1], Santosh Aryal[1] [1]The Ben and Maytee Fisch College of Pharmacy, The University of Texas at Tyler	Cesar Aparicio
55	3:00	5-6	**The Role of the Cation in Ionic Liquid Facilitated Transdermal Transport** Alysha Hunter[1] [1]University of Mississippi	Alysha Hunter

Session 6: Biology and Biochemistry

Session Chair: Maricica Pacurari, Jackson State University
Co-Chair: Hamed Benghuzzi, Mississippi Academy of Sciences

Room# B	**Session 6: Biology and Biochemistry** **Session Chair**: Maricica Pacurari **Co-Chair:** Hamed Benghuzzi			
Abstract Number	**Presentation Time**	**Presentation Number**	**Presentation Title**	**Name of the Presenting Author**
123	1:45	6-1	**A Novel Functional Assay to Simultaneously Measure Platelet Aggregation and Mitochondrial Function** Railey Mayatt, Steven Everman, Gage Sanders, Blake Littlejohn, Kristen Carter, Ngoc Hoang, Kristin Edwards, Matthew Kutcher [1]University of Mississippi Medical Center	Railey Mayatt
133	2:00	6-2	**Nir-1 Localizes at Plasma Membrane in Alveolar Cells Exposed to Cadmium** Maricica Pacurari[1, 2], Nneoma Nwaiwu[1] [1]Jackson State University, [2]RCMI	Maricia Pacurari
129	2:15	6-3	**Engineering Redox-Responsive Biomolecular Condensates from Designer Peptides for Mechanistic Insights and Therapeutic Delivery** Malay Mondal[1], Windfield S. Swetman[1], Shazeed-Ul Karim[1], Sabine Shrestha[1], Fengwei Bai Bai[1], Faqing Huang[1], Anant	Malay Mondal

			K. Paravastu[2], Tristan D. Clemons[1], Vijay Rangachari[1] [1]The University of Southern Mississippi, Hattiesburg, MS [5]School of Chemical and Biomolecular Engineering, Georgia Institute of Technology, Atlanta, GA,	
126	2:30	6-4	**α7-Nicotinic Acetylcholine Receptor Activation Attenuates IL-13-Induced Inflammatory Responses in BEAS-2B Cells** Vitoria Caroline Queiroz[1], Nathalia Mountouro Pinheiro[2], Amal Al-Shweiky[2], Iolanda De Fátima Lopes Calvo Tibério[1], Ayman K. Hamouda[2], Carla Máximo Prado[3] [1]USP, [2]UT-Tyler, [3]UNIFESP	Vitoria Caroline Queiroz
121	2:45	6-5	**Development of a Functional Rice-Based Extruded Breakfast Cereal Through Traditional and Modern Milling Approaches for Obesity Management, Blood Glucose Control, and Sustainable Food Systems** Dr Annamalai A Pondicherry University (A Central University), Puducherry, India	Annamalai A
105	3:00	6-6	**Network-Guided Prioritization and Structure-Based Drug Repurposing of Rcs Phosphorelay Proteins of Hypervirulent Carbapenem-Resistant Klebsiella pneumoniae** Lakshmi PTV[1], Annapurna Kumari[1], A Annamalai[1] [1]Department of Bioinformatics, School of Life Science, Pondicherry University, Pondicherry, India	Lakshmi PTV

Session 7: Wearable Technologies

Session Chair: Albert Manero, University of Central Florida, Limbitless Solutions
Co-Chair: May Abdelaziz, University of Texas at Tyler

Room# A	**Session 7:** **Session Chair**: Albert Manero **Co-Chair:** May Abdelaziz			
Abstract Number	**Presentation Time**	**Presentation Number**	**Presentation Title**	**Name of the Presenting Author**
73	3:30	7-1	**A Comprehensive Review of a Wearable Centric Game Based Training Program for Prosthetic Arm Use** Peter Smith, Matt Dombrowski, John Sparkman, Albert Manero UCF Limbitless Solutions	Peter Smith
46	3:45	7-2	**Assessing the Effects of Multiplayer Gameplay with a Wearable EMG Flex Controller for Prosthesis Training** Sophie Bennett, Joaquin Royer, Maanya Pradeep, Abrianna Lalle, Delaney Gunnell, Ethan Bell, Pavan Senthil[1], Arina Nemati, Peter Smith, Matt Dombrowski, John Sparkman, Albert Manero University of Central Florida, Limbitless Solutions	Sophie Bennett
33	4:00	7-3	**Evaluating the Suitability of a Circumferentially Arranged Haptic Feedback System for Future Application in Upper Limb Prostheses** John Ilemsky[1, 2], Henry Wong[1, 2], Andrew Hansen[1, 2], Sophie Bennett[1, 2], Arina Nemati[1, 2], Stephania Castro[3], Kara Dell[4], George DeLong[5], Paul Khoury[6], Jordan Dalton[7], Pavan Senthil[1], Vivian Rivera[1], John Sparkman[1, 2], Jacqueline Flores-Otero[1], Damla Turgut[1], Albert Manero[1, 2] [1]University of Central Florida, [2]Limbitless Solutions, [3]Georgia Institute of Technology, [4]Mercer University, [5]University of North Carolina Asheville, [6]Rensselaer Polytechnic Institute, [7]Hope College	John Ilemsky, Sophie Bennett
77	4:15	7-4	**Evaluating Upper-Limb Prosthesis Biomechanical Design and Training Strategies towards Optimized Everyday Task Performance** Mckenzie John[1, 2], Edith Herndon[1, 2], Macie Sullivan[1, 2], Sophie Bennett[1, 2], Andrew Hansen[1, 2], John Sparkman[1, 2], Jacqueline	Mckenzie John

			Flores-Otero[1], Peter Smith[1, 2], Matt Dombrowski[1, 2], Albert Manero[1, 2] [1]University of Central Florida, [2]Limbitless Solutions	
56	4:30	7-5	**Efficacy of Therapeutic Gaming System After Stroke Stabilization in the Acute Setting- Design of A Pilot Study** Viviana Rivera[1, 2], Albert Manero[2], Jacqueline Flores[3], William Freeman[4], Mark Bowden[5], Peter Smith[6], Matt Dombrowski[7] [1]University of Central Florida- College of Medicine, [2]Limbitless Solutions, University of Central Florida, Orlando, FL, [3]Department of Physical Therapy, University of Central Florida, Orlando, FL, [4]Mayo Clinic, Jacksonville, FL, [5]Brooks Rehabilitation, Jacksonville, Florida, United States, [6]Nicholson School of Communication and Media, University of Central Florida, Orlando, FL, [7]School of Visual Arts and Design, University of Central Florida, Orlando, Florida	Viviana Rivera
15	4:45	7-6	**Guided Degeneration: Using Generative AI Failure to Inform Early-Stage Wearables Design** Benjamin Bush Auburn University	Benjamin Bush

Session 8: Targeting Signaling Pathway in Chronic Disease

Session Chair: Zakaria Abd Elmageed, VCOM School of Osteopathic Medicine
Co-Chair: Mourad Zerfaoui, Emory University

SESSION KEYNOTE

Promising Anticancer Potential of the Nutraceutical Supplements, Dimethyl Sulfoxide (DMSO), Methyl Sulfonyl Methane (MSM) and Ethyl Pyruvate (EP), in Specific DMEP formulations

Debasis Mondal

DeBusk College of Osteopathic Medicine

Dr. Debasis Mondal is Professor of Microbiology and Infectious Disease at the DeBusk College of Osteopathic Medicine (DCOM), Lincoln Memorial University (LMU), in Knoxville, Tennessee, where he serves as Co-Director of the Medical Foundations of Microbiology and Infectious Immunology (MFMII) course. Prior to joining LMU in 2019, he was an Associate Professor in the Department of Pharmacology at Tulane University School of Medicine.

An internationally recognized investigator, Dr. Mondal's research focuses on the molecular mechanisms underlying prostate cancer progression, with particular emphasis on oxidative stress, endoplasmic reticulum stress, and signaling pathways that regulate tumor aggressiveness and therapeutic response. His research has been continuously supported by the National Institutes of Health (NIH) and the U.S. Department of Defense (DoD), resulting in more than 75 peer-reviewed publications, several of which have been recognized as featured articles.

In addition to his research accomplishments, Dr. [Name] is a dedicated educator and mentor who has trained numerous undergraduate, graduate, postdoctoral, and medical students. His trainees have received multiple national and international awards for their research presentations. His keynote address will highlight advances in molecular mechanisms of disease, translational cancer research, and the integration of basic science discoveries into innovative therapeutic strategies, including emerging applications relevant to osteopathic medicine.

Room# B	**Session 8: Targeting Signaling Pathway in Chronic Disease** **Session Chair**: Zakaria Abd Elmageed **Co-Chair:** Mourad Zerfaoui			
Abstract Number	**Presentation Time**	**Presentation Number**	**Presentation Title**	**Name of the Presenting Author**
45 Keynote	3:30	Keynote	**Promising Anticancer Potential Of The Nutraceutical Supplements, Dimethyl Sulfoxide (DMSO), Methyl Sulfonyl Methane (MSM) and Ethyl Pyruvate (EP), in Specific DMEP formulations** Debasis Mondal DeBusk College of Osteopathic Medicine	Debasis Mondal
4	4:00	8-1	**Small Ubiquitin-Like Modifier Protein (SUMO) Pathway Blockade For The Treatment Of Aggressive Phenotypes Of Prostate Cancer** Maysoon Makhlouf, Berony Geneste, Zakaria Abd Elmageed	Maysoon Makhlouf

			Edward Via College of Osteopathic Medicine (VCOM), Monroe, LA	
136	4:15	8-2	**The Role of Transient YAP Signaling in Liver Regeneration** Karel Alcedo University of Mississippi	Karel Alcedo
91	4:30	8-3	**Loss of the Aryl Hydrocarbon Receptor (AhR) Promotes Cancer Cell Resistance to BRAFV600E Targeted Therapies** Mourad Zerfaoui[1], Youssef Errami[2] [1]Emory University, [2]Baylor College of Medicine	Mourad Zerfaoui
87	4:45	8-4	**Blood Platelet RNA Signatures in Breast Cancer Reveal Novel Drug Repurposing Candidates via CTD Inference Network and Open Targets Integration** Md Mashfiquer Rahman[1], Sharmin Nahar[1], Kailash Dhakal[1], Md Mostafijur Rahman[1], Khairul Anam[2], Sonalika Ray[3], Urska Cvek[1] [1]Louisiana State University Shreveport, [2]Pacific State University, [3]Louisiana State University	Md Mashfiquer Rahman, Kailash Dhakal, Md Mostafijur Rahman

NOLA Downtown

End of Friday

Saturday Oral Presentations Sessions

Session 9: Synthesis and Applications of Polymeric Hydrogels

Session Chair: Amol Janorkar, University of Mississippi Medical Center
Co-Chair: Jimmy Lawrence, Louisiana State University

Room# A	Session 9: Synthesis and Applications of Polymeric Hydrogels **Session Chair**: Amol Janorkar **Co-Chair:** Jimmy Lawrence			
Abstract Number	**Presentation Time**	**Presentation Number**	**Presentation Title**	**Name of the Presenting Author**
110	8:30	9-1	**Development of a Hydrogel-Based Osteoarthritis Model for Evaluating MMP13 Inhibitors** Melanie Ecker University of North Texas	Melanie Ecker
99	8:45	9-2	**Tunable Thermogels via Controlled Assembly of Patchy Micelles** Urara Hasegawa Pennsylvania State University	Urar Hasegawa
95	9:00	9-3	**Bisphosphonate-Crosslinked Ionotropic Hydrogels as an Alternative to Alginate Systems** Andre van der Vlies, Urara Hasegawa The Pennsylvania State University	Andre van der Vlies
36	9:15	9-4	**Thiol-Clickable Gelatin-Based Hydrogels for 3D Cell Culture** Sara Swank, Melanie Ecker, Peter VanNatta University of North Texas	Sara Swank
5	9:30	9-5	**Non-Invasive Eyedrop Based Delivery System for The Treatment of Retinoblastoma** Daniel Alday, Renee Carter, Carlos Astete, Cristina Sabliov, Qi Cai Louisiana State University	Daniel Alday
28	9:45	9-6	**Influence of Solvent Selection on GelMA Hydrogel Properties: Implications for Preparation and Performance** Sajal Chakraborty[1], Izabele Heyward[2], Salil Desai[2], Mohammad A Azad[3] [1]Departments of Applied Science and Technology, [2]Industrial and Systems Engineering Department, and [3]Department of Chemical, Biological & Bioengineering, North Carolina A&T State University	Sajal Chakraborty

Session 10: AI Applications in Healthcare - II

Session Chair: Subhajit Chakrabarty, Louisiana State University
Co-Chair: Kenneth Butler, University of Mississippi Medical Center

Room# B	**Session 10: AI Applications in Healthcare - II** **Session Chair**: Subhajit Chakrabarty **Co-Chair:** Kenneth Butler			
Abstract Number	**Presentation Time**	**Presentation Number**	**Presentation Title**	**Name of the Presenting Author**
66	8:30	10-1	**AI, Neurodegenerative Diseases and BCI's 4 Examples: Ethical and Anticipated Ethical Issues** Richard Wilson, Chloe Bourne Towson University	Richard Wilson, Chloe Bourne
26	8:43	10-2	**Feasible Diagnostic Region Exploration for Edge-Oriented Melanoma Screening Decision Support** Chung Hyun Goh The University of Texas at Tyler	Chung Hyun Goh
19	8:56	10-3	**Classification and clustering of mortality outcomes in colorectal cancer on long panel PLCO data** Udaysinh Rathod, Devesh Sarda, Subhajit Chakrabarty, Zhao Qingsong Louisiana State University	Udaysinh Rathod
18	9:09	10-4	**Reducing Low-Yield Colonoscopy using Machine Learning** Ochiabuto Jideofor[1, 2] [1]Graduate Student, [2]Louisiana State University Shreveport	Ochiabuto Jideofor
152	9:22	10-5	**Developing Self-Supervised Continual Machine Learning for Adaptive Pediatric Myoelectric Control** Armelle Varillas[1, 2], John Sparkman[2], Damla Turgut[2], Albert Manero[2] [1]Johns Hopkins University, [2]University of Central Florida	Armelle Varillas
6	9:35	10-6	**Let's build a working model to replace radiologists with AI** David Dinhofer Advanced Imaging and Informatics 375 Paramus Rd, Paramus, NJ	David Dinhofer
128	9:48	10-7	**Machine Learning-Based Detection of Parkinson's Disease Using Smartwatch Motion Sensor Data** Jamya Peoples, Anshuman Jaiswal, Victor Bii, Deepa Reghu, Charles Bland [1]Mississippi Valley State University	Jamya Peoples

Session 11: Medical Devices and Implants

Session Chair: Melanie Ecker, University of North Texas
Co-Chair: Yufeng Dong, Louisiana State University Health Shreveport

Room# A	Session 11: Medical Devices and Implants **Session Chair**: Melanie Ecker **Co-Chair:** Yufeng Dong			
Abstract Number	**Presentation Time**	**Presentation Number**	**Presentation Title**	**Name of the Presenting Author**
51	10:15	11-1	**Tissue Engineered Bioactive Scaffolds for Spinal Fusion Applications** Yufeng Dong, Alan Ogden, Giovanni Solitro, Patrick Massey LSU Health-Shreveport	Yufeng Dong
89	10:30	11-2	**Utility of 3D-Printed Device for D50 Injections: Preventing Gastrostomy Tube Leakage** Jensen Crifasi[1], Madeline Gautreaux[1], Cole Evensky[2], Dominic Lincoln[1], Kiley Pulliam[1], Steven Alexander[1], Giovanni Solitro[1], Donald Sorrells[1] [1]LSU Health Science Shreveport, [2]Willis Knighton Medical System	Jensen Crifasi
41	10:45	11-3	**Surface Engineering of PEEK and PEKK Implants for Enhanced Cellular Response** Shruti Chhabra[1], Michelle Tucci[2], Lir-Wan Fan[3], Susana Salazar Marocho[1], Randall Scott Williamson[1] [1]Biomedical Materials Science Department, University of Mississippi Medical Center, [2]Department of Anesthesiology, University of Mississippi Medical Center, [3]Department of Pediatric Neonotalogy, University of Mississippi Medical Center	Shruti Chhabra
25	11:00	11-4	**CFD/FSI-Guided Optimization of a Low-Resistance Ventilator Inline Mixing Chamber for Uniform Aerosol Medication Delivery** Mason Smith, Chung Hyun Goh The University of Texas at Tyler	Chung Hyun Goh
60	11:15	11-5	**Stem Design Over Cerclage: A Biomechanical Determinant of Intraoperative Fracture Risk in Osteoporotic THA** Ifeoluwapo Bankole, Hongjia He, Steven Schroder, Nicholas Dunbar McGovern Medical School at UTHealth	Nicholas Dunbar

61	11:30	11-6	**Impact of Ramus Fracture Obliquity and Screw Configuration on Pelvic Stability: A Finite Element Study** Kathryn Barth, Hongjia He, Patrick Kellam, Nicholas Dunbar [1]McGovern Medical School at UTHealth	Nicholas Dunbar

Session 12: Biomedical Education and Research Training

Session Chair: Judy Gordy University of Mississippi Medical Center
Co-Chair: Joseph Cameron, Jackson State University

SESSION KEYNOTE

Applying ANCOVA and Other Statistical Tools in Quasi-Experimental Research Design: Evidence from a Flipped Classroom Study

Dr. Jamil Ibrahim

Mississippi Academy of Sciences

Dr. Jamil Ibrahim has over 30 years of research and teaching experience. He had multiple appointments where he worked as Scientist IV, Research Supervisor, Associate Professor at SHRP, and Associate Professor at the School of Medicine, Department of Dermatology at the University of Mississippi Medical Center (UMMC). He has extensive work experience in teaching, research, and service. He taught graduate and undergraduate courses in Biostatistics, Research, Health Care Decision Making, and Epidemiology. He has a strong track record of academic and research achievements, including publications and presentations at MAS and other scientific societies, and he has participated in various research projects regionally and nationally. He has authored and co-authored many peer- reviewed scientific papers and presented over 100 abstracts at conferences and meetings nationwide. He has also demonstrated a strong commitment to advancing science and contributed several times to his respective scientific organizations, including MAS, where he has also played leadership roles as chair and co-chair of the Math, Computer Science, and Statistics divisions. He is the Mississippi Academy of Sciences President-elect and has received many awards from MAS. Dr. Ibrahim received numerous awards, including the Gold Humanism Award from UMMC and the Unsung Hero Award from the Mississippi Association of Institutional Research. Over the years, Dr. Ibrahim has been involved with many grants, research, and service activities, including developing, chairing, and administering the campus-wide faculty, student, and employee assessment and evaluation activities. He also served on curriculum committees, educational committees, research committees, service and scholarship committees and web committees at schools' level, departmental level and institutional levels at the UMMC including the Institutional Assessment Committee, Academic Affairs Council Committee, School of Medicine Admissions Interview Subcommittee, School of Medicine Curriculum Committee, Opioid Research and Stewardship Program Committee, Research Affairs Committee, and the Southern Association of Colleges and School Commission on Colleges (SACSCOC) Writing Committee. In addition to his role at the UMMC as a statistical consultant, Dr. Ibrahim is a graduate adjunct faculty member at the JSU School of Population Health, where he taught courses in Biostatistics, Public Health, and Epidemiology.

Room# B	Session 12: Biomedical Education and Research Training **Session Chair**: Judy Gordy **Co-Chair:** Joseph Cameron			
Abstract Number	**Presentation Time**	**Presentation Number**	**Presentation Title**	**Name of the Presenting Author**
119 (Keynote)	10:15	Keynote	**Applying ANCOVA and Other Statistical Tools in Quasi-Experimental Research Design: Evidence from a Flipped Classroom Study** Jamil Ibrahim[1], Ibrahim Ibrahim[2], Saja Ibrahim[3], Waseem Ibrahim[4], Hidaya Ibrahim[5] [1]University of Mississippi Medical Center, [2]4D Implant Prosthodontic Center, [3]University of Jordan Medical School, [4]Arab American University, School of Dentistry, [5]Al-Najah University, School of Pharmacy	Jamil Ibrahim
62	10:45	12-1	**Integrating Self-Care Practices into Undergraduate Nursing Education to Address Workforce Well-Being - A Mixed-Methods Study** Xiaoshan Gordy, Chelsey Andries, Deidra Morgan, Jacob Daniels, Jennifer Hargett, Kimberly Douglas, Meagan Cherry, Robin Parish, Xiaoqian Zhu, Chanthanisha Patterson, Seena Haines University of Mississippi Medical Center	Xiaoshan Gordy
35	11:00	12-2	**Vertical Integration and Clinical Application for Histology and Anatomy Review Curriculum in a Medical School** Dongmei Cui, William P. Daley, Norma B. Ojeda University of Mississippi Medical Center	Dongmei Cui
134	11:15	12-3	**An Oasis is a Data Desert: Incorporating a Genomics Module into an Undergraduate Biology Course** Chinyere Knight Department of Biology, College of Arts and Science, Tuskegee University	Chinyere Knight
142	11:30	12-4	**The Evolution of Anatomical Sciences Education and Its Implications for Biomedical Engineering** Edgar Meyer University of Mississippi Medical Center	Edgar Meyer

12:00-1:15 PLENARY

The Population Health Lessons I Learned from the COVID-19 Pandemic

Given by

John C. Higginbotham, PhD

Vice Chancellor for Research and Economic Development

University of Mississippi

University, MS

Dr. John C. Higginbotham serves as the Vice Chancellor for Research and Economic Development at The University of Mississippi, bringing over 25 years of expertise in research, grant writing, and university leadership to his role as the university's chief research officer. He is deeply committed to fostering a vibrant research ecosystem by supporting faculty, staff, and students in pursuing innovative scholarly activities and creative projects across diverse disciplines, including social sciences, physical sciences, arts, and humanities. With a passion for interdisciplinary collaboration, Dr. Higginbotham actively promotes partnerships with communities, businesses, and industry to drive technological advancement, knowledge creation, and economic growth, aligning with the university's strategic mission to enhance its reputation as a leader in innovation and discovery. His leadership ensures that research opportunities are accessible and impactful, creating exciting possibilities for Ole Miss researchers to address society's most pressing challenges while strengthening ties with external stakeholders.

Session 13: Drug Delivery at the Nanoscale - II

Session Chair: Kenneth Butler, University of Mississippi Medical Center
Co-Chair: Qi Cai, Louisiana State University

SESSION KEYNOTE

Extracellular Vesicles Reengineered with Liposomes For Targeted Drug Delivery

Santosh Aryal, PhD

University of Texas at Tyler

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

Room# B	**Session 13: Drug Delivery at the Nanoscale - II** **Session Chair**: Kenneth Butler **Co-Chair:** Qi Cai			
Abstract Number	**Presentation Time**	**Presentation Number**	**Presentation Title**	**Name of the Presenting Author**
7	1:30	Keynote	**Extracellular Vesicles Reengineered with Liposomes For Targeted Drug Delivery** Santosh Aryal The Ben and Maytee Fisch College of Pharmacy, The University of Texas at Tyler, Tyler, TX	Santosh Aryal
84	2:00	13-1	**Novel coformulation of Pembrolizumab and Ultrasound-Targeted Microbubble Modulation Improves Delivery within Tumor Microenvironment and Reduces Systemic Exposure** Imani Kirven[1], Patrice Penfornis[1], Muhammad Siddiqui[1], Kenneth Butler[1], Richard Roman[1],	Imani Kirven

			Clayton Larsen[2], Candace Howard[1], Pier Paolo Claudio[1] [1]University of Mississippi Medical Center, Jackson, MS, [3]Vesselon, Inc., Wilton, CT	
102	2:30	13-3	**Enhancing Tumor Targeting with NK Cell-Derived Hybrid Vesicles: A Proteomic and Functional Study** Viswanathan Sundaram, Alisha Upreti, Sriyam Joshi, Cesar Aparicio, Santosh Aryal The Ben and Maytee Fisch College of Pharmacy, The University of Texas at Tyler	Viswanathan Sundaram, Alisha Upreti
75	2:45	13-4	**Engineering and Optimization of Polymeric Nanoparticles for Brain Drug Delivery.** Afoma Okafor[1]Anthony Koo[2], Joshua Worsham[1], Yeoheung Yun[2], Eunsoo Yoo[1] North Carolina Agricultural and Technical State University, Greensboro, NC, 2College of Engineering, North Carolina State University, Raleigh, NC, USA	Afoma Okafor

Session 14: Electrophysiology and Neuromodulation

Session Chair: Deepak Kumbhare, LSU Health Shreveport
Co-Chair: Julie Schwertfeger, LSU Health Shreveport

SESSION KEYNOTE

Novel Nicotinic Receptor Potentiators for Parkinson's Disease

Ayman K Hamouda, PhD

The University of Texas at Tyler

Dr. Hamouda is a professor in the Department of Pharmaceutical Sciences and Health Outcome at the Fisch College of Pharmacy, The University of Texas at Tyler. His academic training includes a bachelor's degree in pharmacy from Al-Azhar University-Gaza, a PhD in Pharmacology from Texas Tech University Health Sciences Center, and postdoctoral and instructor training in neurobiology at Harvard Medical School. He has 14 years of teaching and research experience at Texas A&M University and The University of Texas at Tyler. Dr. Hamouda's research focuses on neuropharmacology, with an emphasis on understanding the structure, function, and pharmacology of pentameric ligand-gated ion channels, such as nicotinic acetylcholine receptors (nAChRs). His research is currently funded by two NIH grants to develop selective nAChR positive allosteric modulators to probe the function of brain nAChRs and explore potential therapeutic applications for nicotine addiction and neurodegenerative diseases.

Abstract: Parkinson's disease (PD) is a multifactorial neurodegenerative disorder characterized by the accumulation of abnormal α-synuclein into Lewy bodies, loss of striatal dopaminergic neurons, and perturbation of other neurotransmitter pathways. α4β2 nicotinic acetylcholine receptors (nAChRs) are highly expressed on dopaminergic neurons and directly modulate dopaminergic tone. As such, α4β2 nAChRs represent a promising therapeutic target for neuroprotection and potential disease-modifying effects that improve motor and cognitive symptoms associated with

PD. This presentation will provide an overview of our efforts to develop α4β2 nAChR positive allosteric modulators with favorable pharmacological profiles. These studies include *in vitro* characterization of novel compounds using electrophysiological recordings, radioligand binding, cell-based assays, and computational analyses, as well as *in vivo* testing in a 6-hydroxydopamine-induced PD-like zebrafish model.

Room# A	**Session 14: Electrophysiology and Neuromodulation** **Session Chair**: Deepak Kumbhare **Co-Chair:** Julie Schwertfeger			
Abstract Number	**Presentation Time**	**Presentation Number**	**Presentation Title**	**Name of the Presenting Author**
	1:30	Keynote	**Novel Nicotinic Receptor Potentiators for Parkinson's Disease** Ayman Hamouda University of Texas at Tyler	Ayman Hamouda
16	2:00	14-1	**Rewiring Addiction: Modulation of Brain Networks in Methamphetamine Dependence** Greyson Jadwin[1], Michael Minamyer[1], Bo Wood[1], Patrick Patisaul[1], Nicholas Mccomb[1], Kevin Murnane[1], Jamie Toms[1], Deepak Kumbhare[1] [1]Louisiana State University Health Science Center-Shreveport	Greysom Jadwin
81	2:15	14-2	**Assessing The Efficacy; On Cognition and Stress In Stroke Patients: A Scoping Review** Niels Dickson[1], Julie Schwertfeger[1] [1]Louisiana State University Health Sciences Center Shreveport	Niels Dickson, Julie Schwertfeger
53	2:30	14-3	**Characterizing Neuronal Spike Activity and EMG Correlates in Patients Undergoing Deep Brain Stimulation** Kinan Kasabali[1], Ryan Diaz[1], Ibraheem Hachem[1], Jamie Toms[1], Deepak Kumbhare[1] [1]Louisiana State University Health Center	Kinan Kasabali
17	2:45	14-4	**A Multi-Study sEEG Research Platform for Seizure Prediction and Cognitive Mapping in Drug-Resistant Epilepsy** Luke Landry[1] [1]LSUHS School of Medicine	Luke Landry

Session 15: Biomedical Engineering - II

Session Chair: Melanie Ecker, *University of North Texas*
Co-Chair: Donald Sorrells, *Louisiana State University Health Science Center*

SESSION KEYNOTE

BEAUTY BEYOND JEWELRY: Genuine vs "Fake-News" Metallo-Intercalation of Glowing Golden-Triangle & Platinum-Chain Phosphors in Polymer Nanocomposites for Dual Bioimaging/Therapeutic Apps

Mohammad Omary

University of North Texas

Prof. Mohammad A. Omary, PhD is Regents Professor of Chemistry, Physics, and Mechanical Engineering at the University of North Texas and serves as Editor-in-Chief of *Comments on Inorganic Chemistry*. An internationally recognized inorganic chemist and materials scientist, his research focuses on the design of molecular, supramolecular, and nanostructured materials for energy, environmental, electronic, and biomedical applications. His pioneering work has advanced phosphorescent materials for energy-efficient lighting and imaging, photovoltaic materials for solar energy conversion, molecular semiconductors, metal-organic frameworks, and plasmonic nanoparticles for cancer theranostics and drug delivery. Dr. Omary has led more than $22 million in externally funded research supported by the U.S. Department of Energy, National Science Foundation, NASA, Department of Defense, and other federal agencies. Recognized among Stanford University's World's Top 2% of Scientists since 2019, he has authored more than 165 peer-reviewed publications, holds numerous patent disclosures, and has mentored hundreds of undergraduate, graduate, and postdoctoral researchers while fostering global interdisciplinary collaborations.

Abstract: Mohammad A. Omary,* Nur G. Rabah, Anna Ilundu, Bisola Adeyemi, Gabriel Re Calderon, Omar Valsson, Elizabeth Skellam, and Taeyul Choi

Departments of Chemistry and Mechanical Engineering, University of North Texas, University of North Texas, Denton, Texas 76203, United States

**Corresponding and Presenting Author (Keynote Speaker Invitee): omary@unt.edu* This project describes sensitization the photoluminescence quantum yield (PLQY) of novel "light-switching complexes" *vs* state-of-the-art predecessors. DNA intercalation in predecessors is manifest *via* pendant ORGANIC ligands (*i.e.*, distant-dppz in $[Ru(bpy/phen)_2dppz]^{2+}$ away from metal centers) *vs* INORGANIC-coordination-sphere genuine metallo-intercalation herein (*e.g.*, triangular gold(I)-9-membered-ring cyclic-trinuclear complexes; oligomeric-chain platinum(II)-bis(pyridyltriazolates)). Phosphorescence sensitization for $[Ru(bpy)_2dppz]^{2+}$-type conventional metallo-intercalators entails PLQY increases from merely 10^{-4} (0.01%) levels in buffer solutions without DNA to merely 10^{-3} (0.1%) levels in buffered-aqueous DNA or organic solvents. Novel complexes herein can attain drastically higher sensitization to reach PLQY = 0.5-1.0 (50-100%) "on" state levels in aqueous media of micellar biocompatible polymers nanoparticle; indeed, even the "off" level herein is higher than the "on" level of conventional metallo-intercalators (0.5% *vs* 0.1%)! The light-switching "on"

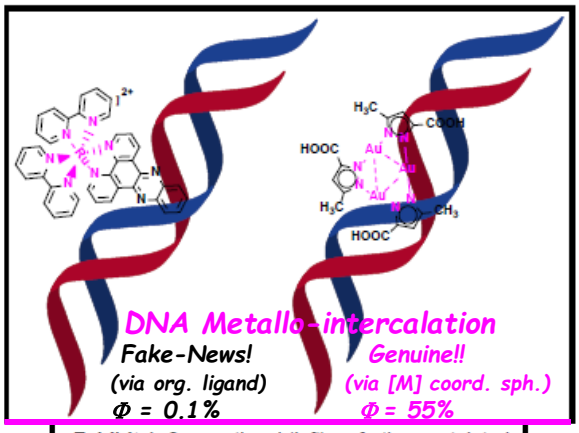

Exhibit 1. Conventional (left) vs further-metalated (right) metallointercalation. Note the coordination sphere (in pink) is outside and inside DNA's major grove, respectively.

state herein, therefore, amounts to 100x > its "off" state and > 500x or > 5000% the "on" state of Ru(II)-dppz complexes! Furthermore, DFT computations reveal > 50% higher binding energy to DNA base pairs by representative planar phosphors *vs* conventional organic intercalators. The combination of extremely high PLQYs in aqueous buffer environments and high binding energies of the novel metallo-intercalators are promising toward alternative dyes in standard agarose gel electrophoresis kits used for DNA bioimaging (*e.g.*, ethidium bromide; ellipticine; cyber-safe series) upon further developments of different classes of d^{10} and d^8 bright/fast phosphors (> 50% PLQY/100 ns lifetime range) under investigation.

Room# B	**Session 15: Biomedical Engineering - II** **Session Chair**: Melanie Ecker **Co-Chair:** Donald Sorrells			
Abstract Number	**Presentation Time**	**Presentation Number**	**Presentation Title**	**Name of the Presenting Author**
54	3:15	Keynote	**BEAUTY BEYOND JEWELRY: Genuine vs "Fake-News" Metallo-Intercalation of Glowing Golden-Triangle & Platinum-Chain Phosphors in Polymer Nanocomposites for Dual Bioimaging/Therapeutic Apps** Mohammad Omary[1], Nur Rabah[1], Anna Ilundu[1], Bisola Adeyemi[1], Gabriel Re Calderon[1], Omar Valsson[1], Elizabeth Skellam[1], Taeyul Choi[1] [1]University of North Texas	Mohammad Omary
71	3:45	15-1	**Luminescent Perovskite Microfibers for Imaging Applications** Suprabhat Paramanick[1], Mohammad Alizadeh Poshtiri[1], Sampson Gyamerah[1], Humayun Ahmad[1], Santanu Kundu[1], Prabhakar Pradhan[1], Mahesh Gangishetty[1] [1]Mississippi State University	Mahesh Gangishetty
22	8:00	17-1	**Thiol-ene Microparticle Platform for pH-Activated Release of Doxycycline** Chipo Chapusha[1], Nicholas McGowan[1], Paige Smith[1], Anthony Hasley[1], Mary Carr[2], Mary Marquart[2], Jared Cobb[3], Amol Janorkar[1] [1]University of Mississippi Medical Center[3]Environmental Laboratory, Engineer Research and Development Center, U.S. Army Corps of Engineers, Vicksburg, MS 3	Chipo Chapusha
103	4:15	15-3	**Extracellular Vesicle Mediated Wound Healing Study Using Cell Scratch Model In Vitro** Madeleine Harris[1], Viswanathan Sundaram[1], Israel Joshua Santhosh[1], Santosh Aryal[1] [1]The Ben and Maytee Fisch College of Pharmacy, The University of Texas at Tyler	Madeleine Harris

Session 16: Biomedical Education and Research Training

Session Chair: Joseph Cameron, Jackson State University
Co-Chair: Judy Gordy University of Mississippi Medical Center

Room# A	**Session 16: Biomedical Education and Research Training** **Session Chair**: Joseph Cameron **Co-Chair:** Judy Gordy			
Abstract Number	**Presentation Time**	**Presentation Number**	**Presentation Title**	**Name of the Presenting Author**
109	3:15	16-1	**Cognitive Cartography: Boosting RADS Mastery with Right-Brain visualization and Whole- Brain Memory Techniques** Aryan Ahuja, Sean Cassingham, Zhiyun Yang LSU Health Shreveport	Aryan Ahuja
159	3:30	16-2	**Transgenic Animals and Atryn and the Future Biotech: Ethical Responsibility** Olanis Sanchez and Richard Wilson	Olanis Sanchez
1	3:45	16-3	**Effects of Low-Level Laser Therapy on Patients with Carpal Tunnel Syndrome: A Systematic Review** Felix Adah, Joy Kuebler, Kimberly Holt, and William Pannell University of Mississippi Medical Center	Felix Adah
151	4:00	16-4	**Systematic Review of Free Orthopedic Price Verification Tools and Gap Analysis in Consumer-Facing Price Transparency Implementation** Rupesh Tarwala[1], Vedant Vaksha[2], Mohammad Athar[2], Ocean Thakar[2], Paresh Patel[2], Ambreen Sharif[2], Fiona Zheng[2], Rajwinder Singh[2], Blaize Haas[2], Jay Sangwan[2], Suhirad Khokhar[3], Aryan Verma[2], Nakul Karkare[2] [1]Department of Orthopedic Surgery, Lenox Hill Hospital, New York, NY, [2]Complete Orthopedics, [3]Department of Orthopaedics, Marshall Health, Huntington, WV	Rupesh Tarwala
70	4:15	16-5	**Water scarcity and Disease and Neurodegenerative Diseases: Ethical and Anticipatory Ethical Issues** Kaitlyn Finch and Richard Wilson Towson University	Kaitlyn Finch
150	4:30	16-6	**Data Sourcing Strategy, Tool Feasibility, and Implementation Framework for National Orthopedic Price Transparency Database** Rupesh Tarwala[1], Vedant Vaksha[2], Mohammad Athar[2], Ocean Thakar[2], Ambreen Sharif[2], Paresh Patel[2], Fiona Zheng[2], Rajwinder Singh[2],	Rupesh Tarwala

			Blaize Haas[2], Jay Sangwan[2], Suhirad Khokhar[3], Aryan Verma[2], Nakul Karkare[2] [1]Department of Orthopedic Surgery, Lenox Hill Hospital, New York, NY, [2]Complete Orthopedics, [3]Department of Orthopaedics, Marshall Health, Huntington, WV	

Poster Session

September 12, 2026

Co Chairs: Ibrahim Farah, Michelle Tucci, Jamil Ibrahim, Raja Reddy
4:30-6:00: Room C

Poster Number	Abstract Number	Presentation Title	Name of the Presenting Author
1	148	**Rate Citability, Cross-Source Concordance, and Data Verifiability in Orthopedic Price Transparency Across Carriers, Hospitals, and Vendors** Rupesh Tarwala[1], Vedant Vaksha[2], Mohammad Athar[2], Ocean Thakar[2], Paresh Patel[2], Ambreen Sharif[2], Fiona Zheng[2], Blaize Haas[2], Rajwinder Singh[2], Jay Sangwan[2], Suhirad Khokhar[3], Aryan Verma[2], Nakul Karkare[2] [1]Department of Orthopedic Surgery, Lenox Hill Hospital, New York, NY, [2]Complete Orthopedics, [3]Department of Orthopaedics, Marshall Health, Huntington, WV	Rupesh Tarwala
2	147	**Commercial Negotiated Rates, Setting-Specific Variation, and Benchmarking for Orthopedic Joint Replacement Procedures** Rupesh Tarwala[1], Vedant Vaksha[2], Mohammad Athar[2], Ocean Thakar[2], Paresh Patel[2], Ambreen Sharif[2], Fiona Zheng[2], Rajwinder Singh[2], Blaize Haas[2], Jay Sangwan[2], Suhirad Khokar[3], Aryan Verma[2], Nakul Karkare[2] [1]Department of Orthopedic Surgery, Lenox Hill Hospital, New York, NY, [2]Complete Orthopedics, [3]Department of Orthopaedics, Marshall Health, Huntington, WV	Rupesh Tarwala
3	146	**Ghost Rates and Data Quality Dimensions in Orthopedic Price Transparency: A Multi-Payer National Analysis** Rupesh Tarwala[1], Vedant Vaksha[2], Mohammad Athar[2], Ocean Thakar[2], Paresh Patel[2], Ambreen Sharif[2], Fiona Zheng[2], Rajwinder Singh[2], Jay Sangwan[2], Suhirad Khokar[3], Aryan Verma[2], Nakul Karkare[2], Blaize Haas[2] [1]Department of Orthopedic Surgery, Lenox Hill Hospital, New York, NY, [2]Complete Orthopedics, [3]Department of Orthopaedics, Marshall Health, Huntington, WV	Rupesh Tarwala
4	145	**Geographic Disparities in Pediatric Healthcare Provider Distribution Across United States States and Territories** Hema Verman[1], Shefali Karkare[2] [1]Complete Orthopedics, [2]Cohen Children's Medical Center	Hema Verma

5	144	**Understanding Challenges in Food Rx Initiatives: Leveraging Artificial Intelligence for Solutions** Hema Verma[1], Aryan Verma[1] Complete Orthopedics, New York, NY Shefali Karkare, MD Cohen Children's Medical Center-Northwell, New Hyde Park, NY	Hema Verma
6	143	**Geographic Distribution of Pediatric Level 3 and Level 4 Epilepsy Centers in the United States** Hema Verma, MD Complete Orthopedics, New York, NY Shefali Karkare, MD Cohen Children's Medical Center-Northwell, New Hyde Park, NY	Hema Verma
7	141	**Integrated Training Programs for Preparing the Next Generation of Professionals through Biomedical Research Education and Workforce Development at Tuskegee University** Honghe Wang[1], Timothy Turner[1] [1]Tuskegee University	Honghe Wang
8	140	**Evaluation of α4β2 nAChR PAMs in a Zebrafish Model of Parkinson's Disease** Kwadwo Appiah-Poku[1], Nathalia M Pinheiro Menegasso[1], Nataly Sanchez[1], Ganesh Thakur[2], Bret Bill[1], Ayman Hamouda[1] [1]University of Texas, [2]Northeastern University	Kwadwo Appiah-Poku
9	139	**Design of Conjugated Polymers and Molecules towards Biomedical Imaging and Sensing** Graham S. Collier[1] [1]University of Southern Mississippi	Graham S. Collier
10	138	**Cannabidiol (CBD): Trending Non-Pharmaceutical Products with not fully elucidated pharmacology.** Amal Al-Shweiky[1], Nathalia M. Pinheiro Menegasso[1], Sarah Thompson[1], Robert Beaudoin[1], Ayman Hamouda[1] [1]University of Texas	Amal Al Shweiky
11	137	**The Role of Transient YAP Signaling in Liver Regeneration** Karel Alcedo[1] [1]University of Mississippi	Karel Alcedo
12	132	**Genomic Insights into Efibula americana TULF14: Fungal Metabolic Versatility for Biomedical Innovation** Kingsley Bentum[1], Chinyere Knight[2] [1]College of Agriculture Environment and Nutrition Science, [2]Department of Biology, College of Arts and Science	Chinyere Knight
13	131	**Contribution Of Colonoscopy Assets To The Colorectal Cancer Disparities Between High Density- Low Density Counties And Between Urban- Rural Counties In Mississippi.**	Bidhayak Roy

		Bidhayak Roy, Roy J. Duhe, Salit Chakma, Fazlay S. Faruque University of Mississippi Medical Center,	
14	127	**Development and Characterization of BSA-Functionalized PNVCL Particles with Tunable Thermoresponsive Behavior for Biomedical Applications** Gabriel Re Calderon[1], Robert Smith[2], Tae-Youl Choi[2], Mohammad Omary[1] [1]UNT Chemistry, [2]UNT Mechanical Engineering	Gabriel Re Calderon
15	3	**Hydrogels and Thiol-ene Microparticles for Antibiotic Release to Treat Osteomyelitis** Anna Rourke-Funderburg, Chipo Chapusha, Sheetal Chowdhury, Amol Janorkar Department of Biomedical Materials Science, School of Dentistry, University of Mississippi Medical Center, Jackson	Amol Janorkar
16	113	**Evaluating the Effects of Different Nanoparticle Formulations on Tumor Spheroid Morphology, Viability, and Penetration** Micaela Lopez Krol[1], Rayan El Messoussi Garti[1]	Micaela Lopez Krol, Rayan El Messoussi Garti
17	112	**Effect of Hydrodynamic Radius of Discrete Bottle Brush polymers on enhancing 19F MRI Performance through the Architectural Precision.** Anupama Aloka Bandaralage[1], Titilayo Oluwole[1], Parikshit Guragain[1], Jimmy Lawrence[1] [1]Louisiana State University	Anupama Aloka Bandaralage
18	111	**Designing boronic acid-containing bottlebrush polymers: Impact of hydrophilic side chain length on precision sensing.** Titilayo Oluwole[1], Alejandro Ramirez[1], Anupama Bandara[1], Jimmy Lawrence[1] [1]Louisiana State University	Titilayo Oluwole
19	100	**Isolation and hybridization of PDX-Derived Extracellular Vesicle with Liposome to Study Precision in Tumor Targeting** Alisha Upreti[1], Viswanathan Sundaram[1], Neeraj Saini[2], Santosh Aryal[1] [1]The Ben and Maytee Fishch College of Pharmacy, The University of Texas at Tyler, [2]Department of Stem Cell Transplantation and Cellular Therapy, The University of Texas MD Anderson Cancer Center, Houston, Texas	Alisha Upreti
20	98	**Investigating The Effectiveness of Nurses' Hand Hygiene Knowledge, Attitude, Practice, And Hand Hygiene Methods on the Bacterial Contamination Level on Hands** Yu-Ching Tu[1], Md Mushfiqur Rahman[2], Md Rokibul Hasan[2], Jonathan Lee[3], Michelle Tucci[4], Haifeng Wang[5], Lir-Wan Fan[3] Hwa University of Medical Technology, University of Mississippi Medical Center, Mississippi State University, and	Yu Ching Tu

21	97	**Mapping of Chronic Motor Effects Following LPS Exposure in Neonatal Rats Using a Function-on-Scalar Regression Approach** Md Mushfiqur Rahman[1], Jonathan Lee[2], Md Rokibul Hasan[1], Lu-Tai Tien[3], Yu-Ching Tu[4], Michelle Tucci[5], Norma Ojeda[6], Yi Pang[2], Lir-Wan Fan[2], Pratim Niyogi[1] University of Mississippi	Md Mushfiqur Rahman
22	96	**A Longitudinal Study of Neonatal Inflammation-Induced Sex-Specific Effects on Sleep and Homeostatic Responses to Sleep Disruptions in Adolescent Rats** Md Rokibul Hasan[1], Jonathan Lee[2], Md Mushfiqur Rahman[1], Silu Lu[2], Joseph Crosby[2], Charles Matheny[2], James Shaffery[3], Norma Ojeda[4], Haifeng Wang[5], Lu-Tai Tien[6], Michelle Tucci[7], Lir-Wan Fan[2], Pratim Niyogi[1] University of Mississippi Medical Center, Jackson, MS	Md Rokibul Hasan
23	85	**Antimicrobial and Fire-Retardant Solutions for Hospital Textiles** Vladimir Reukov[1], Brinkley Vaughn[1], Evan Buach[1], Ambry Lofton[1], Justin Brown[1], Kimberly Castro Godinez[1], Quoc-Nghia Duong[1], Joyjit Ghosh[1] [1]University of Georgia	Vladimir Reukov
24	83	**Bioengineered Mineralized Mycelium Composites for Sustainable Structural Applications** Vladimir Reukov University of Georgia	Vladimir Reukov
25	82	**Anticancer Effects of the Novel Cathepsin L Inhibitor Nn9 in Metastatic Colorectal Cancer Cells** Kayode Komolafe, Olamide Crown, Titilope Komolafe, Felicite Noubissi, Ifedayo Ogungbe, Barbara Graham Jackson, State University	Kayode Komolafe
26	80	**Influence of Walking Biomechanics Based on How Different Orthosis Designs Constrain the Foot and Ankle in Healthy Adults** Perri Johnson, Max Paquette, Denis DiAngelo University of Memphis	Perri Johnson
27	79	**Cadmium Induces Chromatin Condensation** Nneoma Nwaiwu Jackson State University	Nneoma Nwaiwu
28	157	**AI Machine Learning and Medicinal Plants: Ethical and Anticipated Ethical Issues** Anthony Puleo and Richard Wilson	Anthony Puleo
29	68	**Neurodegenerative Diseases, BCI's and Alzheimer's Disease: Ethical and Anticipated Ethical Issues** Chloe Bourne[1], Richard Wilson[1] [1]Towson University	Chloe Bourne

30	65	**Nanoplastics and Neurodegenerative Diseases: Dementia and Alzheimer's** Benjamin Rozencwaig[1], Richard Wilson[2] [1]University of Maryland, [2]Towson University Plastic, one of the most preferred materials in today's	Richard Wilson
31	63	**Medical Device Sustainability: An Ethical and Anticipatory Ethical Analysis** Giovanni Solitro[1], Richard Wilson[2] [1]LSU, [2]Towson University	Giovanni Solitro, Richard Wilson
32	58	**Diabetic Nephropathy and the Effects of *Hippocratea velutina* on Treatment** KymMiyiah Vernado, Maricica Pacurari Jackson State University	KymMiyiah Vernado[1]
33	159	**Transgenic Animals and Atryn and the Future Biotech: Ethical Responsibility** Olanis Sanchez and Richard Wilson	Olanis Sanchez
34	44	**Ovarian Vein Syndrome: A Case Report on Cadaveric Study** Gongchao Yang, Timothy Dasinger, Yuefeng Lu, Dongmei Cui, Norma Ojeda University of Mississippi Medical Center, Jackson, MS	Gongchao Yang
35	42	**Surface Engineering Of Polymeric Implants for Enhanced Cellular Response** Shruti Chhabra[1], Michelle Tucci[2], Lir-Wan Fan[3], Randall Scott Williamson[1] University of Mississippi Medical Center, Jackson, MS	Shruti Chhabra
36	40	**-Integrity of the acetabular wall with augmentation of acetabular defect** Yusra Soorya Louisiana State University Health Sciences Center at Shreveport, Shreveport, LA	Yusra Soorya
37	34	**Suppression of T Helper Cells by Abatacept Experimental PCOS** Zahara Poe, Mohadetheh Moulana Jackson State University, Jackson, MS	Zahara Poe
38	27	**Development of a 3D-printed polylactic acid trabecular bone scaffold enabling hematopoietic stem cell-derived cells production for blood transfusion.** Patrice Penfornis[1], John Hollis Tackett[2], Turner C. Smith[3], Imani A. Kirven[1], Pier Paolo Claudio[1] [1]Department of Pharmacology and Toxicology, [2]School of Medicine, [3]School of Engineering	Patrice Penfornis
39	24	**Anti-Gastrostomy and Anti-Fouling Gastrostomy (PEG) Tube** Hannah Yared[1], Nadine Hassanieh[1]	Hannah Yared, Nadine Hassanieh

		[1]UCLA Biomedical Engineering Society	
40	23	**Assessment of Progressive Training with Serious Games for Wearable Temporalis EMG Wheelchair Control** Arina Nemati[1], Sophie Bennett[1], Abrianna Lalle[1], Ethan Bell[1], Delaney Gunnell[1], Maanya Pradeep[1], Macie Sullivan[1], John Ilemsky[1], Alex Da Vera Cruz[1], Hayden Eicke[1], Peter Smith[1], Matt Dombrowski[1], John Sparkman[1], Albert Manero[1] University of Central Florida	Arina Nemati
41	2	**Advancing Neuromuscular Disorder Diagnosis and Adaptive Electroceutical Therapy through Real-Time Electromyography and Hybrid Deep Learning** Sidharth Patsamatla[1] [1]West Shore Jr/Sr High School	Sidharth Patsamatla[1]
42	153	**Maternal Inflammation Exacerbates Intrauterine Growth Restriction-Induced Cognitive Dysfunction and Brain Vascular Deficits in Juvenile Rats With Sex-Specific Effects** Ashya Richardson, Jonathan Lee, Madisyn Avery, Tyra Lockett, Almia Valentine, Sumana Ramarao, Michelle Tucci, Norma Ojeda, Lir-Wan Fan University of Mississippi Medical Center, Jackson, MS	Ashya Richardson
43	154	**-Reinforcement Learning-Driven De Novo Drug Design for Glioblastoma: A Multi-Objective Approach with NoisyNet, Entropy Regularization, Prioritized Experience Replay, and Intrinsic Curiosity** Joyce Li[1], Yanhui Guo[2] [1]Georgia Institute of Technology, [2]University of Illinois Springfield	Joyce Li
44	155	**Synthesis of Durable Gold Nanoparticle-Embedded Cotton Fibers for Biocompatible Textile Applications** **Faqrul Hassan[1, 2]** [1]Oak Ridge Institute for Science and Education, [2]United States Department of Agriculture	Faqrul Hassan
45	156	**Beyond Gray Level Co-occurrence Matrices: Third-Order Texture Analysis Using Co-occurrence Tensors for Image Classification** Caden Edwards, Abdur Rahman* College of Engineering and Science, Louisiana Tech University, Ruston, LA 71270	Caden Edwards, Abdur Rahman
46	158	**Longitudinal Characterization of Cardiometabolic and Renal Risk Across the Pediatric Obesity Spectrum: A Retrospective EHR Study** Prisha Chhabra, Jordan Mallette, John Clemmer Department of Department of Physiology and Biophysics, University of Mississippi Medical Center	Prisha Chhabra

6:00-9:30 **Banquet: Hilton AP, Room #D**

Outstanding Saha Distinguished Speaker Awardee

Ahamed El-Ghannam, PhD

University of North Carolina at Charlotte

Title: Silica as a Multifunctional Bioactive Signal: Mechanistic Insights into Bone Formation, Vascularization, Innervation, and Immune Modulation.

Dr. El-Ghannam is a professor of Orthopedic Biomaterials and Tissue Engineering in the Mechanical Engineering and Engineering Science Department at the University of North Carolina at Charlotte. He has several US patents on the 3D printing of a bioactive SiC tissue-engineering scaffold, the design of novel SCPC bioactive resorbable ceramics, the coating of bioceramics on titanium and cobalt-chromium alloy, the additive manufacture of a bioactive SiC orthopedic fixation device, and a SiC space mirror. The laboratory of Dr. EL-Ghannam got funds from Siemens Energy, DePuy J&J company, North Carolina Biotechnology center, DoD, NASA and others. Dr. El-Ghannam has successfully taken a novel resorbable bioactive ceramic (Shefabone^{M} SCPC) from the laboratory bench to the surgery room through FDA approval. He has many collaborators from universities, industry and medical institutes in US and worldwide. Dr. El-Ghannam publications cover wide span of topics including Materials Science and Engineering, life sciences, molecular biology, drug delivery and animal and Clinical assessment of tissue response. Dr. Ghannam has been an organizer, keynote speaker and a chair in national and international biomaterials conferences and has served as the associate editor of the JBMR-A for the last 16 years. He authored and co-authored biomaterials books, book chapters and have many publications in biomedical materials, engineering, dental and orthopedic journals. He was recognized recently by Stanford University in the list of the top 2% most widely cited scientists in Bioengineering.

End of Saturday

Sunday Oral Presentations Sessions

Session 17: Cell Signaling

Session Chair: Farah Deba, University of Texas at Tyler
Co-Chair: Ayman Hamouda, University of Texas at Tyler

SESSION KEYNOTE

Cholinergic Signaling in Lung Inflammation: Experimental Models and Translational Perspectives

Carla M. Prado

Federal University of São Paulo (UNIFESP)

Carla Maximo Prado is Full Professor in the Department of Bioscience at the Federal University of São Paulo (UNIFESP) and Head of the Laboratory of Pulmonary Inflammation Studies. She obtained her degree in Physiotherapy from the Methodist University of Piracicaba and her PhD in Medical Sciences (Experimental Pathophysiology) from the University of São Paulo (USP) with a FAPESP fellowship, followed by postdoctoral training in pulmonary pathophysiology at the USP School of Medicine. She was also a FAPESP Visiting Research Fellow at the University of Texas at Tyler, USA for four months in 2023-2024.
Professor Prado joined UNIFESP in 2008, becoming Associate Professor in 2015 and Full Professor in 2024. She teaches the module *From Tissues to Systems* for undergraduate students and her research focuses on pulmonary inflammation and remodeling, particularly on the role of cholinergic pathways and nicotinic receptors in experimental in vivo and in vitro models of respiratory diseases.
She currently serves as Vice Coordinator and advisor of the Interdisciplinary Graduate Program in Health Sciences and coordinates the lato sensu postgraduate program in Human Physiology and Pathophysiology at UNIFESP. She is also an advisor in the Graduate Program in Medical Sciences at USP.

Abstract: Inflammatory lung diseases involve complex interactions between structural cells, immune cells, and multiple signaling pathways that regulate inflammation and tissue repair. Among these pathways, cholinergic signaling has emerged as a critical modulator of inflammatory responses in the respiratory system. Over the last several years, our group has investigated the role of cholinergic signaling in these processes using complementary in vivo and in vitro experimental models.

This lecture will present evidence showing how reduced and pharmacological modulation of cholinergic signaling influence pulmonary inflammation across different experimental models. Findings obtained from vesicular acetylcholine transporter (VAChT)-deficient mice will illustrate the impact of impaired cholinergic neurotransmission on the development and progression of several experimental models of lung disease. The therapeutic relevance of α7 nicotinic acetylcholine receptor (α7 nAChR) activation will be discussed, highlighting its ability to attenuate inflammatory responses in experimental models. In addition, the lecture will explore the systemic consequences of lung inflammation, including alterations in central nicotinic receptor expression associated with neuroinflammatory responses, supporting an integrated view of lung-brain communication. The presentation will also address recent findings on the relationship between cholinergic signaling and ACE2 regulation, illustrating how experimental models have contributed to a better understanding of signaling pathways involved in pulmonary inflammation and host defense. Overall, the lecture will provide a translational perspective on how experimental models can reveal novel mechanism of cell signaling and support the development of innovative therapeutic strategies for inflammatory lung diseases.

Room# A	Session 13: Drug Delivery **Session Chair**: Farah Deba **Co-Chair:** Ayman Hamouda			
Abstract Number	**Presentation Time**	**Presentation Number**	**Presentation Title**	**Name of the Presenting Author**
	8:00	Keynote	**Cholinergic Signaling in Lung Inflammation: Experimental Models and Translational Perspectives** Carla M. Prado Federal University of São Paulo (UNIFESP	Carla Prado
8	8:30	17-1	**Exploiting Lichen Natural Products For The Development Of Novel Therapies Against Triple-Negative Breast Cancer** Hassan Ebrahim Department of Biomedical Sciences, Edward Via College of Osteopathic Medicine, Monroe, LA	Hassan Ebrahim
115	8:45	17-2	**NPY Y1 Receptor Antagonism as a Non Hormonal Strategy to Preserve Reproductive Tissue Integrity in an Ovariectomized Rat Model** Kenneth Butler[1], Michelle Tucci[1], Hamed Benghuzzi[2], Gary Hamil[1, 3] [1]University of MS Medical Center, [2]Jackson State University, [3]Belhaven University	Kenneth Butler
11	8:15	17-3	**Reversible, site-specific blood-brain barrier modulation by high-definition transcranial direct current stimulation of piezoelectric nanoparticles.** Salona Roy[1], Umisha Siwakoti[2], Daniel Alday[1], Carlos Astete[1], Cristina Sabliov[1], Elisa Castagnola[2], Qi Cai[1] [1]Louisiana State University, [2]Louisiana Tech University	Salona Roy
86	9:45	17-4	**Effects of Sequential Sub-Threshold Impulse and Oscillatory Loading on Viability and Morphological Changes in Human Microglial Cell Lines** Sumaya Sharmin[1], Ashfaq Adnan[1] [1]The University of Texas at Arlington	Sumaya Sharmin
135	9:15	17-6	**Repurposing Liposomal Drug Delivery through Surface Charge and Biogenic Modification with Extracellular Vesicles** Anavya Jernigan[1], Cesar Aparicio[1], Viswanathan Sundaram[1], Santosh Aryal[1] [1]The Ben and Maytee Fisch College of Pharmacy, The University of Texas at Tyler	Anavya Jernigan

Session 18: Medical Imaging

Session Chair: David Gordy, University of Mississippi Medical Center
Co-Chair: Mohammad Azad, North Carolina Agricultural and Technical State University

SESSION KEYNOTE

Title: Functional Precision Medicine the New Frontier

Candace M. Howard, MD, PhD

University of Mississippi Medical Center

Dr. Candace M. Howard is a tenured Professor of Radiology and Pediatrics at the University of Mississippi Medical Center, where she serves as Division Chief of Cardiothoracic and Body Imaging and as Vice Chair of Radiology Research. She founded and directs UMMC's Biomedical Imaging & Engineering graduate track, one of only two programs nationally that combine a radiology residency with doctoral training.

Dr. Howard earned her MD and PhD in molecular genetics from Thomas Jefferson University, where her thesis on tumor suppressor genes was published in the *Journal of the National Cancer Institute*. Her dual training uniquely positions her work at the intersection of biomarker development, radiomics, artificial intelligence, and image-guided therapeutics. She serves on NSF/NIH Hybrid Review Panels for AI grants and is the clinical PI of the first successful multi-institutional randomized trial in functional precision medicine for recurrent glioblastoma.

She has authored over 100 peer-reviewed publications and supported more than $34 million in research funding. A Fellow of the American College of Radiology, she was selected for the 2024–2025 SCARD–GE Healthcare LEAD Program and the 2025 AAR Radiology Management Program, in 2023 was named UMMC's Trailblazer of the Year for Excellence in Medical Education, and in 2025 received the Dr. LouAnn Woodward Vice Chancellor's Award from GWIMS (Group on Women in Medicine and Science) for academic leadership and the advancement of women in academic medicine.

Room# B	**Session 18: Medical Imaging** **Session Chair**: David Gordy **Co-Chair:** Mohammad Azad			
Abstract Number	**Presentation Time**	**Presentation Number**	**Presentation Title**	**Name of the Presenting Author**
	7:45	Keynote	**Functional Precision Medicine the New Frontier**	Candace Howard
48	8:15	18-1	**Optimizing Imaging Selection in Pediatric Appendicitis: The Role of Body Composition and Anthropometric Measures** Nellie Massey, Mary M. Snyder, Aubrey R. Smyly M.D., Seth T. Lirette Ph.D, Candace M. Howard M.D., Ph.D. University of Mississippi Medical Center, Jackson, MS,	Nellie Massey

59	8:30	18-2	**Integrating AI-Based Photogrammetry to Aid Custom Pediatric Prosthetic Socket Development** Om Vishanagra[1, 2], John Sparkman[1, 2], Albert Manero[1, 2] [1]University of Central Florida, [2]Limbitless Solutions	Om Vishanagra
47	8:45	18-3	**Radiomic Feature Analysis of Post-Treatment Surveillance Imaging to Identify Residual Disease in Head and Neck Squamous Cell Carcinoma: A Machine Learning Approach** Aubrey R. Smyly M.D.[1, 2], Seth T. Lirette Ph.D.[1], Candace M. Howard M.D., Ph.D.[1, 2] [1]Department of Radiology, University of Mississippi Medical Center, Jackson, MS, [2]School of Graduate Studies in the Health Sciences, University of Mississippi Medical Center, Jackson, MS	Aubert R. Smyly
106	9::00	18-4	**Discrete Brush Polymers: Architectural Precision for High Performance Metal-Free ^{19}F MRI Contrast Agents** Jimmy Lawrence[1], Titilayo Oluwole[1], Parikshit Guragain[1] [1]Louisiana State University	Jimmy Lawrence
49	9:15	18-5	**The Silent Liver in a Viral Storm: Fibrosis Progression and Clinical Severity in MASLD Patients with COVID-19** Mary M. Snyder[1], Nellie Massey[1], Aubrey R. Smyly M.D.[1, 2], Seth T. Lirette Ph.D.[1], Candace M. Howard M.D., Ph.D.[1, 2] [1]Department of Radiology, University of Mississippi Medical Center, Jackson, MS, [2]School of Graduate Studies in the Health Sciences, University of Mississippi Medical Center, Jackson, MS	Mary M Snyder

19: Surface Modification and Characterization for Biomedical Applications

Session Chair: Narayan Bhattarai, North Carolina A&T State University
Co-Chair: Michelle Tucci, University of Mississippi Medical Center

SESSION KEYNOTE

Biomaterial-Enabled Release of Bioactive Metal Ions for Vascularized Tissue Regeneration

Dr. Narayan Bhattarai

North Carolina A&T State University

Dr. Narayan Bhattarai is Professor of Bioengineering in the Department of Chemical, Biological, and Bioengineering at North Carolina A&T State University, where he directs the Biomaterials and Tissue Engineering Laboratory and serves as Director of the Undergraduate Bioengineering Program. His research focuses on biomaterials, biodegradable polymers, nanomedicine, drug delivery, and tissue engineering, with current projects supported by the National Science Foundation and the U.S. Department of Defense. Prior to joining North Carolina A&T, Dr. Bhattarai was a postdoctoral researcher and instructor at the University of Washington. He has mentored more than 50 graduate and undergraduate researchers and has authored over 100 peer-reviewed publications, five book chapters, four U.S. patents, and more than 90 conference abstracts. Recognized among Stanford University's Top 2% Most-Cited Scientists in Biomedical Engineering, Dr. Bhattarai has also received multiple honors for excellence in biomaterials research and education. His innovative work continues to advance regenerative medicine and biomedical engineering.

Room# A	**Session 19: Surface Modification and Characterization for Biomedical Applications** **Session Chair**: Narayan Bhattarai **Co-Chair:** Michelle Tucci			
Abstract Number	**Presentation Time**	**Presentation Number**	**Presentation Title**	**Name of the Presenting Author**
21	9:45	Keynote	**Biomaterial-Enabled Release of Bioactive Metal Ions for Vascularized Tissue Regeneration** Narayan Bhattarai, Sita Shrestha North Carolina A&T State University	Narayan Bhattarai
9	10:15	19-1	**Designing Tunable Polymeric Biointerfaces to Decode Cytoskeletal Mechanics** Rupesh Kandel[1], Jacqueline Robinson[1], Laurel Fishburn[1], Jorge Almodóvar[2], Nikki Reinemann[1] [1]University of Mississippi, [2]University of Maryland Baltimore County	Rupesh Kandel
31	10:30	19-2	**Fatty Acid-Modified Chitosan Membranes: Dual Antimicrobial and Occlusive Effects on Periodontal Bacteria** Kamrun Nahar[1], Alex Bryan[1], Joel Bumgardner[1]	Kamrun Nahar

			[1]The University of Memphis	
13	10:45	19-3	**Elastin-Based Coatings to Enable Long-Term 3D Adipose Spheroid Culture and Recapitulate Hypoxia-Induced Insulin Resistance** Sheetal Chowdhury[1], Joshua Speed[2], Gene Bidwell[3], Amol Janorkar[1] [1]Department of Biomedical Materials Science, University of Mississippi Medical Center, Jackson, MS, [2]Department of Physiology and Biophysics, University of Mississippi Medical Center, Jackson, MS, [3]Department of Neurology, University of Mississippi Medical Center, Jackson, MS	Sheetal Chowdhury
39	11:00	19-4	**Biocompatibility of SAM-Functionalized ITO Surface for HT-29 Colon Cancer Cell Culture: Toward a Gut-on-Chip Platform** Jewel Mallick[1], Debasish Kuila[2] [1]Department of Applied Science and Technology, College of Science and Technology, North Carolina A&T State University, [2]Department of Chemistry, North Carolina A&T State University	Jewel Mallick

Session 20: Ethical Issues in Biomedical Research
Session Chair: Richard Wilson/Subrata Saha,
Co-Chair: Kenneth Butler / Lamar Hamil

Room# B	**Session 20: PANEL: Ethical issues in Biomedical Research** **Session Chair**: Richard Wilson/ Subrata Saha **Co-Chair:** Kenneth Butler / Lamar Hamil			
Abstract Number	**Presentation Time**	**Presentation Number**	**Presentation Title**	**Name of the Presenting Author**
117	9:45	20-1	**Applying ANCOVA and Other Statistical Tools in Quasi-Experimental Research Design: Evidence from a Flipped Classroom Study** Jamil Ibrahim[1], Ibrahim Ibrahim[2], Saja Ibrahim[3], Waseem Ibrahim[4], Hidaya Ibrahim[5] [1]University of Mississippi Medical Center, [2]4D Implant Prosthodontic Center, [3]University of Jordan Medical School, [4]Arab American University, School of Dentistry, [5]Al-Najah University, School of Pharmacy	Jamil Ibrahim
116	10:00	20-2	**Autonomy and Decision-Making Capacity in Neurodegenerative Disease** Gary Hamil[1, 2], Michelle Tucci[1], Hamed Benghuzzi[3], Kenneth Butler[1]	Gary Hamil

			[1]University of MS Medical Center, [2]Belhaven University, [3]Jackson State University	
64	10:15	20-3	**Anticipatory Ethics for Biomechanical and Biomedical Engineering.** Richard Wilson[1] [1] Towson University	Richard Wilson
69	10:30	20-4	**Post CRISPR Gene Editing: An Ethical and Anticipatory Ethical Analysis** Richard Wilson[1], Michael Nestor[1] [1]Towson University	Richard Wilson, Micheal Nestor
149	10:45	20-5	**Hospital Orthopedic Price Transparency Compliance, Federal Template Evolution, and Regulatory Impact on Data Accessibility** Rupesh Tarwala[1], Vedant Vaksha[2], Mohammad Athar[2], Ocean Thakar[2], Paresh Patel[2], Ambreen Sharif[2], Fiona Zheng[2], Rajwinder Singh[2], Blaize Haas[2], Jay Sangwan[2], Suhirad Khokhar[3] [1]Department of Orthopedic Surgery, Lenox Hill Hospital, New York, NY, [2]Complete Orthopedics, [3]Department of Orthopaedics, Marshall Health, Huntington, WV	Rupesh Tarwala
157	11:00	20-6	**AI and Machine Learning on Medicinal Plants with Ethics** Anthony Puleo and Richard Wilson Towson University	Anthony Puleo

11:30-12:30-PANEL

"Engaging Professional Program Students in Meritorious Basic Science Research: Challenges and Rewards"

Chair: Dr. Ayman K Hamouda
Co-Chair: Dr. Santosh Aryal

Abstract: Professional Pharmacy, Dental, and Medical students who are interested in pursuing research always find themselves must choose between research projects intended for graduate students and postdoctoral researchers which they don't have the time and/or experience to do or to get involved in research opportunities intended for undergraduate students which are below their intended goals and not worthwhile their time. Therefore, providing a platform for professional program students to have structured research experience that is tailored to them is both challenging and rewarding. This Session will feature inputs and prospectives from faculty and professional students who are engaged as mentors and trainees in basic science research.

End of Oral Sessions

12:30-1:00 Students' Awards and Closing Ceremony

See you on the 43rd Annual SBEC

University of North Texas, Denton, TX, Date: 9/9-9/12-2027.

(Inquiry directed to Dr. Melanie Ecker, Program Chair (melanie.ecker@@unt.edu)).

Abstracts

1-Effects of Low-Level Laser Therapy on Patients with Carpal Tunnel Syndrome: A Systematic Review.

Felix Adah, Joy Kuebler, Kimberly Holt, and William Pannell

University of Mississippi Medical Center, SHRP, Department of Physical Therapy

Purpose/Hypothesis: Carpal tunnel syndrome (CTS) is a common entrapment neuropathy affecting many patients referred for physical therapy. It is not conclusive that Low-level laser therapy (LLLT) is effective in alleviating pain and improving functional deficits in patients with carpal tunnel syndrome. The purpose of this systematic review was to evaluate the effects of low-level laser therapy in reducing pain and increasing function in patients with carpal tunnel syndrome. **Materials and Methods:** The PubMed database was searched between January 2010 and January 2025. Specific terms and combinations were used for the search. Electronic limitations included human subjects, English-language, and randomized controlled trials. In addition to electronic limitations, an abstract screening was conducted to further eliminate studies that did not specifically focus on the effects of laser therapy on pain, hand function, or grip strength in patients with carpal tunnel syndrome. Patients with severe symptoms were excluded from the study. Study quality was evaluated using the PEDro scale, which assesses the validity of randomized controlled trials in physical therapy research. **Results:** The total number of studies that were identified by the PubMed electronic search was 22. Five studies met all the criteria for this systematic review. The average PEDro score was 8.6/10, with a range of 7/10 to 10/10. Regarding CEBM levels of evidence, all studies were assigned level II, indicating high-quality evidence.**Conclusions:** In all five studies, in the LLLT groups, there was a significant within-group difference with a decrease in pain ($p<0.05$). Four of the studies that used Grip Strength as an outcome variable showed a significant increase ($p<0.05$), and three of the studies that used the Boston Scale (Symptom and Functional Security Scale, SSS and FSS, respectively) as outcome measures demonstrated significant improvement ($p<0.05$) post-treatment. However, the effects of LLLT on the assessed dependent variables did not differ significantly from the control ($p>0.05$) in one of the studies. The PEDro scores range from 7 to 10, and the CEBM scores are II. The positive effect of LLLT on pain reduction and power grip, or increased function, in this study is well established by pre- and post-treatment analyses, although one of the studies did not show superiority of LLLT over the control. It is recommended that future research examine the energy level at which lasers can be delivered to achieve optimal clinical efficacy.

2 - Advancing Neuromuscular Disorder Diagnosis and Adaptive Electroceutical Therapy through Real-Time Electromyography and Hybrid Deep Learning

Sidharth Patsamatla[1]

[1]West Shore Jr/Sr High School

Neuromuscular disorders are a class of conditions that deteriorate the nerves controlling voluntary skeletal muscle, contributing to progressive motor dysfunction, losses in mobility and coordination, and muscle atrophy. According to the National Institute of Health, it is estimated that around every 1 in 3,500 people are affected by a neuromuscular disorder. Current clinical diagnostic approaches involve nerve conduction studies and needle electromyography, which are invasive and have limited sensitivity in detecting early neuromuscular changes. Similarly, clinical techniques for therapy such as physiotherapy, primarily manage symptoms and can't adapt to individual patient-specific anatomy. This research develops a software framework that improves the management of neuromuscular disorders through biophysical modeling and biomedical signal processing algorithms. Surface electromyography signals are preprocessed to capture high-dimensional neuromuscular time-series features. A comprehensive machine learning pipeline integrating a support vector machine (SVM) and a hybrid convolutional neural network - long short-term memory network (CNN-LSTM) was developed. The SVM is leveraged for low-latency muscle activation state detection, while the hybrid CNN-LSTM is employed for classifying spatiotemporal patterns associated with neuromuscular disorders. In parallel, a computational representation of the Hodgin-Huxley conductance model was engineered to simulate motor neuron and muscle responses under various electrical stimulation parameters. The deep learning algorithms were evaluated on various industry-standard statistical metrics. The SVM achieved a 94.4% classification accuracy with a 20 ms inference latency while the hybrid CNN-LSTM achieved a 96.1% diagnostic accuracy (ROC-AUC = 0.97), posing significant implications in the field of computational neuroengineering.

3 - Hydrogels and Thiol-ene Microparticles for Antibiotic Release to Treat Osteomyelitis

Anna Rourke-Funderburg[1], Chipo Chapusha[1], Sheetal Chowdhury[1], Amol Janorkar[1]

[1]Department of Biomedical Materials Science, School of Dentistry, University of Mississippi Medical Center

Approximately 400,000 fractures and surgical procedures per year are complicated by osteomyelitis, or infection of the bone. Current treatments rely on mechanical debridement of the infected or necrotic bone, which may create a defect in the bone that is unable to fully heal. Following debridement, antibiotics are administered either systemically or locally. Local antibiotic treatment shows optimal results but is hindered by the poor characteristics of poly(methyl methacrylate) (PMMA) bone cement which is used as the antibiotic carrier. To overcome these limitations, we are using extracellular matrix protein-based hydrogels containing collagen and elastin-like polypeptide (ELP), a genetically engineered version of mammalian elastin. Our previous work has shown these hydrogels induce bone growth *in vivo*. In this work, we paired these ELP-collagen hydrogels with antibiotic-loaded thiol-ene microparticles to investigate their drug release kinetics and biocompatibility. Microparticles were synthesized using thiol-ene polymerization and were soaked in doxycycline, a broad-spectrum antibiotic. After soaking, microparticles were mixed with collagen and ELP and allowed to solidify into hydrogels. Doxycycline release was monitored via UV-Vis spectrophotometry for 7 days. Biocompatibility was investigated by exposing pre-osteoblast cells to the samples for 7 days and measuring cell viability and DNA concentration. Doxycycline-loaded hydrogels released ~90% of their doxycycline content by day 5, while hydrogels with doxycycline-loaded microparticles released only ~35%. Microparticles alone and when incorporated into hydrogels reduced cell viability and DNA concentration compared to the control. Encapsulating the microparticles in hydrogels significantly increased both the cell viability and DNA concentration compared to the microparticles alone. This work lays the foundation for the utilization of a dual component drug delivery system based on microparticles and hydrogels. This system can both treat the osteomyelitis and regrow the surrounding bone. This project is supported by the United Stated Department of Agriculture (#2023-697013-39909) and the National science Foundation (#2414448).

4 - Small Ubiquitin-Like Modifier Protein (SUMO) Pathway Blockade For The Treatment Of Aggressive Phenotypes Of Prostate Cancer

Maysoon Makhlouf[1], Berony Geneste[1], Zakaria Abd Elmageed[1]

[1]Edward Via College of Osteopathic Medicine (VCOM)

Background and Objective: Prostate cancer (PCa) is the most frequently diagnosed malignancy among older American men, and progression to aggressive forms including castration-resistant PCa (CRPC) remains a major therapeutic obstacle. Although chemotherapy and targeted agents like enzalutamide (ENZ) constitute standard treatment options, resistance inevitably emerges. This highlights the urgent need for innovative therapeutic strategies capable of simultaneously targeting multiple oncogenic pathways. Small ubiquitin-like modifier (SUMO) proteins represent a promising target. This study aims to assess the combined antitumor effects of inhibiting cell SUMOylation and antiandrogens in aggressive PCa cells. **Methods:** Aggressive PC-3M and CWR-R1ca cells were treated with varying concentrations of specific SUMO inhibitor TAK-981, ENZ, or both agents. IC_{50} values were determined for each drug and sublethal 0.1× and 0.5× IC_{50} concentrations were selected to evaluate individual and combined effects *in vitro* and in a preclinical xenograft mouse model. **Results:** Treatment of CRPC cells with sublethal IC_{50} of TAK-981 showed a significant decrease in cell proliferation and migration ($p<0.001$). The most effective combination was 0.1× IC_{50} TAK-981with 0.5× IC_{50} ENZ. In vivo, TAK-981 (10 mg/kg/day for three weeks) reduced tumor volume by 50.1% ($p<0.001$), outperforming ENZ alone (26% reduction). Combining both agents further enhanced tumor suppression by an additional 10.3%. This was also confirmed by Ki67 immunostaining in the resected tumor tissues. **Conclusion:** The study represents novel therapeutic strategy for aggressive PCa by simultaneously targeting androgen receptor and SUMOylation pathways. Dual inhibition effectively suppressed CRPC growth, suggesting a promising approach that may improve treatment outcomes and extend patient survival.

5 - Non-invasive eyedrop based delivery system for the treatment of retinoblastoma

Daniel Alday[1], Renee Carter[1], Carlos Astete[1], Cristina Sabliov[1], Qi Cai[1]

[1]Louisiana State University

Retinoblastoma is the most common primary intraocular malignancy in children, yet treatment remains challenging due to the invasive nature of localized drug delivery and systemic toxicity associated with conventional chemotherapy. This presents an urgent need for non-invasive, accessible delivery systems to improve patient outcomes and comfort. This research presents a novel, topical delivery platform designed to cross ocular barriers and target retinoblastoma. We developed a thermosensitive in situ gel platform using 20% (w/v) Poloxamer 407 (P407). This system encapsulates ANG1005, a peptide-drug conjugate consisting of three Paclitaxel molecules linked to Angiopep-2, which targets the low-density lipoprotein receptor-related protein-1 found on Y79 cells. This formulation was optimized for its rheological properties, enabling room temperature topical application and subsequent gelation with a sol-to-gel transition of 23.61 ± 0.27°C. A human corneal-retinoblastoma co-culture model using HCE-T and Y79 cells was established to evaluate trans corneal penetration and tumor specificity. In vitro studies revealed that ANG1005 was significantly more potent than Taxol in Y79 cells, with a half-maximal inhibitory concentration of 4.43 nM compared to 10.53 nM. Finally, therapeutic efficacy and safety were validated in an orthotopic Y79-GFP retinoblastoma mouse model. In vivo data revealed that the P407-ANG1005 topical gel reduced the total radiant efficiency of

tumor eyes by ~4.8-fold compared to Saline control eyes and ~2-fold compared to P407-Paclitaxel eyes. Histological examination revealed no evidence of off-target toxicity to major organs. In conclusion, this P407-ANG1005 system provides a potent, non-invasive alternative for retinoblastoma therapy.

6 - Let's build a working model to replace radiologists with AI

David Dinhofer[1]

[1]Advanced Imaging and Informatics

I am a radiologist and medical informaticist. I have watched the transition to the (welcome) computerization of Radiology. The transition from film based documentation of imaging studies to digital imaging was a major revolution which has given us the ability to do remote reading, image quality improvement, image storage, rapid image sharing, computer aided diagnosis and more.. Over 20 years ago, the news reported that computer aided diagnosis would replace radiologists in mammography. That didn't happen. Now, the news and social media are full of reports that radiologists are no longer needed as AI will replace us (Does this sound familiar?). History tells us that is not so easy. What is it that has kept AI software from even doing a piece of the radiologists work and responsibilities. Let's take a look at the specifics of what it would take to replace a radiologist by AI software. The answer is in the details and a challenge for future engineering professionals.

7 - Extracellular vesicles reengineered with liposomes for targeted drug delivery

Santosh Aryal[1]

[1]The Ben and Maytee Fisch College of Pharmacy, The University of Texas at Tyler

Keynote: Intracellular communication maintains tissue and organ evolution across species, driven by cell-borne nanoparticulate chaperones that target cells and deliver the necessary information. These chaperones are cell-released membrane vesicles, broadly defined as extracellular vesicles (EVs), which are differentiated based on their biogenesis, release pathways, size, content, and function. The content of EVs consists of lipids, nucleic acids, and, more specifically, proteins associated with the plasma membrane, organelles, and cytosol. Due to the presence of plasma membrane and cytosolic signature proteins, EVs are well equipped to recognize target cells; therefore, they are of great interest for targeted drug delivery technologies. However, clinical translation is challenging due to the inherent heterogeneity caused by varied cellular microenvironments, limited isolation yields, and colloidal instability. Therefore, it is crucial to understand the factors that affect EV production and stability to ensure functional reproducibility. These isolated vesicles are multimodal and heterogeneous in colloidal size, ranging from 50 to 300 nanometers, and are rich in surface proteins such as CD63, HSP70, TSG101, ALIX, and NKG2D (for NK cell membrane vesicles). However, when these vesicles were reengineered with synthetic liposomes, they formed a unimodal nanoparticle. Reengineered nanoparticles were found to be highly stable for a prolonged period. To further evaluate reengineered nanoparticles, we labeled them with a near-infrared dye or a gadolinium-based contrast agent, both of which exhibit rapid cellular uptake and enhanced tumor accumulation. Given the importance of targeted drug delivery to minimize off-target effects, we are optimistic that the presented reengineering concept holds promise for designing a drug delivery system that maximizes nanoparticle homing to the tumor.

Acknowledgment: Thanks to the support from the National Institute of Biomedical Imaging and Bioengineering, 1R15EB036962-01.

8 - Exploiting Lichen Natural Products For The Development Of Novel Therapies Against Triple-Negative Breast Cancer

Hassan Ebrahim[1]

[1]Department of Biomedical Sciences, Edward Via College of Osteopathic Medicine, Monroe, Louisiana, 71203.

Triple-negative breast cancer (TNBC) is an aggressive subtype of breast malignancies defined by absence of hormone receptors and human epidermal growth factor receptor 2 (HER2). Treatment of TNBC is very challenging due to lack of well-defined molecular targets, whereas chemotherapy remains the primary therapeutic option. While many patients initially respond well to cytotoxic therapies, resistance inevitably develops, leading to deadly disease progression. Additionally, cytotoxic agents are nonspecific and associated with intolerable adverse reactions, which limit dosing and duration of the treatments. Lichens are unique symbiotic creatures of a mycobiont (fungus) and a photobiont (alga or cyanobacterium). They harbor a wide array of complex natural products with novel scaffolds that have gained more scientific interest for their potential pharmaceutical applications. Our research group has leveraged multiple lichen acids for the development of anti-TNBC therapeutics. Usnic acid, a dibenzofuran, was isolated from the fruticose lichen *Usnea strigosa* (Parmeliaceae), and showed significant anticancer properties against MDA-MB-231 and MDA-MB-468 TNBC cells at low μM levels, with minimal toxicity on nontumorigenic MCF-10A mammary epithelial cells. Furthermore, we identified the mechanistic target of rapamycin (mTOR) as a potential macromolecular target mediating the anticancer effects of usnic acid. Building up on this discovery, we employed a rational drug design strategy to synthesize usnic acid analogs with enhanced potency at nM range. Additionally, we validated the

efficacy of usnic acid analogs in TNBC preclinical mouse models, where analogs significantly suppressed tumor growth. Recently, we have discovered usnic acid analogs as novel degraders of oncogenic tyrosine kinase mesenchymal-epithelial transition factor receptor (c-Met), which were correlated with their antitumor and antimetastatic effects in in-vivo models. In conclusion, lichens offer a rich source of biomolecules with promising potential towards TNBC. Continued investigation into lichen acid molecules would enable the development of novel therapies, ultimately contributing to more effective treatment strategies for patients with otherwise difficult-to-treat TNBC.

9 - Designing Tunable Polymeric Biointerfaces to Decode Cytoskeletal Mechanics

Rupesh Kandel[1], Jacqueline Robinson[1], Laurel Fishburn[1], Jorge Almodóvar[2], Nikki Reinemann[1]

[1]University of Mississippi, [2]University of Maryland Baltimore County

Cytoskeletal components exhibit emergent behaviors that are highly responsive to the mechanical properties of their microenvironment; however, the mechanisms by which substrate mechanics regulate these dynamics remain unclear. Prior *in vitro* reconstitution assays were mostly performed on rigid substrates, limiting their physiological relevance. To overcome this constraint, we engineered mechanically tunable polymeric biointerfaces via layer-by-layer (LbL) assembly of heparin and collagen (HEP/COL) multilayers. The nanoscale architecture, thickness, and viscoelastic properties of these films were quantitatively characterized using quartz crystal microbalance with dissipation (QCM-D), revealing systematic modulation of interfacial mechanics with increasing bilayer number. Cytoskeletal interactions with these substrates were probed using total internal reflection fluorescence (TIRF) microscopy, enabling high-resolution visualization of actin filament binding, organization, and dynamics at the interface. Furthermore, optical trap-based assays were employed to quantify actomyosin activity and force generation as a function of substrate mechanical compliance. Our preliminary results demonstrate that modest variations in multilayer assembly significantly alter actin binding, filament organization, and motor-driven contractility. These findings establish HEP/COL biointerfaces as a versatile platform for dissecting the role of substrate viscoelasticity in regulating cytoskeletal mechanics and mechanobiological feedback.

10 - Geometry Over Material: Biomimetic Inspiration and Unexpected Cross-Sectional Findings in FEA Based Structural Optimization of an Upper Limb Exoskeleton Frame

Matt Liqua[1], Blythe Seraphim[1], Garrett Murdock Murdock[1], Thomas Dozier[1], Jackson Kitchens[1]

[1]Georgia Southern University

Chronic musculoskeletal conditions affect more than half of adults aged 50 and older, threatening functional independence within elderly populations. Rigid exoskeletal frames offer a potential assistive avenue, but no studies have systematically examined the structural optimization principles for this application. A structural optimization finite elemental analysis (FEA) study was conducted across fourteen design iterations of an upper arm exoskeleton, evaluating static structural, modal, transient, and fatigue performance against five engineering constraints. Across four materials on identical geometry, Von-Mises stress varied by a mean absolute deviation (MAD) of only 0.115 MPa, while total deformation had a MAD of 0.822 mm. Static and fatigue factors of safety improved by 1.8× and 1.65× respectively with the selection of aluminum 7075-T6 over aluminum 6061-T6. Rail separation distance, governed by the parallel axis theorem Ad^2 term, was identified as one of the dominant structural design variables, contributing 64.7× more to the second moment of area than cross-sectional geometry alone. The dual rail system governed Von-Mises stress by distributing applied loading across two parallel members, reducing the stress demand on each. Only three of fourteen iterations satisfied all five constraints simultaneously: V10, V13, and V14. Contrary to the biomimetically inspired hypothesis, hollow circular rails outperformed avian inspired hollow elliptical rails at equal cross-sectional area, reducing equivalent stress by 47%, total deformation by 61%, and increasing fundamental frequency by 81%. These findings suggest that for rigid wearables, geometric configuration governs structural performance, while material determines static and fatigue factors of safety.

11 - Reversible, site-specific blood-brain barrier modulation by high-definition transcranial direct current stimulation of piezoelectric nanoparticles.

Salona Roy[1], Umisha Siwakoti[2], Daniel Alday[1], Carlos Astete[1], Cristina Sabliov[1], Elisa Castagnola[2], Qi Cai[1]

[1]Louisiana State University, [2]Louisiana Tech University

Precise, noninvasive, and reversible modulation of the blood-brain barrier (BBB) represents a transformative strategy for targeted cortical drug delivery and the treatment of central nervous system disorders, including neurodegenerative diseases. However, current approaches are often invasive and lack spatial specificity. Recent advances in high-definition transcranial direct current stimulation (HD-tDCS) enable focal neuromodulation, while piezoelectric nanoparticles (PNPs) offer a unique platform for converting electrical stimulation into localized mechanical cues. Here, we present a tunable and spatially precise platform integrating HD-tDCS with piezoelectric nanoparticles for controlled BBB modulation. In methodology, custom tungsten electrodes and a multielectrode array (MEA) were engineered to deliver focal electrical stimulation using an animal stimulation device. Poly(lactic acid) (PLLA) nanoparticles were synthesized and surface-functionalized with albumin to

enhance biocompatibility and BBB targeting. In vitro BBB models were incubated with PLLA-Alb nanoparticles followed by direct current stimulation. For in vivo validation, rodents received nanoparticle administration followed by MEA stimulation then permeability, reversibility, and tissue safety were assessed. BBB modulation in vitro was evaluated using trans-endothelial electrical resistance (TEER), apparent permeability, and immunohistochemical analysis of tight junction proteins. BBB permeability was tunable regulated as a function of stimulation intensity, duration, and nanoparticle concentration. Optimal in vitro modulation was achieved at 0.10 mA for 5 min with 0.5 mg/mL nanoparticles, with complete recovery of barrier integrity within 3 h. In vivo, optimal parameters were 150 mg/kg nanoparticle dose and 0.8 mA stimulation for 8 min. FITC-dextran confirmed localized BBB opening, while immunohistochemistry demonstrated no significant alterations in tight junction integrity or glial activation markers, supporting reversible BBB modulation without overt neurotoxicity or inflammation. These findings establish a safe, reversible, and translationally promising platform for targeted CNS therapeutic delivery.

12 - Choline-Based LAT1 Substrate Ionic Liquids as potential Drug Delivery Enhancers

Mercedes Pride[1], Eden Tanner[1]

[1]University of Mississippi

L-type amino acid transporter 1 (LAT1) mainly transports large, neutral, and essential amino acids across cell membranes; specifically leucine, isoleucine, valine, phenylalanine, tryptophan, tyrosine, methionine, and histidine. This transporter is also expressed at the blood brain barrier to allow the transport of nutrients and is overexpressed in multiple cancers. We therefore see an opportunity to utilize this mechanism for targeted delivery in multiple disease models. We synthesized 7 of the 8 amino acid substrates into choline based ionic liquids (ILs) at 1:1 and 1:2 ratios and used those ILs to modify different polymeric nanoparticles (PLGA and PEG-PCL). Chemical and physical characterization of these materials were conducted using techniques including Fourier Transform Infrared spectroscopy, Nuclear Magnetic Resonance spectroscopy, Dynamic Light Scattering, Scanning Electron Microscopy, and Thermogravimetric Analysis. Biological experiments (Hemolysis and Cytotoxicity) were performed to assess biocompatibility with red blood cells and other cell types. Other biological experiments (Fluorescence-Activated Cell Sorting of whole blood and cellular uptake) were used to determine if modifying these polymeric nanoparticle systems results in an increase of affinity towards certain biological components. After evaluating the performance of these materials, any samples that show promising results will continue to be studied with specific cell types and environments to mimic certain disease models.

13 - Elastin-Based Coatings to Enable Long-Term 3D Adipose Spheroid Culture and Recapitulate Hypoxia-Induced Insulin Resistance

Sheetal Chowdhury[1], Joshua Speed[2], Gene Bidwell[3], Amol Janorkar[1]

[1]Department of Biomedical Materials Science, University of Mississippi Medical Center, Jackson, MS, [2]Department of Physiology and Biophysics, University of Mississippi Medical Center, Jackson, MS, [3]Department of Neurology, University of Mississippi Medical Center, Jackson, MS

Current *in vitro* adipose models fail to capture key aspects of progressive adiposity, particularly gradual intracellular lipid accumulation within a long-term three-dimensional (3D) structure. To address this, we developed elastin-like polypeptide-polyethyleneimine (ELP-PEI) coatings to support 3D spheroid formation of human adipose-derived stem cells (hASCs) and their differentiation into adipocytes over extended culture periods. To enhance spheroid adhesion and retention, ELP was functionalized with Arg-Gly-Asp (RGD) motifs at either the N- or C-terminus, generating RGD-modified ELP-PEI conjugates. These constructs were synthesized using genetically engineered Escherichia coli expressing ELP-$(RGD)_3$ or $(RGD)_3$-ELP, followed by EDC/NHS-mediated conjugation with PEI. Both 3T3-L1 preadipocytes and hASCs were cultured on coated plates, forming spheroids within 3 days and undergoing adipogenic differentiation and maturation for up to 8 weeks. Functional assessments included spheroid morphology, glucose uptake, and expression of adipogenic markers such as adiponectin and PPAR-γ. ELP-PEI coatings supported stable spheroid formation with enhanced adipogenic differentiation, evidenced by a fourfold increase in triglyceride accumulation but showed spheroid loss over the culture period. In contrast, RGD-modified coatings impaired adipogenic maturation, with transient spheroid disassembly followed by reformation into larger aggregates. Increasing spheroid size on ELP-PEI induced hypoxia, marked by elevated HIF-1α levels and reduced glucose uptake, indicating insulin resistance. Similar trends were observed in hASC spheroids. Treatment with a HIF-1α inhibitor restored glucose uptake, demonstrating reversibility. Overall, ELP-PEI coatings enable long-term 3D adipose culture that recapitulates hypoxia-induced, reversible insulin resistance, providing a physiologically relevant platform for studying adipose dysfunction and reducing reliance on animal models.

14 - Ionic Liquid Coated PEG-PLGA Nanoparticles for Transporter-Independent Brain Delivery of Thyroid Hormone (Liothyronine) via Red Blood Cell Hitchhiking

Hena Gain[1]

[1]University of Mississippi

Drug delivery to the brain remains one of the biggest challenges in medicine. The blood-brain barrier prevents approximately 98% of small molecule drugs and nearly all large molecules from entering the brain, limiting treatment of diseases such as Alzheimer's, Parkinson's disease, and transporter-deficient conditions including Allan-Herndon-Dudley syndrome (AHDS). AHDS is an X-linked neurodevelopmental disorder caused by loss-of-function mutations in the thyroid hormone transporter, MCT8. Without functional MCT8 at the blood-brain barrier, circulating triiodothyronine (T3) cannot adequately enter the brain, resulting in central hypothyroidism and elevated peripheral T3 levels. Conventional thyroid hormone replacement does not correct this deficit, highlighting the need for transporter-independent delivery strategies. A new approach uses ionic liquid coatings that enable nanoparticles to hitchhike on red blood cells, improving brain delivery of thyroid hormone without the MCT8 transporters. We are developing PEG-PLGA nanoparticles that encapsulate T3 and are surface-modified with a choline-based ionic liquid to enable MCT8-independent delivery. The nanoparticles are produced by nanoprecipitation and coated to control hydrodynamic diameter, surface charge, and stability. Optimized formulations show reproducible sizes with low polydispersity and a mildly anionic zeta potential suitable for red blood cell (RBC) hitchhiking. The nanoparticles exhibit high T3 encapsulation efficiency, sustained release, and efficient uptake in HMC3 microglial cells. In mouse and human whole blood, ionic liquid-coated nanoparticles show higher RBC hitchhiking than bare PEG-PLGA while maintaining hemolysis below 5%, and >90% cell viability up to 2 mM. These results support ionic liquid-coated PEG-PLGA nanoparticles as a promising transporter-independent platform for targeted thyroid hormone delivery to the brain.

15 - Guided Degeneration: Using Generative AI Failure to Inform Early-Stage Wearables Design

Benjamin Bush[1]

[1]Auburn University

Advances in artificial intelligence (AI)-driven text-to-image generators have enabled the rapid production of high-fidelity visual content, yet these systems lack an inherent understanding of aesthetic appropriateness, contextual meaning, or physical feasibility. Within a lectrue-based classroom setting, this research examines how emerging designers can leverage both the strengths and limitations of generative AI to support early-stage brand exploration.

Rather than optimizing prompts toward an idealized final image, students were encouraged to continually push the AI beyond the brand's desired visual language and mark the point where clarity, brand coherence, or plausibility degraded. This process reframed image "failure" or degeneration as a productive design signal rather than an error. As AI output diverged from intended brand values, students demonstrated heightened aesthetic sensitivity and intervened to support potential user appropriateness.

The findings suggest that AI image degeneration can function as a pedagogical mechanism, helping students articulate their own comprehension of design knowledge and refine visual intent through contrast and misalignment. This paper proposes a model of human-AI co-creation in which young designers act as interpretive agents, guiding, correcting, and critically curating algorithmic output.

Such a framework has broader implications for visual communication disciplines, including the design of wearables where customer accuracy, appropriateness, and cultural context are essential. By positioning AI as a catalyst for reflection rather than an aesthetic authority, this research contributes to emerging discussions on responsible and effective human-centered AI integration in design practice.

16 - Rewiring Addiction: Modulation of Brain Networks in Methamphetamine Dependence

Greyson Jadwin[1], Michael Minamyer[1], Bo Wood[1], Patrick Patisaul[1], Nicholas Mccomb[1], Kevin Murnane[1], Jamie Toms[1], Deepak Kumbhare[1]

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Methamphetamine (Meth) addiction is a growing problem in the U.S., with overdose rates rising and no definitively effective drugs or methods to treat the condition. Chronic meth usage causes a pathological increase in connectivity between the elements of the default mode network (DMN) and abnormal signaling in reward circuitry of the brain, both being associated with addiction. There has been imaging done by our team that shows a rigid connectivity between the elements of the DMN in patients with meth addiction. One supposed solution to this is psychedelics, a class of drugs with shown capability for altering network connectivity and increased neuroplasticity in the brain. In efforts to study this, our team administered psychedelics (2,5-Dimethoxy-4-iodoamphetamine (DOI) and Psilocybin) to naïve rats. EEGs were conducted on these rats, followed by coherence, correlation, and weighted phase lag index analyses showing a reduction in the interaction between DMN elements. In future efforts we plan to assess the spectral and connectivity metrics in meth-addicted rats pre and post psychedelic exposure in the DMN and reward circuits. A second solution being explored by our team is the utilization of deep brain stimulation (DBS) on the nucleus accumbens to restore healthy signaling in these networks. Through our team's work we intend to develop new and effective strategies for altering neural pathways reducing or removing the cravings associated with addiction entirely.

17 - A Multi-Study sEEG Research Platform for Seizure Prediction and Cognitive Mapping in Drug-Resistant Epilepsy

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Stereoelectroencephalography (sEEG) offers exceptional spatiotemporal resolution for studying epileptic networks and cognition in patients undergoing surgical evaluation for drug-resistant epilepsy. We describe the establishment and expansion of a structured sEEG research program at LSU Health Shreveport built across four interdisciplinary studies.

Two foundational studies have been completed. The first validated a stimulus-locked neural recording framework, demonstrating reproducible, channel-specific cortical responses to auditory stimuli across implanted sEEG contacts, confirming the technical integrity of our acquisition pipeline. The second applied a feature-based machine learning approach incorporating RMS amplitude, spectral entropy, and event-related spectral perturbations to classify preictal, ictal, and postictal neural states, achieving 92.7% accuracy (AUC = 0.93) with a K-nearest neighbors classifier.

Two prospective studies are now underway. The first extends our paradigm to an associative memory task with psychophysical response tracking, examining the neural correlates of encoding and retrieval in relation to seizure burden and surgical outcome. The second establishes a multi-institutional collaboration applying advanced machine learning to pooled sEEG datasets, targeting improved generalizability and early seizure onset prediction.

This program demonstrates the feasibility of conducting rigorous, multi-study cognitive and electrophysiological research within the clinical sEEG framework. Our results support sEEG as a dual-purpose platform capable of advancing both mechanistic understanding of epilepsy and clinically translatable seizure forecasting tools.

18 - Reducing Low-Yield Colonoscopy using Machine Learning

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Colorectal cancer (CRC) screening commonly relies on endoscopic tests to detect precancerous lesions. Flexible sigmoidoscopy (FSG) is a short endoscopic examination that inspects the rectum, but it does not visualize the entire colon. Colonoscopy requires intensive bowel preparation and often sedation to examine the entire colon. In a Prostate, Lung, Colorectal, and Ovarian (PLCO) Cancer Screening Trial, FSG is used as a screening test; participants with FSG-detected polyps were referred for diagnostic colonoscopy. Many of these follow-up colonoscopies do not reveal advanced neoplasia and can be considered “low yield”. Reducing low-yield colonoscopies without missing important lesions is a key goal for improving the value of CRC screening.

We use colorectal datasets from the PLCO Cancer Data Access System, which include colorectal screening data with FSG exam-level data. Colonoscopy yield is classified as high-yield if advanced colorectal neoplasia is documented in the corresponding diagnostic exam and low-yield otherwise. Predictor variables are derived from FSG exam data. We outlined a modeling strategy that compares logistic regression with Gradient Boosting ML methods to estimate the probability that a referred colonoscopy will be high-yield.

The PLCO colorectal dataset is used to identify FSG patterns associated with higher and lower probabilities of advanced neoplasia. Logistic regression and XGBoost ML models are compared to determine whether incorporating more detailed FSG data meaningfully improves risk stratification beyond simple exam result categories.

Using detailed FSG data from the PLCO colorectal screening datasets, it is possible to build and evaluate models that estimate the probability that a follow-up colonoscopy will detect advanced colorectal neoplasia. By framing results in terms of colonoscopy yield, this approach provides a transparent way to explore how FSG findings and ML could support more targeted use of colonoscopy in colorectal cancer screening.

19 - Classification and clustering of mortality outcomes in colorectal cancer on long panel PLCO data

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INTRODUCTION: Most existing predictive studies frame colorectal cancer (CRC) mortality as a binary outcome (alive vs. dead), which can obscure clinically meaningful distinctions between cancer-specific mortality and competing risks. Further, modeling of treatment outcomes of long panel data has been a major challenge for several reasons: (a) lack of data for a good long panel (b) identification of cause of exit/death (c) lack of sufficient factors in the panel data (not much missing data in the panel) (d) lack of validated computational tools/methods in this domain.

DATA: We choose the PLCO data that is one of the longest and richest panel data for mortality outcomes in USA available in public domain, enrolling about 155,000 participants between 1993 and 2001 and still following patients in 2025. Cohort assembly and harmonization produced a modeling cohort of 2,473 confirmed CRC cases. Our classes are: alive, death by CRC

and death by other causes. The dataset was partitioned using train-test splits (75/25, 80/20, and 85/15), and class imbalance was handled using SMOTE upsampling, Tomek, and Edited Nearest Neighbors.

METHODS: Models evaluated were Logistic Regression (one-vs-rest and multinomial), Random Forest, Extra Trees, Gradient Boosting, AdaBoost, Decision Tree, Linear Discriminant Analysis, Quadratic Discriminant Analysis, Naive Bayes, k-Nearest Neighbors, and Support Vector Machines. Hyperparameters were tuned and 5-fold cross validation was performed. K-means and DBSCAN clustering were also performed. Fetcher importance was observed.

RESULTS/CONCLUSION: Random Forest achieved the best overall performance with 86.4% accuracy and F1 score of 0.85. Clustering gave deeper insight into the data from an unsupervised perspective. Our models are not merely learning mortality status but are capturing clinically meaningful distinctions between competing causes of death. The scientific contribution is the multiclass approach and long panel modeling in this domain. This work is potentially significant because it can be applied in other long-panel data involving medical outcomes.

20 - Repurposing Cisplatin into Pt(IV) prodrug with varied lipophilicity for targeted anticancer effect

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Despite its status as a gold-standard chemotherapeutic, cisplatin, a platinum (II) complex, is suffered by rapid systemic clearance, off-target toxicity, and the emergence of chemoresistance. To circumvent these pharmacological barriers, research has pivoted toward octahedrally coordinated platinum (IV) prodrugs, which offer enhanced kinetic stability, reduced toxicity, reduced off-target interactions, and show target-specific effects. This study reports the synthesis and chemical characterization of novel cisplatin-based Pt (IV) derivatives functionalized via axial coordination with butyric, isobutyric, and trimethylacetic acids. By employing these specific aliphatic motifs, the lipophilicity and reduction potentials of the complexes were strategically modulated. The synthesized derivatives were obtained in favorable yields (50%-80%), with structural integrity and purity were confirmed via NMR spectroscopy, FT-IR, and thin-layer chromatography (TLC). Stability assays demonstrated that these complexes remain inert under physiological conditions and are susceptible to intracellular reduction. Current efforts involve quantifying the extent of platinum-DNA adduct formation and determining IC_{50} values across various malignant cell lines to elucidate the impact of axial ligand branching on antiproliferative activity. Finally, a potent analog is selected to engineer nanomedicine to target specific drug delivery and therapeutic outcomes, which shows enhanced drug delivery as compared to that of the free drug. While more study is needed to understand a structural activity relation, we are optimistic that these strategic derivatizations could hold promise for repurposing new drug candidates.

21 - Biomaterial-Enabled Release of Bioactive Metal Ions for Vascularized Tissue Regeneration

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Developing biomaterials that mimic native tissue microenvironments is essential for enhancing regenerative outcomes. This study reports biodegradable zinc- and magnesium-integrated electrospun scaffolds that replicate extracellular matrix architecture while enabling controlled release of bioactive metal ions. Cellular studies using human dermal fibroblasts, endothelial cells, and macrophages evaluated cell behavior, immunomodulation, and angiogenic potential. Zn^{2+} release enhanced fibroblast differentiation, as indicated by increased α-smooth muscle actin and vimentin expression, and promoted macrophage polarization from a pro-inflammatory M1 phenotype toward a regenerative M2 phenotype. In combination with fibroblast-derived soluble factors, controlled Zn^{2+} release significantly increased endothelial metabolic activity and neovascularization, evidenced by elevated CD31 and VE-cadherin expression in HUVECs. Collectively, these findings demonstrate that metal-integrated scaffolds create a pro-regenerative microenvironment that supports angiogenesis and wound healing, highlighting their potential for vascularized tissue regeneration applications.

22 - Thiol-ene Microparticle Platform for pH-Activated Release of Doxycycline

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Doxycycline is a broad-spectrum tetracycline antibiotic with anti-inflammatory and anti-collagenase properties, making it beneficial for treating bacterial and inflammatory diseases. This study synthesized thiol-ene microparticles for pH-responsive doxycycline release to improve local drug delivery while reducing systemic exposure and antibiotic resistance. Four microparticle formulations (F1-F4) were synthesized via suspension polymerization and loaded with Doxycycline at 20 mg/mL

(D20) or 50 mg/mL (D50) for 24 hours. Drug release was evaluated in PBS at pH 3, 5, 7, and 8 over 5 days using NanoDrop UV-Vis analysis. Antibacterial activity against Methicillin-resistant Staphylococcus aureus (MRSA VA 1312/10) was assessed. Thiol-ene microparticles (~325 μm) were successfully synthesized and exhibited stable, pH-dependent doxycycline release. In the initial antibacterial study, formulations were pre-soaked in 50 mg/mL doxycycline (D50) and showed reduced MRSA counts by day 1 relative to the starting inoculum (7.67×10^7 CFU/mL). By day 7, F1 showed continued bacterial reduction; F2 achieved complete eradication; F3 showed bacterial regrowth; and F4 showed no significant change. Based on these results, F2 was selected for further evaluation under drug-loaded and unloaded conditions. F2 microparticles pre-soaked in 20 mg/mL (D20) or 50 mg/mL doxycycline (D50) were tested at non-cytotoxic loadings of 2-12 mg, alongside free doxycycline as a positive control. All drug-loaded groups achieved complete MRSA eradication by day 1, while unloaded controls showed normal bacterial growth relative to the starting inoculum (3.00×10^7 CFU/mL). Overall, F2 microparticles released sufficient doxycycline to eliminate MRSA and prevent regrowth, performing comparably to free doxycycline.

23 - Assessment of Progressive Training with Serious Games for Wearable Temporalis EMG Wheelchair Control

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Amyotrophic Lateral Sclerosis (ALS) is a neurodegenerative disease that leads to a gradual decline of musculature control. This progressive loss can limit the patient's ability to use assistive technology interfaces, such as a powered wheelchair joystick. A novel electromyographic (EMG) temporalis interface was designed to enable hands-free joystick control for patients with neurodegenerative diseases, helping them retain their functional independence. The interface collects signals from temporalis muscle activation and translates them into motor outputs. This interface has been tested in a previous study using a PC gamified training platform through *Limbitless Journey*. Previous literature has established that increasing fidelity in simulated training environments can enhance the performance of trained real-world tasks. To adhere to this concept, this study extended into Virtual Reality (VR) and Mixed Reality (MR) modes. Progression through training modes may allow users to become more familiar with the training system while nurturing real-world skills.

This study seeks to evaluate the efficacy of a progressive training regimen for learning how to navigate a hands-free powered wheelchair. Participants will be split into two cohorts, with cohort 1 undergoing static training using only the PC version of *Journey.* Participants in cohort 2 will undergo progressive training using the PC, VR, and MR modes. After completing the training, both cohorts will perform a series of tasks using the Dalhousie University Wheelchair Skills Test. Results will cultivate a better understanding of the efficacy of a progressive training program as well as assess the generalizability of skills learned in the gamified environment.

24 - Anti-Gastrostomy and Anti-Fouling Gastrostomy (PEG) Tube

Hannah Yared[1], Nadine Hassanieh[1]

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Percutaneous endoscopic gastrostomy (PEG) tubes provide long-term enteral nutrition for patients who cannot safely swallow, but accidental dislodgement and clogging remain common complications that interrupt feeding and require urgent intervention. These issues are especially problematic in home-care and low-resource settings where timely tube replacement may not be available, increasing the risk of infection, stoma closure, and prolonged nutritional disruption.

This project proposes a PEG tube safety system designed to reduce tube failure through three integrated features: a force-attenuating retractable sheath, a breakaway connector, and an anti-fouling internal coating. The retractable mechanism dissipates external forces applied to the tube, while the breakaway adapter disconnects under excessive tension to prevent displacement of the internal retention bumper. A zwitterionic anti-fouling coating reduces microbial adhesion and biofilm formation to help minimize clogging.

Key design criteria include reducing accidental dislodgement forces, maintaining adequate nutritional flow rates, and ensuring compatibility with existing PEG systems. Initial CAD development and FEA modeling demonstrate feasibility in reducing force transmission to the internal retention mechanism.

Current limitations include potential spring fatigue during long-term cyclic loading and the challenge of balancing sheath flexibility with durability. Future work will focus on mechanical testing, material optimization, and flow rate evaluation to assess long-term reliability and clinical performance.

25 - CFD/FSI-Guided Optimization of a Low-Resistance Ventilator Inline Mixing Chamber for Uniform Aerosol Medication Delivery

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Ventilator-integrated aerosol delivery systems require compact inline components that improve medication-air mixing while minimizing added resistance in the breathing circuit. Although prior respiratory aerosol studies have examined nebulizer placement, delivery efficiency, and deposition behavior, less attention has been given to chamber-level optimization of compact ventilator-inline mixing devices using mixing-uniformity and hydraulic-performance metrics. This study presents a computational fluid dynamics (CFD) and one-way fluid-structure interaction (FSI) investigation of a ventilator inline medication mixing chamber designed for standard respiratory connectors. Steady incompressible Reynolds-averaged Navier-Stokes simulations were performed using the shear stress transport (SST) k-ω turbulence model, and medication transport was modeled using passive scalar transport for early-stage design screening.

These responses guided multi-objective geometry selection that balanced outlet uniformity, hydraulic resistance, and structural response. CFD screening showed that increasing inlet velocity from 0.4 to 0.8 m/s increased pressure drop (ΔP) from 0.8641 Pa to 2.4937 Pa, whereas outlet coefficient of variation (CoV) changed only from 0.0016 to 0.0019.

Geometric screening showed that increasing outlet diameter from 5 mm to 7 mm reduced ΔP from 0.8641 Pa to 0.4550 Pa while maintaining CoV at 0.0016. In the final optimized CFD/FSI comparison, a 100 mm × 25 mm chamber reduced high-flow ΔP from 2.4936 Pa to 2.4459 Pa, CoV from 0.0019 to 0.0017, and maximum deformation from to relative to the 100 mm × 22 mm baseline. These results establish a reproducible preliminary CFD/FSI optimization framework for future transient breath-profile analysis, multiphase aerosol modeling, and experimental validation.

26 - Feasible Diagnostic Region Exploration for Edge-Oriented Melanoma Screening Decision Support

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Melanoma screening AI is often evaluated as a standalone image-classification task, but translation toward biomedical decision-support instrumentation requires more than high accuracy. A practical screening workflow must jointly consider sensitivity, specificity, false-negative risk, cross-dataset behavior, and eventual edge-inference feasibility. This study presents a feasibility-oriented framework for organizing open-source melanoma diagnostic AI development using a top-down inductive design exploration method (IDEM). Public ISIC Challenge 2016 and 2017 dermoscopic image datasets were used to construct melanoma-versus-benign pipelines with class-weighted ResNet18 and lightweight MobileNetV2 models. Diagnostic requirements were defined as sensitivity ≥ 0.80, specificity ≥ 0.70, and AUC ≥ 0.80. Candidate configurations were organized across dataset, model architecture, class weighting, preprocessing, and decision threshold. Hyper-dimensional error margin index (HDEMI)-based robust feasibility evaluation was used to classify candidate operating points as feasible or infeasible, and an SVM-based active-learning layer was added to reduce exhaustive candidate evaluation while preserving feasible-region identification.

Preliminary results showed that a class-weighted ResNet18 model on ISIC Challenge 2016 achieved a feasible operating point with sensitivity of 0.808, specificity of 0.711, and AUC of 0.823. On Challenge 2017, MobileNetV2 improved held-out test AUC to 0.833 and achieved sensitivity of 0.752, specificity of 0.770, and balanced accuracy of 0.761 at a validation-selected balanced threshold, approaching but not fully satisfying the predefined feasibility criteria. Active learning reduced HDEMI-evaluated configurations from 303 to 121, a 60.07% reduction, while maintaining 99.67% agreement with the full HDEMI-based reference classification. These results support feasible-region exploration as a decision-support strategy for robustness-aware, edge-oriented melanoma screening systems.

27 - Development of a 3D-printed polylactic acid trabecular bone scaffold enabling hematopoietic stem cell-derived cells production for blood transfusion.

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Global demand for packed red blood cells (RBCs) exceeds supply, with over 85 million units collected annually yet limited by donor availability, blood type compatibility, and transfusion risks. In vitro generation of universal O/Rh(-) RBCs from hematopoietic stem cells (HSCs) offers a promising alternative, but current systems lack sufficient yield. Because erythropoiesis depends on the bone marrow niche, we developed a biomimetic 3D culture platform to enhance RBC production.

A trabecular bone scaffold was designed from human femur CT data using 3D Slicer and fabricated in polylactic acid (PLA) via fused filament fabrication, with perfusion components printed by stereolithography. Human umbilical cord blood-derived HSCs were co-cultured with M2 macrophages within a closed perfusion system to recreate erythroblastic island (EBI) niches. Erythroid maturation was assessed by microscopy, flow cytometry, and oxygen-binding analysis.

The 3D scaffold supported spatial organization of EBIs and promoted physiologic maturation, producing erythrocytes with characteristic biconcave morphology, hemoglobin expression, and oxygen-carrying capacity. Co-culture within the scaffold yielded 56% mature RBCs versus 26% in 2D or scaffold-free conditions.

This perfusable PLA-based system effectively recapitulates key features of the bone marrow microenvironment and significantly improves erythropoiesis efficiency. It represents a scalable platform for producing transfusion-ready RBCs in vitro. Future work will optimize culture parameters and evaluate in vivo functionality and survival in murine transfusion models.

28 Influence of Solvent Selection on GelMA Hydrogel Properties: Implications for Preparation and Performance

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Gelatin methacryloyl (GelMA) hydrogels are typically prepared in phosphate-buffered saline (PBS), Dulbecco's phosphate-buffered saline (DPBS), or deionized (DI) water, with solvent choice often treated as a methodological detail rather than a critical design variable. Here, we show that solvent selection significantly influences the physical properties of GelMA hydrogels. To examine this effect, GelMA hydrogels were prepared at varying concentrations using the same photo-crosslinked conditions, and were subsequently evaluated through rheological, mechanical, and swelling analyses. The findings demonstrated clear solvent-dependent differences in viscoelastic properties, compressive modulus, and swelling behavior, with the solvent-dependent response varying across rheological, mechanical, and swelling measurements. Overall, PBS generally yielded the stiffest hydrogels; DI showed the highest swelling, and DPBS exhibited intermediate but distinct responses. These results indicate that solvent selection directly influences the hydrogel network formation and contributes to differences in equilibrium structure and final material performance. The observed differences further suggest that solvent choice should not be treated as interchangeable during GelMA hydrogel preparation. Instead, it should be considered a critical experimental variable that strongly influences hydrogel behavior and final performance. Ongoing degradation studies are being conducted to further examine how solvent-dependent network differences influence long-term hydrogel stability and behavior over time.

30 - Additive Manufacturing of Multi-Stimuli Responsive Shape Memory Polymer for Biomedical Applications.

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Thermo-responsive Shape Memory Polymers (SMPs) are among the prospective classes of smart materials, which respond to a multi variety of stimuli, but their use in applications involving dynamic environments, e.g., the GI tract, is limited by the mismatch in mechanical properties compared to soft tissue materials. In this work, we aim to evaluate and compare thiol-ene-based SMP systems created via conventional casting and Stereolithography (SLA) 3D-printing technologies for the purpose of creating patient-specific self-softening devices for GI applications. Resin compositions comprising TATATO and TMTMP monomers along with photoinitiator (TPO) and additional ingredients (Pyrogallol and Sudan-1) were developed for SLA 3D-printing on Phrozen Sonic Mini 8KS, while casting resins contained no additives. The comprehensive analysis of these networks involved FTIR analysis to ensure full conversion of thiols and Rheology tests to characterize printability of materials, as well as Thermomechanical Analysis (DMA) under both dry and physiological (PBS) conditions. The obtained polymer networks exhibited self-softening effect, with glass transition temperature of samples varying from 25 to 40°C in dry condition and reducing when placed in PBS due to water-induced plasticization. Mechanical test showed that dry samples were rigid with E modulus ≈ 1.3 GPa, whereas wet samples became soft with E ≈ 15 MPa, retaining their dimensions with minimal swelling (~<1.6%). Qualitative and quantitative Shape Memory test results showed high recovery efficiency (98-100%), and SLA-printed systems also displayed fast recovery triggered by water (1.5 to 2.0 seconds). Printed thiol-ene polymers were non-toxic to cells and biocompatible, having high configurability and fast response to water and temperature.

31 - Fatty Acid-Modified Chitosan Membranes: Dual Antimicrobial and Occlusive Effects on Periodontal Bacteria

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Guided bone regeneration (GBR) membranes are used to support bone regeneration following periodontal disease or injury, but bacterial contamination when exposed remains a significant challenge. Chitosan's intrinsic antimicrobial properties make it a promising candidate for GBR membrane development. This study evaluated the antimicrobial and bacterial occlusive characteristics of hexanoic anhydride-modified electro-spun chitosan membranes (HA-ESCMs) against *Porphyromonas gingivalis*, as compared to a commercial collagen membrane.

Sterile HA-ESCMs and collagen GBR membranes were punched and fitted into 24-well plate cell crowns. *P. gingivalis* was seeded into upper chamber and incubated anaerobically for 1, 4 and 7 days (n = 4). Bacterial viability in the supernatant, on

the membrane and at the bottom of the wells was measured by BacTiter-Glo. Live/dead staining and scanning electron microscopy (SEM) were also used to evaluate viability and bacterial attachment.

Bacterial viability decreased from day 1 to day 7 in the supernatant and on the membrane by 75% and 74% for HA-ESCM, and 95% and 89% for collagen, respectively. There was no statistically significant difference in bacterial viability between HA-ESCMs and collagen membranes ($p > 0.05$). Lowest bacterial viability was observed at the bottom of the wells consistently which confirmed both membranes inhibited bacteria penetration. Live/dead and SEM imaging supported these findings, showing no viable and adherent bacteria on the membrane surfaces.

These results indicate that HA-ESCMs have antimicrobial activity and may be useful as GBR membranes for periodontal regeneration applications.

32 - Engineering Equity: Low-cost Development of a Female Crash Test Dummy

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Crash test dummies are critical instruments for assessing automobile injuries and improving vehicle safety. Their high precision biofidelity identifies the probability of injury (PI) to validate car protective systems. However, the current models contain a significant gender-based data gap. While the 50th percentile male model has advanced exponentially, there is no standardized, low-cost dummy for the 50th percentile female body. This anatomical oversight fails to account for physiological discrepancies between the sexes, leading to women being 47% more likely to be severely injured in collisions than their male counterparts. This project seeks to address these inaccuracies by developing an affordable, biofidelic torso modeled after the 50th percentile woman.

Women sustain disproportionately high rates of trauma to the torso, head, and cervix. This study prioritized the development of these areas, optimizing the accuracy of the skull, spine, ribcage, and pelvis. To simulate the structural modulus of bone, polyethylene terephthalate glycol (PETG) was utilized for the skeletal framework. Its fracture resistance and structural precision during 3D printing contributed to accurate female dimensions and bodily structure. Additionally, silicon with a Shore Hardness of 30 and 45 was used to mold tissues, internal organs, and intervertebral disks. Their mixture ratios were tailored between tissue softness and cartilage firmness. Leveraging the refined crash test dummy dimensions, load cells, tri-axial accelerometers, and gyroscopes were placed on prominent PI areas to capture high-resolution kinematic data. A machine learning model trained with public datasets from the National Highway Traffic Safety Administration (NHTSA) calculated the Abbreviated Injury Scale (AIS) to quantify trauma based on anatomic structure and severity. This affordable, standardized assessment provides a predictive tool that can account for specific vulnerabilities of female physiology in automobile collisions.

Further research will refine the model's biofidelity to meet NHTSA standards by developing articulated limbs with high-mobility joints. Especially in the lower extremities, refining the materials used to simulate leg and foot dynamics will capture another susceptible PI area in women.

33 - Evaluating the Suitability of a Circumferentially Arranged Haptic Feedback System for Future Application in Upper Limb Prostheses

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Persistent high rejection rates of upper-limb myoelectric prostheses are partially attributed to the device's inability to provide somatosensory feedback. The integration of somatic sensation in prostheses includes using technology to create a feedback loop between the device and user, a feature missing from many prosthetic devices that can improve control and embodiment. This research aims to examine the feasibility of motor vibrations to understand how vibrotactile sensations can improve human-machine interactions.

A study is being conducted to assess the effectiveness of circumferentially arranged haptic feedback systems for future application in upper-limb prostheses. A haptic language consisting of nine vibrational patterns was developed along with a prototype haptic sleeve that was placed on the non-dominant arm. Users first complete a 10-minute familiarization period with access to a haptic language aid, followed by two evaluation periods with no aid. The evaluation periods examine user ability to identify the haptic patterns from memory both with and without cognitive load. To simulate cognitive workload found in everyday life, users complete a jigsaw puzzle while receiving sporadic haptic cues.

Preliminary data regarding pattern matching accuracy, system usability, user experience, and perceived workload has been collected. Post-assessment surveys used to assess the usability and intuitiveness of the haptic system include the System

Usability Scale (SUS), NASA Task Load Index (NASA-TLX) and User Experience Questionnaire (UEQ). Continued data collection is underway to better understand the effectiveness of the haptic feedback system and advance the development of real-time feedback in myoelectric prostheses.

34 - Suppression of T Helper Cells by Abatacept Experimental PCOS

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Polycystic ovary syndrome (PCOS) is the most common endocrine disorder in women of reproductive age, frequently associated with hyperandrogenism and low-grade systemic inflammation. However, the precise pathways underpinning chronic inflammation remain elusive. This study aims to test whether suppression of T helper cells (Th cells) with Abatacept (ABT) decreases chronic inflammation in a rat model of PCOS. Abatacept treats autoimmune diseases by blocking T cell activation. To produce a rat model with a hyperandrogenic state similar to that of women with PCOS, female Sprague Dawley rats were implanted with dihydrotestosterone (DHT) pellets subcutaneously (7.5 mg/ 90 days). These rats were referred to as hyperandrogenemic female (HAF) rats. After eight weeks of DHT treatments, all rats received intravenous infusions of Abatacept (100mg/kg). Following seven days of infusion, blood samples were collected, and peripheral blood lymphocytes were then isolated. The percentages of CD4+ and CD8+ T cells were measured by flow cytometry. In HAF rats, the percentage of CD4+ T cells was significantly elevated, but it was normalized after Abatacept infusions. In the placebo rats, there was no significant elevation of CD4+ T cells, and the Abatacept infusions had no effect. The study suggests that suppression of CD4+ cells as a potential source of inflammatory cytokines with an anti-inflammatory drug such as Abatacept is a potential treatment for the chronic inflammation in PCOS.

35 - Vertical Integration and Clinical Application for Histology and Anatomy Review Curriculum in a Medical School

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Introduction: Fourth-year medical student review courses vary widely across medical schools, often lacking a structured approach. The integration of foundational and clinical sciences into medical education is a new paradigm that necessitates a new approach, innovative technologies, and a commitment from educators. **Methods:** We implemented histology and pathology together to review histology content, integrate clinical cases, discuss with students, and present students' cases during the review of the histology curriculum. The anatomy review curriculum utilizes virtual reality (VR) and simulation to teach anatomy with clinical applications to fourth-year medical students. **Results**: These approaches reflect the Institutional requirements of the updated curriculum in the School of Medicine, aiming to improve the alignment of educational content with topics relevant to residency and internship. The addition of clinical case integration and simulation training enables learning through repetition with real-time feedback and immediate rewards for successful task completion. These factors enrich the learning process for medical students, preparing them for real-life clinical scenarios. **Conclusion**: Innovative educational frameworks enable students to acquire essential anatomical knowledge and procedural skills, thereby enhancing their readiness for future clinical responsibilities.

36 Thiol-Clickable Gelatin-Based Hydrogels for 3D Cell Culture

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Covalently crosslinked gelatin hydrogels (ex: gelatin methacrylate, GelMA) have been investigated for use in three-dimensional (3D) cell culture due to inherent bioactivity and proliferation within the denatured collagen precursor. Current systems, however, lack precise control over mechanical properties, and therefore limit the ability to tailor the microenvironment for specific cell types. In addition, the currently utilized chain-growth photopolymerization mechanism has a potential for side reactions with embedded cell surface components and requires harsh irradiation conditions, which could lead to cytotoxicity.

To overcome these limitations, a superfast curing mechanism is suggested, in which thiol groups react efficiently with non-homopolymerizable alkenes to produce a well-defined matrix that does not require a high radical concentration for photoinitiation. Mechanical customization of the hydrogel is achievable through variation in degree of functionalization of the gelatin backbone, dependent on conditions such as pH, reactant concentration, and time, as well as crosslinker length and branching. We aim to provide a framework for GelAGE (allylated) and GelSH (thiolated) hydrogel fabrication by elucidating the molecular mechanism of gelatin functionalization and the crosslinking reactions controlling network stiffness. Although each hydrogel system can independently achieve a wide range of compressive moduli, further customization can be achieved through orthogonal interpenetration of allylated gelatin (GelAGE) crosslinked with various thiol monomers and thiolated gelatin (GelSH) crosslinked with various diene monomers or direct crosslinking of GelAGE with GelSH precursors. These

insights provide the foundation for engineering hydrogels that mimic the viscoelastic and structural characteristics of cartilage, enabling advanced in vitro models for osteoarthritis research.

37 Removal of Microplastics from Industrial Water Using Chitosan-Coated Textile Lint: A Sustainable Approach to Wastewater Remediation

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Microplastic pollution has become a great environmental concern due to its durability in aquatic ecosystems and harmful effects on marine life and human health. Conventional removal methods often involve non-biodegradable chemicals, and high costs. Single use of chitosan often results in smaller flocs and lower efficiency, even though it has been found as a biodegradable flocculant for microplastic removal. This study proposes a sustainable remediation strategy by utilizing textile lint, an abundant byproduct of the textile industry, as a fibrous substrate coated with chitosan to enhance flocculation of microplastic and sedimentation.

Textile lint having a high surface area, porous structure, and interconnected fibrous network that improves contact with suspended microplastic particles. The fibers enhance microplastic removal through physical entrapment, interception, and bridging mechanisms, while also promoting hydrophobic interactions with microplastic particles along with surface modification which further introduces positively charged functional groups that attract negatively charged microplastics through electrostatic interactions, and enhances removal efficiency.

Textile lint was modified using chitosan solutions of different concentrations (0.3%, 1%, and 1.5%) to enhance its ability to capture suspended microplastic particles. Flocculation experiments were conducted and particle aggregation, and removal efficiency under varying treatment dosages was evaluated. Fourier Transform Infrared Spectroscopy (FTIR), Thermogravimetric Analysis (TGA), and Differential Scanning Calorimetry (DSC) was applied for material characterization, to confirm successful surface modification, and assess material stability.

Preliminary results with higher chitosan concentrations showed improved and faster floc formation and showed effective sedimentation of microplastics. Biological validation was done using brine shrimp exposure tests which indicated significantly reduced ingestion of fluorescent microplastics after treatment.

This study highlights a circular economy strategy that transforms abundant textile waste into an eco-friendly microplastic contaminated water treatment material, offering scalable potential for sustainable wastewater management and microplastic pollution control.

38 - Detecting and Identifying Inflammatory Biomarkers in a Female Hyperandrogenemic Rat Model of Polycystic Ovary Syndrome

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Polycystic ovary syndrome (PCOS) is the most common hormonal disorder in post-pubertal women. Although low-grade systemic inflammation and hyperandrogenism are associated with PCOS, the specifics of both symptoms' pathological involvement in the PCOS disorder remain unclear. Currently, a question of particular interest is the different inflammatory biomarkers and the hyperandrogenemic female (HAF) rat, a direct reflection of a human female case of PCOS. This study aims to simulate and establish knowledge in relation to hyperandrogenism in human females, using female HAF rat models to determine the inflammatory biomarkers of hyperandrogenemic female HAF rats. To produce a rat model with a hyperandrogenic state similar to that of women with PCOS, female Sprague Dawley rats were implanted with dihydrotestosterone (DHT) pellets subcutaneously (7.5 mg/ 90 days) at age 4-5 weeks. After 10-12 weeks of DHT treatments, blood samples were collected, centrifuged, and different cytokines were analyzed in plasma using the Quantikine ELISA assay. In the collected results, specific cytokines increased in the HAF rat model, like the IL-6 cytokine, which was the most elevated and exhibited around a 3-fold increase. The study suggests an association of chronically elevated androgens with inflammatory cytokines and a potential immune system dysregulation in HAF rats. Moreover, these findings suggest that reducing the inflammation or blocking these cytokine pathways could improve immunopathogenesis in PCOS patients.

39 - Biocompatibility of SAM-Functionalized ITO Surface for HT-29 Colon Cancer Cell Culture: Toward a Gut-on-Chip Platform

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Purpose: This research was conducted to study the biocompatibility of indium tin oxide (ITO) surface functionalized with different self-assembled monolayers (SAM), such as ITO-APTES (-NH_2), ITO-MPS (-SH), and ITO-ODT (-CH_3), toward HT-29 human colon cancer cells, and to find the best surface for culturing these cells.

Method: ITO substrates were functionalized via wet chemistry and characterized by water contact angle goniometry and ATR-FTIR spectroscopy. HT-29 cells were cultured in all ITO-based SAMs using ITO as a control. Cell proliferation was assessed by inverted microscopy (Days 1-2); viability by automatic cell counter, AAT Bioquest Live/Dead fluorescence assay with ImageJ quantification, and metabolic activity by MTT assay (absorbance at 570 nm, reference 630 nm) after 48-hour culture on ITO, ITO-APTES, ITO-MPS, and ITO-ODT.

Results: ATR-FTIR confirmed SAM deposition on all surfaces. Contact angles ranged from 44.65° ± 2.94° (ITO-APTES, hydrophilic) to 104.55° ± 3.22° (ITO-ODT, hydrophobic). ITO-APTES and ITO-MPS showed superior HT-29 proliferation by Day 2. Live/Dead analysis indicated the highest viability on ITO-APTES, consistent with favorable -NH_3^+ membrane electrostatic interactions. MTT assay data ranked ITO-APTES highest, followed by ITO-MPS, ITO-ODT, and bare ITO.

Conclusion: ITO-APTES is the optimal SAM-modified substrate for HT-29 culture, yielding the greatest metabolic activity, cell proliferation, and live/dead ratio. These data support ITO-APTES as a conductive platform for future NMR-based metabolomic studies of colon cancer cells and using this surface in a microfluidic device to engineer a Gut-on-Chip platform.

40 - Integrity of the acetabular wall with augmentation of acetabular defect

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BACKGROUND: A total hip arthroplasty is an effective and cost-efficient orthopedic surgical procedure that is aimed at reconstructing the acetabulofemoral joint to improve function in patients with hip related pathologies. (Varacallo et al., 2025) In total hip arthroplasty (THA), surgeons use radiographic imaging and templating to position the prosthetic cup according to the press-fit principle, where slight underreaming creates contact force between the rim and peripheral bone that overall improves joint stability post-operatively. (Widmer et al., 2002) Although surgeons commonly underream the acetabulum by 1-2 mm, excessive underreaming or removal of the acetabular rim defects may weaken stability and increase the risk of acetabular fractures, particular in patients with poor bone quality.(Fehring et al., 2014; Amirouche et al., 2014; Zhang et al., 2025) In this study we aim to identify the acetabular wall stiffness and strength as determined by levels of underreaming based on the presence of a superolateral defect using bone surrogates. It is hypothesized that there is a correlation between a decreased in stiffness and strength of the acetabular wall when a defect is present and reamed out.

METHODS: Fourteen polyurethane bone surrogate hemipelves with a 57 mm acetabulum were used as specimens. Seven of the specimens were induced with a superolateral acetabular defect that was consistent with the Paprosky type IIB classification. (Telleria & Gee, 2013) The specimens were potted in resin and then reamed from 54 mm to 61 mm and then subjected to mechanical testing using an Instron 8874 with a custom fixture. The peak expansion force at failure was recorded for the control and defected samples based on level of underreaming.

RESULTS: The expansion force at which failure was reached was affected by the underreaming diameter in both the control and defected surrogate pelvises. At 1 mm underreaming there was little difference between the control and defected samples ($p = 0.05$) with a average force of 85.19 ± 7.63 N and 78. 01 ± 3.90 N, respectively. At 4 mm underreaming, the stiffness of the control was higher than the defected sample with a force of 189.28 ± 29.25 N and 159. 11± 19.99 N, respectively, needed to achieve failure ($p = 0.05$).

CONCLUSION: Increasing the underreaming causes improved resistance to expansion forces however it reduces structural stiffness in defected acetabulum. These findings suggest that aggressive reaming in conjunction with larger cup implantation in defected acetabulum may increase implant stability but at the risk of structural failure. (Amirouche et al., 2014; Gautreaux et al., 2023) Ultimately, future studies using cadaveric models and physiological loading conditions are needed to further define the underreaming thresholds and their effects on acetabular stiffness and integrity.

41 - Surface Engineering of PEEK and PEKK Implants for Enhanced Cellular Response

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Objective: This study aimed to evaluate the effect of sulfonation on the surface properties and biological performance of polyetheretherketone (PEEK) and polyetherketoneketone (PEKK) implants, focusing on enhancing cellular response for potential dental and craniofacial applications.

Methods: Implants were fabricated in four groups: untreated PEEK (PEEK), untreated PEKK (PEKK), sulfonated and hydrothermally treated PEEK (sPEEK), and sulfonated and hydrothermally treated PEKK (sPEKK). Surface characterization was performed using scanning electron microscopy (SEM), Fourier-transform infrared spectroscopy (FTIR), contact angle analysis, and surface profilometry with Laser Confocal Microscopy (LCM). SEM and confocal images assessed surface roughness and porosity, while FTIR confirmed chemical modification. Hydrophilicity was evaluated by contact angle analysis. *In vitro* studies using MC3T3 osteoblastic cells assessed cytocompatibility via MTT assay, DNA quantification, alkaline phosphatase (ALP), and Alizarin Red assays. *In vivo* studies were initiated on rats ($n=5$ per group) with cranial implantation of samples; animals were sacrificed for subsequent micro-CT, histological, and mechanical push-out evaluations, which are currently ongoing.

Results: SEM and confocal analyses revealed markedly increased surface roughness and porosity in sPEEK and sPEKK compared to untreated controls. FTIR spectra confirmed sulfonic acid groups after sulfonation and their subsequent removal after hydrothermal treatment. Contact angle measurements showed enhanced hydrophilicity for all sulfonated surfaces. Cell culture assays demonstrated significantly higher cell viability, DNA content, ALP activity, and mineralization in sulfonated samples, confirming improved osteogenic potential. Statistical analysis confirmed significant differences ($p < 0.05$) among groups.

Conclusion: Sulfonation followed by hydrothermal treatment effectively modified PEEK and PEKK implant surfaces, creating micro-rough, porous, and hydrophilic morphologies conducive to enhanced cellular activity. These findings suggest surface-engineered PEEK and PEKK polymers as promising next-generation biomaterials for dental and craniofacial implant applications. *In vivo* outcomes are currently being processed to validate their performance further.

43 - Computational Modeling of Bur-Bone Interaction and Thermal Response in Sinus Surgery

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Bone removal using high-speed rotary burs is a fundamental component of many surgical procedures, particularly in ear, nose, and throat (ENT) interventions such as sinus surgery. Unlike conventional twist drills, surgical burs enable controlled, layer-by-layer bone removal near critical anatomical structures, where excessive heat generation can cause thermal damage to affected bone and tissue. However, predicting heat generation during bone removal remains challenging due to the complex interaction between surgical technique, tool geometry, and bone material behavior.

This study presents a computational framework for modeling bur-bone interaction and associated heat generation during sinus bone removal. A high-fidelity three-dimensional numerical model was developed using LS-DYNA coupled with the Smooth Particle Garlerkin (SPG) method, which is well-suited for capturing large deformation, material separation, and complex contact conditions. To improve clinical relevance, surgeon-informed inputs, including feed rates and applied loads, were identified through collaboration with otolaryngologists to incorporate into the modeling approach.

Simulations were conducted on a representative bur-bone analog system to predict temperature distribution under simulated operating conditions. Simulation results were evaluated against measured temperature data from controlled experimental testing.

The results demonstrate strong agreement between the SPG model and the experimental results, with a prediction error of less than 2%. Although this study focused on sinus surgery, the validated SPG framework is broadly applicable to other surgical procedures involving high-speed bone removal.

44 - Ovarian Vein Syndrome: A Case Report on Cadaveric Study

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Objection: Ovarian vein syndrome is a rare disease that may cause acute or chronic pain in the flank and pelvis. However, there has been debate about the existence of this medical condition. This cadaveric finding reported a case of an 85-year-old female donor with a dilated right ovarian vein and ureter.

Finding: There is a noticeable increase in the size of both the right ureter and ovarian vein, which measure 7.16mm and 5.53mm, respectively. The right renal pelvis has a diameter of 17.54 mm. The measurement of the left ureter and ovarian vein was 1.41mm and 3.34mm, respectively. The diameter of the left renal pelvis is 7.37mm.

Discussion: The majority of the population's right ovarian vein drains into the IVC through a narrow angle. The donor's ovarian vein drains to the junction of the right renal vein and the IVC at a 90-degree angle. This anatomical variation, along with the current generated by the right renal vein and the IVC, can slow down the blood circulation in the right ovarian vein. The right ovarian vein widened over time. The ureter was squeezed against the IVC and the right common iliac artery due to the enlarged ovarian vein.

Conclusion: The dilation of the right ovarian vein may have been caused by anatomical variation or stenosis of the right ovarian vein at the junction of the right renal vein and the IVC. When dealing with chronic pelvic pain conditions, healthcare professionals should be aware of the anatomical variations of the ovarian vein.

45 - Promising anticancer potential of the nutraceutical supplements, dimethyl sulfoxide (DMSO), methyl sulfonyl methane (MSM) and ethyl pyruvate (EP), in specific DMEP formulations

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Background: Allopathic anticancer treatments face several challenges, underscoring the need for cheaper and safer therapeutic strategies. Cancer cells use oxidative stress and redox signaling for their aggressive growth, and several plant-derived antioxidants, e.g. Sulforaphane, Curcumin, etc., are being tested as alternate cancer therapies. However, human approval of these experimental phytochemicals will require significant time, cost, and will face uncertainty in the clinic. Several small molecule antioxidants are approved as generally recognized as safe (GRAS) nutraceutical supplements. Therefore, we are investigating the anticancer effects of already tested and approved nutraceutical combinations. Our published studies showed that dimethyl sulfoxide (DMSO), often used as a topical anti-inflammatory agent, can suppress aggressive properties in prostate cancer (PCa) cells and rapidly decreases androgen receptor (AR) expression. Here, we present data on the effects of combining DMSO with two other GRAS-approved nutraceuticals, i.e. methyl sulfonyl methane (MSM) and ethyl pyruvate (EP).

Methods. Two aggressive PCa cell lines (C42B and 22Rv1) were exposed to low doses of DMSO (0.5-3.0%), MSM (0.5-3.0%) or EP (0.05-0.4%), alone or in specific DMEP combinations. Cell proliferation was measured following both acute (24-96 h) or chronic (10-12 days) exposures. Cell migrations were measured by wound-heal assay at 12-48 h, and clonogenic abilities on PCa cells were measured by CFU-assays after 12-14 days. Western immunoblot studies measured their temporal effects on AR protein levels, both the full-length AR and of the constitutively active AR-variant, AR-V7.

Results. Acute exposure to individual agents showed a dose-dependent suppression in proliferation (~30-90%), migration (~25-85%) and clonogenic ability (50-90%). Interestingly, a more potent suppression in all three aggressive properties in PCa cells was observed following exposure to much lower doses of each agent in DMEP combinations. Chronic exposures (2 wk/ 3 times) to lower doses of DMEP showed a profound level of suppression in cancer cell growth and viability. Immunoblots showed rapid decreases in both AR and AR-V7 proteins in both cancer cell lines.

Conclusions. At clinically achievable doses, DMSO, MSM and EP, especially in specific DMEP combinations, show potent anticancer effects *in vitro*. Their safety-tested use in humans suggests that DMEP formulations may have great promise as a chronic and safe therapy in cancer patients.

46 - Assessing the Effects of Multiplayer Gameplay with a Wearable EMG Flex Controller for Prosthesis Training

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Electromyographic (EMG) sensors placed on the surface of the skin record electrical signals generated by muscle contraction, which are translated to prompt prosthesis actuation. Training adherence may improve the muscular control required for EMG prosthesis actuation. EMG-powered prostheses introduce benefits including increased capabilities, comfort, and control, especially for children with congenital limb differences. Gamified training in pediatric populations is proven to facilitate faster and more efficient prosthesis control. Existing literature suggests that multiplayer gameplay results in increased enjoyment and social connectivity, which may increase training adherence. However, this had not been studied in a gamified EMG training environment.

Limbitless Redline is a multiplayer side-scrolling motorcycle racing game that combines classic motorcycle racing with combat elements. Players control acceleration by contracting their non-dominant forearm muscles with an EMG Flex Controller and manage steering with a one-handed controller.

Participants were split into 4 cohorts containing 1, 2, 3, and 4 players, respectively, and played three rounds of *Limbitless Redline*. Post-assessment surveys were completed after gameplay to compare the effects of single and multiplayer environments. 48 participants were included in the analysis. Results show that enjoyment was higher in cohort 4 than in cohort 1, and that social connectivity was higher in all multiplayer cohorts (2, 3, and 4) compared to the single-player cohort 1. These results support that engagement factors increase in multiplayer environments. Multiplayer capabilities in gamified training may improve adherence to training methods and the overall user experience.

47 - Radiomic Feature Analysis of Post-Treatment Surveillance Imaging to Identify Residual Disease in Head and Neck Squamous Cell Carcinoma: A Machine Learning Approach

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INTRODUCTION: Surveillance imaging for head and neck cancer patients treated with definitive chemoradiotherapy has difficulty differentiating residual disease from radiation changes or inflammation. Early detection of residual disease is crucial as these patients have poor outcomes if not treated aggressively. Conversely, imaging shortcomings may lead to unnecessary interventions, including salvage surgery in patients without residual disease.

PURPOSE: To assess the use of machine learning models to differentiate residual disease from radiation changes using radiomic features extracted from surveillance CT scans.

MATERIALS AND METHODS: A HIPAA-compliant, IRB-approved retrospective post hoc analysis was performed on patients with squamous cell carcinoma of the head and neck(HNSCC) treated with definitive chemoradiotherapy. Thirty-six patients with reported residual disease on the first surveillance CT soft tissue of the neck (two months post-chemoradiation) were selected. Follow-up imaging, salvage surgery pathology, and long-term outcomes were collected. Gross tumor volumes (GTVs) were transferred from the treatment planning CT (CT1) to a DICOM viewer (MIM Software Inc., v6.7.10). A radiologist contoured residual lesions on the two-month follow-up CT (CT2) and three-month follow-up PET/CT (CT3). GTVs were exported to MATLAB via a Java extension in MIM, and radiomic features were extracted from 2D ROIs and 3D VOIs using in-house algorithms. Machine learning models then identified features predictive of disease progression.

RESULTS: Support vector machine models using 2D radiomic features from CT2 were associated with residual disease on PET/CT (AUC=0.702). 2D features from PET/CT had moderate predictive ability for positive pathology (AUC=0.667). Neural network and random forest models of 3D features from CT2 and PET/CT showed good and moderate predictive ability (AUC=0.720 and 0.678, respectively).

CONCLUSION: Radiomics-based machine learning shows promise for non-invasively distinguishing residual HNSCC from post-radiation changes, supporting more precise surveillance and reducing unnecessary salvage interventions. Larger prospective validation is warranted.

48 Optimizing Imaging Selection in Pediatric Appendicitis: The Role of Body Composition and Anthropometric Measures

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INTRODUCTION: Appendicitis is among the most common causes of acute pediatric abdominal pain and surgical intervention. Ultrasonography is the recommended first-line imaging modality in children; however, obesity adversely affects diagnostic accuracy and time-to-diagnosis, often necessitating CT due to ultrasound artifact. While elevated BMI is known to impact adult appendicitis outcomes, the influence of abdominal adiposity on diagnostic accuracy in children remains poorly characterized.

OBJECTIVE: To determine the correlation between abdominal adipose distribution, anthropometric measures, and the diagnostic accuracy of ultrasound versus CT in detecting appendicitis in obese and lean pediatric patients.

MATERIALS AND METHODS: An IRB-approved, single-center retrospective pilot study(2015-2019) screened 1,111 pediatric patients with appendicitis-like symptoms; 396 met inclusion criteria (evaluated with both ultrasound and abdominal CT). Two independent medical students, trained by a board-certified body fellowship radiologist, performed measurements using OsiriX MD (v9.0.2): waist circumference (WC) at the iliac crest and sagittal abdominal diameter (SAD) at L4/L5. Paraspinal muscle and abdominal fat volumes were quantified from a single L4/L5 slice using sliceOmatic (Tomovision v5.0) multi-layer segmentation. Alvarado scores were derived from clinical and laboratory findings. Pearson correlation coefficients and a two-way mixed-effects ICC model evaluated relationships and observer reliability.

RESULTS: SAD and WC demonstrated strong direct proportionality to total adipose tissue(cm^2), with R^2=0.79 for both measures—paralleling prior adult findings. Inter-observer agreement was excellent (ICC=0.99).

CONCLUSION: SAD and WC are robust, highly reproducible surrogates for abdominal adiposity in children. These findings support their integration into imaging-pathway decisions, with ongoing analyses aimed at defining anthropometric thresholds that optimize ultrasound-versus-CT selection—potentially reducing cost, radiation exposure, and time-to-treatment in pediatric appendicitis.

49 - The Silent Liver in a Viral Storm: Fibrosis Progression and Clinical Severity in MASLD Patients with COVID-19

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PURPOSE: Metabolic dysfunction-associated steatotic liver disease (MASLD) is increasingly recognized as a contributor to systemic inflammation and metabolic dysregulation, potentially predisposing patients to severe COVID-19 outcomes through progressive hepatic fibrosis. This study examines fibrosis progression and clinical severity in MASLD patients diagnosed with COVID-19, providing insight into interactions between liver disease, inflammatory response, and disease progression.

METHODS AND MATERIALS: This IRB-approved, HIPAA-compliant retrospective single-center observational study analyzed patients with prior MASLD diagnosis who underwent non-contrast or contrast-enhanced CT imaging between January 2004 and June 2016(N=621). Demographic, imaging, clinical, and laboratory data were extracted from electronic health records, including COVID-19 testing and hospitalization history (January 2019-December 2021), laboratory values within one year of COVID-19 diagnosis, BMI, diabetes status, age, and antihypertensive medication use (ACE inhibitors vs. ARBs). Serologic FIB-4 and NAFLD fibrosis scores were calculated. Patients missing required laboratory values were excluded, yielding a final cohort of 33 patients.

RESULTS: Six patients with longitudinal laboratory data demonstrated increased fibrosis scores at the time of COVID-19 diagnosis, suggesting possible progression of hepatic dysfunction. Among hospitalized patients, 50% were receiving ACE-inhibitor therapy, while none were on angiotensin-receptor blockers (ARBs), warranting exploration into a potential association between ACE-inhibitor use and COVID-19 severity in MASLD patients.

CONCLUSIONS: MASLD patients diagnosed with COVID-19 exhibited elevated fibrosis scores, suggesting hepatic disease progression influenced by systemic inflammatory stress. Prevalent ACE-inhibitor use among hospitalized patients highlights the need for further research into metabolic-liver interactions affecting disease severity. Given the rising U.S. prevalence of MASLD, these preliminary findings underscore the necessity of larger-scale studies to stratify MASLD-associated risk in viral illness and define mechanisms influencing patient outcomes.

50 - Computational Chemistry - Inclusive Tools to Study Nanomaterials

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Nanomaterials and their derivatives play an increasingly important role in the consumer market. Sustaining this growth requires continuous investigation of their properties and the development of new materials with improved performance and functionality.

Computational chemistry provides efficient and cost-effective methods for studying nanomaterials. Among them, Density Functional Theory (DFT) is widely used to evaluate the fundamental properties of novel nanomaterials and to establish relationships between their structures and properties. These approaches also support the rational design of materials with targeted characteristics.

Some nanomaterials may pose risks to the environment and human health. Therefore, their toxicity must be carefully evaluated before commercial application. Computational tools offer efficient strategies for predicting the toxicity of nanomaterials, often even prior to their experimental characterization.

Recent advances in computer hardware have significantly accelerated the development of computational techniques capable of exploiting increased computational power. Molecular dynamics (MD) methods are among the most important of these approaches, providing tools to investigate structural changes in nanomaterials and their interactions with surrounding compounds as a function of time.

This presentation will discuss effective computational approaches and current challenges in the study of nanomaterials. Examples illustrating the applications of DFT, toxicity predictions, and molecular dynamics simulations will be presented. The talk will conclude with a summary of recent progress in the field and perspectives on future developments.

51 - Tissue Engineered Bioactive Scaffolds for Spinal Fusion Applications

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Spinal fusion is a surgical intervention that has been widely used to treat a range of spinal pathologies, including degenerative disc disease, Scoliosis and vertebrae fractures. Although this is a promising treatment, the failure rate is still high, ranging from 10% to 46% mostly due to inadequate fixation and insufficient bone ingrowth leading to reduced bone-implant interface integration [1]. Materials commonly used for implanted cages include titanium alloys, durable polymers like polyether ether ketone, and biodegradable options such as polylactic acid (PLA), while higher stiffness in metal cage often causes local bone absorption by stress shielding, weaker stiffness and quicker degradation in PLA can lead to premature failure of the implant before the bone tissue has fully united. In fusion, the ideal implant not only can maintain stable bone contact with minimized stress shielding but also can induce rapid bone formation between vertebrae. Polycaprolactone (PCL) is an FDA-approved biodegradable, biocompatible polymer that can be used in a broad range of tissue engineering applications but has not been used for spinal fusion. Compared to PLA, PCL has a low melting temperature of 60°C, a slower degradation rate and a better mechanical property [2], which provides long-term structural stability making it a more suitable biomaterial for weight-bearing bone tissue regeneration. Recent advances in 3D printing and stem cell biology have enabled us to develop a novel tissue engineered biomimetic PCL scaffold to replace traditional interbody cages for enhanced spinal fusion. In this study, we aim to first optimize the PCL scaffold structure design by correlating pull-out forces and stiffness with lattice density and different surface patterns, and then combined with growth factor JAG1[3] and stem cells for enhanced bone regeneration. 3D-printed polylactic acid porous implants with four different densities (10%, 15%, 20%, and 25%) and two lattice patterns (gyroid and honeycomb), each with a 20 mm diameter were tested in two phases using an Instron 8874 mechanical testing machine (Instron, Norwood, MA). Our findings suggest that gyroid in the 25% infill density resulted in the highest contact stability but also greater stiffness that could hinder bone integration while lowest density lattice lacked contact stability. The compromise between contact stability and lattice stiffness was found for gyroid patterns at 20% infill density, which can be used for optimal implant design. More importantly, when this optimized scaffold combined with growth factor JAG1 coating and bone marrow stem cell loading, a significantly enhanced chondro-osteogenesis was observed inside the scaffold. These data clearly indicate our novel designed, 3D printed, JAG1 coated, and stem cell seeded scaffold not only has improved stability with optimized structure and surface but also has strong chondro-osteogenic induction which could be used to replace traditional cages for rapid spinal fusion.

53 - Characterizing Neuronal Spike Activity and EMG Correlates in Patients Undergoing Deep Brain Stimulation

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Neurons within the motor territories of the basal ganglia play a critical role in modulating movement and shaping the motor profile of an individual. Understanding this neuronal encoding could provide biomarkers for adaptive deep brain stimulation (DBS). This project aims to determine how neuronal spike activity changes during active and passive body movements and to develop algorithms capable of identifying firing patterns corresponding to specific motor actions. Movement disorders affect over 300 million people worldwide and arise from disrupted signaling within the basal ganglia-thalamocortical circuit; however, the neuronal mechanisms underlying movement generation and pathology remain poorly understood. Using intraoperative microelectrode recordings (MER) from patients undergoing DBS, neuronal discharges were captured during active and passive limb movements, with simultaneous intraoperative electromyography (EMG) recordings obtained to correlate neural firing with muscle activation and movement onset. Spike sorting and classification were performed using a custom MATLAB-based interface employing amplitude thresholding, principal component analysis, and k-means clustering, followed by analysis with a validated tri-component discrimination algorithm quantifying Poissonian irregularity, burstiness, and non-stationarity. We hypothesized that neuronal spike characteristics dynamically shift with voluntary movement and tremor, producing distinct signatures reflective of motor intent, muscle activation, or pathological oscillations. Preliminary results support this hypothesis, revealing region-specific transformations in firing behavior, particularly burstiness, pausing, firing rate, and oscillatory activity within the globus pallidus internus (GPi) during tremor episodes. These findings suggest that neuronal spike features, integrated with intraoperative EMG activity, may correlate with movement and support future closed-loop DBS systems.

54 - BEAUTY BEYOND JEWELRY: Genuine vs "Fake-News" Metallo-Intercalation of Glowing Golden-Triangle & Platinum-Chain Phosphors in Polymer Nanocomposites for Dual Bioimaging/Therapeutic Apps

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This project describes sensitization the photoluminescence quantum yield (PLQY) of novel “light-switching complexes” *vs* state-of-the-art predecessors. DNA intercalation in predecessors is manifest *via* pendant ORGANIC ligands (*i.e.*, distant-dppz in $[Ru(bpy/phen)_2dppz]^{2+}$ away from metal centers) *vs* INORGANIC-coordination-sphere genuine metallo-intercalation herein (*e.g.*, triangular gold(I)-9-membered-ring cyclic-trinuclear complexes; oligomeric-chain platinum(II)-bis(pyridyltriazolates)). Phosphorescence sensitization for $[Ru(bpy)_2dppz]^{2+}$-type conventional metallo-intercalators entails PLQY increases from merely 10^{-4} (0.01%) levels in buffer solutions without DNA to merely 10^{-3} (0.1%) levels in buffered-aqueous DNA or organic solvents. Novel complexes herein can attain drastically higher sensitization to reach PLQY = 0.5-1.0 (50-100%) “on” state levels in aqueous media of micellar biocompatible polymers nanoparticle; indeed, even the “off” level herein is higher than the “on” level of conventional metallo-intercalators (0.5% *vs* 0.1%)! The light-switching “on” state herein, therefore, amounts to 100x > its “off” state and > 500x or > 5000% the “on” state of Ru(II)-dppz complexes! Furthermore, DFT computations reveal > 50% higher binding energy to DNA base pairs by representative planar phosphors *vs* conventional organic intercalators. The combination of extremely high PLQYs in aqueous buffer environments and high binding energies of the novel metallo-intercalators are promising toward alternative dyes in standard agarose gel electrophoresis kits used for DNA bioimaging (*e.g.*, ethidium bromide; ellipticine; cyber-safe series) upon further developments of different classes of d^{10} and d^8 bright/fast phosphors (> 50% PLQY/100 ns lifetime range) under investigation.

55 - The Role of the Cation in Ionic Liquid Facilitated Transdermal Transport

Alysha Hunter[1]

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Transdermal drug delivery is inviting to researchers and patients because it is non-invasive, painless, and avoids the first-pass effect. This method is easily administered further increasing patient compliance. However, the excellent barrier function provided by the top layers of the skin means that most drugs cannot traverse the skin without aid. Ionic liquids (ILs), which are salts that are liquid <100 C, have been shown to act as chemical permeation enhancers and facilitate delivery of large molecules, including protein therapeutics such as insulin. Previous work has established the importance of the anion’s chemical structure, however the role of the cation has yet to be explored. In view of this, a range of nitrogen-based cations were synthesized with 2-octenoic and citronellic acid anions in a 1:2 ratio. The ability of the ILs to transport Rhodamine-tagged 10,000 g/mol Dextran, a model hydrophilic drug, across the skin barrier was examined through ex vivo porcine skin experiments. Franz Diffusion Cells were assembled to mimic the transport of the drug through the skin and into the bloodstream. The drug was extracted from the skin and into 50% Methanol/PBS by removing the different layers of skin and putting them into scintillation vials. The samples were centrifuged to remove any pieces of skin, and the liquid was placed into a 96 well plate. The Rhodamine-

tagged Dextran was measured using a fluorescent plate reader to quantify the amount of dye-tagged dextran in each layer of the skin. The results indicated that there is a significant difference between the choline and pyridinium cations when paired with the citronellic anion in the epidermis, and choline and imidazolium cations paired with 2-octenoic acid in the dermis layer. This supports the conclusion that the cation does play a part in facilitating the transport in some cases despite the anion's interactions with the skin lipids. Fourier transform infrared spectroscopy was also used on thin skin sections to determine whether the ionic liquids are facilitating diffusion by extracting lipids or fluidizing them to cross the stratum corneum barrier.

56 - Efficacy of Therapeutic Gaming System After Stroke Stabilization in the Acute Setting- Design of A Pilot Study

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Strokes, caused by a disruption of cerebral perfusion, are the third leading cause of death and disability worldwide. With an estimation of nearly 800,000 incidences per year , developments in care remain crucial for continued best practice regarding treatment. After stabilization, early rehabilitation is thought to be essential to prevent maladaptive neuroplastic changes though barriers to care include prolonged wait times for rehabilitation programs, prescription of rote movement rehearsal, and a need for healthcare provider observation The aim of this pre-post pilot study is to evaluate the efficacy of combined rehabilitation within the context of the acute rehabilitation setting against a control group. As a supplement to traditional rehabilitation, serious games may provide participants with structured task repetition within the context of progressive exercise in the hope of motor learning towards the restoration of functional limb movement and improved quality of life. Patients will be given a tablet and Flex Controller, allowing for the measurement of contractile force through velocity changes as detected by surface electromyography sensors. Serious games developed by the research facility will be used as an adjuvant to traditional rehabilitation. Before and after intervention, participants will complete various surveys, including the Stroke Study Quality of Life Index and the Inpatient Rehabilitation Facility- Patient Assessment Instrument, section GG. Additionally, the use of a novel program, the Muscular Discretization Assessment Tool, was developed for the measurement of accuracy, repetitions, and strength of muscular contraction in stroke patients.

57 - A Reproducible AI-Driven Framework for Multi-Group Gene Expression and Pathway Analysis

Clever Nyengerai[1], Maricica Pacurari[1]

[1]Jackson State University

Modern science can now study thousands of genes at the same time using advanced technologies such as RNA sequencing (RNA-seq) and quantitative PCR (qPCR). These technologies produce huge amounts of data, but analyzing the information can be difficult, time-consuming, and confusing because researchers often need to use many different computer programs. This study introduces a new artificial intelligence (AI)-assisted system that makes gene analysis faster, easier, and more organized within one complete workflow.

The system automatically performs important steps needed to prepare and analyze gene data. These steps include cleaning the data, organizing it, adjusting values for fair comparison, and combining information from different experiments. The AI system also compares healthy and treated samples to identify genes that become more active or less active under certain conditions. This helps researchers quickly detect important biological changes.

A major focus of the study is the Transforming Growth Factor beta (TGF-β) pathway. This pathway plays an important role in how cells grow, repair tissues, fight disease, and communicate with each other. Problems in this pathway are linked to illnesses such as cancer, inflammation, and fibrosis. The AI workflow automatically identifies genes connected to the TGF-β pathway and tracks how these genes behave in different experiments.

The system also connects the results to biological databases such as Gene Ontology (GO) and KEGG to help explain the meaning of the findings in a simple and organized way. By bringing all results together into one system, the workflow improves accuracy, saves time, reduces human error, and makes research easier to repeat.

Overall, this study shows that AI can greatly improve the way scientists study genes and diseases, helping advance modern medicine, genomics, and personalized healthcare.

58 - Diabetic Nephropathy and the Effects of Hippocratea velutina on Treatment

KymMiyiah Vernado[1], Maricica Pacurari[1]

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When diabetes remains uncontrolled, it can cause serious complications and damage to major organs and tissues. This is a major contribution to diabetic nephropathy, as a result of complications from Type 2 diabetes, characterized by structural damage of the kidneys creating an extensive health concern. Diabetes mellitus is a disease caused by hyperglycemia and glucose intolerance due to insulin impairment, a hormone regulator for glucose. Diabetes mellitus develops when the pancreas does not make enough insulin, or any at all. This disease results from chronic hyperglycemia and high blood pressure leading to chronic kidney failure due to changes in the kidney structure. In this study, kidney damage in diabetic mice was examined, and a plant extract, *Hippocratea velutina*, was assessed for potential therapeutic effects to evaluate its effectiveness of slowing the progression of glomerular loss and renoprotection. The HV plant is known for its bioactive phytochemical constituents, and its promising therapeutic potential. Female CBL57 mice at 10 weeks old were injected with either a citrate buffer or streptozotocin for seven consecutive days. After 9 days, mice with blood glucose levels above 200 mg/dL were considered diabetic and split into two groups: STZ (n=5) and STZ+HV (n=5). HV extract was given by mouth and after 2 weeks, the mice were sacrificed, and kidneys were collected for analysis. H&E staining was used to look at kidney tissues on a microscopic level. The findings suggest that *Hippocratea velutina* may help reduce damage to the kidneys related to diabetes and provide potential support for renal protection in diabetic conditions.

59 - Integrating AI-Based Photogrammetry to Aid Custom Pediatric Prosthetic Socket Development

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Rejection rates for upper limb myoelectric prostheses remain high at upwards of 35%. The prosthetic socket, serving as the primary interface between the patient's residual limb and their prosthesis, is a key contributor to device abandonment due to potential discomfort. Conventional socket designs often fail to account for the complex geometry of limbs. Utilizing photogrammetry may provide an alternative method to generate accurate 3D limb models, serving as the basis for personalized sockets.

Photogrammetry determines an object's dimensions and shape by analyzing images taken from multiple perspectives to calculate camera orientation and object coordinates. Previous research has demonstrated photogrammetry's feasibility in socket design workflows to digitize socket interiors and to model limbs using smartphones.

Compared to other modeling techniques, photogrammetry offers a cost-effective alternative for generating high-resolution 3D models. This research introduces the design of a low-cost, photogrammatic enclosure that enables 360-degree capture of a patient's residual limb. The setup includes 28 cameras, managed by seven Raspberry Pi 3B+ microcontrollers. A central Raspberry Pi 5 coordinates all image capture. A Python script executed on the Pi 5 signals each Pi 3B+ to capture images from its cameras. The resulting 28-image set is processed using Apple's RealityKit API, which integrates artificial intelligence to construct a high-fidelity 3D model of the limb.

This workflow shows promise to substantially automate the modeling procedures while reducing errors during image acquisition. Once the model is complete, a custom socket interface is generated; this offers a faster, reproducible, and more comfortable alternative to traditional manual methods.

60 - Stem Design Over Cerclage: A Biomechanical Determinant of Intraoperative Fracture Risk in Osteoporotic THA

Ifeoluwapo Bankole[1], Hongjia He[1], Steven Schroder[1], Nicholas Dunbar[1]

[1]McGovern Medical School at UTHealth

Introduction: Intraoperative periprosthetic femoral fractures remain a common complication in total hip arthroplasty (THA), particularly among geriatric patients with osteoporotic bone. While prophylactic cerclage cabling and collared stem designs have been proposed to mitigate fracture risk, their biomechanical efficacy in osteoporotic bone is not well defined. This study quantified insertion-induced stresses and estimated maximum impaction force (MIF) for different cementless femoral stem designs with and without cerclage.

Methods: Five Dorr Type B femora were reconstructed from CT data and implanted with three cementless stems: a blade stem, a triple-taper collarless stem, and a triple-taper collared stem. A best-fit prophylactic cerclage cable was applied proximal to the lesser trochanter. Dynamic finite element analyses simulated four sequential axial impactions (5-20 kN). Osteoporotic bone properties were modeled with reduced density and stiffness. Peak cortical stresses were recorded proximally and distally, and MIF at local failure (135 MPa) was estimated via polynomial interpolation. Paired t-tests assessed differences (α=0.05).

Results: Distally, the blade stem generated significantly higher stresses at 15-20 kN and lower MIFs (42-84%) compared to both triple-taper designs. The collarless triple-taper stem also had lower MIF than the collared design. Proximally, the collared

stem exhibited higher stresses and lower MIF than the collarless design. Cerclage did not significantly affect triple-taper stems distally but reduced peak stresses in the blade stem and collared stem at select loads.

Conclusion: Triple-taper stems demonstrated superior fracture resistance relative to blade stems in osteoporotic bone. Collars may shift load proximally, while prophylactic cerclage showed limited and inconsistent protective benefit, suggesting stem geometry is the dominant determinant of fracture risk in cementless THA.

61 - Impact of Ramus Fracture Obliquity and Screw Configuration on Pelvic Stability: A Finite Element Study

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Introduction: Pelvic ring fractures involving the sacrum and pubic rami present significant challenges in fixation stability, particularly under physiologic loading. While multiple screw configurations are used clinically, the effects of fracture morphology and fixation strategy on mechanical stability remain incompletely understood. This study used finite element (FE) analysis to evaluate the biomechanical performance of common posterior and anterior fixation constructs across varying superior pubic ramus fracture obliquities.

Methods: A three-dimensional FE model of a healthy male pelvis was reconstructed from CT imaging. A LC-1 fracture model was created with three superior ramus fracture obliquities (0°, 30°, 60°). Four fixation strategies were evaluated: two iliosacral screws (ISS), single transsacral screw (TSS), and each combined with a superior ramus screw (SRS), for a total of 12 models. Ligaments were represented as linear springs, and material properties were assigned based on prior literature. Physiologic loading conditions simulated protected gait, standing, and lateral compression. Micromotion at fracture sites and stress components within screws were quantified.

Results: Micromotion was lower for one TSS compared with two ISS at both the sacrum (0.31mm vs. 0.42mm) and SR (1.56mm vs. 2.55mm). The addition of a SRS reduced sacral micromotion to 0.9mm and SR micromotion to ≤0.01mm for both conditions. Maximum von Mises stresses on the posterior screws were higher for TSS compared with ISS (183.6MPa vs. 108.6MPa) but were decreased for both conditions with the addition of SRS (135.1MPa vs. 81.4MPa).

Conclusion: Combined anterior-posterior fixation enhances pelvic stability compared to posterior fixation alone, particularly in oblique ramus fractures. TITS constructs provide improved mechanical performance over TIS fixation. These findings highlight the importance of fracture morphology and fixation strategy in optimizing pelvic fracture stability and may inform surgical decision-making.

62 - Integrating Self-Care Practices into Undergraduate Nursing Education to Address Workforce Well-Being - A Mixed-Methods Study

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Background: Nursing is considered one of the most stressful healthcare professions with a significant risk of burnout. Sustainable changes to address burnout require engagement at the organizational level. This effort must begin at the foundation—nursing schools—where future nurses are trained to become the backbone of the future healthcare workforce.

Objective: This study aims to implement and evaluate the effectiveness of a structured intervention program designed to promote well-being among first-year BSN nursing students.

Methods: This study will employ a sequential explanatory mixed-methods design to implement a self-care intervention in four undergraduate BSN nursing programs. The intervention includes 1) purposeful self-care mini-lessons on topics informed by student feedback and developed by a nationally board-certified well-being coach, 2) a novel multisensory intervention - CLAS (Color, Light, Aromatherapy, and Sound) therapy - that delivers synchronized visual, auditory, and olfactory stimuli to promote relaxation and mood regulation. To assess the effectiveness of the intervention, a survey will be administered at baseline, immediately after the post-intervention, and two semesters later. Interviews will also be conducted to gain insights into student experiences and perceptions of the intervention. Repeated measures ANOVA will be performed to assess the differences among students who participate in mini-lessons or CLAS and changes over time. Thematic analysis will be utilized to identify emerging themes from interviews.

Expected Results: Participants are anticipated to show significant improvement in assessed outcomes. Qualitative interviews will reveal students' perceptions of the intervention, which will either support or challenge the quantitative findings.

Conclusion: Overall, the study is anticipated to provide evidence for the effectiveness of self-care education and CLAS sessions on student well-being. If proven to be effective, we can potentially establish a new model for self-care integration that can be easily adopted not only into nursing curricula but also across other disciplines. We may also tailor it to support frontline nurses at the current medical center and in other healthcare settings.

63 - Medical Device Sustainability: An Ethical and Anticipatory Ethical Analysis

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The European Green Deal is the strategy aiming to transform the EU into a modern, resource efficient and competitive economy, with no net emissions of greenhouse gases by mid-century. The main goal is to harness the significant potential in global markets for low-emission technologies, sustainable products and services in order to achieve climate neutrality by 2050. Product sustainability, within the biomedical field means designing, producing, distributing, and explanting in ways that minimize environmental impact, ensure ethical sourcing, and maintain patient safety throughout the product's lifecycle.

In current use, medical devices production is mainly demanded to third parties that have centralized production so the device distribution is performed with a just in time approach that relies heavily on parcel distribution. Furthermore, most of them are disposed as biohazard and therefore kept outside the recycling pathway used for regular consumer products and disposed trough either incineration or landfill.

For example, as per the requirements of Medical Device Regulation MDR rules, if a device follows a sustainable pathway to recycling, the instructions for use (IFU) for that device would need to reflect this pathway and the methods of preparation for recycling such as post use cleaning and decontamination prior to recycling. This is currently not the case with most IFU's. Currently most IFU's of single-use medical devices will have instructions on how to clean and recycle any batteries the product may have, but not the actual device itself. The IFU will usually only direct and instruct correct disposal to waste of the product. Manufacturers will possibly need to consider, and take the necessary steps in the future to allow safe and validated cleaning processes of the whole product.

This analysis will examine the pathways to developing more sustainable medical devices and the ethical and anticipated ethical issues related to developing sustainable medical devices. This will serve as a foundation for making recommendations and developing policy for all the stakeholders involved in developing and using Medical Devices.

64 - Anticipatory Ethics for Biomechanical and Biomedical Engineering.

Richard Wilson[1]

[1]Towson University

Biomedical engineering is the application of the principles and problem-solving techniques of engineering to biology and medicine. This is evident throughout healthcare, from diagnosis and analysis to treatment and recovery, and has entered the public conscience though the proliferation of implantable medical devices, such as pacemakers and artificial hips, to more futuristic technologies such as stem cell engineering and the 3-D printing of biological organs. Engineering itself is an innovative field, the origin of ideas leading to everything from automobiles to aerospace, skyscrapers to sonar. **Biomedical engineering** focuses on the advances that improve human health and health care at all levels.

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

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

This analysis will be a survey of some major topics in biomechanical engineering while introducing ethical and Anticipated Ethical issues with examples from within the fields of biomedical and biomechanical engineering.

65 - Nanoplastics and Neurodegenerative Diseases: Dementia and Alzheimer's

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Plastic, one of the most preferred materials in today's industrial world is posing serious threat to environment and consumers' health in many direct and indirect ways. Exposure to harmful chemicals during manufacturing, leaching in the stored food items while using plastic packages or chewing of plastic teethers and toys by children are linked with severe adverse health outcomes such as cancers, birth defects, impaired immunity, endocrine disruption, developmental and reproductive effects etc.

Promotion of plastics substitutes and safe disposal of plastic waste requires urgent and definitive action to take care of this potential health hazard in future. Emerging evidence shows that micro and nanoplastics might accumulate in the brain and

could affect Alzheimer's disease (AD)-like pathology in animals. However, causation in humans isn't proven yet. There's uncertainty about the effects of microplastics on humans

Emerging evidence from preclinical and review studies suggests micro- and nanoplastics can accumulate in the brain and may worsen Alzheimer's-like pathology, but a direct causal link in humans has not been established yet. What the research shows so far is that accumulation and Alzheimer's-like effects (preclinical) in Animal and model studies indicate micro- and nanoplastics can enter brain tissue and interact with Alzheimer's pathways (e.g., amyloid, tau), triggering inflammation, oxidative stress, and neuronal injury. A University of Rhode Island report highlights brain accumulation and accelerated Alzheimer's symptoms in genetically at-risk. A study co-led by Monash University found exposure to polystyrene nanoplastics could rapidly worsen Alzheimer's disease in models and drive effects beyond the brain to organs like the liver, heart, and gut. Reviews summarize five harm mechanisms—immune activation, blood-brain barrier disruption, oxidative stress, mitochondrial damage, and neuron injury—linking microplastics exposure to neurodegenerative processes relevant to Alzheimer's and Parkinson's.

This analysis will focus on the ethical and anticipated ethical issues related to the potential for micro and nanoplastics to accumulate in the brain which could affect the development of dementia and Alzheimer's disease in humans.

66 - AI, Neurodegenerative Diseases and BCI's 4 Examples: Ethical and Anticipated Ethical Issues

Richard Wilson[1], Chloe Bourne[1]

[1]Towson University

Advancements in neurotechnology are rapidly transforming approaches to neurological care, particularly through the development of brain-computer interfaces (BCIs), which enable direct communication between neural activity and external systems. As neurodegenerative diseases continue to increase in prevalence and remain largely incurable, BCIs offer emerging possibilities for improving diagnosis, restoring lost motor or cognitive function, and supporting patient independence. AI-supported BCI medical systems are crucial for all of these developments.

However, technologies capable of accessing and interpreting neural activity introduce complex ethical questions, especially when applied to populations experiencing progressive cognitive and neurological decline. The integration of BCIs into clinical care requires careful evaluation not only of technological capability, but also of patient autonomy, mental privacy, informed consent, and long-term responsibility related to long term care.

This research aims at exploring the ethical implications of integrating Brain-Computer Interfaces into the care of neurodegenerative diseases. This research will describe the technical aspect of BCI's while focusing on how beliefs, decision-making processes, and stakeholder perspectives influence ethical analysis and projected outcomes surrounding emerging neurotechnology. The analysis will be based on the current state of BCI technologies and established bioethical principles and decision-based ethical frameworks to examine how patients, developers, and governing institutions interpret both the risks and potential benefits of BCI adoption.

The research plan focuses specifically on Alzheimer's disease, Parkinson's disease, Amyotrophic Lateral Sclerosis, and Huntington's disease to capture variation in cognitive impairment, motor degeneration, disease progression, and target patient populations. By examining current treatment approaches alongside developing BCI applications, this work will evaluate how technological intervention may reshape care practices and patient experiences across distinct neurological conditions. Particular attention will be given to how progressive changes in cognition and agency may influence consent, treatment decisions, and ethical responsibility when neural data becomes integrated into AI-supported BCI medical systems and the Ethical and Anticipated Ethical Issues with all of these developments

67 - Maternal immune activation alters fetal and neonatal microglia phenotypes and disrupts neurogenesis in mice

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[1]University of Mississippi Medical Center

Background: Autism spectrum disorder (ASD) is a highly heterogeneous neurodevelopmental disability characterized by diverse etiology, neuropathology, and clinical presentations. Postmortem studies highlights several hallmark features, including microglial activation, increased cortical neuron density, and an imbalance between glutamatergic and GABAergic neurotransmission. This study aimed to investigate how maternal immune activation (MIA), a significant etiological factor, programs microglial phenotypes and aberrant neurogenesis in offspring.

Methods: MIA was induced in pregnant mice at embryonic (E) day 12.5 via intraperitoneal lipopolysaccharide (LPS) injection. Microglial phenotypes and neurogenesis were characterized between E15.5 and postnatal (P) day 21 by immunohistochemistry, flow cytometry, and cytokine array.

Results: MIA induced a robust increase in microglia, especially in the neurogenic regions, of fetal and neonatal mice. Under homeostatic condition, E15.5 and P4 microglia exhibited significant heterogeneity, comprising CD86+/CD206− (M1-like) and

CD86+/CD206+ (mixed M1/M2-like) subpopulations. MIA significantly shifted this landscape, reducing the M1-like fraction while increasing the mixed M1/M2-like population. This change was associated with upregulation of numerous pleiotropic cytokines. MIA triggered a marked increase in Ki67+/Nestin+ and Tbr2+ neural progenitor cells in the subventricular zone (SVZ) of newborn mice. By the juvenile stage, MIA offspring exhibited sex-specific alterations of interneurons in the medial prefrontal cortex, characterized by a male-specific reduction of Parvalbumin+ and concomitant increase in Reelin+ interneurons.

Conclusions: MIA programs microglia towards a pleotropic phenotype that may drive excessive neurogenesis in ASD patients.

68 - Neurodegenerative Diseases, BCI's and Alzheimer's Disease: Ethical and Anticipated Ethical Issues

Chloe Bourne[1], Richard Wilson[1]

[1]Towson University

Brain-computer interfaces (BCIs) are rapidly advancing neurotechnology's capable of translating neural activity into functional outputs, creating new possibilities for diagnosis, communication, cognitive support, and patient assistance. As these technologies move closer to clinical integration, they are increasingly being explored for use in care for victims of Alzheimer's disease, a neurodegenerative condition characterized by progressive cognitive decline, memory impairment, and reduced decision-making capacity. BCIs used in Alzheimer's care may assist with communication, cognitive training, monitoring neural activity, and supporting daily functioning. However, the progressive and individualized nature of Alzheimer's disease creates significant technical and ethical challenges related to reliability, patient advocacy, autonomy, and long-term care.

This analysis explores these concerns through an anticipatory ethical analysis grounded in established bioethical principles and the Beliefs, Desires, Intentions, Actions, and Outcomes (BDIAO) model of rational agency. By connecting the progression of Alzheimer's disease with stakeholder perspectives, the analysis examines how declining cognition and increasing dependence on caregivers influence informed consent, treatment decisions, and ethical responsibility surrounding BCI implementation. Particular attention is given to the roles of patients, caregivers, developers, and governing institutions in protecting vulnerable individuals as neurotechnology becomes more integrated into clinical care.

The goal of this analysis is to examine how the interaction between cognitive decline, caregiving structures, and neurotechnology design may reshape future Alzheimer's treatment and patient experiences. By evaluating both the technical limitations and ethical risks associated with BCI integration, this work emphasizes the importance of anticipatory safeguards, ongoing consent evaluation, and responsible innovation before widespread clinical adoption occurs.

69 - Post CRISPR Gene Editing: An Ethical and Anticipatory Ethical Analysis

Richard Wilson[1], Michael Nestor[1]

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Post-CRISPR techniques for gene editing focus on **precision, reduced toxicity, and expanded edit types**. They range from base and prime editing for small changes to PASTE and integrases for large insertions, and from non-CRISPR nucleases to epigenome editing for functional regulation. These tools are increasingly used alongside or as alternatives to CRISPR-Cas9 to meet the demands of research, therapy, and industrial applications.

Following the rise of CRISPR-Cas9, researchers have developed **post-CRISPR** or **next-generation** gene editing methods to address its limitations—such as off-target effects, delivery challenges, and the need for more precise edits—while expanding the range of possible genome modifications. **Post-CRISPR Gene Editing Techniques**

1. Precise Genome Editing (PGE): PGE aims to correct single-base mutations or insert small sequences without the double-strand breaks (DSBs) that can cause genomic instability. Advances include:

2. Base Editing: Base editors combine a catalytically impaired Cas protein with a base-modifying enzyme (e.g., cytidine deaminase) to directly convert one base pair to another without DSBs. This is ideal for correcting point mutations in human diseases.

3. Prime Editing: A more versatile PGE method using a Cas9 nickase fused to a reverse transcriptase. It can insert, delete, or replace DNA sequences in a single step, with minimal DSBs, making it suitable for complex edits.

4. Dual Prime Editing: An advanced form of prime editing that uses two guide RNAs to target larger DNA insertions or deletions, enabling more complex genomic changes..

5. PASTE (Programmable Addition via Site-Specific Targeting Elements)

PASTE editors insert larger DNA fragments without DSBs, avoiding chromosomal rearrangements. They are complementary to CRISPR-Cas9 for applications requiring big insertions..

6. Alternative Nucleases

7. Non-CRISPR Platforms

8. Epigenome Editing

While not altering DNA sequence, epigenome editors (e.g., CRISPR-dCas9 fused to epigenetic modifiers) can turn genes on/off or alter chromatin states without cutting DNA.

This Ethical and Anticipatory Ethical Analysis will focus on issues with Post CRISPR Gene Editing.

70 - Water Scarcity and Disease and Neurodegenerative Diseases: Ethical and Anticipatory Ethical Issues

Kaitlyn Finch and Richard Wilson

Towson University

Research suggests that the chemical composition of drinking water, particularly trace minerals and hardness, may influence the risk of neurodegenerative diseases such as Alzheimer's and vascular dementia. Key findings from recent studies include:

Aluminum exposure has been linked in some studies to increased cognitive decline, though results are mixed. Aluminum is a known neurotoxin that can accumulate in the brain and may promote neurofibrillary tangle formation, a hallmark of Alzheimer's disease.

Soft to moderately hard water (low in calcium and magnesium) has been associated with a higher risk of vascular dementia compared to hard water supplies. Soft water contains less than about 120 mg of calcium carbonate per litre, and low magnesium levels have also been linked to a 25% higher dementia risk . The proposed mechanism is that low mineral intake over time may impair vascular health and neuronal resilience.

Protective minerals such as silica, calcium, and higher pH have been shown in some studies to be associated with better cognitive outcomes in the elderly. These minerals may support vascular integrity, reduce oxidative stress, and maintain neuronal function.

Environmental toxicants in water, such as certain heavy metals or industrial contaminants, can also contribute to neurodegeneration. While not all water sources are contaminated, exposure to such toxins can exacerbate brain aging and disease risk.

These associations do not prove that water composition *causes* neurodegenerative disease. Dementia risk is strongly influenced by well-established factors like age, genetics, cardiovascular health, smoking, and high blood pressure.

The effect of water type, if any, is likely small compared to major modifiable risk factors.

More research is needed to measure multiple trace minerals in water and to confirm causal pathways.

This analysis is aimed at identifying Ethical and Anticipated Ethical Issues related Water scarcity, Diseases and in particular concerns about Neurodegenerative Diseases.

71 - Luminescent Perovskite Microfibers for Imaging Applications

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Lead halide perovskites exhibit outstanding optical properties; however, their intrinsic instability under moisture, heat, and ultraviolet (UV) irradiation remains a major obstacle to practical applications. Here, we show single- and dual-emissive core-shell perovskite composite fibers fabricated via coaxial electrospinning. $CsPbBr_3$, PEA_2PbBr_4, and $CsPbI_3$ are encapsulated within a hydrophobic and optically transparent poly(methyl methacrylate) (PMMA) matrix, enabling precise spatial distribution of distinct perovskite compositions within the core and shell regions. This engineered architecture facilitates tunable single- and dual-emission across the visible spectrum.

The dual-emissive fibers exhibit excellent water stability, retaining their luminescence after 9 days of water exposure. Moreover, their emission remains stable under simultaneous thermal stress (50 °C) and UV irradiation in water for up to 40 min. Notably, the green-emitting core-shell fibers demonstrate robust random lasing (RL) performance in diverse environments, including air, water, and acidic media (pH = 3), underscoring their exceptional environmental resilience. Furthermore, RL generated from these fibers enables speckle-free imaging with an ultra-low speckle contrast (K = 0.008), significantly outperforming a conventional continuous-wave (CW) laser

73 - A Comprehensive Review of a Wearable Centric Game Based Training Program for Prosthetic Arm Use

Peter Smith[1], Matt Dombrowski[1], John Sparkman[1], Albert Manero[1]

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The rejection rates for prosthetic arms among children are high. Cited reasons include devices being perceived as unattractive, heavy or cumbersome, and difficult to master, challenges that compound significantly with advanced myoelectric prosthetic arms. Limbitless Solutions addresses all three dimensions of rejection through distinct research and design initiatives. For the

challenge of usability, the program has developed a three-phase, game-based training ecosystem designed to ensure that every recipient becomes a confident, capable user with the skills and knowledge needed to control their device.

The first phase focuses on pre-device muscle conditioning, using game-based activities to build the strength and awareness of the residual limb muscles that will drive the prosthetic. The second phase guides skill acquisition, progressively unlocking multigesture support as users demonstrate mastery, drawing on principles of motor learning and flow theory to embed therapeutic milestones within intrinsically motivating gameplay. The third phase provides sustainment through ongoing play experiences that keep users practicing functional control long after initial device fitting, framing continued rehabilitation as play rather than clinical obligation.

Together, these phases form a scaffolded progression from first contact with EMG control through to confident, multi-gesture fluency. The Limbitless training platform has been evaluated across multiple clinical trials in partnership with medical teams. The program represents a scalable model for accessible prosthetic care that demonstrates how creative technology disciplines, game design, interaction design, and motor learning science, can meaningfully advance pediatric rehabilitation outcomes.

74 - Encapsulation of Bacteriophage into Biodegradable Microspheres for Treatment of Orthopaedic Infections

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The current standard of care for orthopaedic device-related infections (ODRIs) includes up to 6 weeks of IV antibiotics as well as multiple surgical procedures to irrigate and debride the infection site and remove and replace the infected device. *Staphylococcus aureus* is the most common causative organism in ODRIs and is increasingly challenging to treat due to antimicrobial resistance (AMR) and biofilm formation. Bacteriophage (phage) therapy is now being considered as a treatment option for AMR ODRIs, and we currently have a small library of phage that specifically target *S. aureus* bacteria. Phage lyse targeted bacterial cells while leaving human cells intact and self-replicate in the presence of host bacteria allowing for amplification at the site of infection, in contrast to antibiotics whose concentration decreases over time. We have tested multiple formulations of biodegradable microspheres for local delivery of phage for treatment of ODRIs. These formulations all result in the ability to deliver phage locally, but vary in the entrapment efficiency and temporal elution profile of the phage. Batches of microspheres manufactured from polylactic-glycolic acid (PLGA), PLGA combined with alginate, poly-ethylene oxide or polycaprolactone, gelatin type A and B, and chitosan. The microspheres made with PLGA, either alone or in combination with other polymers, resulted in microspheres that eluted less than $1x10^4$ plaque forming units (PFU)/ml over the course of 10 days. By contrast, particles composed of gelatins or chitosan resulted in up to 1×10^{10} PFU/ml of phage over the same time period, and continued eluting phage for up 4 additional weeks.

75 - Engineering and Optimization of Polymeric Nanoparticles for Brain Drug Delivery.

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Neurological disorders such as Alzheimer's disease, Parkinson's disease, and other central nervous system (CNS) diseases remain difficult to treat due to the presence of the blood-brain barrier (BBB), which acts like the brain's gatekeeper for maintaining brain homeostatic environment. This prevents the transport of therapeutic drugs and large biomolecules from entering the brain. Nanoparticle-based drug delivery systems have emerged as a strategy to overcome and improve therapeutic drug delivery to the CNS. In this study, polymeric nanoparticles (PNPs) poly(lactic-co-glycolic acid)-polyethylene glycol (PLGA-PEG) and poly(ε-caprolactone)-polyethylene glycol (PCL-PEG) were formulated and optimized for potential brain drug delivery applications.

Nanoparticles were synthesized using an oil-in-water emulsion solvent evaporation method and loaded with Nile Red as a model hydrophobic drug. The physicochemical characterization was performed using dynamic light scattering (DLS) and nanoparticle tracking analysis (NTA) to evaluate particle size, polydispersity index (PDI), zeta potential (ZP), and particle distribution. The NP morphology was assessed using a transmission electron microscope.

Our findings showed that Nile Red loaded PLGA-PEG nanoparticles exhibited a z-average particle size of 193.6 ± 14.4 nm, a low PDI value of 0.070 ± 0.020 , and a zeta potential of −28.7 ± 8.6 mV (mean ± SD, n = 3), indicating high uniformity, colloidal stability, and a size range acceptable for brain drug delivery applications. Nile Red loaded PCL-PEG nanoparticles exhibited a z-average particle size of 100.16 ± 5.37nm, a PDI value of 0.204 ± 0.009, and a zeta potential of −10.31 ± 1.43 mV (mean ± SD, n = 3). Comparative analysis demonstrated that PLGA-PEG nanoparticles exhibited greater colloidal stability due to stronger negative surface charge, while PCL-PEG formulation showed a weaker surface charge and comparatively reduced stability despite achieving smaller nanoparticle size.

To further enhance brain drug delivery, ongoing studies will involve the surface functionalization of nanoparticles with Angiopep-2, a ligand known to bind with low-density lipoprotein receptor-related protein 1 (LRP1) expressed on brain endothelial cells. This receptor-mediated targeting strategy is expected to improve nanoparticle transport across the BBB and enhance CNS drug delivery efficiency.

76 - Influence of Elastin-Like Polypeptide Chain Length on Environmentally Responsive QCM Sensor Interfaces

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Elastin-like polypeptides (ELPs) are promising materials for responsive sensing interfaces because of their reversible phase-transition behavior and tunable molecular architecture. In this study, the influence of ELP chain length on quartz crystal microbalance (QCM)-based sensor performance was investigated by comparing medium-length ($[VPGVG]_{40}$) and long-length ($[VPGVG]_{120}$) ELP coatings grafted onto QCM substrates. ELPs were covalently immobilized using APTES silanization followed by hexamethylene diisocyanate (HMDI) coupling. Surface modification and coating formation were characterized using Fourier transform infrared spectroscopy (FTIR), ellipsometry, and static water contact angle measurements. Atomic force microscopy (AFM) performed in both air and aqueous environments was used to evaluate nanoscale morphology and hydration-dependent conformational behavior of the coatings. Quartz crystal microbalance with dissipation monitoring (QCM-D) was employed to assess sensor responses to NaCl gradients and bovine serum albumin (BSA) solutions at sub-physiological and near-physiological concentrations. Both ELP coatings demonstrated environmentally responsive behavior, exhibiting measurable frequency and dissipation changes in response to salinity and protein exposure. Distinct differences in QCM-D response and surface morphology between $[VPGVG]_{40}$ and $[VPGVG]_{120}$ coatings indicate that ELP chain length significantly affects interfacial hydration, viscoelasticity, and conformational dynamics. Ongoing analysis aims to further correlate AFM-observed morphological changes with QCM-D measurements to better understand how molecular architecture and environmental stimuli collectively influence sensor performance. These findings highlight the potential of ELP-modified QCM platforms for responsive biosensing applications and for studying protein behavior at solid-liquid interfaces.

77 - Evaluating Upper-Limb Prosthesis Biomechanical Design and Training Strategies towards Optimized Everyday Task Performance

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Learning to purposefully use an upper limb prosthesis requires significant training efforts, which may lead to patient discouragement and device rejection. Our team developed a novel electromyographic prosthetic arm and is investigating methods to better align prosthetic design and training strategies for essential Activities of Daily Living (ADLs). ADLs are basic, everyday tasks that support independent living.

Benchmarks are being developed to compare the in-house device with prostheses described in the literature by evaluating the biomechanics and performance of both body-powered and electromyographic upper limb prostheses. This research aims to evaluate the ability of different prosthetic devices to perform ADLs and provide recommendations for design modifications and training methodologies to improve everyday task performance**.**

The research device currently presents design limitations in range of motion, elbow flexion, and rotational movement compared to a non-amputated limb. Certain ADLs may therefore require modified rehabilitation approaches or compensatory strategies, particularly when considering differences between transradial and transhumeral prosthetic design.

Current training methods include both physical and gamified approaches. Gamified training utilizes a wearable electromyographic sensor and custom tablet-based games, in which muscle contraction triggers different character actions. Physical training tasks include block and cup stacking, moving objects, and fine dexterity exercises. The addition of physical exercises and device-specific strategies that mirror movements required for ADLs may improve performance. Aligning prosthetic training with specialized, age-appropriate ADLs may improve training adherence, functional independence, and long-term device integration.

79 - Cadmium Induces Chromatin Condensation

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Cadmium is a highly toxic transition metal and known human carcinogen frequently introduced to the lungs through tobacco smoke and industrial fumes. Exposure is strongly linked to chronic lung disease and cytotoxicity, though the exact molecular gates facilitating this damage remain under investigation. Nir-1, a protein localized at ER-plasma membrane junctions,

regulates the replenishment of PIP_2 , a key lipid for cell signaling and membrane integrity. We hypothesized that Nir-1 may act as a molecular gate that influences cadmium entry and subsequent cytotoxic effects.

A549 lung cells were treated with cadmium concentrations of 5, 10, and 20 µg/mL to evaluate dose-dependent nuclear changes. To investigate oxidative mitigation, cells were also treated with 100 µg/mL of catalase. Chromatin condensation, the structural compacting of DNA and proteins, was visualized using Hoechst staining to monitor apoptotic activity and genotoxicity. Fluorescent images were captured via a Cytation 5 Imaging Reader at 4X and 10X objectives to quantify morphology changes.

Experimental data revealed that cadmium exposure triggers significant, dose-dependent chromatin condensation within the nuclei. This condensation represents a severe consequence of cadmium uptake, signaling the onset of programmed cell death (apoptosis) and genotoxic damage. While catalase alone maintained nuclear structures similar to the control group, its co-administration with cadmium significantly reduced the percentage of condensed chromatin. This suggests that a primary consequence of cadmium-induced lung cytotoxicity is oxidative stress-driven nuclear destruction.

These findings confirm that cadmium induces profound nuclear compaction and eventual cell death in lung epithelium. The structural condensation of chromatin serves as a definitive indicator of the metal's cytotoxic impact. Ongoing research will focus on Nir-1's role in this pathway, utilizing gain and loss of function models to determine if Nir-1 acts as the primary gate enabling cadmium to disrupt membrane signaling and initiate these terminal nuclear changes.

80 - INFLUENCE OF WALKING BIOMECHANICS BASED ON HOW DIFFERENT ORTHOSIS DESIGNS CONSTRAIN THE FOOT AND ANKLE IN HEALTHY ADULTS

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Tibial bone stress injuries (TBSIs) are common in military trainees (29-74%) and recreational runners (21.9%). Clinicians often prescribe a walking boot (WB) for 3-26 weeks; however, the rigid design reduces ankle mobility, decreases muscle activity, causing muscle atrophy within 7 days of wear, delaying recovery. Reduced ankle mobility also limits ankle joint moments, shifting mechanical demands proximally to the knee and hip. A custom Dynamic Ankle Orthosis (DAO) was developed to apply a distractive force across the lower limb, reducing vertical in-shoe force and tibial compressive force while preserving natural ankle motion during walking. Preliminary findings from a prior comfort study in our lab demonstrated significantly reduced peak transverse (shin) force in the DAO compared to the WB during overground walking ($r=0.9$, $p<0.002$). Additional research is needed to determine how transverse loading is distributed across the tibia and how lower-limb constraint from different orthosis designs influences these forces. This study will evaluate transverse tibial loading and lower-extremity joint mechanics associated with different orthosis designs: semi-constrained (pinned; DAO) versus fully constrained (fixed; WB). Fifteen participants will walk on a treadmill (1.3m/s) while wearing DAO and WB. Preliminary results (n=2) demonstrate significantly lower peak transverse force in the DAO concentrated at 22% tibial length (from the ankle), compared to 33% tibial length for the WB. We hypothesize that the DAO improves recovery outcomes by preserving ankle mobility, reducing tibial shear force buildup that could aggravate an existing TBSI, and minimizing biomechanical compensations associated with WB limb-length discrepancy.

81 - Assessing the efficacy tDCS on cognition and stress in stroke patients: A scoping review

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Background: Stroke is a leading cause of disability globally with many people experiencing cognitive changes and increased levels of stress that persist months to years after the stroke event. Transcranial direct-current stimulation (tDCS) is a low-cost, non-invasive brain stimulation intervention evidenced to improve cognitive functioning. However, there is a great amount of variability in the existing literature across people with stroke, stroke characteristics, and tDCS parameters, which contributes to the existing gap in knowledge on what tDCS treatment parameters have the best efficacy for improving cognition and or stress resilience after stroke.

Methods: A systematic scoping review of the existing tDCS interventions with cognition and or stress outcomes for people with stroke will be completed using JBI methodology. A priori data items from the PI's prior published scoping review will be extracted and mapped; these include tDCS treatment parameters, theoretical mechanism of effect, regions of interest, participant and stroke descriptive data, and the consensus guideline checklist items for safety and replicability. Included will be completed human studies that use tDCS with or without a paired behavioral intervention. A medical research librarian trained in systematic review methodology will tailor search strings for PubMed, Embase, Web of Science, and CINAHL databases.

Results: The results will be graphically displayed to map the range of methods, participant descriptors, use of guideline method elements, and evidence of efficacy.

Conclusion: The graphical and textual results and discussion will support identifying improved methods to advance this important area of clinical translation research.

82 - ANTICANCER EFFECTS OF THE NOVEL CATHEPSIN L INHIBITOR NN9 IN METASTATIC COLORECTAL CANCER CELLS

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Colorectal cancer is the third most frequent cancer in the United States and represents approximately 10% of all cancer diagnoses and deaths globally each year. Cathepsin L (CatL) is a lysosomal cysteine protease that is frequently overexpressed in human cancers and has been associated with tumor aggressiveness, metastasis, and poor prognosis. The present study evaluated the anticancer effects and mechanistic actions of a novel CatL inhibitor, NN9, in human metastatic colorectal adenocarcinoma SW620 cells. The effect of NN9 on cancer-related pathways such as apoptosis, autophagy, and cell proliferation was evaluated in the cancer cells by qPCR, western blotting, ELISA, and annexin V/PI flow cytometry after treatment of the cells with the compound for 24-72 h. NN9 significantly affected autophagic and proliferative markers by increasing SQSTM1 accumulation and mTOR signaling and decreasing LAMP and Beclin-1 expression. The compound also suppressed the expression of the oncogenic markers CEA and KI-67 after 48-72 h of treatment. In addition, NN9 modulated HIF-1 protein expression and increased apoptotic cell death in treated SW620 cells. The observed effects occurred with NN9 alone or when combined with oxaliplatin. The results revealed that NN9 modulated autophagy, apoptosis and oncogenic signaling pathways to exert its anticancer effects in colorectal cancer cells. These findings show the therapeutic potential of CatL inhibition as a promising strategy for the treatment of colorectal cancer.

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83 - Bioengineered Mineralized Mycelium Composites for Sustainable Structural Applications

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The growing demand for sustainable packaging materials raises the question of whether bio-based composites derived from recycled woody biomass can achieve sufficient mechanical stability and durability while remaining biodegradable. This study investigates a bioengineered approach that combines fungal mycelium self-assembly with biologically mediated calcium carbonate mineralization. We propose that integrating biological growth with controlled mineral reinforcement may enhance structural cohesion and improve resistance to moisture-induced degradation compared to non-mineralized composites. Woody biomass particles are inoculated with microbial strains to establish a binding network and promote in situ mineral deposition within the porous scaffold. Structural development will be characterized using microscopy, while mechanical behavior will be evaluated through compressive testing. Moisture response and dimensional stability will be assessed under controlled humidity and wetting conditions. Anticipated outcomes include improved stiffness, retention and reduced moisture sensitivity relative to untreated systems. This work explores a potentially scalable strategy for addressing key durability limitations of bio-based materials and contributes to the development of more robust, environmentally responsible composites.

84 - Novel coformulation of Pembrolizumab and Ultrasound-Targeted Microbubble Modulation Improves Delivery within Tumor Microenvironment and Reduces Systemic Exposure

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Poor intratumoral drug distribution remains a fundamental bioengineering challenge limiting the efficacy of antibody-based immunotherapy in solid tumors. Elevated interstitial fluid pressure, aberrant vasculature, and dense extracellular matrix collectively restrict macromolecular penetration, making delivery system design as critical as drug selection. We evaluated a novel co-formulation platform pairing a murine anti-PD-1 antibody (RMP1-14) with Imagent® microbubble/liposome (MBLP) complexes, activated by focused ultrasound, to achieve localized intratumoral antibody delivery in immunocompetent MC-38 colorectal tumor-bearing mice. Five groups were evaluated: isotype control, isotype/MBLP/US, RMP1-14 alone, RMP1-14/MBLP, and RMP1-14/MBLP/US. Survival was assessed by Kaplan-Meier analysis, tumor necrosis by H&E analysis,

antibody biodistribution by immunohistochemistry, and tumor hemodynamics by laser speckle imaging. MBLP/US delivery produced a 6.1-fold increase in intratumoral antibody accumulation versus free antibody (19.5% vs. 3.2%; p=0.0003), with simultaneous reductions in off-target organ exposure (64-98%) in spleen, liver, kidney, and heart. Laser speckle imaging confirmed a transient ~30% increase in tumor perfusion during MBLP/US treatment, consistent with stable cavitation-mediated hemodynamic effects that returned to baseline upon cessation of sonication, arguing against thermal mechanisms. Both RMP1-14 alone ($p = 0.013$) and RMP1-14/MBLP/US ($p = 0.047$) showed statistically significant survival improvements compared to isotype control, with the RMP1-14/MBLP/US group achieving the longest mean survival (57.8 days vs. 18.1 days) and complete tumor regression (2/8 animals). These findings establish MBLP/US co-formulation as a promising platform for spatially selective antibody delivery, with implications for improving the therapeutic index of checkpoint inhibitors, and possibly other therapies in solid tumors characterized by poor perfusion or high stromal resistance.

85 - Antimicrobial and Fire-Retardant Solutions for Hospital Textiles

Vladimir Reukov[1], Brinkley Vaughn[1], Evan Buach[1], Ambry Lofton[1], Justin Brown[1], Kimberly Castro Godinez[1], Quoc-Nghia Duong[1], Joyjit Ghosh[1]

[1]University of Georgia

Hospital soft surfaces present a dual faceted problem. They are incredibly difficult to disinfect, decontaminate, and sanitize properly, but are also highly prone to microbial contamination. Additionally, hospitals have strict governmental fire retardant (FR) regulations for textiles due to the widespread use of readily combustible materials like isopropanol, oxygen, and more.

However, current FR treatments reduce the antimicrobial effect of current microbial textile solutions. This negative effect results in solutions offering solely fire retardancy or antimicrobial properties.

Our study aims to bridge the gap between antimicrobial capabilities and fire-retardant standards. We propose that combining a proprietary chitosan-based antimicrobial coating (Silver Shell®) with phosphate compounds will produce a novel solution that can act as both an antimicrobial and fire-retardant for a variety of soft surfaces. To test this, we will perform AATCC and flame retardancy testing. We predict that this novel coating will reduce infection risks and provide microbial protection while enhancing fire safety.

86 - Effects of Sequential Sub-Threshold Impulse and Oscillatory Loading on Viability and Morphological Changes in Human Microglial Cell Lines

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Human Microglial Cells constituting around 10% of the human brain, such as Human Microglia Clone 3 (HMC3), are directly involved in the immune function of the central nervous system (CNS). Understanding how these cells respond to mechanical forces is directly linked to understanding traumatic brain injury mechanisms. However, existing HMC3 studies mainly focus on post-injury inflammatory signaling rather than the mechanical failure process. The objective of the current study is to establish an experimental methodology to evaluate cell response under repeated subthreshold impulse and oscillatory motion applied in sequence. For this investigation, experiments were conducted using HMC3 cells obtained from American Tissue Culture Collection. To reproduce controlled mechanical loading and accelerative impact conditions, a custom oscillatory platform was developed comprising a rigid lever arm fabricated and mounted on a central pivot supported by a 3D-printed base. Mechanical excitation was delivered using a high-precision linear actuator mounted vertically on a rigid fixing post, interfacing directly with one end of the oscillatory platform and a petri dish containing a 2D HMC3 cell culture substrate on the other end. Accelerative motion magnitudes ranging from 15g to 30g and impact frequencies of 1.11 Hz, 2.22 Hz, and 4.44 Hz were applied, and cellular changes were monitored for up to 30 minutes post-impact. Cell morphology and injury were assessed using live/dead fluorescence-stained images conducted in BZ Analyzer and ImageJ software and an MTS cell growth and proliferation kit. Based on the observed outcomes, a result matrix relating motion range and frequency variation with cell viability and morphological shift response was proposed.

87 - Blood Platelet RNA Signatures in Breast Cancer Reveal Novel Drug Repurposing Candidates via CTD Inference Network and Open Targets Integration

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Breast cancer remains one of the leading causes of cancer-related mortality worldwide, necessitating the identification of novel molecular targets through minimally invasive approaches. Tumor-educated platelets (TEPs) carry cancer-reprogrammed RNA signatures detectable in peripheral blood, offering a promising non-invasive source for transcriptomic biomarker discovery. In this study, we performed a comprehensive bioinformatics analysis of GEO dataset GSE68086, comprising 17 breast cancer

TEP samples and 9 healthy controls. Following quality control and normalization, PCA demonstrated clear sample-level separation (PC1 15.47%, PC2 14.01%), with DEG analysis and PCA cross-validated using both iDEP and independent R-based workflows (gage, gageData, pathview, clusterProfiler; R 4.x). Differential expression analysis identified 164 filtered DEGs at FDR < 0.05 and $|\log_2 FC| > 4$, comprising 143 upregulated and 21 downregulated genes. Pathway enrichment via ShinyGO 0.85.1 revealed coordinated upregulation of endocrine signaling pathways and significant downregulation of adaptive immune pathways. REVIGO GO-BP treemap analysis clustered DEGs into ten functional modules, including transmembrane transport, DNA repair, cell proliferation, and regulation of gene expression. GeneMANIA protein-protein interaction network analysis identified 1,118 interactions, and CytoHubba MCC ranking prioritized EGFR, AKT1, and ESR1 as the top three hub genes. Four-way Venn analysis across CTD, Open Targets, GeneCards, and the DEG list highlighted five tri-database validated marker genes (ELP1, TFRC, VPS39, HMMR, CXCL8) and two bridge genes (ERBB2 and CDH1) — genes that connect multiple pathway and network modules, linking known disease-associated genes within interaction networks. TEP transcriptomics thus provides a tractable non-invasive framework for identifying candidate biomarkers

88 - Neuropeptide Y Y1 receptor antagonist reduces maternal inflammation and reduced-uterine perfusion pressure-induced placental efficiency reduction and fetal growth restriction

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Pregnancy increases uterine blood flow, a necessary condition for normal fetal growth and development. Neuropeptide Y (NPY) mediates various biological effects, including vasoconstriction, which may be associated with preeclampsia, a pregnancy complication usually characterized by hypertension, decreased birth weight, and neurological dysfunction. Experimental studies have suggested that reduced uterine perfusion pressure (RUPP), maternal inflammation, and elevated NPY levels can lead to impaired fetal development. This study investigated whether treatment with NPY Y1 receptor antagonist (Y1R-ANT) reduces maternal inflammation, RUPP-induced fetal inflammation, lipid peroxidation, poor fetal development, and neurobehavioral deficits in pregnant rats. Lipopolysaccharide (LPS) (100 μg/kg) was administered intraperitoneally on gestational day 13 (G13), and RUPP surgery was performed on G14. From G14, Y1R-ANT was delivered via intraperitoneal micro-osmotic pump infusion at 5 μg/kg/day for 6 days. Y-maze and Plus maze tests were conducted on G19, and placenta and fetal tissue were collected on G20. Y1R-ANT treatment reduced short-term memory deficits and anxiety-like behavior in the Y-maze and Plus maze tests. Furthermore, Y1R-ANT reduced maternal inflammation and RUPP-induced reduction in placental efficiency, placental size, and fetal weight. Y1R-ANT also attenuated maternal inflammation and RUPP-induced increases in fetal proinflammatory cytokines and thiobarbituric acid-reactive substances (TBARS) content at embryonic day 20 (E20). These findings suggest that Y1 receptor antagonism may reduce vasoconstriction-associated maternal LPS exposure and RUPP-induced neurobehavioral deficits in pregnant rats, while also mitigating fetal inflammation, lipid peroxidation, and poor fetal development. These results may help clarify mechanisms underlying inflammation- and RUPP-induced poor fetal development and support therapeutic development.

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89 - Utility of 3D-Printed Device for D50 Injections: Preventing Gastrostomy Tube Leakage

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Purpose: Gastrostomy tubes play an important nutrition role for patients unable to tolerate oral intake. Unfortunately, gastrostomy tube complications include peristomal leakage. Current management includes local wound care, temporary tube removal, or relocation of the tube to a new site. Injectable bulking agents have been successful at managing conditions like pediatric rectal prolapse and interstitial cystitis. Injections of 50% dextrose (D50) around the gastrostomy tract has been proposed to stiffen the surrounding tissue and decrease tract diameter sufficiently, thereby decreasing leakage.

Methods: A 3D-printed surgical resin guide was developed to create a reproducible injection pattern. The guide's parameters are customizable. A static gastrostomy leakage model was then created using porcine abdominal wall and an intravenous saline bag. Leakage was measured over time before and after D50 injection.

Results: D50 injections using our 3D-printed guide resulted in a significant reduction in leakage within the gastrostomy model ($p = 0.0055$). Leakage was reduced by over 45%. CT scans also demonstrated accumulation around the stoma site as predicted.

Conclusion: D50 injection in this gastrostomy model significantly reduced leakage. The imaging studies suggest a D50 bulking mechanism may explain the leakage reduction. Further in vivo studies are warranted to confirm this observation.

90 - Simulation of a Butterfly Semi-Open Shunt Tip Geometry for Ventricular Flow Optimization

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Hydrocephalus is a neurological condition characterized by the abnormal accumulation of cerebrospinal fluid within the brain ventricles, which can elevate intracranial pressure and damage surrounding tissue. Ventriculoperitoneal (VP) shunts remain the standard treatment, but long-term reliability is limited by proximal catheter obstruction. Obstruction is often associated with stagnant flow regions, uneven inflow distribution, and wall shear stress conditions that may promote cellular adhesion, debris accumulation, or local tissue irritation.

This study evaluates a semi-open proximal shunt tip with a butterfly-inspired slit geometry designed to improve cerebrospinal fluid inflow near the distal end of the catheter. Computational fluid dynamics (CFD) simulations are performed in ANSYS Fluent under physiologically relevant canine cerebrospinal fluid flow conditions. The butterfly semi-open design is analyzed to determine how the slit configuration alters the velocity distribution, pressure gradient, flow-entry patterns, and wall shear stress within the catheter lumen and near the inflow region. Special attention is given to whether the butterfly opening reduces low-shear stagnation zones commonly observed near closed catheter tips while avoiding excessive localized shear.

The simulated performance of the butterfly geometry is compared with previously studied Open and semi-open arc-slope tip variants. This comparison provides quantitative insight into how tip geometry influences flow uniformity and shear distribution. The findings are expected to guide the development of proximal ventricular shunt designs with reduced risk of obstruction and improved long-term function.

91 - Loss of the Aryl Hydrocarbon Receptor (AhR) Promotes Cancer Cell Resistance to BRAFV600E Targeted Therapies

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Predicting a patient's response to chemotherapies and identifying additional molecular targets to improve treatment efficacy are major objectives in cancer research. $BRAF^{V600E}$ inhibitors targeting the MAP kinase pathway showed promising initial clinical results in thyroid cancers (TCs) for metastatic or recurrent tumors refractory to radioiodine treatments. $BRAF^{V600E}$-targeted therapies have also been approved by the FDA for the treatment of some unresectable or metastatic $BRAF^{V600E+}$ solid tumors. Still, for most patients, the response to $BRAF^{V600E}$ blocking therapy is transient due to cell proliferation reactivation through escape pathways. We performed a genome-wide CRISPR screen to reveal targets in TCs that facilitate resistance or sensitize thyroid cancer cells to inhibitors of the MAP kinase pathway. Among the genes that consistently altered MAPK inhibitor treatment response, we identified the Aryl hydrocarbon Receptor (AhR) and its molecular partner, the AhR nuclear translocator (ARNT). The AHR-ARNT heteroduplex is an environmental sensor that integrates extracellular, endogenous, and metabolic signals to equilibrate cell activity. Inactivation of AhR or ARNT increased TC cells' resistance to targeted therapies. Our study revealed that AhR-deficient cancer cells expressed elevated activity in genes linked to the TGFβ-mediated SMAD2/3 pathway after drug treatment. Our results suggest that SMAD2/3 competes to bind ARNT and that the loss of AhR gives cancer cells a potent escape pathway to targeted therapies, counteracting MAPK inhibition with SMAD activation to sustain cancer cell proliferation

92 - Neonatal inflammation induces ADHD-like behaviors and affects homeostatic responses to sleep disruptions in adolescent rats with sex-specific effects: machine learning-based analysis

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Neuroinflammation may play an important role in the association between sleep disturbances and neurodevelopmental disorders such as attention-deficit/hyperactivity disorder (ADHD). The current study examined whether machine learning-based pattern analysis identified sleep patterns associated with ADHD in juvenile rats exposed to perinatal inflammation and sleep disruptions. Sprague-Dawley male and female rat pups received intraperitoneal injections of lipopolysaccharide (LPS) (2 mg/kg) or saline on postnatal day 5 (P5). Behavioral testing was performed at P35, followed by implantation of a sleep recording electrode on P39, and exposure to sleep disruptions on P47. Baseline sleep, sleep disruption, and recovery sleep were recorded on P46, P47, and P48, respectively, for 24 hours. Four groups (n=5/sex/group) were included: Saline-Baseline, Saline-Recovery, LPS-Baseline, and LPS-Recovery. Our results showed that neonatal LPS treatment induced ADHD-like behaviors, including hyperactivity and inattention at P35 in both males and females, with a higher effect in males. Additionally, neonatal LPS treatment interfered with REM sleep and homeostatic sleep recovery following sleep disturbances in adolescent (P49) rats. Six unsupervised machine learning models were recruited to analyze the feature interaction patterns among the collected high-dimensional sleep data. These models identified relative theta power and relative spindle power as features significantly associated with ADHD and perinatal inflammation in an experimental model of sleep disruption in male rats. These findings suggest that machine learning-based analysis of sleep data from subjects exposed to perinatal inflammation and sleep disruptions could help in identifying neurodevelopmental disorders and may inform the development of new treatments targeting sleep disorders associated with ADHD.

93 - Explainable machine learning of neonatal LPS exposure-enhanced adult methamphetamine-induced reinstated behavioral sensitization and dopamine transporter changes

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

94 - Developing Novel Polymeric Materials for Biomedical Applications

Sharon Hamilton[1]

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Recent evolutions in the field of biomaterials have focused on developing materials that can facilely interface with biological systems to treat or replace tissues or functions of the body. Natural polymers including polysaccharides have been investigated as suitable biomaterials to mimic the environment of body tissues and facilitate tissue regeneration. Chitosan, collagen, and sodium alginate are water-soluble, natural macromolecules that have been used in applications such as cell scaffolding, drug delivery, and wound healing. Additionally, biocompatible synthetic polymers, such as poly(acrylic acid), are of significant importance within the fields of tissue engineering, drug delivery, and biomedical implants. Both natural and synthetic polymers

can be modified to attach biomimetic and bioactive moieties to further enhance the final macromolecular product. Electrospinning polymers yields nanofibers that have shown promise in a variety of biomedical applications, including tissue scaffolds. Modern wound healing treatments have capabilities including preventing infection and encouraging cell growth; however, little research has been published on the development of synthetic analogs to costly biomolecules. My lab investigates the development of biomimetic polymers through the modification of commercially available polymeric backbones. It is anticipated that these biomimics will prove to be suitable materials for use in a variety of biomedical applications including wound healing.

95 - Bisphosphonate-Crosslinked Ionotropic Hydrogels as an Alternative to Alginate Systems

Andre van der Vlies[1], Urara Hasegawa[1]

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Ionotropic hydrogels consist of polymers bearing chelating ligands that crosslink with multivalent metal ions through metal-ligand coordination. Their mild gelation—triggered simply by adding biologically relevant ions such as Ca^{2+}, Mg^{2+}, or Zn^{2+}—has made them highly attractive for biomedical use. Alginate, which forms Ca^{2+}-crosslinked gels, is the classic example and has been widely applied in wound dressings, controlled growth-factor release, and immunoprotected islet encapsulation. However, alginate systems face limitations, including the high viscosity of pre-gel solutions and the cost of pharmaceutical-grade material. This motivates the development of alternative ionotropic hydrogel platforms.

Here, we describe polymers functionalized with bisphosphonate side groups that crosslink with divalent cations such as Ca^{2+} and Zn^{2+} through stable metal-phosphate coordination. These bisphosphonate-containing polymers, synthesized from N-acryloyl alendronic acid, form hydrogels across a broad range of polymer and ion concentrations. Rheological measurements show elastic moduli spanning 5-100 kPa, depending on formulation. Owing to the reversible nature of the metal-phosphate interactions, the hydrogels also exhibit self-healing and shear-thinning behavior. Together, these properties position bisphosphonate-based hydrogels as promising alternatives to alginate for applications including wound dressings, localized drug delivery, and tissue-engineering scaffolds.

96 - A Longitudinal Study of Neonatal Inflammation-Induced Sex-Specific Effects on Sleep and Homeostatic Responses to Sleep Disruptions in Adolescent Rats

Md Rokibul Hasan[1], Jonathan Lee[2], Md Mushfiqur Rahman[1], Silu Lu[2], Joseph Crosby[2], Charles Matheny[2], James Shaffery[3], Norma Ojeda[4], Haifeng Wang[5], Lu-Tai Tien[6], Michelle Tucci[7], Lir-Wan Fan[2], Pratim Niyogi[1]

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Perinatal exposure to inflammation may play an important role in the association between sleep disturbances and the development of neurodevelopmental disorders, such as attention-deficit/hyperactivity disorder. This study aims to longitudinally examine the detailed changes in sleep patterns in adolescent rats exposed to perinatal inflammation and sleep disruptions. Intraperitoneal injections of lipopolysaccharide (LPS) (2 mg/kg) or saline were administered on postnatal day 5 (P5) to Sprague-Dawley male and female rat. Sleep recording electrodes were implanted on P39, and sleep-disruption exposure began on P47 for 24 hours. Baseline sleep and recovery sleep were recorded for 24 hours on P46 and P48, respectively. A hierarchical sequence of six models, including ordinary least squares regression to fit baseline or recovery data and longitudinal models to fit simultaneously across both light and dark phases, was fitted for each sleep stage, including wake, REM, non-REM, and total sleep. Our results showed that neonatal LPS treatment interfered with spontaneous REM sleep duration and episode duration (baseline sleep), with a greater effect in males. Neonatal LPS treatment also interfered with sleep homeostatic responses in both non-REM and REM sleep to sleep disruptions, including sleep duration, episode duration, and episode number (recovery sleep), with a greater effect in males. Our study provided a comprehensive view of chronic inflammation and sleep disruptions affecting sleep patterns and sex-specific homeostatic responses, and could serve as a strong tool for identifying neurodevelopmental disorders using sleep data in subjects exposed to perinatal inflammation and sleep disruptions.

97 - Mapping of Chronic Motor Effects Following LPS Exposure in Neonatal Rats Using a Function-on-Scalar Regression Approach

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Preterm birth remains a major public health concern in the United States, with infection- and inflammation-related mechanisms contributing significantly to early-life neurological vulnerability. Previous studies have shown that intracerebral lipopolysaccharide (LPS) exposure in postnatal day 5 (P5) rats disrupts dopaminergic developmental pathways and induces motor dysfunction in male adult. To determine if neonatal systemic LPS exposure has the same effects and sex-specific differences, the present study used a function-on-scalar regression approach to evaluate systemic LPS exposure-induced long-lasting motor dysfunction in both male and female rats. 48 Sprague-Dawley rats (balanced by sex) received LPS or saline intraperitoneally on P5 and were assessed across ten locomotor, sensorimotor, and growth outcomes from P5 to P70. Longitudinal trajectories were analyzed using naïve linear regression, generalized least squares with compound-symmetry correlation, and function-on-scalar regression (FOSR). Across outcomes, systemic LPS exposure produced long-lasting motor impairments followed by spontaneous recovery by P63-P70, with the period of maximum divergence localized to approximately P14-P49, corresponding to a critical window of dopaminergic and sensorimotor maturation. LPS-exposed groups exhibited concurrent locomotor hyperactivity and sensorimotor deficits, consistent with dopaminergic sensitization alongside fine-motor disruption. FOSR substantially outperformed conventional models, with adjusted R^2 gains up to 0.59, revealing nonlinear, age-specific treatment effects not captured by linear interaction terms. Sex differences were modest but detectable in age-varying trajectories. These findings demonstrate that systemic LPS administration effectively recapitulates the neurobehavioral effects of systemic exposure, with sex-specific differences, and validate systemic LPS as a biologically and clinically relevant model of neonatal inflammatory injury.

98 - Investigating the Effectiveness of Nurses' Hand Hygiene Knowledge, Attitude, Practice, and Hand Hygiene Methods on the Bacterial Contamination Level On Hands

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Healthcare-associated infections (HAIs) are a major cause of death and disability among medical and patient populations worldwide, and hand hygiene is closely linked to HAIs. The aim of this study was to investigate the effectiveness of hand hygiene knowledge, attitudes, and practices, as well as various hand hygiene methods, on mean bacterial colony-forming unit (CFU) counts and the types of bacteria present on nurses' hands. A total of 75 nurses from various clinical grades and departments within a hospital in southern Taiwan were included in the study. A self-administered questionnaire was used to assess all participants' knowledge, attitudes, and practices regarding hand hygiene. Handprints of the dominant hand from each participant were pressed onto blood agar plates during the same clinical session at various time points: before or after contact with patients and the clinical environment, and after hand hygiene, using standard or nonstandard methods. Our results indicated a positive correlation between attitude and practice. Following hand hygiene, CFUs of Gram-positive cocci (GPC), Gram-negative bacteria (GNB), and **Gram-positive bacteria (GPB)** were significantly lower than after contact with patients and the clinical environment in all groups. In addition, the mean CFUs of GPC following hand hygiene were significantly lower with the standard hand hygiene method than with the nonstandard method. The effectiveness of both hand hygiene methods in reducing bacterial contamination on hands, along with the positive correlation between attitude and practice, suggests that continuous education and frequent training sessions are warranted to reinforce hand hygiene compliance and reduce cross-contamination.

99 - Tunable Thermogels via Controlled Assembly of Patchy Micelles

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Thermogels are an important class of injectable hydrogels that are liquid prior to administration and undergo a sol-gel transition upon heating to body temperature. This property enables minimally invasive delivery. However, despite extensive efforts, it remains challenging to precisely control key material properties—including gelation behavior, mechanical strength, stability, and network structure—thereby limiting broader clinical applications.

To address these limitations, we developed a new design strategy for thermogels based on polymeric micelles bearing multiple temperature-sensitive patchy domains. The mixed-shell micelles were prepared from two amphiphilic block copolymers, poly(N-acryloylmorpholine)-block-poly(N-benzylacrylamide) (PAM-PBz) and poly(N-isopropylacrylamide)-block-PBz (PNIPAM-PBz). The hydrophobic PBz segments drive micelle formation, resulting in a core-shell structure, while the PAM and PNIPAM blocks form the shell. Within the shell, these polymers phase separate into PAM-rich and PNIPAM-rich domains. The PNIPAM-rich domains act as discrete patches that induce controlled intermicellar association above their lower critical solution temperature (~32 °C), enabling the formation of homogeneous three-dimensional hydrogel networks without macroscopic aggregation or void formation. The mechanical properties of the resulting hydrogels can be tuned over a wide range (150 Pa to 2.3 kPa) by adjusting the composition and molecular weight of the block copolymers.

This patchy micelle-based platform provides a versatile approach for designing injectable, in situ-forming hydrogels with finely tunable properties, with potential applications in wound healing, tissue engineering, and localized drug delivery.

100 - Isolation and hybridization of PDX-Derived Extracellular Vesicle with Liposome to Study Precision in Tumor Targeting

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physicochemical properties. Biologically derived and biomimetic drug delivery systems have attracted increased attention because they can be used to preserve the functional properties of the parent cells while enhancing biocompatibility in physiological conditions. In this study, we develop a hybrid nanodelivery platform that combines extracellular vesicles (EVs) derived from patient-derived xenograft (PDX) models with engineered synthetic liposomes to achieve controlled, targeted drug delivery. The EVs were isolated from PDX cells and fused with cationic and anionic liposomes to study the influence of charge on the hybrid vesicle's delivery properties. The derived EV-liposome hybrids were thoroughly characterized for size (100 to 200 nm), PDI (0.2 to 0.3), concentration, and zeta potential, to determine particle size distribution, morphology, surface charge, and membrane integrity. Also, the protein markers CD63, Alix, TSG101, CD81, and CD9 were assessed in hybridized vesicles to ensure the reengineering and delivery potentials. The hybridization method allowed effective manipulation of surface charge, with various anionic and cationic profiles regulating vesicle stability and cellular interactions. This study establishes a versatile, adaptable strategy for the design of next-generation nanotherapeutic delivery systems with enhanced targeting potential and functional performance.

101 - Repurposing Liposomal Drug Delivery through Surface Charge and Biogenic Modification with Extracellular Vesicles

Anavya Jernigan[1], Cesar Aparicio[1], Viswanathan Sundaram[1], Santosh Aryal[1]

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Advancements in nanomedicine have established liposomes as premier candidates for chemotherapy delivery due to their biocompatibility and extended systemic circulation. However, the therapeutic efficacy of these vesicles remains heavily dependent on their physicochemical properties such as size, stability, and surface functionality. Among these properties, surface charge, in particular, is the one that has direct influence in initiating cellular interaction such as noncovalent and biomolecular interactions to establish stable communication. In this pilot study, we have successfully established the synthetic parameters to synthesize liposomes with cationic (Surface zeta potential +20±4 mV) and anionic (Surface zetapotential -20±3 mV) surface properties with the hydrodynamic diameter ranging from 100 to 150 nm. Both particles are highly stable in their aqueous dispersion for prolonged period. A passive drug loading was carried using liposomal extrusion process that yields in 15±4 %wt/wt of doxorubicin loading. Furthermore, to install biogenic properties with the aim of enhancing targeted drug delivery, we have hybridized these synthetic liposomes with the extracellular vesicle derived from breast cancer cell MDA-MB-231 and evaluated cellular targeting using related and non-related cancer cells. We observed dose dependent toxicity and enhancing targeting in related cancer cells. While further studies are needed, we anticipate that cationic formulations would demonstrate

superior targeting and therapeutic outcomes compared to anionic counterparts, driven by enhanced membrane-vesicle interactions and increased payload delivery per internalization event.

102 - Enhancing Tumor Targeting with NK Cell-Derived Hybrid Vesicles: A Proteomic and Functional Study

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The recent technological advancement of nanomedicine has given rise to considerable in the delivery efficiency, therapeutic efficacy and diagnostic precision of therapeutic drugs and diagnostic agents. However, conventional nano drug delivery systems still have major limitations including nanotoxicity, immunogenicity, heterogenous biodistribution, poor tumor accumulation and rapid systemic clearance. To address these limitations, we employed a biogenic strategy leveraging extracellular vesicles (EVs) isolated from natural killer (NK) cells which possessing inherent tumor homing capabilities and bio functional cargo. In this study, NK cell derived EVs engineered as biomimetic nanocarriers by hybridized with synthetic liposomes to develop hybrid liposomal extracellular vesicles (HLEVs) for enhanced tumor targeted delivery. EVs were isolated using sequential centrifugation and filtration followed by physicochemical, biological and proteomic profile characterization. Proteomic profile assessment was performed to identify and validate key protein signatures associated with NK cell molecular functionality and tumor targeting potential. he EVs demonstrated a size range of 30-170 nm and a zeta potential of −19 ± 5 mV. To improve stability and transport efficiency, EVs were re-engineered using pre-synthesized liposomes (150 ± 5 nm) via mechanical extrusion, yielding hybrid liposomal EVs (HLEVs) with a consistent hydrodynamic diameter of 155 ± 5 nm and a zeta potential of −41 ± 1.5 mV. Proteomic analysis validated the enrichment of markers associated with NK cells and extracellular vesicles, such as CD63, NKG2D, NKp30, CD56, TSG101, and ALIX, underscoring the retention of functional protein cargo post-hybridization. In vitro investigations utilizing breast cancer cell lines and in vivo assessments in tumor-bearing Nu/Nu nude mice revealed superior tumor targeting, cellular uptake, and biodistribution of HLEVs relative to native EVs. This work highlights the importance of proteome profiling in comprehending and enhancing biomimetic nanocarriers. The altered HLEVs platform exhibits significant potential as a targeted drug delivery method, utilizing NK cell-derived protein signatures to enhance tumor selectivity and reduce off-target effects in cancer treatment.

103 - Extracellular Vesicle Mediated Wound Healing Study Using Cell Scratch Model In Vitro

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Extracellular vesicles (EVs) are membrane-bound nanostructures naturally secreted by several cell types, including fibroblasts, immune cells, and neoplastic cells. They facilitate intercellular communication by transporting bioactive cargo, including proteins, lipids, and nucleic acids. Therefore, EVs promote many cellular processes, for example, wound healing and tissue repair by promoting angiogenesis, regulating inflammation, and remodeling the extracellular matrix. Within this background, the objective of this work is to evaluate the efficiency of EVs in wound healing using cell migration assays. EVs originating from NIH3T3 mouse fibroblast cells were isolated using ultracentrifugation and ultrafiltration techniques. These EVs were characterized using multi-angle light scattering and analyzed for EV-specific protein biomarkers using an enzyme-linked assay. The wound-healing experiment was carried out by culturing NIH3T3 cells in 12-well plates. After full confluence, a cell-scratch-based wound was created, and the healing process was evaluated at varying concentrations of EVs (5%, 10%, and 20%, equivalent to the serum protein concentration). The healing process was captured using a live cell imaging system. Time-lapse images were captured at 10-minute intervals over 72 hours to evaluate the healing process by measuring the area of scar tissue and cell migration kinetics. Isolated EVs were found to be nano entities with a size range from 50 to 200 nm. The surface chemistry shows that these vesicles are negatively charged, with a zeta potential of 18 ± 5 mV. We observed that EVs are rich in CD-63, and facilitate cell migration in a dependent manner. Given the rapid advances in EV-based research and their biogenic nature, EVs could hold promise for various biomedical applications, including drug delivery and regenerative medicine.

104 - Prediction of Alzheimer's Disease using Multimodal Data

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People with Alzheimer's Disease (AD) have been proven to have reduced memory and cognitive levels currently, doctors utilize various techniques with imaging to classify a patient with AD. This study aims to utilize s/fMRIs with Emergency Health Records (EHR) data to train 3D models to accurately classify the differing levels of AD. Our dataset will be using Alzheimer's Disease Neuroimaging Initiative (ADNI) and Open Access Series of Imaging Studies (OASIS) MRI imaging. From the ADNI dataset, we used 450 patients each and 90 patients from OASIS, for the test dataset. We used deep learning models: CNN, ResNet-50, ResNet-100, MobileNet, VGG-16, and ViT to perform multi-class classification. In which, we passed both the types of MRIs with EHR data, allowing the model to determine the level of AD. Our results indicate high model accuracy in the multi-class classification of the brain s/fMRIs on the AD scale. Our best model for fMRI achieved an accuracy of 84% on the

test dataset. The multimodal model was able to achieve an accuracy of 85% on the test dataset. The 3D model was able to effectively predict the cognitive level of AD based on just the s/fMRI and EHR data of a patient. The significance of this work is to help neurosurgeons and neurological doctors hasten their timeliness of the diagnosis and prognosis using brain s/fMRIs and EHR data to determine and help patients with cognitive disabilities due to AD.

105 - Network-Guided Prioritization and Structure-Based Drug Repurposing of Rcs Phosphorelay Proteins of Hypervirulent Carbapenem-Resistant Klebsiella pneumoniae

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Hypervirulent carbapenem-resistant *Klebsiella pneumoniae* (hv-CRKp) represents a major global health threat due to the convergence of multidrug resistance, enhanced biofilm formation, and increased virulence, severely limiting available therapeutic options. In the present study, an integrated computational framework of the whole-genome sequences combining subtractive proteomics, network biology, structural characterization and drug repurposing identified to prioritize novel anti-virulence therapeutic targets in *K. pneumoniae*. Whole-genome analysis of 49 Indian clinical isolates (PRJNA925003) revealed extensive resistome and virulome diversity, including the widespread occurrence of ESBLs, carbapenemases (*blaNDM-1*, *blaNDM-5*, *blaCTX-M-15*, and OXA-type β-lactamases), diverse plasmid profiles, and high-risk sequence types such as ST14 and ST147. However, in order to identify pathogen-specific targets, the complete proteome of the carbapenem-resistant hypervirulent strain CR-hvKP005 alone was subjected to a subtractive proteomics pipeline involving CD-HIT, DEG, GEPTOP, BLASTp, and VFDB analyses. Protein-protein interaction network analysis identified the Rcs phosphorelay system as a central virulence-associated regulatory axis. Among the prioritized proteins, RcsC emerged as the top-ranked hub protein, while RcsB, the terminal response regulator of the same signalling pathway, was additionally selected due to its coordinated role in capsule biosynthesis, stress adaptation, immune evasion, and biofilm regulation. Structural modelling and validation of Rcs-associated targets were performed using Alphafold, PROCHECK, ERRAT, and GalaxyRefine. Structure-based virtual screening of FDA-approved compounds identified Bleomycin, Pentagastrin, Desmopressin, Goserelin, and Nelfinavir as promising inhibitors with favourable binding affinities and stable intermolecular interactions. Molecular dynamic simulations further confirmed the conformational stability of the protein-ligand complexes under physiological conditions. Collectively, this study highlights the RcsC-RcsB phosphorelay system as a promising anti-virulence therapeutic target and demonstrates the potential of computational drug repurposing for developing alternative treatment strategies against hv-CRKp infections.

106 - Discrete Brush Polymers: Architectural Precision for High Performance Metal-Free ^{19}F MRI Contrast Agents

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Fluorine-19 (^{19}F) MRI holds significant promise as a quantitative, background-free imaging modality for cell tracking, inflammation detection, and targeted diagnostics. However, clinical translation remains limited by the availability of molecularly precise and biocompatible fluorinated contrast agents. In this work, we describe the design and characterization of precision bottlebrush polymers as a platform for next-generation ^{19}F MRI agents. By leveraging controlled polymerization techniques and chromatographic isolation strategies, we access discrete oligomeric building blocks bearing zwitterionic side chains with truly monodisperse molecular weight distributions. The separation and precise incorporation of these zwitterionic segments, inspired by phosphorylcholine motifs found in cell membranes, enables systematic tuning of stealth properties, aqueous solubility, and fluorine payload without reliance on linear PEG-based chemistries. Assembly of these components into well-defined bottlebrush architectures yields fluorinated contrast agents that exhibit strong ^{19}F MRI signal, favorable signal-to-noise ratios at clinically relevant field strengths, and high cytocompatibility across a range of concentrations. Structure-property relationships governing molecular uniformity, fluorine content, and zwitterionic corona density are explored, revealing design rules that connect architectural precision to imaging performance. These findings establish a synthetic framework for building the next generation of metal-free, structurally defined MRI contrast agents with properties tunable at the molecular level.

107 - Designer peptide-based supramolecular polymer for biomedical applications

Tristan Clemons[1]

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Reversible hierarchical self-assembly of molecules is harnessed by living systems to control the formation of structures such as protein assemblies, cellular membranes, and cytoskeletal filaments, among others. By controlling multiple orthogonal interactions between molecules, we can design supramolecular polymeric systems that mimic these reversible hierarchical processes. This class of materials offers distinct advantages for biomedical applications, including the ability to rapidly assemble following the high shear forces associated with injection or spray delivery, tunable degradation profiles, and the capacity to interact intimately with biological systems for functional applications. In my presentation today, I will provide

insight into some of the recent peptide-based supramolecular polymer systems we have been developing in the Clemons Lab, highlighting their potential utility in the treatment of disease and injury.

109 - Cognitive Cartography: Boosting RADS Mastery with Right-Brain visualization and Whole- Brain Memory Techniques

Aryan Ahuja[1], Sean Cassingham[1], Zhiyun Yang[1]

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RADS systems are cognitively demanding and difficult to retain and recall using traditional rote, table-based methods alone, which primarily engage left-brain processing. Right-brain visual memory techniques may transform abstract concepts into memorable and intuitive symbols and figures. This study investigates the efficacy of a novel whole-brain learning tool that integrates color, imagery, emotion, and metaphor to improve understanding and recall of RADS systems.

Whole-brain learning, combining tables with visual figures, improved both recall accuracy and recall time by engaging logic alongside imagination. Results from this crossover study support the benefit of incorporating right-brain visual tools, particularly for visual learners.

Group A results demonstrated that recall scores increased with whole-brain learning under Immediate and Combined conditions ($p < 0.05$). A positive trend was observed for Delayed recall ($p = 0.081$, not statistically significant). Recall time improved under Delayed and Combined conditions ($p < 0.05$), with a positive trend for Immediate recall time improvement ($p = 0.095$).

Group B participants ($n = 8$), who began with whole-brain (text + visual) learning, showed no significant change in recall score or recall time after switching to text-only methods (all $p > 0.05$). These findings suggest a possible ceiling effect, with slight upward drift attributable to test familiarity rather than benefit from left-brain methods alone.

This approach may be adaptable to broader medical education, helping learners overcome cognitive overload associated with complex classification systems.

110 - Development of a Hydrogel-Based Osteoarthritis Model for Evaluating MMP13 Inhibitors

Melanie Ecker[1]

[1]University of North Texas

Osteoarthritis (OA) is a degenerative joint disease characterized by progressive cartilage degradation, inflammation, and pain, yet effective disease-modifying therapies remain unavailable. A major challenge in OA therapeutic development is the lack of physiologically relevant in vitro models that accurately mimic the cartilage microenvironment and disease progression.

This work presents the development of a three-dimensional hydrogel-based OA model using gelatin methacryloyl (GelMA)-alginate constructs to create a cell-supportive matrix with cartilage-like properties. Chondrocyte-laden hydrogels were fabricated to model healthy and OA-like tissue environments through the introduction of inflammatory stimuli associated with cartilage degeneration.

A key focus of this research is matrix metalloproteinase-13 (MMP13), a major enzyme involved in extracellular matrix breakdown during OA progression. Using this platform, the effects of MMP13 inhibition were evaluated to assess their potential for reducing cartilage degradation and preserving tissue integrity. Preliminary findings demonstrate that the GelMA-alginate system supports cell viability and enables investigation of OA-related changes and therapeutic responses.

These results highlight the promise of hydrogel-based OA models as physiologically relevant platforms for studying disease mechanisms and screening potential OA therapeutics.

111 - Designing boronic acid-containing bottlebrush polymers: Impact of hydrophilic side chain length on precision sensing.

Titilayo Oluwole[1], Alejandro Ramirez[1], Anupama Bandara[1], Jimmy Lawrence[1]

[1]Louisiana State University

The ability of boronic acid to form dynamic covalent bonds has been used for sensing applications over time. However, sensing with the phenylboronic acid (PBA) group is used in hydrogels or spin-coated films, which suffer from swelling, strict pH control, and limited structural definition. The current approach relies on this polymer network, which restricts analyte diffusion, has a slow response time, and limits the integration of multiple functionalities. To address this challenge, we synthesized a precise bottlebrush polymer (PBP) (a bottlebrush polymer with discrete side chains) containing PBA units via ROMP. Bottlebrush polymers (BBPs) provide a way to position PBA units along a single backbone while independently tuning side-chain chemistry, length, and sequence. This approach should improve colloidal stability, maintain more uniform access of analytes to PBA units, and create a modular framework for combining glucose-binding, antifouling, and signal-transducing segments into a single polymer. We will demonstrate how the use of discrete side chains, different backbone chemistries, and

their brush architecture affects glucose-sensing efficiency, providing clear design rules for stable materials with broad pH tolerance.

112 - Effect of Hydrodynamic Radius of Discrete Bottle Brush polymers on enhancing 19F MRI Performance through the Architectural Precision.

Anupama Aloka Bandaralage[1], Titilayo Oluwole[1], Parikshit Guragain[1], Jimmy Lawrence[1]

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The precise control of polymer architecture makes polymeric materials useful for biomedical imaging applications, as their molecular size can be precisely controlled. However, despite this advantage of polymers, most polymeric 19F contrast agents with a good signal-to-noise ratio are often close to the kidney filtration threshold of 6 nm, making them removed quickly from the body through the kidneys.

To address this, we used click chemistry to design a bottle-brush polymer with a hydrodynamic radius greater than 6 nm. In this study, the effect of hydrodynamic radius on the performance of fluorinated discrete bottle-brush polymers as contrast agents for 19F Magnetic Resonance Imaging was investigated. Our study focuses on the synthesis of structurally precise bottle-brush polymers with varying side-chain densities to identify the optimal side-chain density that increases blood circulation time, reduces renal clearance, and enhances MRI signal retention. The polymers were characterized by nuclear magnetic resonance (NMR) spectroscopy, dynamic light scattering (DLS), and gel permeation chromatography to evaluate their size and molecular uniformity. In this study, we will show that controlling the side chain density of brush polymers can improve their performance in biomedical imaging. It may also help to develop safer metal-free MRI contrast agents in the future.

113 - Evaluating the Effects of Different Nanoparticle Formulations on Tumor Spheroid Morphology, Viability, and Penetration

Micaela Lopez Krol[1], Rayan El Messoussi Garti[1]

[1]Florida International University

Glioblastoma (GBM) is one of the most aggressive and treatment-resistant forms of brain cancer due to rapid tumor growth, limited drug penetration, and the presence of physiological barriers that restrict therapeutic delivery. Conventional two-dimensional cell culture models often fail to accurately replicate the complex tumor microenvironment observed in vivo, limiting their predictive value for nanoparticle transport and therapeutic response. Three-dimensional tumor spheroids provide a more physiologically relevant platform by mimicking tumor architecture, cellular interactions, diffusion gradients, and resistance mechanisms found in solid tumors. The objective of this study is to evaluate the effects of different nanoparticle formulations on penetration, morphology, and viability within glioblastoma spheroid models.

Nanoparticles will be synthesized using varying formulation parameters to investigate the influence of physicochemical properties on tumor interaction and transport behavior. Formulations will be characterized based on particle size, polydispersity index (PDI), zeta potential, and colloidal stability using dynamic light scattering techniques. U87 glioblastoma spheroids will be generated using ultra-low attachment culture plates and maintained under standardized conditions prior to treatment exposure. Following nanoparticle administration, spheroid morphology and structural integrity will be monitored using brightfield microscopy, while nanoparticle penetration and spatial distribution within the spheroid structure will be evaluated through fluorescence imaging.

This work is expected to demonstrate how nanoparticle formulation properties influence transport behavior and therapeutic interactions within three-dimensional tumor environments. The findings from this study will support the development of optimized nanoparticle-based delivery systems for future applications in targeted glioblastoma therapy and intranasal brain drug delivery strategies.

114 - Simulated Minds: AI and the Illusion of Consciousness

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

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

Artificial intelligence (AI) was first formally introduced by John McCarthy during the Dartmouth Conference in 1956, which transformed how people perceive the mind, cognition, and the differences between organic and artificial systems. As AI has become integrated into our daily lives—from conversational chatbots to large decision-support tools—our dependence on these technologies has steadily increased. This growing reliance has intensified a long-standing philosophical concern: the illusion of consciousness in advanced AI systems. Consciousness is generally understood to involve subjective experience, self-awareness, and intentionality. However, it remains one of the most challenging and unresolved questions in the philosophy of mind and cognitive science. Machines cannot instantiate phenomenological subjectivity, insofar as they do not participate in the embodied, affect-laden, and historically situated modes of being that enable humans to constitute meaning through lived experience. They do not truly feel, perceive, or experience reality. Nonetheless, contemporary AI systems can convincingly

simulate conversation, emotional understanding, and reflective reasoning. Consequently, users may attribute awareness, intention, or agency to these systems, which are fundamentally performing statistical pattern recognition rather than engaging in conscious thought. The rise of immersive AI platforms has further blurred the line between humans and machines, sparking renewed debate about the factors that distinguish human cognition. The human capacity for intention, moral judgment, and subjective meaning remains central to this distinction, even as AI becomes increasingly adept at mimicking these traits. This tension raises important ethical and epistemological questions: How should society interpret behaviors that appear intelligent or conscious? How does our growing reliance on AI reshape our understanding of the mind? This paper explores the historical, technological, and philosophical foundations of this tension, highlighting the difference between genuine consciousness and its increasingly persuasive mechanical imitation.

115 - NPY Y1 Receptor Antagonism as a Non Hormonal Strategy to Preserve Reproductive Tissue Integrity in an Ovariectomized Rat Model

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

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

Introduction: Menopause is marked by a loss of estrogen, which leads to metabolic disturbances, weight gain, and deterioration of reproductive tissues. Concurrently, levels of circulating neuropeptide Y (NPY) tend to increase, affecting appetite, blood vessel tone, and reproductive health. Since estrogen and NPY have opposing biological effects, blocking the Y1 receptor has emerged as a potential non-hormonal treatment strategy. This study aimed to compare the effects of estrogen replacement with NPY Y1 receptor blockade on metabolic outcomes, the structure of vital organs, and the morphology of reproductive tissues in an ovariectomized (OVX) rat model of menopause.

Methods: Adult female Sprague-Dawley rats (n = 25) underwent bilateral ovariectomy and were assigned to one of four groups: OVX control, OVX with a sham implant, OVX with an estrogen implant, or OVX with an NPY antagonist implant. Intact females served as baseline controls. The animals were evaluated at 2, 4, and 8 weeks. Outcomes included measurements of body weight, wet weights of major organs, and both gross and histological assessments of the reproductive tract. Additionally, serum concentrations of estrogen and NPY were measured. Statistical analyses were conducted using one-way ANOVA with Tukey HSD ($\alpha = 0.05$) and Cohen's d for effect size estimation.

Results: The OVX and sham animals exhibited significant weight gain compared to the intact control group. After 8 weeks, ANOVA analysis confirmed substantial differences between the groups ($F = 15.39$, $p < 0.001$). The effect sizes were quite large for both the OVX and sham groups ($d = 2.74$ and 2.75, respectively) and notably high for the NPY antagonist-treated animals ($d = 2.53$). In contrast, the estrogen-treated animals demonstrated only a moderate effect size ($d = 0.61$), indicating a degree of metabolic normalization.

Tukey HSD analysis revealed significant weight differences between the control group and the OVX, sham, and NPY antagonist groups ($p < 0.01$). The estrogen-treated animals showed no significant difference in weight compared to the controls, but they were significantly lighter than the sham animals ($p = 0.005$). While NPY antagonist treatment produced moderate, beneficial effects on weight, it did not achieve statistical significance when compared to the OVX group.

Reproductive tissues in OVX and sham-operated animals exhibited severe atrophy. Tissues treated with an NPY antagonist resembled those of intact controls more closely, showing improved vascularity. In contrast, tissues treated with estrogen were enlarged and filled with fluid, indicating increased epithelial activation. Histological analysis revealed that estrogen treatment restored keratinizing squamous maturation, while NPY antagonism increased epithelial thickness and vascularity without promoting estrogen-dependent keratinization. There were no significant differences in the weights of vital organs among the different groups. Serum analysis confirmed that estrogen levels were restored only in the estrogen-treated animals, and NPY antagonist treatment did not affect circulating levels of estrogen or NPY.

Discussion: Estrogen replacement and NPY Y1 receptor antagonism each alleviated the metabolic and reproductive changes caused by OVX, but they did so through different mechanisms. Estrogen produced traditional proliferative and metabolic effects, while NPY1 blockade enhanced vascularity and epithelial organization independently of estrogen.

Conclusion: NPY Y1 receptor antagonism offers significant structural and metabolic benefits in a post-surgical menopausal rodent model, highlighting its potential as a non-hormonal therapeutic approach. While estrogen effectively restores metabolic function and epithelial maturation, NPY1 blockade preserves the integrity of reproductive tissue without triggering estrogen-driven proliferation, which warrants further investigation for potential clinical applications.

116 - Autonomy and Decision-Making Capacity in Neurodegenerative Disease

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

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

Neurodegenerative diseases, such as Alzheimer's disease, frontotemporal dementia, and Parkinson's disease, pose complex ethical challenges because they progressively and unevenly impair cognition, judgment, and functional abilities. This paper explores how autonomy and decision-making capacity should be understood in these conditions, arguing that both are dynamic concepts rather than fixed clinical or moral categories. While individuals may lose decisional capacity in some areas, they can still express enduring values, preferences, and goals that deserve ethical recognition. Drawing on core principles of bioethics, this analysis advocates for a framework that preserves self-determination for as long as possible through supported decision-making, advance care planning, and ongoing, individualized assessments of capacity. Furthermore, the paper argues that respect for autonomy must be balanced with beneficence and nonmaleficence, particularly when patients are no longer able to understand risks or consequences. By emphasizing dignity, agency, and relational care, this paper presents a practical ethical approach that avoids unnecessary paternalism while safeguarding vulnerable individuals as their capacities evolve.

117 - Beyond the Dotted Line: Challenges of Longitudinal Informed Consent in Medicine

Kenneth Butler[1], Gary Hamil[1, 2]

[1]University of MS Medical Center, [2]Belhaven University

Broad consent models that integrate long-term biospecimen storage with continuous access to Electronic Medical Records (EMRs) are highly valuable for large-scale biobanking and longitudinal research. They facilitate real-time clinical phenotyping and long-term outcome tracking. However, the ongoing retrieval of health data over time presents significant bioethical challenges. First, traditional informed consent is often inadequate because participants may struggle to fully understand the long duration, broad scope, and future uses of their data. Second, the accumulation of data heightens privacy risks, especially for vulnerable populations who may have historical reasons to distrust medical research. Third, integrating dynamic data can lead to incidental clinical findings, creating uncertainty about a researcher's obligation to communicate them. Finally, the potential for commercialization or data sharing with third parties can undermine community trust, particularly if the research benefits do not return to participants. To address these challenges and protect participant autonomy, institutions should implement transparent, participant-centered governance by improving the initial consent process by using layered information, multimedia tools, and "teach-back" methods. Additionally, research institutions should establish dynamic consent platforms to allow individuals to adjust their data-sharing preferences over time. Tiered access controls and continuous auditing can minimize data risks. Furthermore, community advisory boards and clear policies regarding incidental findings will help ensure that research practices remain equitable, secure, and trustworthy.

118 - Using AI to Link Differentially Methylated Regions to Symptom Heterogeneity in Autism Spectrum Disorder

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Autism Spectrum Disorder (ASD) is a complex and multifactorial neurodevelopmental condition that is characterized by a heterogeneous array of symptoms including deficits in speech, language, communications, and social skills (Acerbi Da Silva & Stumpp, 2025). Although heritable factors are estimated to play a role in 80-90% of ASD cases, clear genetic factors are identified in only 10-20% of cases (Kayhan et al., 2026; Oh et al., 2024). This suggests that factors beyond strict genetics may play a significant role in the pathogenesis of ASD.

Epigenetics refers to the differential and dynamic expression of genes due to factors including age, genetic makeup, and environment, and epigenetic mechanisms, specifically DNA methylation, has been linked to ASD etiology (Srivastava, 2026., Ladd-Acosta et al., 2014). Therefore, while epigenetic research is a promising route towards a better understanding and the development of precision treatment of ASD, the traditional analytical methods struggle due to the large and high-dimensional nature of epigenomic data (Holder et al., 2017, Srivastava, 2026).

Artificial intelligence (AI) and machine learning (ML), however, represent two approaches which are adept at gaining insight from particularly complex data (Brasil et al., 2021). AI algorithms, for example, are far more capable than conventional methods for tasks such as identifying differentially methylated regions (DMRs) that may be associated with ASD (Holder et al., 2017). Furthermore, these tools can assist in discovering associations between specific epimutations and their phenotypic counterparts. Indeed, such associations have already been discovered, such as the link between the FOXO3 gene and patient's social communication abilities, the ASCL1 gene and nonverbal communication, and the OXTR gene and symptoms such as eye gaze and lack of empathy (Oh et al., 2024; Kao et al., 2025).

AI/ML provides the ability to bridge the gap between complex molecular data analysis of DMR sties and understanding the clinical presentation of ASD. This will allow for both a deeper understanding of ASD symptomology as well as the development and application of personalized therapeutic options for individuals with ASD (Mahmoud et al., 2026). Moreover, due to the reversible nature of epimutation, DMR sites are good candidates for precision therapy targets. Epigenetic treatment options such as histone modifiers, environmental intervention, and targeted molecular therapies will allow for the advent of true

precision medicine treatment options to target the core causes of ASD, rather than just treating the symptoms (Kao et al., 2025; Fujita-Jimbo et al., 2026; Strathearn et al., 2023).

119 - Applying ANCOVA and Other Statistical Tools in Quasi-Experimental Research Design: Evidence from a Flipped Classroom Study

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Quasi-experimental designs are widely used in biomedical education research when random assignment of participants is impractical or impossible. These designs are commonly employed to evaluate educational interventions, such as flipped classroom instruction, simulation-based learning, and curriculum innovations. Despite their frequent use, key statistical concepts—including power analysis, statistical significance, and effect size—are often misunderstood or reported incompletely, potentially limiting the interpretation and reproducibility of research findings. This study investigated the effectiveness of a flipped classroom approach compared to traditional lecture-based instruction in a statistics course at a selected southern university in 2024 academic year.

One hundred and thirty undergraduate students were randomly assigned to either a flipped classroom group (n = 65) or a traditional lecture-based instruction group (n = 65). The results of an ANCOVA model indicated that the flipped classroom group had significantly higher post-test scores compared to the traditional lecture-based instruction group, controlling for pre-test scores ($F(1, 127) = 8.12$, $p = 0.03$, Cohen's $d = 0.54$). Additionally, students in the flipped classroom group reported higher levels of engagement and satisfaction with the course material. Also, partial eta squared (ηp^2) was used to quantify the proportion of variance in learning outcomes explained by the instructional intervention after controlling for pretest scores. Reporting effect sizes using Cohen's d or partial eta squared alongside p-values enables researchers to assess both statistical significance and practical importance.

The findings of this study suggest that the flipped classroom approach is an effective way to improve student learning outcomes and student scores in a statistics course. All statistical analyses were calculated with Statistical Program for the Social Sciences (SPSS) statistical software for Windows, version 26.0, G power and excel.

120 - Elucidating versatile strategies to design synthetic lipids

Alejandro Ramirez[1], Titilayo Oluwole[1], Jimmy Lawrence[1]

[1]Louisiana State University

Natural phospholipids tune membrane fluidity through tail unsaturation and chain length, but virtually all synthetic lipid analogs have kept alkyl chains as hydrophobic tails, leaving a much wider design space unexplored. We present a versatile modular strategy that replaces conventional alkyl tails with discrete, non-alkyl hydrophobic segments, enabling direct control over tail rigidity and self-assembly behavior from a single modular platform. A branched norbornane core serves as a glycerol-backbone mimic, with a phosphorylcholine headgroup and two discrete hydrophobic tails, rubbery oligodimethylsiloxane or glassy oligostyrene ($Đ = 1.0$). All constructs are designed to match the molecular weight regime of natural phospholipids, ensuring relevant packing geometry and bilayer-forming behavior. Because every component is molecularly defined, the packing parameter of each analog is precisely set rather than averaged over a distribution, enabling one-unit-at-a-time tuning of tail rigidity and its direct impact on membrane fluidity and self-assembly morphology, properties completely inaccessible to conventional alkyl-based lipid designs.

121 - Development of a Functional Rice-Based Extruded Breakfast Cereal Through Traditional and Modern Milling Approaches for Obesity Management, Blood Glucose Control, and Sustainable Food Systems

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The increasing prevalence of obesity, diabetes mellitus, and other lifestyle-related disorders has created a growing demand for nutritious ready-to-eat foods with enhanced functional properties. This study aimed to develop an alternative rice-based extruded breakfast cereal for obesity management and blood glucose control using traditional black rice (*Oryza sativa* L.), popularly known as Karuppu Kavuni, in combination with sorghum (*Sorghum bicolor* L.), finger millet (*Eleusine coracana*), and corn starch. These grains were selected owing to their rich nutritional composition, high dietary fibre content, low glycemic index, and potential health-promoting benefits. To establish suitable processing conditions, the effects of traditional and modern milling methods on the nutritional, structural, and functional properties of sorghum and finger millet flours were investigated. Recently developed sorghum varieties (SVT-55 and SVT-68) and tribal finger millet landraces of southern Odisha (Kundrabati, Laxmipur Kalia, Gupteswar Bharati, and Malyabanta Mami) were evaluated. Traditional milling methods included stone hand grinding and hand pounding, while modern methods comprised mixer grinding and pulverizer milling. Nutritional

characteristics were assessed through CHNS elemental analysis and ash determination, whereas structural and functional properties were evaluated using particle size distribution, bulk density, swelling power, water absorption capacity, oil absorption capacity, solubility, moisture content, pH, gelatinization behaviour, viscosity, and foaming capacity following standard AOAC procedures. The results indicated that modern milling produced finer particles but altered functional behaviour, likely due to increased mechanical stress and heat generation. In contrast, traditionally milled flours retained higher protein and ash contents, exhibited coarser particle size distributions, and demonstrated superior functional properties, including higher swelling power, water absorption capacity, and oil absorption capacity. Based on these findings, coarse flour fractions obtained through traditional milling were selected for extrusion processing. The developed extruded breakfast cereals were analysed for tannins, flavonoids, anthocyanins, and textural characteristics. Extrusion significantly reduced flavonoid and tannin contents due to thermal degradation and mechanical shear. Anthocyanin levels were highest in black rice-based formulations and decreased following extrusion. Despite the reduction in antioxidant compounds, extrusion improved textural quality and overall product acceptability. The study demonstrates that traditional milling can better preserve the nutritional and functional quality of cereal flours, while extrusion technology can enhance the sensory and textural attributes of ready-to-eat breakfast cereals. The developed product represents a promising functional food for obesity management and blood glucose regulation and contributes to the advancement of sustainable and innovative food systems through the utilization of traditional grains and underutilized millet resources.

122 - Machine Learning Guided Optimization of 3D Printed Tablets

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[1]Department of Mechanical Engineering, University of Mississippi, [2]School of Pharmacy, University of Mississippi

Three-dimensional (3D) printing is one of the most promising technologies for fabricating personalized oral dosage forms. 3D-printing deposits material through sequential layering to print solid objects possess several intrinsic advantages such as fabrication of complex geometric structures for versatile drug release profiles, enhancing patient preference, palatability and swallowability, reducing the pill burden, and increasing dose accuracy. However, the quality of 3D-printing process is governed by a large set of processing parameters and environmental conditions. Determining the conditions for printability among billions of combinations of processing and environmental parameters is expensive and highly time-consuming. In this work we have demonstrated that the integration of machine learning can reduce production costs and time through parameter optimization using a machine learning based adaptive design strategy. The aim is to maximize improvement in the targeted printing behavior during each of the subsequent iteration until the desired 3D-printing behavior is reached. The novelty of this approach is that only a subset of data needs to be generated (tens to hundreds) to achieve the targeted printing behavior. At each iteration machine learning guided printing conditions were tested experimentally, added to the existing dataset, and the machine learning model was retrained iteratively until convergence. This novel machine learning enabled method of fabricating 3D-printed tablets holds significant promise for future research, potentially leading to groundbreaking advancements in the field of personalized medicine. Our machine learning guided approach also exhibits significant potential to accelerate the process of drug development to commercialization of the dosage form which typically takes at least a decade.

123 - A novel functional assay to simultaneously measure platelet aggregation and mitochondrial function

Railey Mayatt[1], Steven Everman[1], Gage Sanders[1], Blake Littlejohn[1], Kristen Carter[2], Ngoc Hoang[1], Kristin Edwards[1], Matthew Kutcher[1]

[1]University of Mississippi Medical Center, [2]University of Michigan Medical School

Platelet function is traditionally measured based on aggregation; however, these studies capture only one aspect of multifaceted cellular behavior. Platelet oxygen consumption is a sensitive measure of bioenergetic health, but changes in oxygen flux have never been dynamically correlated with standard platelet aggregation. We describe a novel assay which allows simultaneous real-time measurement of platelet oxygen consumption and light transmission aggregometry in response to platelet activation. Rodent platelets were collected and resuspended in 1.25mM CaCl2 and 2.8mM D-glucose; platelets were then placed in an E-series Oroboros O2k oximetry chamber with a Fluo LED2 optical sensor module (Oroboros Instruments, Austria). The optical sensor's standard light filters were replaced with a visible blue light gel filter in order to use the instrument's chamber illumination light for light transmission aggregometry. Oxygen flux was air-calibrated and measured continuously before and after 5ug/mL collagen to stimulate platelet activation. Light transmission was measured as voltage change from pre-activation steady state, and oxygen flux measured in pmol/s normalized to 10^8 platelets. Collagen stimulation induced a 1.9-fold increase in platelet oxygen consumption, peaking within 60 seconds and reverting to steady state within 15 minutes. In parallel, peak platelet aggregation was seen in 4 minutes, reverting to 50% of peak within 15 minutes. Overall, the dynamic, simultaneous measurement of platelet oxygen consumption and aggregation is feasible by modification of a commercially available high-resolution oximeter. This technique will allow new insight into mechanisms of platelet activation, as well as facilitate the testing of novel platelet-targeted therapeutics.

124 - Improving Graphics in Scientific Communication in Neuroscience Research

Chung-Fan Chang[1], Jonathan Lee[2], Lir-Wan Fan[2]

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This presentation focuses on research opportunities in data visualization and in improving graphical representations used in neuroscience research papers. To explore and investigate visualization techniques and methodologies that enhance the clarity, accuracy, and effectiveness of data analysis and scientific communication. Explore software such as Python and Midjourney that can help create professional, interactive graphics while ensuring visuals remain understandable in grayscale printing. Delivering clear and effective visuals in scientific communication and research to guide viewers through the data logically and help explain the research question, methodology, and conclusions. We will demonstrate how to beautify bar charts for comparisons, line graphics for trends, and scatter plots for relationships between variables. How to use color contrast or annotations to emphasize significant results and to direct the viewer's attention to the information hierarchy. How it will share ideas of storytelling with data. We aim to continue this research and gather feedback from peers to determine whether the graphics are understandable and visually effective.

125 - Development and Characterization of BSA-Functionalized PNVCL Particles with Tunable Thermoresponsive Behavior for Biomedical Applications

Gabriel Re Calderon[1]

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Stimuli-responsive polymers have attracted significant interest for biomedical applications due to their ability to respond to environmental changes in a controlled manner. Poly(N-vinylcaprolactam) (PNVCL) is a promising thermoresponsive polymer with significant potential in biomedical applications due to extreme biocompatibility and tunable lower critical solution temperature (LCST). However, PNVCL has a native LCST of 32°C, which limits its effectiveness due to the need for a responsiveness closer to physiological temperature to execute biological applications. In this work, PNVCL will be copolymerized with acrylic acid and other hydrophilic copolymers to increase the LCST. PNVCL will also be decorated with BSA to introduce biologically relevant surface functionality and improve uptake by the pancreas and serve as an essential cog to the drug delivery system being designed. PNVCL material will be characterized through measurements of mean particle size and zeta potential to evaluate particle stability and surface properties. Thermoresponsive behavior will be investigated by monitoring optical density (OD) as a function of temperature using UV-visible spectrophotometry, allowing determination of phase transition behavior and LCST. In addition to temperature-dependent studies, the influence of environmental factors including pH and solvent composition on particle swelling, stability, and phase transition behavior will be examined. Poly(lactic-co-glycolic acid) (PLGA) systems containing BSA are prepared and characterized as a comparative control in terms of thermal response, stability, and potential suitability for biomedical delivery applications. This work seeks to establish a versatile thermoresponsive biomaterial system with tunable transition temperatures near physiological conditions, and development of protein-functionalized polymers for drug delivery.

126 - α7-nicotinic acetylcholine receptor activation attenuates IL-13-induced inflammatory responses in BEAS-2B cells

Vitoria Caroline Queiroz[1], Nathalia Mountouro Pinheiro[2], Amal Al-Shweiky[2], Iolanda De Fátima Lopes Calvo Tibério[1], Ayman K. Hamouda[2], Carla Máximo Prado[3]

[1]USP, [2]UT-Tyler, [3]UNIFESP

Introduction: Asthma is a chronic inflammatory airway disease marked by heterogeneous immune responses, including type 2 inflammation and, in severe forms, increased expression of pro-inflammatory mediadores such as IL-6 and TNF-α signalling. Increasing evidence suggests that acetylcholine (ACh), through nicotinic acetylcholine receptors (nAChRs), especially the α7 subtype, exerts immunomodulatory effects against lung inflammation. However, the role of α7-nAChR signalling in airway epithelial cells responses remains incompletely understood. **Aim:** To evaluate if IL-13 alters nAChR expression in BEAS-2B cells and whether activation of α7-nAChR modulates IL-13-induced pro-inflammatory responses. **Methods:** BEAS-2B cells were stimulated with IL-13 (1250ng/mL) and treated with or without selective α7-nAChR agonist PNU-282987 (100uM). Inflammatory gene expression and nAChR was analyzed. **Results:** IL-13 significantly increased α7-nAChR gene expression ($p<0.05$), whereas α4 and β2 nAChR subunits remained unchanged. IL-13 stimulation also increased the expression of IL-6 ($p<0.01$), TNF-α ($p<0.05$), IL-4 ($P<0.05$), IL-5 ($P<0.05$) and NF-κB ($p<0.01$), but not change IL-1β compared with control cells. Treatment with PNU-282987 significantly reduced IL-6, TNF-α and NF-κB and attenuated IL-13-induced α7-nAChR upregulation ($p<0.05$ for all). **Conclusion:** Activation of α7-nAChR by PNU-282987 attenuated IL-13-induced pro-inflammatory mediators expression in BEAS-2B, supporting a modulatory role of cholinergic signaling in airway epithelial cells responses.

Financial support: FAPESP (2022/02510-5 and 2023/09694-7), UT Tyler.

127 - Development and Characterization of BSA-Functionalized PNVCL Particles with Tunable Thermoresponsive Behavior for Biomedical Applications

Gabriel Re Calderon[1], Robert Smith[2], Tae-Youl Choi[2], Mohammad Omary[1]

[1]UNT Chemistry, [2]UNT Mechanical Engineering

Stimuli-responsive polymers have attracted significant interest for biomedical applications due to their ability to respond to environmental changes in a controlled manner. Poly(N-vinylcaprolactam) (PNVCL) is a promising thermoresponsive polymer with significant potential in biomedical applications due to extreme biocompatibility and tunable lower critical solution temperature (LCST). However, PNVCL has a native LCST of 32°C, which limits its effectiveness due to the need for a responsiveness closer to physiological temperature to execute biological applications. In this work, PNVCL will be copolymerized with acrylic acid and other hydrophilic copolymers to increase the LCST. PNVCL will also be decorated with BSA to introduce biologically relevant surface functionality and improve uptake by the pancreas and serve as an essential cog to the drug delivery system being designed. PNVCL material will be characterized through measurements of mean particle size and zeta potential to evaluate particle stability and surface properties. Thermoresponsive behavior will be investigated by monitoring optical density (OD) as a function of temperature using UV-visible spectrophotometry, allowing determination of phase transition behavior and LCST. In addition to temperature-dependent studies, the influence of environmental factors including pH and solvent composition on particle swelling, stability, and phase transition behavior will be examined. Poly(lactic-co-glycolic acid) (PLGA) systems containing BSA are prepared and characterized as a comparative control in terms of thermal response, stability, and potential suitability for biomedical delivery applications. This work seeks to establish a versatile thermoresponsive biomaterial system with tunable transition temperatures near physiological conditions, and the development of protein-functionalized polymers for drug delivery.

128 - Machine Learning-Based Detection of Parkinson's Disease Using Smartwatch Motion Sensor Data

Jamya Peoples[1], Anshuman Jaiswal[1], Victor Bii[1], Deepa Reghu[1], Charles Bland[1]

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Parkinson's disease is a progressive neurodegenerative disorder that affects movement, leading to symptoms such as tremors, bradykinesia, and rigidity. Traditional diagnostic methods rely on subjective clinical assessments, often resulting in delayed diagnosis. Wearable devices equipped with motion sensors offer a non-invasive and continuous monitoring approach, enabling early detection of movement abnormalities. In this study, a machine learning application was developed for diagnosing Parkinson's disease using motion sensor data from smartwatches.

Motion data from accelerometers and gyroscopes from 469 participants were processed into statistical features. Two machine learning classifiers were applied. The Random Forest model achieved an accuracy of 80.91% in distinguishing Parkinson's disease from Healthy Controls and 91.76% for Parkinson's disease versus Essential Tremor. The K-Nearest Neighbors model performed slightly better, achieving 82.84% accuracy for Parkinson's disease versus Healthy Controls and 92.95% for Parkinson's disease versus Essential Tremor. Both models demonstrated high recall for Parkinson's disease detection, reaching

95% for Parkinson's disease versus Healthy Controls and 99% for Parkinson's disease versus Essential Tremor. However, distinguishing Parkinson's disease from Essential Tremor posed a challenge, with a lower recall of 36% for Essential Tremor detection.

This study demonstrates the potential of smartwatch-based motion sensor data and machine learning techniques in detecting Parkinson's disease. The findings support the feasibility of using wearable technology for non-invasive and early diagnosis of movement disorders. Future research will include applying additional statistical features, as well as advanced deep learning models, including Neural Networks and Recurrent Neural Networks.

129 - Engineering Redox-Responsive Biomolecular Condensates from Designer Peptides for Mechanistic Insights and Therapeutic Delivery

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Biomolecular condensates are membrane-less compartments that form through liquid-liquid phase separation (LLPS) and play important roles in cellular organization and regulation. Although the molecular principles governing condensate formation have been extensively studied, the contribution of cysteine residues remains poorly understood. In this work, we designed a series of cysteine-containing peptides to examine how disulfide bond formation influences condensate behavior. We observed that cysteine residues promote condensate stability under oxidizing conditions through reversible disulfide crosslinks, while reducing environments trigger condensate dissolution. These findings suggest that cysteines function as tunable covalent interaction sites that alter the connectivity of condensate networks and facilitate phase separation at lower concentrations. Guided by these insights, we developed a cysteine-rich peptide, PSP-2, to create redox-responsive condensates for intracellular cargo delivery. PSP-2 condensates efficiently encapsulated a broad range of molecules, including fluorescent dyes, proteins, plasmid DNA, and mRNA, while exhibiting minimal cytotoxicity in cultured cells. Following cellular uptake, the reducing intracellular environment promoted condensate disassembly and cargo release. Notably, PSP-2 condensates achieved DNA and mRNA transfection efficiencies of approximately 88% and 80%, respectively, outperforming Lipofectamine 3000® under the conditions tested. Overall, this study identifies cysteine-mediated disulfide interactions as an important mechanism for regulating biomolecular condensates and demonstrates their potential for engineering responsive delivery systems. These findings provide new insights into condensate design and highlight redox-sensitive condensates as promising platforms for therapeutic delivery and biomaterial development.

130 - Screening Self-assembling Peptides in 3D Cancer Spheroids

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Translational prescreening of anticancer drugs remains challenging due to the limited predictive power of traditional models, poor drug penetration, and inadequate representation of tumor complexity, often leading to reduced clinical efficacy. To address this challenge, we utilized a three-dimensional (3D) breast cancer spheroid model cultured on a high-throughput pillar plate platform to better replicate the tumor microenvironment. This system supports dynamic flow-based testing and enables the evaluation of treatment responses under physiologically relevant conditions. To optimize spheroid formation and stability, various hydrogel formulations were tested. These compositions were selected to support spheroid viability and model both invasive and non-invasive tumor phenotypes. Once optimized, the platform was used to assess the therapeutic potential of an enzyme-induced self-assembling peptide (EISAP), Fmoc-FF-pTyr, which forms nanostructures in response to enzymatic activity within the tumor microenvironment. Treatment with EISAP, both alone and in combination with doxorubicin, was evaluated under static and dynamic conditions. Notably, co-treatment under dynamic flow significantly enhanced cytotoxic effects compared to static cultures, suggesting improved drug delivery and retention. Fluorescence labeling confirmed internalization of the peptide and its distribution throughout the spheroids.Overall, this study demonstrates the utility of a dynamic 3D spheroid platform for modeling drug-resistant tumors and evaluating novel therapeutic approaches. The combination of biomimetic culture conditions and enzyme-responsive peptide systems offers a promising strategy to improve treatment outcomes in breast cancer and beyond.

131 - Contribution of colonoscopy assets to the colorectal cancer disparities between high density- low density counties and between urban- rural counties in Mississippi.

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Background: Colorectal cancer (CRC) is the fourth most diagnosed cancer and the second leading cause of cancer-related death in the US. Mississippi experiences a disproportionate burden, particularly in rural and low-population density counties where access to colonoscopy services is limited.

Objective: To examine disparities in CRC incidence and mortality rates across high and low population density and urban-rural counties in Mississippi and to evaluate the relationship between colonoscopy assets and CRC outcomes.

Methods: Age-adjusted CRC incidence and mortality rates (2016-2021) were compared by population density (high- low), urbanicity-rurality, sex (female- male) and race (black- white) using two sample t-tests. Differences of colonoscopy assets (performed colonoscopies, registered gastroenterologists, certified endoscopists) in counties of high-low population density and urban-rural counties were examined by two sample t-tests. Spearman's rank correlation test was used to find see the correlation between assets and rates. Then, GLM of gaussian family under log link function was used to find out the association of assets with the rates.

Results: Low-density and rural counties had significantly higher CRC incidence and mortality rates. Male and Black populations experienced significantly higher CRC burden. Colonoscopy assets were more concentrated in high-density and urban counties. Significant weak correlations were found among assets and rates. GLM indicated assets were not significantly associated with rates, but population density was a significant factor.

Conclusion: Significant geographic and demographic disparities in CRC burden persist in Mississippi. Population density appears to be an important factor, while the role of colonoscopy assets distribution requires further investigation.

132 - Genomic Insights into Efibula americana TULF14: Fungal Metabolic Versatility for Biomedical Innovation

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Exploring novel fungal metabolic pathways enables the production of natural products, potential sustainable biomaterials, scaffolds for tissue engineering, and tools for detoxifying environmental/medical pollutants. *Efibula americana* TULF-14, identified at Tuskegee University, is a basidiomycete fungus (Irpicaceae, Polyporales), representing an under-explored source of lignocellulolytic enzymes with broad implications for biomedical technologies. This project characterized the TULF-14 whole mitochondrial genome assembly, structural annotation, and gene architecture. First, unique cultures recovered from the Lafayette Frederick Collection were identified using ITS1/ITS4 primers. The consensus sequence was deposited into GenBank, and accession numbers were generated. DNA was extracted and purified from TULF-14 fungal biomass harvested from culture grown on potato dextrose agar (PDA) at the Arizona Genome Institute (AGI). The *Efibula americana* TULF-14 v1.0 genome was sequenced using PacBio long-read technology, assembled with Flye, and annotated using the Joint Genome Institute (JGI) Annotation Pipeline. Genome-wide analysis of this novel species revealed an extensive repertoire of carbohydrate-active enzymes (CAZymes) comprising 171 glycoside hydrolases, 64 glycosyltransferases, 57 auxiliary activity enzymes, 43 carbohydrate-binding modules, 14 carbohydrate esterases, and 8 polysaccharide lyases. Although these are yet to be further explored, these metabolites suggest a substantial biotechnological and biomedical potential. In addition to its capacity for lignocellulose degradation, the genome indicates promise for the discovery of antimicrobial and anticancer metabolites, immunomodulatory polysaccharides, oxidative enzymes with pharmaceutical applications, and biocatalysts for environmental detoxification and public health protection. Beyond the aforementioned applications, the genome sequence, currently deposited into the Mycocosm database, expands the fungal reference library for comparative studies in biomedical engineering.

133 - Nir-1 localizes at plasma membrane in alveolar cells exposed to cadmium

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Introduction. Cadmium is a highly toxic heavy metal that has been linked to significant cellular damage in the lung cells leading oxidative stress, disrupted signaling pathways, and cytotoxicity. How cadmium disrupts signaling pathways is not fully known. Phosphatidylinositol 4,5-bisphosphate (PIP_2) is a key lipid molecule located in the inner side of the plasma membrane that regulates diverse cellular processes including endocytosis and exocytosis. The cycling of PIP2 occurs through phosphatidylinositol (PI) cycle and is mediated by lipid transfer proteins (LTP) called PI transfer proteins (PITPs) which includes Nir1 (PITPNM3/RdgBαIII), Nir2 (PITPNM1/RdgBαI), and Nir3 (PITPNM2/RdgBαII). Nir1 has been shown to

regulate PIP2 homeostasis by constitutively localizing at ER-PM junctions and promoting the recruitment of Nir2. Nir1 has also been associated with several human diseases including cancer metastasis and epithelial-to-mesenchymal transition. In the present study, we hypothesize that Nir1 may function as a potential molecular sensor that influences cadmium lung cytotoxicity.

Materials and Methods. A549 cells were exposed to different concentrations of CdCl2 (µg/ml) for 24 h and the cytotoxic effect and Nir1 localization were assessed. Cell viability was measured using cell proliferation assay (Abcam) and Nir1 localization was determined using immunocytochemistry (Thermofisher Scientific).

Results. Cadmium cytotoxicity was evaluated using 5 different concentrations (0, 5, 10, 20, 40 µg/ml). Cell viability was measured after 24h and we found that concentrations higher than 5 µg/ml significantly decreased cell viability. Nir1 intensity on the plasma membrane was significantly increased by CdCl2 at concentration of 5 µg/ml.

Conclusion. The data shows that Nir1 acts as a sensor to cadmium cytotoxic potential in lung cells and perturbs plasma membrane lipid transfer protein Nir1

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134 - An Oasis is a Data Desert: Incorporating a Genomics Module into an Undergraduate Biology Course

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Fungi colonize most terrestrial and aquatic habitats, playing a vital role in the decomposition and assimilation of organic material. The Kingdom Fungi has a plethora of cryptic and underexplored taxa with potential in the biomedical industry. Genome sequences contribute to the construction of the evolutionary history of fungi, enhances the understanding of ecological dynamics and global change. The -omics era is booming and recommended mandatory training for STEM workforce development. However, over 82 percent of HBCUs, including Tuskegee University (TU), are in data deserts. The Mycological Curriculum for Education and Discovery (Myco-Ed), is a national program supporting access to bioinformatic workflows and platforms. The goal of this study was to compare students' bioinformatics score before and after their participation in the MycoEd genomics module. Pre and post surveys were implemented in four credit hour General Ecology course (Biol 311) to quantify bioinformatics gains. Students were introduced to the NCBI and JGI Mycocosm databases to guide the retrieval of fungal genomic data. Students characterized the genomes and constructed phylogenetic trees using MEGA 12. Quantitative survey data will be analyzed using descriptive and inferential statistics. Biodiversity and climate research is a novel area of investigation for TU students which addresses cross cutting themes in biomedical engineering practically the "One Health, One World" model. Future studies will conduct correlational analysis to determine the relationship between Myco-Ed genomic modules the Myco-Ed network for protocol and training optimization.

135 - Development of Silk Protein-Based Drug Delivery System for Lung Cancer Treatment

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Recent advances in drug delivery systems (DDS) have emphasized the need for site-specific delivery with minimal systemic toxicity. Lung cancer treatment remains challenging because conventional chemotherapy has limited efficacy and severe side effects. Although nanoparticle-based DDS improve pharmacokinetics and controlled drug release, selective accumulation in lung tissue remains limited due to rapid hepatic and splenic clearance.

To address these limitations, silk sericin-fibroin composite discoidal microparticles (SSSF-DSPs) were developed as a lung-targeted DDS. Particles were fabricated with a discoidal geometry of approximately 3 µm; this shape promotes margination toward vessel walls and preferential lodging in lung capillaries. Silk sericin (SS) contributes biocompatibility and drug-loading capacity, while silk fibroin (SF) provides structural integrity and pH-responsive mechanical properties.

The SSSF-DSPs exhibited uniform morphology and accelerated docetaxel release under acidic conditions (pH 5.4) while maintaining stability at physiological pH (7.4).

In vitro cytotoxicity assays using A549 and SCC7 cancer cells demonstrated enhanced anticancer activity of docetaxel-loaded SSSF-DSPs compared with free docetaxel. In vivo biodistribution studies confirmed preferential lung accumulation following intravenous administration, resulting in effective suppression of metastatic lung nodules and prolonged survival with reduced systemic toxicity.

SSSF-DSPs represent a promising geometry-mediated, pH-responsive chemotherapy platform for metastatic lung cancer, combining enhanced antitumor efficacy with an improved systemic safety profile.

136 - The Role of Transient YAP Signaling in Liver Regeneration

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The transcriptional co-activator YAP is a central regulator of liver regeneration, orchestrating the proliferative and metabolic responses required to restore damaged tissue. Paradoxically, the same mechanisms drive hepatomegaly and tumor formation, raising a fundamental question about the underlying mechanisms that dictate whether YAP promotes regeneration or pathological growth. To address this gap, we developed an in vivo model of dynamic YAP signaling using a doxycycline-inducible system to control the transient expression of a constitutively active YAP in hepatocytes. We found that while YAP-dependent effects on liver growth and cell proliferation are reversible, there are metabolic changes in the liver that remain stable even after YAP inactivation. By coupling RNAseq and ATACseq analyses, we unraveled persistent changes in gene expression and chromatin remodeling, particularly those involved in metabolic processes. Furthermore, we demonstrated that transient YAP signaling sensitizes the liver to develop more severe liver injuries than normally induced in an unprimed liver. Collectively, our findings suggest that transient YAP activation imparts a form of cellular memory that primes the liver toward disease susceptibility. This work highlights a previously unrecognized long-term consequence of transient YAP signaling that carry implications for regenerative medicine.

137 - Microstructure-Based Multiscale Modeling of Articular Cartilage Mechanics

Saiful Islam[1]

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Articular cartilage derives its load bearing and near-frictionless function from a highly organized, depth-dependent collagen network in a hydrated proteoglycan matrix. Disruption of this architecture is an early hallmark of osteoarthritis, yet linking microstructural change to whole-tissue mechanics remains challenging. Finite-element models that explicitly resolve the microstructure including collagen fibrils, pericellular matrix, and embedded chondrocytes; capture this link but are far too costly for joint-scale simulation. We present a multiscale homogenization framework that replaces the explicit microstructure with an equivalent tissue-level continuum while preserving its mechanical behavior.

Representative volume elements of the superficial, middle, and deep zones were built from zone-specific collagen orientation and proteoglycan content. Their effective properties were assigned as depth-dependent, orthotropic engineering constants within a biphasic continuum in Abaqus.

The framework reproduced cartilage's characteristic depth-dependent anisotropy: the superficial zone was stiffest parallel to the joint surface (≈3.0 MPa) and about 13 times softer perpendicular to it (≈0.22 MPa), reversing with depth to the deep zone, stiffest perpendicular to the surface (≈1.73 MPa). We benchmarked the continuum against an experimentally validated microstructural model under multi-step unconfined-compression stress relaxation. It predicted peak forces rising from ≈0.32 to ≈0.71 N, an equilibrium force of ≈0.13 N, and fiber-dominated stresses approaching ≈5 MPa in the superficial zone; the homogenized continuum reproduced this response within ≈8% while cutting solution time from roughly a day to under an hour.

By providing fast, microstructure-derived properties, the framework enables full three-dimensional cartilage models, impractical when every fibril and cell is resolved explicitly, supporting future research on osteoarthritis and engineered cartilage.

138 - Cannabidiol (CBD): Trending Non-Pharmaceutical Products with not fully elucidated pharmacology.

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Cannabidiol (CBD) is a non-psychoactive phytocannabinoid derived from Cannabis sativa that has gained widespread popularity for both medical and recreational uses. Following the legalization of hemp-derived CBD products containing less than 0.3% tetrahydrocannabinol (THC), the market has expanded rapidly, leading to the incorporation of CBD into oils, capsules, topical formulations, foods, beverages, and vaping products. However, unlike conventional FDA-approved pharmaceuticals, many over-the-counter CBD products are manufactured without standardized quality control measures, potentially resulting in variability in cannabinoid content, bioavailability, and biological effects. This short presentation will provide an overview of ongoing efforts to characterize commercially available CBD products and evaluate CBD biological effects at cellular level. These studies span from analytical chemistry approaches to cell-based assays to collectively advance our understanding of CBD pharmacological and toxicological effects and support the development of evidence-based assessments of CBD products safety.

139 - Design of Conjugated Polymers and Molecules towards Biomedical Imaging and Sensing

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Conjugated polymers have proven to be useful materials in numerous applications, including electronics, sensors, and biologics, because the ability to install application specific functionalities via synthetic transformations. For example, ionic species may be tethered to the conjugated backbone that enables typically hydrophobic conductive polymers to be interfaced with hydrophilic environments. Subsequent stimuli-responsive changes of emission and perceived colors enables their utility as biologic sensors. This talk will describe synthetic efforts that accomplish these goals and provide a perspective on future design paradigms that will enable attaining next-generation optoelectronic materials suited for bioapplications. Synthesis of novel charged polymers will be discussed to highlight the tailorability of synthetically-simple, yet tunable building blocks that lead to new macromolecular properties such as aqueous compatibility. These polymers are also sensitive to their environments where rates of degradation are controlled by choice of acid, including sensitivity to PFAS. Synthetic tailorability is also exploited to develop vibrant color switches with application of electrochemical potentials such that these materials may be viable in neurological sensing. Combined, next generation biomaterials are envisioned to be accessible through a "ground up" approach by exploiting scalable and simple syntheses to access desired properties.

140 - Evaluation of α4β2 nAChR PAMs in a Zebrafish Model of Parkinson's Disease

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Parkinson's disease (PD) is a neurodegenerative disorder characterized by progressive loss of dopaminergic neurons and motor dysfunction. While current therapies alleviate symptoms, they do not halt disease progression, highlighting the need for novel therapeutic strategies. α4β2 nicotinic acetylcholine receptors (nAChRs) are highly expressed on dopaminergic neurons and represent promising therapeutic targets due to their role in regulating dopamine release and neuronal survival. Positive allosteric modulators (PAMs) of α4β2 nAChRs have the potential to be neuroprotective agents by enhancing receptor function while preserving physiological cholinergic signaling. **Methods:** Zebrafish larvae were exposed to 6-hydroxydopamine (6-OHDA) beginning at 3 days post-fertilization (dpf) to induce a Parkinson's disease-like phenotype. Lead α4β2 nAChR PAMs were evaluated for their ability to mitigate neurotoxin-induced behavioral and molecular alterations. Locomotor activity was assessed using automated behavioral tracking, and gene expression analyses were performed to evaluate biomarkers associated with dopaminergic signaling, mitochondrial function, and oxidative stress responses. **Results:** Exposure to 6-OHDA induced locomotor deficits and molecular alterations consistent with dopaminergic dysfunction and oxidative stress. Preliminary data suggest reversal of 6-OHDA-induced molecular and behavioral changes upon treatment with α4β2 nAChR PAMs. Correlation analyses further supported an association between preservation of dopaminergic markers and improved behavioral outcomes. **Conclusion:** These findings demonstrate the neuroprotective potential of α4β2 nAChR PAMs in a zebrafish model of Parkinson's disease. By improving behavioral performance and attenuating molecular alterations associated with dopaminergic neurodegeneration, these compounds represent promising candidates for further development as therapeutic strategies for Parkinson's disease.

141 - Integrated Training Programs for Preparing the Next Generation of Professionals through Biomedical Research Education and Workforce Development at Tuskegee University

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[1]Tuskegee University

Tuskegee University (TU), a historically Black university with a longstanding commitment to STEM education, has developed comprehensive biomedical research education programs aimed at preparing the next generation of diverse professionals for research and healthcare careers. These programs integrate undergraduate and graduate training through a continuum of research education, mentorship, and workforce development initiatives designed to enhance student success and career readiness.

TU's cancer research education programs (REC) in partnership with Morehouse School of Medicine and the University of Alabama at Birmingham O'Neal Cancer Center, is designed to increase the exposure of scholars to biomedical research. These programs strengthen the educational pipeline from high school, undergraduate education to graduate, medical, and research careers by providing early exposure to cancer and biomedical research. Tuskegee students benefit from advanced research training, cross-institutional collaborations, and exposure to translational biomedical research environments.

In addition, TU is advancing genomic workforce development through an NIH/NHGRI-supported training initiative that equips undergraduate and graduate students with foundational and applied skills in genomics, bioinformatics, and precision medicine. This program emphasizes interdisciplinary training, integrating genomics research with data science, ethical considerations, and health disparities, thereby preparing trainees for emerging careers in genomic and biomedical sciences.

Collectively, these programs create a synergistic training ecosystem that combines experiential learning, mentorship, and interdisciplinary collaboration. This model enhances student competencies in biomedical and genomic sciences while strengthening the representation of Tuskegee graduates in the national STEM workforce. TU's integrated approach provides a scalable framework for advancing inclusive excellence in biomedical and science education.

142 - The Evolution of Anatomical Sciences Education and Its Implications for Biomedical Engineering

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Anatomical sciences education has undergone a profound transformation since the Renaissance-era foundations established by Andreas Vesalius, whose systematic cadaveric dissection studies laid the groundwork for modern biomedical knowledge. For centuries, cadaveric dissection served as the irreplaceable cornerstone of anatomical instruction, providing tactile, kinesthetic, and visual learning experiences unmatched by any other modality. However, declining cadaver availability, mounting ethical complexities, resource constraints, and the escalating cognitive demands of modern health professions curricula have collectively accelerated a broad pedagogical evolution toward multimedia, technology-enhanced instructional models.

Plastination, introduced by Gunther von Hagens in 1977, represented an early landmark in this evolution. By replacing biological fluids and lipids with durable polymer resins, plastination produces odorless, lifelike specimens with extended longevity, improving accessibility and handling compared to formalin-fixed cadavers. A 2024 systematic review and meta-analysis published in Anatomical Sciences Education found that plastinated specimens produced comparable knowledge outcomes to traditional cadaveric methods, while students reported enhanced ease of use, improved spatial understanding, and greater motivation to study (Goh et al., 2024).

The integration of radiologic imaging, including computed tomography (CT), magnetic resonance imaging (MRI), and cross-sectional ultrasound, into anatomy curricula has further bridged the gap between gross anatomy and clinical practice. Radiologic anatomy reinforces three-dimensional spatial reasoning, prepares students for diagnostic imaging interpretation, and aligns anatomical education more directly with clinical competencies. Three-dimensional printing has extended this radiologic-anatomical connection: CT- and MRI-derived datasets can be processed into high-fidelity physical models enabling hands-on exploration of structures otherwise inaccessible or rare in cadaveric specimens. A systematic review and meta-analysis confirmed that 3D-printed models yield significant improvements in knowledge acquisition over traditional two-dimensional methods, with junior learners deriving the greatest benefit (Costello et al., 2020).

Virtual and augmented reality (VR/AR) technologies have further expanded the pedagogical toolkit available to anatomists. A 2024 meta-analysis in Anatomical Sciences Education demonstrated a moderate, statistically significant effect of VR on knowledge scores relative to traditional methods, while over 85% of students rated extended-reality technologies as useful for anatomical learning (García-Robles et al., 2024; Salimi et al., 2024). Gamification strategies, including Jeopardy-style review games, digital quiz platforms, and serious game applications, complement these technologies by promoting active retrieval practice, reducing academic anxiety, and sustaining engagement across distributed learning sessions (Pathiraja & Ranasinghe, 2024).

These convergent innovations in anatomical sciences education carry significant implications for the field of biomedical engineering. Biomedical engineering is fundamentally reliant on anatomical knowledge, from biomechanics and prosthetic design to tissue engineering, medical imaging systems, and surgical device development. Enhanced anatomical literacy, cultivated through 3D printing, VR, and radiologic integration, produces graduates better equipped to conceptualize anatomically accurate scaffold geometries, design patient-specific implants, and interpret imaging data during device validation. Conversely, biomedical engineering innovations reciprocally advance anatomical education: CT- and MRI-based segmentation tools, additive manufacturing platforms, and extended-reality systems developed within engineering contexts are the very technologies enabling the next generation of anatomical pedagogy. This bidirectional relationship positions anatomical sciences and biomedical engineering as mutually reinforcing disciplines whose continued convergence promises to improve both educational outcomes and translational biomedical innovation.

143 - Geographic Distribution of Pediatric Level 3 and Level 4 Epilepsy Centers in the United States

Hema Verma[1], Shefali Karkare[2]

[1]Complete Orthopedics, [2]Cohen Children's Medical Center

Background: Pediatric epilepsy surgery and advanced epilepsy care are concentrated within specialized centers. However, the geographic distribution of pediatric epilepsy centers and potential disparities in access across the United States remain poorly characterized.

Methods: We conducted a national descriptive geospatial analysis of pediatric Level 3 and Level 4 epilepsy centers accredited by the National Association of Epilepsy Centers (NAEC). Centers were identified using publicly available NAEC directories.

Locations were geocoded using 5-digit ZIP codes linked to 2020 United States Census ZIP Code Tabulation Areas (ZCTAs), and representative points were used for spatial mapping. State-level distributions were summarized descriptively for the contiguous United States.

Results: A total of 132 pediatric Level 3 and Level 4 epilepsy centers were identified across 38 states and the District of Columbia. The highest number of centers was observed in New York (n = 16), followed by California (n = 11) and Texas (n = 9). Ten states—primarily in the Mountain West and Northern Plains regions—had no pediatric Level 3 or Level 4 centers. Regional clustering was most prominent in the Northeast and major metropolitan areas.

Conclusions: Pediatric epilepsy centers in the United States demonstrate substantial geographic concentration, with notable gaps in several regions. These disparities may contribute to delayed access to advanced epilepsy care and surgical evaluation for children in underserved areas. Policy and telehealth strategies may help mitigate geographic inequities.

144 - Understanding Challenges in Food Rx Initiatives: Leveraging Artificial Intelligence for Solutions

Hema Verma[1], Aryan Verma[1]

[1]Complete Orthopedics

Food prescription programs represent a promising healthcare intervention addressing chronic disease management and nutritional insecurity. While empirical evidence demonstrates substantial benefits—including reduced hospital admissions, improved health outcomes, and significant cost savings—implementation barriers substantially limit program efficacy and scalability. This comprehensive review examines gaps and limitations in current Food Rx initiatives, including limited access to services, transportation constraints, inadequate healthcare provider training, time limitations, and insufficient clinician knowledge regarding program resources. Healthcare professionals express need for enhanced cultural humility and culinary nutrition competencies. Additionally, inconsistencies in program target populations, delivery mechanisms, and evaluation methodologies hinder comparative effectiveness research and sustainability assessment. Artificial intelligence technologies—including machine learning, deep learning, and natural language processing—offer transformative potential to address these implementation challenges. Current AI applications such as RxFood, iSpy, SnakChat, and GoodMeasureMeals demonstrate efficacy in dietary assessment, carbohydrate counting, food identification, and real-time nutritional monitoring. Integration of AI into Food Rx programs facilitates personalized nutrition recommendations, reduces provider time burden, enables continuous patient monitoring, and provides evidence-based feedback for program optimization. Electronic health record integration via standardized access protocols renders such systems technically feasible across diverse healthcare settings. With 94.6% of Americans having internet access and robust broadband penetration, digital barriers to adoption are minimal. This review proposes AI-integrated food prescription programs as a cost-effective solution to enhance program fidelity, expand care delivery capacity, and mitigate documented implementation gaps. Future research must validate AI integration across diverse populations, establish clinical outcome benchmarks, and ensure safeguards against algorithmic bias. Healthcare providers should view AI as a supportive diagnostic and monitoring tool augmenting—not replacing—human clinical expertise and judgment. Strategic integration of AI technologies within comprehensive Food Rx frameworks can advance healthcare toward more precise, equitable, and economically sustainable nutrition-focused care delivery.

145 - Geographic Disparities in Pediatric Healthcare Provider Distribution Across the United States and Territories

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Background: Equitable access to specialized pediatric healthcare services is essential for child population health outcomes. However, significant geographic disparities in the distribution of pediatric provider infrastructure across the United States remain inadequately characterized.

Methods: We conducted a descriptive analysis of pediatric hospital distribution by state and territory. Data were aggregated from fifty states and United States territories to characterize geographic variation in provider density and accessibility.

Results: Substantial geographic disparities were identified in pediatric hospital distribution. States with the highest concentrations included California (108), New York (83), and Illinois (59), while significant underservice was evident in rural and less populated states including Iowa (1), Kansas (1), New Mexico (1), Nevada (1), Rhode Island (1), and Vermont (1). The highest concentrations were in states with major metropolitan areas, whereas sparse distribution characterized many rural and frontier regions.

Conclusions: Geographic disparities in pediatric hospital availability represent a significant barrier to equitable healthcare access. These findings underscore the need for policy interventions targeting underserved regions to ensure all children have access to specialized pediatric care regardless of geographic location.

146 - Ghost Rates and Data Quality Dimensions in Orthopedic Price Transparency: A Multi-Payer National Analysis

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Background: Transparency in Coverage (TiC) mandates require commercial insurers to publish negotiated rates for all services. Previous research has documented that ghost rates (negotiated rates for services a provider would never perform) constitute a substantial proportion of published rate data. However, no published study has quantified the ghost rate problem within a single surgical specialty, nor has ghost rate existence been characterized across multiple data quality dimensions simultaneously.

Methods: Analysis of a proprietary national orthopedic surgery dataset derived from carrier machine-readable files (MRFs). The dataset includes rows across multiple carriers, states, unique National Provider Identifiers (NPIs), metropolitan statistical areas, and unique billing codes. Orthopedic surgery providers were identified using two criteria: facility provider type classified as Orthopaedic Surgery, or provider taxonomy codes within the 2085 family (encompassing all orthopedic sub-specialties). All remaining rows were classified as non-orthopedic. Ghost rates were classified by dimension: (1) provider-specialty-to-billing-code mismatches, (2) place-of-service anomalies where orthopedic surgeons carry rates at clinically implausible locations, and (3) corporate default rates applied uniformly across networks regardless of local market conditions. Rate citability (traceability to original carrier MRF source) was assessed. Vendor-assigned metadata fields (confidence scoring, rate type, data vintage) were evaluated as single-field filters for data quality discrimination.

Results: Ghost rates constitute a multi-dimensional quality problem spanning three independent dimensions. Provider-specialty-to-billing-code mismatches account for a substantial portion of rows. Place-of-service anomalies represent a second, previously unreported dimension, with orthopedic surgeons carrying negotiated rates at ambulances, schools, hospices, psychiatric residential treatment centers, and custodial care facilities. Corporate default rates represent a third dimension, with a large proportion of rows flagged as BlueCross BlueShield PPO default rates applied uniformly across provider networks. A single vendor-assigned confidence score field discriminates reliably between citable rates (traceable to carrier MRFs) and estimated rates (vendor-derived without source documentation) with near-perfect accuracy. Data version updates show citability degradation rather than improvement, with newer versions expanding dataset breadth by substituting vendor-estimated rates for verified rates. Rate citability varies dramatically across carriers, ranging from minimal citability at some payers to near-complete citability at others.

Conclusion: A four-field filtering approach incorporating provider taxonomy, place of service, billing class, and confidence scoring is necessary to identify both dimensions of ghost rates in orthopedic transparency data. Single-field or single-source approaches are insufficient for data quality assurance in consumer-facing orthopedic pricing tools.

147 - Commercial Negotiated Rates, Setting-Specific Variation, and Benchmarking for Orthopedic Joint Replacement Procedures

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Background: Commercial negotiated rates for orthopedic joint replacement procedures vary substantially by carrier, care setting (facility versus non-facility, ambulatory surgery center versus hospital), and orthopedic sub-specialty. Setting-specific and carrier-specific benchmarking is necessary for valid price comparison and cost containment strategy. However, percent-of-Medicare benchmarking for orthopedic professional fees by individual commercial carrier using Transparency in Coverage data has not been published.

Methods: Analysis of a proprietary national orthopedic surgery dataset containing negotiated rates for joint replacement and major orthopedic procedures across multiple commercial carriers. Restriction to rows where facility provider type was Orthopaedic Surgery and Medicare professional benchmark was populated and greater than zero. Stratification by place of service (facility versus non-facility, ambulatory surgery center). Calculation of percent-of-Medicare ratios comparing commercial negotiated rates to Medicare professional fee schedules. Assessment of rate variation by carrier and setting. Sub-specialty taxonomy code analysis identifying pricing variation across orthopedic sub-specialties (general, spine, foot/ankle, pediatric, sports medicine, adult reconstructive, hand, musculoskeletal oncology, trauma, surgical critical care, joint replacement).

Results: Commercial orthopedic rates vary substantially relative to Medicare benchmarks. Facility professional fees are systematically lower than non-facility fees, consistent with Medicare's site-of-service adjustment methodology accounting for office overhead differences. Ambulatory surgery center rates differ meaningfully from hospital facility rates. Percent-of-

Medicare benchmarks reveal substantial variation across carriers, with carriers at opposite ends of the distribution showing nearly two-fold difference in commercial-to-Medicare ratios. Substantial proportions of rates fall above and below Medicare across different carriers, with very few carriers at exactly Medicare parity. Sub-specialty taxonomy codes within orthopedic surgery identify meaningful pricing variation, with different orthopedic sub-specialties commanding different commercial negotiated rate premiums relative to Medicare.

Conclusion: Setting-specific and carrier-specific benchmarking is essential for understanding orthopedic price variation. Transparent display of facility versus non-facility rate differential and site-of-service adjustment is necessary for valid patient and employer price comparison for joint replacement and other orthopedic procedures. Sub-specialty differentiation improves price transparency for orthopedic care.

148 - Rate Citability, Cross-Source Concordance, and Data Verifiability in Orthopedic Price Transparency Across Carriers, Hospitals, and Vendors

Rupesh Tarwala[1], Vedant Vaksha[2], Mohammad Athar[2], Ocean Thakar[2], Paresh Patel[2], Ambreen Sharif[2], Fiona Zheng[2], Blaize Haas[2], Rajwinder Singh[2], Jay Sangwan[2], Suhirad Khokhar[3], Aryan Verma[2], Nakul Karkare[2]

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Background: Commercial orthopedic rates are published across multiple sources: carrier machine-readable files (MRFs) under the Transparency in Coverage rule, hospital standard charge files under the Hospital Price Transparency rule, and vendor-curated datasets combining and estimating rates from multiple sources. The degree to which rates from different sources agree for identical providers and procedures remains unknown. Rate citability, the traceability of a published rate to its original source, substantially across sources and carriers but has not been systematically characterized.

Methods: Cross-sectional analysis comparing orthopedic rates across three data source types for identical providers, billing codes, and payers. Assessment of citability (proportion of rows with rates traceable to original source MRFs versus vendor-estimated rates) by carrier and data version. Examination of whether citability improves or degrades with successive data version updates. Multi-source cross-validation comparing provider-level rates across carrier MRFs, hospital standard charge files, and vendor-curated datasets for a sample of providers and procedures where all three sources are available. Calculation of rate concordance ratios between sources.

Results: Rates for the same provider and billing code diverge substantially across sources, with vendor-to-source rate ratios showing wide variation. Citability—the proportion of rows with verified source documentation—exhibits extreme variation across carriers, with minimal citability at some payers and near-complete citability at others. Data version updates demonstrate citability degradation, with expanded datasets substituting vendor-estimated rates for verified rates. A single metadata field identifying citable source rates can discriminate high-quality from estimated rates with near-perfect accuracy. Cross-source concordance analyses reveal substantial divergence when four independent rate sources are available for the same provider-code combinations, with only a small proportion of comparisons showing exact matching across sources.

Conclusion: Single-source price displays are unreliable for orthopedic comparison. Multi-source cross-validation is necessary for rate verifiability. Newer data versions prioritize coverage breadth over verifiability. Citability must be stratified and reported alongside completeness metrics in transparency data assessments.

149 - Hospital Orthopedic Price Transparency Compliance, Federal Template Evolution, and Regulatory Impact on Data Accessibility

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Background: Federal hospital price transparency regulations have evolved through successive CMS template versions (v2.2.0 and v3.0.0), with requirements effective January 1, 2026 including volume data fields, named-officer attestation, and median/percentile allowed amounts derived from encounter data (ERA). Compliance outcomes for orthopedic services and the actual impact of template standardization on data usability and equity have not been systematically evaluated across multiple hospitals and regulatory environments.

Methods: Retrospective comparison of hospital standard charge files from multiple community hospitals operating under different CMS template versions, file formats (CSV versus JSON), and state regulatory environments. Measurement of negotiated dollar amount disclosure completeness, availability of volume/utilization fields, file format accessibility (machine-readable versus human-readable by non-technical staff), metadata completeness, and compliance variation by institutional and

regulatory context. Assessment of how template version adoption correlates with actual negotiated dollar disclosure rates for orthopedic services.

Results: Negotiated dollar amount availability ranges from complete non-disclosure to full disclosure across hospitals operating under identical federal requirements. Hospitals adopting newer template versions (v3.0.0 with named-officer attestation and volume data requirements) achieved substantially higher compliance with negotiated dollar disclosure than those on older templates (v2.2.0). Compliance correlates with template version adoption and institutional commitment, not with state regulatory environment intensity. Rural hospitals can achieve complete compliance independent of state regulatory infrastructure. File format choice (CSV versus JSON) creates meaningful accessibility barriers for non-technical staff and patients, with JSON files inaccessible to spreadsheet applications and requiring programming tools for parsing. State regulatory environment and presence of state-level infrastructure (APCD mandates, enforcement, Medicaid expansion) does not predict hospital-level compliance outcomes.

Conclusion: Federal template standardization, volume data requirements, and named-officer attestation are more effective compliance drivers than state-level regulatory infrastructure. Format standardization mandating CSV or human-readable output is necessary for equitable patient and staff access to orthopedic pricing data. Institutional commitment to disclosure may matter more than external enforcement pressure.

150 - Data Sourcing Strategy, Tool Feasibility, and Implementation Framework for National Orthopedic Price Transparency Database

Rupesh Tarwala[1], Vedant Vaksha[2], Mohammad Athar[2], Ocean Thakar[2], Ambreen Sharif[2], Paresh Patel[2], Fiona Zheng[2], Rajwinder Singh[2], Blaize Haas[2], Jay Sangwan[2], Suhirad Khokhar[3], Aryan Verma[2], Nakul Karkare[2]

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Background: Building a consumer orthopedic price transparency database requires selecting among multiple data source types (carrier machine-readable files, hospital standard charge files, vendor-curated datasets) and integrating available verification tools. The practical trade-offs between coverage completeness, rate verifiability, cross-source concordance capability, format accessibility, and technical requirement barriers have not been systematically evaluated in the academic literature.

Methods: Comprehensive inventory and assessment of carrier machine-readable file access methods for major commercial insurers, hospital file standards and compliance, commercial vendors with row-level provenance tracking, and consumer/staff-facing verification tools. Evaluation across dimensions: coverage completeness, rate verifiability (citability), cross-source concordance capability, file format accessibility, requirement for technical staff, cost structure, and enforcement history. Analysis of ghost rate prevalence in direct MRF ingestion versus hospital file sourcing. Comparison of reliability of hospital MRFs versus carrier MRFs following recent CMS template mandates.

Results: Direct machine-readable file ingestion is technically feasible but operationally impractical at scale due to ghost rate prevalence, format fragmentation, and volume. Hospital machine-readable files have become more reliable than carrier files for facility-level rates following recent template mandates and attestation requirements, with placeholder values now banned and volume data required. Carrier files remain necessary but face substantial verifiability challenges for professional and physician rates, with the majority of rows containing vendor-estimated rather than source-verified rates. Very few free tools meet basic criteria for non-technical staff use and payer-specific rate return at the billing code level. Enforcement is asymmetric, with hospitals facing substantial enforcement pressure and civil penalties while commercial insurers face no public enforcement.

Conclusion: A realistic five-layer hybrid sourcing strategy is implementable and balances operational feasibility with data verifiability: hospital files for facility codes, vendor-mediated carrier data for professional codes, Medicare fee schedules as reference benchmarks, vendor cross-checking for ghost rate filtering, and direct verification for high-volume shoppable orthopedic procedures. This strategy acknowledges the strengths and limitations of each data source while maintaining transparency about rate sourcing.

151 - Systematic Review of Free Orthopedic Price Verification Tools and Gap Analysis in Consumer-Facing Price Transparency Implementation

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Background: Patients, employers, and clinical staff need free, accessible tools to verify payer-specific orthopedic negotiated rates at the billing code level. The universe of available tools and their functionality has not been systematically cataloged.

Many tools referenced in practice have been deprecated, acquired, or archived, and the functional ecosystem remains poorly characterized.

Methods: Systematic review of all publicly available orthopedic and general healthcare price transparency tools. Classification by operational status (currently functional versus deprecated/archived), usability by non-technical staff (browser and spreadsheet only, no programming required), payer-specificity of returned data (payer-specific rate return at billing code level versus benchmark/gateway only), cost (free versus paid), and functional capability. Gap analysis comparing available data in carrier and hospital machine-readable files against what patients and clinical staff actually see on consumer healthcare platforms. Assessment of whether published rate data reaches end users.

Results: Only a small number of free, non-technical, payer-specific orthopedic price verification tools are currently functional. Multiple tools that were previously available and widely referenced have been deprecated, acquired by private companies, or archived. All community-maintained free databases have ceased active data collection. Patient-facing healthcare platforms display detailed Medicare utilization data and clinical information but show substantial variation in commercial pricing information display, with some platforms displaying zero commercial insurance pricing information despite existence of such data in vendor datasets and hospital standard charge files. Staff verification workflows lack standardized tools and require training on available resources. The gap between available published rate data and what consumers see represents a substantial implementation barrier.

Conclusion: The free verification tool ecosystem is inadequate for orthopedic price transparency implementation. Standardized tool development and designated primary verification platforms are necessary to close the gap between published data availability and actual patient and staff access. Education for clinical staff on available verification resources and methodology is urgent and necessary.

152 - Developing Self-Supervised Continual Machine Learning for Adaptive Pediatric Myoelectric Control

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Current estimates from the CDC indicate that approximately four of every 10,000 live births involve congenital upper-limb deficiency. Children with upper limb differences present unique prosthetic challenges underrepresented in electromyographic actuated device research. Use of upper limb prosthesis can require significant training which may lead to high abandonment rates. Rapid growth cycles requiring frequent refitting, and limited tolerance for extensive calibration procedures, make these challenges more pronounced. Currently, myoelectric systems primarily focus on adult amputee populations, using high-density electrode arrays that require extensive signal processing which creates cost and complexity barriers to pediatric deployment.

This research presents a pediatric-focused co-adaptive framework deployable on single-point microcontrollers, in contrast to conventional high-density approaches that require dedicated computing hardware. This training system processes 8-channel sEMG with 6-axis IMU fusion for 9-gesture classification using the NinaPro DB8 protocol, combining temporal convolutional networks with prospective learning to enable self-supervised adaptation from natural movement sequences.

The co-adaptive approach enables: (1) subject-independent pre-training via leave-one-subject-out (LOSO) cross-validation that establishes baseline gesture recognition without calibration, and (2) continuous learning during device operation that leverages gesture prediction to personalize performance while preventing catastrophic forgetting. By storing compressed feature representations rather than raw signals, the entire system operates with minimal on-device memory. This framework presents a promising step forward toward adaptive myoelectric control systems that can grow and learn alongside the children.

153 - Maternal inflammation exacerbates intrauterine growth restriction-induced cognitive dysfunction and brain vascular deficits in juvenile rats with sex-specific effects

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Epidemiological and experimental studies associate intrauterine growth restriction (IUGR) with neurodevelopmental impairments. These studies have demonstrated that systemic inflammation during pregnancy primes microglia activation and elevates pro-inflammatory cytokine levels, which may contribute to behavioral dysfunction in rat offspring. This study further examines whether maternal inflammation via lipopolysaccharide (LPS) exposure exacerbates neonatal inflammation, oxidative stress, and motor and cognitive deficits associated with IUGR in juvenile rats. LPS (100 μg/kg) was administered intraperitoneally to pregnant rats on gestation day 13 (G13), followed by reduced uterine perfusion pressure (RUPP) surgery on G14 to induce IUGR. Sensorimotor and cognitive-behavioral tests were conducted on postnatal day 8 (P8) and on P21-P25,

respectively. Brain vascular volume was assessed using microcomputed tomography (microCT) at P25. Our results show that maternal LPS exposure increased IUGR-induced sensorimotor dysfunctions at P8, and increased inflammatory cytokines and thiobarbituric acid reactive substances (TBARS) in P0 and P8 neonatal rats. In juvenile rats, exposure to LPS during gestation worsened IUGR-associated motor disturbances, including increases in rearing events, as well as cognitive deficits in short-term memory, learning, and long-term memory. The results suggest that exposure to LPS during gestation enhances IUGR-associated inflammation, lipid peroxidation, and cognitive deficits, including learning and memory, in neonatal and juvenile rats, and reduces cerebral vascular volume at P25. This model serves as a valuable method for studying mechanisms underlying neurodevelopmental dysfunction in developing children associated with exposure to inflammation and growth restriction during gestation and may help inform future therapeutic strategies.

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154 - Reinforcement Learning-Driven De Novo Drug Design for Glioblastoma: A Multi-Objective Approach with NoisyNet, Entropy Regularization, Prioritized Experience Replay, and Intrinsic Curiosity

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Glioblastoma multiforme (GBM) is a highly lethal brain malignancy with limited therapeutic options due to the blood-brain barrier (BBB) and tumor heterogeneity. Traditional de novo drug discovery is slow and resource-intensive, necessitating advanced AI-driven methodologies. In this study, we present a multi-objective deep reinforcement learning (DRL) framework for de novo drug design targeting GBM. To address the critical challenges of sparse rewards, premature convergence, and limited chemical diversity in molecular generation, our approach synergistically integrates four established DRL mechanisms: NoisyNet exploration, entropy regularization, prioritized experience replay (PER), and an intrinsic curiosity module (ICM). The multi-objective reward function optimizes drug-likeness (QED), synthetic accessibility (SA score), BBB permeability, and target affinity (pIC50) against EGFR, IDH1, VEGFR2, and mTOR. Trained on 6,028 ChEMBL compounds with known GBM-related activity, the agent generated 20 chemically valid, high-quality candidates within 200 episodes. The top three candidates exhibited an average QED of 0.78, high predicted BBB permeability (score > 0.65), and a mean docking affinity of −9.6 kcal/mol against EGFR, with moderate synthetic accessibility (3-5 steps). Compared to reference ChEMBL compounds, the generated candidates demonstrated superior BBB-related profiles (reduced topological polar surface area and fewer hydrogen-bond donors/acceptors) while maintaining comparable or better drug-likeness. These results demonstrate that combining state-dependent exploration, diversity constraints, prioritized learning, and curiosity-driven exploration significantly accelerates the discovery of high-quality, brain-penetrant therapeutic candidates for glioblastoma.

155 - Synthesis of Durable Gold Nanoparticle-Embedded Cotton Fibers for Biocompatible Textile Applications

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The development of a facile, reductant- and stabilizer-free alkali-mediated synthesis of gold nanoparticles (AuNPs) within cotton fibers for biocompatible textiles is described in this study. Uses of external chemicals compromise the biocompatibility of AuNPs. Besides, alkali-mediated synthesis of AuNPs inside cotton has not been successful previously. Herein, AuNPs are synthesized *in situ* within the interior of cotton fibers under alkaline conditions using an Au(III) (Au^{3+}) precursor (tetrachloroauric acid, $HAuCl_4$). A mechanism of AuNP formation using cotton cellulose has been studied to understand the formation of Au^{3+}-cellulose complexes and their subsequent reduction to zero-valent atoms. AuNP-infused cotton fibers (AuNP-cotton) were analyzed using ultraviolet-visible (UV-Vis) spectroscopy and the surface plasmon resonance (SPR) peak at 538 nm confirms the reduction of Au^{3+} precursor and the formation of metallic AuNP (Au^0). The obtained AuNPs are spherical with an average diameter of 12.25 nm. Au content in treated cotton was determined to be 1.66 wt% using graphite furnace atomic absorption spectroscopy (GFAAS). High-resolution electron microscopy techniques reveal the internal formation of AuNPs within the cotton fibers, which are uniformly distributed without agglomeration. The AuNPs incorporated into cotton fabric demonstrated superior laundering durability under intense mechanical force, retaining 82% of AuNPs after 50 home laundering cycles. Rapid and efficient catalytic activity of AuNP-cotton demonstrates easy accessibility of AuNPs surface for chemical interactions across multiple cycles. Notably, non-toxicity toward mouse fibroblast cells and efficient photothermal conversion efficiency (2.3-6.4%) suggests that AuNP-cotton has strong potential to support human cell growth and suitability for biocompatible applications.

156-Beyond Gray Level Co-occurrence Matrices: Third-Order Texture Analysis Using Co-occurrence Tensors for Image Classification

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Texture analysis plays a critical role in computer-aided image analysis, particularly in applications where interpretable feature representations are preferred over deep learning models. The Gray Level Co-occurrence Matrix (GLCM) is one of the most widely used handcrafted texture descriptors but is fundamentally limited to pairwise pixel relationships, capturing only second-order spatial statistics. This study introduces a generalized texture representation based on a three-dimensional Co-occurrence Tensor (CTC) that models triplet pixel relationships and extends the traditional Haralick texture features to third-order spatial statistics. Two hypotheses were investigated: (1) CTC features outperform conventional GLCM features in classification accuracy, and (2) combining both feature sets provides additional performance gains. GLCM and CTC features were extracted using sixteen directional configurations and evaluated on three publicly available datasets spanning medical imaging, construction material classification, and industrial quality inspection. Performance was assessed using thirteen machine learning classifiers with stratified five-fold cross-validation. CTC features consistently outperformed GLCM features across all datasets, improving mean classification accuracy from 0.919 to 0.993, from 0.702 to 0.723, and from 0.615 to 0.626. Feature concatenation yielded additional improvements only on the most challenging dataset, indicating that third-order statistics capture much of the discriminative information contained in conventional pairwise descriptors while providing complementary information when needed. These findings establish CTC as a promising handcrafted feature framework for biomedical image analysis and other texture-based classification applications.

157-AI and Machine Learning on Medicinal Plants with Ethics

Anthony Puleo and Richard Wilson

Towson University

Although genetic modification of the Madagascar Periwinkle (*Catharanthus roseus*), a key source of vincristine and vinblastine, has substantial medical benefits including cancer treatment, it also presents considerable ethical and technical challenges. Recent advances in **artificial intelligence** and **machine learning** have become central to improving the efficiency and safety of plant genome engineering. Machine-learning models trained on large biochemical datasets enhance **enzyme to substrate prediction** and forecast how specific edits will influence downstream metabolite flux. Deep-learning architectures further support **CRISPR guide-RNA design** by reducing off-target probabilities and optimizing edit precision. Together, these computational tools increase the plant's ability to withstand environmental stress, stabilize alkaloid output, and address long-standing issues with the scalability and dependability of therapeutic plants.

However, there are hazards associated with genome editing therapeutic plants, including metabolic disturbance, regulatory complexity, and off-target mutations that persist despite algorithmic screening. Ethical concerns also emerge, including potential monopolization, ecological loss, and the exploitation of Indigenous Malagasy people who have historically used the plant. Using ethical frameworks including **distributive justice**, **autonomy**, **positive rights**, **non-maleficence**, and **Kantian ethics**, this study investigates these issues from the stakeholder perspectives of cancer patients, Indigenous communities, and pharmaceutical businesses. As a proactive strategy for controlling long-term safety, equity, and sociotechnical consequences, **anticipatory ethics** is also introduced to evaluate emerging AI-driven biotechnologies before widespread implementation.

All things considered, there is a lot of promise for treating cancer with genetically modified C. roseus. However, this research concludes that responsible growth requires open governance, equitable sharing of benefits, and strict ethical oversight under the direction of a thorough ethical analysis based on accepted ethical standards.

158 Longitudinal Characterization of Cardiometabolic and Renal Risk Across the Pediatric Obesity Spectrum: A Retrospective EHR Study

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Childhood obesity is increasingly being recognized as an early risk factor for adverse cardiometabolic and renal outcomes, yet the longitudinal evolution of physiological metrics and subsequent clinical outcomes in this population remains underexplored. We conducted a retrospective cohort study using de-identified pediatric electronic health record data extracted from UMMC's Research Data Warehouse (RDW), providing a large clinical dataset representing a racially diverse pediatric population in a region disproportionately affected by obesity. Reproducible computational pipelines were developed to curate, harmonize and integrate anthropometric, laboratory, medication, and diagnosis data to allow for longitudinal phenotyping. Participants were

stratified using CDC recommended age- and sex- specific pediatric BMI classifications and followed longitudinally using linear mixed-effects models to evaluate trajectories of BMI percent of the 95th percentile, blood pressure and estimated glomerular filtration rate (eGFR). Cox proportional hazards models were used to examine associations between obesity severity and incident chronic kidney disease, hypertension, type 2 diabetes, and persistent proteinuria among patients without baseline diabetes. Increasing obesity severity was associated with progressively less favorable cardiometabolic and renal trajectories and a graded increase in the risk of clinically significant outcomes over time. By leveraging longitudinal EHR data and reproducible computational analyses, this study provides a scalable framework for characterizing disease progression in pediatric obesity and identifying children at greatest risk for future cardiometabolic and renal complications. Improved understanding of these trajectories may facilitate earlier risk stratification, guide targeted preventive interventions and inform future precision medicine approaches to reduce the long-term burden of obesity-related chronic disease.

159-ATryn and the Future of Biotech: Ai, Transgenic Animals, and Ethical Responsibility

Olanis Sanchez and Richard Wilson

Towson University

The development of ATryn, the first FDA-approved drug produced from the milk of transgenic goats, represents a major advancement in biotechnology while raising important ethical questions about the moral boundaries of science and perceptions of humanity's responsibilities toward non-human life. This paper focuses on the scientific and ethical dimensions of ATryn's development, using it as a case study to examine how transgenic animals are engineered and brought into clinical use. Central to this process is the increasing role of artificial intelligence (AI) and machine learning (ML), which are transforming gene-editing technologies by improving precision, efficiency, and predictive modeling in the creation of transgenic organisms. AI-driven tools can analyze large genomic datasets, identify optimal gene insertion sites, predict gene expression outcomes, and reduce unintended off-target effects during genetic modification. By accelerating the design and evaluation of transgenic organisms, these technologies have the potential to increase the speed and reliability of pharmaceutical development while reducing costly trial-and-error experimentation.

Using anticipatory ethics as a guiding framework, this research explores how ethical responsibility is distributed among key stakeholders involved in ATryn's development, including patients, biotechnology companies, regulatory agencies, and the animals themselves. The ethical analysis is grounded in consequentialism, Kantian ethics, care ethics, and established bioethical principles to compare how each group interprets the moral implications of producing pharmaceuticals through genetically modified animals. Patients may justify ATryn based on its life-saving outcomes, while biotechnology companies emphasize safety, innovation, and regulatory responsibility. In contrast, the use of animals raises concerns centered on welfare, justice, and the moral limits of scientific intervention.

The growing integration of AI and machine learning into biotechnology further intensifies these ethical challenges by expanding the scale and capability of genetic engineering while potentially obscuring accountability in decision-making processes. As algorithmic systems become increasingly involved in guiding scientific research and development, questions emerge regarding transparency, oversight, and the distribution of responsibility when unintended consequences occur. This paper argues that anticipatory ethics is essential in guiding the continued development of technologies like ATryn, ensuring that future scientific progress balances biotechnological innovation with transparency, moral responsibility, and respect for both human and non-human life.