PROCEEDINGS OF THE THIRTY-EIGHTH SOUTHERN BIOMEDICAL ENGINEERING CONFERENCE

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PROCEEDINGS OF THE 2022 THIRTY EIGHT SOUTHERN BIOMEDICAL ENGINEERING CONFERENCE

25-28 August, 2022

Hilton New Orleans Airport
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North Carolina Agricultural and Technical State University

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NSF-DMR BMAT Program

Endorsed by
Society for Biomaterials
Rocky Mountain Biomedical Engineering Symposium

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38th Annual Meeting

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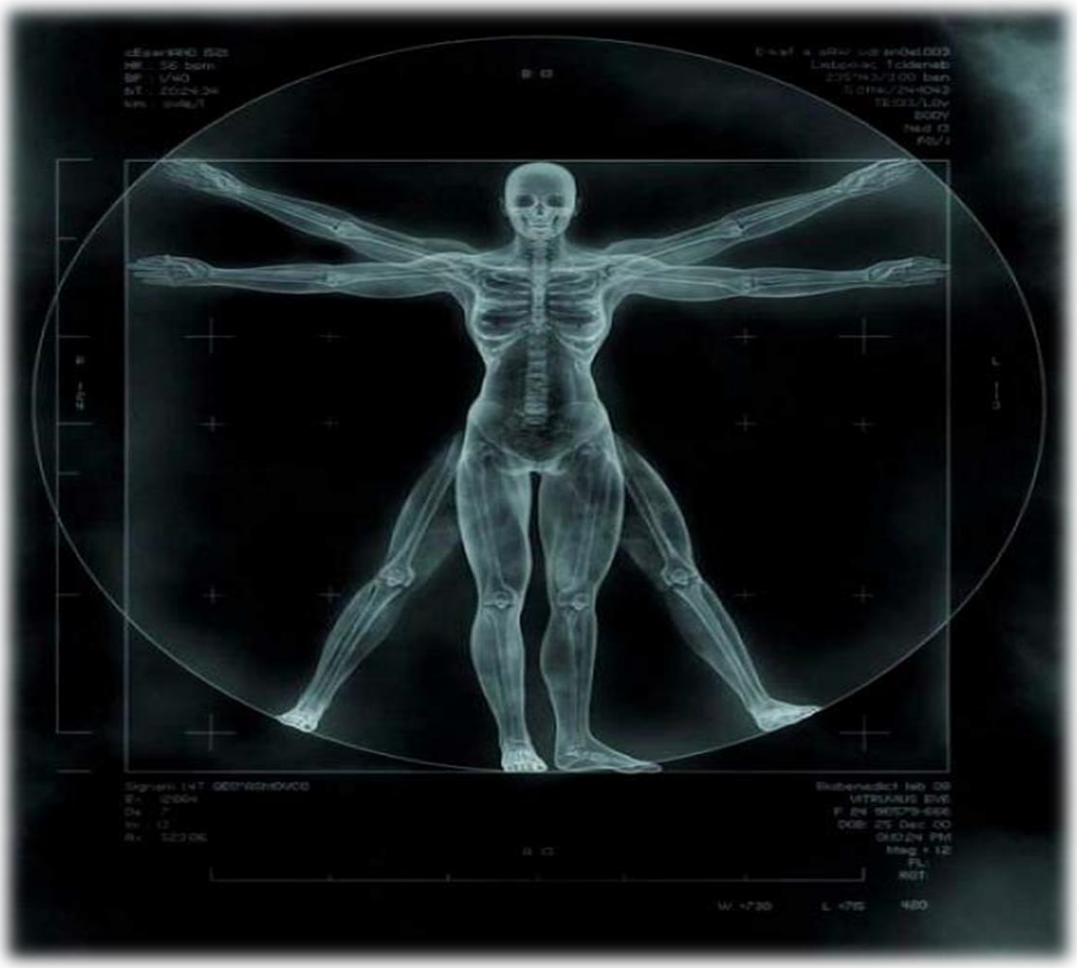

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38th SOUTHERN BIOMEDICAL ENGINEERING CONFERENCE

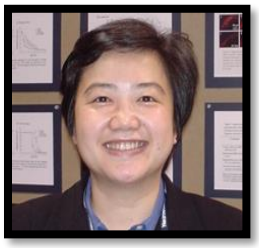
Program

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

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

Program Co-Chair: Dr. Alan Eberhardt, *University of Alabama at Birmingham* (aeberhar@uab.edu)

Dr. Eberhardt received his undergraduate and Master's degrees in Civil Engineering from the University of Delaware. He received his doctorate in Theoretical and Applied Mechanics from Northwestern University. He was hired at UAB in 1991 as an Assistant Professor in Mechanical Engineering but transferred to the Department of Biomedical Engineering (BME) in 1999. For over 30 years, he has been highly active in teaching, research and service in the School of Engineering at UAB. He has been a productive researcher in orthopedic/injury biomechanics at UAB and is the Director of the Experimental Biomechanics Core. Currently, as Professor and Associate Chair of Education in BME, he oversees all activities related to undergraduate and graduate education in the Department of Biomedical Engineering at UAB.



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

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

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

She is a Professor of Anesthesiology at the University of Mississippi Medical Center in Jackson, MS. Dr. Tucci has been involved in a leadership role for various state, national and international organizations. After completing her undergraduate training at Seton Hill University, in Pennsylvania she completed a Master's degree in Biology at the University of Dayton in Ohio. Following her move to Mississippi, she completed her PhD in pharmacology and Toxicology in 2000. Aside from her work supervising and overseeing resident's basic science research in orthopedic surgery for several years, she has also mentored and supervised a number of undergraduate and graduate students from diverse disciplines. She has served on over 80 doctoral dissertation committees, has published over 300 full journal publications (several in prestigious journals such as J. of Investigative Surgery, J. of Clin Investigation, Analytical Biochemistry, J. of Immunology, Infection & Immunity, Cancer Investigation, Microsurgery, Alcohol, Critical Reviews in Biomed Eng, J. of Gerontology, Pediatric Research, Annals of Pharmacotherapy, J. of Spinal Disorders and Techniques, J. Oral Pathol Med, to name afew), and published over 500 abstracts at state, regional, national and international meetings (Italy, France, Spain, Canada, Poland, and China). Her leadership role in various societies includes Director and program chair at the Rocky Mountain Biomedical Engineering Society; Program Chair at the Academy of Surgical Research, Program and conference organizer at the Southern Biomedical Engineering meetings, Chair of Pathology Implant SIG at the Society for Biomaterials, to name a few. She served/serving in editorial boards in several journals as well as member of various NIH special review panels. She is serving as Chief Editor of the Biomed Science Instrumentation and Chief Editor for Journal of the Mississippi Academy of Sciences. Previously, she has been recognized for her work and service by the Academy of Surgical Research, the Mississippi Academy of Sciences Outstanding Contribution to Science, Peeler Dudley Outstanding Service Award, Douglas Walker Award and recently was inducted as fellow in American Institute of the Biomedical and Biological Engineering.

Conference-Co-Chair: Dr. Ham Benghuzzi, Mississippi Academy of Sciences and JSU,

Hamed.A.Benghuzzi@jsums.edu

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

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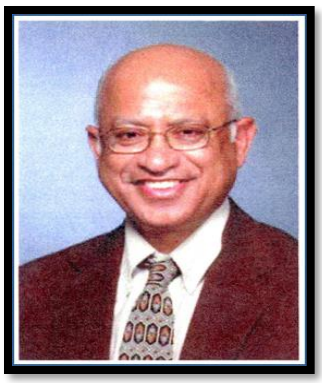
Giving life to a world of materials

SBEC HISTORY



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

The SBEC serves a special purpose by emphasizing participation from young professionals and advanced students. Since established investigators present papers in the same sessions with the students, it encourages a high level of professionalism as a standard for young investigators and students. Submission of papers from individuals from around the world is encouraged. However, if their papers are accepted, an author or co-author must attend the conference to present their work and to interact with other attendees. In keeping with the emphasis on student participation, the SBEC presents best paper and presentation awards to undergraduate, graduate, and professional students.

Program and Organizing Committee

Name	Affiliation	Email
Narayan Bhattarai	North Carolina A&T State University	nbhattar@ncat.edu
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Alan Eberhardt	University of Alabama Birmingham	aeberhar@uab.edu
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Vladimir Reukov	University of Georgia	Reukov@uga.edu
Lisa McCammon (Staff)	MAS	

Conference Information

The format of the conference is to have concurrent sessions, with each presentation limited to 10 minutes (8-minute presentation and 2-minute discussions). Room assignments for each session will be posted at the conference.

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

The Conference will be held at the **Hilton New Orleans Airport, Airline Highway, Kenner, LA.** Driving directions can be found at the end of the program. Participating hotels can be found on the SBEC website at: http://sbec18.org.

All the accepted papers will be published in a July issue of the Biomedical Sciences Instrumentation Vol 58 (3).

Student Awards:

Top undergraduate and graduate students for podium and poster presentations will be recognized at the awards ceremony on Saturday (must be present to receive cash prizes).

Registration

Registration Fee includes access to all conference events, program copy, manuscript fee, lunches, banquet, coffee breaks and snacks. Initial on-site registration will be held from 3:00-6:00 p.m., Thursday, August 25, 2022, and will continue all day Friday and Saturday. Participants are encouraged to pre-register by **June 30th** to take advantage of the reduced discounted registration rates. More information in how to register can be found at: http://sbec18.org.

Registration Fees (http://sbec18.org)	Before June 30, 2022	After June 30, 2022 Regular Registration Fee*
Investigators **registration fee for SBEC**	**$375**	**$475**
Student **registration fee for SBEC**	**$225**	**$375**
Companion Fee	**$150**	**$180**
Manuscript publication Fee	**$90**	**$90**

Onsite registration is subject to 25% fee.

Conference registration fees are non-refundable after July 10th, 2022 (refund prior 7/10 is subject to service fee of 75% (food and beverages, printing cost, etc…

Abstract will be removed from the program if presenter fails to register according to the time lines (by 7/25.2022).

Track Chairs

I. Dr. Narayan Bhattarai: Sessions # 1A, 1B, 3B, 5B
II. Dr. Alan Eberhardt: 4A, 4B, 6A, 7B
III. Dr Lir-Wan Fan.: Sessions # 2A, 2B, 3A, 5A
IV. Drs. Michelle Tucci and Ham Benghuzzi: Sessions #6B, 8B, Poster

Track	Session	Chair	Co-Chair
I	**Session IA: Biomaterials**	**Amol Janorkar, Ph.D.** University of Mississippi Medical Center	**Narayan Bhattarai, Ph.D.** North Carolina A&T State University
I	**Session IB: Nanomedicine/Cancer Chemotherapeutics**	**Aryal Santosh, Ph.D.** University of Texas at Tyler Texas	**Eunsoo Yoo, Ph.D.** North Carolina A&T State University
III	**Session 2A: Microfluidics**	**Kunal Mitra, Ph.D.,** Florida Institute of Technology	**Kenneth Butler, Ph.D.** University of Mississippi Medical Center
III	**Session 2B: Neuroscience**	**Lir-Wan Fan, Ph.D.** University of Mississippi Medical Center	**Yi Pang, Ph.D.** University of Mississippi Medical Center
III	**Session 3A: Transplantation and Tissue Regeneration in the era of Precision Medicine**	**Olga McDaniel, Ph.D**. University of Mississippi Medical Center	**Larry McDaniel, Ph.**D. University of Mississippi Medical Center
I	**Session 3B: Training and Education**	**Joseph A. Cameron, Ph.D.** Jackson State University	**Lashanda Brumfield, Ph.D.** Dillard University
II	**Session 4A: Biomechanics**	**Giovanni Solitro, Ph.D.** Louisiana State University Health Shreveport	**Alan Eberhardt, Ph.D.,** University of Alabama at Birmingham
II	**Session 4B: Nanoparticles-1**	**Maricica Pacurari, Ph.D.** Jackson State University	**Vladimir Reukov, Ph.D.** University of Georgia
III	**Session 5A: Medical Devices and Implants**	**Christina Salas, Ph.D.,** The University of New Mexico	Subrata Saha, Ph.D., Washington State University
I	**Session 5B: Biomaterials III/ BioSensors**	**Vladimir Reukov, Ph.D.** University of Georgia	
II	**Session 6A: Rehabilitation/Physical Therapy**	**Felix Adah, Ph.D.** University of Mississippi Medical Center	**Lamar Hamil, Ph.D.** Belhaven University
IV	**Session 6B: Bioethics**	**Subrata Saha, Ph.D.** University of Washington	**Shankar Krishna Ph.D.** Wentworth Institute of Technology
II	**Session 7A: Biomolecules/design/synthesis/evaluations**	**Prem B. Chanda, Ph.D.** Southeastern Louisiana University	
I	**Session 7B: Biomaterials II and Nanoparticle II**	**Narayan Bhattarai, Ph.D.** North Carolina A & T State University	**Bishnu Bastakoti, Ph.D.** North Carolina A & T State University
I	**Session 8A: Orthopaedics/ Biomechanics II**	**Seyed Hamid Reza Sanei, Ph.**D., Penn State University	**Francesco Travascio, Ph.D.** University of Miami
IV	**Session 8B: Advanced Biomedical Applications**	**Ayman K. Hamouda Ph.D.** The University of Texas at Tyler	**Farah Deba, Ph.D.,** The University of Texas at Tyler
IV	**Poster Session**	**Michelle Tucci, Ph.D., University** of Mississippi Medical Center **Ham Benghuzzi, Ph.D.**, MAS/JSU	**Lir-Wan Fan, Ph.D.,** University of Mississippi Medical Center,

	Student Awards	**Michelle Tucci, Ph.D.** University of Mississippi Medical Center,	**Ken Butler, Ph.D.** University of Mississippi Medical Center

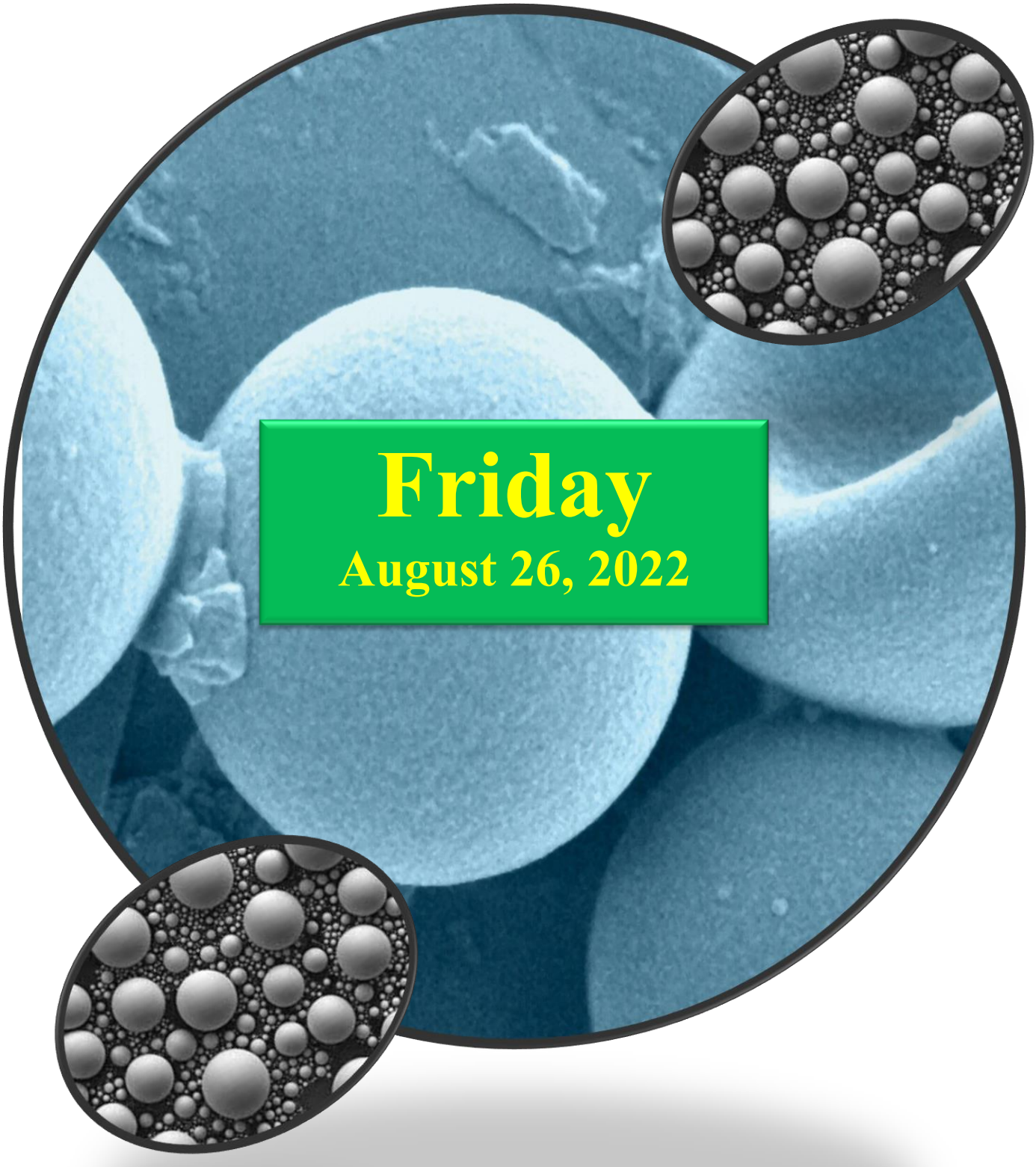
Annual Meeting

Program

Thursday, August 25, 2022

3:00-6:00 pm Registration

Hilton New Orleans Airport


Friday
August 26, 2022

Friday, August 26, 2022

7:00 am-6:00 pm **Registration**
7:30 am-10:30am **Breakfast and visit posters**

8:00-8:30 am **Opening of the Meeting (Room:)**

Program Chair
Dr. Narayan Bhattarai, North Carolina A&T State University
Dr. Subrata Saha's Remarks, **Chair of Steering Committee**

Conference Co-Chair
Dr. Ham Benghuzzi; *Global Training Institute and Mississippi Academy of Sciences*
Conference Co-Chair
Dr. Michelle Tucci, University of Mississippi Medical Center

8:30-8:40 am **Break**

8:40- 10:20 am: Concurrent Scientific Sessions

Session 1A: Biomaterials **Conference Room 1**

8:40-9:00 am Session Keynote

EFFECT OF NANOSCALE TOPOGRAPHIES ON ADSORPTION BEHAVIOR OF BONE MORPHOGENIC PROTEIN (BMP-2) AND OSTEOCHONDRAL TISSUE REGENERATION

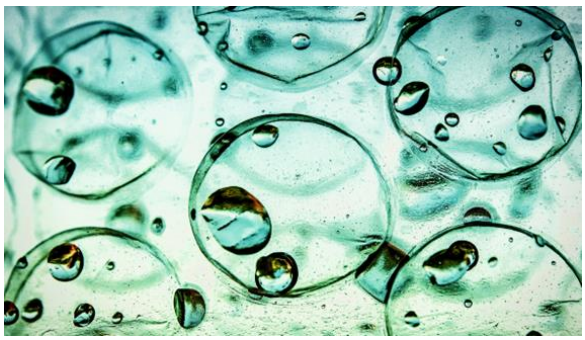
Dr. Salil Desai

North Carolina A&T State University

Dr. Salil Desai is the University Distinguished Professor and Director of the Center of Excellence in Product Design and Advanced Manufacturing at North Carolina A&T State University. Dr. Desai is an internationally recognized leader for his exemplary contributions to advanced biomanufacturing through translatory research. Dr. Desai is recipient the Presidential Award for Excellence in Science, Technology Engineering and Mathematics Mentoring from the White House. His expertise is in the areas of smart cyber-physical systems, hybrid additive, nano and bio manufacturing, Multiphysics modeling, regenerative tissue engineering, product design and realization. At NC A&T, Dr. Desai has spearheaded several programmatic initiatives in advanced manufacturing which include establishment of state-of-the-art infrastructure, curriculum development and outreach activities. He is an adjunct faculty at the Wake Forest University Institute for Regenerative Medicine and also serves as the Associate Editor of the IISE Transactions in Design and Manufacturing. Dr. Desai has extensively published in top-tier journals with over 150 publications and 8 book chapters, patents and invention disclosures. His research has generated over $15 million in funding and $4 million in major research instrumentation awards. For his seminal contributions, he is recipient of several awards including the UNC Board of Governors Award, NSF Career Award and Outstanding Investigator Awards from IISE, ASME, ASEE, SME, Department of Defense and the Oak Ridge National Laboratory. He is also a Fellow of the ASME and IISE professional societies. Desai holds a BS in Mechanical Engineering from the University of Mumbai, a MS and Ph.D. in Industrial Engineering from the University of Pittsburgh.

Concurrent Sessions 1A and 1B

Friday morning	Presentation #	Conference Room: 1
Time		**Session IA: Biomaterials** **Session Co-Chair**: Amol Janorkar, Ph.D., University of Mississippi Medical Center **Co-Chair**: Narayan Bhattarai, Ph.D., North Carolina A&T State University
8:40	**Keynote**	**EFFECT OF NANOSCALE TOPOGRAPHIES ON ADSORPTION BEHAVIOR OF BONE MORPHOGENIC PROTEIN (BMP-2) AND OSTEOCHONDRAL TISSUE REGENERATION** *Salili Desai* *North Carolina A&T State University, Greensboro, NC, USA*
9:10	**1-1A**	**FABRICATION OF CORE SHELL MICROCAPSULES OF ALGINATE HYDROGEL WITH 3D NETWORKS OF CHITIN FBRILS UTILIZING COAXIAL ELECTROSPRAY TECHNIQUES** *Thakur Sapkota, Felix Tettey, Narayan Bhattarai* *Department of Applied Science and Technology, and Chemical, Biological and Bioengineering Engineering, North Carolina A&T State University, Greensboro, NC, 27411, USA.*
9:20	**1-2A**	**A MAGNESIUM-ENRICHED 3D SCAFFOLD ENHANCES NEW BONE DEVELOPMENT IN RAT CRITICAL-SIZED MANDIBLE DEFECT MODEL** *Govinda Bhattarai and Jeong-Chae Lee** *Cluster for Craniofacial Development and Regeneration Research, Institute of Oral Bioscience and School of Dentistry, Jeonbuk National University, Jeonju 54896, Jeollabuk-doRepublic of Korea*
9:30	**1-3A**	**NANOCERIA INFUSED CHITOSAN-PVA HYDROGELS TO TREAT BURN WOUNDS** *Lucas Tavares, Ruchi Patil Borole, Minchan Shim, Vijay Mohakar, Anton Sorkin, Vladimir Reukov** *Department of Textiles, Merchandising, and Interiors, College of Family and Consumer Sciences, University of Georgia, Athens, GA, USA*
9:40	**1-4A**	**THREE-DIMENSIONAL NANOFIBER SCAFFOLDS FOR IN VIVO BETA CELL TRANSPLANTATION FOR THE TREATMENT OF DIABETES MELLITUS** *Orsu Prabhakar and Arun Koyyada* *GITAM School of Pharmacy, GITAM Deemed to be University, Visakhapatnam, India-530045*
9:50	**1-5A**	**TITANIUM ANODIZATION IN ALTERNATIVE ELECTROLYTES** *Amisha Parekh, Parker Odom, Amol V. Janorkar, Michael D. Roach* *Biomedical Materials Science, University of Mississippi Medical Center.*
10:00	**1-6A**	**In Vitro BIOLOGICAL EVALUATION OF PRE-OSTEOBLAST SEEDED GRAFT MATERIALS** *Kshetra Challapalli, Kadie Nobles, Sheetal Chowdhury, Courtney Cates, R. Scott Williamson* *Biomedical Materials Science, University of Mississippi Medical Center*
10:10		**DISCUSSION**
10:20		**BREAK**



Concurrent Session 1B

Friday morning	Presentation #	Conference Room: 2
Time		**Session IB: Nanomedicine/Cancer Chemotherapeutics** **Session Chair**: Aryal Santosh, Ph.D., University of Texas at Tyler Texas **Co-Chair**: Eunsoo Yoo, Ph.D., North Carolina A&T State University
9:00	**1-1B**	**OPTIMIZING EXTRACELLULAR VESICLE ISOLATION AND RE-ENGINEERING AS A DRUG DELIVERY SYSTEM** *Santosh Aryal[*1], Sagar Rayamajhi[2], Tuyen Nguyen[2], Shoukath Sulthana[1]* *[1]Department of Pharmaceutical Sciences and Health Outcomes, The Ben and Maytee Fisch College of Pharmacy, The University of Texas at Tyler, TX, USA and [2]Department of Chemistry, Kansas State University, Manhattan, KS, USA*
9:10	**1-2B**	**BIOMIMETIC TARGETED THERANOSTIC NANOPARTICLES FOR BREAST CANCER TREATMENT** *Suphalak Khamruang Marshall[1], Pavimol Angsantikul[2], Zhiqing Pang[3], Norased Nasongkla[4], Soracha D. Thamphiwatana[1,4*]* *[1] Institute of Biomedical Engineering, Faculty of Medicine, Prince of Songkla University, Songkhla, Thailand, [2] Center for Biomedical Research, Population Council, New York, NY,, USA, [3]Key Laboratory of Smart Drug Delivery, School of Pharmacy, Fudan University, Ministry of Education, Shanghai,, China, [4] Department of Biomedical Engineering, Faculty of Engineering, Mahidol University, Nakorn Pathom , Thailand*
9:20	**1-3B**	**SYNTHESIS AND CHARACTERIZATION OF POLYMERIC NANOPARTICLES: EFFECT OF NANOPARTICLE DENSITY IN CELLULAR COMPATIBILITY AND UPTAKE** *Shoukath Sulthana[1], Prabhat Kattel[1,2], Jiri Trousil[1], David Pearson[1], Santosh Aryal[1]** *[1] Department of Pharmaceutical Sciences and Health Outcomes, The University of Texas at Tyler, Tyler, TX, USA' [2] Department of Biology, College of Arts and Sciences, The University of Texas at Tyler, Tyler, TX , USA*
9:30	**1-4B**	**OPTIMIZING NANOPARTICLE-BASED DRUG DELIVERY TO PREVENT CISPLATIN-INDUCED OTOTOXICITY** *Rohith Arunachalam, Eunsoo Yoo* *North Carolina A&T State University, Greensboro, NC, USA*
9:40	**1-5B**	**EXPERIMENTAL ANALYSIS OF STRUCTURAL AND BIOLOGICAL DAMAGE IN BONE IN CONVENTIONAL AND ULTRASONICALLY-ASSISTED DRILLING** *[a]Khurshid Alam, [b]Yasasween Hewavidana, [c]Mohamed Al-Kindi, [c]Asim Qureshi, [d]Badar Al-Sumri, [b]Vadim Silberschmidt* *[a]Department of Mechanical and Industrial Engineering, Sultan Qaboos University, Sultanate of Oman, [b]School of Mechanical, Electrical and Manufacturing Engineering, Loughborough University, UK, [c]Department of Pathology, Sultan Qaboos University, Sultanate of Oman, [d]Histopathology laboratory, Sultan Qaboos University Hospital, Sultanate of Oman*
9:50	**1-6B**	**ELUCIDATING THE ROLE OF PIN1 INTERACTING PROTEINS, SUPT 5H IN THE TUMORIGENICITY OF BREAST CANCER** *Bilal Lone Ahmad and Yuba Raj Pokharel* *Cancer Biology Laboratory, Faculty of Life Science and Biotechnology Laboratory, South Asian University, New Delhi India-110021*
10:00	**1-7B**	**MIGRATION OF TRIPLE NEGATIVE BREAST CANCER CELLS IN A MECHANICALLY-ACTIVE TUMOR MICROENVIRONMENT** *Adam Kotar, Mary Kathryn Sewell-Loftin* *Department of Biomedical Engineering, O'Neal Comprehensive Cancer Center, University of Alabama at Birmingham, AL, USA*
10:10		**DISCUSSION**

Concurrent Sessions 2A and 2B

10:30 am- 12:00 pm

Session 2A MicroFluidics Conference Room 1

10:30-10:50 **Session Keynote**

VASCULARIZED CORTICAL ORGANOID MICROPHYSIOLOGICAL SYSTEM TO MODEL ALZHEIMER'S DISEASE

Dr. Yeoheung Yun

North Carolina A&T State University

Dr. Yeoheung Yun received both BS Degree and MS Degree from the Department of Mechanical Engineering at Chonbuk National University at South Korea. He then worked on Machatronics Research Center at Chonbuk National University and Artificial Sight Development Research Lab of Ophthalmology Department at Wonkwang Medical College, South Korea. He acquired PhD from University of Cincinnati, Ohio and further developed a career as a Post-doc and Research Assistant Professor at the same place. He led to develop nanomedicine technology such as carbon material synthesis, electroanalytical biosensor, T cell immunology and cancer biology. In particular, Dr. Yun is pioneered on Carbon Nanotube (CNT) synthesis and its use for biomedical application. He grew the longest Carbon Nanotube Array using CVD (Chemical vapor deposition) method at Cincinnati, elucidating new mechanism of carbon nanotube growth. He relocated to North Carolina A&T State University (NC A&T) to establish new Bioengineering Program and also worked as a thrust leader for Engineering Research Center for Revolutionized Metallic Biomaterials (ERC-RMB) to establish 1) new knowledge of degradation mechanism in biodegradable metals, 2) new testing standard development with ASME/ISO and FDA, 3) new knowledge about biocompatibility and toxicity, and 4) bioengineering research capacity at NC A&T. Dr. Yun also pioneered mini-brain technology in terms of stem cell differentiation, organoid, vascularization, high throughput screening, brain disease modeling, extracellular matrix, mechanobiology, hydrogel biomaterials, and computational modeling. Dr. Yun made a significant contribution to develop brain chip platform to screen nerve agents, organophosphates such as sarin as a terrorist attack. Dr. Yun engineered T cell immunology research areas including ion channels, immunological synapse formation, immunosuppressive particles, T cell activation, artificial antigen presenting cell (APC) surface, point-of- care device, lipid vesicles, and CAR T cell therapy. Yun has published over 100 papers in archival journals, 5 patents, one book and five book chapters in areas of including 1) Bioengineering, 2) biomaterials, 3) electrochemistry/corrosion, 4) biosensors/actuators, 5) biomechanics/mechanobiology, 6) immunology, and 7) cancer biology. He gave TedTalk, Spectrum News, Oliver Max Gardner Award, invited talks, and keynote speaker.

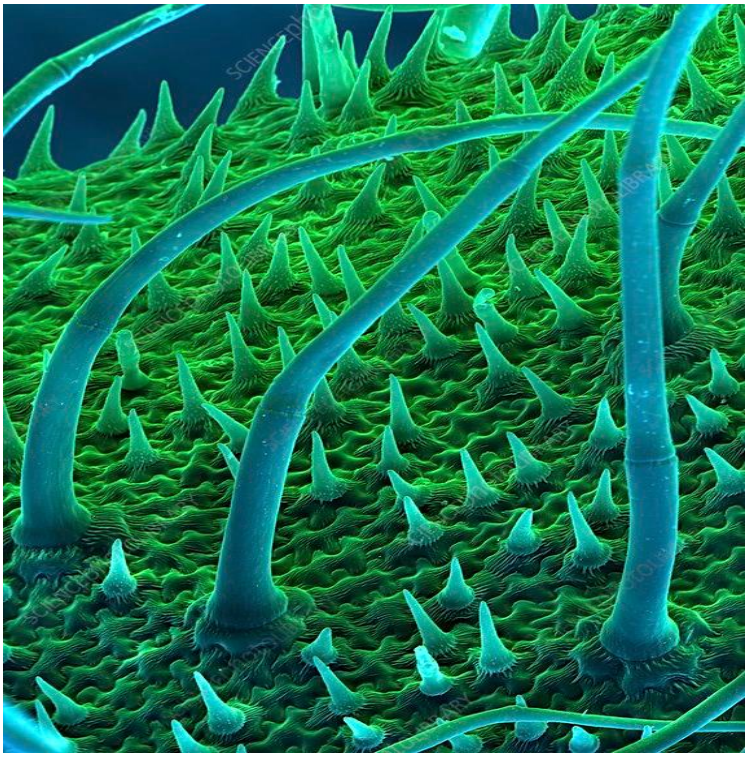
Friday	Presentation #	Conference Room: 1
Time		**Session 2A: Microfluidics** **Session Chair**: Kunal Mitra, Ph.D., Florida Institute of Technology, **Co-Chair**: Kenneth Butler, Ph.D., University of Mississippi Medical Center
10:30	**Keynote**	**VASCULARIZED CORTICAL ORGANOID MICROPHYSIOLOGICAL SYSTEM TO MODEL ALZHEIMER'S DISEASE** *Yeoheung Yun, Balqees Khader, Teal Russell, Qassim Dirir, Yan Li, Chiwan Chiang, and Daniel T. Laskowitz.* *North Carolina A&T State University, Greensboro, NC, USA*
11:00	**2-1A**	**THERMAL MICRO-FINS INFLUENCE ON FLOW STRUCTURES FOR INDUCING LOCAL SHEAR STRESSES ON ADHERED CELLS** *[1]Arupjyoti Kakati, [2]Kunal Mitra, [1]Saurabh Gupta, [1]Arindam Bit* *[1]Biomedical Department, National Institute of Technology Raipur, India* *[2]Biomedical Engineering, Florida Tech, FL, USA*
11:10	**2-2A**	**EFFECTS OF MECHANICAL FORCES IN THE DEVELOPMENT OF BIOPRINTED BLOOD VESSELS** *Khemraj Deshmukh[a], Saurabh Gupta[a], Arindam Bit[a], Kunal Mitra[b*]* *[a]Biomedical Department, National Institute of Technology, Raipur, India* *[b]Biomedical Engineering, Florida Tech, Melbourne, Florida, USA*
11:20	**2-3A**	**CELL CO-CULTURE MICROFLUIDICS PLATFORM WITH AN INTEGRATED HYDRAULIC VALVE FOR CONTROLLED INTERACTION OF BRAIN ENDOTHELIAL CELLS AND ASTROCYTES** *Faria Binte Hossain[1] , Saif Mohammad Ishraq Bari[2] , Gergana Nestorova3,**

		[1]Molecular Science and Nanotechnology, Louisiana Tech University, LA, USA, [2]Biomedical Engineering, The University of Mississippi, MS, USA, [3]College of Biological Sciences, Louisiana Tech University, LA, USA
11:30	**2-4A**	**NUMERICAL ANALYSIS OF THROMBOSIS IN A BIFURCATED MICRO-CAPILLARY VESSEL NETWORK** *[1]Arindam Bit, [2]Kunal Mitra* *[1] Biomedical Department, National Institute of Technology Raipur, India* *[2] Biomedical Engineering Florida Tech, FL, USA*
11:40	**2-5A**	**A NOVEL HYBRID INTEGRATED TUMOR-IMMUNE-MICROENVIRONMENT-ON-CHIP RECAPITULATES CXCR2 MEDIATED DISTINCT NEUTROPHIL BEHAVIOR IN BRAIN METASTATIC BREAST CANCERS** *Simrit Safarulla[1*], Arvind Chandrasekaran[1]* *[1]Bioinspired Microengineering (BIOME)Laboratory ,Department of Chemical, Biological and Bio Engineering, North Carolina A&T State University, USA*
11:50		**DISCUSSION**

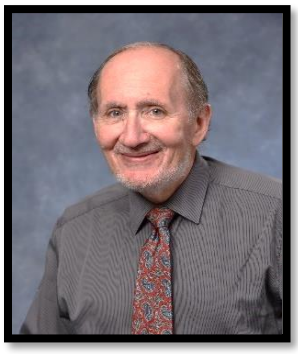
Session 2B Neuroscience Conference Room 2

Friday	Presentation #	Conference Room: 2
Time		**Session 2B: Neuroscience** **Session Chair**: Lir-Wan Fan, Ph.D., University of Mississippi Medical Center **Co-Chair**: Yi Pang, Ph.D., University of Mississippi Medical Center
10:30	**2-1B**	**INTRANASAL INSULIN REDUCES BRAIN INFLAMMATION AND IMPROVES NEUROBEHAVIORAL PERFORMANCE FOLLOWING LIPOPOLYSACCHARIDE EXPOSURE IN NEONATAL RATS** *Lu-Tai Tien[1], Han-Chi Wei[1], Jonathan W Lee[2], John Li[2], Norma B Ojeda[2], Michelle A Tucci[3], Bryan Fan[3], Lir-Wan Fan[2]* *[1]School of Medicine, Fu Jen Catholic University, Xinzhuang Dist, New Taipei City 24205, Taiwan, [2]Department of Pediatrics, Division of Newborn Medicine, University of Mississippi Medical Center, , [3]Department of Anesthesiology, University of Mississippi Medical Center, Jackson, MS, USA*
10:40	**2-2B**	**THYMOQUINONE AS A POTENTIAL PREVENTATIVE THERAPEUTIC AGENT TO PREVENT OXIDATION OF AMYLOID BETA AND TAU IN HUMAN NEUROBLASTOMA CELLS** *Kim Kennedy[1], Kenneth Butler[1], Lir-Wan Fan[1], Ham Benghuzzi[2], and Michelle Tucci[1]* *[1]University of Mississippi Medical Center, Jackson, MS, USA, and Global Training Institute, Flowood, MS, USA*
10:50	**2-3B**	**IMPAIRED DEVELOPMENT OF NEURONAL COMPONENTS IN A RAT MODEL OF WHITE MATTER INJURY** *Yi Pang[1*], Shuying Lin[2], Kathleen Carter[1], John Waddell[1], Norma Ojeda[1], Lir-Wan Fan[1]* *[1]Department of Pediatrics, [2]Department of Physical Therapy, School of Health Related Professions, University of Mississippi Medical Center, Jackson, MS, USA*
11:00	**2-4B**	**MACHINE LEARNING-BASED ANALYSIS OF CHRONIC INFLAMMATION INVOLVEMENT IN A RAT MODEL OF SLEEP DISORDERS** *Lir-Wan Fan[1], Silu Lu[2], Joseph C Crosby[1], Jonathan W Lee[1], James P Shaffery[3], Lu-Tai Tien[4], Michelle A Tucci[5], Haifeng Wang[6], Zhiqian Chen[7], Padmaja Sanapureddy[8], Minal Patel[9], Norma B Ojeda[1]* *[1]Department of Pediatrics, Division of Newborn Medicine, University of Mississippi Medical Center, , [2]Department of Neurology, University of Mississippi Medical Center, [3]Department of Psychiatry and Human Behavior, Animal Behavior Core, University of Mississippi Medical Center, Jackson, MS 39216, USA, [4]School of Medicine, Fu Jen Catholic University, Xinzhuang Dist, New Taipei City 24205, Taiwan, [5]Department of Anesthesiology, University of Mississippi Medical Center, Jackson, MS, USA, [6]Department of Industrial and Systems Engineering, Mississippi State University, Mississippi State, MS, USA, [7]Department of Computer Science and Engineering, Mississippi State University, Mississippi State, MS, USA, [8]G.V. (Sonny) Montgomery Veterans Affairs Medical Center,*

		Jackson, MS, USA, [9]Department of Pediatrics, Division of Pediatric Pulmonary, University of Mississippi Medical Center, Jackson, MS, USA
11:10	**2-5B**	**NEONATAL INTERLEUKIN-1B EXPOSURE EXACERBATES ADULT SUSCEPTIBILITY TO PESTICIDE ROTENONE-INDUCED NIGROSTRIATAL DOPAMINERGIC DISORDER** *Jonathan W Lee[1], Silu Lu1[2], Lu-Tai Tien[3], Shuying Lin[4], Yi Pang[1], Norma B Ojeda[1], Michelle A Tucci[5], Lir-Wan Fan[1]* *[1]Department of Pediatrics, University of Mississippi Medical Center, Jackson, MS, USA, [2]Department of Neurology, University of Mississippi Medical Center, Jackson, MS, USA, [3]School of Medicine, Fu Jen Catholic University, Xinzhuang Dist, New Taipei City 24205, Taiwan, [4]Department of Physical Therapy, University of Mississippi Medical Center, Jackson, MS, USA, [5]Department of Anesthesiology, University of Mississippi Medical Center, Jackson, MS, USA*
11:20	**2-6B**	**RAMAN SPECTROSCOPIC IMAGING OF AMYLOID PLAQUES IN ALZHEIMER'S DISEASE** *Will Chase, Ana Pacheco de Oliveira, Savannah Walker, Ayanjeet Ghosh* *University of Alabama, Tuscaloosa, AL, USA*
11:30	**2-7B**	**EVALUATION OF FADU NASOPHARYNGEAL CARCINOMA CELLS AFTER REPEATED DAILY DOSAGES OF EPIGALLOCATECHIN-3-GALLATE, THYMOQUINONE, AND 5 – FLUOROURACIL** *Sharita Williams* *University of Mississippi Medical Center, Jackson, MS, USA*
11:40	**2-8B**	**MODELING WITHIN GROUP DIFFERENCES IN BIOMARKERS OF OXIDATIVE STRESS AND INSULIN SYNTHESIS OF PANC-1 CELLS EXPOSED TO INCREASING GLUCOSE CONCENTRATIONS** *Lamar Hamil[1], Michelle A. Tucci[1], Hamed A. Benghuzzi[2], Kenneth R. Butler[1,3]* *[1]University of Mississippi Medical Center, Jackson, MS, USA, [2]Global Training Institute Canton, MS, USA, [3]Mississippi College, Clinton, MS,USA*
11:50		**DISCUSSION**



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



HEALTH DISPARITIES FOR UNDERREPRESENTED / UNDERSERVED HEART FAILURE PATIENTS … APPLICATION TO VENTRICULAR ASSIST DEVICES

Dr. Harvey Borovetz
University of Pittsburgh, PA

Dr. Harvey Borovetz is a Distinguished Professor and former Chair (2002-2013) in the Department of Bioengineering, Swanson School of Engineering at the University of Pittsburgh. Professor of Chemical and Petroleum Engineering and Professor in Clinical and Translational Science Institute and a University Honors College Faculty Fellow. Within the McGowan Institute for Regenerative Medicine, Dr. Borovetz held the position of Deputy Director of Artificial Organs and Medical Devices. Dr. Borovetz earned the MS and PhD degrees, in bioengineering, from Carnegie Mellon University. Dr. Borovetz's research interests are focused on the design and clinical utilization of cardiovascular organ replacements for both adult and pediatric patients. Dr. Borovetz served as the academic liaison for the University's Clinical Bioengineering Program in Mechanical Circulatory Support. This program supports patients who are implanted with a left ventricular assist device, or bi-ventricular assist devices, as a bridge to cardiac transplantation or destination therapy. This work in mechanical circulatory support follows Dr. Borovetz's early efforts in which he helped cardiac surgeons apply extracorporeal membrane oxygenation (ECMO) to treat neonates in respiratory distress. Dr. Borovetz was elected Fellow of the American Institute for Medical and Biological Engineering, Fellow of the Biomedical Engineering Society, a Fellow of the Council on Arteriosclerosis, American Heart Association. He is a past member of the Board of Trustees of the American Society for Artificial Internal Organs (ASAIO), and a past member of the Board of Directors of The Biomedical Engineering Society (BMES). Dr. Borovetz served on Scientific Advisory Boards of the University of Louisville Speed Scientific School, the University of Massachusetts, the Departments of Bioengineering at Bucknell University, the Cleveland Clinic Foundation, UCLA, Rutgers University and Pennsylvania State University. He served on numerous NIH and NSF study sections, as an ad hoc reviewer on the Scientific Advisory Committee of the Whitaker Foundation. Dr. Borovetz holds 7 patents and is the author on hundreds of journal articles, abstracts, proceedings papers, and book chapters.

Dr. Borovetz has served as the Executive Director for an NSF Engineering Research Center entitled, “Revolutionizing Metallic Biomaterials.” The ERC applicant organization is North Carolina Agricultural and Technical State University, an HBCU located in Greensboro, NC. Dr. Borovetz, was a Visiting Lecturer, taught/co-taught six courses, “Artificial Organs – Cardiac Assist Devices,” “Cardiac Care in Israel and the United States,” “Implant Biomechanics” (co-instructor), “Biomechanics of Implants” (co-instructor), respectively, in the Department of Mechanical Engineering, Ort Braude College, Karmiel, Israel. Since 2017, Dr. Borovetz has participated in the development of a VAD R&D Program in Hyderabad, India. This effort is part of the charter of a non-profit organization SHARE (Science Health Allied Research and Education) INDIA to promote exchange of technologies between the United States and India.

1:00- 1:30 Round Table Discussion with Plenary Speaker

Concurrent Sessions 3A and 3B

1:30 pm- 2:50 pm

Session 3A Transplantation and Tissue Regeneration in the Era of Precision Medicine

1:30 Keynote — **Conference Room 1**

ORGAN DONATION AND RECOVERY

Kelly Ranum, CEO

Louisiana Organ Procurement Agency

Organ procurement organizations (OPO's) are charged with all aspects of the donation process. Organ donation requires donor hospitals, organ procurement organizations and transplant centers to work together to ensure donation and transplantation happen. Changes in allocation and regulation offer new challenges to the system, but also offer opportunities for greater growth. New donor management protocols and machine preservation are making it possible for more organs to be recovered and transplanted. Donor registries both locally and nationally are aiding OPO's in identifying first person authorizations. Tracking systems are being placed on organs to ensure the organ arrives at its destination. New ways of approaching donation enhancement lead the OPO's now opening donor-care centers over the last several years. The ability to manage donors in a donor care unit and freeing up beds in hospital ICU's is helping to increase the number of organs recovered per donor. Additionally, these donor care centers can schedule OR's any time of the day or night. Hospitals no longer need to bring in on call teams or bump cases in order for the donor recovery to occur. The donation process is evolving and advancing innovation in order to increase the number of lives saved through transplant.

Friday	Presentation #	Conference Room: 1
Time		**Session 3A: Transplantation and Tissue Regeneration in the era of Precision Medicine** **Session Chair**: Olga McDaniel, Ph.D., University of Mississippi Medical Center **Co-Chair**: Larry McDaniel, Ph.D., University of Mississippi Medical Center
1:30	Keynote	**ORGAN DONATION AND RECOVERY** *Kelly Ranum* *Louisiana Organ Procurement Agency, New Orleans, LA*
1:50	3-1A	**TRANSPLANT INFECTIOUS DISEASES** *Larry McDaniel,* *University of Mississippi Medical Center, Jackson, MS,USA*
2:00	3-2A	**POLYMERIC NANOMATERIALS FOR PRECISION MEDICINE AND TISSUE REGENERATION** *Tristan Clemons,* *School of Polymer Science and Engineering, University of Southern Mississippi, Hattiesburg, MS,*
2:10	3-3A	**ENGINEERING THE IMMUNE SYSTEM NOT TO REJECT** *D. Olga McDaniel, Montiana Roseburgh, Jack Neill* *Department of Surgery, University of Mississippi Medical Center, Jackson, MS, USA*
2:20	3-4A	**OSTEOARTHRITIS MANAGEMENT WITH STEM CELL THERAPY** *Gabrielle Thomas, Hope Sabella, Ayaan Khan, Takova Wallace-Gay, Farah Deba* *Department of Pharmaceutical Sciences and Health Outcomes. Fisch College of Pharmacy,* *The University of Texas at Tyler, TX, USA*
2:30	3-5A	**POSSIBLE SYSTEMIC BENEFITS OF THE REPAIR OF SKIN TEARS IN OLDER PATIENTS IN THE DERMATOLOGY CLINIC SETTING** *Ashmi Patel MS[1], Remi Hamel MD[2], Leonard H Goldberg MD[2]* *[1]Texas A&M College of Medicine, Houston Methodist Hospital, Houston, TX, USA, and [2]Houston Methodist Hospital and Derm Surgery Associates, Houston, TX*
2:40	3-6A	***PRIORITIZING COMPLEX DISEASE GENES FROM PUBLIC DATABASES*** *Eric Gong, Jake Y Chen* *The AI.MED Lab, Informatics Institute, the University of Alabama at Birmingham, Birmingham, AL*
2:50		**DISCUSSION**

Concurrent Sessions 3A and 3B

1:30 pm- 2:50 pm
Session 3B: Education &Training
1:30:1:50: Session Keynote **Conference Room 2**

TEACHING EDUCATOR SCIENCE TECHNIQUES (TEST): A NEW PARADIGM FOR ENHANCED BIOMEDICAL AWARENESS

Dr. Babu P. Patlolla
Alcorn State University, MS

Dr. Babu Patlolla currently holds the Dean of the School of Arts and Sciences at Alcorn State University (ASU) since 2013. He has been a faculty member in the Department of Biological Sciences at Alcorn State University for the past twenty-three years and currently serves as Professor of Biology. Since 2011 he is serving on the Mississippi University Research Authority (MURA) Board. Dr. Patlolla is a life member of the Mississippi Academy of Sciences. In 2018 he received the Diversity Award of Excellence at Alcorn State University given by the Mississippi Board of Trustees of State Institutions of Higher Learning (IHL). Dr. Patlolla has a Bachelor of Science in Biology & Chemistry and a Master of Science in Genetics from Osmania University, India. He has a Master of Science in Biology and Ph.D. in Environmental Sciences from Jackson State University.

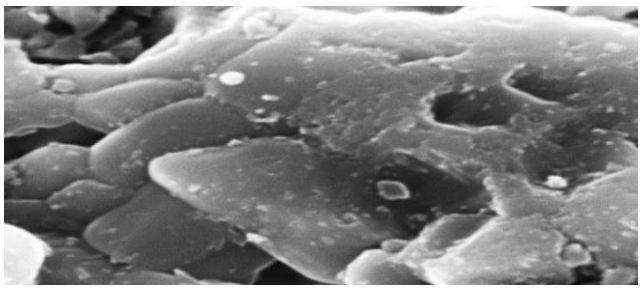
Friday	Presentation #	Conference Room: 2
Time		**Session 3B: Training & Education** **Session Chair**: Joseph A. Cameron, Ph.D., Jackson State University **Co-Chair**: Lashanda Brumfield, Ph.D., Dillard University
1:30	**Keynote**	**TEACHING EDUCATOR SCIENCE TECHNIQUES (TEST): A NEW PARADIGM FOR ENHANCED BIOMEDICAL AWARENESS** *Babu P. Patlolla, Voletta P. Williams, and Leroy Johnson* *Alcorn State University, Lorman, MS, USA*
1:50	**3-1B**	**ENHANCEMENT OF A BME UNDERGRADUATE PROGRAM WITH CLINICAL INNOVATION** *Alan Eberhardt* *Dept. of Biomedical Engineering, University of Alabama at Birmingham, Birmingham, AL, USA*
2:00	**3-2B**	**ACCELERATE EQUITABLE MICROBIAL SURVEILLANCE (ARTEMIS): SARS-COV-2 GENOME SEQUENCING IN THE SOUTHERN US** *Paul Kim[1], Audrey Kim[1], Jamie Newman[2], Jeremy P. Kamil[3], Tom Bishop[4], Krista Queen[5], Gregory Ware[4], Maarten Van Diest, Michael Foster[2§], Laura Lee[2§], Erika Pendleton[2§], Isabella Redman[2§], Madeline Robinson[2§], John Thomas[1§], Lescia Valmond[1§]* *[1]Department of Biological Sciences, Grambling State University, Grambling, LA, USA, [2]School of Biological Sciences, Louisiana Tech University, Ruston, LA, USA, [3]Department of Microbiology and Immunology, Louisiana State University Health Shreveport, Shreveport, LA, USA, [4]Physics and Chemistry Programs, Louisiana Tech University, Ruston, LA, USA, [5]Center for Emerging Viral Threats, Louisiana State University Health Shreveport, Shreveport, LA, USA*
2:10	**3-3B**	**TEACHING CURES IN THE MIDST OF A PANDEMIC** *Gloria Miller, LaDonnya Drummond, Barbara Graham, Jacqueline Stevens, and Timothy Turner* *Department of Biology, Jackson State University, Jackson, MS, USA*
2:20	**3-4B**	**STRESSORS & MENTAL HEALTH AMONG COLLEGE STUDENTS ON HBCU CAMPUSES** *Lashanda Brumfield[1], Mickel Sandifer[2]* *Dillard University School of Population & Health Sciences Department of Public Health New Orleans, Louisiana[1], Emory University Graduate School of Public Health Atlanta, Georgia[2]*
2:30	**3-5B**	**PREDICTION OF COMMUNITY TRANSMISSION LEVEL OF COVID-19 USING MACHINE LEARNING ALGORITHMS BASED ON CDC SOCIAL VULNERABILITY INDEX** *Saviz Saei, Yibin Wang, Mohammad Marufuzzaman, Nazanin Morshedlou, Haifeng Wang* *Mississippi State University, Mississippi State, MS, USA*
2:40		**DISCUSSION**

Break and Visit the Poster 2:50-3:00

Concurrent Sessions 4A and 4B

Session 4A: Biomechanics
3:00 pm- 4:30 pm

Friday	Presentation #	Conference Room: 1
Time		**Session 4A: Biomechanics** **Session Chair**: Giovanni Solitro, Ph.D., Louisiana State University Health Shreveport **Co-Chair**: Alan Eberhardt, Ph.D., University of Alabama at Birmingham
3:00	4-1A	**RECREATING LIGAMENT MECHANICS USING 3D PRINTING** *Natalia D. McIver[1], Christina Salas[2]* *Department of Orthopaedics, The University of New Mexico, Albuquerque, NM, USA* *Center for Biomedical Engineering, University of New Mexico, Albuquerque, NM, USA*
3:10	4-2A	**INVESTIGATION OF THE RADIAL CLEARANCE INFLUENCE ON THE TRIBOLOGICAL BEHAVIOUR OF HARD-ON-SOFT HIP IMPLANTS BASED ON LUBRICATION AND MULTIBODY SIMULATION MODELS** *Alessandro Ruggiero, Alessandro Sicilia* *Department of Industrial Engineering, University of Salerno, Via Giovanni Paolo II, n° 132, 84084 Fisciano, Italy*
3:20	4-3A	**EFFECTS OF COMPRESSIVE STRAIN ON THE DIFFUSIVITY OF FLUORESCEIN IN MENISCUC FIBROCARTLIAGE** *Gabi Schwartz[1], Andy Morejon[1], Thomas M. Best[1], Alicia R. Jackson[1], Francesco Travascio[1,2]* *[1]University of Miami, Coral Gables, FL, USA, [2]Max Biedermann Institute for Biomechanics, Miami Beach, FL, USA*
3:40	4-4A	**BIOMECHANICALLY RECREATING THE PHANTOM FOOT INJURY** *Natalia D. McIver[1,2], Benjamin Albertson[1], Christopher Kurnik[1], Jessica Nelson[3], Dustin Richter[1], Christina Salas[1,2]* *[1]Department of Orthopaedics, University of New Mexico, Albuquerque, NM, USA, [2]Center for Biomedical Engineering, The University of New Mexico, Albuquerque, NM, USA, [3]School of Medicine, University of New Mexico, Albuquerque, NM, USA*
3:50	4-5A	**EFFECT OF LIFTING STRAPS IN MUSCULAR ACTIVATION DURING SNATCH** *Sergio Lemus, Mallory Volvz, Francesco Travascio* *University of Miami, Miami, FL, USA*
4:00	4-6A	**ROLE OF BONE CEMENT AND SUCCESS OF TOTAL JOINT REPLACEMENT** *Subrata Saha, Ph.D.[1], Amit Maha, Ph.D.[2], and Nakul Karkare, M.D.[3]* *[1]Department of Restorative Dentistry, School of Dentistry, University of Washington, Seattle, WA, USA, [2]Department of Mechanical Engineering, Alfred University, Alfred, NY, USA, [3]Lenox Hill Hospital, New York, NY, USA*
4:10	4-7A	**DEVELOPING CUSTOM ADVANCED ORTHOTIC TO IMPROVE BIOMECHANICAL GAIT FOR CONGENITAL SYMBRACHYDACTYLY** *Katherine Tran, Megan Contti, Dominique Courbin, John Sparkman, and Albert Manero* *Limbitless Solutions, University of Central Florida, Orlando, FL, USA*
4:20		**DISCUSSION**



Session 4B: Nanoparticles -1

3:00-3:20 Session Keynote Conference Room 2

EX VIVO ASSESSMENT OF VASCULAR REACTIVITY IN ANIMAL MODEL

Dr. Maricica Pacurari
Jackson State University, MS

Dr. Maricica Pacurari is an Associate Professor of Biology in Department of Biology, College of Science, Engineering, and Technology at Jackson State University, Jackson, MS. Dr. Pacurari holds a doctoral degree in Cell Molecular Biology/Biochemistry from West Virginia University and postdoctoral training from University of Alabama, School of Medicine, Birmingham, Alabama. Dr. Pacurari's expertise is in lung and vascular biology and she conducts research in vascular permeability, acute lung injury, and chronic lung disease specifically investigating how inflammation and oxidative stress mediate intracellular signaling implicated in the pathogenesis of lung disease including pulmonary edema, pulmonary fibrosis, and lung cancer. She has been mentoring and guiding undergraduate and graduate students and post-doctoral research associates to study transcriptional regulation of gene expression under an inflammatory and oxidative stress-induced signaling in vascular and lung model systems, and molecular networks for identification of novel therapeutic targets in pulmonary fibrosis and lung cancer. Dr. Pacurari had received federal funding from NIH and medical research companies. She has published over 35 manuscripts in peer-reviewed prestigious journals. Dr. Pacurari's work has been widely recognized in lung health scientific communities. She received the Faculty Investigator Award from AFMR. Dr. Pacurari serves as an editor for International Journal of Medical Sciences, member of publication committee at Journal of Investigative Medicine, and a reviewer for biomedical journals.

Friday	Presentation #	Conference Room: 2
Time		**Session 4B: Nanoparticles-1** **Session Chair:** Maricica Pacurari, Ph.D., Jackson State University **Co-Chair**: Vladimir Reukov, Ph.D., University of Georgia
3:00	Keynote	**EX VIVO ASSESSMENT OF VASCULAR REACTIVITY IN ANIMAL MODEL** *Maricica Pacurari* *Jackson State University, Jackson, MS, USA*
3:20	4-1B	**CERIUM OXIDE NANOPARTICLES: A PROMISING OUTLOOK INTO OPTHALMIC APPLICATIONS** *Mir Patel, John Burn, Vijay Mohakar, Anton Sorkin, Vladimir Reukov* *University of Georgia, Athens, GA, USA*
3:30	4-2B	**THERMODYNAMIC STUDY OF CERIUM OXIDE NANOPARTICLES AND THEIR EFFECTS ON CELLULAR METABOLISM** Stephen Joseph, Maxwell Jani, Vijay Mohakar, Anton Sorkin, Vladimir Reukov Department of Textiles, Merchandising, and Interiors, College of Family and Consumer Sciences, University of Georgia, Athens, GA, USA
3:40	4-3B	**CELL ADHESION ON BIOCOMPATIBLE ALIGNED SUBMICRON FIBERS** Vijay Mohakar, Anton Sorkin, Sergiy Minko, Vladimir Reukov Department of Textiles, Merchandising, and Interiors, College of Family and Consumer Sciences, University of Georgia, Athens, GA, USA
3:50	4-4B	**MOS2/AUSERS BIOSENSOR FOR EARLY DETECTION OF BREAST CANCER-DERIVED EXOSOMAL MICRO RNAS** *Faith Zablon, Sachin Shendokar, Kristen Dellinger, Shyam Aravamudhan* **Department of Nanoengineering, Joint School of Nanoscience and Nanoengineering, North Carolina A&T State University, Greensboro, NC, USA*
4:00	4-5B	**RADICAL ELIMINATION PROPERTIES OF PEG-NANOCERIA** *Joanna Shephard, Kai White, Carter Spivey, Vijay Mohakar*, Anton Sorkin, Vladimir Reukov* *Department of Textiles, Merchandising, and Interiors, College of Family and Consumer Sciences, University of Georgia, Athens, GA, USA*
4:10	4-6B	**GASTROPROTECTIVE EVALUATION OF GOAT WEED PLANT EXTRACT IN A RODENT MODEL OF ULCER** *Kayode Komolafe[1,2*],Maricica Pacurari[2,3]* *[1]Department of Biochemistry, Faculty of Science, Federal University Oye-Ekiti, PMB 373, Oye-Ekiti, Ekiti State, Nigeria, [2]RCMI Center for Health Disparities Research (RCHDR), Jackson State University, Jackson, MS, USA, [3]Department of Biology, Jackson State University, Jackson, MS, USA,*
4:20		**DISCUSSION**

4:30:5:25 WORKSHOP I

Taking Implantable Devices and Materials Research Beyond Cellular and Animal Models: Recruitment and Retention in Clinical Trials

Dr. Kenneth Butler

University of Mississippi Medical Center

Dr. Kenneth Butler is a professor of medicine at the University of Mississippi Medical Center and laboratory director at the Gertrude C. Ford Memory Impairment and Neurodegenerative Dementia (MIND) Research Center. He has been involved in biomaterials research for over 20 years and has primarily focused on the biocompatibility of ceramics materials by evaluating the tissue-implant response. Dr. Butler has served as research mentor to 30 residents and graduate students, post-docs, and junior faculty in the medical, graduate, and pharmacy schools. He has been an active member of both intramural and extramural grant review teams for both national and international organizations. Dr. Butler has served as a board member and officer in the Mississippi Academy of Sciences and the Rocky Mountain Bioengineering Symposium. In 2014, he was elected a fellow of the AHA in the Council on Epidemiology and Prevention. He has authored or co-authored more than 70 peer-reviewed journal articles and published more than 110 abstracts. His research interests include the evaluation of the tissue-implant response, biocompatibility of implantable materials, and development of machine learning protocols that may be useful in the prediction of material biocompatibility.

4:30-5:20 Taking Implantable Devices and Materials Research Beyond Cellular and Animal Models: Recruitment, Retention, and Laboratory Biosafety in Clinical Trials

Moderator: Lamar Hamil, PhD

4:30 **Human Subject Recruitment Challenges in Biomedical Research – Stacee B. Naylor, MSN, Kenneth Butler, PhD**

a. Recruitment Strategies b. Retention c. Special Populations
   - i Cognitively impaired participants
   - ii Older adults

4:55 **Best Practices for Biosafety and Waste Disposal in Clinical Research – Kimberly Kennedy, PhD**

a. Awareness and compliance of laboratory safety practices required at the prescribed level of biosafety
b. Containment equipment and facilities
c. Training laboratory personnel
d. Study/lab closure

Taking Implantable Devices and Materials Research Beyond Cellular and Animal Models: Recruitment, Retention, and Completing Clinical Trials

Kenneth R. Butler, Kimberly S. Kennedy, Stacee B. Naylor, and Gary L Hamil

University of Mississippi Medical Center Jackson, MS, USA, Mississippi College, Clinton, MS, USA,, and Belhaven University, Jackson, MS, USA

Despite many successful randomized control trials utilizing various devices and biomaterials with cellular and animal models, challenges exist on how to efficiently and effectively recruit and retain participants. Adequate research participation and retention during a trial are critical for the conclusiveness and validity of the results. Study and laboratory closure procedures are equally important.

This workshop aims to take the mystery out of the recruitment and retention process in randomized controlled trials. We will summarize existing literature reviews and interventions shown to improve recruitment and retention. We will provide pearls from leaders in the field related to ethical considerations, approval process, and informed consent and discuss obstacles with special populations. Challenges related to human subject recruitment and retention in biomedical research and practical interventions will be discussed, followed by best practices for completion or termination of a clinical trial.

Innovative strategies within the framework of ethics and privacy regulations are needed to ensure successful recruitment and retention of subjects, completion of the work, and best practices following completion of work. This workshop will expose strategies to overcome challenging issues in clinical trials research and consequently save the time and resources of the funding agencies, researchers, and participants.

5:30-6:30 PM Poster Session

Poster Session: Co-Chairs Michelle Tucci, Ph.D., University of Mississippi Medical Center Lir Wan Fan, Ph.D., University of Mississippi Medical Center	**P#**
BIOMIMICKING HYDROPHOBICITY USING MICRO SCALE STRUCTURES FOR BIOMEDICAL APPLICATIONS *Roma Desai, Jhonatam Cordeiro, Bishnu Bastakoti, Kristen Dellinger* *North Carolina A & T State University, Greensboro, NC, USA*	1
ATTENTION DEFICIT/HYPERACTIVITY DISORDER I IDENTIFICATION VIA GRAPH DEEP LEARNING WITH TEMPORAL BRAIN NETWORKS *Yibin Wang, Haifeng Wang, Lir-Wan Fan, Norma Ojeda* *Mississippi State University, Mississippi State, MS, USA, University of Mississippi Medical Center, Jackson, MS*	2
IN SEARCH OF MULTI-TARGETED DIRECTED LIGANDS FOR ALZHEIMER'S DISEASE *Josue Gaona, Tulsiben Patel, Delight A. Onyejebu, Ayman K. Hamouda* *University of Texas at Tyler, Tyler, TX, USA*	3
SYNTHESIS AND POTENTIAL THERAPEUTICS OF HOLLOW BARIUM CARBONATE NANOPARTICLES *Nischal Bhattarai and Bishnu Prasad Bastakoti* *North Carolina A & T State University, Greensboro, NC, USA*	4
PAREPARATION AND CHARACTERIZATION OF HYDROGEL MICROCAPSULES USING HYBRID NANOFIBERS OF PCL/GELATIN *Felix Tettey, Thakur Sapkota, Salil Desai, Narayan Bhattarai* *North Carolina A & T State University, Greensboro, NC, USA*	5
USING CERIUM OXIDE NANOPARTICLES TO TREAT REACTIVE OXYGEN SPECIES INDUCED FIBROSIS *Helly (Krishna) Ajay Patel, Hayley Cotton, Anya Shroff, Vijay Mohakar, Anton Sorkin, Vladimir Reukov* *University of Georgia, Athens, GA, USA*	6
APPLICATION OF CELL CULTURE FOR ALTERNATIVE PROTEIN PRODUCTION *Krisitn Braschler, Shruti Kumthekar, Vijay Mohakar, Anton Sorkin, Vladimir Reukov* *University of Georgia, Athens, GA, USA*	7
THE NANCOCERIA-MEDIATED PHENOTYPIC TRANSITION OF MACROPHAGES BETWEEEN M1 AND M2 FORMS *Jacob D. Glassman, Patrick Beale, Logan Eagle, Thomas Layton, Vijay Mohakar, Anton Sorkin, Vladimir Reukov* *University of Georgia, Athens, GA, USA*	8
DEVELOPMENT OF XANTHAN-GUM GELATIN HYDROGELS FOR BIOPRINTING *Jessica Patel, Vijay Mohakar, Anton Sorkin, Vladimir Reukov* *University of Georgia, Athens, GA, USA*	9
IMAGE BASED 3D PRINTING FOR NEURO-ENDOVASCULAR PLANNING AND TRAINING *Dao N., Stewart C, Sharma P., Giovanni S., Sarkar K, Alexander J.* *Louisiana State University Health Shreveport, Shreveport, LA, USA*	10
WASTEWATER-BASED EPIDEMIOLOGY FOR SARS-COV-2 SURVEILLANCE *Lescia Valmond[1§], John Thomas[1§], Audrey Kim[1], Paul Kim[1]* *[1]Department of Biological Sciences, Grambling State University, Grambling, LA, USA*	11
SPATIAL AND TEMPORAL VARIATION IN SOCIAL DETERMINANTS OF HEALTH (SDH) AND COVID-19 RELATED HEALTH OUTCOMES IN USA *S M Asger Ali*, Kathleen Sherman-Morris, Qingmin Meng and Shrinidhi Ambinakudige* *Department of Geoscience, Mississippi State University, Mississippi State, MS, USA*	12
GREEN SYNTHESIS AND CHARACTERIZATION OF ZINC OXIDE NANOPARTICLES FOR BIOMEDICAL APPLICATIONS *Rajiv Acharya[1], Felix Tettey[2], Narayan Bhattarai[2], Niranjan Parajuli[1]* *[1]Biological Chemistry Lab, Central Department of Chemistry, Tribhuvan University, Kirtipur, Kathmandu, 44600, Nepal, [2]Department of Chemical, Biological and Bioengineering, North Carolina A & T State University, Greensboro, NC, USA*	13
SURFACE MODIFIED TITANATE VIA ELECTRO COPOLYMERIZATION OF CHITOSAN TO POLYANILINE FOR TISSUE MICROSTRUCTURE BIOMATERIALS CLUES FOR PROMOTING BONE REGENERATION OF HBM-MSCS *Bishnu Kumar Shrestha [*, a], Sita Shrestha [a], Chan Hee Park [a, b], and Cheol Sang Kim [a, b]* *[a]Department of Bionanosystem Engineering, Graduate School, Jeonbuk National University, Jeonju 561-756, Republic of Korea*	14
CELLULAR EFFECTS OF CATABOLIC INFLAMMATORY CYTOKINES ON CHONDROCYTES *Tracye Lawyer[1], Michelle Tucci[1], and Hamed Benghuzzi[2]* *[1]University of Mississippi Medical Center, Jackson, MS USA and [2]Global Training Institute, Flowood, MS, USA*	15
INNOVATIVE DRUG APPLICATION SYSTEM FOR MEDIUM-THROUGHPUT SCREENING USING TWO-ELECTRODE VOLTAGE-CLAMP RECORDING *Karan Venaik, Suvam Pokharel, Md Sharif Ahmed, Naei Barakat, Hassan El Kishky, Ayman K. Hamouda*	16

END OF FRIDAY SESSIONS


Saturday
August 27, 2022

Saturday, August 27, 2022

7:00 am-4:00 pm **Registration (Hotel Lobby)**

Keynote Speakers for Sessions 5A and 5B

Session 5A Medical Devices

8:00-8:30 **Session Keynote I** **Conference room 1**

TISSUE ENGINEERING FOR THE DAMAGED MENISCUS: CURRENT CONCEPTS AND FUTURE PROSPECTIVES

Dr. Francesco Travascio

University of Miami

Dr. Francesco Travascio is Associate Professor at the Mechanical and Aerospace Engineering Department of the University of Miami, where he directs the Musculoskeletal Biomechanics Laboratory. He is also Associate Director of the Max Biedermann Institute for Biomechanics at Mount Sinai Medical Center in Miami Beach. Dr. Travascio received his B.S. and M.S. in Materials Engineering at the University of Naples Federico II (Italy) in 2001, and a Ph.D. in Chemical Engineering in 2004. He also holds a doctoral degree in Biomedical Engineering (University of Miami, 2009). Before his academic appointment at the University of Miami, he worked for two years as a bioengineer at MAKO Surgical, Inc. (now MAKO Stryker, Inc.). Dr. Travascio's expertise are in the areas of occupational and sports biomechanics, as well as orthopaedics. His current research on meniscal tissue is funded by the National Institute of Musculoskeletal and Skin Diseases (NIAMS). Dr. Travascio is author of two books and more than 100 scientific publications. He is also a Fellow of the American Society of Mechanical Engineers (ASME), and an active member of the Orthopaedic Research Society.

Session 5A Medical Devices

9:45-10:10 **Session Keynote II** **Conference Room 1**

DEVELOPMENT OF TOOLS FOR SURGICAL TRAINING: THE ROLE OF THE HAPTIC FEEDBACK

Dr. Giovanni Solitro

Louisiana State University Health Shreveport

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

Session 5A: Medical Devices and Implants
Time 8:00 -10:20

		Conference Room: 1
Time	**Presentation #**	**Session 5A: Medical Devices and Implants** **Session Chair:** Christina Salas, Ph.D., The University of New Mexico **Co-Chair** : Subrata Saha, Ph.D., Washington State University
8:00	**Keynote**	**TISSUE ENGINEERING FOR THE DAMAGED MENISCUS: CURRENT CONCEPTS AND FUTURE PROSPECTIVES** *Francesco Travascio* *University of Miami, Miami, FL,USA*
8:30	**5-1A**	**AUDIOVISUAL VENTILATION FEEDBACK FROM A NOVEL HANDHELD MONITORING DEVICE IMPROVES MANUAL VENTILATION IN A RANDOMIZED CROSSOVER MANIKIN STUDY** *Luke A. White[1], Benjamin S. Maxey[1], Giovanni F. Solitro[2], Steven A. Conrad[3-5], J. Steven Alexander[1, 3],* *[1]Department of Molecular & Cellular Physiology,[2] Department of Orthopedic Surgery, [3] Department of Medicine, [4] Department of Emergency Medicine, [5] Department of Pediatrics, [6] Department of Neurology, Louisiana State University Health, Shreveport, LA, USA*
8:40	**5-2 A**	**NOTHCED JAGGED 1 COATING ENHANCES 3D-PRINTED BONE SCAFFOLD VASCULARIZATION AND CALLUS FORMATION** *Emma Dong, Giovanni Solitro, J. Steven Alexander, Yufeng Dong* *Louisiana State University Health Shreveport, Shreveport, LA, USA*
8:50	**5-3 A**	**USE OF INTESTIONAL EXPANSION SLEEVE (IES) FOR DISTRACTION ENTEROGENESIS IN SHORT GUT SYNDROME: PRECLINICAL STUDIES IN RAT SMALL INTESTINES** *Collyn O'Quin[1], Sean D Clayton, MD[1], Lexus Trosclair, MD[1], Hannah Meyer[1], Zachary Connelly, PhD[1], Ross Reiger[1], H Nhi Dao[2], Andrew Minagar[2], Luke White, PhD[2], Giovanni Solitro, PhD[3], J Steven Alexander, PhD[2], Donald Sorrells, MD, FACS[1]* *[1]Department of Surgery, [2]Department of Molecular and Cellular Physiology, [3]Department of Orthopedic Surgery, Louisiana State University Health, Shreveport, LA, USA*
9:00	**5-4 A**	**VAGINAL ATRESIA/AGENESIS: EXPERIMENTAL EVIDENCE OF CANAL EXPANSION WITH A NOVEL DEVICE** *Hanna Meyer, Lexus Trosclair, Sean D. Connelly, Ross Reiger, H Nhi Dao, Andrew Minagar, Luke White, Giovanni Solitro, Miriam Haskin, Mil Shah-Bruce, J Steven Alexander, Donald Sorrells* *Louisiana State University Health Shreveport, Shreveport, LA, USA*
9:10	**5-5A**	**ADDITIVE MANUFACTURING OF CONTINUOUS CARBON FIBER COMPOSITES FOR ORTHOPEDIC FIXATION DEVICES MEDICAL DEVICES AND IMPLANTS** *Seyed Hamid Reza Sanei* *Department of Mechanical Engineering, Pennsylvania State University, Erie, PA, USA*
9:20		**Discussion**
9:45	**Keynote**	**DEVELOPMENT OF TOOLS FOR SURGICAL TRAINING: THE ROLE OF THE HAPTIC FEEDBACK** *Giovanni Solitro, Patrick Massey, Wayne Scalisi, and R Shane Barton* *Department of Orthopaedic Surgery, Louisiana State University Health-Shreveport, LA, USA*
10:10		**BREAK**

Session 5B: Biomaterials III/ BioSensors

		Conference Room: 2
Time	Presentation #	**Session 5B: Biomaterials III/BioSensors** **Session Chair:** Vladimir Reukov, Ph.D., University of Georgia
8:00	**5-1B**	**DUAL POLYMER THERMORESPONSIVE SURFACES FOR IMPROVED CELL SHEET DETACHMENT** *Anton Sorkin*, Vijay Mohakar, Sergiy Minko, Vladimir Reukov.* *Department of Textiles, Merchandising, and Interiors, College of Family and Consumer Sciences, University of Georgia, Athens, GA, USA*
8:10	**5-2B**	**NANOSIZED CERIA OXIDE AS INHIBITOR OF STREPTOCOCCUS MUTANS METABOLISM** *Herchel Patel, Sejal Gandhi, Alyssa Che, Kamal Patel, Rani Patel, Dhruvi Patel, Vijay Mohakar, Anton Sorkin, Vladimir Reukov* *Department of Textiles, Merchandising, and Interiors, College of Family and Consumer Sciences, University of Georgia, Athens, GA, USA*
8:20	**5-3B**	***DESIGN AND MODELING OF A MULTI-PARAMETRIC FIBER-OPTIC BIOSENSOR*** *Nafize I. Hossain, SK Nayemuzzaman and Shawana Tabassum* *Department of Electrical Engineering, The University of Texas at Tyler, Tyler, Texas, USA*
8:30	**5-4B**	**HAPTICS IN SOFT EFFECTORS FOR SMART INTERACTIVE ASSISTIVE FRAMEWORKS** *Prabha Sundaravadivel and Ashton Fitzgerald* *Department of Electrical Engineering, The University of Texas at Tyler, Tyler, Texas, USA*
8:40	**5-5B**	**KIRIGAMI ARCHITECTURE FOR ULTRAFLEXIBLE BIOSENSOR DESIGN** *Nafize I. Hossain and Shawana Tabassum* *Department of Electrical Engineering, The University of Texas at Tyler, Tyler, Texas, USA*
8:50	**5-6B**	**UTILIZING EMG AND EYE TRACKING FOR SERIOUS GAME CONTROL FOR POPULATIONS WITH NEURODEGENERATIVE DISEASES** *Peter Smith, Matt Dombrowski, Shea McLinden, Dominique Courbin, John Sparkman, and Albert Manero* *Limbitless Solutions, University of Central Florida, Orlando, FL, USA*
9:00	**5-7B**	**IMPROVEMENT IN MUSCLE CONTROL VIA SERIOUS GAMING FOR PROSTHETIC USAGE** *Peter Smith, Matt Dombrowski, Shea McLinden, Calvin MacDonald, Devon Lynn, Katherine Tran, Kelsey Robinson, Dominique Courbin, John Sparkman, and Albert Manero* *Limbitless Solutions, University of Central Florida, Orlando, FL, USA*
9:10	**5-8B**	**ASSESSMENT OF INFLUENCE OF DEGREE OF CALCIFICATION OVER PERFORMANCE OF TRICUSPID AORTIC VALVE USING FULLY COUPLED FLUID-STRUCTURE INTERACTION MODEL** *Ankush Pratap Singh1, Santanu Majumder1, Amit Roy Chowdhury1, Subrata Saha2* *[1]Department of Aerospace Engineering and Applied Mechanics, Indian Institute of Engineering Science and Technology, Shibpur, India, [2]Department of Restorative Dentistry, University of Washington, Seattle, WA, USA*
9:20	**5-9B**	**INFLUENCE OF CHRISTENSEN TMJ IMPLANT DIMENSIONS ON BIOMECHANICAL STABILITY OF TMJ–A PARAMETRIC STUDY** *Anik Banerjee[1*], Amit Roy Chowdhury[1], Subrata Saha[2]* *[1]Department of Aerospace Engineering and Applied Mechanics, Indian Institute of Engineering Science and Technology, Shibpur, India, [2]Department of Restorative Dentistry, School of Dentistry, University of Washington, Seattle, WA, USA*
9:30		**DISCUSSION**

Concurrent Sessions 6A and 6B

Time 10:30 -11:50

Session 6A: Rehabilitation/Physical Therapy

		Conference Room: 1
Time	Presentation #	**Session 6A: Rehabilitation/Physical Therapy** **Session Chair:** Felix Adah, Ph.D., University of Mississippi Medical Center **Co-Chair** : Lamar Hamil, Ph.D., Belhaven University
10:30	**6-1A**	**THE EFFECTS OF ELECTRODE PLACEMENTS, KNEE JOINT ANGLE AND E-STIMULATION PLUS VOLITIONAL CONTRACTION** *Felix Adah, Mark Weber, Janet Slaughter, Williams Pannell, Michael Brown and Joy Kuebler* *University of Mississippi medical Center, Jackson MS, USA*
10:40	**6-2A**	**THE EFFECT OF A FREE COMMUNITY PEDIATRIC HEALTH INITIATIVE ON BMI, FITNESS MEASURES, AND QUALITY OF LIFE** *Leah M. Swahlan[1], Ben S. Killen[1], Alison L. Olsen[1], Kim C. Wilcox[1], W. Cody Pannell[1], Janet P. Slaughter[1], Shuying Lin[1], Rachel K. Dear[2]* *[1]Department of Physical Therapy, School of Health-Related Professions, University of Mississippi Medical Center, Jackson, MS, USA, [2]Center for Integrative Health, University of Mississippi Medical Center, Jackson, MS, USA*
10:50	**6-3A**	**EFFECTS OF BACKWARD WALKING ON GAIT PARAMETERS IN PEOPLE WITH STROKE: A SYSTEMATIC REVIEW** *Brian P. Kramer, Taytum M. Reid, Alex T. Shepard, Madeline O. Tisdale, Kim Curbow Wilcox* *[1] Department of Physical Therapy, School of Health Related Professions, University of Mississippi Medical Center, Jackson, MS, USA*
11:00	**6-4A**	**THE EFFECTS OF PRONE POSITIONING IN MECHANICALLY VENTILATED PATIENTS WITH COVID-19: A SYSTEMATIC REVIEW** *Claire Golding, Baryn Rasberry, Ben Griffith, John Robertson, Melanie Lauderdale* *Department of Physical Therapy, School of Health Related Professions, University of Mississippi Medical Center, Jackson, MS, USA*
11:10	**6-5A**	**EFFECTS OF BOTULINUM TOXIN ON GAIT IN CHILDREN WITH CEREBRAL PALSY: A SYSTEMATIC REVIEW** *Cora N. Geno, Kolby D. Wesson, Allyn C. Edmonson, Rachel A. Sollie, Shuying Lin** *Department of Physical Therapy, School of Health Related Professions, University of Mississippi Medical Center, Jackson, MS, USA*
11:20	**6-6A**	**THE BENEFITS OF SIT-TO-STAND DESKS IN THE CLASSROOM: A SYSTEMATIC REVIEW** *Kelsey L. Sumrall, Stanley J. Litwin, Regie J. Alkuino, Christopher L. Pieroni, Joy C. Kuebler,* *The University of Mississippi Medical Center, School of Health Related Professions, Jackson, MS, USA*
11:40		**DISCUSSION**

Session 6B: Bioethics

		Conference Room: 2
Time	**Presentation #**	**Session 6B: Bioethics** **Session Chair:** Subrata Saha, Ph.D., University of Washington **Co-Chair**: Shankar Krishna Ph.D., Wentworth Institute of Technology
10:30	**6-1B**	**DENTAL IMPLANT TREATMENT DECISIONS: CHALLENGES AND OPPORTUNITIES** *Ajay Kashi, Subrata Saha* *[1]Private Practice, Rochester, NY, USA, [2]Department of Restorative Dentistry, University of Washington, Seattle, WA, USA*
10:40	**6-2B**	**ONE GIANT LEAP---FROM THE LAB TO COMMERICAL SUCCESS** *Richard Treharne* *Memphis, TN, USA*
10:50	**6-3B**	**COMPARISON OF DEVICE MANUFACTURING INDUSTRIES RELATION WITH ORTHOPAEDIC HAND SURGEONS AND PLASTIC HAND SURGEONS** *Suhirad Khokhar, MD[1] , Akshay Malhotra[2] , Shivleen Gill, MBBS, MHA[3], Zubin Panthaki MD[4], Vedant Vaksha MD[5] , Rupesh Tarwala MD[6], Nakul V. Karkare, MD[7]* *[1]Hand Surgery Fellow, University of Miami/Jackson Memorial Hospital, Miami, FL, [2]Student, Brown University, Providence, RI, USA, [3]University of Scranton, 800 Linden St, Scranton, PA, USA, [4]University of Miami/Jackson Memorial Hospital, Miami, FL, USA, [5]Complete Orthopedics 2500 Nesconset Hwy 10D, Stony Brook, NY, USA, [6]Reconstruction Orthopedic Surgeon, Lenox Hill Hospital 100 E 77th St, New York, NY, USA*

11:00	**6-4B**	**DESIGNING A COLLABORATIVE COURSE ON BIOMEDICAL ETHICS FOR ENGINEERING STUDENTS** *Shankar Krishnan, Martha Zequera Diaz, Jorge Monzon* *Pontificia Universidad Javeiriana, Colombia*
11:10	**6-5B**	**ETHICS AND EXPERIENCE OF THE COVID 19 PANDEMIC IN A DIVISION 1 ATHLETIC PROGRAM** *Larry Bowman, Douglas Reeves, Tenley Murphy* *Clemson University, Clemson, SC, USA*
11:20	**6-6B**	**3D PRINTING OF BONES AND NANOTECHNOLOGY: ETHICAL AND ANTICIPATED ETHICAL ISSUES** *Richard Wilson* *Townson University, Townson, MD, USA*
11:30	**6-7B**	**THOUGH I WALK THROUGH THE VALLEY OF DEATH… LESSONS LEARNED THROUGH DEVELOPMENT OF A NEW REHABILITATION DEVICE** *Alan Eberhardt* *University of Alabama at Birmingham, Birmingham, AL, USA*
11:40		**DISCUSSION**

12:00 -1:00 Plenary Speaker and Lunch

Title: AUGMENTING BIOMEDICAL ENGINEERING FEDERATION PARTNERSHIPS IN THE ACADEMIA-INDUSTRY-GOVERNMENT TRIPLE HELIX MODEL

By

Dr. Shankar Krishnan

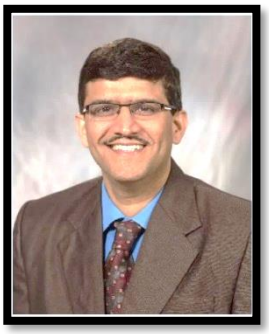
Vice President, International Union for Physical and Engineering Sciences in Medicine; Past President, International Federation for Medical and Biological Engineering

Shankar Krishnan has over thirty-five years of biomedical engineering and management experience in academia, medical device manufacturing industry and hospitals. He was the founding Director of the Biomedical Engineering department and a full professor at Wentworth Institute in Boston, USA. Previously, he was an assistant director at Massachusetts General Hospital and a teaching affiliate of Harvard Medical School in Boston. He has also held faculty appointments at Universities in Illinois, Miami, and Singapore. At the Nanyang Technological University in Singapore, he was the founding Director of the Biomedical Engineering Research Center and the founding Head of the Bioengineering division. He was the Co-Director for a 15 million USD research grant from the Agency for Science and Technology Research. He also worked in R&D at Coulter Electronics in Miami and in hospital design and operations management at Bechtel for megaprojects in healthcare. He has served in the National Medical Research Council in Singapore. His research interests include biomedical signals and image processing, telemedicine, A.I., medical robotics, and Biomedical Engineering education. He has been developing novel models in the development of BME curricula, design of BME labs, co-ops, and internships for BME students, and essential activities for accreditation of BME programs. He has over 300 publications in conference proceedings, journal papers and book chapters. He has presented several invited keynote and plenary talks in several national and international Conferences. He keeps active memberships in AAMI, ACCE, ASEE, ASME, BMES, IEEE-BMES. MassMedic and RSNA. He is a Fellow of AIMBE, and a Fellow of IUPESM. He has served as an Officer in the Administrative Council of the International Federation for Medical and Biological Engineering (IFMBE) for 19 years, and he was the President of IFMBE from 2018 to 2022. He is the Vice President of the International Union of Physical and Engineering Sciences in Medicine (2022-2025). He was elected to serve in the Executive Council of the World Federation of Engineering Organizations (2022-2024). He was a member of a team which received the CIMIT Kennedy Innovation Award in Boston. He received the IFMBE John Hopps Distinguished Service Award in 2022.

Workshop II

1:15-1:50

Title: Time Management Skills for Student Research



Dr. Amol Janorkar

University of Mississippi Medical Center, Jackson, MS, USA

Amol V. Janorkar received his B.S. in chemical engineering from University of Mumbai Department of Chemical Technology (UDCT) in 2000 and his Ph.D. in chemical engineering from Clemson University in 2005. Subsequently, he did a two-year postdoctoral research fellowship at the Center for Engineering in Medicine with a joint appointment at the Harvard Medical School, Massachusetts General Hospital, and Shriners Hospital for Children. He joined the faculty of the Department of Biomedical Materials Science, School of Dentistry at the University of Mississippi Medical Center (UMMC) in August 2007 as an Assistant Professor. Dr. Janorkar was promoted to the rank of Associate Professor (with tenure) in July 2013 and then to the rank of Professor in July 2017. Beginning in July 2020, Dr. Janorkar was entrusted with the responsibility of being the Chairperson for the Department of Biomedical Materials Science. With his training and experience in the field of biomaterials and tissue engineering over the past 19 years, Dr. Janorkar leads a research group that focuses on cell-biomaterial interactions to direct cell morphology and ultimate cell function. The Janorkar Lab uses chemical and physical modification of biopolymer substrates to create three-dimensional in vitro tissue models that achieve enhanced survival and biological function versus conventional cultures for liver, adipose, and bone tissue engineering. His research has been funded by the National Science Foundation (NSF), the National Institutes of Health (NIDCR and NIBIB), and the United States Department of Agriculture (USDA). Dr. Janorkar has published over 60 journal articles and 50 conference proceedings. Dr. Janorkar and his students have made over 100 conference presentations. Recognizing these research accomplishments, the University of Mississippi Medical Center has awarded Dr. Janorkar the Gold, Silver, and Bronze Medallions for Research Excellence.

Dr. Janorkar serves as the Director of the summer research program that has trained over 200 dental and undergraduate students over past 14 years. Recognizing his contributions to dental research, he has been inducted into the Omicron Kappa Upsilon National Dental Honor Society, which rarely inducts non-dentist faculty members. Dr. Janorkar also served as the Director of the Ph.D. graduate program with focus on Biomedical Materials Science from 2016-2020. He continues to serve as the director and course faculty for several dental and graduate courses. Dr. Janorkar has mentored over 50 graduate, undergraduate, dental, and medical students and post-docs. His students have won 44 awards for outstanding research at local and national levels. Recognizing his teaching and mentoring, Dr. Janorkar was awarded the TEACH (Toward Educational Advancement in Care and Health) Prize, the highest award given to an educator by the University of Mississippi Medical Center. He has also been inducted into the Nelson Order of Teaching Excellence. Dr. Janorkar is a senior member of the American Institute of Chemical Engineers (AIChE) and an active member of the Society for Biomaterials (SFB).

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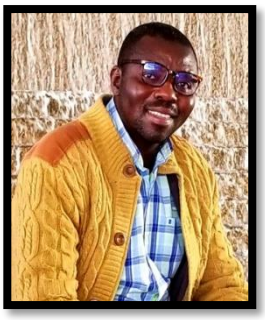
Concurrent Sessions 7A and 7B

Time 2:00 -3:20

Session 7A Biomolecules/design/synthesis/evaluations
2:00-2:20 Session Keynote Conference Room 1



AMINOBIPHENYL-2-OLS, AND O-TRIALKYLSILYL AND O-TRIARYLSILYL OXIMES AS POTENTIAL INHIBITORS OF CUTANEOUS MELANOMA AND NON-MELANOMA SKIN CANCER CELLS

Dr. Jean Fotie
Southeastern Louisiana University, Hammond, LA, USA

Professor Fotie obtained his PhD in Medicinal Chemistry and Natural Products from the University of Yaoundé I in Cameroon (2004), after completing most of his research work as a visiting PhD student at Potsdam University in Germany, under a DAAD scholarship. He completed his postdoctoral work in bioinorganic chemistry at McGill University in Montreal Canada under Prof. Scott Bohle (2004 – 2006), before moving to the Ohio State University School of Pharmacy as a World Health Organization (WHO) Research Scholar (2006 – 2008) under Prof. Karl Werbovetz, working on the development of potential therapies for neglected diseases. He began his independent career at Southeastern Louisiana University in 2008, with his primary interests being green and sustainable catalysis, and organosilicon medicinal chemistry. He is currently a professor of organic chemistry and holder of the Edward G. Schlieder Endowed Professorship of Environmental Studies and Sustainability.

		Conference Room: 1
Time	**Presentation #**	**Session 7A: Biomolecules/design/synthesis/evaluations** **Session Chair:** Prem B. Chanda, Ph.D., Southeastern Louisiana University
2:00	**Keynote**	**2'-AMINOBIPHENYL-2-OLS, AND O-TRIALKYLSILYL AND O-TRIARYLSILYL OXIMES AS POTENTIAL INHIBITORS OF CUTANEOUS MELANOMA AND NON-MELANOMA SKIN CANCER CELLS** *Samuel T. Boateng[a], Tithi Roy[a], Mercy E. Agbo[b], Roxane-Cherille N. Chamcheu[a], Jean Christopher Chamcheu[a], Jean Fotie,[b*]* *[a]School of Basic Pharmaceutical and Toxicological Sciences, College of Pharmacy, University of Louisiana - Monroe, Monroe, LA, USA, [b]Department of Chemistry and Physics, Southeastern Louisiana University, Hammond, LA, USA*
2:20	**7-1A**	**HETEROCYCLIC ANTICANCER COMPOUNDS: SYNTHESIS AND BIOLOGICAL EVALUATION** *Siva Murru* *University of Louisiana Monroe, Monroe, LA, USA*
2:30	**7-2A**	**NEW DERIVATIVES OF 1,3-DIOXOISOINDOLINE: POTENTIAL BREAST CANCER THERAPEUTICS THAT ARE S6K1 INHIBITORS** *Rajesh Komati[b], Shahensha Shaik[a], Melyssa Bratton[c], Linh Tran[a], Kymmia Petty[a], Rion Sam[a], Elijah Henderson-Johnson[a], Breyanah Graham[a], Christopher Williams[a], and Jayalakshmi Sridhar[a]** *[a]Xavier University of Louisiana, New Orleans, LA, USA and [b]Nicholls State University, Thibodaux, LA, USA, [c]Biospecimen Core Laboratory, Louisiana Cancer Research Center, New Orleans, LA, USA*
2:40	**7-3A**	**DIASTEREOSELECTIVE ALDOL REACTIONS OF N, N-DIALKYLPHENYLACETAMIDES TOWARDS THE SYNTHESIS OF BUILDING BLOCKS OF BIOACTIVE COMPOUNDS** *Sean Reliford, Ben Peco, Aaron McCullough, Stafford Primeaux, Dalton Cambre, and Prem B. Chanda* *Department of Chemistry and Physics, Southeastern Louisiana University, Hammond, LA, USA.*
2:50	**7-4A**	**ARYL-FUSED (IMIDAZOLE, PYRAZINE AND PYRROLE) BORONATED DYE DERIVATIVES** *Moses Ihachi,* *Southeastern Louisiana University, Hammond, LA, USA*
3:00	**7-5A**	**FLUORESCENT DYES AND THEIR APPLICATIONS IN CELL IMAGING** *Prabin Rai* *Division of Sciences and Mathematics, Louisiana State University at Eunice* *2048 Johnson Hwy, Eunice LA, USA*
3:10		**DISCUSSION**

Session 7 B BIOMATERALS II AND NANOPARTICLES II

2:00-2:20 Session Keynote Conference Room 2

BIOENGINEERED SURFACES REDUCE IMPLANT-RELATED INFECTIONS

Dr. Bingyun Li
Department of Orthopaedics, School of Medicine
West Virginia University, Morgantown, WV, USA

Dr. Bingyun Li is a full Professor in the Department of Orthopaedics at School of Medicine, West Virginia University. He was elected into the American Institute for Medical and Biological Engineering (AIMBE) College of Fellows in 2018. He is a member of the Society for Biomaterials (SFB), Orthopedic Research Society (ORS), American Society for Microbiology (ASM), Materials Research Society (MRS), International Chinese Musculoskeletal Research Society (ICMRS), and Chinese Association for Biomaterials (CAB). Dr. Li has served as topic chair of Infection and Inflammation of the ORS Program Committee, Chair of the Liaison Committee of SFB, Chair of the Communication Committee of ICMRS, and President of CAB. Dr. Li's research focuses on bioengineering, nanomedicine, advanced materials, infection, and immunology. He has supervised 114 trainees, and his research group has published more than 100 peer-reviewed articles (h-index=46), four edited books, 11 book chapters, four U.S. patents, and 166 abstracts. Dr. Li has given 65 invited talks including two keynote talks at the European Cells and Materials Annual Conference in 2019 and at the World Biomaterials Congress in 2020. Dr. Li has received multiple prestigious awards including the Berton Rahn Prize from AO Foundation in 2011, the Pfizer Best Scientific Paper Award from Asia Pacific Orthopedic Association in 2013, and the Collaborative Exchange Award from Orthopedic Research Society in 2013. He received the Vice President's Outstanding Achievement Award in Research and Scholarly Activities from his institution in 2020.

		Conference Room: 2
Time	Presentation #	**Session 7B: Biomaterials II and Nanoparticle II** **Session Chair:** Narayan Bhattarai, Ph.D., North Carolina A & T State University **Co-Chair**: Bishnu Bastakoti, Ph.D. North Carolina A & T State University
2:00	**Keynote**	**BIOENGINEERED SURFACES REDUCES IMPLANT RELATED INFECTIONS** *Bingyu Li* *University of West Virginia, Morgantown, WV*
2:20	**7-1B**	**NEW DEVELOPMENT IN MESOPOROUS MATERIALS FOR DRUG DELIVERY** *Bishnu P. Bastakoti, Rabin Dahal, Jayada Yancey* *Department of Chemistry, North Carolina A&T State University, Greensboro, NC*
2:30	**7-2B**	**ENGINEERING ANTIOXIDANT AND OXYGEN-RELEASING LIGNIN COMPOSITES TO ACCELERATE WOUND HEALING** *Sarah E. Jimenez[1], Walker D. Short[2], Naresh T. Deoli[3], Anna C. Guidry[1], Swathi Balaji[2], Jangwook P. Jung[1]* *[1]Department of Biological Engineering, Louisiana State University, Baton Rouge, LA, USA* *[2]Division of Pediatric Surgery, Department of Surgery, Texas Children's Hospital and Baylor College of Medicine, Houston, TX, USA* *[3]Louisiana Accelerator Center, University of Louisiana, Lafayette, LA, USA*
2:40	**7-3B**	**LIGNIN COMPOSITES WITH SUSTAINED OXYGENATION AND ANTIOXIDANT PROPERTIES IMPROVE NEOVASCULARIZATION AND HEALING OF DIABETIC WOUNDS.** *Phillip Kogan[1], Benjamin W. Padon[1], Olutoye Oluyinka[1], Walker D. Short[1], Aditya A. Kaul[1], Lane D. Yutzy[2], Fayiz Faruk[1], Olivia S. Jung[2], Ling Yu[1], Hui Li[1], Jangwook P. Jung[2], Swathi Balaji[1]* *[1]Department of Pediatric Surgery, Texas Children's Hospital & Baylor College of Medicine, Houston, TX* *[2]Department of Biological Engineering, Louisiana State University, Baton Rouge, LA*
2:50	**7-4B**	**CHARACTERIZATION OF POLYCAPROLACTONE AND ZINC COMPOSITE NANOFIBER FOR BIOMEDICAL APPLICATIONS** *Felix Tettey, Saudi Sheikh, Dekonti Davies, Narayan Bhattarai* *Department of Industrial and System Engineering, Chemical, Biological and Bioengineering Engineering, North Carolina A&T State University, Greensboro, NC, USA*
3:00	**7-5B**	***THE MECHANOBIOLOGY OF NEUTROPHIL EXTRACELLULAR TRAPS*** *Arvind Chandrasekaran* *North Carolina A & T State University, Greensboro, NC*
3:10	**7-6B**	***TOPICAL BCL-2/BCL-XL INHIBITOR REVERSES BLEOMYCIN-INDUCED SKIN FIBROSIS*** *Md Nurul Huda[1], Edgar Borrego Puerta[2], Renato Aguilera[2,3], Md Nurunnabi[1,3,4,5]* *[1]Pharmaceutical Sciences, [2]Biological Sciences, [3]Border Biomedical Research Center, [4]Biomedical Engineering, and [5]Aerospace Center, University of Texas at El Paso, TX, USA*
3:20		**DISCUSSION**

Concurrent Sessions 8A and 8B

3:30 -5:20

Session 8A Orthopaedics/Biomechanics II:

Time 3:30 Keynote Conference Room 1

RECONSRUCTION OF BONE DEFECTS USING NOVEL BIOSCAFFOLDS CONCEPTS AND RESULTS IN ANIMAL MODELS

Dr. Steven J. Alexander
Louisiana State University

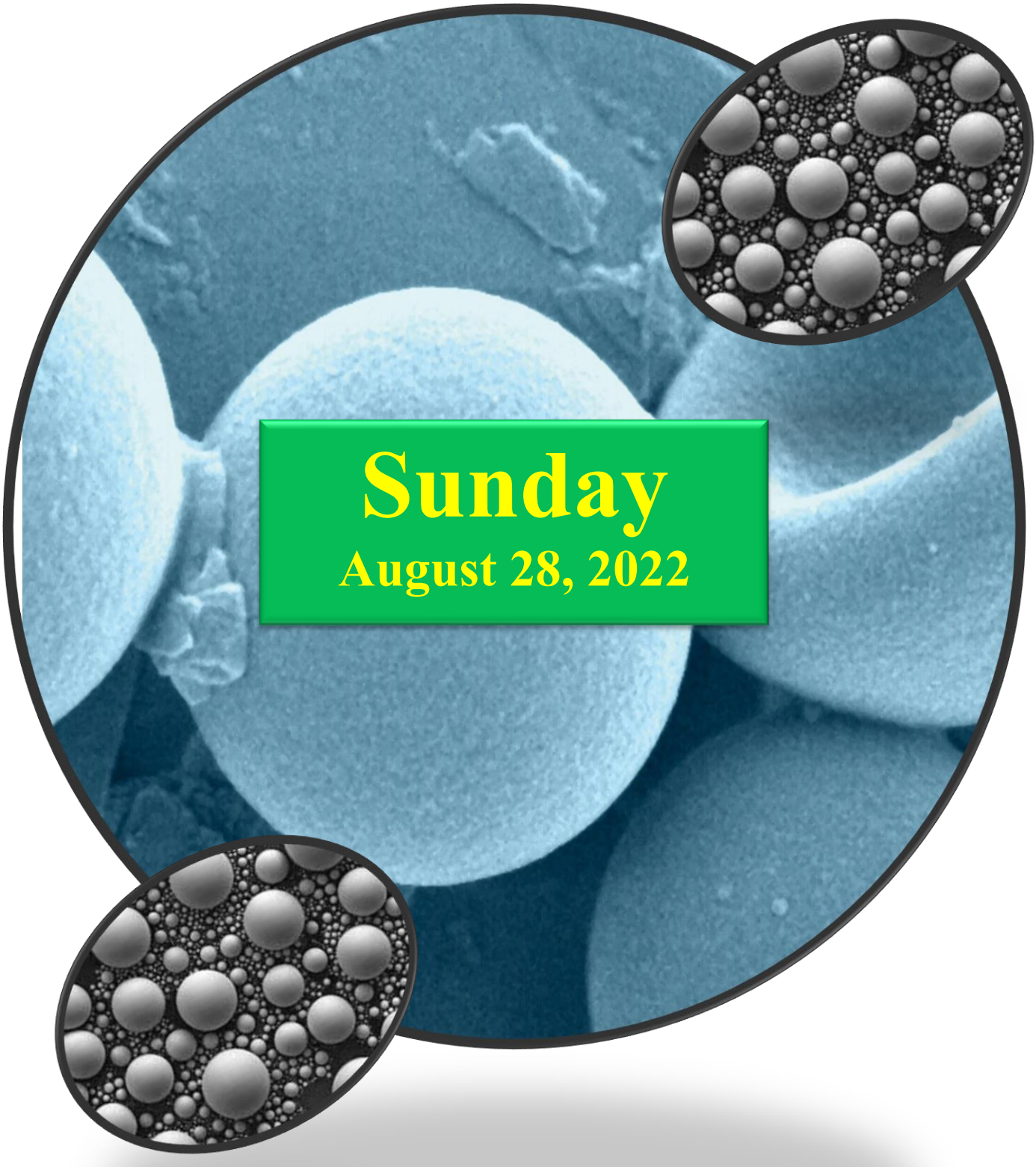
Dr. Alexander's research career has focused on investigating vascular physiology and pathophysiology of endothelial inflammatory mechanisms cells in tissue injury and disease. In recent years, his laboratory has focused on stem cell protection and restitution of tissues against forms of ischemic and inflammatory injury. His lab has a track history of studying forms of central nervous system vascular injury and blood brain barrier including a recent patent on protection against ischemic injury in transplantation. He has also been funded to work in the fields of MS and Alzheimer's therapeutics. His lab has applied stem cells to create synthetic tissues and 3D printed models.

		Conference Room: 1
Time	Presentation #	**Session 8A: Orthopaedics/Biomechanics II** **Session Chair:** Seyed Hamid Reza Sanei, Ph.D., Penn State University **Co-Chair**: Francesco Travascio, Ph.D., University of Miami, Miami, FL
3:30	**Keynote**	**RECONSRUCTION OF BONE DEFECTS USING NOVEL BIOSCAFFOLDS CONCEPTS AND RESULTS IN ANIMAL MODELS** *Alexander JS[1], Yun JW[1], Dao N[1], Villalba S[2], Stewart C[1], White L[1], Boyer C[1], Dong Y[1], Wang Y[1], Woerner J[1], Romero E[1], Villinger F[3], Fontenot J[3], Morgan K[1], Daley H[3], Aoyagi G[3], Miller A[1],* *[1]Molecular and Cellular Physiology, Louisiana State University Health-Shreveport, LA, USA, [2] Biological Sciences, Louisiana State University Shreveport, LA, USA, [3]New Iberia Research Center, University of Louisiana at Lafayette, Lafayette, LA, USA*
3:50	**8-1A**	**BONE DENSITY RELEVANCE IN DETERMINING MINIMAL NUMBER OF SCREWS NEEDED FOR STABLE ANTERIOR LUMBAR INTERBODY FUSION** *Dies Ross[1], Andrew S Zhang[1], Milan Mody[2], Mathew Root[1], Trevor Carroll[1], and Giovanni F Solitro[1]* *[1]Louisiana State University Health-Shreveport, [2]Willis-Knighton Health System Shreveport, LA, USA*
4:00	**8-2A**	**NONINVASIVE SHAPE FITTING METHOD QUARTILES CAM MORPHOLOGY IN FEMORACETABULAR IMPINGEMENT SYNDROME: IMPLICATIONS FOR DIAGNOSIS AND SURGICAL PLANNING** *Martina Guidetti[1], Philip Malloy[1,2], Alexander C. Newhouse[1], Thomas D. Alter[1], Shane J. Nho[1], Alejandro A. Espinoza Orías[1]* *[1]Rush University Medical Center, Chicago, IL, [2]Arcadia University, Glenside, PA, USA*
4:10	**8-3A**	**PIN HOLE DEFECT OSTEOGENIC RESPONSE TO DISTAL SCREW CONFIGURATION** *Jorge Guzman, Giovanni Solitro, Patrick Massey, Wayne Scalisi and Francesco Travascio* *University of Miami, Miami FL, USA, and Louisiana State University Health Shreveport, Shreveport, LA, USA*
4:20	**8-4A**	**RESISTANT TO IMPACT OF OSTEOCHONDRAL AUTOGRAPHS IN RELATION TO THEIR HARVESTING REGION** *Christian Bonner BS, Patrick A. Massey MD, Wayne Scalisi MD, Kaylee Nettles, Richard S. Barton MD, and Giovanni F. Solitro PhD* *Department of Orthopaedic Surgery, Louisiana State University Health, Shreveport, LA, USA*
4:30	**8-5A**	**MECHANICAL TESTING A NOVEL, LOW COST, ALL-SUTURE ANCHOR** *Maren Baur, Natalia D McIver, Dominique Spence, Naga Suresh Cheppali, Christina Salas* *Department of Orthopaedics, University of New Mexico, Albuquerque, NM, USA* *Center for Biomedical Engineering, University of New Mexico, Albuquerque, NM, USA*
4:40	**8-6A**	**CHANGES TO ROTATOR CUFF MUSCLE LENGTH DURING ABDUCTION AFTER SUPERIOR CAPSULAR RECONTSTRUCTION (SCR) AND REVERSE TOTAL SHOULDER ARTHROPLASTY (RTSA)** *Eric Hu[1], Martine Dolan[1], Farid Amirouche, PhD[1,2]*

		[1]Department of Orthopaedic Surgery, 835 South Wolcott, College of Medicine, University of Illinois at Chicago, Chicago, IL USA, [2]Orthopaedic and Spine Institute, Department of Orthopaedic Surgery, Northshore University, Health System an Affiliate of University of Chicago Pritzker School of Medicine, 2650 Ridge Avenue, Suite 2505, Walgreen Building, Evanston, IL, USA
4:50	**8-7A**	**BIOMATERIALS IN SMALL JOINT SURFACE REPLACEMENT ARTHROPLASTY** *Suhirad Khokhar, MD[1], Daniel Komlos, Ph.D., MD[2], Zubin J. Panthaki MD[3], Akshay Malhotra[4], Shivleen Gill, MBBS, MHA[5], Vedant Vaksha MD[6], Rupesh Tarwala MD[7], Nakul V. Karkare, MD[8]* *[1,2]University of Miami/Jackson Memorial Hospital, Miami, FL, USA, [3]University of Miami/Jackson Memorial Hospital, Miami, FL, USA, [4]Brown University, Providence, RI, USA, [5]University of Scranton, Scranton, PA, USA, [6]Complete Orthopedics Stony Brook, NY, USA, [7,8]Adult Reconstruction Orthopedic Surgeon, Lenox Hill Hospital 100 E 77th St, New York, NY, USA*
5:00	**8-8A**	**EFFECT OF LASSO SUTURE ORIENTATION ON STABILITY OF TYPE 2 REGAN MORREY CORONOID FRACTURES** *Shelby Rider M.S., Christopher Caldwell M.D., Giovanni Solitro PhD, Brad Chauvin M.D., Shane Barton M.D.* *Louisiana State University Health Science Center, Shreveport, LA, USA*
5:10	**8-9A**	**SMART ORTHOPAEDIC IMPLANTS VIA INTEGRATED SELF SENSING PIEZOELECTRICS** *Steven Anton* *Department of Mechanical Engineering, Tennessee Technological University, Cookeville, TN,*
5:20		**DISCUSSION**

Session 8B: Innovative Devices and Drug Delivery

		Conference Room: 2
Time	**Presentation #**	**Session 8B: Advanced Biomedical Applications** **Session Chair:** Ayman K. Hamouda Ph.D., The University of Texas at Tyler **Co-Chair**: Farah Deba, Ph.D., University of Texas at Tyler
3:30	**8-1B**	**APPLICATION OF ARTIFICIAL INTELLIGENCE IN RECENT ANTI CANCER DRUG DISCOVERY, PURIFICATION, AND STRUCTURAL ELUCIDATION** *Hamed I. Ali* *Texas A&M University, College Station, TX, USA*
3:40	**8-2B**	**ENIGEERED TYROSINE KINASE RECEPTOR DIMERS AS A DRUG DISCOVERY TOLL** *Allison Sunderhaus, Ramsha Imran, Amanda Goudelock, Dustin Oatterson and Mary H Abdel Aziz* *The University of Texas at Tyler, Tyler, TX, USA*
3:50	**8-3B**	***LESSONS LEARNED MONITORING ZEBRAFISH MOVEMENT IN RESPONSE TO DRUG APPLICATIONS*** *Brent Bill* *The University of Texas at Tyler, Depart of Biology, 3900 University Blvd, Tyler, Texas, USA*
4:00	**8-4B**	**EVALUATION OF PAIN DRUGS BY MECHANICAL AND THERMAL RESPONSE** *Gabrielle Thomas, Ayaan Khan, Hope Sabella, Ayman K. Hamouda, Farah Deba** *Department of Pharmaceutical Sciences and Health Outcomes. Fisch College of Pharmacy* *The University of Texas at Tyler, TX, USA*
4:10	**8-5B**	**NEW INSIGHTS INTO THE UTILITY OF EXOSOMES AS BIOMARKERS AND DRUG DELIVERY VEHICLES** *Zakaria Abd Elmageed* *Department of Biomedical Sciences, VCOM, University of Louisiana at Monroe, LA, USA*
4:20	**8-6B**	**INNOVATIVE DRUG APPLICATIO SYSTEM FOR MEDIUM THROUGHPUT SCREENING USING TWO ELECTRODE VOLTAGE CLAMP RECORDING** *Karan Venaik, Suvam Pokharel, Md Sharif Ahmed, Naei Barakat, Hassan El Kishky, Ayman K. Hamouda* *The University of Texas at Tyler, Tyler, TX, USA*
4:30		**DISCUSSION**


Sunday
August 28, 2022

Sunday, August 28, 2022

7:00 am-10:00 am **Breakfast and Social**

ABSTRACTS

August 26, 2022

Session 1A: Biomaterials

Fabrication of core-shell microcapsules of alginate hydrogel with 3D networks of chitin fibrils utilizing co-axial electrospray techniques

Thakur Sapkota, Felix Tettey, Narayan Bhattarai

Department of Applied Science and Technology, and Chemical, Biological and Bioengineering Engineering, North Carolina A&T State University, Greensboro, NC, 27411, USA.

Alginate based hydrogels has been used in many tissues engineering applications such as drug delivery and cell delivery. The hydrophilic nature and gelling tendency of alginate with divalent cations has established potential platform for these applications. Incorporation of chitin into alginates further widens its application due to strengthening the mechanical strength and providing better cell binding sites for the efficient formation of a cell spheroids. Although, there have been taken huge steps to design core shell structure, the establishment of standard parameters to create microcapsules with uniform size distribution has still facing challenge. The process parameters: voltage, concentration, flow rate of core and shell polymer solutions, distance between crossing linking bath to nozzle tip greatly impacts the size distribution of the core-shell microcapsules. Hence, in this work we intend to establish a standard process parameter to fabricate a core-shell microcapsules for cell spheroid formation with narrow size distributions.

A Magnesium-Enriched 3D Scaffold Enhances New Bone Development In Rat Critical-Sized Mandible Defect Model (poster)

*Govinda Bhattarai and Jeong-Chae Lee**

*Cluster for Craniofacial Development and Regeneration Research, Institute of Oral Bioscience and School of Dentistry, Jeollabuk National University, Jeonju 54896, Jeollabuk-do Republic of Korea**

Large craniofacial defects are frequently caused by accidental injury, oncological surgery and infection. Therapeutic treatments for patients with craniofacial defects are commonly accompanied by multiple invasive surgeries and bone graft over extended periods. Researchers have focused their efforts on the development of scaffold biomaterials that can enhance bone regeneration in reconstructive surgical treatments. Despite the widespread observations on the osteogenic effects of magnesium ion, its diverse roles during bone healing have not been systemically investigated. We explored whether magnesium enriched chitosan scaffold is an ideal approach for bone tissue engineering. We developed magnesium engrafted chitosan scaffold and investigated whether implanting this scaffold mediated bone formation using rat model of critically sized mandible defects. Implanting magnesium loaded chitosan scaffold greatly enhances bone regeneration at the defect via the activation osteogenic, angiogenic and Wnt related signaling pathway, compared with only chitosan. Treatment with magnesium ions increases proliferation and mineralization of cultures bone marrow stromal cells via activation of canonical Wnt signaling axis at a greater rate than control. Collectively, this study demonstrates that chitosan scaffold impregnated with magnesium enhances bone regeneration at therapeutic sites, and this enhancement is associated with magnesium mediated osteogenesis and angiogenesis responses

Nanoceria Infused Chitosan-PVA Hydrogels to Treat Burn Wounds

*Lucas Tavares, Ruchi Patil Borole, Minchan Shim, Vijay Mohakar, Anton Sorkin, Vladimir Reukov**

Department of Textiles, Merchandising, and Interiors, College of Family and Consumer Sciences, University of Georgia, Athens, GA, USA

Burn wounds are highly dangerous injuries with significant mortality rates. They are painful and increase the risk of bacterial infection. Burn wounds could also harm adjacent tissues by releasing dangerous compounds. Thus, their treatment should work quickly and effectively. Hydrogels are used as burn wound dressings that provide a suitable environment for regeneration. They closely imitate the structure of the skin's extracellular matrix and have high water uptake properties, providing a moist environment for faster healing. Chitosan-PVA based hydrogels demonstrated antibacterial and healing effects on wounds. Nanoparticles of cerium oxide called nanoceria were shown to reduce local oxidative stress by decomposing reactive oxygen species. The goal of this study is to learn the effects of nanoceria infused chitosan-PVA hydrogels on wound regeneration. We characterized hydrogels with various chitosan-PVA ratios, crosslinked with tetraethylorthosilicate. We found out that hydrogels with one-to-one ratio of the materials have the bests welling capabilities. These findings improved the procedure for making hydrogels capable of maintaining a moist environment for better wound healing. Further experiments demonstrated the biocompatibility and antibacterial properties of the hydrogels crosslinked with glutaraldehyde, where 3T3 fibroblasts seeded on the hydrogels were shown to be viable and zone of inhibition tests performed with E. coli demonstrated the antibacterial capacity of the hydrogels. Future studies will determine the antioxidant capacity and further bioactive properties ofthe nanoceria infused hydrogel. Once the small-scale procedure is well established the proposed methods could be implemented in clinical applications to aid in burn wound recovery.

Three-Dimensional Nanofiber Scaffolds For *In Vivo* Beta Cell Transplantation For the Treatment of Diabetes Mellitus

Orsu Prabhakar and Arun Koyyada

GITAM School of Pharmacy, GITAM Deemed to be University, Visakhapatnam, India-530045

Islet transplantation has been demonstrated as a successful alternative in the treatment of diabetes. However, islets infused at several sites showed meagre survivability and time-dependent cell activity loss. We employed a porous, polymer nanofiber scaffold potentiated with reduced graphene oxide as a three-dimensional platform for beta cell transplantation. The porous architecture improves cell infiltrations and aid in the neovascularization of beta cells. The scaffolds seeded with RIN-5F (rat insulinoma) cells were transplanted in diabetic rats at epididymal fat pads. The implanted scaffold rendered normoglycemia (blood glucose < 200 mg/dl) in rats within six days compared to direct RIN-5F cells transplanted groups. The histology of the newly developed graft in the scaffold group demonstrated neovascularisation and fibrinogen and collagen production. It was supported by the RT-PCR report, which showed upregulation of Nkx 6.1 (transcription factor) and VEGFa gene expression (vascular endothelial growth factor). Therefore, this polymer scaffold could act as a potential platform for *in vivo* transplantation of beta cells in treating diabetes.

Session IB: Nanomedicine /Cancer Chemotherapeutics

Elucidating The Role of PIN1 Interacting Proteins, SUPT5H in the Tumorigenicity of Breast Cancer

Bilal Lone Ahmad and Yuba Raj Pokharel

Cancer Biology Laboratory, Faculty of Life Science and Biotechnology Laboratory, South Asian University, New Delhi India-

Abnormal activation of Kinases is a well-known process that occurs in a wider range of cancers. The phosphorylation of Serine/Threonine (Ser/Thr) preceding by Proline (Pro) is a frequent modification in most of the signaling pathways. The pSer/Thr-Pro motif in a protein adopts two completely distinct cis or trans conformations, a process catalyzed specifically by prolyl isomerase PIN1 and determines the fate of proline-directed phosphoproteins in multiple pathways. PIN1 is an oncoprotein that is commonly overexpressed and/or overactivated in most human cancers and is associated with the distortions of the wider signaling network to fuel cancer progression. Abnormal PIN1 activation disrupts the balance in cancer to activate at least 40 oncogenes and inactivate at least 20 tumor suppressors. A study from our laboratory filters the top ten PIN1 interacting proteins with similar functions to PIN1. Out of the top ten PIN1 interacting, this study aimed to elucidate the role of SUPT5H in the tumorigenicity of breast cancer. We found that PIN1 specifically interacts with SUPT5H through the WW domain, and this interaction maintains the abundance and provides stability to SUPT5H. We further observed the elevated expression of SUPT5H in breast cancer tissues compared to adjacent normal tissues. Besides, we also demonstrated the role and molecular mechanism of SUPT5H in the tumorigenicity of breast cancer and how SUPT5H contributes to breast cancer cell proliferation, migration, invasion, cell cycle, apoptosis, and stemness, and revealed the oncogenic function of SUPT5H.

Optimizing Extracellular Vesicle Isolation and Re-Engineering as A Drug Delivery System

*Santosh Aryal[*1], Sagar Rayamajhi[2], Tuyen Nguyen[2], Shoukath Sulthana[1]*

[1]Department of Pharmaceutical Sciences and Health Outcomes, The Ben and Maytee Fisch College of Pharmacy, The University of Texas at Tyler, TX, USA, [2]Department of Chemistry, Kansas State University, Manhattan, KS

Extracellular vesicles (EVs) have shown breakthrough promises in drug delivery, disease diagnosis, and therapy owing to their inherent characteristics acquired from parent cells. However, translation is challenged due to the innate heterogeneity caused by varied cellular environmental factors, limitations in isolation yield, and colloidal instability. Therefore, it is crucial to understand EV production and stability factors to ensure functional reproducibility. Toward these endeavors, this study aims to explore the role of nutrient and heat stress on EV production and its re-engineering possibilities with synthetic nanoparticles to improve colloidal stability. For this purpose, an optimized ultrafiltration-size exclusion chromatography-based technique was developed, which isolates small EVs ranging from 130 to 220 nm. The result shows higher EVs production in cancerous cells compared to noncancerous cells, which increases with environmental stress. Similarly, EVs were extracted from mouse macrophage (J774A.1) and were re-engineered with a synthetic liposome and anticancer doxorubicin using membrane fusion. Re-engineering process was confirmed by fluorescent resonance energy transfer (FRET), which showed a diminished FRET effect due to the fusion-induced distance between two FRET pairs. Re-engineered EVs showed indicted characteristic surface proteins such as CD63, TNF-α, CD9, TSG 101 etc., responsible for target recognition. This talk will discuss the tackling of chemistry and engineering challenges to develop an EV-based drug delivery system. The talk will be concluded with the properties and findings of re-engineered EVs, including therapy, safety, and superior contrast enhancement properties for imaging and therapy.

Acknowledgments: This work is supported by the National Institute of Biomedical Imaging and Bioengineering (NIBIB), National Institute of Health, under award number 1R15EB030815-01.

Biomimetic Targeted Theranostic Nanoparticles for Breast Cancer Treatment

Suphalak Khamruang Marshall[1], Pavimol Angsantikul[2], Zhiqing Pang[3], Norased Nasongkla[4], ***Soracha D. Thamphiwatana[1,4*]***

[1] *Institute of Biomedical Engineering, Faculty of Medicine, Prince of Songkla University, Songkhla 90110, Thailand*

[2] *Center for Biomedical Research, Population Council, 1230 York Ave, New York, NY 10065, USA*

[3] *Key Laboratory of Smart Drug Delivery, School of Pharmacy, Fudan University, Ministry of Education, Shanghai 201203, China,* [4] *Department of Biomedical Engineering, Faculty of Engineering, Mahidol University, Nakorn Pathom 73170, Thailand*

There has been considerable attention in developing biomimetic drug delivery system for biomedical applications. Employing cell membrane as a surface coating has shown to be a promising platform for several disease treatments. Cell-membrane coating nanoparticles exhibit enhanced immunocompatibility and prolonged circulation time. Herein, red blood cell (RBC) membrane cloaked nanoparticle with enhanced targeting functionality is designed for targeted nanotheranostic against cancer. Naturally derived human RBC membrane modified with targeting ligand is coated onto polymeric nanoparticles cores containing both chemotherapy and imaging agent. Using Epithelial cell adhesion molecule (EpCAM)-positive MCF-7 breast cancer cells as a disease model, nature-inspired Targeted Theranostic human Red Blood Cell membrane-coated polymeric Nanoparticles (TT-RBC-NPs) platform is not only capable of specifically binding to targeted cancer cells, effectively delivering doxorubicin (DOX) but also visualizing targeted cancer cells. The TT-RBC-NPs achieved an extended-release profile with the majority of the drug release occurring within 5 days. The TT-RBC-NPs enabled enhanced cytotoxic efficacy against EpCAM positive MCF-7 breast cancer over the non-targeted NPs. Additionally, fluorescence images of targeted cancer cells incubated with the TT-RBC-NPs visually indicated the increased cellular uptake of TT-RBC-NPs inside the breast cancer cells. Taken together, this TT-RBC-NP platform sets the foundation for the next-generation stealth theranostic platforms for systemic cargo delivery for treatment and diagnostic of cancer.

Presentation Type: Recorded video + zoom (question session)

Synthesis and Characterization of Polymeric Nanoparticles: Effect of Nanoparticle Density in Cellular Compatibility and Uptake

*Shoukath Sulthana[1], Prabhat Kattel[1,2], Jiri Trousil[1], David Pearson[1], Santosh Aryal[1]**

[1] *Department of Pharmaceutical Sciences and Health Outcomes, The University of Texas at Tyler, Tyler, TX, USA*

[2] *Department of Biology, College of Arts and Sciences, The University of Texas at Tyler, Tyler, TX, USA*

Biodegradable and biocompatible polymeric nanoparticles (NPs) stand out as a key tool for improving drug bioavailability, reducing inherent toxicity, and targeting the intended site. Most importantly, the ease of polymer synthesis and its derivatization to add functional properties makes them potentially ideal to fulfill the requirements for intended therapeutic applications. Among many polymers, US-FDA approved poly(l-lactic-co-glycolic) acid (PLGA) is widely used biocompatible and biodegradable co-polymers in drug delivery and in implantable biomaterials. While many studies have been conducted using PLGA NPs as a drug delivery system, less attention has been given to understanding the effect of NPs density in cellular behaviors such as uptake and toxicity induced due to the mass effect. Here we discuss the synthesis of PLGA NPs with varying NPs mass, and their colloidal and biological properties. Following nanoprecipitation, we have synthesized PLGA NPs sizes ranging from 60 to 100 nm by varying initial PLGA feed in the system. These NPs were found to be stable for a prolonged period in biological medium. We further studied cellular uptake and found these NPs are biocompatible, however, they are differentially uptaken by the diseased and immune cells, which are greatly influenced by NPs density. In this talk, we will discuss the kinetics, biocompatibility, and contrast enhancement properties of these NPs. Given the importance of PLGA-based NPs in drug delivery, we hope this study will help in the NPs roadmap to build rules in NPs design consideration for therapeutic applications.

Optimizing Nanoparticle-Based Drug Delivery to Prevent Cisplatin-Induced Ototoxicity

Rohith Arunachalam, Eunsoo Yoo

North Carolina A&T State University, Greensboro, NC, USA

Cisplatin is one of the first lines of chemotherapy drugs. Since it is well known that cisplatin induces DNA damage and reactive oxygen species (ROS) generation as the same pathway to kill cancer cells, also thiol functional groups (i.e. glutathione, GSH) can bind to cisplatin, and there is a great demand for thiol binding reaction with cisplatin to prevent the ototoxicity (hearing loss/damage). The inner ear is inaccessible with conventional systemic drug delivery due to strong physiological and anatomical barriers. There is a growing interest in treating inner ear disorders by nanoparticle drug-delivery systems to targeted sites and controlled release from the inner ear.

The ultimate objective of this project is to develop engineered/synthetic nanoparticles for drug delivery into the inner ear system to protect hair cells from drug-induced ototoxicity caused by cisplatin chemotherapy. In this study, we synthesized different types of liposomes with/without GSH. The nanoparticles were characterized by different techniques. In addition, a cell viability assay was tested in the HEI-OC1 cell line and cisplatin scavenging activity was performed to confirm the otoprotective effect.

Recent results showed low cisplatin scavenging efficiency. GSH can be oxidized to form oxidized glutathione (GSSG) which has a disulfide bond between two thiol functional groups of GSHs. GSHs will lose their thiol functional groups without thiol protection reaction. As a future endeavor, this nanoparticle system can be used for co-delivering GSHs and catalyzing enzymes as a combination system.

Experimental Analysis of Structural and Biological Damage in Bone in Conventional and Ultrasonically-assisted Drilling

Khurshid Alam[a], Yasasween Hewavidana[b], Mohamed Al-Kindi[c], Asim Qureshi[c], Badar Al-Sumri[d], Vadim Silberschmidt[b]

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Drilling of bone with a hard metallic drill is a common surgical procedure used in various contexts in orthopedics, neurosurgery, and dentistry. Structural and biological damage in the form of microcracks and delamination and death of cells in the immediate vicinity of the drilled holes are some of the negative outcomes associated with the drilling process. In addition, high levels of drilling force and torque as well as a temperature-rise above normal physiological levels are the inevitable outcomes of drilling in bone. Mechanical and thermal damage as result of drilling can hamper the engagement of metallic fixative components to the bone adjacent to the drilled hole, eventually causing failure of fixation. One of the drilling techniques in which microvibrations are imposed on the drill along the feed direction is known as vibrational drilling or ultrasonically assisted drilling. The aim of this study is to move closer to minimally invasive surgical procedures in bones by comparative analysis of structural and biological damage in the bone tissue using the prescribed drilling techniques. Ultrasonic drilling, in combination with medium drilling speed and drilling at shallow depth, was found to produce fewer cracks in the delicate structure of the bone, minimized delamination at the entrance and exit of the holes and resulted in minimum death of cells near the cut surfaces compared to conventional drilling. Ultrasonically assisted drilling, with an appropriately selected frequency and amplitude of vibration and other drilling parameters, could induce less damage in bone compared to conventional drilling. This study suggests the further research on establishing relationship between geometry and size of the drill bit and irreversible damage it can induce in delicate tissues of bone in surgical intervention using all possible parameters and conditions in real orthopedic surgical procedures.

Session 2A: Microfluidics

Vascularized Cortical Organoid Microphysiological System To Model Alzheimer's Disease

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Human induced pluripotent stem cell (hiPSC)-derived brain organoids can recapitulate the complex cytoarchitecture of the brain as well as the genetic and epigenetic footprint of human brain development. Although the brain organoids are able to mimic the structures and functions of brain *in vitro*, the 3D models have difficulty in integrating a complex vascular network that can provide the interaction with organoids. Here we report on a microfluidic-based three-dimensional, vascularized cortical organoid tissue construct consisting of 1) a perfused micro-vessel against an extracellular matrix (ECM), dynamic flow and membrane-free culture of the endothelial layer, 2) a sprouted vascular network using a combination of angiogenic factors, and 3) a vascularized hiPSC-derived cortical organoid. We report on an optimization of density/stiffness of ECM to induce angiogenic sprouting and effect of angiogenic factors to trigger robust, rapid, and directional angiogenesis for concentration-driven and repetitive sprout formation. Vascularized network in the microfluidic device was further characterized in terms of morphology, directional alignment under perfusion, lumen formation, and permeability. HiPSC-derived cortical organoid was generated, placed, and integrated into a vascularized network in the vascularized microfluidic device. We investigate how vascularized micro-vessels interact with cortical organoid. This paper further demonstrates the potential utility of a membrane-free vascularized cortical organoid in perfusion used to model Alzheimer's disease and for toxicity screening of nerve agents.

Thermal Micro-Fins Influence on Flow Structures for Inducing Local Shear Stresses on Adhered Cells

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Micropatterning of the substrate plays a crucial role in defining the cellular adhesiveness over the substrate. Patterning in the form of fins and pillars was found more pronouncing than micro wells while promoting cellular adhesion over these micro-structures. However, challenges associated with the promotion of cellular adherence are the surface treatment of these microstructures and at the same time, the systemic arrangement of these structures over the length of the substrate in culture media. In this paper, the above-mentioned challenge has been addressed by the thermo-fluidic coupling approach. A numerical model has been developed to induce heat transfer to the flowing media through the thickness of the substrate in the presence of different sets of micro-fins arrangement over the substrate. Heat profiling of the substrate along its axial length has been obtained to induce a differential magnitude of heat waves along the length of the substrate. Simultaneously, the heat transfer from the substrate to the working fluid helps in developing the heterogeneous distribution of the entropy of the fluidic molecules. The presence of micro-fins was found to promote such entropy, resulting in the development of local vortices of the fluid surrounding the fins of different circular radii, depending on the magnitude of heat transfer from the substrate to the fluid. Further, the localized oscillatory shear index (OSI) and the relative residual time (RRT) near the wall of the fins were evaluated. OSI value was found near 0.5, while the RRT magnitude was found higher for lower radii of vortices. Such phenomena promote

the differential shear stress distribution over the wall of the fins, which can be correlated with the heat flux distribution at the surface of the substrate. Such phenomena promote the regulated adherence of the cells over the substrate. The proposed method is advantageous and sensitive for cell distribution over the substrate. It can address the fabrication issue related to the wavy pattern of tissue arrangement inside annular structures like the trachea, blood vessel, and esophagus.

Effects of Mechanical Forces in The Development of Bioprinted Blood Vessels

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Blood vessels are an essential part of the human body because these vessels are responsible for flowing blood into the body, maintaining homeostasis, and providing nutrients to cells. Most of the previous studies deal with the systemic development of a 3D scaffold for the formulation of blood vessels, followed by seeding of cells on the scaffold, leaving it for culture in a controlled environment of a bioreactor. In addition, most studies used a perfusion bioreactor because of its mechanical advantages rather than a rotatory bioreactor. The present study involves the use of a 3D printer along with a rotatory bioreactor that mimics the angiogenesis process to fabricate serpentine blood vessel structure. The use of a rotatory bioreactor will provide an adequate amount of stress for the growth of human endothelial cells on the vessel walls. In the current study, physiological and sinusoidal flow were used to generate mechanical forces to mimic the blood flow circulation inside the blood vessel. Variation of pressure, velocity, stress, and the shear rate were influenced by the inlet and the outlet boundary conditions, as well as due to the viscosity of the acting fluid. Numerical analysis has been performed using COMSOL Multi-physics to obtain pressure, velocity, shear stress, and vorticity on these bioprinted vascular constructs as a function of various wall boundary and inlet velocity conditions. Experimental characterization of the bioprinted constructs provides information about the cellular viability when maintained in the bioreactor over an extended period of time.

Cell Co-Culture Microfluidics Platform with an Integrated Hydraulic Valve for Controlled Interaction of Brain Endothelial Cells and Astrocytes

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Lab-on-a-chip systems for real-time analysis of neural cell communication is an emerging topic of neuroscience research that can provide a better understanding of brain functionality. Astrocyte and HBEC-5i co-culture provide in vitro model of the blood-brain barrier. The successful employment of lab-on-a-chip cell co-culture devices in research settings requires fabricating materials that are not cytotoxic to the cells. Controlled and reversible separation of cell culture chambers is crucial for real-time studies of extracellular-mediated cell-to-cell communications. This study demonstrated a 3D printed cell co-culture microfluidic platform that can allow the cells that enable controlled separation of the chambers and provide the long-term viability of the cell lines. The platform consists of two 27.5 mm × 35 mm × 10 mm cell culture chambers separated by an Elastic Resin 3D printed hydraulic valve (10 mm × 35 mm × 9.5 mm). The actuation of the valve is controlled using hydraulic pressure exerted by the chamber positioned directly above the valve. The deflection of the valve barrier provides separation of the cell chambers and the individual microenvironments. Upon the release of the pressure, the valve returns to its original position and allows the exchange of signaling molecules between the cells. The lower glass channel wall of the microfluidic device was coated with gelatin and Poly-L-Lysine to provide cellular attachment for HBEC-5i cells and astrocytes. The polyelectrolyte immobilization efficacy was assessed via atomic force microscopy while the viability of the cell was assessed using fluorescent-based methods.

Numerical Analysis of Thrombosis in a Bifurcated Micro-Capillary Vessel Network

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Thrombosis is a major concern of vascular disorder, and most drug delivery-based mechanisms also face challenges in the identification of the region of transition at the onset of the thrombosis in the micro-capillaries. In the current study, numerical modeling has been performed to evaluate the flow physics of simulated blood (working fluid) near the thrombosis vicinity in the upstream and downstream regions of a bifurcated micro-capillary vessel. The area of thrombosis has been modeled in two-fold: first, stenoses of 20% to 50% have been induced at the region of interest. Secondly, thrombosis has been modeled by the symmetric distribution of the micro-fins at the region of the stenoses. The blood flow was modeled using non-Newtonian Power Law characteristics because of the enhanced role of hematocrit in a capillary with thrombosis. The local shear stress distribution near the wall at upstream and downstream, and the region of stenoses were evaluated. Further, the oscillatory shear index (OSI) and relative residual time (RRT) were also derived from the time-averaged wall shear stress parameter. The flowing blood was further modulated with a sinusoidal carrier pressure wave to amplify the value of OSI and RRT at the region of transition. It was observed that the

incorporation of carrier pressure waves enhances the capability of the models to identify the transition from a non-thrombus to a thrombosis region by increasing the magnitude of OSI and RRT. Such a simple yet effective model can be implemented to simulate the actuation of drug-loaded nanocarriers for drug release at the onset of the thrombosis in micro-capillary.

A Novel Hybrid Integrated Tumor-Immune-Microenvironment-On-Chiprecapitulates Cxcr2 Mediated Distinct Neutrophil Behavior In Brain metastatic Breast Cancers

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The Tumor Immune Microenvironment (TIME), dictated by the microscale interactions between tumor cells and the host immune system is a key determinant of the tumor fate. In order to study in-vitro the micro physiological dynamics within TIME, there exists a need to develop a cell culture platform that can accurately recapitulate the host tumor interactions. In this work, we engineered a novel, 3D bioprinting enabled three-dimensional TIME-on-Chip with integrated microfluidics, by applying the principles of tissue engineering, additive manufacturing, and hybrid integration to microfabrication. To achieve this, we generated 3D tumoroids in polyacrylamide microwells embedded within a collagenous stroma, and magnetically hybridized this setup with microfluidic channels fabricated on a porous membrane. Our on-demand hybrid integration method allows for easy disassembly and reassembly of the components for conducting post-assay analyses and furthermore, our device setup can also be accommodated to any existing analytical or imaging tools. Using this device, we successfully demonstratedCXCR2 mediated neutrophil behavior within a brain metastatic breast cancer microenvironment, through chemotaxis and Neutrophil Extracellular Traps (NETs) formation. The reciprocal tumor responses and their drug-induced suppression confirm the applicability of our device for complex biomimetic tumor research such as tumor-neutrophil interactional investigations, and immune-therapeutic drug testing.

Session 2 B: Neuroscience

Intranasal insulin reduces brain inflammation and improves neurobehavioral performance following lipopolysaccharide exposure in neonatal rats

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Inflammation and oxidative stress play important roles in neonatal brain damage. Previous studies from our lab showed that systemic administration of lipopolysaccharide (LPS) induces brain damage and neurobehavioral dysfunction in neonatal rats, which is associated with the production of pro-inflammatory cytokines and oxidative stress. Recent studies suggest that intranasal insulin treatment could be a neuroprotective agent in adult animals. Therefore, the objective of this study was to determine whether intranasal insulin treatment reduces LPS-induced brain inflammation and oxidative stress, as well as neurobehavioral dysfunction in neonatal rats. LPS (2 mg/kg) or sterile saline was administered via intraperitoneal (i.p.) injection in postnatal day 5 (P5) Sprague Dawley rat pups, and recombinant human insulin (25 μg) or vehicle was administered to each nostril 5 min after LPS injection. Sensorimotor behavioral tests were carried out 24 hours (P6) after LPS exposure and brain tissues were collected to determine pro-inflammatory cytokine interleukin-1β (IL-1β) and lipid peroxidation. Our results showed that intranasal insulin reduced LPS-induced sensorimotor disturbances, as indicated by improvement in righting reflex, negative geotaxis, wire hanging maneuver, and hind limb suspension tests at P6. Intranasal insulin also reduced LPS-induced increase in levels of IL-1β and thiobarbituric acid reactive substances (TBARS) contents, suggesting anti-inflammatory and anti-oxidative effects. Our study suggests that intranasal insulin affords a broad neuroprotection by targeting multiple signaling pathways including inflammation and oxidative stress.

Thymoquinone as a Potential Preventive Therapeutic Agent to Reduce Prevent Oxidation of Amyloid Beta and Tau in Human Neuroblastoma Cells

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Alzheimer's disease (AD) is the only cause of death among the top 10 diseases that cannot be prevented, cured, or slowed with the current treatments available. Amyloid beta is thought to be the main initiator of AD cognitive decline, activating internal pathways which lead to inflammation, oxidation, and cell death. The objective of this study was to determine if pretreatment of human SH-SY5Y neuroblastoma cells, a model for AD, with antioxidants thymoquinone (TQ) 30 minutes prior to a challenge with lipopolysaccharide (LPS), an inflammatory mediator, can prevent oxidation of amyloid beta (Aβ) and Tau. Following treatment, cells were incubated and groups evaluated at 24, 48, and 72 hours. Human amyloid precursor protein (APP) enzyme-linked immune-sorbent assay (ELISA) and nitric

oxide assays were performed from supernatant whereas protein and glutathione assays were performed from cells. When LPS was added to cells, Aβ significantly increased 3-fold compared to untreated cells. The addition of TQ, reduced Aβ back toward control value at the initial time point. LPS also caused a significant increase in nitric oxide without changes in glutathione. TQ administered to the cells prior to a challenge with LPS resulted in a decrease in nitric oxide and an increase in glutathione which may be a possible mechanism to reduce inflammation and reduce oxidation. Signaling pathways implemented in the SH-SY5Y cells following LPS will be discussed.

Impaired Development of Neuronal Components in a Rat Model of White Matter Injury

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White matter injury (WMI), a leading cause of neurodevelopmental problems in preterm infants, is characterized by predominant injury to oligodendrocyte (OL) progenitor cells and impaired myelination of the brain white matter, while the gray matter is relatively spared. Emerging evidence suggests that subtle injury or developmental compromise of neuronal components (neurons, axons, and synapses) also contribute to functional impairments. The aim of this study is to test the hypothesis that neuroinflammation in neonatal rats (equivalent to preterm infants) is sufficient to induce injury or developmental impairments in neuronal components. Neuroinflammation was induced in postnatal (P) day 5 rats by intracerebral injection of lipopolysaccharide (LPS). Our data revealed that, in addition to developmental impairments in OLs (reduced immature OLs and impaired myelination), neuroinflammation also led to acute axonal damage (positive immunostaining of beta-amyloid precursor protein), a significant decrease of immature neuron marker doublecortin (DCX), and reduced dendritic marker microtubule-associated protein 2 (MAP2), 2 days following LPS injection. At P21, the expression of postsynaptic density protein 95 (PSD95) was significantly lower in LPS-treated rats, while the level of DCX was unchanged. These pathological changes were associated with neurological dysfunctions assessed by a battery of neurobehavioral tests. In conclusion, our study suggests that developmental disturbance in neuronal components contribute to functional deficits in preterm infants with WMI.

Machine Learning-Based Analysis of Chronic Inflammation Involvement in a Rat Model Of Sleep Disorders

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Inflammation may play an important role in the association between sleep disorders and Parkinson's disease (PD) development. The objective of the current study was to examine whether perinatal lipopolysaccharide (LPS) exposure results in chronic inflammation, neurodegeneration, and related sleep disorders later in life. Intraperitoneal injections of LPS (2 mg/kg) or saline were administered on postnatal day 5 (P5) Sprague-Dawley male rat pups, and surgery/sleep recording electrode implantation was conducted on P39. Baseline sleep recording, sleep disturbances, and recovery sleep were recorded on P46, P47 and P48 for 24 hours, respectively. Brain inflammation and neuronal damage were examined at P49. Our results showed that neonatal LPS treatment interfered with REM sleep and sleep homeostatic responses (recovery sleep) to sleep disruption in adolescent rats (P49). Machine learning-based analysis of these sleep data has identified relative theta and spindle power as important features associated with chronic inflammation and sleep disruption in the present experimental model of sleep disorders. Neonatal LPS treatment also induced chronic microglia activation and brain damage including the loss of TH+ neurons in the locus coeruleus of the P49 rat brain. These data suggest that neuroinflammation initiated at neonatal life persists into adolescent ages, which may contribute to neurodegeneration and sleep disorders by disrupting sleep homeostatic responses, namely, recovery sleep. Our results underscore the importance of machine learning-based analysis to study biological mechanisms underlying sleep disorders involving neuronal injury induced by infection/inflammation. In addition, these results could help in developing new treatments for sleep disorders associated with PD.

Neonatal Interleukin-1β Exposure Exacerbates Adult Susceptibility to Pesticide Rotenone-Induced Nigrostriatal Dopaminergic Disorder

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Early life brain inflammation has been proposed to play important roles in the development of neurodegenerative disorders in adult life. Our previous studies showed that interleukin-1β (IL-1β), a proinflammatory cytokine, plays an important role in mediating dopaminergic neuronal injury in the neonatal rat brain. To examine whether neonatal IL-1β exposure enhances dopaminergic neuron susceptibility to rotenone neurotoxicity at adult ages, Sprague-Dawley male rats at postnatal day 5 (P5) were pre-treated with IL-1β (1 μg/kg) via intracerebral injection, and then challenged with rotenone through subcutaneous mini-pump infusion (1.25 mg/kg per day for 14 days) at P70. A single IL-1β exposure resulted in motor function deficits during the developmental period but were spontaneously recoverable by P70. Single IL-1β exposure also suppressed tyrosine hydroxylase (TH) expression in the substantia nigra (SN) at P70. A low dose of rotenone treatment resulted in Parkinsonism-like symptoms including bradykinesia, akinesia and rigidity in rats with neonatal exposure to IL-1β, but not in those without the neonatal IL-1β exposure. Neonatal IL-1β exposure also enhanced adult susceptibility to rotenone-induced loss of dopaminergic neurons as indicated by reduced numbers of TH+ cells and Fluoro-Gold (FG)+ nigrostriatal projecting neurons in the SN of P98 rats. These results suggest that perinatal neuroinflammation may enhance adult susceptibility to develop neurodegenerative disorders triggered by environmental toxins at an ordinarily non-toxic or sub-toxic dose. Our model may be useful for studying mechanisms involved in the pathogenesis of nonfamilial Parkinson's disease.

Raman Spectroscopic Imaging of Amyloid Plaques in Alzheimer's Disease

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Alzheimer's disease (AD) is the seventh leading cause of death in United States adults with cost of care estimated to be three-hundred billion dollars. As the US population ages, this figure is estimated to surpass one trillion dollars. Amyloid plaques are a pathological hallmark of AD and are believed to play a critical role in disease onset and progression. However, the structure of the amyloid protein in plaques, and their specific role in AD pathogenesis is still not well understood. Raman microscopy is a useful analytical technique for investigating tissue chemistry in AD brain specimens and allows for investigation of protein structures and associated chemical moieties in amyloid plaques. The aim of this work is to identify Raman spectral markers within amyloid plaques in formalin-fixed paraffin-embedded (FFPE) diseased brain tissues. Using optical images obtained from an optical microscope, immunohistochemically stained tissue sections are analyzed to identify plaque location. Selected plaques are then mapped using a Raman microscope. Using the spectral data collected, the unique chemical composition of plaques can be identified, offering key molecular insights about AD. Raman maps revealing the association of carotenoids with amyloid aggregates will be presented, along with spectral variations within plaques of different pathological subtypes.

Evaluation of FADU Nasopharyngeal Carcinoma Cells after Repeated Daily Dosages of Epigallocatechin-3-Gallate, Thymoquinone, and 5 – Fluorouracil

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Cells treated by repeated continuous delivery methods rather than a single dose method destroy cells over a shorter period of time than conventional delivery. The FaDu squamous cell carcinoma cell line was used to test repeated doses of natural (EgCg and TQ) drugs and a chemotherapeutic (5-FU) drug to determine if repeated doses would be more effective at destroying cancer cells than a single bolus dose. Cells were treated repeatedly with IC_{50} concentrations of EgCg, TQ, and 5-FU at 24, 48, and 72 hours. Sustained levels of cellular reduction were noted at 72 hours. At 72 hours, cells treated with three doses of EgCg had a 24% reduction while cells treated with TQ three times had a reduction of 23% at 72 hours. A third treatment with 5-FU resulted in a 35% reduction at 72 hours. The measure of cellular damage and cellular toxicity measured by lactate dehydrogenase (LDH) at 72 hours were significant. EgCg had a 72% increase from control value with TQ and 5-FU having a 76% and 89% increase, respectively. At 72 hours, EgCg and TQ amount of cellular reduction was higher with repeated daily dosing versus a single dose. Repeated delivery of 5-FU was comparable to a conventional single treatment. Egcg and TQ proved they are effective in cellular reduction, increasing cellular damage, and disrupting cellular function.

Modeling Within Group Differences in Biomarkers of Oxidative Stress and Insulin Synthesis of PANC-1 Cells Exposed to Increasing Glucose Concentrations

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The incidence of diabetes has continued to rise among the US population and can have devastating effects on patients if poorly controlled. Ongoing efforts are being made to better treat diabetes. Previous experiments from our lab provided proof that PANC-1 cells can be manipulated to produce insulin by increasing the amount of glucose in culture medium. This study aimed to provide additional information regarding the function of PANC-1 cells by evaluating cell counts, insulin secretion, glutathione, and malondialdehyde (MDA) production in response to increasing glucose challenge within the control, 1%, 2.5%, and 5% extra glucose groups at 24-, 48-, and 72-hours. Initially, cells were grown in flasks with a control medium and then split into four separate groups containing control media or media containing an extra 1%, 2.5%, or 5% extra glucose. Cells from the three cultures were plated (1 x 10^5 cells/well) and treated with control, 1%, 2.5%, or 5% glucose for 24-, 48-, and 72-hours. Cells and supernatants were harvested, and cell counts, insulin secretion, glutathione, and MDA production were compared across all three phases within groups. Data were analyzed using parametric statistics to compare changes within all four groups using the ANOVA statistic and Bonferroni post-hoc testing (α=0.05). There were statistically significant differences within groups at 24-, 48-, and 72-hours ($p<0.05$). Although cell numbers declined over the 72-hour study period, insulin production increased with rising glucose media ($p<0.05$). As insulin secretion increased over time, both MDA and glutathione levels also rose ($p<0.05$). As cell counts decreased with rising glucose media, MDA levels rose showing an increase in free radical formation and oxidative stress. Glutathione levels also increased as MDA increased to counteract increased oxidative degradation on PANC-1 cells. This study contributes valuable quantitative data regarding cell count and biomarker secretion of PANC-1 cells over 72-hours with increasing glucose challenge**.** It further demonstrates that PANC-1 cells adapt to increasing glucose concentrations by increasing insulin production and increasing glutathione production to counteract MDA production despite decreased cell counts. PANC-1 cells continue to show proof of concept as possibly being a useful component of drug delivery systems for the treatment of diabetes.

Session 3A: Transplantation, Tissue regeneration, Challenges and Policies in the era of Precision Medicine

Organ Donation and Recovery

KellyRanum, CEO

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Organ procurement organizations (OPO's) are charged with all aspects of the donation process. Organ donation requires donor hospitals, organ procurement organizations and transplant centers to work together to ensure donation and transplantation happen. Changes in allocation and regulation offer new challenges to the system, but also offer opportunities for greater growth. New donor management protocols and machine preservation are making it possible for more organs to be recovered and transplanted. Donor registries both locally and nationally are aiding OPO's in identifying first person authorizations. Tracking systems are being placed on organs to ensure the organ arrives at its destination.

New ways of approaching donation enhancement lead the OPO's now opening donor care centers over the last several years. The ability to manage donors in a donor care unit and freeing up beds in hospital ICU's is helping to increase the number of organs recovered per donor. Additionally, these donor care centers can schedule OR's any time of the day or night. Hospitals no longer need to bring in on call teams or bump cases in order for the donor recovery to occur. The donation process is evolving and advancing innovation in order to increase the number of lives saved through transplant.

Transplant Infectious Diseases

Larry McDaniel

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In the era of precision medicine, human transplantation has evolved to improved outcomes for transplant recipients. The prevention, diagnosis, and management of infectious diseases in human transplantation are major contributors to improved outcomes. The risk of serious infections in recipients is determined by exposures and the patient's immune status. Specific microbiologic diagnoses are necessary to optimize therapy. Considerations must include infectious exposures, immunosuppressive drugs, and antimicrobial prophylaxis. A wide spectrum of potential pathogens can infect immunocompromised hosts. Many of these are infrequent pathogens in normal individuals. Application of multi-omics approaches, including shotgun metagenomics and metabolomics, has served for identification of phenotypes of both the microbiota and the host. Host innate immunity is the first line of defense to recognize and react to pathogens. Immune cells such as macrophages, dendritic cells (DCs), neutrophils and monocytes, as well as non-classical lymphoid cells such as innate lymphoid cells, mucosal-associated invariant T (MAIT) cells, natural killer (NK), are considered to have a protective role against pathogens. Application of quantitative molecular microbial assays and advanced antimicrobial therapies have advanced patient care. Pathogen-specific immunity and dynamic interactions between the recipient's microbiome are being investigated. The role of infection in the stimulation of the recipient's response to the graft is being explored. Major hurdles include the shifting epidemiology of infections, increasing antimicrobial resistance, and

suboptimal assays for the microbiologic screening of donors. The impact of infectious diseases remains a key to the clinical outcome and scientific investigation of human transplantation.

Polymeric Nanomaterials for Precision Medicine and Tissue Regeneration

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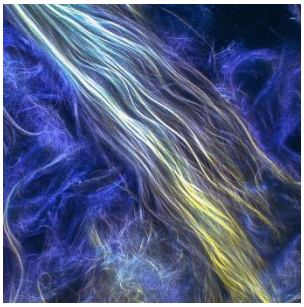

Reversible hierarchical self-assembly of molecules, have been harnessed by living systems to control the formation of structures such as protein assemblies, cellular membranes, cytoskeletal filaments along with many others. By controlling multiple orthogonal interactions between molecules, we can design supramolecular polymeric systems that mimic these reversible hierarchical processes. A key advantage of supramolecular polymers is the capability for monomers to undergo dynamic exchange among the polymer assemblies, which if harnessed, can lead to interesting material properties. In my presentation today, I will provide an introduction into peptide amphiphile based supramolecular polymers as an exciting platform for biomaterial development, and provide examples of the utilization of these systems in precision nanomedicine and tissue regeneration applications.

Engineering the immune system not to reject

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Introduction: Organ transplantation is a major therapeutic approach in end stage disease with organ dysfunction. Mechanical devices to replace or for restoration of organ structure/function remain a challenge because many biological functions cannot be replicated. The immune system plays a central role in the recovery process including restoration of organ function after allograft transplantation. Organ or tissue chip development following tissue engineering through reprogramming of immune system criteria has been proposed as the next-generation of regenerative medicine and transplantation.

Methods: Current approaches in regenerative medicine includes cell-based therapeutics; combination of cells and scaffolds to stimulate tissue repair *in vivo* and building of tissues *ex vivo* for implantation. Training stimulatory pathways of immunity that induce macrophage polarization, antigen presentation, T cell activation and cytokine production are included.

Results: Previously, we have shown that human recipients can tolerate their transplanted organ when infusing the donor bone-marrow cells, prior to the kidney transplantation. This is known the induction of tolerance through mixed chimerism. However, this approach required a specialized conditioning regimen to allow allograft survival with less or minimized immunosuppressant. Furthermore, during organ procurement (recovery) stimulatory signals released in the donor organ due to ischemia-reperfusion injury, encounter trained macrophages to secrete pro-inflammatory cytokines leading to allograft rejection. We reported the AIF-1-TLR2 interactions favor the induction of tolerance, under blockade with anti-AIF-1, through the secretion of IL-10 by graft-infiltrating macrophages.

Conclusions: Advances in immune modulation through reprogramming of immune system arranges the foundation to train the immunity in organ transplantation not to reject through epigenetic modification of the immune microenvironment.

Osteoarthritis Management With Stem Cell Therapy

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Osteoarthritis is a type of degenerative joint disease that primarily targets the joint tissues

in hands, knees, and hips. The progression of this disease leads to inflammation of the joint, pain, stiffness, decrease in bone density and mobility resulting in changing of the shape of bones. In fact, there is no true cure for osteoarthritis, but there are many ways to help manage symptoms and decrease the level of discomfort and pain. In arthritis, inflammation affecting the joints which is the most common symptom of pain that usually worsens with aging. To overcome the limitations of knee osteoarthritis, stem-cell-based therapy is being utilized to recover the knee from the pain and regenerate the cartilage from its recent damaged state. The objective of this study is to effectively manage osteoarthritis by Human Mesenchymal Stem Cell (hMSC) delivery to bone cartilage. In our study, we examined pain associated behavior test in papain induced osteoarthritis rat through mechanical and thermal allodynia tests. Mechanical allodynia was carried out by up and down method by the application of von Frey filaments of varying forces from 7.5g to 11g. The thermal allodynia test was measured by Hot plate nociceptive response. Paw withdrawal, licking, and shaking were considered as positive responses. Our research demonstrates that stem cell therapy could be a promising treatment in terms of combating tissue regeneration of rat knees to improve the pain state in the target area.

Possible Systemic Benefits of the Repair of Skin Tears in Older Patients in the Dermatology Clinic Setting

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Background and Significance: Elderly patients may need emergency department (ED) visits even after skin tears, resulting in high healthcare bills and discontinuity of care. The following quality engineering-focused proof of concept model reflects the opportunity for direct process improvement in the treatment of skin tears and its systemic impacts. **Design**: The wound (Figure 1) is anesthetized (Figure 2).The edges are unfurled and realigned(Figures3-5). Edges are sutured with 5-0 or 6-0 Ethilon (Figure 6).Follow-up occurs in 7-14 days. **Results:** These steps approximate the skin for optimal healing. This was performed in an office setting bya dermatologic surgeon without markedly increasing the patient load. No adverse events occurred. **Discussion & Conclusion:** Factors involved in fragile skin include aging; patients with instability are at increased risk of falling and injuries. The thinning of the epidermis with age is likely the greatest factor in the increased vulnerability of skin to traumatic injury and decreased resistance to shearing forces[1].To promote continuity of care and increase patients' investment in their treatment, dermatologists can treat these wounds in an office setting. This alleviates barriers to care including the avoidance of crowded EDs(especially due to COVID-19) and lack of familiarity with ED physicians. Increasing awareness of this treatment option can alleviate these concerns. In conclusion, treatment of skin tears by the dermatologists a viable option to reduce ED burden and provide patients with outpatient treatment and close follow-up.

References

Farage MA, Miller KW, Elsner P, Maibach HI. Characteristics of the Aging Skin. Adv WoundCare (New Rochelle). 2013 Feb;2(1):5-10. doi: 10.1089/wound.2011.0356. PMID: 24527317;PMCID: PMC384054

Prioritizing Complex Disease Genes From Public Databases

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Complex human diseases are defined not only by sophisticated patterns of genetic variants/mutations but also by many genes, RNAs, proteins, and other biomolecules functionally affected downstream. Therefore, integrating multiple modalities of functional genomic data is a critical translational research topic. This work reports the combined use of two bioinformatics databases, PAGER[1-3] and BEERE[4], to compile and prioritize disease genes that offer new disease biology insights. PAGER 3.0 contains 44,313 gene sets called PAGs and 3,174,323 PAG-to-PAG relationships, outperforming other gene set databases such as MSigDB by coverage of PAGs and PAG-to-PAG relationships. BEERE can perform network-based gene ranking of an input list of disease-related terms or genes, enabling the retrieval of the most relevant disease genes from many candidate genes with unknown relevance to the disease.

In a case study, we demonstrated a new approach for conveniently generating disease gene lists with the integrative use of PAGER and BEERE, using glioblastoma (GBM). From PAGER, we retrieved 153 GBM-related gene sets containing 49,866 redundant genes. Next, we calculated a heuristic score to filter the list down to 663 non-redundant genes by accounting for each gene's RP score and its PAG coverage for GBM. Furthermore, we ranked these genes using BEERE's function to construct a GBM candidate gene network linked by 12,787 protein interactions. Top-ranking genes and the term glioblastoma were further used in BEERE to build a literature citation network. Our result showed that 8 of the top 10-ranked genes are highly significant in literature.

Reference:

1. Yue, Z., et al., *PAGER: constructing PAGs and new PAG-PAG relationships for network biology.* Bioinformatics, 2015. 31(12): p. i250-7.
2. Yue, Z., et al., *PAGER Web APP: An Interactive, Online Gene Set and Network Interpretation Tool for Functional Genomics.* Frontiers in Genetics, 2022. 13.
3. Yue, Z., et al., *PAGER 2.0: an update to the pathway, annotated-list and gene-signature electronic repository for Human Network Biology.* Nucleic Acids Res, 2018. 46(D1): p. D668-D676.
4. Yue, Z., et al., *BEERE: a web server for biomedical entity expansion, ranking and explorations.* Nucleic Acids Res, 2019. 47(W1): p. W578-W586.

Session 3B: Education & Training

Teaching Educators Science Techniques (TEST): A New Paradigm For Enhanced Biomedical Awareness

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This project was focused on making students aware of biomedical opportunities by offering training to K12 teachers in modern techniques used in biomedical field. The goals of the project were to: train teachers in modern techniques used in biology and chemistry; make them well aware of the computer applications in the biomedical field; stimulate their interest and increase the motivational levels of teachers and students in biomedical area; provide academic support designed to enhance the academic achievement of students. A four week workshops were conducted or three years in the summer for twenty or more teachers consisting of in-service teachers in grades' six through twelve in the surrounding school districts of Alcorn State University; Natchez/Adams, Brookhaven, Claiborne, Hazlehurst, Jefferson, Vicksburg, Warren Central, and Wilkinson Schools. Field trips to the NASA Stennis Space Center, Gulf Coast Research Laboratory, USDA ARS laboratories at Starkville and, Natural Science Museum have provided opportunities for the participants to observe different educational environments and learn biomedical techniques with hands on experience.

The quality of this program enhanced teachers' ability to become trained in modern biology techniques, better prepare students and motivate them to pursue biomedical related research in their higher studies.

Enhancement of a BME Undergraduate Program with Clinical Innovation

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To improve the biomedical engineering (BME) undergraduate program at UAB, three specific opportunities for strategic enhancement were identified: i) a need to create a cohesive experience for BME underclassmen, as student exposure to BME was limited in the first two years; ii) a large gap between the early design courses and the senior capstone; iii) a need for higher level engineering design activities in the capstone experience. As a result, we are modifying our curriculum to include a new freshman course, Introduction to Clinical Innovation & Design Thinking**,** emphasizing needs finding and development of solutions to unsolved clinical problems through clinical exposure and classroom instruction. Each year, rising BME juniors will embark on a summer clinical immersion in which they will perform customer discovery surrounding medical/assistive devices, develop preliminary designs and business plans. Lastly, the Senior Capstone Experience will be enhanced by inclusion of projects mined in the summer immersion, new lectures in best practices in engineering design, and new online business modules that improve student learning outcomes and increase the potential for patentable designs. This initiative will catalyze the mindset toward discovery, innovation, design, and commercialization early in the curriculum within the framework of medical devices, procedures, and processes.

AcceleRaTe Equitable MIcrobial Surveillance (ARTEMIS): SARS-CoV-2 genome sequencing in the Southern US

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Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is a highly infectious respiratory virus that emerged in late 2019 and is the cause of the ongoing COVID-19 pandemic. Mutations that occur spontaneously over time coupled with uncontrolled global transmission have led to the evolution of more infectious 'variants of concern,' such as Delta and Omicron. Monitoring these genetic changes through viral genome sequencing can aid the public health response by identifying transmission chains and infection clusters, assessing the effectiveness of mitigation measures, while also providing key data necessary to ensure that diagnostics, vaccines, and therapies are up to date. Unfortunately, rural and less affluent communities in the US have been underrepresented in the viral genomic surveillance data. The uneven distribution of viral genome sequencing efforts has led to poor coverage of virus activity in thousands of communities, preventing prompt detection of new variants.

Our aims were to increase representativeness in SARS-CoV-2 genomic surveillance during the current pandemic, and to strengthen regional capacity for microbial genomic surveillance in preparation for future outbreaks. To achieve these aims, we worked closely with campus and community clinics in Louisiana and formed partnerships with academic institutions in Georgia and Mississippi to obtain clinical specimens from consenting patients for sequencing. The specimens were sequenced using high-throughput Illumina or rapid Nanopore platforms and the viral whole genome sequence data were shared through the GISAID initiative. Here, we report on the development and progress of project ARTEMIS, our effort to AcceleRaTe Equitable MIcrobial Surveillance in the southern US.

Teaching CUREs in the Midst of a Pandemic

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The Jackson State University Course-Based Undergraduate Research Experience (JSU-CURE) is a program designed to enhance the undergraduate STEM education offerings in the JSU Department of Biology, and in turn, better equip and prepare our underrepresented students for entrance into STEM-related professional careers. The purpose of this poster is to share ways by which the JSU-CURE mission was accomplished during the recent period when there were limited face-to-face interactions due to the COVID-19 restrictions. Our aim was to teach basic research skills in a safe, interesting, and course-based manner via remote virtual methods. The research activities employed included: 1) Locating, reading, and citing reliable resources, 2) Making observations, and producing a written scientific report complete with Purpose, Objectives, Materials and Methods, Results, Discussion, and Reference sections, and 3) Designing, performing, and writing a scientific report describing the experiment. Examples of the experiments conducted included: 1) Seed germination under various environmental conditions, 2) Plant propagation under various environmental conditions, and 3) Discussions of common objects such as flowers, fruits, or leaves, which required

observations, research, annotated photos, and scientific reports. The ultimate goal of the JSU-CURE Program is to transform traditionally taught lectures and labs into courses that actively engage students in authentic scientific inquiry through inquiry-based instruction. The project will also enhance undergraduate academic performances by: developing research skill-sets, stimulating interests in discovering and understanding the intricacies within the biological sciences, and preparing them for entry into graduate studies and/or STEM workforce.

Stressors & Mental Health Among College Students on HBCU Campuses

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Introduction: As of 2019,the Annual Report of the Center for Collegiate Mental Health [2] reported that anxiety continues as the most common problem among students who completed the Counseling Center Assessment of Psychological Symptoms, with 67.7% of 82,685 respondents participating in the report. Clinicians also reported that anxiety continues to be the most common diagnosis of the students that seek services at on campus counseling centers. Mental illness can affect students' motivation, concentration, and social interactions, and college success [1]. The effects of the lockdown and stay-at-home orders has brought a negative impact on higher education. It has brought into focus the mental health of various affected populations and the many disparities facing them, as well as the need for more programming aimed to serve students at historically black universities. A recent review of virus outbreaks and pandemics documented stressors such as infection fears, frustration, boredom, inadequate supplies, inadequate information, financial loss, and stigma [5]. Much of the current literature on psychological impacts of COVID-19 has emerged from the earliest hot spots in China. Although several studies have assessed mental health issues during epidemics, most have focused on health workers, patients, children, the general population, and Predominantly White Institutions (PWIs) [6,7]. **Methods:** This literature review was developed using three previous surveys conducted on multiple institutions of higher education campuses; The Healthy Minds Network Study (HMS), National College Health Assessment (NCHA), and the United Negro College Funds (UNCF) 2021 survey on the Mental Health disparities among HBUCs and PBIs. **Results:** Results supports the need for more baseline data to in order to support the justification of funding more mental health services and resources on HBCU campuses, due to the lack of representation of HBCUs and PBIs in each study; as well as the very limited number of participates in the UNCF survey. **Conclusion:** The review supports a baseline need for future HBCU studies to support anticipated funding by way of applied grants, to better serve the mental illness disparities faced by the students on an HBUC & a PBI campus.

1. Unger K. Handbook on Supported Education: Providing Services for Students With Psychiatric Disabilities. Charleston, SC: BookSurge Publishing; 2007.
2. 2019 annual report. Center for Collegiate Mental Health. University Park, PA: Penn State University; 2020. URL: https://ccmh.memberclicks.net/assets/docs/2019-CCMH-Annual-Report_3.17.20.pdf [accessed 2020-05-11]
3. Son C, Hegde S, Smith A, Wang X, Sasangohar F Effects of COVID-19 on College Students' Mental Health in the United States: Interview Survey Study J Med Internet Res 2020;22(9):e21279 doi: 10.2196/21279PMID: 32805704PMCID: 7473764
4. Brooks SK, Webster RK, Smith LE, Woodland L, Wessely S, Greenberg N, et al. The psychological impact of quarantine and how to reduce it: rapid review of the evidence. Lancet 2020 Mar 14;395(10227):912-920 [FREE Full text] [CrossRef] [Medline]
5. Lai J, Ma S, Wang Y, Cai Z, Hu J, Wei N, et al. Factors associated with mental health outcomes among health care workers exposed to coronavirus disease 2019. JAMA Netw Open 2020 Mar 02;3(3):e203976 [FREE Full text] [CrossRef] [Medline]
6. Xie X, Xue Q, Zhou Y, Zhu K, Liu Q, Zhang J, et al. Mental health status among children in home confinement during the coronavirus disease 2019 outbreak in Hubei Province, China. JAMA Pediatr 2020 Apr 24:e201619 [FREE Full text] [CrossRef] [Medline]
7. Kirzinger A, Kearney A, Hamel L, Brodie M. KFF health tracking poll - early April 2020: the impact Of coronavirus on life In America. Kaiser Family Foundation. 2020 Apr

   URL: https://www.kff.org/health-reform/report/kff-health-tracking-poll-early-april-2020/

Prediction of community transmission level of Covid-19 using machine learning algorithms based on CDC Social Vulnerability Index

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Response to hazardous events is crucial in every community, whether natural or anthropogenic disasters. CDC Social Vulnerability Index (SVI) helps people who need support. Social vulnerability refers to the number of adverse effects on external stress, including natural causes or disease outbreaks like the Coronavirus Disease 19 (COVID-19) pandemic on human health. The SVI dataset possesses California state of the US, subdivisions of counties of 15 features into four groups as related themes (i.e., socioeconomic status; household composition and disability; minority status and language; and housing type and transportation). In addition to the SVI dataset, the recent COVID-19 data tracker for each county posted by the CDC shows the new cases per 100,000 persons in the last seven days. The transmission values are low, moderate, substantial, and high. The impact of SVI on COVID-19 attracts the attention of researchers to find the relationships between SVI and COVID-19 incidence. This paper aims to incorporate SVI data and the incidence in the United States using ten machine learning algorithms for COVID-19 transmission level classification. The experimental results show the proper prediction based on the community transmission level of

COVID-19 by considering the features of SVI. Among all used machine learning methods, Random Forest achieved the best performance based on the percentage of various performance metrics accuracy, precision, and recall.

Session 4A: Biomechanics

Recreating Ligament Mechanics Using 3D Printing

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While much research has focused on the chemical characteristics of ligaments for tissue engineered scaffold design, few have evaluated the mechanical properties of potential materials and fewer have investigated using 3D printing to recreate ligament architecture that closely simulates mechanical behavior. Seven fresh-frozen ACLs were cyclically loaded to quantify viscoelastic effects and then loaded to failure. Stress relaxation curves were fit to a single spring-dashpot model and Peleg's model to understand the viscoelastic material needs. Tough-polylactic acid (T-PLA), polylactic acid (PLA), and thermoplastic polyurethane (TPU) were used to print three types of ligament fibers: Type I- high crimp angle; Type II- reduced crimp angle; Type III- straight fibers. Each fiber type of each material and composites of the three fibers were experimentally tested. Average Young's modulus (E) of the seven ACLs was 25.44(18.07) MPa and ultimate tensile strength (UTS) was 3.48(1.97) MPa. The Peleg model had the best fit to the experimental ACL data with an R-squared average of 0.87. When testing composite fibers: E- TPLA 1042.8MPa, PLA 1279.4MPa TPU 46.4MPa; UTS- TPLA 34.2MPa, PLA 35.4MPa; Yield point- TPU 0.67MPa. CAD and 3D printing can be used to create models of ligaments with structural features similar to native ligaments using a variety of materials. TPLA and PLA had significantly higher E and UTS than the test ACL tissue. The hyperelastic TPU E and UTS were similar to the ACL, but TPU's hyperelasticity generated very different material behavior than the ACL. Additional biocompatible 3D printed materials and composite materials will be tested and reported.

Investigation of The Radial Clearance Influence on the Tribological Behaviour of Hard-On-Soft Hip Implants Based on Lubrication And Multibody Simulation Models

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The aim of this work is to analyse the tribological response of an artificial hip joint made of Ultra High Molecular Weight Polyethylene acetabular cup against ceramic femoral head to a variation of the implant radial clearance. The *in silico* analysis is conducted by taking advantage of the interaction between a multibody model and a lubrication one, both developed in Matlab (MathWorks, Portola Valley, CA) by the authors. The multibody model solves the inverse dynamics of the musculoskeletal mechanical system associated to the lower limb apparatus, elaborating the muscular actions and the joint reactions produced by the gait cycle kinematics input.

The lubrication model is based on the numerical solution of the Reynolds equation: it is supplied by the hip joint loads and relative angular velocities obtained from the multibody simulation and it elaborates the tribological quantities associated to the mixed elasto-hydrodynamic lubrication mode (fluid/contact pressure, surfaces' separation, wear penetration depth, etc.).

The whole computational tool obtained by the merging of the two models is used to conduct a parametric analysis with respect to the implant radial clearance, in order to study its role in the framework of the prosthesis wear prediction during its design.

Effects Of Compressive Strain on ohe Diffusivity of Fluorescein in Meniscus Fibrocartilage

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Meniscus fibrocartilage is a key component in proper knee joint function. Due to its avascularity, the tissue relies on diffusion through the extracellular matrix to deliver nutrients throughout for appropriate repair of injury and protection against secondary pathologies. Previous studies have characterized solute diffusivity in the uncompressed meniscus; however, it is important to investigate the tissue under compression due to its normal physiological loading. The objective of this study was to investigate average diffusion coefficient and anisotropic ratio, defined as ratio of the diffusion coefficient in the direction of the tissue collagen fibers to that orthogonal, of the meniscus fibrocartilage under compressive strain. Tissue samples were harvested from the central portion of porcine medial menisci and tested via fluorescence recovery after photobleaching to measure diffusivity of fluorescein (332 Da) under 0%, 10%, and 20% compressive strain. Diffusion coefficient significantly decreased as strain increased. In contrast, the anisotropic ratio was not affected by the strain applied to the tissue, suggesting that compressive strains used in this study did not alter the diffusive pathways in the meniscus. Our findings provide new knowledge on the transport properties of the meniscus fibrocartilage that can be used to further understand tissue pathophysiology and approaches to tissue restoration and protection.

Biomechanically Recreating the Phantom Foot Injury

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The phantom foot injury is common in skiers and results in damage to the anterior cruciate ligament (ACL) when a skier falls backwards while going downhill. The body is positioned with the hips below the knees, the torso facing the downhill ski, and all of their weight on the inside edge of the back of the downhill ski. This injury mechanism produces excessive internal rotation and valgus moment on the knee. While it has been simulated using finite element modeling, it has not been experimentally reproduced using cadaveric tissue. We report on our method for recreating this injury for future evaluations of the effectiveness of ski boot binding release prior to ACL injury. A custom test fixture was mounted in a Model 585 MTS actuator using a 25 kN axial/150 N-m torsional load cell. A fresh frozen cadaveric specimen, mid-femur to toe was placed in a ski boot. The boot was attached to bindings set at the highest DIN setting to ensure the boot would not be released from the ski. The ski was mounted at an angle to recreate the skier's position of the leg during the fall. The femur was fixed in an aluminum cylinder attached to an angle vise to create a 120° knee flexion angle and 20° valgus rotation. An anterior tibial force of 220N was applied using ratchet straps attached to a force gauge and an axial load of 550N was applied axially. The actuator was set to rotational control of 140° in 1 sec. This set up resulted in knee dislocation, lateral capsule rupture, and a torn ACL and LCL verified during dissection. Max torque was recorded at 149N but it may have been higher because it exceeded the range of the load cell. Subsequent testing on 4 additional limbs will be completed using a 50 kN/250 N-m load/torque cell and reported.

Effect of Lifting Straps in Muscular Activation During Snatch

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The snatch is one of the two lifts contested in Olympic weightlifting. Alternate grip variations, such as lifting straps (LS), are used to compensate for the limiting nature of grip strength in lifts. It is commonly believed that LS help maintaining the muscular integrity of the hand and alleviate fatigue in the forearms. However, this has not been supported with measurable data on muscular activation yet. Therefore, the objective of this study was to quantitatively compare the muscular activation with and without LS during a snatch. 9 male semi-professional weightlifters participated to this study. Signals from 8 muscle groups on the dominant side were measured via EMG when lifters performed a snatch at 80% of their maximum effort. A one-sample t-test compared the extent of muscular activation with and without LS through different phases of the lift. It was found that wearing LS decreases forearm muscle activation by 16% during the pull phase, increases the medial deltoid by 13% during the top of 1st pull phase, and increases vastus lateralis and lateral dorsalis activation by 22% and 42% respectively during the 2nd pull phase. These results confirm that wearing LS spares the use of the forearm muscle which reduces problems of fatigue.

The Role of Bone Cement Mixing Methods on the Success of Cemented Total Joint Replacements

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Bone Cements are used extensively for fixing the artificial joints to the bone. It fills the space between the bone and the prosthesis. All bone cements are based on polymethyl methacrylate (PMMA). Most often the powdered PMMA and the liquid monomer are mixed by hand or mixed in a vacuum, producing a dough. However, hand mixing often entraps air bubbles making the bone cement porous. Porosity makes the cement mechanically weaker. Our previous studies have shown that mixing of bone cement with vibration allows the porosity to be reduced improving the mechanical strength of the bone cement. We have also shown that applying vibration during insertion of a simulated total hip replacement significantly increases the shear strength between the bone and bone cement. A new design of a vibration mixer for bone cement to make the product more reproducible will all be presented.

Session 4B: Nanoparticles I

***Ex Vivo* Assessment of Vascular Reactivity in Animal Model**

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Endothelial dysfunction is an early marker of vascular disease and a risk factor for cardiovascular disease. Vasomotor tone analysis provides a physiological information about vascular reactivity. In the present study we used wire and pressure myography to assess endothelium-dependent relaxation of three different blood vessels from a rat model of nephrectomy (Nx). Vascular reactivity was measured in three blood vessels collected in ice-cold Krebs-Ringer buffer. Blood vessels were cut in rings and mounted in the wire-myograph chamber and vascular reactivity (vasoconstriction and vasorelaxation) was assessed. A cumulative dose-response vasoconstriction and vasodilation in response to vasoconstrictors (phenylephrine, Phe) and vasodilators (acetylcholine, ACh) was collected. Sensitivity to Phe or Ach (pEC_{50}) and E_{max} contraction and relaxation were calculated using non-linear sigmoid regression curve (GraphPad). In some experiments specific inhibitors to endothelium-dependent relaxation factors were used. The results of this study indicated that vascular reactivity varied

depending on the size of the blood vessel. Also, while ex-vivo vasoreactivity assessment of blood vessels using wire-myography provides a controlled setting for physiological and pharmacological analysis, some limitations may exist as opposed to in vivo setting.

Cerium Oxide Nanoparticles: A Promising Outlook into Ophthalmic Applications

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Cerium oxide nanoparticles called nanoceria are being studied in the biomedical field for their ability to combat oxidative stress and help regeneration. Nanoceria acts as a free radical scavenger and can be effective in reducing the damage caused by reactive oxygen species. Cerium oxide is auto-regenerative due to oxygen vacancies and the ability to switch between two oxidation states. At the nanoscale, nanoceria has an extensive surface area relative to their volume, increasing the concentration of oxygen vacancies. Increased oxygen vacancies allow for more effective free-radical scavenging. Reactive oxygen species form due to acute inflammation, which can cause damage to the cells and healthy tissues. The buildup of reactive oxygen species can ultimately lead to chronic inflammation and other complications. Nanoceria has been shown to be biocompatible with cellular tissues, among other properties, making them a potential new treatment for ophthalmic diseases, including cataracts, chronic inflammation, DryEye syndrome, retinal degeneration, and other diseases. This study aims to encapsulate nanoceria into liposomes to be used in eye drops. Nanoceria is poorly soluble in water and does not penetrate the ocular surface effectively. Encapsulating the nanoceria in liposomes has been shown to make nanoceria miscible and could effectively help them penetrate the ocular surface. Incorporating the nanoceria into eye drops could lead to the development of non-invasive alternatives to commonly used intravitreal injections.

Developing Custom Advanced Orthotic to Improve Biomechanical Gait for Congenital Symbrachydactyly

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Congenital foot abnormalities can make finding a comfortable shoe difficult. Improperly fitting footwear can lead to feelings of discomfort and pain as well as functional limitations [1]. A variety of conditions can cause foot abnormalities [2], with approximately 1 in 1000 people born with clubfoot congenital differences [3]. These differences may require individuals to look for other options in footwear. Personalized orthotics can help prevent movement related injuries by aligning the lower limb kinematics to optimize comfort [4,5,6]. This study introduces a custom silicone insole orthotic, for an individual with toe loss and symbrachydactyly, a unilateral congenital bone condition that is characterized by the lack of formation of bones [7]. The goal of this project is to make a personalizable shoe insole that can support the unique foot geometry inside a commercial shoe, thereby improving the fit, comfort, and locomotion. The design and manufacturing of the orthotic involved computer aided design, 3D printing custom molding, casting silicone, and degassing to develop optimal sizing and fit. The implementation of the orthotic looks to improve biomechanical potential in gait and mobility improvement, with future work looking to measure the change from baseline [8].

References

1. Menz, H. B., & Lord, S. R. (1999). Footwear and postural stability in older people. *Journal of the American Podiatric Medical Association*, *89*(7), 346-357.
2. Rampal, Virginie, and Fabienne Giuliano. "Forefoot malformations, deformities and other congenital defects in children." Orthopaedics & Traumatology: Surgery & Research 106.1 (2020): S115-S123.
3. Ansar, A., Rahman, A. E., Romero, L., Haider, M. R., Rahman, M. M., Moinuddin, M., & Hoque, D. M. E. (2018). Systematic review and meta-analysis of global birth prevalence of clubfoot: a study protocol. *BMJ open*, *8*(3), e019246.
4. Nigg, B M et al. "Shoe inserts and orthotics for sport and physical activities." *Medicine and science in sports and exercise* vol. 31,7 Suppl (1999).
5. Jafarnezhadgero A, Madadi-Shad M, Alavi-Mehr SM, Granacher U. "The long-term use of foot orthoses affects walking kinematics and kinetics of children with flexible flat feet: A randomized controlled trial." *PLOS ONE 13*, (2018).
6. Mayor, Susan. "Foot orthoses reduce sports injury but shock absorbing insoles do not, study finds" *BMJ* 2016;
7. Goodell, Parker B., et al. "Symbrachydactyly." *HAND*, vol. 11, no. 3, Sept. 2016, pp. 262–270, doi:10.1177/1558944715614857.
8. Nagano, Hanatsu, and Rezaul K Begg. "Shoe-Insole Technology for Injury Prevention in Walking." *Sensors (Basel, Switzerland)* vol. 18,5 1468. 8 May. 2018, doi:10.3390/s18051468

Thermodynamic Study of Cerium Oxide Nanoparticles and Their Effects on Cellular Metabolism

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Oxidative stress was associated with a large range of health conditions. It is caused by the accumulation of reactive oxidative species above cellular neutralization capability. Cells generally defend against oxidative stress with ROS decomposing enzymes such as superoxide dismutase and catalase. Cerium oxide nanoparticles display activity similar to superoxide dismutase and catalase, allowing them to combat oxidative stress. Oxidative stress can impair the mitochondrial function and energy output of cells, which can be measured as heat with closed ampoule isothermal

microcalorimetry. Thermodynamic analysis of the cell's response to nanoceria treatment can help improve understanding of its general medical applications. Murine macrophages of the RAW264.7 cell line were cultured in 10% FBS supplemented DMEM media with 1% AA until it reached 90-95% confluency monitored by the EVOS M5000 microscope. After establishing a baseline heat output for healthy cells using a TAM-III isothermal microcalorimeter, the heat flow was measured in cells under induced oxidative stress and cells treated with nanoceria. After nanoceria treatment, data collected from the microcalorimeter will be analyzed for heat flow regression to normal cellular levels. Various concentrations of nanoceria were tested to identify the optimal dosage at which its antioxidative properties are most effective. In this study, we described the effect of nanoceria on mitochondrial activity.

Cell Adhesion on Biocompatible Aligned Submicron Fibers

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The everlasting domain of nanomaterials has brought alternative approaches in the biomedical fields such as diagnosis, or analysis, therapeutics, and pharmacology. Fibers, nanofibers, or films are important for biomedical research to solve medical problems and improve life quality. Recently such biomaterials have been spreading their wings in the medical domain intensively to solve many potential problems – from basic science to incorporation of such materials in prosthetics to reduce the autoimmune response, increasing the life of prosthetics. Biomaterials could be used in kit-based methods, tissue engineering and many others. Such biomaterials study not only focuses on improving one's life but also on preventing an afflicted injury or disease. Our work comprises of synthesis of such specific polymeric fibers, which will eventually diminish the need for the enzymatic method for cell line harvesting. Enzyme production is not economical, nor does it give good cell harvest, as enzymes damage the cell line of interest –reducing the potential of the cells to culture and may generate false-positive results. We focus on selective characteristic improvement of biomaterials as they are more biocompatible. We work side by side with biomaterials in a controlled environment, mimicking system temperature – biologically analyzing the synthesized specific biomaterials with the cell lines and observing the attributes of cell lines. The integration of new biomaterials and methods with nanofibers will carve the path for nanomaterials, which will eventually enhance the performance of the biomedical field.

Mos2/Ausers Biosensor for Early Detection of Breast Cancer-Derived Exosomal MicroRNAs

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According to the WHO, breast cancer cases amounted to 2.2 million globally in 2020.Early breast cancer detection can help restrict metastasis and improves survival ratesby 80%.Metastatic breast cancer is attributable to the delay in the diagnosis due to the absence of monitoring approaches for the disease, the lack of sensitive and specific biomarker targets, and selective real-time tools for biomarker detection. MicroRNAs encapsulated in exosomes have shown stability and sensitivity as biomarkers in breast cancer. Exosomal miRNAs as breast cancer biomarkers play crucial roles in regulating tumorigenesis. miRNA dysregulation promotes metastasis and drug resistance by controlling signaling pathways and the expression of protein-coding genes. For example, exosomal miR-9 promotes tumor growth by switching the normal fibroblasts (NFs) to cancer-associated fibroblasts (CAFs), while miR-210promotes angiogenesis by controlling hypoxic stress in the tumor microenvironment. MoS2/Au biosensors based on Surface-Enhanced Raman Scattering (SERS) are suitable for detecting biological targets with high specificity and sensitivity. In this work, we present aMoS2/Au-based SERS biosensor for the detection ofexosomalmiR-9 and miR-210derivedfrom breast cancer cell lines for early breast cancer diagnosis. The design and fabricationoftheMoS2/Au biosensor involve Au-thiol functionalization with locked nucleic acid (LNA)as capture probe and R6G andCy3asRaman probes. LNA with complementary sequences for the target miRNA hybridizes to detect the miR-210/miR-9 targets. LNA labeled with the Raman tag will produce a shift in the Raman signal for each miRNA.

Radical Elimination Properties of PEG-Nanoceria

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High concentrations of reactive oxygen species (ROS) were linked to diseases such as cancers and neurodegeneration. Cerium oxide nanoparticles (nanoceria) are promising in medical applications for their ability to break down various ROS. The inactivation of ROS occurs on the surface of the particle. Therefore, the catalytic efficiency is higher with smaller particles. Nanoceria can also produce ROS by inverting the cycle depending on the pH. Under the biological pH of 7, nanoceria decomposes ROS, while under more acidic conditions, produces it. We propose coating nanoceria in hydrophilic polymers to reduce ROS production and increase solubility. It is essential to improve the biocompatibility, longevity of residence, and internalization rate to increase the nanoceria range of biomedical applications. Polyethylene glycol (PEG) is a hydrophilic nonimmunogenic polymer with antioxidative properties. It

makes it an ideal coating for cerium nanoparticles. PEG-nanoceria was synthesized from Ce (III) nitrate by precipitation in a basic solution containing PEG. We observed the mitigation of radical generation by nanoceria coated with PEG of varying molecular mass. Additionally, morphological analysis by dynamic light scattering was used to assess the size distribution and particle organization. Atomic force microscopy and Fourier transformed infrared spectroscopy were used to confirm sample size. Thus, we described a way to improve nanoceria delivery to treat ROS-associated diseases.

Gastroprotective Evaluation of Goatweed Plant Extract in a Rodent Model of Ulcer

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Peptic ulcer isa multifactorial and debilitating gastro-intestinal disorder affecting around 10 million individuals globally. The potency of many anti-ulcerogenic drugs is associated with side effects, thus necessitating the quest for natural alternatives. In a 14-day long treatment, experimental rats were orally gavagedwith1.25, 2.5 or 5.5 mg/kg b.w lyophilized juice extract of goat weed (Ageratum conzoides), ACJE. Ulcer was induced in fasting animals by oral ethanol (96%; 5 mL/kg) instillation, following which rats were euthanized to evaluate the extent of ulceration, stomach histological architecture and biochemical indices of toxicity/oxidative stress. The increased ulcer scores ($p<0.001$; 9 folds) and gastric juice secretions ($p<0.001$; 1.5 folds) as well as decreased gastric juice pH ($p<0.001$; 1.5 folds) in induced, untreated animals were mitigated by ACJE pre-treatment. Rats exposed to 2.5mg/kg ACJE showed comparable effects to the standard drug, ranitidine, in terms of the reversal of ulcer scores (37 vs 68%), gastric juice volume (65 vs 62%) and pH (54 vs 52%).Also, the significantly($p<0.05$)increased LDL-cholesterol and decreased HDL-cholesterol in ulcerated animals were prevented by ACJE(2.5 mg/kg)pre-treatment. Furthermore, the gastroprotective effect of ACJE was underscored by histological evidence and reversal of oxidative stress indices in the stomach of induced rats. The results revealed that ACJE is gastroprotective and could be a source of alternative anti-ulcerogenic agent.

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Session 5A: Medical Devices

Tissue Engineering for the Damaged Meniscus: Current Concepts and Future Prospectives

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The meniscus is a fibrocartilaginous tissue in the knee, whose function is to distribute load, and ensure congruency and stability of the joint during motion. Traumatic injuries to the meniscus are very frequent and usually present as tears into the tissue. Tear suturing is the current standard of care. However, this approach has limited success: often, sutures fail, the affected portion of the tissue is consequently removed, and degeneration of the surrounding cartilaginous tissue begins. It is believed that the development of a tissue engineered construct substituting the damaged meniscus is the ideal approach to an improved treatment of meniscal injury. Such a construct should be able to recapitulate the mechanical behavior of the native tissue. However, to date, current literature lacks full elucidation of its characteristics. In this talk, we will illustrate current concepts in meniscal repair and present our advances in understanding the behavior of the meniscus in relation to its unique compositional and structural features. This acquired new knowledge is then deployed for the development of a novel computational model of the meniscal tissue that is projected in the future development of suitable tissue engineered constructs for meniscus repair.

Audiovisual Ventilation Feedback from a Novel Handheld Monitoring Device Improves Manual Ventilation in a Randomized Crossover Manikin Study

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Although simple in concept, manual ventilation is a difficult clinical skill to perform safely and effectively. We developed the *B*ag valve mask *E*mergency *N*arration *G*uided *I*nstrument (*BENGI*), a handheld tidal volume feedback device that provides audiovisual feedback in real-time on the correctness of the user's manual ventilation. To test whether the BENGI improves manual ventilation, a randomized crossover manikin simulation study was performed. Participants (n = 20) were recruited from the medical school to manually ventilate both with and without the BENGI. Participants were asked to manually ventilate a manikin under four different scenarios with varying tidal volumes and respiratory rates, representing adult (Scenario 1, 500 mL at 10 min^{-1}; Scenario 2, 750 mL at 10 min^{-1}), pediatric (Scenario 3, 300 mL at 10 min^{-1}), and neonatal (Scenario 4, 20 mL at 60 min^{-1}) clinical scenarios. Respiratory parameters, including tidal volume and respiratory rate delivery, were measured. Intra-participant (standard deviations throughout a given test) and inter-participant variations (standard deviation among all participants for a given scenario) in respiratory parameters were assessed.

In all four scenarios, BENGI use during manual ventilation significantly reduced absolute deviations towards the target values in respiratory rates ($p<0.0001$) and tidal volume ($p < 0.05$) with greater advantages for Scenario 1 (19±7mL with BENGI versus 142±116mL without). Both intra- and inter-participant variations in tidal volumes and respiratory rates were also significantly reduced with BENGI use. Thus, BENGI use improved both tidal volume and respiratory rate accuracy and consistency during manual ventilation in a manikin simulation study. The BENGI may then have utility as both a medical and training device for improving manual ventilation and reducing manual hyperventilation.

Notch Jagged1 Coating Enhances 3d-Printed Bone Scaffold Vascularization And Callus Formation

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Vascular penetration is essential to deliver cells and growth factors that promote bone callus formation in large bone defect repair surgery. Although multiple signaling pathways are involved in regulation of angiogenesis, increasing evidence shows that Jagged1 (JAG1)-mediated Notch signaling plays a crucial role in angiogenesis during development. In this study, 3D-printed biodegradable Polycaprolactone (PCL) scaffolds with similar biomechanical properties to real bone were coated with JAG1 protein or lgG (a control protein) and seeded with angiogenic endothelial stem cells (ESCs). Cell cultures were used to observe the JAG1-induced vessel tube formation. Tetramethylbenzidine (TMB) assay was performed to monitor the controlled release of JAG1 from PCL scaffolds. Finally, a mouse bone defect model was used to test the in vivo repair ability of JAG1 and ESCs loaded scaffold. We found that ESCs exposed to JAG1 resulted in a measurable increase of capillary tube formation with thicker tubes and more connections. TMB assay showed the JAG1 protein cross-linked on the surface of PCL scaffold could hold on to and slowly release JAG1 protein over 11 days and possibly even weeks. More importantly, an enhanced vascularization and bone callus formation was observed surrounding the JAG1-coated scaffolds in the bone defect mouse model. Therefore, our results support the idea that JAG1 protein-coated PCL scaffold could be used as a novel bone substitute for rapid bone defect repair by enhancing local ESC angiogenesis and subsequent vascularization.

Use of Intestinal Expansion Sleeves (IES) For Distraction Enterogenesis in Short Gut Syndrome: Preclinical Studies in Rat Small Intestines

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Pediatric surgeons often encounter patients with intestinal failure due to inadequate intestinal length (short gut syndrome/SGS). Patients with SGS compensate with gastroparesis and slow dilation of the intestinal diameter. This process may take weeks, months or years requiring supplemental parenteral nutrition for adequate growth. Here, we propose a proof-of-concept mechanical bowel elongation approach using a self-expanding prototype of an intestinal expansion sleeve (IES) for use in SGS to accelerate the process of freedom from parenteral nutrition. The IES is pre-contracted by diametric expansion over a dilator, inserted into the gut and anchored with bioabsorbable sutures, and then deployed by removing the dilator leading to longitudinal axis expansion. Mechanical characterization of these prototypes was performed using an Instron 8874 Testing System. These devices were deployed in small intestines of Sprague Dawley rats. IES length– tension relationships and post-implant gut expansion were measured *ex vivo*. Histology of the gut before and after implantation was also evaluated. Mechanical load testing data revealed that the sleeves can exercise an elongation force of 2.8±0.4N at 50% of compression. Deployed within small bowel at 72 ± 5% of initial length (i.l.) the sleeves expanded significantly to 92 ± 7% of i.l. ($p < 0.001$, $n = 11$). This resulted in an immediate 21 ± 8% increase in gut length. The IES device significantly decreased thickness of serosal, muscular and mucosal layers and resulted in lengthening of the gut. The IES represents a promising platform to obtain longitudinal gut elongation via distraction enterogenesis in SGS.

Vaginal Atresia/Agenesis: Experimental Evidence of Canal Expansion with A Novel Device

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Vaginal agenesis or atresia seen in genetic disorders such as Mayer-Rokitansky-Küster-Hauser (MRKH) syndrome or androgen insensitivity syndrome (AIS) causes significant sexual dysfunction. Current treatments are either mechanical dilation of the vaginal canal or surgical reconstruction. Surgical reconstruction has significant risks with complication rates as high as 40%. Therefore, we aim to evaluate the feasibility of a vaginal expansion sleeve (VES) as potential treatment for vaginal atresia. The proprietary VES is made of cylindrical layered polyethylene terephthalate with helicoid trusses characterized by isometric

ends. In the current study, following mechanical characterization of the device, we deployed the VES in the vagina of Sprague Dawley rats and anchored with nonabsorbable sutures. We measured VES length-tension relationships and measured post implant vaginal canal expansion *ex vivo*. Histology of the vagina before and after implantation was also evaluated. Mechanical testing revealed that 3D printed sleeve caps severely compromised the sleeve in compression and did not allow for sleeve expansion. Testing of sleeves without caps at 30mm resulted in a expansion force of 11.7±3.4N and 2.0±0.1N at 50% and 40% respectively. The implanted 20mm VES resulted in 5.36mm ±1.18 expansion of vaginal canal. Vaginal length was increased by 32.5 ± 23.6% (p=0.004, Student t test). Histology demonstrates thinning of the vaginal wall.

The novel VES device resulted in significant expansion of the vaginal canal. Our 3D printed sleeve caps impaired the expansion potential of the VES. The VES device without caps represents a unique potential treatment for vaginal atresia.

Additive Manufacturing of Continuous Carbon Fiber Composites for Orthopedic Fixation Devices

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This investigation focuses on developing a new model of Ilizarov fixation device used for orthopedic trauma as primary fixation or support of internal fixation, as well as for orthopedic reconstructions for bone fusions. The innovative design is based on the use of continuous reinforced carbon fibers through an Additive Manufacturing process, thus eliminating the disadvantages of the existing fixators, answering to the need of easily customizable and on-demand available external fixators. The use of the carbon fiber reinforced polymer embedded in a polyamide 6/6 matrix offers significant weight reduction compared to metallic counterpart while maintaining structural integrity due to presence of continuous aerospace grade carbon fibers. Moreover, the reinforced polymer makes the fixator an excellent radiolucent device to be used in Magnetic Resonance Imaging and X-ray without an interference in imaging. Parts are manufactured through an additive process using a Markforged composite 3D printer. The additive manufacturing approach provides design freedom, eliminates the necessity of intermediate mold or central facility, as in conventional composites production, making it a perfect candidate to be used in medical deserts, developing, Remote Enables Automation, Scalability And Multiparity.

Development of Tools for Surgical Training: The Role of the Haptic Feedback

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In surgical training there is a variety of simulators with various levels of complexity but their systematic adoption in training programs is currently limited by the costs of existing solutions and their geographical availability. Simplified low-cost models have been previously proposed but their popularization has been limited by the low fidelity in replicating human anatomy. We have developed virtual reality surgical simulator and 3D printed anatomical models that are low cost and easy to share since rely on cloud technologies or common Fused Deposition Modeling (FDM) printing technology. The talk will go over the challenges in the development and use of these technologies. More specifically, we will go over the limitations of virtual reality simulations and the experimental evaluation of the educational validity of a novel 3D printed arthroscopic shoulder simulator (PASS) in relation to a widely adopted and commercially available shoulder simulator. The studies performed are prospective randomized control trials approved by the local IRB in which both Medical Students and Expert Surgeons were recruited. The studies were centered around surgical tasks that included, screw insertions, probing different locations, placing a suture anchor, pulling sutures through portals, and measuring anatomy. The subjects completed anatomy test before and after the given tasks and a questionnaire as well. Educational value were determined by anatomy test scores before and after performing the simulation tasks, user feedback, and construct validity was determined by measuring the time to completion. Tools such as the PASS can create ground for widespread training techniques that can overcome economical and geographical barriers. Improved anatomy knowledge and consistency in duration that is crucial for the adoption of these tools in structured educational programs has been documented and will be illustrated in prospective of future developments.

Session 5B: Biomaterials III/BioSensors

Dual Polymer Thermos Responsive Surfaces for Improved Cell Sheet Detachment

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Artificial cellular sheet creation is a prominent tool in wound regeneration and an appealing alternative to transplantation. Cells are grown in cultures and detached when confluency is reached. Conventional detachment with trypsin damages the extracellular matrix and therefore is not suitable. A common way to detach an intact cell sheet is to use a nanolayer of a thermor esponsive polymer PNIPAM as a substrate. Under normal cell growth conditions, PNIPAM is hydrophobic, and cells adhere to it well. When the temperature is lowered below 27°C, PNIPAM becomes hydrated and expands, detaching the cell sheet from the surface. Conventionally the uniform layer of PNIPAM is used. However, this approach

requires a precise polymer thickness to create well adhesive surfaces, which significantly raises the production costs. To address this issue, we separated adhering and detaching functions of the substrate by using two polymers in a nanoscale pattern. We used a common cell adherent peptide poly-RGD and non-adherent PNIPAM. PNIPAM regions are thinner than ones of RGD but can expand over them, displacing the adhered cells. This approach allows for less precision in the layer thickness. The nanostructure and the thickness of the surface were characterised using the Atomic Force Microscopy. To assess the detaching abilities of the surfaces we cultured cells on them. The data was compared to existing research on cell sheet creation. Preliminary results show similar performance to the uniform surface. Thus, we developed and described a cheaper alternative to conventional cell sheet detaching surfaces

Nanosized Ceria Oxide as Inhibitor of Streptococcus Mutans Metabolism

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The accumulation of dental plaques leads to periodontal and dental infections such as caries. The formation of cavities can be attributed to the Streptococcus mutans, the most abundant bacterium in the mouth. By metabolizing sugars, bacteria release lactic acid, which dissolves calcium salts and leads to tooth decay. Cerium oxide nanoparticles called nanoceria have been studied extensively because of their versatility. The nanoceria was shown to prevent biofilm formation in previous studies. We hypothesized whether nanoceria could decrease lactic acid formation by disrupting bacterial metabolic activity. We compared the growth speed and acid production with and without the presence of nanoceria and sucrose. Sucrose was used to imitate food residue in the mouth. We measured the Optical Density and counted Colony Forming Units. This way, the S. mutans growth rate was measured in different conditions. Media pH was also checked to show lactic acid production. Resazurin assay was used to quantify bacterial viability. Results revealed that nanoceria halts lactic acid production. The optical density tests showed a significantly shorter logarithmic phase of growth in the presence of nanoceria. Resazurin assay also showed lower viability levels in the presence of nanoceria when compared to samples without it. Through circular dichroism, we plan to continue to study how nanoceria affects dehydrogenase enzyme configurations. This research will provide an avenue for future nanoceria implementation within dental products such as toothpaste and floss.

Design and Modeling of a Multi-parametric Fiber-optic Biosensor

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The traditional dialysis probes are limited to administering drugs and sampling molecules, and hence require additional sensing devices for sample analysis. Sensors inscribed at optical fibers make them suitable for in situ and remote monitoring due to their miniaturized footprint and ability to track surface reaction kinematics. One that is embedded with dialysis catheters could aid clinicians in developing real-time diagnosis and prognosis for patients. Toward this end, we aim to develop an in vivo optical sensor probe that has multiple sensing regions on it depending on the number of target analytes to be studied. The localized surface plasmon resonance (LSPR) sensors are formed at the distal end of an optical fiber, with a core diameter ranging from 10 μm -200 μm. The gold nanoparticles coated fiber sensor exhibits LSPR intensity shifts upon varying adsorption and desorption of the target biomarkers. Each sensing region of the graded probe is coated with a different antibody functionalization layer that is selective to a particular biomarker. For instance, to selectively capture target A and B, two regions near the tip of the fiber are coated with anti-A and anti-B molecules, respectively. Finite element method was used to simulate the structure using COMSOL Multiphysics. The potential LSPR overlap issue between the two sensing regions was studied through differential functionalization, i.e., coating the two regions of the fiber with gold nanoparticles having different shapes/sizes/thicknesses.

Haptics In Soft Effectors For Smart Interactive Assistive Frameworks

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Tactile sensors help in modeling intrinsic and external touch sensation. Tactile sensing can refer to the touch in multiple points of contact and refer to the process of detecting and measuring a given property of a contact event in a predetermined area at multiple points of contact. The Haptic system helps in creating a “sense of touch” about the environment through stimuli at a single contact point. Effectors are the end point of robotic frameworks that interact with the real world. From prosthetic hands to precision grippers, effectors made of soft flexible materials have been used for various biomedical applications. The research goal of this project is to integrate haptics in soft effectors for two way communication in an assistive framework. In this research, we will investigate the use of haptics for creating environmental awareness and for taking the user input. Modeling the user input using the haptics will include interpreting the hand gestures. The proposed framework will use the haptic signals at specific frequencies to provide sensor feedback and interpret the user’s hand gestures as user inputs for navigation assistance. In implementing such a framework, the research will also focus on the use of micro actuators or vibration motors for providing precise feedback. The framework will include custom-made soft effectors, robotic cane/walker, algorithms to model the user input,

actuators, and vibration sensitive filaments for closing the loop. This research will significantly contribute to the next generation mobility assistive frameworks with interactive feature.

Kirigami Architecture for Ultra flexible Biosensor Design

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Kirigami, which is a Japanese art of cutting papers, has inspired a new and emerging field of reconfigurable and ultra-flexible sensor design. Although significant progress has been made in developing new generation of wearable and flexible biosensor design, they are mostly limited to selection of novel composition of materials and lack structural maneuverability. In contrast, kirigami-based structures have superior stretch ability and repeatability due to out-of-plane deformations and thus experience less strain within the structure as compared to the applied strain. High stretchability, repeatability and stability are desired features of wearable strain sensors that monitor physiological parameters including respiration and muscle movements. Here, we designed kirigami structures and analyzed the stress-strain behavior using the finite element analysis in Solid works. Tensile, compressive and torsion strains were applied, and the resulting displacements were measured. It was observed that the kirigami architecture resulted in negligible strain on the sensing region. In addition, the kirigami structure was physically formed on a 125-micrometerthick polyimide sheet using a craft cutter, with graphene as the sensing layer. When the structurewas bent, the polyimide sheet underwent three-dimensional deformations owing to the kirigami configuration, resulting in a bendable device without causing significant deformation of the materials. Thus, our sensor holds the potential to detect subtle bending with high sensitivity without losing structural integrity.

Assessment of Influence of Degree of Calcification over Performance of Tricuspid Aortic Valve Using Fully Coupled Fluid-Structure Interaction Model

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Hemodynamics factors are presumed to be a potential factor for calcification of tricuspid aortic valve. The influence of these factors over performance of heart valve is determined by parameters like valve orifice area or transvalvular pressure gradient using echocardiography but with substantial errors. Fluid-structure interaction (FSI) modelling has been widely adopted as an alternative method for accurate assessment of aortic valve performance. In this study, structural and fluid flow analysis are coupled using system coupling module of commercial modelling software ANSYS to account for flow dynamics and leaflet deformation simultaneously. Tricuspid aortic valve was modelled using simplified three-dimensional geometry and inlet velocity boundary condition obtained via echocardiography was utilized. Four blood models, three non-Newtonian (Power law, Walburn-Schnek and carreu model) and one Newtonian model were used. Calcification of aortic valve was modeled by varying the young's modulus of aortic valve leaflet. Simulation result indicate significant change in hemodynamics of healthy and calcified aortic valve. Calcification results in decreases in valve orifice area and velocity increase at orifice. At peak systole, transvalvular pressure gradient and wall shear stress both increased significantly with increases in degree of calcification.

Influence of Christensen TMJ implant dimensions on Biomechanical stability of TMJ–a parametric study

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Resection after tumors or trauma causes abnormalities in the human mandible. Various surgical techniques have been advocated, and biomechanics of the joint must be considered to limit long-term failures. In this study, CT-Scan data from a patient is reconstructed using image processing software (Materialize MIMICS) after processing the DICOM file to create a 3D model of the skull. The masticatory movement and stress distribution on the mandible are studied using a finite element model. The load-bearing and stress-absorbing properties of the articular disc in the temporomandibular disc (TMJ) are unique. It is considered in the study because it possesses a viscoelastic behavior due to the proteoglycan composition and collagen fibers. Other Finite element analysis models with total TMJ replacement implants are compared to the reported stress distribution. The temporomandibular joint in the patient is replaced by an implant head that mimics the condylar head and a fossa implant linked to the skull. The goal of this study is to design an implant head and compare the stress distribution along the mandible in various implant heads to other recent studies, including a patient-specific model. It also accounted for the least peri-implant stresses and the distribution of fixation screw stress. The von-Mises stress and shear stress have both been studied in order to determine the failure criteria of the implant head and fossa attachments. When compared to the intact mandible, the implant head of the patient-specific model was found to be close to the range.

Session 6A: Rehabilitation/Physical Therapy

The Effects of Electrode Placements, Knee Joint Angle and E-Stimulation Plus Volitional Contraction

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Background: During electrical muscle stimulation (EMS)I joint placements, electrode placements and instruction to patients are carried out for clinical efficacy and for patient comfort. There a limited guideline on how these are to be carried out. The purposes of this study were three folds, (1) to compare the comfortability of subjects when electrodes are placed parallel and perpendicular to the muscle fibers of the quadriceps muscle; (2) to examine the comfort level of the subjects with the knee at 45° flexion and 0° flexion; and (3) to examine the tolerability of the EMS of the quadriceps muscles with stimulation alone and stimulation plus volitional contraction.

Methods: Twenty-two physical therapy students; mean +/- SD age 24.2 +/-3.1 years selected over two years period participated in the study. In the first test, two electrodes, one placed at the proximal anterolateral aspect of the thigh and the other at the distal portion of the other placed at the distal portion of the vastus medialis muscle at predetermined motor points. The knee was stabilized at 45° flexion. The amplitude was raised to a point of maximally tolerated contraction. The amplitude and comfort level (using a scale of 1 to 10, 10 being the worst pain or discomfort) were recorded. The experiment was repeated but the electrodes were placed perpendicular to the quadriceps muscle with one electrode on the mid-belly of the vastus medialis and the other directly across over the vastus lateralis. The second part of the experiments measured the amplitude and comfort level of the subjects for maximally tolerated contraction of the quadriceps when the knee was stabilized at 45° flexion and at 0° flexion. Finally, the amplitude and comfort levels were measured with knee stabilized at 45° flexion and contraction elicited with electrical stimulation alone on one hand and electrical stimulation plus volitional contraction of the quadriceps. The mean of the amplitude and comfort level measured with pain scale were calculated and compared using t-test.

Results: The results showed the comfort level when the electrodes were placed parallel to the quadriceps was not statically different from the electrodes were placed perpendicular to the muscles ($p = 0.06$). However, the comfort level and tolerability (measured with current (MA) tolerated) were statistically different with the knee at 45° compared to the knee at 0°, $p = 0.001$ and $p = 0.03$ respectively. The results also showed that the subjects tolerated muscular contraction induced by stimulation plus volitional contraction compared to electrical stimulation alone, $p = 0.05$.

Conclusion: During electrical stimulation, electrodes placed parallel to the muscles, joints placed out of range to lengthen the muscle being stimulated, and patients contracting volitionally of the stimulated muscles along with the electrical stimulation present better clinical efficacy.

The Effect of a Free Community Pediatric Health Initiative on BMI, Fitness Measures, and Quality of Life

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Background: Pediatric obesity affects approximately 18% of children in the United States. Childhood obesity contributes to several health-related issues including diabetes, hypertension, decreased quality of life (QOL), and adult morbidity. Programs tailored toward educating children and parents on healthy lifestyle choices, exercise, and nutrition have been shown to improve health-related outcomes for this population.

Objective: The purpose of this study was to retrospectively investigate the effects of an 8-week community pediatric health program on Body Mass Index (BMI), fitness measures, and QOL in overweight children.

Methods: Subjects aged 8-16 years were recruited from a hospital-based weight management clinic to participate in an 8-week weight loss program. Subjects attended weekly one-hour sessions consisting of education on health and wellness, exercise instruction, home program development, and practical goal-setting. Seven children participated in the program and completed all outcome measures. Outcome measures included BMI, functional strength (jumping jacks, wall sits, push-ups, and sit-ups), balance (single-limb stance, SLS), flexibility (straight leg raise, SLR), endurance (6-minute walk test, 6MWT), and QOL assessment (Pediatric Quality of Life Inventory, PQOL). Outcomes were assessed at baseline and week eight.

Results: Although the BMI did not show clinically significant improvement, three functional strength measures, endurance, and flexibility showed statistically significant improvement at week eight.

Conclusion: The findings indicate—a community-based pediatric health and wellness program resulted in significant improvement in the fitness of overweight children. Further research is needed to determine the long-term effects of this program.

Effects of Backward Walking on Gait Parameters in People with Stroke: A Systematic Review

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Background: Gait deficits after stroke often include an asymmetrical gait pattern, slower cadence, and decreased stride and step length. A comprehensive rehabilitation program is needed to address gait deficits im the post-stroke population. Backward walking training (BWT), has been reported to produce positive results on specific gait deficits.

Objective: Determine if backward walking is more effective than traditional interventions in improving gait parameters in people following stroke.

Methods: Embase, CINAHL, and PubMed databases were searched, utilizing search terms related to backward walking, stroke, and gait parameters. The search was limited to articles written in English within the past 10 years. Titles and abstracts were screened, followed by full text assessment. Inclusion criteria consisted of (1) people after a stroke diagnosis (2) backward walking as a therapeutic intervention and (3) articles with outcome measures. Exclusion criteria consisted of (1) neurological disorders other than stroke, (2) interventions that were not backward walking, and (3) articles without outcome measures. The articles were assessed using Pedro and the McGill Mixed Methods Appraisal Tool-2018.

Results: Eight articles were selected for full-text assessment. After applying inclusion and exclusion criteria, six articles were included in the final review. These studies, comprising of 180 total participants, evaluated various gait parameters following BWT. Study results revealed significant improvement in gait parameters of gait speed, step length, stride length, cadence, and balance.

Conclusion: The findings from this systematic review indicate that backward walking is effective in improving gait parameters in people following stroke.

The Effects of Prone Positioning in Mechanically Ventilated Patients with COVID-19: A Systematic Review

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Background: The COVID-19 pandemic presented challenging times for everyone and impacted healthcare tremendously. Prone positioning was implemented to address inadequate oxygenation in mechanically ventilated patients with COVID-19. Prone positioning (PP), which involves placing a patient face down, improves gas exchange and oxygen perfusion. For this reason, PP was introduced as a treatment option for patients with hypoxemia secondary to COVID-19.

Objective: The purpose of this systematic review was to analyze the effects of PP on mechanically ventilated patients with COVID-19**.**

Methods: PubMed and EMBASE databases were searched using terms relating to PP, COVID-19, and mechanical ventilation. Researchers screened titles, abstracts, and full texts, removing any duplicates. The JBI quality assessment tool was used to assess selected articles.
Results: Six studies met inclusion criteria for the study, with a total of 421 participants. Primary outcomes assessed included oxygenation parameters. All included studies met the JBI quality assessment criteria to be deemed acceptable for included the systematic review.

Conclusion: Physical therapists play an important role in mobility of patients in the ICU setting and may be involved in determining treatments to improve oxygenation in patients with COVID-19. Data consistently indicated that prone positioning may be an appropriate intervention to improve oxygenation in patients with respiratory failure due to COVID-19. Several articles indicated increased time in prone may lead to increase in improvements in oxygenation, but continued research is needed to determine the optimal time in prone. Due to the novelty of COVID-19, limited research participants, and low-level research study design, more studies on this topic are recommended.

Effects of Botulinum Toxin on Gait in Children with Cerebral Palsy: A Systematic Review

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Background: Cerebral palsy (CP) is the most common motor disability in children. Children with CP face ongoing challenges associated with impaired gait, partially due to varied levels of lower extremity (LE) spasticity. The benefits of botulinum toxin (BoNT) as a pharmacological intervention to decrease spasticity could potentially improve gait impairments in children with CP.

Objective: The purpose of this systematic review (SR) was to evaluate the effects of BoNT on gait in children with CP.

Methods: PubMed and Embase were searched on November 18, 2021 for randomized controlled trials or quasi-experimental studies with control that investigated the effectiveness of BoNT on gait in children with CP. Only studies published since 2011 were included in the current review. Risk of bias of the included studies was assessed with PEDro.

Results: Seven studies with a total number of 373 individuals with CP were included in this SR. The interventional group received BoNT injection in addition to routine care, while the control group only received routine care. Our findings revealed BoNT improved gait at 4-12 weeks following injection as compared to the control group ($p<0.05$) in 6 out of 7 studies. However, one study showed BoNT did not add to the clinical effectiveness of rehabilitation as compared to control ($p>0.05$). Side effects including local muscle weakness were noted in a small portion of participants. The

average PEDro score is 7.7/10, indicating good quality of the included studies.

Conclusion: BoNT could potentially improve ambulation in children with CP.

References:

1. Bax M, Goldstein M, Rosenbaum P, Leviton A, Paneth N, Dan B, Jacobsson B, Damiano D; Executive Committee for the Definition of Cerebral

   Palsy. (2005) Proposed definition and classification of cerebral palsy, April 2005. Dev Med Child Neurol 47: 571–576.

2. Delgado MR, Tilton A, Russman B, et al. AbobotulinumtoxinA for Equinus Foot Deformity in Cerebral Palsy: A Randomized Controlled Trial. Pediatrics. 2016;137(2):e20152830

The Benefits of Sit-To-Stand Desks in the Classroom: A Systematic Review

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BACKGROUND: Sedentation rates in students have been rising due to the introduction of new technology that keeps young students primarily stationary. Since students are in a school setting for at least half of the time that they are awake, the classroom would be an efficient and effective place to introduce a sit-to-stand desk to promote healthy behavior at an early age.

METHODS: The inclusion criteria included students who had availability to a sit-to-stand desk or participate in active standing in the classroom. Exclusion criteria excluded non-students, students using sit-to-stand desks prior to this study, and participants who were unable to sit-stand for half a day. PubMed and Embase databases were searched. The PRISMA was utilized to organize findings as well as the Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies to assign each article a quality rating with each one scoring either “fair” or “good.”

RESULTS: Eight articles met the inclusion criteria: four “good” ratings and four “fair” ratings on the Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies.

DISCUSSION AND CONCLUSION: These studies collectively showed that the implementation of sit-to-stand desks or standing breaks improved attentiveness, cardio metabolic health, and activity levels in the students while decreasing sedentary time and sitting durations as compared to the control group. The hope is that the implementation of sit-to-stand desks early in school aged children will have an increased carryover rate and decrease overall sedentary behavior that will progress throughout adulthood.

Session 6B: Bioethics

Dental Implant Treatment Decisions: Challenges and Opportunities

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Dental implants are implantable biomedical devices and they are being increasingly used in clinical dentistry as replacement options for missing teeth. With the advent of social media, advertising and the increase in word of mouth publicity, dental implant treatments have introduced several challenges including the ability of patients in understanding such therapies completely. Frequently the decision to invest time, money and resources can be a challenge for patients and their families. Additionally, the inability of patients to seldom reverse these treatment decisions following surgery can be mentally and physically problematic. The help of animation videos, physical models, decision trees and consent forms to assist patients navigate the complexities of undergoing surgery(s) can be useful tools. There are however several hurdles in introducing such tools including the level of training of clinician(s) and their support staff, the time required, the educational level of patients and the quality of the tools themselves. Since there does not exist a quantitative means to assess such tools from both a clinician and a patient perspective it is challenging to gauge their effectiveness. A subjective analysis of such quantitative data can be useful so that future generations of patients can be helped with their treatment decisions.

One Giant Leap---From the Lab to Commercial Success

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Research can be fun and interesting work especially if it is trying to solve a big problem. All research should have an underlying goal of helping humanity. If not, then why do it? Publication is often the end goal, but is anyone listening to the work? Why are virtually all innovations in medical devices started outside the U.S.? This talk will give some examples in the orthopaedic device world and other types of medical devices and explain the hidden hurdles involved in the U.S. that try to kill new ideas before they can take root. Why is it so difficult to go from the lab to a commercial setting? A big part of the reason is regulatory hurdles created by people who mean well but end of stifling the very innovation and better life everyone wants to see. Part of the reason is the timeline needed to make it happen and the limitations and cost of financing the effort.

For the uninitiated this talk will explain what the field of Regulatory Science and how important it is to humanity, to economics, and to the field of medicine.

Comparison of Device Manufacturing Industries Relation with Orthopaedic Hand Surgeons and Plastic Hand Surgeons

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Each year, the Open Payments Database (OPD) is made available by the Centers for Medicare & Medicaid Services (CMS), most recently on June 30, 2021. Using the OPD for the most recent year, 2020, the authors analyze and compare orthopedic hand surgery and plastic hand surgery interactions with device manufacturing industries. We analyzed payments in the OPD from January 1, 2014, to December 31, 2020. In our investigation, we analyzed the general payments data from the OPD's three databases (general payments, research payments, and ownership). We collected the physician's payment type, payment value, nature of payment (gift, education, lodging, food, etc.), and the state where the payment was received. A chi-square analysis will be conducted on the nature of the payment and the number of payments made in each category. The data will be extracted using Python coding and will be one of the first to utilize the entire raw data for the years 2014-2020. The median amount of payments received by orthopedic hand surgeons was $235.28 in 2014, with a mean of $4,571.35. In contrast, plastic hand surgeons received a median of $172.10 and a mean of $5,378.00. Surgeons are in a unique position in their interaction with the device manufacturing industries, which may benefit patient outcomes. The present data demonstrates significant variability between median payments made to orthopedic and plastic hand surgeons and the nature of payments made to each hand surgeon. Future policy decisions should center on ethical discussions within and around that subspecialty, so the industry surgeon relationship results in better management and care of patients.

Designing A Collaborative Course On Biomedical Ethics For Engineering Students

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Ethics is particularly important in multiple disciplines of engineering due to its direct and vital impact on the quality of life for all people. According to the National Society of Professional Engineers, the services provided by engineers require honesty, impartiality, fairness, and equity while protecting the public health, safety, and welfare. Students from multiple engineering disciplines are required to have an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments as specified by ABET student outcome 4. It has been observed that engineering students taking an ethics course offered under humanities are not actively engaged in the course due to the generalities of the coverage. The objective of this paper is to propose a new Biomedical Ethics course designed with specific examples of case histories applicable to engineering conducted in conjunction with active learning to enable enhanced student engagement and achieve the intended student learning outcomes.

The proposal for the new Biomedical Ethics course is based on a collaborative effort by three international faculty. The initial segment of the proposed course will cover the standard principles of ethics while dealing with ethical dilemmas related to safety, clinical trials, patient privacy, informed consent, conflict of interest, etc., from a general perspective. The remaining segment will involve selected case histories applied to the specific branch of engineering, such as interdisciplinary, biomedical, electrical engineering, and industrial engineering. The course is to keep the students fully engaged employing a debate type format to steer the students to visualize ethical issues from diverse points of view. The debating mode introduces active and healthy competition among students coupled with analysis, assessment and decision making when faced with real-life, discipline-specific ethical challenges. The recent pandemic highlighted the ethical concerns encountered by engineers from different disciplines. Based on the students' non-active engagement, the new course will employ active learning pedagogies. The proposed course will be offered by collaborating engineering at two universities,

In conclusion, the design of an innovative Biomedical Ethics course with engineering discipline-specific segments involving real-life ethics cases conducted with active learning pedagogies would enhance the interests and engagement of students and lead to better student learning outcomes.

Ethics and Experience of the Covid 19 Pandemic in a Division 1 Athletic Program

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More than 60,000 Covid 19 tests have been administered to 789 Clemson University athletes, Coaches, and Staff. Medical evaluation and treatment protocols were required for expert and ethical care for the athletic team. The procedures for testing and treatment along with outcomes will be reported.

Competition between schools with last minute decision making will be discussed. The importance of an independent medical staff will be presented. The ethical care of the athletes and staff of a Division 1 University during such unchartered events will be summarized

3D Printing of Bones and Nanotechnology: Ethical and Anticipated Ethical Issues

Richard Wilson

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It is common for people to break or lose bones due to both accidents and diseases. In order to treat medical problems

related to bones, doctors implant bone grafts or bits of bone tissue from a donor. These grafts and bone tissues can be held in place with wires and screws, while implants can help the body regenerate healthy bone structure.

Unfortunately, grafts and bone tissue implants have a number of difficulties. First, the bone graft must be cut to fit precisely where the old bone used to be. Second, if metal plates or scaffolding are inserted during surgery, they usually have to be surgically removed later on. Finally, for those missing a large amount of bone, such as in arms or legs, often the only option is to amputate the limb.

3D printed bone technologies could potentially change all of this by making the process more natural and convenient for the patient. Doctors would no longer have to take a bone graft from another bone or search for a bone donor: They could simply scan the area of the injury and employ nanomaterials to model the structure of the new bone.

With the ongoing development of technologies related to 3D scanning and modeling, and nanotechnology, every bone implant could be shaped precisely to the patient's bone. Speed of production also plays an important role when looking to save a limb, is another reason why 3D printing of bones provides a good candidate for a solution.

Once 3D printed, a bone can then be implanted into a patient. Ideally, the bone graft will dissolve as new bone grows, reducing the need for more surgery. Although such bones can be printed using compounds similar to natural bone, researchers are also looking into printing bones in other materials with special properties.

This analysis will examine the design, development of 3D Printing of Bones and the use of naotechnology in medical contexts and conclude with an Ethical and Anticipatory Ethical analysis of the issues related to the future development of 3D Printing of Bones in the medical domain.

Though I Walk Through the Valley of Death… Lessons Learned Through Development of a New Rehabilitation Device

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The so-called "Valley of Death" in product development refers to the funding gap often seen at the translational and early clinical development stages. The present abstract describes the author's experiences in the context of a new rehabilitation device for adults with post-stroke hemiparesis. The Differential Resistance Elliptical Exercise Machine (DREEM) is an adjustable, motorized elliptical machine that can vary resistive leg forces independently and control the loading of a user's limbs. In pursuit of commercialization, the author applied to the following programs and sponsors: NSF DARE - supports engineering research that improves quality of life for persons with disabilities [1]; NIH STTR - to stimulate technological innovation [2]; NSF PFI - technology translation of prior NSF-funded research projects [3]. Unfortunately, none of the submitted proposals were funded. Our low tech, low cost solution was sufficiently innovative to excite reviewers at NSF. Our failure to provide rigorous clinical evaluation strategies and lack of appropriate sample sizes led to poor reviews from the NIH. As funding is essential for the continuation of any project in academia, the likelihood of the DREEM machines passing out of the Valley of Death seems more and more unlikely.

References:

[1] https://beta.nsf.gov/funding/opportunities/disability-and-rehabilitation-engineering-dare-1.

[2]https://www.nigms.nih.gov/grants-and-funding/research-funding/small-business-research

[3] https://www.nsf.gov/pubs/2019/nsf19506/nsf19506.htm

Session 7A: Biomolecules/ design /synthesis/ evaluations

2'-Aminobiphenyl-2-Ols, and O-Trialkylsilyl and O-Triarylsilyl Oximes as Potential Inhibitors of Cutaneous Melanoma and Non-Melanoma Skin Cancer Cells

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The incidence of melanoma and nonmelanoma skin cancers (NMSC) worldwide is increasing at a faster pace, and this rise is undoubtably related to the increased exposure to ultraviolet (UV) light from the sun as a result of the continuous ozone layer depletion and prolonged outdoor activities. As such, melanoma and nonmelanoma skin cancers (NMSC) are believed to be the fastest growing and most prevalent types of cancer in white populations. In fact, a dose-dependent increase in the risk of cutaneous malignant melanoma and squamous cell carcinoma (SCC) was found to be associated with intensive UV exposure in childhood and adolescence, although epidemiological studies have shown that the majority of melanoma cases are caused, at least in part, by excessive exposure to sunlight, while squamous cell carcinoma is primarily associated with cumulative, but intermittent exposure to sunlight.1 As part of a continuous effort in our lab to uncover novel, safer and more effective chemotherapeutic agents against melanoma and nonmelanoma skin cancers, a series of 2'-aminobiphenyl-2-ols, and O-trialkylsilyl and O-triarylsilyl oximes designed and synthesized in our lab was screened in vitro against A375, SKMEL-28, A431, SCC-12 skin cancer cell lines, with the most potent compound displaying IC50s of 1.81 μM, 3.76 μM, and 2.97 μM against A375, SKMEL-28 and A431, respectively. Some of these compounds induced apoptosis of SCC-12 and SK-MEL-28 cells in a dose-dependent manner, as evidenced by the downregulation of Bcl-2 and upregulation of Bax protein expression levels, cleaved caspase-3, -9 and PARP levels. They also significantly

reduced scratch wound healing, colony formation, and activated expression levels of major cancer molecular targets such as RSK/AKT/ERK1/2,and S6K1. Preliminary in silico studies using the SwissADME web-tool indicated that these compounds displayed high GI tract absorption, good skin permeation, and a high biodegradable profile.

1. Leiter U., Garbe, C. Adv. Exp. Med. Biol. 2008, 624, 89-103.

Heterocyclic Anticancer Compounds: Synthesis and Biological Evaluation

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Abstract: Despite immense advances in the field of basic and clinical research, cancer remains one of the leading causes of death in the world. In the U.S., lung cancer is by far the leading cause of cancer-related death among both men and women. Similarly, skin cancers are also high-risk and aggressive type of cancers with a rising incidence of new cases with a high number of deaths. Although the treatment with Tyrosine Kinase Inhibitors (TKIs) has improved the outcomes for cancer patients, acquired resistance to TKIs causing the treatment failure. Challenges around multi-drug resistance, poor therapeutic efficacy, adverse side-effects and poor bioavailability necessitate the continued development of novel anti-cancer agents. Along those lines, we are working on synthesis and biological evaluation of five and six membered heterocyclic compounds as potential anticancer agents. We have recently identified a set of compounds exhibiting anticancer activity particularly towards non-small cell lung cancer (NSCLC), cutaneous melanoma cancer (CMCs) and non-melanoma cancer (NMC) cell lines with HaCaT keratinocytes as a control. In addition to that, we performed cell cycle analysis and obtained data from kinase profiling studies. Data from our synthetic approaches and biological assays will be presented.

New Derivatives of 1,3-dioxoisoindoline: Potential Breast Cancer Therapeutics that are S6K1 Inhibitors

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Currently, ~3.8 million women in the United States are diagnosed with breast cancer, the second leading cause of cancer related death in women. The correlation of the ribosomal protein S6 kinase 1 (S6K1) activity and breast cancer is evident from the amplification of S6K1 localized chromosomal region 17q23 in 20% of primary breast cancers. S6K1 is the principal kinase effector downstream of the PI3K/mTOR regulatory signaling pathway. Over-expression of S6K1 has been associated elevated proliferation rates in tumors, poor prognosis and an increased risk of local recurrence. S6K1 plays an important role in the progression of ER-positive (ER+) breast cancer, HER2 positive (HER2+) breast cancer and node-negative premenopausal breast cancer. Inhibition of this kinase can be beneficial for the treatment of several types of breast cancer. Our group has identified new molecules that are derivatives of 6-amido-4-aminoisoindoline-1,3-dione core structure as S6K1 inhibitors with low micromolar inhibition potency (IC50 = 2-5 μM). These compounds also inhibited the growth of HER2+ (SKBR3 and HER2Δ16), ER+ and triple negative breast cancer cells (MDA-MB-231 and MDA-MB-468) with a range of EC50 values (2 – 2000 μM). The EC50 values of growth inhibition of these compounds varied by the type of breast cancer cells and were in direct correlation with the expression levels of S6K1 in those cell lines. These results clearly indicate that high efficacy S6K1 inhibitors can function as potential therapeutics for multiple types of breast cancer. Future work involves in-vivo studies to understand the efficacy and pharmacokinetics of the three compounds.

Diastereoselective Aldol Reactions of N, N-Dialkylphenylacetamides towards the Synthesis of Building Blocks of Bioactive Compounds

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β-hydroxy-α-substituted carbonyl compounds are important synthetic precursors for several bioactive compounds. Stereo-controlled boron-mediated aldol reactions of esters such as acetates, propionates, trifluoropropionates, and phenylacetates are well explored in order to prepare synthetic precursors. However, such reactions of carboxylic acid amides are rarely studied. In the early report of boronmediated aldol reaction of tertiary amides, it was reported that a mixture of dialkylboron triflate and tertiary amine could not enolize unactivated or weakly activated carboxylic acid amides. As opposed to this report, we have successfully developed boron-mediated syn- and anti-selective aldol reactions of N, N-dialkylphenylacetamides. We will report the optimization of reaction conditions and progress in exploring the scope of this reaction.

Aryl-fused (Imidazole, Pyrazine and Pyrrole) Boronated Dye Derivatives

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This research encompasses the synthesize of new boron-based dyes, investigation of their photochemical and cellular properties for potential applications in fluorescence labelling and in bioimaging. The new dyes are expected to complement known BODIPYs (boron-dipyrromethenes) fluorophores which have been studied extensively, but absorb only in the visible region of the spectrum. The new proposed dyes are expected to absorb at UV-Vis, far-red or near-IR wavelengths which is an attractive property for deep tissue imaging since light penetration through body tissue is known to increase with increased wavelength. In vivo fluorescence helps the physician to avoid unnecessary cuts during surgery. The proposed aryl fused dimers are expected to display red-shifted absorptions and emissions and enhanced fluorescence compared with BODIPY dyes. Readily available synthetic materials and laser probes will be used in this investigation. To enhance cellular uptake, tumor cell selectivity, and

controlled cellular retention, we will meticulously choose the "R" group and substitute the boron center to functionalize the proposed dye with water-solubilizing PEG, sugars, sulfonic acid, quaternarium ammonium groups, or amino acids. Cell studies will be done using human HEp2 cells. Collaboration with Dr. Parkinson a computational chemist, at SELU predicted favorable HOMO-LUMO gaps and absorbance spectra that indicated possible high fluorescence quantum yields and triplet state life times of the dyes using theoretical DFT calculations. Each synthesized dye will be screened for cytotoxicity, thermal stability and photostability.

Fluorescent Dyes and Their Applications in Cell Imaging

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For precise imaging of the cells and cellular organelles, super-resolution microscopy has been used for some time. Fluorescent dye is an integral part of SR microscopy. Rhodamine dyes are relatively photo-resistive, with high quantum yield and extinction coefficient and ample possibility of structural modification for the biological taggings. Photoswitchable rhodamine spirolactam is suitable for SR microscopy. A series of spirolactams have been designed, synthesized, analyzed, and applied in the study of the cell surface of *Caulobacter crescentus.*

Session 7 B: Biomaterials II/Nanoparticles II

Bioengineered Surfaces Reduce Implant-related Infections

Bingyun Li, PhD,

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The invention and use of antibiotics are given credit for the significant reduction of infections and saving millions of lives. However, the wide use of antibiotics has also created the latest big challenge inpatient care, i.e., antibiotic resistant bacteria, which have been increasing in recent decades .Besides antibiotic resistance, infection treatments face other challenges including biofilm formation, intra-cellular infection, delayed wound healing, etc. The recentCOVID-19 has further reminded us of the challenges in dealing with infections. In this presentation, a variety of biomedical engineering approaches is developed to modify implant surfaces. Biomaterials that tune the host's immune response against implant-related infections will be presented, and a few nanotechnology approaches will be discussed.

New Development in Mesoporous Materials for Drug Delivery

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Mesoporous materials have experienced impressive consideration in drug delivery due to the possibility of tuning the physicochemical properties of the matrices and easy grafting of biomolecules and stimuli-sensitive technology. The structural advantages of those materials provide excellent drug-loading capacity with controlled release. We have used laboratory-designed macromolecules to tune the structural properties of mesoporous materials. Spherical micelles of the asymmetric triblock copolymer are used as templates and structure-directing agents. The presence of porogen, reactive block, and stabilizer in a single micelle makes the method unique to synthesize numerous compositions that are difficult for the formation of mesoporous structures. We will discuss the use of a silica-based drug delivery system including, controlled release, targeting, and tracking abilities.

Engineering Antioxidant and Oxygen-Releasing Lignin Composites to Accelerate Wound Healing

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High amounts of reactive oxygen species (ROS) at the affected site hamper vascularization. Thus, this oxidative stress increases inflammation and scarring in the wound. Novel engineered biomaterials that scavenge ROS and facilitate the controlled released of oxygen into the wound can increase cellular infiltration and promote anti-inflammatory signals to the wounded microenvironments. It is hypothesized that the application of lignin, a natural antioxidant from lignocellulose, in composites with ROS-scavenging and oxygen-releasing properties will enhance neovascularization and attenuate inflammation to promote wound healing. To achieve locoregional oxygenation and antioxidation in the wounds, we developed injectable lignin composites and assessed the enhancement of vascularization and wound healing responses in wild type (WT) C57BL/6N mice. The lignin composites developed in our laboratory showed the capability of 1) incorporating CaO_2 in nanoparticle (NPs) of lignin (termed CPO), 2) maintenance of oxygen release for at least 7 days, 3) shear thinning properties of lignin composite precursors, which enables the injection of lignin composites to the site of wounds and 4) modulating mechanical properties by incorporating CPO NPs. In animal experiments, wound vascularity was promoted by the lignin composite with CPO NPs as evidenced by increased $CD31^+$ endothelial cells and vessel formation at day 7. The oxygen release and antioxidation capacity of the lignin composite improved wound healing associated with enhanced neovascularization, representing new frontiers in potentially attenuating fibrosis and improving wound healing by injectable, engineered biomaterials.

Lignin Composites with Sustained Oxygenation and Antioxidant Properties Improve Neovascularization and Healing of Diabetic Wounds

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Non-healing diabetic wounds are characterized by impaired neovascularization, increased levels of reactive oxygen species (ROS), chronic low-grade inflammation and hypoxia which disrupt mechanisms of wound healing. We engineered novel lignin-based composites with ROS-scavenging and oxygen-releasing properties and hypothesized that they enhance neovascularization and attenuate inflammation to promote diabetic wound healing. Thiolated lignosulfonate (TLS) was covalently conjugated to methacrylated gelatin to form injectable hydrogels, and sodium lignosulfonate (SLS) nanoparticles encapsulating calcium peroxide (CPO) were added for sustained oxygen release. The dual function of CPO-lignin composites promoted endothelial cell branching and their reorganization into capillary-like network formation and corrected high glucose-induced changes in their VEGF and HIF1-α expression *in vitro*. When applied to skin wounds in wildtype (C57BL/6N) and diabetic (db/db) mice, CPO-lignin composites promoted granulation tissue and $CD31^+$ capillary lumen formation at d7. Interestingly, in db/db wounds, CPO-lignin treatment decreased HIF-1α expression and macrophage infiltration. We also noted reduced VEGF staining in the hyperproliferative leading epidermis of the wounds at d7, but quantification of VEGF in the homogenized wound tissue using immunoblotting showed an increase at d7, suggesting dermal angiogenesis is promoted by CPO-lignin composites in diabetic wounds. Wound analysis at later times points showed visibly improved healing, supported by the presence of a robust granulating wound bed, along with an increase in the $CD31^+$ lumens noted at d14 in the db/db wounds and reduced scarring noted at day 30 in wildtype mice, suggesting CPO-lignin promotes better remodeling. In conclusion, our data showed that the engineered lignin biomaterials with multiple wound healing-promotive functions, including pro-angiogenic, sustained oxygenation and ROS–scavenging properties can synergistically correct diabetes-associated cell and wound microenvironmental impairments to promote wound healing.

Characterization of Polycaprolactone and Zinc Composite Nanofiber for Biomedical Applications

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Composite nanofibers have been excessively explored as supporting scaffolds in most biomedical applications such as drug delivery and tissue regeneration. A wide range of biological, synthetic and hybrid polymers, and metal and ceramic particles have been used to design composite scaffolds with desirable biological, physical, and chemical properties. Polycaprolactone, a synthetic polymer has been used extensively as an implantable biomaterial because, it is biocompatible, biodegradable and has a good mechanical strength. Zinc (Zn), a biodegradable mineral exhibits superb in vivo biocompatibility, and capable of releasing Zn ions during degradation which has been proven to enhance healing of damaged tissue but can be toxic when released in excess in the body. A PCL-Zn composite fiber with complimentary shared properties can be designed for biomedical application. In this study, PCL-Zn composite nanofibers with various composition ratios were produced using electrospinning technique. The composite electrospun fibers were characterized using Scanning Electron Microscope (SEM) for the surface morphology, uniaxial testing machine (Instron) for tensile mechanical properties, X-ray diffraction (XRD) and Differential Scanning Calorimetry (DSC) for crystalline properties. 3T3 fibroblast cells and HUVECs Cells will be cultured parallelly on fibers for cell viability or response and cytotoxicity study.

The Mechanobiology of Neutrophil Extracellular Traps

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Introduction: Under certain conditions, neutrophils can release DNA into their surroundings, forming protein web structures called Neutrophil Extracellular Traps (NETs). NETs can trap circulating foreign bodies and have been implicated in a wide variety of homeostatic and pathogenic disease processes, including tumor progression. However, the mechanisms by which NETs mediate cellular activity in the surrounding tissues remains unclear. Mechanical rigidity of the cellular microenvironment plays an important role in affecting cellular function and mediating the transition from healthy to diseased states. Here, we hypothesize that the formation of NETs within 3D extracellular matrices (ECM) during disease progression can stiffen tissues sufficiently to induce biological effects related to tumor growth and progression.
Materials and Methods: Human neutrophils were isolated from the whole blood of healthy donors. Where applicable, NET formation was stimulated with 500 nM phorbol 12-myristate 13-acetate (PMA), and labelled with 5 μM sytox orange. NET morphology was evaluated in various ECM (type-I bovine collagen, 3% ionically-crosslinked alginate), and tissue stiffness was measuring using optical magnetic twisting cytometry. Rates of NET formation were calculated based on morphological analysis of fluorescent labels. Assays for cancer invasion were conducted using MDA-MB-231 spheroids embedded in collagen; and collagen contraction assays were conducted in collagen microdroplets laden with 5×10^6 /mL HS-5 fibroblasts, each with varying NET content.
Results and Discussion: NET morphology was distinct based on characteristics of the surrounding matrix (Fig 1A). Stiffer 3D ECM with smaller pore sizes limited extrusion, particularly compared to unfettered extrusion on 2D surfaces. Mechanical characterization of the NET-laden tissues reveals that when neutrophils are loaded into collagen gels at 3×10^5 cells/mL and stimulated with PMA, the NETs increase the rigidity of collagen gel by ~200% (Fig 1B). Since such changes in tissue rigidity are known to be sufficiently large to induce invasive cancer migration in other systems, we cultured cancer spheroids and embedded them in collagen. In the NETs-induced stiffer collagen matrices, cancer cells invaded into the surrounding ECM, while the spheroids remained stable in the presence of

neutrophils alone, or when treated with 1μM ROCK inhibitor (Fig 1C). These results demonstrate that elevated stiffness caused by NET accumulation may be sufficient to trigger certain cancer phenotypes. To further demonstrate the potential biomechanical role of NETs in 3D tissues, we conducted a collagen contraction assay to determine whether increased stiffness could limit tissue contraction. As expected, increasing presence of NETs decreased the amount by which the gel contracts, and this effect is abrogated by using neutrophil elastase inhibitor (NEI) to degrade any NETs that are formed. Interestingly, the most mechanically-enhanced collagen gels demonstrated contraction only along the outer periphery of the gel, suggesting that tissue densification during contraction further limits the ability of the gel to remodel.

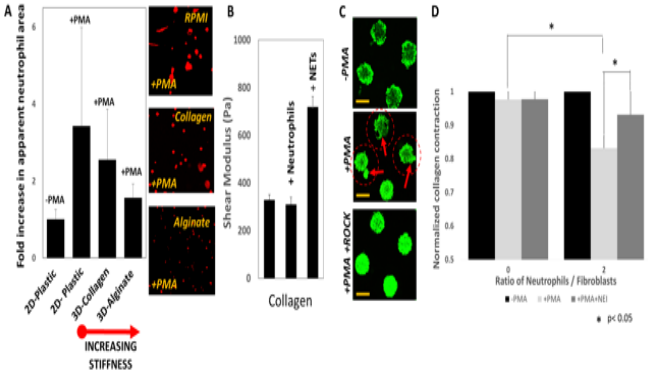

Figure 1: (a) Comparison of NETs extrusion under different ECM stiffnesses (b) OMTC measurements for collagen with and without stimulated neutrophils. (c) Increased 24h migration (indicated) of metastatic MDAMB231 cells into the surrounding NETs laden collagen matrix (scale bar 250□m) (d) Results of collagen contraction for varying ratios of stimulated neutrophils to fibroblasts

Conclusions: Our results suggest a novel modality by which NETs alter biological function, based on mechanical stiffening of tissues. We demonstrate the potential impact of this mechanism in cancer invasion and collagen contraction. Since NETs can accumulate in tissues over time, and given the relatively high concentrations of stimulated neutrophils required to observe these phenotypic differences, these findings may also contribute towards understanding the relationship between mechanics, chronic inflammation and disease progression.

Topical BCL-2/BCL-Xl Inhibitor Reverses Bleomycin-Induced Skin Fibrosis

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Pathological fibrosis is distinguished from physiological wound healing by persistent myofibroblast activation, suggesting that therapies that induce myofibroblast apoptosis selectively could prevent progression and potentially reverse the established fibrosis, such as for scleroderma (a heterogeneous autoimmune disease characterized by multi-organ fibrosis). Navitoclax (NAVI) is a BCL-2/BCL-xL inhibitor with anti-fibrotic properties and has been investigated as a therapeutic for skin fibrosis. NAVI makes myofibroblasts particularly vulnerable to apoptosis. However, despite NAVI's significant potency, its clinical use is limited due to the risk of thrombocytopenia it poses. Therefore, in this work we utilized a newly developed ionic liquid formulation of NAVI for direct topical application to skin fibroblasts, thereby avoiding systemic circulation and off-target effects. The ionic liquid composed of octanoic acid and choline bicarbonate (COA) exerts its effect by increasing the skin pore size and allowing its payload to cross the skin barriers. Therapeutic inhibition of BCL-xL by NAVI results in myofibroblast death and effectively cures pre-existing fibrosis, as demonstrated in a scleroderma mouse model. Overall, our findings elucidate that topical delivery of NAVI inhibits anti-apoptotic proteins BCL-2/BCL-xL in myofibroblasts, with minimal presence of the drug in the systemic circulation, resulting in an accelerated therapeutic effect with no discernible drug-associated toxicity

Session 8A: Orthopaedics/Biomechanics II

Keynote

Reconstruction Of Bone Defects Using Novel Bioscaffolds: Concepts And Results In Animal Models

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Bone defects are important clinical complications which are currently managed by use of autologous bone grafts, cadaveric bone paste and biologic materials. These approaches have several limitations which may be overcome by bioscaffolds which can be 3D-printed and 3D-sculpted to patient specific contours. These appliances can also accommodate living stem cells which may encourage healing. We used two animal models of bone reconstruction in rabbits (n=3) and macaques (n=4) in which 3D printed glutaraldehyde cross-linked polyvinyl alcohol (PVA) matrices were implanted within the cranium either without modifications or after seeding with human placental stem cells or stem cells plus halloysite nanotubes. After seeding with cells, these implants were frozen and cryo-sculpted to fit within surgically created cranial bone defects. These implants were allowed to heal and tissues harvested to examine and compare success and extent of bone repair. We found that these bioscaffolds were well tolerated and produced neither infection or inflammation. Tissue healing was measured by CT, dexascan bone density, and histopathology to evaluate mineralization and wound closure. In rabbits, we observed that compared to blank (no implant), non-modified implants showed similar bone density whereas stem cell and stem cell/halloysite were less dense. Bone Inserts have been successfully acid demineralized and sectioned with differentiation studies ongoing in vitro and vascularization

and osteogenesis being evaluated in vivo. 3D printed PVA matrices represent a novel, customizable and well-tolerated platform for bone reconstruction.

Noninvasive Shape-Fitting Method Quantifies Cam Morphology In Femoroacetabular Impingement Syndrome: Implications For Diagnosis And Surgical Planning

Martina Guidetti[1], Philip Malloy[1,2], Alexander C. Newhouse[1], Thomas D. Alter[1], Shane J. Nho[1], Alejandro A. Espinoza Orías[1]

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There are considerable limitations associated with the standard 2D imaging currently used for diagnosis and surgical planning of cam type femoro-acetabular impingement syndrome (FAIS). The aim of this study was to determine the accuracy of a patient-specific shape-fitting method that quantifies cam morphology in 3D based on preoperative MRI imaging. Preoperative and postoperative 1.5T MRI scans were acquired on n=15 patients to generate 3D models of the proximal femur, in turn used to create actual and virtual cam. Actual cams, used as reference, were reconstructed by subtracting postoperative from preoperative 3D model. Virtual cams were generated by subtracting preoperative 3D model and virtual shape template produced with the shape-fitting method. The shape-fitting method steps included 3 steps: landmark identification, shape fitting of known shapes to femoral head and neck, and smoothing of the Boolean union of the fitted shapes to obtain the virtual shape template. We tested the accuracy of the shape-fitting method by evaluating the agreement of height, surface area, and volume quantifying virtual and actual cams. Accuracy of the shape-fitting method demonstrated a 97.8% average level of agreement between these metrics. The shape-fitting technique is a non-invasive and patient-specific tool for the quantification and localization of cam morphology.

Author Disclosure Information: M.G., A.C.N., T.D.A., P.M., A.A.E.O. (N) S.J.N. (CONMED Linvatec, OSSÜR, Allosource, Arthrex, DJ Orthopaedics, Athletico, Miomed, Smith & Nephew, Stryker)

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Relationship Between Number of Screws and Density in Anterior Lumbar Interbody Fusion

Dies Ross[1], Andrew S Zhang[1], Milan Mody[2], Mathew Root[1], Trevor Carroll[1], and Giovanni F Solitro[1]

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Anterior lumbar interbody fusion (ALIF) constitutes 16% of all LIFs in the US. The use of integrated screws is attractive to surgeons because of the ease of implantation and no additional profile. However, the number of screws necessary for safe and stable implantation in various bone densities is not yet fully understood. Bone surrogates were tested through two rigid fixtures connected to the Instron 8872 (Norwood, MA) testing machine. The fixtures were free to rotate around the transverse axis while the superior fixture was displaced axially at 10mm/min until failure of the construct was exhibited as a 90% reduction of applied load. Mechanical testing data was acquired at a frequency of 100 Hz and every 2N increments. Force peak values were recorded as Failure loads and analyzed using Two-way ANOVA for differences among all the groups while T-Test was used for specific differences. Level of significance was set at 0.05. The recorded values ranged from 368N±31 for the highest density with four screws to the values of 65N±8 for the low-density surrogate implanted with only two screws. The failure load of the construct was influenced by the number of screws ($p<0.01$) and density ($p=0.01$).

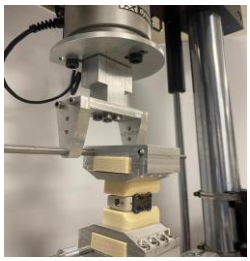

Figure 1: Experimental apparatus

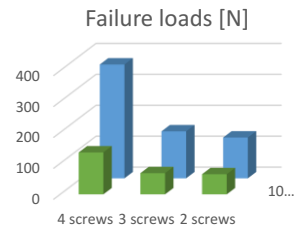

Figure 2: Recorded failure loads

Pin Hole Defect Osteogenic Response to Distal Screw Configuration

Jorge Guzman[1], Giovanni F. Solitro[2], Patrick Massey[2], Wayne Scalisi[2], and Francesco Travascio[1,3]

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High energy complex poly-trauma tibia fractures are often stabilized with provisional fixator prior to surgical permanent fixation in order to allow for surrounding soft tissue to heal. This mitigates complications of infection, but presents its own unique complications. When removing the provisional stabilizer, pin hole defects are left in the bone. These defects may cause decrease in bone strength which weaken the bone and may cause stress fractures.

A previously validated 3D model of a generic tibia with a diaphyseal fracture in the medial portion of the bone was utilized and pin hole defects made in the distal portion. The definitive fixation consists of plating with screws. The most distal screw configurations were investigated to assess the impact on the pin-hole osteogenesis. Finite element simulations were done that placed physiological loading conditions on the tibia in order to assess the stress transmitted to the defects. The study revealed that bridging pin holes between two screws decreases the osteogenic response by an average difference of 36.3% throughout the weeks studied. Use of unicrotical vs bicortical distal screw had no significant

impact on the osteogenic response of the pin hole with an average difference of 1.62%. While the type of distal screw seems to be insignificant to pin hole healing, bridging of the pin tracks did impart a difference.

Resistance to Impact of Osteochondral Autografts In Relation To Their Harvesting Region

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One successful treatment option for cartilage tears in the knee is osteochondral autograft transfer (OAT). A cylinder plug of bone and cartilage is removed from a donor region and impacted into a recipient region. When impacting the donor plug, the cartilage can crack or fracture if impacting with significant force. The purpose of this study was to analyze the different OAT donor regions and determine which regions are more resilient to impaction fracture. Four donor regions were tested including the lateral trochlea (LT), medial trochlea (MT), lateral intercondylar notch (LIN), and medial intercondylar notch (MIN). Five plugs were harvested on each region of each knee for a total of 160 plugs, using a 6mm OAT harvest kit (Arthrex, Naples, FL). OAT plugs were impacted into a 6mm cylinder hole which had been created in a sawbones bone surrogate block. The cartilage of each plug was examined and marked as either in tact or cracked. A chi-square was used to compare the rate of cartilage fracture for each region. The rate of cartilage fracture for the 4 donor regions was 46 %. The specific regions had a fracture rate of 40%, 62.5%, 28% and 52.5% for the LIN, MIN, LT, and MT, respectively. There was a difference in the rate of fracture with the LIN and LT having the lowest risk of fracture (p=.01). In light of our findings, for OAT surgery, in harvesting plugs, priority should be given to the two identified regions since they are more resilient to damage during impaction.

Mechanical Testing A Novel, Low-Cost, All-Suture Anchor

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In the United States, the cost of medical supplies for a procedure (suture, implants, dressings) is covered in part by the insurance company. In other countries, a patient must purchase their own medical supplies for the procedure ahead of time. One such example are suture anchors. Suture anchors are used to reattach tendons or ligaments to bone following an injury. There are many suture anchor options in use for orthopaedic surgery and they are all expensive. A low-cost option would make this type of surgery more accessible to patients around the world. Using four stitches, 2.0 braided polyblend suture was passed through a 2.5cm long piece of Mersilene tape. The four stitches were repeated so that there were two loose ends of suture on either end of the tape. Different densities of saw bones blocks were cut to fit in a custom fixture. Suture anchors were deployed in the synthetic bone blocks by predrilling a 0.1065" pilot hole, placing the anchor inside, and gently pulling on the four ends of suture to bunch up the Mersilene tape. The block was subsequently placed in a custom fixture and the suture ends were hand tied around the end of the load cell on an Instron testing machine. Sutures were pulled at 90° to secure the anchor and was then uniaxially loaded to failure. Failure of the anchor system occurred at 220N, which is higher than reported failure of commercially available anchors in bone. Further examination revealed that the suture tore through the Mersilene tape. This alternate soft anchor may be a viable option for those in need of a low-cost option, but further material options, deployment techniques, and loading angles must be explored before cadaveric testing is done.

Changes To Rotator Cuff Muscle Length During Abduction After Superior Capsular Recontstruction (Scr) And Reverse Total Shoulder Arthroplasty (RTSA)

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The rotator cuff (RC) is a group of four muscles that helps maintain dynamic stability of the glenohumeral joint and provides force rotation of the shoulder[1]. Rotator cuff tears are a common injury that may result in pain and limited joint stability[1]. Superior capsular reconstruction (SCR) and reverse total shoulder arthroplasty (rTSA) are two popular treatment options for complete RC tears that can improve abduction strength and mobility[2,3]. The change in muscle length, or excursion, during joint rotation can be used to assess muscle function[4]. The goal of this study is to measure muscle excursion during shoulder abduction in SCR/rTSA repaired shoulders to demonstrate their biomechanical contributions during limb movement after surgery. The experiment was performed using an apparatus to abduct six cadaveric shoulders under three conditions: intact, SCR, and rTSA. Digital points were tracked at muscle origin and insertion to calculate muscle length. While the supraspinatus no longer contributes to abduction after rTSA, our results showed significantly greater values of theoretical excursion compared to the intact shoulder which is in line with the inferior-medial shift of the glenohumeral joint center of

rotation produced after rTSA ($p<0.05$). Teres minor showed no significant differences in excursion between conditions, while subscapularis excursion was significantly smaller after SCR ($p<0.05$). For infraspinatus, both rTSA and SCR produced significantly smaller excursions ($p<0.05$). Significantly lower values of excursion could suggest that the muscle was utilized more as a stabilizer. These results may be important for evaluating RC performance after surgical repair.

References:

1. Bedi A, Dines J, Warren RF, Dines DM. Massive tears of the rotator cuff. *J Bone Jt Surg - Ser A*. Published online 2010. doi:10.2106/JBJS.I.01531
2. Oh JH, Park MS, Rhee SM. Treatment strategy for irreparable rotator cuff tears. *CiOS Clin Orthop Surg*. Published online 2018. doi:10.4055/cios.2018.10.2.119
3. Rybalko D, Bobko A, Amirouche F, et al. Biomechanical effects of superior capsular reconstruction in a rotator cuff–deficient shoulder: a cadaveric study. *J Shoulder Elb Surg*. Published online 2020. doi:10.1016/j.jse.2020.03.007
4. Ward SR, Hentzen ER, Smallwood LH, et al. Rotator cuff muscle architecture: Implications for glenohumeral stability. *Clin Orthop Relat Res*. Published online 2006. doi:10.1097/01.blo.0000194680.94882.d3

Biomaterials in Small Joint Surface Replacement Arthroplasty

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Small joint arthroplasty has been around since the early 1940s. Still, despite the advances in biomaterials and implant designs, the outcomes have not translated to the success seen in hip and knee replacement surgery. Advances in biomaterials have led to implant designs incorporating both metal and nonmetal alloys such as ceramics, titanium, cobalt-chromium, pyro-carbon, silicone polymers, and UHMWPE (ultrahigh-molecular-weight polyethylene). Some bio-compatible materials such as titanium, integrate readily with bone but may not serve as an ideal articulation surface. Others, such as silicone, release particulate debris that may cause inflammatory reactions.

Newer biomaterials such as pyrocarbons introduced in the recent decades have excellent wear properties but show

poor bone integration. While a metacarpophalangeal joint surface replacement has shown promising outcomes, proximal interphalangeal joint surface replacement is still associated with complications as high as 40-60%. Continued advances in implant designs and biomaterials for replicating the complex biomechanics of the small joints in hand may, over time, achieve the success seen in large joint replacements such as hip and knee. In this literature review, we will discuss ongoing advances and the future of small joint replacement in hand surgery.

Effect of Lasso Suture Orientation on Stability of Type 2 Regan-Morrey Coronoid Fractures

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Purpose: The Terrible Triad of the elbow is a constellation of elbow dislocation, radial head fracture, and coronoid process fracture. The most common type of coronoid fracture documented with this triad is type II Regan-Morrey coronoid fractures. Preferred reduction method for this fracture type is the lasso technique, medial-lateral tunnel orientation being the gold standard. Considering elbow anatomy, we saw an opportunity to potentially improve reduction outcomes by altering the tunnel orientation to a proximal-distal orientation.

Method: A type 2 Regan-Morrey fracture was created in 12 fresh frozen cadaveric elbows at 50% of the coronoid height using an oscillating saw. The humero-ulnar joint was placed in 0 degrees flexion then loaded at a rate of 10 mm/min to failure.

Results: The control technique (medio-lateral tunnels) showed failure load of 150±81N that was not significantly different ($p=0.825$) than the 134±116N measured for the modified technique (distal-proximal tunnels). The portion of the load-displacement curve used to calculate stiffness was linear ($R^2 = 0.94±0.04$) with determination coefficients that did not differ between the two groups ($p=0.351$). For stiffness, we measured 17±13N/mm and 14±12 N/mm respectively for control and modified techniques that did not result in a significant difference ($p =0.674$).

Conclusion: In this first attempt to improve the shortcomings of the lasso technique, we found that changing from medio-lateral to proximal-distal drilling directions did not result in an appreciable biomechanical benefit.

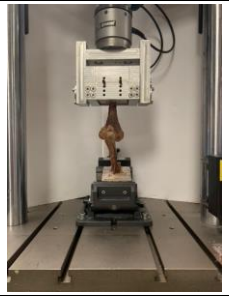

Fig. 1: Experimental setup

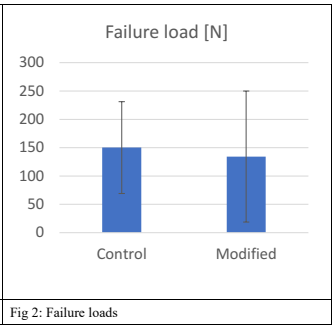

Fig 2: Failure loads

Smart Orthopedic Implants via Integrated Self-Sensing Piezoelectrics

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Millions of Americans are living with joint replacements; and with the aging population and rise of obesity, more and more people need orthopedic implant seach year. While arthroplasty is generally successful and helps alleviate pain and return joint function, implants sometimes fail. With current failure rates of total hip and total knee arthroplasty around 4% and 7.6%, respectively, there is a need to improve implant design and surgical techniques to increase the success rate of joint replacement surgery. The most common failure modes include instability, aseptic loosening, and infection. With a focus on instability and aseptic loosening in total knee arthroplasty (TKA), the orthopedic community currently hypothesizes that compartmental force balance is a key attribute to successful operations. While compartmental balance can be assessed intraoperatively via commercial intraoperative sensing systems, no commercial device exists for in vivo postoperative sensing of forces in the replaced joint to monitor for instability. Similarly, there is no commercial device for in vivo monitoring of aseptic loosening of the cemented interface. The focus of this work is two-fold: to integrate piezoelectric transducers into the polyethylene tibial bearing for self-powered compartmental force and contact point sensing, and to investigate bio-piezoelectric nanocomposite bone cement for self-sensing of aseptic loosening. First, a summary of our past work on compartmental force and contact point sensing with embedded piezoelectric transducers in TKAis presented. Then, details of our current work on fabricating and evaluating bio-nanocomposite bone cement are discussed. Finally, future research directions are provided.

Session 8B: Innovative Devices and Drug Delivery

Application of Artificial Intelligence in Recent Anti-Cancer Drug Discovery, Purification, and Structural Elucidation

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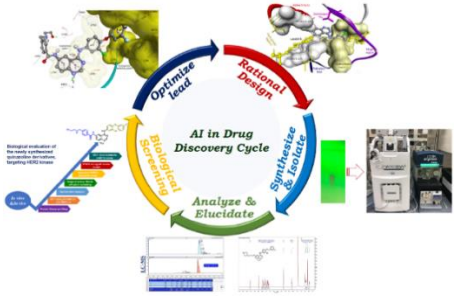
Artificial intelligence (AI) for drug discovery combines human and machine intelligence to tackle the major challenge of identifying novel molecule for a specific target. AI's primary goal is to minimize the overall time required in the drug discovery process. Currently, AI in the drug discovery and healthcare infrastructure market is rising globally from $0.36 billion in 2020 to $0.47 billion in 2021 at a compound annual growth rate (CAGR) of 30.6% and is projected to reach $1.69 billion in 2025 with considerable CAGR of 38%. Utilizing the most recent AI-based technologies will not only speed up the time required for the products to come to the market but will also improve the quality and the overall safety of the of pharmaceutical products along with being cost-effective.

AI for drug discovery can be intensively applied at various steps between drug designing to drug screening including **1**) Rational drug design: for prediction of 3D structure of target protein, drug-receptor interaction, de novo drug design, and prediction of potential drug activity. **2**) Chemical synthesis: AI can not only expedite for hassle-free hit-to-lead compound discovery, but also offer the synthetic/retrosynthetic routes of these molecules with structural elucidation, with follow-up reactions. In addition to, understanding of drug–target interactions, structure-activity relationship (SAR) of the identified structures, and developing reaction mechanism. **3**) Drug screening of small molecules: prediction of physicochemical, ADME and toxicology, and screening of compound libraries for efficacy against specific targets.

Employing the above strategies made significant strides in drug discovery, thus the biotech pharmaceutical companies utilizing an AI-first approach, are currently developing more than 150 small-molecule drugs, of which 15 are in clinical trials.



Engineered Tyrosine Kinase Receptor Dimers As A Drug Discovery Tool

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Bioengineered models that mimic natural systems are used to simplify and facilitate studying complex functions in controlled environments. One of the major bioengineering applications is the design of proteins with specific modified characteristics such as improved stability or enhanced catalytic properties. Tyrosine kinase receptors like the Human Epidermal growth factor Receptors (HERs) are implicated in a multitude of human pathogenesis related to cellular signaling. They are clinically validated targets that are common in aggressive types of cancers. The receptor response is mediated through a critical dimerization step necessary to activate the intracellular kinase domain (KD) and initiate signaling. This step is challenging to replicate *in-vitro*, which complicates drug discovery efforts. Allosteric

inhibitors that bind at the KD dimer interface have the potential to prevent dimerization and may lead to a novel class of small molecules that act allosterically as protein–protein inhibitors. Our lab has developed an *in-vitro* model of an artificial HER-KD receptor capable of spontaneous dimerization in solution through protein engineering. The model was capable of mimicking *in-vivo* receptor activation and response to known clinical inhibitors. The advantage of the model to identify allosteric compounds that bind at HERs dimer interface will be discussed.

Lessons learned monitoring zebrafish movement in response to drug applications.

Brent Bill

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Zebrafish, *Danio rerio*, have been developed as a prominent genetic and behavioral model. It has received attention due to it potential as a high-throughput drug screening tool generally by using a single behavioral assay to assess large numbers of small molecules. By contrast, we have decided to look at fewer drugs, but at multiple levels of data acquisition by implementing both larval and adult behavioral assays from the literature. Specifically, we focused on swimming behavior to assess drug sensitization, novel tank (anxiety), drug withdrawal, movement coordination, and activity levels. We capture videos of the behaviors using off-the-shelf webcams and a high-speed camera. The videos are scored either manually or with Ethovision, a motion tracking software. I will describe our successes and failures to implement the behavioral regime to assess drugs for nicotine cessation therapies and Parkinson's Disease. Our goal is to establish an equivalent construct validity to current mammalian models.

Evaluation Of Pain Drug By Mechanical And Thermal Response

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Pain is a symptom of many disorders. It complicates medical treatment due to having other disease conditions which increase the cost of medical treatment. Pain also hinders people's ability to work and function in society. Level of pain is also important because it is related to level of patient's discomfort. Therefore, pain management is a necessary step to develop a new pain drug. Nociceptive behavior assay in animal model is a method of choice to evaluate pain drug on the basis of mechanical and thermal allodynia response. The mechanical pain response was measured by von-Frey filament test which quantify allodynia response to noxious mechanical sensitivity. On the other hand, thermal allodynia response was measured by hot plate and tail flick test. In both test, animal behavior was observed by their licking, jumping, paw withdrawal. The sensory neuron at the skin can recognize the inflammation due to injury or extreme temperature or pressure without injury. In both circumstances, animal showed painful response which is main parameter to evaluate the new pain drug. Therefore, the von-Frey and hot plate – tail flick are the most appropriate nociceptive assessment behavior tool to develop a pain drug.

New Insights Into The Utility Of Exosomes As Biomarkers And Drug Delivery Vehicles

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Small extracellular vesicles (exosomes) are nano-membrane vesicles released to the extracellular fluids by various cell types at normal and pathophysiological conditions. Exosomes transfer their cargo of bioactive molecules such as mRNA, non-coding RNA, DNA, proteins, and lipids, to the target cells. These microvesicles serve as key regulators for multiple cellular processes, including cancer progression and metastasis. Hence, exosomes isolated from blood, urine, milk or saliva can be used as predictive diagnostic and prognostic tumor biomarkers. Here, we will discuss the major obstacles that hampered the clinical utilities of exosomes as biomarkers and drug-targeted delivery system. One of these obstacles is the inconsistency of isolation and characterization of exosomes. As a key element in supporting tumor growth and metastasis, exosomes have emerged as a challenge in the treatment of cancer disease by promoting drug resistance, angiogenesis, and metastasis. In addition, elucidating the molecular mechanisms of tumor microenvironment reprogrammed by exosomes draws more attention for development of new and effective therapeutic interventions. Given that exosomes have proven as an efficient delivery vehicle to target cells, natural or modified exosomes are used to specifically deliver therapeutic cargo for treatment of various cancer types**.**

Innovative Drug Application System For Medium-Throughput Screening Using Two-Electrode Voltage-Clamp Recording.

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Two-electrode voltage-clamp (TEVC) recording offers an initial step to demonstrate the effect of new drug candidates on transmembrane electrical activity and identify drugs that selectively target ion channels. TEVC recording from *Xenopus* oocytes expressing an ion channel molecular target is relatively easy, quick, and requires minimal use of equipment and animals. The large size of Xenopus oocytes enables a high expression level of the intended ion channels via cRNA injection and large whole-cell macroscopic currents (in the microampere range) upon drug application. However, a major limitation of current TEVC systems is the lack of efficient drug application system. This talk will cover

our collaborative interdisciplinary efforts to design, prototype, and test a multichannel, remotely operated TEVC drug exchange system. The proposed system will allow accurate drug application, rapid drug/drug and drug/buffer exchanges, avoid unnecessarily prolonged drug application and subsequent ion channel desensitization, and minimize space and technical requirements compared to the currently used drug application apparatus.

Utilizing EMG and Eye Tracking For Serious Game Control For Populations With Neurodegenerative Diseases

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As the prevalence of neurodegenerative diseases has risen, the impact of ALS is now approximately 5.2 per 100,000 and Parkinson's 572 per 100,000 in the population [2, 6, 7].

Characteristic changes to patients with neurodegenerative diseases includes changes to motor control, cognitive symptoms, or both [3]. Symptoms that alter motor control can make traditional gaming experiences and controllers inaccessible [4]. Advancement in accessibility for gaming have allowed users to gain autonomy in gaming and can be used to train for outcomes in everyday life.

For this research a serious game was developed, which utilizes eye tracking to visually select menu controls in concert with electromyography sensors for gameplay control to simulate and train the control of a novel EMG powered wheelchair device. By providing an accessible interface, patients experience greater autonomy in more aspects of their life. Improvements in autonomy are correlated to improvement in overall quality of life [5]. The gamified training is designed to provide autonomy to the powered wheelchair users by teaching users how to control their wheelchair, with the use of flexion of temporalis muscles instead of having an attendant who steers the wheelchair.

The training system is a novel approach to combining EMG and eye tracking to provide a better user experience for the users. In-lab usability testing is being followed up with multiple studies that explore the general usability of the system, and its effectiveness as a training mechanism.

References:

1. Cummings J. (2017). Disease modification and Neuroprotection in neurodegenerative disorders. Translational neurodegeneration, 6, 25. https://doi.org/10.1186/s40035-017-0096-2
2. Kondo, K. (1996). Rising prevalence of neurodegenerative diseases worldwide. *Internal medicine*, *35*(4), 238-238.
3. Hardiman, O., Doherty, C. P., Elamin, M., & Bede, P. (2011). *Neurodegenerative disorders* (pp. 115-117). London: Springer.
4. Dombrowski, M., Smith, P., & Buyssens, R. (2017). Designing Alternative Interactive Techniques to Aid in Prosthetic Rehabilitation for Children. In *Advances in Affective and Pleasurable Design* (pp. 647-655). Springer, Cham.
5. Montuclard, L., Garrouste-Orgeas, M., Timsit, J. F., Misset, B., De Jonghe, B., & Carlet, J. (2000). Outcome, functional autonomy, and quality of life of elderly patients with a long-term intensive care unit stay. *Critical care medicine*, *28*(10), 3389-3395.

Improvement in Muscle Control via Serious Gaming For Prosthetic Usage

Peter Smith, Matt Dombrowski, Shea McLinden, Calvin MacDonald, Devon Lynn, Katherine Tran, Kelsey Robinson, Dominique Courbin, John Sparkman, and Albert Manero

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Prosthesis users often reject their devices from inability to control them, among other cited factors including weight and social stigma [1]. Therapeutic training and rehabilitation efforts can be used to increase the rates of upper limb prosthetic retention [2]. By providing access to convenient methods of training and control through digitally accessible serious gaming, this may increase device retention based on a better understanding of control schemas. Investigators utilized a serious game which trains users on the control technique in game that would be used for their prosthetic. The serious game utilizes electromyography to record input of muscle flexion as an alternate input [3]. The prosthetic is controlled with muscle movements from the input of the EMG, so the game is representative of the same movements necessary to control the prosthesis [4]. The usability and performance of participants, predominantly college age without limb amputation, was evaluated in a research study.

Cohort one played a free play environment, encouraged experimentation of muscle controls incentivized by power ups and stars. Cohort two had a clear goal in challenge mode where they were to jump through rings by flexing their muscles the appropriate amount. This cohort focused on their muscle contraction strength discretization for application of multi-gesture control. Results of this study showed that users' skills increased from their pre-test to post-test scores similarly for both cohorts. This shows both practice from a structured set, and freeplay can be good practice as long as the same skills are being applied in both instances of the training.

References:

1. Wagner, L. V., Bagley, A. M., & James, M. A. (2007). Reasons for prosthetic rejection by children with unilateral congenital transverse forearm total deficiency. *JPO: Journal of Prosthetics and Orthotics*, *19*(2), 51-54.
2. Resnik, L., Meucci, M. R., Lieberman-Klinger, S., Fantini, C., Kelty, D. L., Disla, R., & Sasson, N. (2012). Advanced upper limb prosthetic devices: implications for upper limb prosthetic rehabilitation. *Archives of physical medicine and rehabilitation*, *93*(4), 710-717.
3. Dombrowski, M., Smith, P., & Buyssens, R. (2017). Designing Alternative Interactive Techniques to Aid in Prosthetic Rehabilitation for Children. In *Advances in Affective and Pleasurable Design* (pp. 647-655). Springer, Cham.
4. Manero, A., Sparkman, J., Dombrowski, M., Buyssens, R., & Smith, P. A. (2018, July). Developing and training multi-gestural prosthetic arms. In *International Conference on Virtual, Augmented and Mixed Reality* (pp. 427-437). Springer, Cham.

Poster Session

Degradation and Release Study of Zinc Particles Incorporated Polycaprolactone Nanofibers

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Zinc (Zn) is a biodegradable metal of interest with biomaterial applications due to its moderate degradation rate. It is also an essential trace element in the human body, present in all organs, tissues, body secretions, and fluids and it plays a role in wound healing. This research used the electrospinning technique to incorporate Zn particles into nanofibers. Various ratios of Zn metal nanoparticles were incorporated into polycaprolactone (PCL) nanofiber meshes. Physiochemical properties of the mesh were analyzed by scanning electron microscopy (SEM), Transmission electron microscopy, Fourier-transform Infrared spectroscopy (FTIR), and X-ray diffraction. In vitro release of Zn ion (Zn^{2+}) was investigated in cell culture conditions up to 21 days and quantified through inductively coupled plasma optical emission spectrometry (ICP-OES).

Biomimicking Hydrophobicity using Microscale Structures for Biomedical Applications

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Hydrophobic surfaces provide special characteristics for biomedical applications ranging from tunable protein adsorption, cellular interactions, hemocompatibility to antibacterial coatings. In this research, our group bio-mimics the hair-like micro-whisker structures of magnolia leaf using a synthetic polymeric formulation. Optical and scanning electron micrography images revealed the presence of micro-whiskers resulting in higher contact angles. The top layer of magnolia leaf had a contact angle of 50º as compared to the hydrophobic bottom layer at 98º. A synthetic polymeric formulation was coated on different materials to study its effect on hydrophobicity. The coating was replicated (n=3) on each of the candidate materials including glass, polymer, fabric, wood and stainless. A surface tensiometer was used to measure the transition from hydrophilic to hydrophobic interactions between water and candidate substrate materials. Contact angle measurements revealed an increase in hydrophobicity for all the materials from its original uncoated surface. Glass displayed the highest increase in contact angle from 37º to 90º. A phase analysis of the coated region was performed to characterize the surface exposure of glass substrate to the synthetic polymeric formulation. An increase in coated region showed significant increase in contact angle from 50º to 95º. This research lays the foundation to develop and understand hydrophobic coatings for several biomedical applications including non-fouling implant surfaces, lab-on-chip devices, and other diagnostic tools.

Attention-Deficit/Hyperactivity Disorder Identification via Graph Deep Learning with Temporal Brain Networks

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Attention-deficit/hyperactivity disorder (ADHD) is one of the most common neuro-developmental disorders among school-age children. This disorder is recognized by an occurrence of inattention and hyperactivity impulsivity. ADHD identification is generally challenging. Brain network provides a mathematical description of the complex connections and interactions among neurons in brain. In this research, we propose a graph deep learning method to classify ADHD using time series brain functional magnetic resonance imaging (fMRI) data. A graph diffusion convolutional recurrent network (GDCRN) architecture is developed for the time series graph-structured ADHD classification. Correlation matrices at different time stamps are constructed based on the fMRI acquisition repetition time, which are converted to multiple adjacency matrices for brain networks. Both spatial and temporal features are extracted. Different training scenarios are designed for the experimental test. The proposed GDCRN has been compared with other state-of-the-art graph deep learning algorithms. The experimental results have demonstrated that our model is able to classify ADHD and non-ADHD patients. The outcome of this research is expected to promote the implementation of artificial intelligence techniques for ADHD identification and brain network analysis.

In Search Of Multi-Targeted Directed Ligands For Alzheimer's Disease

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Alzheimer's disease (AD) is the result of multiple underlying pathologies that include accumulation of Amyloid Beta-containing plaques, accumulation of tau-containing neurofibrillary tangles, and perturbation of forebrain neocortical cholinergic pathways. In this study we are using lead pharmacophores in a Multi-Target-Directed Ligand (MTDL) approach to identify candidate molecules targeting multiple AD-associated pathologies. This includes enhancement of cholinergic transmission via potentiation of acetylcholine receptors and/or inhibition of acetylcholine esterase (AChE) as well as prevent/reduce amyloid plaques formation via inhibition of β-secretase and/or Aβ fibrillation/aggregation. Our initial pharmacological characterization of MTDLs includes: 1) ability to enhance ACh-induced current in oocytes expressing the α4β2 nAChR using two-electrode voltage-clamp recording; 2) ability to inhibit AChE using colorimetric AChE Inhibitor Screening Kit; 3) ability to inhibit β-secretase using fluorimetric BACE1 screening assay; 4) ability to inhibit amyloid fibrillization of the Aβ1–40 peptide using Thioflavin fluorescence assay. So far, compounds known to potentiate nAChR (dFBr, CMPI, LY2087101, NS9283) were tested. Unlike other compounds, dFBr showed significant inhibition of β-secretase and AChE enzymatic activity at micromolar concentrations. dFBr is a promising pharmacophore to develop MTDL that enhance cholinergic system and reduce Aβ-peptide formation and aggregation. Lead optimization of dFBr holds a promise that a novel MTDLs with disease-modifying properties for AD will emerge.

Synthesis and Potential Therapeutics of Hollow Barium Carbonate Nanoparticles

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Barium carbonate (BaCO3)has attracted a lot of recent research due to its many important applications in producing ferroelectric materials, optical glass, and drug carriers. Hollow nanostructures have great potential especially in drug carrier applications due to their high surface area and large void space. The synthesis of nanoparticles with hollow voids is always difficult due to the fast precipitation reaction between Ba2+ionsand CO32-ions. Here, we report the synthesis of hollow nanospheres of BaCO3using polymeric micelles as a template. The electrostatic interaction of Ba2+ion with laboratory-designed polymeric micelles followed by the controlled mineralization of BaCO3allows the synthesis of hollow nanospheres of BaCO3. The obtained BaCO3nanospheres exhibit acceptable biocompatibility, showing great promise for intracellular bio application in the future.

Preparation and Characterization of Hydrogel Microcapsules Using Hybrid Nanofibers of Polycaprolactone/Gelatin

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Cell encapsulated microcapsule has been proven as an alternative strategy for cell therapy application. The encapsulation technique for this application is possible with the help of alginate hydrogel since it is one of the most useful and promising biomaterials. Its several benefits as being biocompatible, less toxic, easy to form a gel, and the ability that it is in abundance to acquire naturally from seaweed makes it ideal. The use of alginate microcapsule has however been impeded by their mechanical instability and high porosity. To overcome these problems, we first developed an electrospun composite nanofiber of polycaprolactone (PCL)-gelatin, and several physicochemical properties of the fibers were analyzed. The filtered cryoground powder solution of the PCL-gelatin was embedded in the alginate hydrogel using the electrospraying technique which involved the mixing of the alginate solution and filtered cryoground powder solution of PCL-gelatin and subjecting the mixture to a high voltage source producing the Alginate PCL-gelatin (APG) microcapsules. Microcapsules must be adequately stable and as such needs mechanical capacity to control movements inside out. The (APG) microcapsules were characterized using diverse tools such as Scanning Electron Microscopy (SEM) for their morphology, Fourier Infrared Spectroscopy (FTIR) for their chemical compositions, and Cell scale Micro Tester for their mechanical properties. A force-displacement curve obtained in the mechanical testing was analyzed to measure young's modulus (YM) for each specimen. The stiffness of the composite (APG) microcapsule increased as fiber concentrations were increased as compared to alginate only as the control.

Utilizing Cerium Oxide Nanoparticles To Treat Reactive Oxygen Species Induced Fibrosis

Helly (Krishna) Ajay Patel, Hayley Cotton, Anya Shroff, Vijay Mohakar, Anton Sorkin, Dr. Vladimir Reukov*

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

Application Of Cell Culture For Alternative Protein Production

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Cell-based meat production is a promising, environmentally-viable solution to the increasing demand for meat due to population growth. The strategy of cultivating meat via lab growth methods may reduce the amount of environmental damage and ethical concerns surrounding animal agriculture. The ultimate goal of the study is to cultivate and differentiate pluripotent embryonic shrimp stem cells into myocytes and adipocytes. Then test the viability of the cells and introduce the cells to scaffolds that mimic vasculature to produce cell-based shrimp meat. In order to assess viability, a series of staining techniques and assays were used. These include LIVE/DEAD, MTT and Alamar Blue assays. Using these methods, we determined the ratio of proliferating to non-proliferating cells. In this study, we described the cell culture for further usage in meat growing applications. Future studies will focus on increasing cell adherence to a matrix of hierarchical structures and differentiation into proper muscle and adipose cells.

The Nanoceria-Mediated Phenotypic Transition Of Macrophages Between M1 And M2 Forms

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Macrophages are essential in immune response and wound healing. Macrophages exist mainly in two forms – M1 and M2. Classically activated, M1, promotes inflammation and protects from bacterial and viral infections in many ways, including secretion of reactive oxygen species (ROS). Alternatively activated, M2, shows anti-inflammatory activity and promotes proliferation to help wound healing. The transition between these two phenotypes is crucial in the proper repair of damaged tissues. The development of macrophages is heavily dependent on ROS levels. Nanocrystals of cerium oxide can catalyze ROS breakdown and, therefore, are interesting as additives to biomaterials. Ceria nanoparticles were already used to treat some diseases associated with oxidative stress. There is also an established delivery system of the nanoceria to tissues. In this study, in vitro techniques that quantify cell metabolism and ROS content demonstrated nanoceria's capacity to mediate the phenotypic switch of RAW 264.7 macrophages. Thus, we showed that transition between macrophage types could be achieved using nanocrystal of cerium oxide. Nanoceria can also be used as a regeneration-promoting additive to the biomaterials.

Development Of A Xanthan Gum-Gelatin Hydrogels For Bioprinting

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Recently, there have been many technological advancements in additive manufacturing, such as bioprinting. Bioprinting allows the creation of tissue with contrasting cell types using a combination of different materials. A major limitation of the current commercial wound dressings is their low compatibility. The effectiveness of a biopolymer is also defined by many parameters, including its adhesion capacity to tissues, sufficient residence time and the effect on bacterial growth. This research aims to produce a wound-healing media that is both antibacterial and able to support cell growth. We chose two biomaterials as bioprinting media - xanthan gum and gelatin. Xanthan gum has low swelling and remains highly functional in critical environments. Gelatin maintains moisture, is affordable and has the potential to accelerate wound healing by supporting cell viability. We measured the cell viability and regenerative potential of six hydrogels with varying concentrations of the biopolymers to find optimal conditions. Further research will focus on incorporating the nanoceria to prevent bacterial growth. Inhibition zone tests will be used to evaluate the antibacterial effect. Thus we created a hydrogel media with two biopolymers and described its potential in wound healing applications.

Image-Based 3D Printing for Neuro-Endovascular Planning and Training

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The use of 3D Printed (3DP) patient-specific anatomical models in clinical settings have been increasing in recent years. Cerebrovascular Disease (CVD) is an ideal application of 3D modeling due to CVD's inherent complex three-dimensional nature and the limitations of standard two- dimensional imaging to convey 3D information. The success and efficacy of endovascular procedures is dependent on the operator's experience along with thorough understanding of neurovascular anatomy and disease pathology. We produced 3DP neurovascular models to improve overall safety and efficacy of EVP planning and training. Using CT/MR imaging, we obtained DICOM data of patient-specific cerebral aneurysms. The DICOM was subsequently segmented in 3D Slicer to produce an STL of the regions of interest (ROI). Autodesk Meshmixer was then used to refine the ROI and create hollow vascular networks. The models were printed out of elastic 50A resin with the Formlabs Form 2 printer and suspended in blocks of clear Silacryl resin. The block models were then fitted for perfusion and used for EVP training. These blocks presented convenient and durable models which could be repeatedly used not only as teaching tools but are also used for planning and can be potentially used for testing devices. Furthermore, these networks can easily be fitted for flow perfusion and tracer administration, enabling realistic haptic feedback in 3D. Complex 3DP endovascular models created using this approach demonstrate great potential in facilitating endovascular planning, clinical care and patient education.

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Wastewater-Based Epidemiology for SARS-CoV-2 Surveillance

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SARS-CoV-2 is a virus that causes severe acute respiratory syndrome and rapidly spreads through respiratory droplets. It is also excreted in feces and as a result, can be detected in the wastewater. Wastewater-based epidemiology is used to detect the presence of viral molecules at a community level and can provide real-time information about the amount of virus present.

In this study, wastewater was collected weekly from the Grambling campus and the city of Grambling. The virus was concentrated from the wastewater, the viral RNA was extracted, reverse transcribed to cDNA, and this cDNA was used to perform RT-qPCR for the N1 and N2 genes of SARS-CoV-2. The data was normalized to the number of gene copies of Pepper Mild Mottled Virus (PMMoV), a well-established fecal indicator. We found that there was a correlation between the number of SARS-CoV-2 viral particles and the number of cases reported in the area.

Spatial and Temporal Variation In Social Determinants Of Health (SDH) And COVID-19 Related Health Outcomes In The USA

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Since the outbreak in early January 2020, COVID-19 has been responsible for more than 88 million cases and 976 K deaths across the United States. The death toll put the United States at another tragic milestone as the number surpassed the deaths caused by the 1918 flu. The pandemic, however, did not similarly affect the whole United States and studies showed that the health impact related to COVID-19 significantly varies with socio-economic and demographic characteristics. In this study, we have examined the spatial pattern of COVID-19 in the USA and its associations with Social Determinants of Health (SDH) by utilizing County Health Rankings & Roadmaps (CHRR) dataset. Using Geographic information systems (GIS), GeoDa, and SPSS, we conducted exploratory and spatial regression between cumulative COVID-19 cases and deaths based on three periods:1) January 20, 2020 – June 30, 2021; 2) July 1, 2021 – November 30, 2020; and 3) December 1, 2021 – April 30, 2022. The findings of our analysis revealed significant hotspot of cumulative cases and deaths across the lower south-east and upper north-west USA. Our analysis also showed significant associations between SDH variables and COVID 19-related health outcomes. For example, the percentage of adult smoking, diabetes prevalence, adult obesity, residential regression, and population older than 65 were significantly associated with both cases and deaths in all three periods. Our analysis demonstrated the usefulness of SDH in predicting the spatial burden of COVID-19 disease and mortality in the USA.

Green Synthesis and Characterization of Zinc Oxide Nanoparticles for Biomedical Applications (poster)

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Zinc oxide nanoparticles (ZnO NPs) have attracted the attention of many researchers due to their wide range of applications in the field of photocatalyst, antibacterial, anti-inflammatory, antiviral, antioxidant, and rapid wound healing study. Zinc and its metal oxide possess nontoxic activity towards animal cells and can be obtained easily through its precursors. Several studies have confirmed that ZnO particles changes in reactive oxygen species (ROS) production that alters biological activity. Green synthesis of ZnO NPs using plant products is preferred over that of conventional synthetic procedures because of the economic and environmental benefits. In this research, ZnO NPs are synthesized by using plan extracts of locally available three plants e.g. Cynodon dactylon, Artemisia vulgaris, and Acacia catechu. These plants have high phytochemical constituents like alkaloids, flavonoids, tannins, phenol, glycosides, saponins, etc. These phytochemicals have ability to reduce the zinc from its precursors into ZnO nano particles and stabilize them against the particle-particle agglomeration. The biosynthesized nanoparticles are characterized by using different techniques such as Transmission Electron microscopy and Scanning Electron microscopy for detailed structural characteristics such as particle size, shape and distribution; X-ray diffraction for identification of crystalline and amorphous phases, Fourier Transmitted Infra-red spectroscopy for identification of various functional groups, UV-Vis spectrophotometry for analysis of optical properties the nanoparticles. Cellular uptake and toxicity of these nanoparticles are studied by exposing these particles with 3T3 fibroblast cells and human umbilical vein endothelial cells (HUVEC).

Surface modified titanate via electro copolymerization of chitosan to polyaniline for tissue microstructure biomaterials clues for promoting bone regeneration of hBM-MSCc.

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Artificial Bone grafts are one of the most commonly transplanted tissues associated with therapeutic strategy that could offer promising adventages over autologous grafts and likely to be the best way to increase health benefits and quality life of patients. Osteoporotic fractures and bone diseases are worldwide health problems with a high prevalence in society. Until recently, antiresorptive and anabolic agents have been used to inhibit osteoclasts activity but long-term medication becomes highly economic burden and cardio-cerebrovascular adverse effects. People using long-term medicines including steroid tablets, anti-epileptic drugs, and also anti-cancer drugs are at high risk in osteoporosis that trigger to bone fracture. Currently, various constituents of nanomaterials including strontium, titanium, alumina zinc magnesium, zirconia, and many other metal-based bio glass and ceramics are used to speed up the rate at which heal of bone fracture and tissue repair. These biocaramic can provide microstructure for cell to restore cellular functions. However, high-cost production, bioinertness, wear resistance, nonporous architecture, and low bioactive properties take-away or cut off their demand for advance bioceramic in orthopedic and hard tissue engineering applications. In this study, anodized titanate was fabricated, which subsequently coated with chitosan (CS) covalently bonded to polyaniline (PANI) nanolayer through electrochemical process. The designing of innovative materials has been proposed for osteoconductive, osteoinductive, and bone tissue regeneration. The biomimetic approach through in vitro cell experiment of human bone marrow-derived mesenchymal stem cells (hBM-MSCs) promoted the osteogenesis through osteoblast differentiation. Notably, the bone-related genes (collagen-I, OPN, OCN, and RUNX 2) were highly expressed within the TiO2NTs-PANI@CS over the period, indicating bone cell formation. In addition, the surface architectural, roughness, and load baring ability of such TiO2NTs-PANI@CS-based biofilm conferred strong anti-corrosion, the ability to nucleate biomineralization and protein adsorption, which showed excellent biocompatibility in vitro. These findings suggest that the osteoinductive-like platform of biomedical device has a widespread applicability and provide opportunity to regenerate tissue, reconstruction of defect site and could be potential interfacial tissue-construct in hard tissue engineering applications.

Cellular Effects of Catabolic Inflammatory Cytokines on Chondrocytes

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The inhibitory effects of pro-inflammatory cytokines interleukin 1β, tumor necrosis factor-α, and interleukin-6 on articular chondrocyte growth dynamics are well documented. Previous studies have shown that IL-1β and TNFα inhibit chondrocyte differentiation and induce cell death. In contrast to bone remodeling, the cartilage remodeling process mediated entirely by chondrocytes. Most importantly, the chondrocyte is responsible not only for the synthesis of the complex extracellular matrix of the articular cartilage, but it is also the source of proteinases and other precursors that degrade the damaged matrix to permit repair. IL-1β and TNFα appear to play important roles in affecting chondrocyte function. Numerous studies have shown that IL-1β stimulates chondrocytes to increase production of matrix metalloproteinases (MMP's) and other degradative products. It hypothesized that IL-1β is extremely important to cartilage destruction, while TNFα appears to drive the inflammatory process. Recent studies demonstrated that other cytokines may be directly or indirectly involved in the inflammatory process of hard tissues. For example, IL-6 has been proposed as a contributor to the pathogenesis of osteoarthritis. The objective of this study was to evaluate matrix degradation markers, apoptosis, cellular damage markers, and cellular morphology of chondrocytes following a challenge with inflammatory cytokines and how this impacts clinical healing and tissue regeneration.

Assessment of Cardiovascular Disease Impact Perception In Southern HBCU Students

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Historically Black College and Universities (HBCU) students were investigated through a questionnaire regarding their perspectives on cardiovascular disease (CVD) prevalence in their minority communities. These CVD related diseases are currently the leading cause of death globally and in the state of Louisiana (LA). Additionally, CVD plagues African American residents at an increased rate in the state. According to the Louisiana Department of Health, Louisiana is ranked 41st in the diagnosis of cardiovascular disease and the 42 percentiles of obese adults and adults with diabetes. In conjunction with the CDC and the Association of State Public Health Nutritionists, our research has allowed for an in-depth analysis of students' understanding of healthy living habits and disease prevention. The project began with a series of study materials, a two-hour focus group, and an anonymous survey. Upon completion, the project provided significant information that will help into subsequent phases of creating and implementing a curriculum to educate students and their families on the severity of cardiovascular disease amongst African Americans.

3D Bioprinting, Bioinks and Nanotechnology in Medicine: Ethical and Anticipated Ethical Issues

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Bioprinting is an emerging technology with various applications in tissue engineering making functional tissue constructs to replace injured or diseased tissues. This is a relatively new approach that provides high reproducibility and precise control over the fabricated constructs in an automated manner, potentially enabling high-throughput production. During the bioprinting process, a solution of a biomaterial or a mixture of several biomaterials in the hydrogel form, usually encapsulating the desired cell types, termed the bioink, is used for creating tissue constructs. This bioink in conjunction with developments in nanotechnology can be cross-linked or stabilized during or immediately after bioprinting to generate the final shape, structure, and architecture of the designed tissue engineering construct. Bioinks may be made from natural or synthetic bionanomaterials alone, or a combination of the two as hybrid materials. In certain cases, cell aggregates without any additional biomaterials can also be adopted for use as a bioink for bioprinting processes. An ideal bioink should possess proper mechanical, rheological, and biological properties of the target tissues, which are essential to ensure correct functionality of the bioprinted tissues and organs. In this review, we provide an in-depth discussion of the different bioinks currently employed for bioprinting, and outline some future perspectives in their further development.

This analysis will examine the design, development of bioinks for bioprinting employing bionanotechnology in medical contexts and conclude with an Ethical and Anticipatory Ethical analysis of the issues related to the future development of bioinks for bioprinting employing Nanotechnology in the medical domain.

3D Printing, Hydrogels and Nanomedicine: Ethical and Anticipated Ethical Issues

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Additive manufacturing which is more commonly known as 3D printing, is currently at the center of innovations and applications in a wide variety of fields including as prototyping, manufacturing, aerospace, education, and medicine. Recent developments in technological and materials research in medicine have enabled breakthroughs in 3D bioprinting. Developments in 3D printing have enabled 3D bioprinting, where biomaterials and cells are used to create scaffolds and functional living tissues (e.g. skin, cartilage, etc.).

This analysis focuses on the classification and applications of hydrogels, as well as design considerations in their production (i.e. physical and biological parameters). The materials required for the 3D printing of hydrogels, such as biopolymers, synthetic polymers, and nanocomposites, are mainly discussed. More importantly, future perspectives on 3D printing hydrogels including new materials, 4D printing, emerging printing technologies, etc. and their importance in biomedical and bioengineering applications are also discussed.

These discussions are the foundation for a discussion of the ethical and anticipated ethical issues with 3D printing, hydrogels and bio-nanotechnology in nanomedicine.

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

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

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

Reduction in Uterine Perfusion-induced Intrauterine Growth Restriction Enhances Susceptibility to Ischemic Stroke-Induced Neurobehavioral Deficits and Brain Damage in Adult Rats

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The main outcome of intrauterine growth restriction (IUGR), low birth weight children, has the highest occurrence in Mississippi of over 11% in the past 20 years. Epidemiological and experimental studies suggests a link between IUGR and an increased risk to develop diseases later in life. Previous studies have established that IUGR rats have increased susceptibility to hypoxic-ischemic insult which can lead to neurodevelopmental delay, but there is still little

evidence indicating whether IUGR individuals have increased susceptibility for ischemic brain injury. The objective of this study was to investigate the link between reduction in uterine perfusion (RUP)-induced IUGR and the increased risk of developing ischemic brain injury later in life. At gestation day 14 of rat dams, RUP was utilized to induce IUGR in the offspring. At 5 months, middle cerebral artery occlusion (MCAO) was used to induce ischemic stroke in IUGR and control groups. 24 hours post-stroke, motor, sensory, and neurobehavioral tests were assessed, and subjects were euthanized to collect brain tissue samples for analysis of ischemic damage. Hypomotor activity, hyperalgesia, allodynia, and decreased brain volume were observed in IUGR rats compared to control rats. IUGR rats were found to display more motor and sensory deficits compared to control rats after MCAO as assessed by neurological severity score. The current study suggests that RUP-induced IUGR enhanced susceptibility of MCAO-induced ischemic brain injury and neurobehavioral dysfunction in adult rats. Our model may be practical in creating a better understanding of ischemic brain insult and the development of potential therapeutic strategies.

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Small Extracellular Vesicle-Derived MicroRNAs As A Diagnostic And Therapeutic Tool In Melanoma Resistance

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Small extracellular vesicles (sEVs)are secreted from normal and tumor cells as means of cell-to-cell communication. However, cancer cells have higher capacity to releases EVs than normal cells do. Tumor-derived EVs are loaded with specific bioactive molecules that uniquely reflect the condition of their cell of origin. Among their biological cargo, sEVs transport intact and functional microRNAs(miRs) from donor cells to alter gene expression in recipient cells. Thus, resistant cell-specifics EVmiR signatures could be utilized as epigenetic biomarkers to predict drug resistance in cancer cells, as well as therapeutic tools to overcome such resistance. Thus, we aimed to study the role of sEVs in development of drug resistance in melanoma; particularly ,the association of sEVs microRNAs (miRs) with mutant BRAF-V600E specific inhibitor(vemurafenib)resistance.We conducted microarray analysis on resistant melanoma cells followed by quantitative real-time PCR (qPCR) to recognize the specific miR expression profiles in vemurafenib-resistant (A375-NRASQ61K) compared to parental cells and their derived sEVs. Atot al of 31 miRs were differentially expressed based on vemurafenib resistance; 4miRswereupregulated and 27miRsweredownregulated. Our initial characterization focused onmiR-3631-p, as its dysregulation was reported to be linked to malignancy and drug resistance. qPCR analysis confirmed that miR-3631-p was downregulated, while its overexpression sensitized resistant melanoma cells. Conclusively, our results provide further evidence to support the role of sEV-associated miRs in melanoma resistance and their utilities in predicting novel target genes.

Synthesis And Characterization Of Nicotinic Acetylcholine Receptors Positive Allosteric Modulator Loaded Polymeric Nanoparticle To Maximize Brain Bioavailability.

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CMPI (3-(2-Chlorophenyl)-5-(5-methyl-1-(piperidin-4-yl)-1H-pyrazol-4-yl)isoxazole hydrochloride) is a nicotinic acetylcholine receptors (nAChRs) positive allosteric modulator (PAM) that preferentially potentiates the (α4)3(β2)2 nAChR, the major nAChR subtype in the cortex. Precision delivery of nAChR PAMs such as CMPI to brain nAChRs that are associated with the desired therapeutic effects while avoiding interactions with peripheral nAChRs that are associated with undesired side effects is critical to the development of nAChR PAM-based therapeutics. Towards this endeavor, this study aims to explore nano formulation strategies to maximize cellular delivery of CMPI. A biodegradable and biocompatible, the US-FDA-approved, poly(l-lactic-co-glycolic) acid (PLGA) was used to engineer nanoparticles (NPs) to solubilize CMPI in its hydrophobic core in an aqueous environment using the nanoprecipitation with the drug loading content of 10±1.2% by weight of NPs. Thus, synthesized polymeric NPs were characterized for their colloidal properties and biological activities. The hydrodynamic size of these NPs was found to range from 60 to 100 nm and are stable for a prolonged period in biological media. An in-vitro drug release study was conducted to envision a sustained release of CMPI under physiological conditions, which shows distinct kinetics of CMPI under experimental conditions in which released drugs from NPs were collected using dialysis techniques. These NPs found to be highly biocompatible when challenged against the human embryonic kidney-293 (HEK-293) cell line that stably expressed α4β2 (HEK-α4β2) nAChRs in a wide range of concentrations. In this pilot study, NPs were further labeled with Alexa fluorophore to track and study cellular uptake using fluorescence microscopy, which showed efficient uptake by HEK-α4β2 cells. Given the superiority of the nanoparticulate system in drug delivery and the unique role of CMPI, we hope this study will help in the development of nAChR PAM formulations that have superior pharmacokinetic profiles, especially their brain bioavailability.

Mechanical Properties Characterization of PCL-Zn Composites for Biomedical Applications

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Due to their versatility and flexibility, polymers have been widely used for biomedical applications, such as tissue engineering, wound healing, and drug delivery. Most polymers are natural or synthetic and each of these categories have their own unique advantages and disadvantages. Forming composites from both natural and synthetic polymers results in shared properties thus increasing the overall functional properties. Polymer and metallic blends have been investigated with promising results due to the versatility of the polymers and the strength of the metals. This research seeks to explore and characterize mechanically PCL and zinc composites for tensile and compression testing. PCL has shown to have robust mechanical properties that do not significantly decrease even under harsher conditions and adding zinc as the metallic composite will help to improve the biodegradability and mechanical capacity of PCL, while still having a low toxicity level. Various ratios of the polymer-metal composite fibers as leveled PZ-0 to PZ-50, with 0 to 50 representing the amount of zinc mixed with the PCL, will be analyzed and compared.

DESIGN AND CHARACTERIZATION OF ELECTROSPUN NANOFIBER MEMBRANE FOR ANTIBACTERIAL DRUG DELIVERY

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Wound healing, a global public health problem, has been an active research focus due to its high susceptibility to bacterial colonization. Several biomaterials and synthetic polymers have been extensively investigated for promoting wound healing and antimicrobial drug delivery. A polyester, Polycaprolactone (PCL), is the US-FDA approved biocompatible and biodegradable polymer for biomedical applications. This is a material of interest in tissue engineering scaffolds, for example, wound dressing. Owing to its enhanced tensile properties, PCL is well studied to engineer porous membrane scaffolds using the electrospinning technique. In this work, we fabricated tetracycline antibiotic complexed with chitosan carrier in a nonwoven PCL nanofiber scaffold. The physicochemical and antimicrobial properties of the fabricated fibrous scaffold were characterized. The porous morphology of the nanofiber scaffolds was monitored using scanning electron microscopy, we analyzed the drug loading content spectrophotometrically at λ_{max} 361 nm and studied drug release in a media of phosphate buffered saline adjusted to match the chronic wound environment (pH of 8.9) over four days. Drug release kinetics was found to be linear with the concentration of carrier chitosan in the scaffolds exhibiting a sustained release profile over a period. Antibacterial properties of 6 mm diameter discs cut from the scaffold were tested against the *Staphylococcus aureus* Newman strain as a model infectious agent in wounds. The increase in chitosan content enhanced the antimicrobial ability assessed by the disc diffusion using the Kirby-Bauer method. The results indicate a uniform release of the antibiotic from the nanofiber membranes that have an enhanced release and longer duration of activity in presence of the added carrier. Future studies will focus on studying the stability of the antibiotics in the membranes as well as comparing their performance to membranes spun with different carriers like nanohydroxyapatite.