



CONFERENCE PROGRAM

BIOMATERIALS DAY

October 26, 2019

Thwing Center,
Case Western Reserve
University, Cleveland



Hosted by Case Western Reserve University, in collaboration with
University of Michigan, Carnegie Mellon University, and University of Pittsburgh

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FOREWORD



SPEAKERS



SCHEDULE



ABSTRACTS



ACKNOWLEDGEMENTS



Case Western Reserve University has always been at the forefront of Biomaterials research, starting from the pioneering work of Dr. James Anderson in biocompatibility to today's multiple research directions in drug delivery, tissue engineering, devices and artificial blood surrogates. Dr. Anderson had a leading role in founding SfB and the Case chapter has been around for more than two decades under the leadership of Drs. Nicholas Ziats, Horst von Recum and Anirban Sen Gupta. Dr. Anderson serves as an editor for SfB's Journal of Biomedical Materials Research, Dr. Ziats is a past President and current Program Committee co-chair, Dr. von Recum is the current National SfB President, and Dr. Sen Gupta serves as chair of the Education and Professional Development Committee and the faculty advisor for Case's SfB chapter.

Case has hosted several SfB Biomaterials Day events - in 2010, 2013, and 2016. These events were previously held in partnership with Purdue University and University of Kentucky, and more recently with University of Michigan, University of Pittsburgh and Carnegie Mellon University.

Case is surrounded by multiple high impact medical institutions as well as biotech companies, that make translational research in the Biomaterials area possible, and events like Biomaterials Day conducive to showcasing these achievements. We are grateful for financial support and sponsorship from SfB, Case BME, Case School of Engineering, the Provost's office and our industry partners - Abeona Therapeutics, Athersys Inc, Haima Therapeutics, Neuronoff Inc, and Viscus Biologics.



Ariella Shikanov, PhD
Associate Professor
Biomedical Engineering
University of Michigan

Dr. Shikanov's research aims to solve premature ovarian insufficiency (POI), which is a common outcome of anticancer treatments in young girls and women. POI causes sterility and complications related to absent ovarian endocrine function such as premature osteopenia, muscle wasting, impaired cognitive development, and accelerated cardiovascular disease. Her group aims to engineer a biomimetic environment that promotes in vitro growth of immature follicles and integrates cellular, molecular and physico-chemical properties with a structural design that allows studying the bi-directional interactions between the follicles and the support cells. Engineered ovarian tissue with controlled physical and biological properties provides supportive environment for ovarian follicle survival and development, graft remodeling and longevity after transplantation.



Yizhou Dong, PhD
Associate Professor
College of Pharmacy
The Ohio State University

Messenger RNA (mRNA) therapeutics have shown great promise for expressing functional proteins. However, the efficient and safe delivery of mRNA remains a key challenge for the clinical application of mRNA based therapeutics. In order to improve mRNA delivery, we designed N 1 ,N 3 ,N 5 -tris(2-aminoethyl)benzene-1,3,5-tricarboxamide (TT) derived lipids. We applied an orthogonal experimental design to investigate the impacts of formulation components on delivery efficiency. In a hemophilia mouse model, TT3 lipid-like nanoparticles, a lead material, was able to fully recover the level of human factor IX (hFIX) to normal physiological values. Two Cpf1 (CRISPR from Prevotella and Francisella 1) nucleases including Acidaminococcus sp. Cpf1 (AsCpf1) and Lachnospiraceae Cpf1 (LbCpf1) displayed comparable genome editing capability to Cas9 in human cells through a single RNA-guided approach. In order to systematically study the structure-activity relationship of engineered CRISPR RNAs (crRNA) and AsCpf1 messenger RNAs (mRNAs) and maximize gene editing efficiency, we designed and assessed a series of Cpf1 crRNAs and Cpf1 mRNA. Our results showed that the combination of the top-performing engineered crRNA and mRNAs augmented the efficiency over 300% in comparison to the combination of unmodified crRNA and plasmid encoding Cpf1. Meanwhile, we discovered that eleven out of sixteen crRNAs from Cpf1

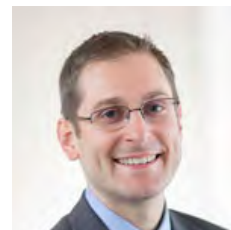
orthologs were able to achieve genome editing. Overall, our findings provide a promising approach for broad genome editing applications.



Julie Renner, PhD
Assistant Professor
Chemical Engineering
Case Western Reserve University

Bridging Biomaterials and Electrochemical Devices using Protein Engineering

Protein engineering is a versatile tool for creating biomaterials, and has found many applications in tissue engineering, drug-delivery and sensing. An emerging area where engineered proteins are also useful, is in the development of electrochemical technologies. These technologies are capable of utilizing renewable energy to manufacture useful chemicals. Bridging these two seemingly unrelated fields, biomaterials and energy technologies, with protein engineering can stimulate novel idea generation. For example, proteins previously utilized for tissue engineering can be useful in creating nanopatterned electrodes for electrochemical devices. That same patterning technology developed for energy applications may also be useful in the culture of human mesenchymal stem cells or sensing.



Andrew Shoffstall, PhD
Assistant Professor
Biomedical Engineering
Case Western Reserve University

Minimizing Trauma at the Neural Interface

Neural interfaces such as electrical stimulation and recording electrodes have many exciting applications for rehabilitation (e.g. brain-computer interface) and other emerging areas of autonomic and peripheral nerve neuromodulation. A significant amount of funding from public and private entities is being invested to discover and further develop devices for a wide range of clinical applications. While non-invasive solutions exist, due to their reliability and target engagement specificity, implanted neural interface devices remain the gold standard for engaging with the nervous system tissues. However, trauma to implant devices may limit the wide-spread adoption of neural interface technology by patients due to the real, or even just perceived, risks of the invasive surgery. Trauma also initiates a secondary injury cascade comprised of inflammation and neurodegeneration, which can be particularly detrimental to brain-implanted electrodes. The result is decreased device performance and limited longevity. In this talk, recent progress on a number of approaches to minimize trauma and bleeding due to device implantation will be presented.

9:00 AM - Welcome Remarks

Anirban Sen Gupta, PhD

9:10 AM - SfB Introduction

Horst von Recum, PhD

9:20 AM - Keynote

Ariella Shikanov, PhD

9:50 AM - Faculty Presentation

Julie Renner, PhD

10:15 AM - Student Presentations

Thwing Ballroom - Novel Biomaterials

Catherine Snyder

Fabrication of non-spherical and multiphasic particles with independent control of particle size, shape and chemistry

Anna Kalmykov

Organ-on-e-chip: Three-dimensional Self-rolled Biosensor Array for Electrical Interrogations of Human Electrogenic Spheroids

Kelsey Swingle

Biomaterials-based Modular Design of Platelet-inspired Nanotechnology for Hemorrhage Control

Thwing Room 201 - Diagnostics

Utku Goreke

Hypoxia enhanced mature red blood cell adhesion in sickle cell disease associates with cardiopulmonary shunts

Yu-Chih Chen, PhD

High-throughput and Contamination-free Microfluidics for Single-cell RNA-sequencing of Rare Circulating Tumor Cells

Andrew Schilb

Visualizing cationic lipid-siRNA release to mediate sustained gene knockdown

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11:00 AM - Poster Presentation

12:30 PM - Lunch & Networking

2:05 PM - Faculty Presentation

Yizhou Dong, PhD

2:30 PM - Panel Discussion

3:30 PM - Faculty Presentation

Andrew Shoffstall, PhD

3:55 PM - Student Presentations

Thwing Ballroom - Tissue Engineering

Prabaha Sikder, PhD

Amorphous Magnesium Phosphate-Polyetheretherketone Composite Biomaterials for 3D Printing of Customized Orthopedic Implants

Dipak Pukale

Subcutaneous priming of neural stem cell-seeded scaffolds improves function following spinal cord injury

Jacqueline Bliley

Perfused 3D Printed Collagen Tubes Support Tissue Viability

Thwing Room 201 - Drug Delivery

Nathan Rohner, PhD

Leveraging Affinity-based Polymers for Long-term Esophageal Antifibrotic Therapy

Nguyen Tram

Antioxidant-Releasing Hydrogels as Vitreous Replacement

Elizabeth Mays

Dual Growth Factor Release Maintained with Heparin-Hyaluronic Acid Nanofibers

4:45 PM - Closing & Awards

Oral Presentations

1. **Catherine Snyder** - *University of Michigan* - Fabrication of non-spherical and multiphase particles with independent control of particle size, shape and chemistry
2. **Anna Kalmykov** - *Carnegie Mellon University* - Organ-on-a-chip: Three-dimensional Self-rolled Biosensor Array for Electrical Interrogations of Human Electrogenic Spheroids
3. **Kelsey Swingle** - *Case Western Reserve University* - Biomaterials-based Modular Design of Platelet-inspired Nanotechnology for Hemorrhage Control
4. **Utku Goreke** - *Case Western Reserve University* - Hypoxia enhanced mature red blood cell adhesion in sickle cell disease associates with cardiopulmonary shunts
5. **Yu-Chih Chen, PhD** - *University of Michigan* - High-throughput and Contamination-free Microfluidics for Single-cell RNA-sequencing of Rare Circulating Tumor Cells
6. **Andrew Schilb** - *Case Western Reserve University* - Visualizing cationic lipid-siRNA release to mediate sustained gene knockdown
7. **Prabaha Sikder, PhD** - *University of Pittsburgh* - Amorphous Magnesium Phosphate-Polyetheretherketone Composite Biomaterials for 3D Printing of Customized Orthopedic Implants
8. **Dipak Pukale** - *University of Akron* - Subcutaneous priming of neural stem cell-seeded scaffolds improves function following spinal cord injury
9. **Jacqueline Bliley** - *Carnegie Mellon University* - Perfused 3D Printed Collagen Tubes Support Tissue Viability
10. **Nathan Rohner, PhD** - *Case Western Reserve University* - Leveraging Affinity-based Polymers for Long-term Esophageal Antifibrotic Therapy
11. **Nguyen Tram** - *The Ohio State University* - Antioxidant-Releasing Hydrogels as Vitreous Replacement
12. **Elizabeth Mays** - *Wayne State University* - Dual Growth Factor Release Maintained with Heparin-Hyaluronic Acid Nanofibers

Poster Presentations

1. **Thomas Knight** - *Carnegie Mellon University* - Effect of Varied Polyacrylamide Substrate Surface Stiffnesses on the Cellular Uptake of Radiolabeled Extracellular Vesicles
2. **Kevin Yang** - *Case Western Reserve University* - Characterizing Mechanical Properties of an Injectable Electrode
3. **Sangjoon Lee, PhD** - *Cleveland State University* - An integrated plate system for human organoid culture and disease modeling
4. **Mazin Hakim** - *Purdue University* - Characterization of Cyclodextrin/Polyethylene Glycol-Based Affinity Binding Polymers for 3D Bioprinting
5. **Adeel Ahmed** - *Rochester Institute of Technology* - Microfluidic Shear Based Approach to Fabricate Physically Distinct Tissue Interfaces
6. **Jiadong Chen** - *The University of Akron* - Bovine Serum Albumin

- Binding to Titanium Dioxide Nanoparticles
7. **Nick Schott** - *University of Michigan* - Harnessing the Pericyte-like Function of Mesenchymal Stromal Cells to Engineer Vascularized Bone
8. **Abdullah Al Saad** - *University of Toledo* - Toughened Zirconia as Dental Implant Material
9. **Sabrina Khan** - *University of Notre Dame* - Targeted Liposomal DM1 Prodrug Formulation for Improved Anti-cancer Effect with High Selectivity
10. **Charles Gabrion** - *Wayne State University* - Design of an Osteochondral Plug from Microencapsulated Differentiated Mesenchymal Stem Cells
11. **Joseph Laws** - *Youngstown State University* - Engineered Biohybrid Cellulose Nanocrystals for Electrochemical Detection of Hydrogen Peroxide
12. **Kaisal Shah** - *Hathaway Brown School* - Modular Amplification of Hemostatic Output with Platelet-Inspired Particles Using Clot-Augmenting Nanomaterials
13. **Debnath Maji** - *Case Western Reserve University* - Toward Point-of-Care Assessment of Platelet Count-induced Changes in Whole Blood Coagulation with a Dielectric Microsensor
14. **Toyyun Cetinkaya** - *Carnegie Mellon University* - Micromachinability of Biodissolvable Carboxymethyl Cellulose (CMC)
15. **Kathleen Young** - *Case Western Reserve University* - Drug-Refillable In Situ Forming Implants for Recurrent Tumor Chemotherapy
16. **Ka Keung Chan** - *Cleveland State University* - Synthesis and Evaluation of Chain-End Functionalized N-Glycan Polymers
17. **Zahra Allahyari** - *Rochester Institute of Technology* - Disrupted Surfaces Reduce Nuclear YAP Localization through Diminished Cell Spreading in ADSCs
18. **Apoorva Vishwakarma** - *University of Akron* - Modification of a commercial polyurethane imparts anti-biofilm activity to combat catheter associated infections
19. **Karim Elhattab** - *The University of Toledo* - Fabrication and Evaluation of 3-D Printed PEEK Scaffolds Containing Macropores by Design
20. **Chukwuma Nweke** - *University of Michigan* - Injectable Gelatin Microcarriers for Osteogenic Differentiation of MSCs and Bone Regeneration
21. **Franklin Mejia** - *University of Notre Dame* - Modular Liposomal Platform for Systematic Analysis of Endosomal Escape in Targeted Systems
22. **Eric Ellis** - *Wayne State University* - HA-CNT Nanofibers with Anti-Inflammatory Microspheres for Enhanced Nerve Regeneration
23. **Tejal Pendekanti** - *Hathaway Brown School* - Combination Targeting of Active Platelets and Fibrin to Enhance Clot-anchorage Efficiency of Nanoparticles Under Flow for Vascular Drug Delivery
24. **Jahnvi Pejavar** - *Case Western Reserve University* - Development of a Hyaluronic Acid Electrochemical Sensor

25. **Wenhuan Sun** - *Carnegie Mellon University* - Strong and Flexible Electrochemically Aligned Collagen Threads with Tunable Mechanical and Geometric Properties
26. **William Schwartzman** - *Case Western Reserve University* - Localized Resveratrol Delivery Improves Recording Quality from Intracortical Microelectrodes
27. **Fjorela Xhyliu** - *Cleveland State University* - Elucidating the Distinct Complexation Affinity of DNA and Carbon Nanotube Recognition Pairs by Optical Spectroscopy
28. **Shayan Gholizadeh** - *Rochester Institute of Technology* - Development of ultrathin membrane platforms for investigation of cell-cell communication and cell transmigration
29. **Elham Malekzadeh** - *The University of Akron* - Thermo-responsive poly(methyl vinyl ether) (PVME) retained by 3-aminopropyltriethoxysilane (APTES) as anti-fouling coatings
30. **Hamza Turkistani** - *University of Michigan* - Antigen-Loaded, FasL-Functionalized Nanoparticles for Allogeneic Skin Transplant Tolerance
31. **Jenna Sjoerdsma** - *University of Notre Dame* - Identifying Immunodominant Epitopes House Dust Mite Protein Der p 2
32. **Amin Vossoughi** - *Wayne State University* - Culturing the co-encapsulated primary hepatocytes with mesenchymal stem cells in a perfusion chip system
33. **Ketan Jolly** - *Case Western Reserve University* - Effects of SynthoPlate and Fibrin-Binding Pullulan in Mitigating Trauma-relevant Coagulopathy
34. **Erica Comber** - *Carnegie Mellon University* - Collagen I fabrication methods for a biomimetic, respiratory support organ
35. **Emerson Lai** - *Case Western Reserve University* - Nonthermal plasma exposure alters anti-biofouling performance of biomedical polymer surfaces
36. **Michael Cantwell** - *Cleveland State University* - Engineering Optical Nanosensors with Carbohydrate Functionality Using Biomimetic Glycopolymers
37. **Nicholas Nun** - *University of Akron* - Effects of Dressing Morphology and Pendant Group Chemistry on Skin Wound Healing
38. **Joshua Sampson** - *University of Michigan* - Scaffold Functionalization Augments B-cell Differentiation in Microporous Scaffold Culture
39. **Xining Gao** - *Carnegie Mellon University* - Fibronectin Nanofiber-Patterned Collagen Scaffolds For Engineering Aligned Cardiac Sheets
40. **Eloise Miller** - *Case Western Reserve University* - Synthetic Periodontal Ligament
41. **Sirilak Phomrak** - *The University of Akron* - Modification of vulcanized natural rubber-bacterial cellulose (NRBC) composites with organosilanes and thermo-responsive polyvinylmethylether (PVME)
42. **Yazmin Hernandez** - *University of Michigan* - Catalase-Loaded

- Protein Nanoparticles for the Protection of Endothelial Cells
43. **Ezgi Yalcintas** - *Carnegie Mellon University* - Tattoo Biosensors as Native In Situ Monitors of Inflammation
44. **Chao-yi Lu** - *Case Western Reserve University* - Broad-spectrum Antimicrobial Activity in Bone Cement Using an Affinity-Based Drug Delivery System
45. **Ustriyana Putu** - *The University of Akron* - Mechanistic Understanding of Calcium Phosphate Phase Transformation by Oligo(l-glutamic acids)
46. **Eric Hobson** - *University of Michigan* - Resonant Acoustic Viscoelastography for the Dynamic Mechanical Characterization of Soft Biomaterials
47. **Santiago Carrasquilla** - *Carnegie Mellon University* - Engineering Multi-Layered Cornea Stroma Constructs Using Aligned ECM Protein Scaffolds
48. **Nadia Ayat, PhD** - *Case Western Reserve University* - Effective MR Molecular Imaging of Aggressive Breast Cancer with an EDB-FN Specific Contrast Agent at a Reduced Dose
49. **Matthew Jennings, PhD** - *University of Akron* - Calcification by Escherichia coli on Solid Media from a Variety of Calcium Sources
50. **Rikako Miki** - *University of Michigan* - Characterization and Analysis of Protein Nanoparticles as Immobilized Enzyme Carriers for Industrial Applications
51. **Yuliang Ding** - *Case Western Reserve University* - Development of an in vitro Model for Liver Cancer Tissue Engineering: Extracellular Matrix Focus on Improving Patient Derived Xenografts
52. **Hannah Baumann** - *University of Akron* - Matrix mechanobiology of the chronic spinal cord injury scar
53. **Caymen Novak** - *University of Michigan* - Ovarian Cancer Cells Under Shear Stress Increase Proliferation, Invasion, and Chemoresistance
54. **Kara Hageman** - *Case Western Reserve University* - Platelet Interactions with Cancer Cells: A Model Study with HeLa Cells
55. **Yen-Ming Tseng** - *University of Akron* - Effect of Dexamethasone on Room Temperature Three-Dimensional Printing, Rheology, and Degradation of a Low Modulus Polyester for Soft Tissue Engineering
56. **Georgia Loutrianakis** - *Case Western Reserve University* - Multi-Ligand Targeted Nanoparticles Increase Deposition to Metastatic Tumors
57. **Amal Narayanan** - *University of Akron* - Chemistry of Underwater Adhesion: From Understanding the Contact Mechanics of Bioinspired Adhesives to Sealing Pericardial Defects
58. **Xinming Wang** - *Case Western Reserve University* - ECM Gel and Tissue Stiffness Synergistically Modulate Cardiomyocyte Proliferation Through Agrin-YAP
59. **Shahrazad Abri** - *University of Akron* - Tailorable Antibacterial Heparin-Chitosan Nanospheres for Efficient Antibiotic Delivery
60. **Morgan Lorkowski** - *Case Western Reserve University* - Dual Agonist Nanoparticle to Activate the Immune System in Pancreatic Cancer

PANEL DISCUSSION



Jan Stegemann, PhD

*Professor
Biomedical Engineering
University of Michigan*



Sarah Busch, PhD

*Associate Director
Neuroscience
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Anirban Sen Gupta, PhD

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Charlie Ren, PhD

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