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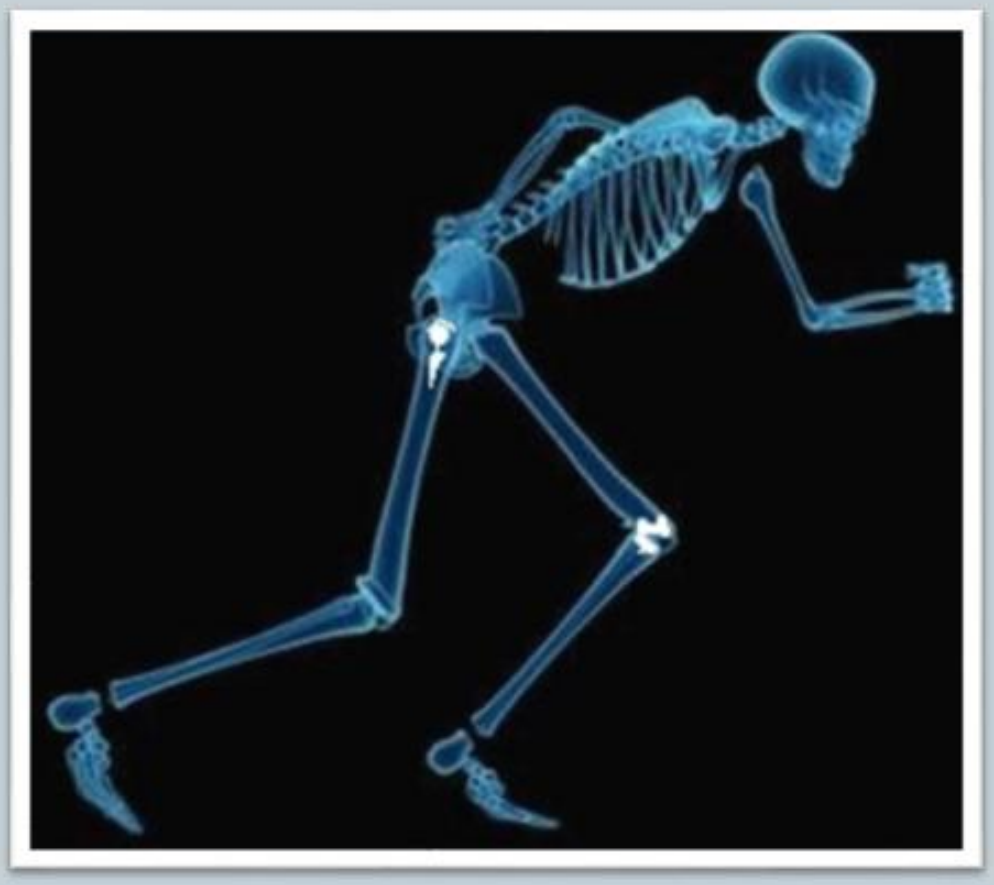
Biomaterials Day

Innovative Technologies In Biomaterials
March 22, 2013



Welcome to the University of Florida's Regional Biomaterials Day 2013!

On behalf of the Biomaterials Day Organizing Committee, we would like to thank you for attending our second annual Biomaterials Day focused on "Innovative Technologies in Biomaterials." The University of Florida's student chapter of the Society for Biomaterials is very proud to host this one-day symposium and provide an opportunity for students, faculty members, and industry representatives from our region to interact and discuss the newest advances in the field. This event is sponsored by the National Society for Biomaterials with the goal of promoting interdisciplinary interactions amongst students and professionals.

Again, thank you for attending and we hope you enjoy this dynamic and exciting opportunity to network and learn about biomaterials.

Regards,

Evelyn Bracho-Sanchez
Program Organizing Committee Chair
UF SFB Chapter Vice-President

Joseph Decker
Program Organizing Committee Member
UF SFB Chapter President

Laura Villada
Program Organizing Committee Member
UF SFB Chapter Treasurer

Brittany Hicks
Program Organizing Committee Member
UF SFB Chapter Secretary

Jessica Rex
Program Organizing Committee Member
UF SFB Chapter Historian

Christine Schaefer
Program Organizing Committee Member
UF SFB Chapter BEC Representative

Melanie Dufva
Program Organizing Committee Member
UF SFB Chapter Web Master

Acknowledgments
The Biomaterials Day organizing committee would like to acknowledge and thank the National Society for Biomaterials for the opportunity to host our second annual Biomaterials Day. Without their financial support, this event would not have been possible. We acknowledge support from the University of Florida's Office of Research. We would also like to thank the following sponsors, again without your contributions this event would not have been possible.
Blue- Bose-Electronforce, Johnson and Johnson
White- J. Crayton Pruitt Family Department of Biomedical Engineering

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SCHEDULE OF EVENTS

Friday March 22nd, 2013

Time	Event
8:00-9:00 AM	Registration and Continental Breakfast
9:00-9:05 AM	**Opening Address** provided by **Dean Cammy Abernathy**
9:05-9:10 AM	**Welcome to Biomaterials Day 2013** **Joseph Decker** UF SFB Chapter President
	INDUSTRY SESSION
9:10-9:40 AM	**"Innovative Solution for Cranioplasty"** **Scott Sidwell** Vice-President of Research and Development at Biomet
9:40-10:00 AM	**"Licensing Technologies"** **Dr. Lenny Terry** Licensing Officer, Office of Technology Licensing
10:00-10:20 AM	**"The Journey of a Biomaterials Scientist"** **Dr. Iris Schumacher** Kimberly Clark Representative
10:20-10:40 AM	**"Bone as a Versatile Biomaterial"** **Dr. Ron Cobb** Vice-President of Biologics at Nanotherapeutics
10:40-12:00 PM	**Graduate student poster session / Break**
12:00-1:00 PM	**Complimentary Lunch**
	ACADEMIA SESSION
1:00-1:30 PM	**Key Note Address: "Bottom-Up Engineering of the Extracellular Matrix"** **Dr. Adam Feinberg** National Institute of Health Innovation Award recipient, Assistant Professor at Carnegie Mellon
1:30-1:50 PM	**"Magnetic Nanoparticles as Nanoscale Probes and Actuators in Complex Fluids and Biological Systems"** **Dr. Carlos Rinaldi** J. Crayton Pruitt Family Department of Biomedical Engineering and Department of Chemical Engineering, University of Florida Professor
1:50-2:10 PM	**" Advances in Nanocomposite Design: Towards Electronic and Biomedical Applications"** **Dr. Jennifer Andrew** Materials Science and Engineering Department, University of Florida Assistant Professor
2:10-2:30 PM	**"Engineering Bioactive Materials for Islet Transplantation"** **Dr. Cherie Stabler** Biomedical Engineering Department, Diabetes Research Institute, University of Miami, Associate Professor
2:30-3:55 PM	**Undergraduate student poster session/ Corporate info session**
3:55-4:00 PM	**Closing Remarks**

KEY NOTE ADDRESS ABSTRACTS

Industry Key Note Address: "Innovative Solution for Cranioplasty"

Scott Sidwell
Vice President, Research and Development
Biomet Microfixation, Jacksonville, FL

Abstract

We will begin with a brief introduction of Biomet including the types of products that are offered as well as the company history. We will present our portfolio of cranioplasty solutions and will discuss the use of poly-ether-ketone-ketone (PEKK) as a novel material for cranioplasty.

Academia Key Note Address: "Bottom-Up Engineering of the Extracellular Matrix"

Adam W. Feinberg, PhD.
Department of Materials Science and Engineering
Department of Biomedical Engineering
Carnegie Mellon University, Pittsburg, PA

Abstract

The extracellular matrix (ECM) is a nanofibrillar network of proteins such as collagen, fibronectin and other molecules that physically integrates cells into tissues and acts as an insoluble, mechanosensitive signaling network. Recent work has demonstrated that the ECM in decellularized organs can serve as a scaffold to regrow tissues by providing instructive cues for cells. However, this is a top-down approach requiring an existing organ to be decellularized first. We asked, why not build the ECM from the bottom-up just like cells do during embryogenesis or wound healing? To do this, we have developed a biomimetic, surface-initiated assembly process that recapitulates how cells naturally build the ECM in tissues. This provides a reductionist system where complexity can be engineered back into the matrix system, which we are exploiting as a tissue engineering platform and basic science tool. Using this technology we are (i) studying basic ECM mechanobiology, (ii) developing strategies to build 3-D protein scaffolds and (iii) applying these scaffolds in cardiac and ophthalmic tissue engineering. In preliminary results, fibronectin nanofibers can undergo strains >8-fold, with complete elastic recovery. Similar studies are ongoing to elucidate the biomechanical properties of laminin and collagen type IV nanofibers. We are also using these ECM nanofibers to engineer scaffolds for cardiac tissue engineering that mimic the ECM structure and composition in the embryonic heart, using developmental biology as a design template. Thus, we are putting the ECM back together from the bottom-up and building ever more complex ECM structures from nanofibers, to basement membranes to 3-D matrices.

SESSION SPEAKER ABSTRACTS

Session 1: "Licensing Technologies"

Lenny Terry, PhD
Licensing Officer
Office of Technology Licensing

Abstract
The University of Florida Office of Technology Licensing has earned a reputation as a leader in commercializing discoveries that make the world a better place. This reputation is the result of a collaborative working relationship between faculty generating new discoveries, Office of Technology Licensing staff, and our commercial partners. UF OTL was established in 1985 to work with inventors to facilitate the transfer of technologies created at UF to the commercial sector for public benefit. We are dedicated to assisting employees who feel they have something new and useful that is potentially able to be patented or copyrighted. The first step is to report a new discovery on our new web-based disclosure form. Upon receipt, we will contact you to schedule an appointment to discuss your new discovery and determine the next steps. OTL is here to ensure your rights are protected.

Session 2: "The Journey of a Biomaterials Scientist"

Iris V. Schumacher, PhD
Customer Solutions Associate Marketing Manager
Kimberly-Clark Corporation

Abstract
Iris V. Schumacher, Ph.D. is a Customer Solutions Associate Marketing Manager for the Kimberly-Clark Corporation. Dr. Schumacher is currently the marketing leader for Kimberly-Clark's largest retailer, Wal-Mart, Inc. within the Kimberly-Clark Professional (KCP) business division. Iris has been with Kimberly-Clark for six years where she has held positions in commercialization, process development, and front-end concept and technology development. Iris has most recently embarked upon the KCP Leadership Development Program (LDP), which makes her one of four candidates to assume this position since the program began in 2009. The KCP LDP is a two year rotational program where candidates obtain cross-functional business experience in six month increments in preparation of assuming a leadership position upon program completion. Through this program, Iris will complete rotational assignments in Sales, Marketing, Product Management, and Strategy.
The purpose of this presentation is intended to broaden the view of potential careers awaiting a biomedical or biomaterials engineer after graduation. An overview of careers at the Kimberly-Clark Corporation will be shared along with details regarding recent innovations in the biomedical/biomaterials space. The presentation will end reflecting on the three most important lessons Dr. Schumacher received at the University of Florida: 1) Authenticity; 2) Ethics; and 3) Accountability.

Session 3: "Bone as a Versatile Biomaterial"

Ron Cobb, PhD
Vice-President of Biologics
Nanotherapeutics

Abstract

Bone has been used in a variety of orthopedic applications. Currently, autograft bone is the gold standard for use in most orthopedic and dental applications due to its inherent osteoinductive, osteoconductive and osteogenic potential. One current market substitute to autograft is bone graft substitutes. Bone graft substitutes come in a variety of materials, structures and delivery systems to be used in bone grafting procedures. These materials are useful in augmenting the healing of bony defects caused by traumatic injury, tumor removal, abnormal skeletal development, cyst removal and prosthetic loosening. Bone graft substitutes may also be used as a drug delivery device. Human and bovine bone loaded with antibiotics such as gentamicin release clinically relevant levels of drug for up to 14 days. No adverse effects on new bone growth were observed. Bone can also be loaded with growth factors. The growth factor loaded devices have been shown to be superior to autograft materials in several different animal studies. Additional studies were performed investigating the ability of bone as a scaffold to deliver mesenchymal stem cells. Taken together, bone is a very versatile biomaterial with numerous applications in the orthopedic and dental market.

ACADEMIA SESSION ABSTRACTS

Session 1: "Magnetic Nanoparticles as Nanoscale Probes and Actuators in Complex Fluids and Biological Systems"

Carlos Rinaldi, PhD
Professor
J. Crayton Pruitt Family Department of Biomedical Engineering
Department of Chemical Engineering
University of Florida

Abstract
Magnetic nanoparticles are of interest in a variety of applications which take advantage of their manipulation using externally applied magnetic fields. Depending on the material used, these nanoparticles may possess either a freely rotating magnetic dipole or a dipole pointing in a fixed particle-locked direction. Their response to magnetic fields depends on the nature of the magnetic material, their coating, and the viscous properties of the suspending medium. In this talk I will briefly summarize our recent work on the response of magnetic nanoparticles in suspension and subjected to time-varying magnetic fields through two topics. First, the dynamic response of magnetic nanoparticles with particle-locked dipoles in oscillating magnetic fields can be used to obtain information of the mechanical properties of the surrounding fluid. This is demonstrated through experiments in which properly functionalized nanoparticles are used to determine the liquid-solid transition temperature in a physical gel and to quantitatively determine the viscosity “felt” by nanoparticles suspended in simple and complex fluids. In the latter case deviations are seen between the nanoscale and macroscale viscosities. Second, application of high frequency and moderate to high amplitude magnetic fields to suspensions of magnetic nanoparticles results in conversion of magnetic energy to thermal energy, resulting in a localized increase in temperature. Such an effect can be applied to the treatment of certain diseases such as cancer. I will present part of our work on developing targeted magnetic nanoparticles which are biocompatible and colloidally stable in biological fluids and *in vitro* evaluation of the applicability of this novel form of treatment in destroying cancer cells.

Session 2: " Advances in Nanocomposite Design: Towards Electronic and Biomedical Applications"

Jennifer S. Andrew, PhD
Assistant Professor
Department of Materials Science and Engineering
University of Florida

Abstract
In many single-phase materials certain properties are mutually exclusive. Examples of this property dichotomy include strength and toughness, high electric permittivity and high magnetic permeability,

and soft and hard magnetic properties. Nanostructured composite materials have the potential to overcome some of these limitation of single-phase materials. From these new materials a number of novel applications ranging from electronics to biomedical devices can be developed and realized. For example, magnetic and ferrolectric materials can be combined on a single particle or fiber, yielding new nanostructured building blocks for multiferroic composites with enhanced properties. By fabricating composites on a single particle or fiber in an anisotropic manner (e.g. Janus-type) the surface and bulk properties of each phase remain accessible, providing additional degrees of freedom in composite design. For biomedical applications, nanocomposites provide a means to combine therapeutic and diagnostics. By taking advantage of how materials with specific size, shape, and chemistry respond and behave in the body new minimally invasive diagnostic platforms that detect diseases at their earliest stages can be realized.

Session 3: "Engineering Bioactive Materials for Islet Transplantation"

Cherie Stabler, PhD
Associate Professor
Biomedical Engineering, Diabetes Research Institute
University of Miami

Abstract
Clinical islet transplantation (CIT), the intraportal infusion of allogeneic pancreatic islets into a diabetic recipient, is a promising treatment for type 1 diabetes; however, the success of clinical islet transplantation is hindered by the location of the implant site, which is prone to mechanical stresses and exposure to high drug and toxin loads, as well as the strong inflammatory and immunological response to the transplant in spite of systemic immunosuppression. To address these challenges, we have focused on three primary strategies: the development of scaffolds to house islets at alternative transplant sites; the fabrication of ultrathin encapsulation protocols for the immuno-camouflage of the transplant; and the production of bioactive biomaterials for the local delivery of oxygen and immunomodulatory drugs and/or cells. Three-dimensional scaffolds serve to create a more favorable islet engraftment site, by ensuring optimal distribution of the transplanted cells, creating a desirable niche for the islets, and promoting vascularization. Ultrathin encapsulation decrease immune recognition via masking cell surfaces, thereby reducing/eliminating the need for systemic immunosuppression. Finally, engineering materials for local oxygen or drug release serves to enhance potency at the transplant site, while minimizing side effects. While these biomaterial approaches serve to enhance the efficacy of islet transplantation for the treatment of Type 1 Diabetes, these platforms have broad applicability to the field of tissue engineering.

POSTER PRESENTATIONS

1. **Name:** Clayton Argenbright
   Title: "*Hierarchical Patterning Using self-assembled block copolymers"*
   Advisor: Anthony Brennan
   Department: Materials Science and Engineering
   Affiliation: University of Florida
   Year: Graduate

2. **Name:** Adwoa Baah-Dwomoh
   Title: "*Using Irreversible Electroporation to Introduce Pores in Bacterial Cellulose Scaffolds for Tissue Engineering"*
   Advisor: Rafael Davalos
   Department: Materials Science and Engineering
   Affiliation: Virginia Institute of Technology
   Year: Graduate

3. **Name:** Jordan Ball
   Title: "*Advanced Nanocomposites for Bone Regeneration"*
   Advisor: Josephine B. Allen
   Department: Materials Science and Engineering
   Affiliation: University of Florida
   Year: Graduate

4. **Name:** Ana Carolina Bohorquez
   Title: "*Studying nanoparticle-protein interactions in situ"*
   Advisor: Carlos Rinaldi
   Department: Biomedical Engineering
   Affiliation: University of Florida
   Year: Graduate

5. **Name:** Evelyn Bracho-Sanchez
   Title: "*Delivery of Indoleamine 2,3-Dioxygenase to Dendritic Cells for the Induction of Tolerance"*
   Advisor: Benjamin Keselowsky
   Department: Biomedical Engineering
   Affiliation: University of Florida
   Year: Graduate

6. **Name:** Matthew Carstens
   Title: *"Drug-Eluting Microarrays for Screening Combinatorial Drug Interactions"*
   Advisor: Benjamin Keselowsky
   Department: Biomedical Engineering
   Affiliation: University of Florida
   Year: Graduate

7. **Name:** Kelsey Crannell
   Title: "*Polymer-based Nanocomposite for the Early Detection of Lung Cancer"*
   Advisor: Jennifer Andrew
   Department: Materials Science and Engineering
   Affiliation: University of Florida
   Year: Graduate

8. **Name:** Joe Decker
   Title: *"A Thermodynamic Approach to Engineering Antifouling Surfaces"*
   Advisor: Anthony Brennan
   Department: Materials Science and Engineering
   Affiliation: University of Florida
   Year: Graduate

9. **Name:** Maria Di BonaVentura
Title: *"Thermal and Mechanical Properties of PET and PC for Potential Food Packaging Applications"*
Advisor: Anthony Brennan
Department: Materials Science and Engineering
Affiliation: University of Florida
Year: Undergraduate

10. **Name:** Maria Di BonaVentura
Title: *"Study of an Mg-2Y-1Sc alloy for biodegradable implant applications"*
Advisor: Michel Manuel
Department: Materials Science and Engineering
Affiliation: University of Florida
Year: Undergraduate

11. **Name:** Rohan Dhavalikar
Title*: "Simulation of Magnetic Particle Imaging"*
Advisor: Carlos Rinaldi
Department: Chemical Engineering
Affiliation: University of Florida
Year: Graduate

12. **Name:** Melanie Dufva
Title: *"Determination of the Phosphate Binding Affinity of Lanthanum Carbonate for Pharmaceutical Application"*
Advisor: Christopher Batich
Department: Materials Science and Engineering
Affiliation: University of Florida
Year: Undergraduate

13. **Name:** Luke Gibson
Title: "*Polyurethane Testing for Tough, Durable Antifouling Topographies"*
Advisor: Anthony Brennan
Department: Materials Science and Engineering
Affiliation: University of Florida
Year: Undergraduate

14. **Name:** Brittany Hicks
Title: *"Effect of Substrate Stiffness on Collective Cell Migration"*
Advisor:
Department: Materials Science and Engineering
Affiliation: University of Florida
Year: Undergraduate

15. **Name:** Cassie Llano
Title: *"Engineering Mucin-Polyelectrolyte Multilayers"*
Advisor: Michael Rubner
Department: Materials Science and Engineering
Affiliation: University of Florida
Year: Undergraduate

16. **Name:** Stefan Kelly
Title: *"Polymer Nanocomposites for Early Diagnosis of Lung Cancer"*
Advisor: Jennifer Andrew
Department: Materials Science and Engineering
Affiliation: University of Florida
Year: Graduate

17. **Name:** Cary Kuliasha
Title: *"Random Acrylate Oligomer Surface Grafting to Poly(dimethyl siloxane) Elastomer Surfaces for Improved Anti-Biofouling"*
Advisor: Anthony Brennan
Department: Materials Science and Engineering
Affiliation: University of Florida
Year: Graduate

18. **Name:** David Lovett
Title: *"Modulation of nuclear shape by substrate rigidity"*
Advisor: Tanmay P. Lele
Department: Chemical Engineering
Affiliation: University of Florida
Year: Graduate

19. **Name:** Lorena Maldonado Camargo
Title: *"Viscosity of Synovial Fluid using Rotational Dynamics Theory of Magnetic Nanoparticles"*
Advisor: Carlos Rinaldi
Department: Chemical Engineering
Affiliation: University of Florida
Year: Graduate

20. **Name:** Adam Monsalve
Title: *"Magneto-mechanical actuation of cell surface receptors using iron oxide particles"*
Advisor: Jon Dobson
Department: Materials Science and Engineering
Affiliation: University of Florida
Year: Graduate

21. **Name:** Jolin Rodrigues
Title: *"A perfused flow phantom of a biological tumor for magnetic nanoparticle-mediated hyperthermia studies"*
Advisor: Jon Dobson
Department: Biomedical Engineering
Affiliation: University of Florida
Year: Graduate

22. **Name:** Michael Springer
Title: *"Differentiation of Adipose Derived Stem Cells on Nanofibrous Collagen and Elastin Matrices"*
Advisor: Josephine Allen
Department: Materials Science and Engineering
Affiliation: University of Florida
Year: Graduate

23. **Name:** Melanie Suaris
Title: Nucleation and Growth of Epithelial Cell Clusters
Advisor: Thomas Angelini
Department: Biomedical Engineering
Affiliation: University of Florida
Year: Graduate

24. **Name:** David Sullivan
Title: Immunogenicity of Decullularized Porcine Liver for Bioengineered Hepatic Tissue
Advisor: Bryon E. Petersen
Department: Biomedical Engineering
Affiliation: University of Florida
Year: Graduate

25. **Name:** Richelle Thomas
Title: *"The Manipulation of Hydrogel Lumen Architecture for Novel Biomedical Applications"*
Advisor: Christine Schmidt
Department: Chemical Engineering
Affiliation: University of Texas at Austin
Year: Graduate

26. **Name:** Laura Villada
Title: *"Porosity effect on anti-fouling efficiency of HEMA-Siloxane based hydrogels"*
Advisor: Anthony Brennan
Department: Materials Science and Engineering
Affiliation: University of Florida
Year: Graduate

27. **Name:** Jessica Weaver
Title: *"Drug-Releasing Constructs Mediate Localized Inflammation in an Islet Transplant Site"*
Advisor: Cherie Stabler
Department: Biomedical Engineering, Diabetes Research Institute
Affiliation: University of Miami
Year: Graduate

28. **Name:** Steven Zehnder
Title: **"***The cytoskeleton drives intercellular fluid flow"*
Advisor: Thomas E. Angelini
Department: Mechanical and Aerospace Engineering
Affiliation: University of Florida
Year: Graduate

29. **Name:** Wenbo Zhang
Title: **"***Nutrient uptake of Bacillus subtilis induced by extracellular matrix"*
Advisor: Thomas E. Angelini
Department: Mechanical and Aerospace Engineering
Affiliation: University of Florida
Year: Graduate

NOTES

NOTES

THANK YOU!

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