Agenda

All events will take place at the Student Activity Center in rooms 1.402 (Auditorium) and 2.410 (Ballroom).

9:00—10:00 a.m. **Breakfast/Registration** (Auditorium)
Poster Setup (Ballroom)

10:00–10:15 a.m. **Opening Remarks: Dr. Laura Suggs**
The University of Texas at Austin, Austin, TX

10:15–11:00 a.m. **Keynote: Dr. Ali Khademhosseini**
Brigham and Women's Hospital, Harvard Medical School, Harvard-MIT Division of Health Sciences and Technology, and Harvard University's Wyss Institute for Biologically Inspired Engineering, Boston and Cambridge, MA
Microengineered Hydrogels for Stem Cell Bioengineering and Tissue Regeneration

11:00–11:30 a.m. **Dr. Thomas Jozefiak**
Discovery at Living Proof Inc., Cambridge, MA
Product-Oriented Discovery: Commerical Success Stories for Polymers and Biomaterials

11:30–12:00 p.m. **Dr. David Paniagua**
Baylor College of Medicine, Houston, TX
Percutaneous Heart Valve: From Bench to Clinical Use

12:00–2:00 p.m. **Lunch & Student Poster Competition** (Ballroom)

2:00–2:20 p.m. p.m. **Dr. Elizabeth Cosgriff-Hernandez**
Texas A&M University, College Station, TX
Biomedical Applications of Emulsion Templating

Biomaterials Day at UT Austin

Translational Research in Texas

Biomaterials Day, funded by the Society for Biomaterials (SFB), is a one-day symposium at five different locations throughout the United States.

Biomaterials Day at The University of Texas at Austin will enhance networking between academic, industrial and government sectors and will increase student exposure to exciting biomaterials research. Students throughout the area, SFB members as well as non-SFB members interested in the biomaterials field attend the event. The symposium will include keynote and invited lectures by leading engineers, physicians, and scientists in the field. Oral presentations from both academic and industrial researchers will showcase ongoing research in the region and promote collaboration and knowledge exchange between institutions and industry. Finally, abstracts will be solicited for a poster session that will provide a venue for student research presentations and networking. Awards will be given for best poster.

SFB officially initiated the Biomaterials Day program in 2008 to highlight cutting-edge research and increase student interest in biomaterials careers.

Society For Biomaterials

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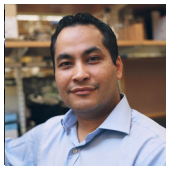
Biomedical Engineering

Biomaterials Day at UT Austin

Translational Research in Texas

Friday, May 31, 2013
Student Activity Center
Rooms 1.402 & 2.410

Speakers



Keynote Speaker

Ali Khademhosseini, **Ph.D**., Associate Professor, Brigham and Women's Hospital, Harvard Medical School, Harvard-MIT Division of Health Sciences and Technology, and Harvard University's Wyss Institute for Biologically Inspired Engineering

Dr. Ali Khademhosseini is an internationally recognized bioengineer regarded for contributions and research in the area of biomedical microdevices and biomaterials. His research is based on developing micro- and nanoscale technologies to control cellular behavior with particular emphasis in developing microscale biomaterials and engineering systems for tissue engineering. Currently, his laboratory is developing technologies to control the formation of vascularized tissues with appropriate microarchitectures as well as regulating stem cell differentiation within microengineered systems. He has edited 4 books and 4 journal special issues and is an author on more than 230 articles in peer reviewed journals, 70 book chapters/editorials, 160 abstracts, and 15 patent/disclosure applications. His work has been published in journals such as PNAS, JACS, Advanced Materials, Nature Materials, Biomaterials and Lab on a chip and highlighted in Nature, Scientific American and Technology Review Magazines. As of January 2013, he has been cited over 8,400 times and has an H-index of 48. Also, he has been invited to give nearly 150 seminars and keynote lectures.

Dr. Khademhosseini is an Associate Editor for the International Journal of Nanomedicine, Biomedical Microdevices, IEEE Transactions on Biomedical Engineering, Organogenesis and a Principal Editor of the journal Nano LIFE. He received his Ph.D. in bioengineering from MIT and MASc and BASc degrees from University of Toronto both in chemical engineering.

Microengineered Hydrogels for Stem Cell Bioengineering and Tissue Regeneration

Micro- and nanoscale technologies are emerging as powerful tools for controlling the interaction between cells and their surroundings for biological studies, tissue engineering, and cell-based screening. In addition, hydrogel biomaterials have been increasingly used in various tissue engineering applications since they provide cells with a hydrated 3D microenvironment that mimics the native extracellular matrix. In our lab we have developed various approaches to merge microscale techniques with hydrogel biomaterials for directing stem cell differentiation and generating complex 3D tissues. In this talk, I will outline our work in controlling the cell-microenvironment interactions by using patterned hydrogels to direct the differentiation of stem cells. In addition, I will describe the fabrication and the use of microscale hydrogels for tissue engineering by using a 'bottom-up' and a 'top-down' approach. Top-down approaches for fabricating complex engineered tissues involve the use of miniaturization techniques to control cell-cell interactions or to recreate biomimetic microvascular networks. Our group has also pioneered bottom-up approaches to generate tissues by the assembly of shape-controlled cell-laden microgels (i.e. tissue building blocks), that resemble functional tissue units. In this approach, microgels were fabricated and induced to self assemble to generate 3D tissue structures with controlled microarchitecture and cell-cell interactions.

Dr. Zahedul Huq, Ph.D., Principal Materials Scientist, Medtronic

Dr. Huq currently serves as Principal Materials Scientist at Medtronic, where his responsibilities include managing a Materials Engineering Lab and R&D of engineering materials for Medical devices applications (soft to hard tissues surgical applications). With Medtronic, he is responsible for materials development/support on new product development and sustaining engineering in the areas of ENT, Spinal, and soft tissue surgeries/navigation. His expertise lies in the fields of biomaterials, engineered materials and surface technologies. He has also directed research programs in corrosion resistant and biocompatible materials, materials for advanced energy application, and nanoparticle technologies. Prior to Medtronic, Dr. Huq worked in automotive and aerospace industry and DOD program. He received his Ph.D. in Metallurgy and Materials Engineering from the Catholic University Leuven, Belgium. He holds U.S. patent and has authored 20 peer reviewed journal publications. His technical affiliation includes American Society of Materials (ASM), Society for Bio-materials (SFB), and American Society of Quality (ASQ).

Biomaterials in the Design and Reliability of Surgical Devices

Biomaterials include a broad range of materials that must meet stringent and diverse requirements to be acceptable for use in the body and to meet the needs of specific devices. Selection of biocompatible materials is very critical in robust medical devices design and development, as there are so many requirements. On the other hand, good failure analysis helps development and manufacturing of reliable and durable products, corrective and preventive actions; ultimately benefits physicians and patients. In this opportunity, will discuss challenges in materials selections, approaches used for failure analysis and problem solving in the systems level.

Robert Sammler, Ph.D.,Senior Research Scientist, The Dow Chemical Company

Dr. Sammler received a Ph.D. in physical chemistry at the University of Wisconsin-Madison in 1985. He worked for 3.5 years in research on engineering polymers at the Experimental Station of the E.I. du-Pont de Nemours and Company in Wilmington, Delaware. He joined Central Research of The Dow Chemical Company in 1989, and is currently a senior research scientist in Material Science and Engineering Laboratory of Core R&D. His expertice is in material science, rheology, cellulosics, thermoplastics, thermosets, and composites. He has published in several diverse areas: rheology of low-Tg inorganic glasses, interfacial tension between immiscible molten high polymers, assessment of long-chain branching in star and comb high polymers with dilute-solution rheology/flow birefringence, rheological detection of low levels of long-chain branching in molten polyolefins, NMR metrics of non-uniform crosslink domains in seeded suspension-polymerized submillimeter beads, and on the fundamentals of thermal gelation and conformational chain collapse in aqueous cellulosic materials. He is a co-inventor of technology used for high-melt-strength polypropylene applications, and for novel cellulosic materials targetted for satiety/weight-control applications.

Design of Cellulose Ether Materials with Novel Thermal Gelation Performance

Cellulosic ether materials are used extensively today in food and pharmaceutical

applications. Recent research has focused on the development of novel methylcellulose (MC) and hydroxypropylmethylcellulose (HPMC) materials with an ability to gel in water at much lower temperatures. The lower gel temperatures of these thermally-active materials enable their use in satiety/weight-control applications. An example of a new MC material is presented that is able to dissolve in cold water (or cold food) at typical food-application concentrations (1 to 2 wt.%) and then gel when warmed to body temperatures (37 ºC) with a gel strength (> 2 Newtons) suitable for satiety applications. The key chemical structural features associated with lower-gel-temperature materials will be discussed. Similar concepts have been applied to decrease the gel temperature of HPMC materials; proposed origins of their strongly-elevated hot gel moduli and strengths, and their new ability to produce syneresed fluid after gelation, will be presented.

This talk will be similar to my presentation at the 244th American Chemical Society National Meeting, Philadelphia, PA, August 19 - 23, 2012, Materials for Health and Medicine; Cellulose and Renewable Materials Division.

Organizing Committee

Laura Suggs, Ph.D.
(Committee Chair) Associate Professor, Biomedical Engineering
The University of Texas at Austin

Elizabeth Cosgriff-Hernandez, Ph.D.
Assistant Professor, Biomedical Engineering
Texas A&M University

Melissa Grunlan, Ph.D.
Associate Professor, Biomedical Engineering
Texas A&M University

Jeffrey Jacot, Ph.D.
Director, Pediatric Cardia Bioengineering Laboratory
Texas Children's Hospital
Assistant Professor, Bioengineering
Rice University

Nicholas A. Peppas, Sc.D.
Department Chair, Biomedical Engineering
Professor, Biomedical Engineering, Chemical Engineering, and Pharmacy
The University of Texas at Austin

2:20–2:40 p.m.	**Dr. Ajay Padsalgikar** St. Jude Medical Center, Minneapolis-St. Paul, MN *Stability of Polyurethanes in Cardiac Applications: A Review of In-vitro and In-vivo Techniques*
2:40–3:00 p.m.	**Dr. Parijat Bhatnagar** Baylor College of Medicine, Houston, TX *Multi-Modal Imaging of Anti-Cancer Genetically Engineered Primary Human T Cells*
3:00–3:20 p.m.	**Break**
3:20–3:40 p.m.	**Dr. Aaron Baker** The University of Texas at Austin, Austin, TX *Engineering Effective Revascularization Technologies for Ischemia in Disease States*
3:40–4:00 p.m.	**Dr. Zahedul Huq** Medtronic, Dallas, TX *Biomaterials in the Design and Reliability of Surgical Devices*
4:00–4:20 p.m.	**Dr. Robert Sammler** The Dow Chemical Company, Saginaw, MI *Design of Cellulose Ether Materials with Novel Thermal Gelation Performance*
4:30–7:00 p.m.	**Reception** (Ballroom) *Student Poster Award Winners Announced*

Elizabeth Cosgriff-Hernandez, Ph.D., Assistant Professor, Department of Biomedical Engineering, Texas A&M University

Dr. Elizabeth Cosgriff-Hernandez is assistant professor in the Department of Biomedical Engineering at Texas A&M University. Her laboratory specializes in the development of hybrid material systems that combine the advantages of synthetic and natural polymers (e.g. collagen) to advance tissue-engineering design. Biomaterial synthesis is complemented by the development of new fabrication strategies that improve the ability to manipulate 3D scaffold architecture. In addition to providing improved scaffolds for tissue repair, these innovative biomaterials and fabrication strategies provide new tools to probe the complex process of tissue remodeling in order to enhance the rational design of biomaterial scaffolds and guide tissue regeneration strategies. The primary applications investigated by the Cosgriff-Hernandez laboratory include cell-responsive biomaterials for ligament tissue engineering; emulsion templating of high-porosity bone grafts; and multilayer vascular grafts based on bioactive hydrogels. She received a Ph.D. in macromolecular science and engineering and a B.S. in biomedical engineering from Case Western University.

Biomedical Applications of Emulsion Templating

Enormous efforts have been made to develop fabrication strategies that generate tissue engineering scaffolds with high porosity to facilitate cellular in-growth, vascularization, and nutrient/waste transport. Injectable scaffolds that cure in situ can fill irregular shaped defects to enhance healing; however, current strategies are often limited by a lack of porosity, biodegradability, or poor mechanical properties. Our laboratory has developed an emulsion templating method that generates high porosity scaffolds that are both biodegradable and injectable. Modulation of polymer chemistry has been used to generate a range of mechanical properties from rigid bone scaffolds to elastomeric, soft tissue grafts. Recently, we have demonstrated that mesenchymal stem cells can be encapsulated in the foam as a means to deliver cells directly to the defect. This unique aspect permits fundamental studies on scaffold permeability and graft vascularization. Overall, emulsion templating has demonstrated great potential to facilitate repair in a wide range of clinical specialties.

Ajay Padsalgikar, Ph.D., Chief Scientist, St. Jude Medical Center

Ajay graduated with a degree in Polymer Engineering from the University of Poona, India and a Ph.D. from Clemson University. In his Ph.D., he worked on the micro-rheology of polymer blends and their resultant structure formation in the process of fiber spinning. While working at the Research & Technology Center at ICI Polyurethanes in Belgium, Ajay worked on the processing of polyurethanes, thermoplastic as well as thermoset. In 1999, ICI Polyurethanes became Huntsman Polyurethanes. Ajay's work continued in the field of processing of polyurethanes and became focused on computer modeling and simulation of the different processes including polyurethane synthesis. In 2002, Ajay joined AorTech Biomaterials. He served as the Chief Scientific Officer of the company and various projects that he was involved with included polyurethane bulk and solution synthesis, chemical engineering of the synthesis of raw materials for polyurethanes, processing of polyurethanes for medical devices. Ajay joined St Jude Medical in December 2012 as a Chief Scientist and is involved with material development, application

and characterization in the cardiac space. He has more than 20 published scientific papers and 10 granted or pending patents.

Stability of Polyurethanes in Cardiac Applications: A Review of In-vitro and In-vivo Techniques

Implantable polyurethanes have been utilized in the medical industry for decades due to the combination of biocompatibility and toughness, abrasion resistance properties and advantages of thermoplastic processability. The long term stability and performance of these materials in the body has been a topic much research and scrutiny. Several in-vitro and in-vivo studies on implantable polyurethanes have demonstrated the main degradation modes in the body are oxidation and hydrolysis. The susceptibility of polyurethanes to these degradation modes depends on the composition of the hard and soft block segments that comprise the material. Defining different degradation pathways and assess material properties that affect biostability are reviewed here. Improved biostability has been found by utilizing polydimethyl siloxane (PDMS) over polyether or polycarbonate systems in the soft block segments of the polyurethanes. This new class of materials that employs PDMS alongside traditional polyurethanes has shown significantly enhanced resistance to degradation, while retaining their toughness and abrasion resistance properties. In a review of different in-vitro methods employed to assess long term stability of implantable polyurethanes, it is shown that traditional accelerated aging techniques such as high temperature water aging, using Time Temperature Superposition (TTS) theory are not applicable when using multi-phase polymer systems. The micro-heterogeneous nature of certain types of polyurethane materials change continuously with temperature, invalidating the use of accelerated testing based on high temperature. With different limitations of the in-vitro techniques, in-vivo data has been the most reliable source.

Parijat Bhatnagar, Ph.D., Assistant Professor (Cell Therapies and Nanomedicine), Baylor College of Medicine

Parijat Bhatnagar is a tenure-track assistant professor in the Department of Obstetrics and Gynecology at Baylor College of Medicine. With background in materials science, biomedical engineering, and translational medicine; he is developing an interdisciplinary translational research laboratory to harness minimally invasive systems to obtain serial samples that can be tested on microfluidic platforms. He is also developing targeted drug delivery methods with spatial and temporal resolution to target tumor and its microenvironment. The focus of his talk is on imaging of adoptively transferred primary T cells engineered to express a CD19-specific chimeric antigen receptor to redirect their specificity to malignant B cells. He will discuss the behavior of T cells when they are loaded with multi-modal imaging agents to enable PET (high-sensitivity) and MRI (high-resolution) detection.

Multi-Modal Imaging of Anti-Cancer Genetically Engineered Primary Human T Cells

Recent developments in cancer medicine have been strongly supplemented by the maturation of cell and gene therapies that have evolved over the past few decades. Adoptive cell therapy is the infusion of T cells genetically modified to express chimeric antigen receptors (CAR) for molecular targeting of tumor-associated antigens on

malignant cell. These T cells have been shown to exert anti-tumor response and are now being actively pursued in clinical trials. The challenge therefore is to determine if these T cells home to their tumor targets in human patients and to determine their dosing schedule for maintaining cytotoxic pressure over the tumor microenvironment. Although, serial sampling from various tissues followed by quantitative PCR or flow cytometry has been used; it is invasive, painful, and does not provide whole-body distribution. At the interface of immunotherapy and nanotechnology, this talk will summarize our efforts in immuno-engineering and development of multi-modal imaging for assessing whole-body biodistribution of T cells. We envision that this technology can be implemented in the clinic for two-step imaging – positron emission tomography (PET) to identify approximate homing locations of labeled T cells with high-sensitivity; and magnetic resonance imaging (MRI) to scan these locations at high-resolution to report on anatomically correlated biodistribution of adoptively transferred T cells. This approach has a clinical appeal as it builds upon ongoing clinical trials for CD19+ B-cell malignancies and uses an approach for generating CD19-specific-CAR+ffLuc+SPION-FL-64Cu+ T cells that can be readily undertaken in compliance with current good manufacturing practice for Phase I/II trials.

Aaron Baker, Ph.D., Assistant Professor, Biomedical Engineering Department, The University of Texas at Austin

Dr. Aaron B. Baker is an Assistant Professor of Biomedical Engineering at the University of Texas at Austin. He received his B.S.E/M.S.E. degrees in Bioengineering from the University of Washington and his Ph.D from the Harvard-MIT Health Sciences and Technology Program. Baker directs the Laboratory for Cardiovascular Bioengineering and Therapeutics whose research uses multidisciplinary approaches to understand the mechanisms of cardiovascular diseases with the ultimate goal of developing novel therapeutic strategies to alter the course of proteoglycan-mediated disease processes. His group's work has been recognized with multiple awards including a New Innovator Award from the National Institutes of Health (NIH). His research is funded through grants from the American Heart Association, NIH, and the Texas 4000 Foundation.

Engineering Effective Revascularization Technologies for Ischemia in Disease States

Chronic myocardial ischemia and peripheral ischemia are leading causes of morbidity and mortality in developed countries. Current therapies for treating ischemia include the use of percutaneous or surgical interventions that have significant risks and limitations. Inducing angiogenesis for the treatment of ischemia is an appealing therapeutic strategy for patients in whom traditional treatment modalities cannot be performed or are ineffective. While therapeutic angiogenesis holds great promise for treating patients with ischemia, none of the current methods have found success in clinical trials. In this work, we examined growth factor signaling pathways in mice and rats with long-term disease to look for "broken links" that would prevent effective therapeutic revascularization. We found that specifically for FGF-2, there was a significant decrease in the co-receptor, syndecan-4, for FGF-2 in the presence of disease. We created a therapeutic strategy of delivering FGF-2 in combination with syndecan-4 proteoliposomes to restore the growth factor responsiveness to the tissues. We found these treatments increased growth factor responsiveness in cells and enhanced the revascularization in rats following the surgical induction of ischemia. Taken together, these studies have identified potential mechanisms through which tissues become resistant to revascularization therapies and have developed a novel therapy that may lead to more effective treatments for patients with ischemic disease.

Thomas Jozefiak, Ph.D., Vice President, Discovery, Living Proof Inc.

Dr. Jozefiak recently joined Living Proof Inc. where he leads a Discovery group seeking to bring innovative biomaterials solutions to problems in skin and hair care. Previously, he was Vice President, Biomaterials Science & Engineering at Genzyme Corporation where he was responsible for product support and new product development for medical devices. His work at Genzyme focused on degradable implantable biomaterials including: adhesion barriers, viscosupplements, hemostats, sealants, dermal fillers, and agents for wound and cartilage repair. He has technical expertise in biomaterials, cheminformatics, polymer and medicinal chemistry. With Genzyme, he helped build a small molecule discovery group and led medicinal chemistry programs in diverse areas including obesity, polycystic kidneydisease, type-II diabetes, and cancer. Jozefiak has also held research positions at GelTex Pharmaceuticals, Eastman Kodak, GE Plastics, and Caltech. He received a Ph.D. in chemistry from the University of Minnesota and a B.S. in chemistry from the University of Massachusetts at Amherst.

Product-Oriented Discovery: Commercial Success Stories for Polymers and Biomaterials

Scientists and engineers in commercial organizations carry out a wide variety of discovery activities ranging from basic research to product development and support. A critically important role for commercial discovery is to bridge the gap between our current scientific understanding and our ability to translate this knowledge into developable products. Product-Oriented Discovery seeks to exploit these gaps to reveal valuable commercialization opportunities.

Product-Oriented Discovery will be illustrated in three case studies where a polymer or biomaterial product was successfully developed after a focused period of research driven by a target product profile. In each case, key inventions were required to enable commercialization of the new product. Successful product-oriented discovery programs have common attributes. The discovery of Renagel® oral phosphate binder, Seprafilm® surgical adhesion barrier, and Focalseal-L® lung sealant each illustrate these attributes and offer valuable lessons for industrial scientists and engineers.

David Paniagua, M.D., Assistant Professor of Medicine, Baylor College of Medicine

Dr. Paniagua's clinical interests are in cardiology, coronary intervention, and valvular heart disease. His research involves development of a heart valve that can be implanted with catheter techniques, rather than through open heart surgery, as well as the use of databases to analyze variables that may determine outcome using logistic regression models. Using regression models, he has developed clinical prediction rules to stratify the risk of complications during percutaneous coronary interventions. He received his M.D. from the University of Costa Rica and was a recipient of a cardiology fellowship with Mount Sinai Medical Center, where he also completed his residency.

Percutaneous Heart Valve: From Bench to Clinical Use

The development of a concept or an idea with a potential clinical applications evolves through a series of steps.The initial one is the negative reception and skepticism, follow by the proof of concept and the required pre-clinical and clinical testing. This presentation will summarized a decade of evolution from the idea of a percutaneous heart valve to the development of the product.