# WEDNESDAY, APRIL 16, 2014

**7:30 am – 7:00 pm** **Registration Open**

**8:00 am – 10:00 am** **Workshop 1: US vs. China – Regulation, Standard, and Innovation – II:**

**Session Co-Chairs:** Andy Doraiswamy, PhD, Arthur Coury, PhD, Xingdong Zhang, PhD, Wei Lui, MD, PhD
**Invited Speakers:** Wei Sun, PhD, Carl Simon, PhD, Hong Lin, Michael Yazemski, MD, PhD, Yiwu Zhao, James M. Anderson, MD, PhD, Yunbing Wang, PhD, Casey Hughes
The workshop is a continuation to the series that began in SFB 2013 to promote discussions between innovation, testing, standards, and regulation for medical devices and biomaterials between US and China. The session will encompass presentations on the topic of regulation, standards, and innovations between the two nations by opinion leaders from academia, regulatory bodies, and industry. The workshop will serve as a forum for discussions in developing a medical device from conception to commercialization between the two countries.

**Workshop 2: Computational Modeling of Local Cardiovascular Therapies: State of the Art and Regulatory Perspectives**

**Session Co-Chairs:** Natalie Atzi, Rami Tzafriri
**Invited Speakers:** Dawn Bardot, PhD, Ismail Guler, MS, Kumaran Kolandaivelu, MD, PhD
Local drug delivery therapies have transformed the practice of cardiovascular medicine, yet the complexity of the underlying physiological forces governing drug distribution and effects severely limit our ability to extrapolate and predict the efficacy and safety of devices based on in vivo studies alone. Computational approaches have emerged as a crucial tool that allow us to model device function, understand the device-tissue interaction, explore the impact of biophysical design modifications, and drive innovation beyond our intuition. This workshop will provide a forum for experts from academia, industry and regulatory agencies and feature presentations that cover state of-the-art developments in computational modeling of local cardiovascular drug delivery systems, and their role in regulatory applications.

**8:00 am – 1:00 pm** **Women in BME Seminar and Lunch**

**Session Chair:** Laura Suggs
**Invited Speakers:** Conley Wake-Zani
The aim of this seminar is to enhance the leadership skills of BME women faculty. SFB has generally had good participation by women at the student and postdoc levels. At the level of senior women faculty, however, the percentage of women is lower, reflecting the low numbers of women in senior STEM positions across the country. Our organization has also struggled to nominate (and elect) successful women for senior awards. The purpose of this seminar is to bring in tools from the business community which will allow women to better progress in leadership roles throughout their career. We propose to bring in a business consultant, Conley Wake Zani. Conley received her Bachelor's and Master's degrees from Rice University. Her graduate work was in the department of Chemical Engineering in the laboratory of Prof. Antonios Mikos. She previously

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worked as a business consultant for Bain & Company. She received her business degree from Harvard Business School and owns her own management consulting company, TeamOne Consulting, and routinely gives leadership seminars across the country and internationally.

**8:30 – 10:00 a.m.** **Technology & Training Forum** ***sponsored by Sanofi***

**Therapeutic Polymers and Biomaterials – Hyaluronan**
This forum will cover the chemistry and biology of HA and the chemical modifications that allow it to be used as an effective medical device. Genzyme (Sanofi) has successfully modified HA to be used in products for both orthopedics and anti-adhesion. HA has unique physical properties that allow it to be used for many indications such as drug delivery and ocular surgery. Genzyme will explore these properties to gain a better understanding for the potential of HA

**10:15 – 11:45 a.m.** **Technology & Training Forum** ***sponsored by Anton Paar***

**Charge Ahead! - Surface Characterization of Biomaterials**
The surface charge of solid materials is best assessed by means of zeta potential analysis performed directly at the solid/water interface using the streaming potential technique. Zeta potential analysis furthermore enables time-resolved adsorption studies of biological compounds, thus contributing to the understanding of e.g. protein-biomaterial interaction. After an introduction to the principles and benefits of zeta potential analysis, the state-of-the-art instrument for zeta potential analysis on solids, SurPASS Elektrokinetic Analyzer, will be presented. Together with its wide range of measuring cells, SurPASS allows for the analysis of biomaterial samples of different shape and geometry over a wide pH range and at different electrolyte compositions.

**10:15 am – 12:00 pm** **Workshop 3: Recent Advances in Rapid Prototyping of Biomaterials**

**Session Chair:** Roger Narayan
**Invited Speakers:** Sang Jin Lee, PhD
Patients and physicians are demanding more individualized, "patient-specific" treatments for injury, trauma, or disease processes. Several investigators have recently examined the use of rapid prototyping technologies, including microcontact printing, fused deposition modeling, selective laser sintering, inkjetting, and laser direct writing, to overcome the limitations associated with conventional processes. These technologies involve fabrication of three-dimensional structures through additive joining of materials in a layer-by-layer manner. For example, recent studies have shown that rapid prototyping techniques may be used to process cells and scaffold materials in order to create patient-specific tissue substitutes. This workshop will review recent developments in rapid prototyping technologies for processing biomaterials into artificial tissues as well as biosensors, drug delivery devices, and medical instruments. Several topics related to rapid prototyping, including processing of radiographic images, development of computer models, novel rapid prototyping technologies, and novel materials for use in rapid prototyping, will be discussed. This workshop will create collaboration

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and discussion among the many groups involved in the development and use of rapid prototyping technologies, including biomaterials engineers, medical scientists, medical device manufacturers, equipment manufacturers, and clinicians. We anticipate that rapid prototyping of biomaterials in medicine, surgery, and dentistry will become more significant in the coming years.

**Workshop 4: Research and Product Development from an Industry Perspective**

**Session Co-Chairs:** Andy Doraiswamy, PhD, Rakhi Jain, PhD
**Invited Speakers:** Shrojai Desai, PhD, Peter Edelman, PhD, Bob Hastings, Steve Van Noy
Differences and disconnects between academic research and corporate research/product development are often debated and widely misunderstood between the two groups. For the 2014 SFB meeting, we would like to invite you to the workshop that will present product development from an industrial perspective. The workshop will be organized as a series of lectures from product development leaders in industry with applications in ophthalmology, cardiology, orthopaedics, and disposable medical devices. The lectures will encompass history, background, current state of the art, immediate and future goals on unmet patient needs, and elucidate the path for product development and regulatory approval.

**1:00 pm – 2:30 pm** **Concurrent Session I**

- **Advances in Ophthalmic Biomaterials:**

  **Contributing SIGs:** Drug Delivery, Ophthalmic Biomaterials, Surface Characterization and Modification
  **Session Co-Chairs:** Andy Doraiswamy, PhD, Rakhi Jain, PhD, Hu Yang, PhD
  Ophthalmic biomaterials arena is a rapidly growing area for advanced biomaterials research with wide-spread clinical applications. The demand for advanced ophthalmic care (non-elective procedures such as cataract surgery, glaucoma surgery, age-related macular disease treatments) is growing at a rapid pace. For the 2014 SFB meeting, we would like to invite you to present on the progress of biomaterials research toward next-generation ophthalmic care. The scope of the session will encompass novel biomaterials technology and implant pathology in the ophthalmic arena.

- **Engineering Cell-Cell Interactions within Biomaterials**

  **Contributing SIG:** Engineering Cells and Their Microenvironments
  **Session Co-Chairs:** Chien-Chi Lin, Sarah Stabenfeldt
  Cell-cell interactions, notably paracrine signaling, are critical processes responsible for regulating a wide range of cellular processes. Engineering the correct balance of paracrine signaling and heterotypic cell-cell interactions within a biomaterial is critical for applications such as developing artificial stem cell niches, modeling the etiology and expansion of disease (e.g. cancer), or regenerating tissues. This symposium will address novel biomaterial systems that enable rigorous study of the role cell-cell interactions, both direct cell contact as well as autocrine and paracrine mediated signaling, play in regulating key cell behavior or material bioactivity.

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- **Microfabrication Techniques for Vascularization of Tissue Engineered Constructs**

  **Contributing SIG:** Tissue Engineering
  **Session Co-Chairs:** Gulden Camci-Unal, Zhen Gu
  Tissue engineered constructs that include cells, biomaterials and small molecules are widely employed in regenerative medicine research. However, lack of vascularization is a significant hurdle in generation of properly functioning tissue mimetics due to potential nutrient and mass transport limitations. The ultimate success of tissue engineering platforms relies on the formation of highly vascularized three dimensional constructs with clinically relevant sizes. Towards this aim, various microfabrication techniques (e.g. microfluidics, bioprinting, micromolding, photolithography) were utilized to develop prevascularized constructs by generating vascular geometries. This session will cover the basics of these technologies, their uses to induce vasculogenesis, and integration of the vascularized tissue constructs into the host. Moreover, a wide spectrum of applications from development of artificial blood vessels and endothelialization to anastomosis and angiogenesis will be emphasized.

- **Pioneering Biomaterial Strategies for Traumatic Craniomaxillofacial Injuries**

  **Contributing SIGs:** Orthopaedic Biomaterials
  **Session Co-Chairs:** Sachin Mamidwar, Delphine Dean, Kurtis Kasper
  Craniofacial bone defects often need distinctly different approaches of therapy compared to orthopedic trauma. This session will have speakers who have tested biomaterials/ composite delivery systems in both orthopedic and craniofacial wounds, and is designed to highlight the differences in results and summarize resulting cues to future efforts. We will also have an emphasis on the appropriate animal models, outcome measures to test material translation to therapy, and regulatory and commercialization pathways.

- **Recent Developments in Heart Valve Technology**

  **Contributing SIG:** Cardiovascular Biomaterials
  **Session Co-Chairs:** Peter Edelman, Kishore Udipi
  We are witnessing a surge in activity related to heart valve technology, especially transcutaneously implanted aortic valves and various approaches to treat mitral valve disease. Several versions of this life-saving device have gained regulatory approvals both in the US and Europe. Many medical device companies are fully engaged in this area including Edwards Life Sciences, Medtronic, St. Jude, Boston Scientific, and Direct Flow to name a few. This session is intended to review the pros and cons of the various biomaterials used in heart valves, designs, and the progress made to date in solving the chronic leaflet calcification problem. Strong industry participation is anticipated.

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- **Surgical Meshes**

  **Session Co-Chairs:** Charles E. Butler, Anshu B. Mathur
  Reconstructive surgery with meshes is commonly used to repair musculofascial defects in the abdominal wall that result from traumatic injury or ventral hernia, to treat diabetic ulcers, and as an hemostatic agent. Current reconstructive options in this arena are autologous tissue (fascial grafts or tissue flaps), which are limited in supply, synthetic materials such as polypropylene (PP mesh) that cause bowel adhesions, and naturally derived degradable extracellular matrix (ECM) scaffolds (acellular dermis, small intestine submucosa) that are animal or human derived, expensive, limited in size, and provide limited control of architecture per patient specific geometry or initial mechanical properties, and biopolymers based such as collagen and chitosan. This session will highlight the fabrication, characterization, preclinical work, and clinical use and outcomes of surgical meshes and further lay out opportunities and future of the area of surgical meshes.

**3:00 pm – 4:00 pm** **Ophthalmic Biomaterials SIG Meeting – Convention Center Room 608**

**3:00 pm – 5:00 pm** **Concurrent Session II**

- **Assessment and Development of Biomaterials Outreach Activities**

  **Contributing SIGs:** Biomaterials Education, Drug Delivery, Tissue Engineering
  **Session Co-Chairs:** Julie C. Liu, Cassandra J. Wright-Walker

  An outreach component often accompanies grant proposals (e.g., NSF CAREER proposal); however, most researchers do not have experience with outreach activities and have not been trained to assess them. This session is geared toward helping educators as well as those in industry learn about various outreach activities and assess if they are truly impactful. This session will include an invited speaker who specializes in education assessment. Additionally, we are looking for abstracts that describe outreach modules developed within the field of biomaterials. The session will conclude with a round table discussion (including the invited speaker and the presenters) of issues pertaining to outreach and assessment. The goal is to have a well-rounded session that would attract not only college-level educators/future educators but also industry representatives.

- **Bio-Inspired Cellular Microenvironments**

  **Contributing SIGs:** Engineering Cells and Their Microenvironments
  **Session Co-Chairs:** Daniel L. Alge, Chelsea M. Kirschner, Anthony Brennan
  Bio-inspired concepts for biomedical engineering are at the forefront of tissue engineering and regenerative medicine. Scientists, engineers and physicians are working together to replicate the sophisticated hierarchical organization and adaptability found in nature and selected by evolution to recapitulate the cellular microenvironment. This session covers the latest bio-inspired materials synthesis techniques and biomedical applications that are advancing the fields of biomaterials and tissue engineering.

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- **Biomaterial Strategies for Innervation, Nerve Repair and Integration**

  **Contributing SIGs:** Proteins and Cells at Interfaces, Tissue Engineering
  **Session Co-Chairs:** Jeffrey R. Capadona, Shelly Sakiyama-Elbert
  The development of effective therapeutic interventions for severe neurological deficits has escaped our community, despite significant developments in synergistic research areas. This symposium will solicit abstracts that facilitate a robust discussion pertaining to the combination of principles required to modulate inflammation, secondary damage, and plasticity, while promoting natural repair and neural regeneration. Presentations should begin to explore the role of advanced biomaterials (natural vs. synthetic), micro-fabricated devices, engineered interfaces, tissue engineering strategies, and an understanding of cell-biomaterials interactions, in order to provide a critical foundation for the next-generation of functional neural rehabilitation.

- **Biomaterials in the Fourth Dimension - Controlling Temporal Properties**

  **Contributing SIGs:** Engineering Cells and Their Microenvironments
  **Session Co-Chairs:** April M. Kloxin, Sarah E. Stabenfeldt
  Dynamic interactions between cells and their microenvironments, especially cell-matrix interactions, play a key role in tissue homeostasis, regeneration, or disease. Understanding and harnessing the dynamics of cell-biomaterial interactions to direct regeneration or understand disease is a challenging, but critically important burgeoning research area in biomaterials science. This symposium will highlight strategies to design biomaterials whose properties change temporally in a predictable, programmable, or even responsive manner and the use of these temporally regulated materials to probe and direct cell function and fate. Topics will include novel biomaterial synthesis and characterization, temporal material modification and characterization strategies, and applications of temporally-evolving biomaterials for cell culture and regenerative medicine.

- **Cardiovascular Drug Delivery**

  **Contributing SIG:** Drug Delivery
  **Session Co-Chairs:** Craig L. Duvall, Peter Edelman
  Cardiovascular disease remains the leading cause of death worldwide, motivating the need for technologies that will improve the outcomes of cardiovascular interventions and/or will stimulate endogenous cardiovascular repair processes. This session will focus upon advanced drug delivery systems designed to target cardiovascular disease to increase the efficacy of conventional and new therapeutic compounds. These systems include drug eluting stents, drug eluting balloons, scaffolds and matrices for controlled drug release, and targeted, nanocarrier systems.

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- **Orthopaedic Polymers**

  **Session Co-Chairs:** Joseph Freeman, Yusuf Khan
  Nondegradable olymers such as UHMWPE, polyethylene and PEEK are currently and extensively used in orthopedic implants for various purposes. Although these polymers possess a unique set of surface and bulk properties that determine their ultimate performance and have a long history of use in orthopedics, further developments enable the industry to make superior implants. This session focuses on long and short-term studies discussing current state-of-the-art advances in various polymeric biomaterials used in orthopedic implants. This session will also focus on novel approaches to using nondegradable polymers as composites.

**5:30 pm – 7:00 pm** **Opening Ceremony**

- **Founders Award Address**: Rena Bizios, PhD, University of Texas at San Antonio

- **Keynote Address: Michael J. Yaszemski, MD, PhD, Mayo Clinic**

Dr. Michael J. Yaszemski is the Keynote Speaker at the 2014 Society for Biomaterials Meeting, Denver Colorado. He is currently the John and Posey Krehbiel Endowed Professor of Orthopaedic Surgery and Bioengineering at the Mayo Clinic and the Director of the Tissue Engineering and Biomaterials Laboratory. In addition, Dr. Yaszemski is a retired Air Force Brigadier General and served in the office of the Air Force Surgeon General and the office of the President of the Uniformed Services University of the Health Services prior to retiring in 2013. He earned his Bachelor of Science and Master of Science degrees in Chemical Engineering from Lehigh University in 1977 and 1978, respectively. Commissioned as a second lieutenant in the Air Force Reserve in 1979, he was promoted to Captain and entered active duty upon graduation with his Doctor of Medicine degree from Georgetown University in 1983. Dr. Yaszemski completed Orthopaedic Surgery residency at Lackland Air Force Base, Texas in 1989 and his spine surgery fellowship at Harvard Medical School in 1991. In 1995, he earned his Doctor of Philosophy degree in Chemical Engineering from the Massachusetts Institute of Technology. As a spine surgeon, Dr. Yaszemski's clinical practice involves spinal surgery and sacro-pelvic tumor surgery. As a researcher, Dr. Yaszemski's focus is on the synthesis and characterization of novel degradable polymers for tissue engineering strategies to facilitate axonal regeneration in spinal cord injuries, bone formation in both segmental and contained skeletal defects, peripheral nerve regeneration in segmental nerve defects, and treatment of musculoskeletal tumors through controlled local drug delivery. The long term potential impact of Dr. Yaszemski's research is to fundamentally change the way many common

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debilitating, life-threatening orthopedic conditions are treated and to revolutionize a number of orthopedic and neurosurgical procedures that have been used for decades.

**7:00 pm – 8:30 pm** **Opening Reception & Poster Session I (In the Exhibit Hall)**

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**7:00 am – 5:30 pm** **Registration Open**

**7:00 am – 8:00 am** **Special Interest Group Meetings (coffee and danish provided)**

**8:00 am – 10:00 am** **Concurrent Session III**

- **Biomaterials Microenvironment for Stem Cells and Tissue Regeneration I**

  **Contributing SIG:** Tissue Engineering
  **Session Co-Chairs:** Peter Ma, Anshu Mathur
  Clinical use of biomaterials can be found in cardiovascular devices, nerve replacement therapy, critical sized defect reconstruction, and stem cell delivery via micro-catheters and scaffolds. For example, reconstruction to restore defects with large volumes of bone secondary to loss of tissue due debilitating diseases is treated with patient derived tissue (e.g. stem cells) and biomaterial therapy. The goal is to fully restore functional tissue or regenerate tissue by stimulating and guiding the body's capacity to regenerate using specially engineered and tissue integrating biomaterials that heal with and without stem cell delivery. Resident host tissues such as the periosteum and perichondrium and induced pluripotent stem cells can be combined for fabricating mechanically robust bone, trachea, musculofascia, and signal conducting nerves. Stem cells have high proliferation capability and can differentiate along multiple lineages. Therefore, stem cells have high potential for regenerative therapies. While recent discoveries have demonstrated that stem cell fate can be directed by certain material structures and properties, there are very limited understandings. This symposium will showcase new advancements in biomaterial microenvironment design and their interactions with stem cells.The idea is to have clinicians/ surgeon scientists of various specialties present in the same session as basic science researchers/ scientists to showcase stem cell -biomaterial therapy from lab to clinic.

- **Engineering Stimuli-Responsive Cues into Biomaterials**

  **Contributing SIGs:** Engineering Cells and Their Microenvironments, Proteins and Cells at Interfaces, Tissue Engineering
  **Session Co-Chairs:** Nathan Gallant, Amol Janorkar
  The native extracellular matrix is instructive, providing a dynamic and spatially heterogeneous constellation of microstructural, mechanical, and compositional cues that can influence cell behavior. Stimuli-responsive materials that mimic this dynamic environment offer unique advantages to direct cell behavior and achieve appropriate biological function. This symposium aims to present and discuss new developments in the approaches and materials that are responsive to environmental cues. The externally controllable stimuli may include (but are not limited to) temperature, pH, or cellular products. Abstracts dealing with biological events on smart materials that are responsive to environmental cues or the cellular microenvironment are solicited from fields as wide ranging as developmental biology, immunology, regenerative medicine, and stem cell biology.

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- **Mechanobiology for Biomaterials Design**

  **Contributing SIG:** Engineering Cells and Their Microenvironments, Tissue Engineering
  **Session Co-Chairs:** Stephanie Bryant, Laura Indolfi, Wei Tan
  An increasing body of evidence has shown that cells interacting with biomaterials can recapitulate the molecular events underlying mechanotransduction in development, including those induced by extracellular matrix mechanics and those by mechanical stresses. These mechanical signals, collaboratively with chemical cues and scaffold structures, allow cells to repair or regenerate damaged tissues, or in the opposite direction to form diseased phenotypes. To this end, novel biomaterials that reproduce physiological-related mechanical environments could enhance both mechanistic understandings and translational potentials of cell fate determination. The goal for this session is to provide a platform to highlight recent biomaterial developments related to this theme, aiming to elicit extensive discussion about mechanobiology underlying healthy versus diseased phenotype differentiation during repair, remodeling or regeneration in for example cardiovascular and musculoskeletal tissue engineering. In this light, since properties of surrounding tissues play important role in mechanotransduction, this session will also highlight new and innovative way to characterize tissue and biomaterial mechanical properties.

- **Nanostructured Biomaterial Surfaces for Cellular and Tissue Engineering**

  **Contributing SIGs:** Nanomaterials, Orthopaedic Biomaterials, Tissue Engineering
  **Session Co-Chairs:** Huinan Liu, Nuno M. Neves
  The topics covered in the Symposium will span from micro- and nano-particles developed to obtain injectable systems for controlled and sustainable release of drugs and bioactive molecules, to porous scaffolds for tissue engineering, hydrogels and patterned surfaces to explore specific functionalities or even self-assembling systems following bottom-up strategies. This Symposium will focus on recent advances on the application of nanostructured surfaces for controlling biological interactions at protein, cellular, and tissue level. Designing materials mimicking the extracellular matrix or interacting with this milieu at the same scale allows exploring new routes in gene therapy or the ability to construct surfaces that have the ability to tailor smart, active, adaptive, signaling and functional activities when in contact with cells and biological fluids. Presentations will include basic science on understanding biomaterial interactions with biological systems at the nano-scale, novel nanostructures' synthesis and fabrication, and applications of nanostructures to medical devices and implants.

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- **Sustainable Approaches to Biomaterials for Drug Delivery**

  **Contributing SIGs:** Drug Delivery, Tissue Engineering
  **Session Co-Chairs:** Noelle Comolli, Jennifer Vernengo
  There is an obvious need to move from fossil fuels as a primary source for polymeric raw materials to renewable resources as starting blocks in the synthesis and manufacturing of biodegradable polymers. While some natural materials are in use, many degradable delivery systems still focus on fossil fuel based polymers. This session seeks papers which discuss new more sustainable fossil fuel based polymer approaches (e.g. greener manufacturing practices), and/or novel degradable polymers from renewable sources (synthesis, purification, and biocompatibility).

- **Panel Discussion: Biomaterial Strategies for Craniomaxillofacial vs. Orthopaedic Bone Defects Biomaterial Strategies for Craniomaxillofacial vs. Orthopaedic Bone Defects**

  **Contributing SIGs:** Orthopaedic Biomaterials
  **Session Co-Chairs:** Teja Guda, Pamela Brown Baer
  Craniofacial bone defects often need distinctly different approaches of therapy compared to orthopedic trauma. This session will have speakers who have tested biomaterials/composite delivery systems in both orthopedic and craniofacial wounds, and is designed to highlight the differences in results and summarize resulting cues to future efforts. We will also have an emphasis on the appropriate animal models, outcome measures to test material translation to therapy, and regulatory and commercialization pathways.

- **Panel Discussion: Regenerative Engineering as the Future of Tissue Engineering**

  **Contributing SIG:** Tissue Engineering
  **Session Chair:** Cato T. Laurencin
  The last quarter century has seen a tremendous rise in the area of research we now call tissue engineering. Indeed, 25 years ago the term tissue engineering was officially coined. What does the future hold? The organizer and panel members will explore the future of tissue engineering, a future described as Regenerative Engineering, where traditional tissue engineering concepts are combined with emerging research in developmental biology/morphogenesis, and where exciting new work in areas of stem cell technology and advanced materials science combine to present enormous possibilities for the regeneration of new tissues. Using musculoskeletal tissues as a paradigm, speakers and panel members will discuss views on regeneration in the future and how biomaterials will play a key role. Six of the seven speakers are participants in a new textbook entitled "Regenerative Engineering".

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**10:15 am – 12:15 pm Concurrent Session IV**

- **Nucleic Acid Delivery**

  **Contributing SIGs:** Drug Delivery, Nanomaterials
  **Session Co-Chairs:** Rebecca Bader, Jordan Green
  Nucleic acids that turn on exogenous genes or interfere with endogenous gene expression, including aptamers, antisense oligonucleotides, DNA, and siRNA, are promising therapeutics for a number of diseases. However, the efficacy of these biologics has been limited by a lack of stability in physiological environments and a low propensity for intracellular internalization. This session will highlight technology aimed at improving the effectiveness of nucleic-acid based treatments.

- **Trends in Surface Modification of Bulk- and Nano-Biomaterials I**

  **Contributing SIG:** Surface Characterization and Modification
  **Session Co-Chairs:** Gopinath Mani, Balakrishnan Sivaraman
  This general session will focus on the recent advances in the surface modification of biomaterials for a variety of biomedical applications including but not limited to nonfouling, wear resistance, corrosion resistance, lubricity, blood compatibility, biosensors, micropatterning, nanopatterning, biomolecule immobilization, osseointegration, antimicrobial surfaces, responsive surfaces, cell capturing surfaces, cell sheet engineering, and tissue engineering. Also, this session will focus on the advances in the surface modification of nanomaterials (nanoparticles, nanotubes, nanofibers, nanorods, etc.) for biomedical applications. The nanomaterial surfaces are often modified with a variety of biomolecules such as proteins, peptides, growth factors, DNAs, ligands, antibodies, and carbohydrates. Also, several different types of coatings are used on nanomaterial surfaces to immobilize biomolecules. This session will highlight the biological responses (protein, cell, and tissue responses) to the surface modified metallic, polymeric, and ceramic bulk- and nano-biomaterials.

- **Material/Tissue Interfacial Phenomena: Lessons Learned from Dental/Craniofacial Reconstructions**

  **Contributing SIGs:** Proteins and Cells at Interfaces, Dental/Craniofacial SIG
  **Session Co-Chairs:** Nathan Gallant, Paulette Spencer
  Despite significant advances, detrimental reactions at the material/tissue interface generally lead to premature failure of the materials used to repair and replace oral and craniofacial tissues. Unraveling the complexity at the material/tissue interface is fundamental for the development of new materials with predictable and controllable properties. Nature has been a source of inspiration for materials design, yet none of the synthetic materials have captured the inherent characteristics of biological materials. Hierarchical structuring is one of the key features providing intricate architectures leading diverse functionality. The interfacial interactions within the functional structure play a critical role in the biological processes. This symposium will emphasize the primacy of understanding the design strategies employed in bio-mimetic and bio-enabled

systems building upon the interfacial interactions applicable to oral and craniofacial tissues. By bringing the wide-range of expertise from various fields, the symposium will provide a platform to address challenges linking fundamentals to clinical application.

- **Ceramics and Composites in Bone Tissue Engineering and Drug Delivery I**

  **Contributing SIGs:** Orthopaedic Biomaterial, Dental/Craniofacial Biomaterials, Nanomaterial
  **Session Co-Chairs:** Susmita Bose, Gautam Gupta
  The symposium on "Ceramics and Composites in Bone Tissue Engineering and Drug Delivery" aims to provide an international forum for scientists and engineers to report latest research findings, to exchange ideas and information to establish research links of the recent advances in ceramics at the nanoscale towards bone implant and drug delivery applications. Industry participation will be encouraged. This symposium will discuss general areas of Ceramics and composites in coatings, resorbable scaffolds, and drug delivery in both orthopaedic and dental applications. In specific, the symposium will focus on these general topics: a) Nanoscale calcium phosphates (CaP) in bone graft and drug delivery; b) Chemistry and grain size effects on properties of bioceramics towards tissue interactions; c) Surface modification of metallic implants; d) Bioceramics in antimicrobial coatings / applications; e) Resorbable CaPs scaffolds in bone tissue engineering and drug delivery; f) Ceramics in dental applications.

- **Biomaterials for Immunomodulation**

  **Contributing SIGs:** Implant Pathology, Proteins and Cells at Interfaces, Tissue Engineering
  **Session Co-Chairs:** Nassir Mokaram, Kara Spiller
  The use of biomaterials to direct processes of the immune system is increasingly being applied toward disease and tissue engineering applications. This session focuses on both elucidating fundamental mechanisms and therapeutic applications involving immuno-modulation through the use of biomaterials. Examples of topics include novel adjuvants for immunotherapies, strategies for tolerizing biomaterials that would otherwise be pro-inflammatory or immunogenic, particle-based artificial antigen-presenting cells, and the development of receptor-targeted controlled release systems for the guided activation of specific immune cells.

- **New Frontiers in Polymers and Fibers for Biomedical Applications**

  **Session Chair:** Shrojal Desai
  Many new polymers and fibers are being designed and synthesized from natural and artificial monomers in both academia and industry to meet the growing clinical needs of tissue engineering, medical devices, and long/short term implant applications. With specific medical device application in mind, these new polymers and fibers may be high performance, smart, customized, permanent, or bioresorbable. They may be of synthetic or natural origin; the fibers may have a range of different cross-sectional shapes and sizes. This session will provide engineers, researchers, and scientists with information about

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the design, synthesis, characterization, processing, and advantages in biocompatibility and biofunctionality of alternative candidate polymers and fibers for developing the next generation of medical devices that will replace traditional materials.

- **Panel Discussion: Devices and Under-represented Minorities**

  **Contributing SIGs:** Orthopaedic Biomaterials
  **Session Chair:** Lynne Jones
  Muscuoskeletal healthcare disparities regarding under-represented minorities exist on several different levels. This is reflected in the prevalence and severity of diseases such as arthritis, the frequency and timing of surgical interventions, and the outcome of these surgeries. It is important for us to be aware of these disparities and identify all factors contributing to these differences. Musculoskeletal disparities as it relates to total joint replacement will be used to illustrate these findings, although this discussion can be extrapolated to other surgeries using biomaterials. In light of the changing landscape of medical care, addressing musculoskeletal health disparities is more important now than ever.

**12:15 pm – 1:15 pm** **Student Education Design Competition**

**1:15 pm – 3:15 pm** **Plenary Session I: Clemson Awards**

- **Clemson Award for Basic Research**
  Elazer Edelman, PhD - Massachusetts Institute of Technology
- **Clemson Award for Applied Research**
  Ravi Bellamkonda, PhD - Georgia Tech/Emory
- **Clemson Award for Contributions to the Literature**
  Rui Reis, PhD - University of Minho

**3:30 pm – 5:30 pm** **Concurrent Session V**

- **Advances in Three Dimensional Scaffolds for Tissue Regeneration I**

  **Contributing SIGs:** Surface Characterization and Modification, Tissue Engineering
  **Session Co-Chairs:** Gulden Camci-Unal, Amol V. Janorkar, Sangamesh Kumbhar, Julie C. Liu
  The major challenges in tissue engineering include: 1) The difficulty in uniformly seeding cells throughout a scaffold; 2) The lack of vascularity in tissue engineering constructs; and 3) The inability to mimic complex three-dimensional (3D) cell-cell and cell-substrate interactions, in particular with multiple cell types. To address these issues, tissue engineering develops 3D scaffolds, where cellular in-growth into the scaffold is essential. The successful tissue regeneration relies on the development of functional 3D scaffolds mimicking the hierarchical structures of natural extracellular matrix (ECM). For example, the interaction of cells with pores, ridges, groves, fibers, nodes and their combinations has proven to be important in controlling cellular processes. This session will provide fundamental insights about cell-cell and cell-matrix interactions. The examples will

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highlight the importance of integrating these cues in 3D environments for engineering complex tissue systems. In addition, the uses of 3D biomaterial scaffolds made from or modified using ceramics, metals, polymers, proteins, and lipids will be reviewed in this session as well as their potential uses in the clinic.

- **Biomolecule Delivery for Regenerative Medicine I**

  **Contributing SIGs:** Drug Delivery, Tissue Engineering
  **Session Co-Chairs:** Danielle Benoit, Balakrishnan Sivaraman
  Regenerative medicine is defined as the "repair, replacement, or regeneration of cells, tissues or organs, to restore impaired tissue function resulting from disease, trauma, or aging". It provides alternatives to organ transplantation, which is limited in its applicability. The design and development of effective strategies for tissue regeneration requires a comprehensive understanding of how cells and biological systems interact with biomolecules (such as growth factors, drugs and other biological agents). Spatio-temporal control over the delivery of these biomolecules is an active area of research in regenerative medicine. Researchers continue to develop novel methods to control the release of these biomolecules to initiate, augment and sustain tissue regeneration. This session will focus on the development, characterization, and implementation of carrier systems for effective biomolecule delivery.

- **Cardiovascular Tissue Engineering: Regenerative Approaches for Ischemic Diseases**

  **Contributing SIGs:** Cardiovascular Biomaterials, Tissue Engineering
  **Session Co-Chairs:** Gulden Camci-Unal, Laura Indolfi
  Regenerative medicine currently holds great promises for creating a new generation of therapies for previously incurable diseases such as ischemia. In this field, material interactions with the body, the drugs, small molecules, and/or the delivered cells play a key role in controlling therapies success. The symposium will feature development of cellular delivery platforms; generation of three dimensional vascularized scaffolds utilizing biomaterials from both synthetic and natural resources; and fabrication of smart functional biomaterials with elastic, conductive, and oxygen-release capabilities. Strategies to improve chemical, physical and mechanical properties of biomaterials to local target delivery of active agents for reperfusing ischemic tissues with little invasive procedures will also be discussed. Moreover, this symposium will cover next generation approaches to augment cell survival and stem cell differentiation for cardiovascular tissues. Major challenges in current models and future directions will also be provided facilitating interactions from biomaterials community with physicians and industries and increasing translation form bench to bedside.

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- **High-throughput Approaches to Modulate Cellular Behavior**

  **Contributing SIG:** Tissue Engineering
  **Session Co-Chairs:** Gulden Camci-Unal, Ben Keselowsky
  Automated high-throughput platforms are powerful tools to study combinatorial effects of biomaterials on cellular response. These strategies present unique advantages over traditional methods for investigation of cell-material interactions. High-throughput platforms have the ability to screen large number of samples in parallel while using minimum amount of samples, and provide rapid and precise analysis. This session will discuss biological applications of high-throughput systems to modulate cell microenvironments by optimizing suitable combinations of materials and biological factors. In addition, the use of high-throughput set-ups for studying various cellular behaviors such as adhesion, growth, proliferation, and differentiation for tissue engineering applications will be covered. In addition to microarray platforms, microfluidic high-throughput systems for studying cell behavior will also be highlighted by this session.

- **SFB Business Plan Competition**

  **Contributing SIGs:** Tissue Engineering, Dental/Craniofacial Biomaterials, Cardiovascular Biomaterials, Biomaterials Education, Engineering Cells and Their Microenvironments, BMPC
  **Session Co-Chairs:** Eric Sussman, Mark Van Dyke, Anne Meyer, Jim Curtis, Carl McMillin
  Were you aware that the Annual Biomaterials Meeting in Denver will include an exciting new competition with cash prizes? If you have entrepreneurial spirit, please plan to attend the SFB Business Plan Competition. The audience will have an important role in judging the business plans which have been pre-selected (by the abstract peer-review process) for podium presentation at this session. This unprecedented event is cosponsored by the Biomaterials and Medical Products Commercialization, Tissue Engineering, Drug Delivery, Dental/Craniofacial, Engineering Cells and Their Microenvironments, Cardiovascular Biomaterials, and Biomaterials Education Special Interest Groups.

- **Translatory Research (Including Theranostics) in Nanomedicine**

  **Contributing SIGs:** Nanomaterials, Ophthalmic Biomaterials, Orthopaedic Biomaterials, Tissue Engineering
  **Session Co-Chairs:** Sarit B. Bhaduri, Ketul C. Popat
  This general session will focus on all applications of nanomaterials in medicine. A comprehensive range of nano-materials will be considered including nano-particulates/fibers, nanocoatings, nanocomposites, NMES, etc. A comprehensive range of medical applications (with an emphasis on Theranostics) of such nanomaterials will also be considered (including tissue regeneration for the following tissues: orthopedic, cartilage, vascular, dental, nervous system, cardio vascular, etc.; drug delivery; ophthamological applications, cancer treatment; dermatological applications, etc.). 6. Target Audience:

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This session is suitable for a number of researchers at the intersection of nanotechnology and medicine. In particular, it will be of high interest to persons from academic, industrial, and clinical sectors.

- **Tutorial: Giving Congress a Piece of your Mind Without Yelling**

  **Invited Speaker:** Milan Yager, AIMBE
  **Session Co-Chairs:** Joel D. Bumgardner, Andy Doraiswamy, Anne Meyer
  This tutorial will provide attendees the keys on how to get a member of Congress to listen to your needs and help unleash the full potential of the biomaterial research, entrepreneurial and medical device industry and the innovation of this great country. While this tutorial will provide a 'best practices guide' it will also reveal the tools lawmakers use to avoid constituent demands and the three secrets to getting your way on Capitol Hill. What do professional "big name" lobbyist have that make them effective and what resource would they love to have that only the biomaterials/bioengineer possess? Long-time Congressional insider, former lobbyist and Administration appointee Milan Yager, AIMBE's Executive Director will be the featured speaker of this tutorial.

**6:30 pm – 9:30 pm** **BIOMATERIALS BASH – Pinnacle Club at the Grand Hyatt**

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**7:00 am – 6:00 pm** **Registration Open**

**7:00 am – 8:00 am** **Special Interest Group Meetings (coffee and danish provided)**

**8:00 am – 10:00 am** **Plenary Session II: Award Addresses**

- **Technology Innovation & Development Award**
  Kishore Udipi, PhD and the Medtronic Resolute Integrity Team - Biopolymer Designs, Inc.
- **Young Investigator Award**
  Brendan Harley, ScD - University of Illinois at Urbana-Champaign
- **International Journal of Nanomedicine Distinguished Scientist Award**
  Kam leong, PhD – Duke University

**10:15 am – 12:15 pm** **Concurrent Session VI**

- **Absorbable Polymers for Medical Devices: Current Status and Future Perspectives**

  **Session Co-Chairs:** Joel Corbett, Meng Deng
  Polymers, whether synthetic, naturally-derived or of biological origin, are widely used in biomaterials research. Although much progress has been made in absorbable polymers for medical device application in the past few decades, interests in the related area continue to grow. This session is designed to highlight recent advances and to discuss future perspectives in the research and development of these materials for implantable devices. Abstracts related to all areas of absorbable polymers are welcomed. These may include new absorbable polymers, novel processing, performance improvement, various medical devices, mechanical and analytical testing, biological and biocompatible evaluation, animal models, sterilization, and stability. The aim of this session is to bring together leaders and to provide researchers with an opportunity to present their work in the field of absorbable polymers, and therefore contributes to the advancement of biomaterials science and medical device development.

- **Advances in Programmable Biomaterials**

  **Contributing SIGs:** Drug Delivery, Tissue Engineering
  **Session Co-Chairs:** Anita Shukla, Yun Wah Lam, Yong Wang
  The field of biomaterials science has evolved from the study of biocompatible and biodegradable materials to the design of stimuli-responsive biomaterials. These materials can be programmed to respond to stimuli resulting from biomolecular recognition (e.g., peptide-, oligonucleotide-, and lipid-based interactions) as well as chemical (e.g. pH and ionic strength) and physical properties (e.g. temperature). The response of the material in the presence of these stimuli can be finely tuned and may result in a change to the chemical or physical properties of the material itself (e.g. shape-memory effect). This session will highlight recent advances in designing such programmable biomaterials. Examples include but are not limited to self-assembled structures such as

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hydrogels, scaffolds, nanoparticles, and multilayer films. In addition to the discussion of the principles of designing such materials, the use of these programmable materials in various biomedical applications including drug delivery and tissue engineering will be presented.

- **Biologically Derived Materials from Natural Resources I**

  **Contributing SIGs:** Drug Delivery, Orthopaedic Biomaterials, Tissue Engineering
  **Session Chair:** Nuno M. Neves
  Biologically derived polymers and composites offer excellent opportunities in the biomaterials field. This versatile class of materials includes biopolymers (polyhydroxy alkanoates, hyaluronic acid), polysaccharides (starch, chitin/chitosan, alginate) or proteins (collagen, fibrin, silk fibroin) enabling developing engineered systems with enhanced biological performance. The innovative use of its characteristics, taking advantage of the similar structure or composition with respect to biological tissues, enables designing high performance solutions for biocompatibility, biodegradability and bioactivity of biomaterials. Also the advanced areas of tissue engineering, drug delivery and smart/active/adaptative systems may benefit from the wealth of natural polymers existing in nature.

- **Cardiovascular Biomaterials and Blood Compatibility I**

  **Contributing SIG:** Surface Characterization and Modification
  **Session Co-Chairs:** Amol Janorkar, Gopinath Mani
  Thrombosis is often a major concern with cardiovascular medical devices such as stents, vascular grafts, heart valves, pacemakers, defibrillators, ventricular assist devices, cardiopulmonary bypass, and artificial heart. Although significant progress has been made in developing and using a wide variety of metallic, polymeric, ceramic, and natural biomaterials for making cardiovascular medical devices, still the blood compatibility of these devices remains an issue. This symposium will focus on (i) recent developments in cardiovascular biomaterials for improving blood compatibility; (ii) the development of novel biomaterials for cardiovascular medical device applications; (iii) novel coatings and surface modification technologies for improving blood compatibility; (iv) in vitro and in vivo evaluation of blood compatibility of biomaterials; (v) clinical evaluation of cardiovascular medical devices; (vi) novel approaches to improve endothelialization of cardiovascular implants and devices.

- **Ceramics and Composites in Bone Tissue Engineering and Drug Delivery III**

  **Contributing SIGs:** Orthopaedic Biomaterial, Dental/Craniofacial Biomaterials, Nanomaterial
  **Session Co-Chairs:** Susmita Bose, Gautam Gupta
  The symposium on "Ceramics and Composites in Bone Tissue Engineering and Drug Delivery" aims to provide an international forum for scientists and engineers to report latest research findings, to exchange ideas and information to establish research links

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of the recent advances in ceramics at the nanoscale towards bone implant and drug delivery applications. Industry participation will be encouraged. This symposium will discuss general areas of Ceramics and composites in coatings, resorbable scaffolds, and drug delivery in both orthopaedic and dental applications. In specific, the symposium will focus on these general topics: a) Nanoscale calcium phosphates (CaP) in bone graft and drug delivery; b) Chemistry and grain size effects on properties of bioceramics towards tissue interactions; c) Surface modification of metallic implants; d) Bioceramics in antimicrobial coatings / applications; e) Resorbable CaPs scaffolds in bone tissue engineering and drug delivery; f) Ceramics in dental applications.

- **Effect of Scaffold Properties on 3D Cell Shape**

  **Contributing SIGs:** Engineering Cells and Their Microenvironments, Proteins and Cells at Their Interfaces
  **Session Co-Chairs:** Jennie Leach, Carl Simon
  There is great interest in using the physical properties of 3D scaffolds to influence cell function due to the low cost and stability of this approach. The chemistry, mechanics and structure of a scaffold may be optimized to direct cell function in vitro or in vivo within a tissue-engineered medical product. Cell shape and cell function are tightly linked and a primary mechanism whereby scaffold properties may direct cell function is through control of 3D cell shape. Thus, it is necessary to measure 3D cell morphology in order to identify the scaffold physical properties that drive cells into morphologies that maximize proliferation, differentiation and tissue regeneration. This symposium will focus on recent work where the effect of scaffold properties on 3D cell shape have been measured, as well as the 3D tools required to image and analyze 3D cell shape.

- **Trends in Surface Modification of Bulk- and Nano-Biomaterials II**

  **Contributing SIG:** Surface Characterization and Modification
  **Session Co-Chairs:** Gopinath Mani, Balakrishnan Sivaraman
  This general session will focus on the recent advances in the surface modification of biomaterials for a variety of biomedical applications including but not limited to nonfouling, wear resistance, corrosion resistance, lubricity, blood compatibility, biosensors, micropatterning, nanopatterning, biomolecule immobilization, osseointegration, antimicrobial surfaces, responsive surfaces, cell capturing surfaces, cell sheet engineering, and tissue engineering. Also, this session will focus on the advances in the surface modification of nanomaterials (nanoparticles, nanotubes, nanofibers, nanorods, etc.) for biomedical applications. The nanomaterial surfaces are often modified with a variety of biomolecules such as proteins, peptides, growth factors, DNAs, ligands, antibodies, and carbohydrates. Also, several different types of coatings are used on nanomaterial surfaces to immobilize biomolecules. This session will highlight the biological responses (protein, cell, and tissue responses) to the surface modified metallic, polymeric, and ceramic bulk- and nano-biomaterials.

**12:15 pm – 1:15 pm** **Student Mentoring Lunch**

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**1:15 pm – 2:45 pm** **Poster Session**

**2:45 pm – 4:15 pm** **SFB Annual Business Meeting/ National Student Chapter**

**4:30 pm – 6:30 pm** **Concurrent Session VII**

- **Alternative Bearing Surfaces**

  **Contributing SIG:** Orthopaedic Biomaterials
  **Session Co-Chairs:** Warren Haggard, Lynne Jones, Tim Topoleski
  The long-term outcome of total joint replacement surgery is inextricably linked to the longevity of the bearing surfaces. Concerns with the wear and degradation of the polyethylene components in metal-on-polyethylene bearings led to the development of highly cross-linked polyethylene as well as to other alternatives. These alternatives include using ceramics and metals as one or both of the components of the bearing couple. Recognizing their strengths and limitations as bearing surfaces is important to the selection of implants by the orthopaedic surgeon. This session will present the laboratory findings and clinical experience with alternative bearing surfaces for total joint arthroplasty.

- **Implantable Drug Delivery Systems for Medical Devices and Cancer Therapy**

  **Contributing SIG:** Drug Delivery
  **Session Co-Chairs:** Agata Exner, Liisa Kuhn, Gopinath Mani
  This general session will focus on the recent advances in the implantable drug delivery systems for medical devices and cancer therapy. Local drug delivery reduces systemic toxicity and provides therapeutic concentrations of drug at the implantation site. Such local drug delivery systems have tremendous applications in several medical devices (cardiovascular, orthopedic, fracture fixation, dental, ophthalmic, and neural) as well as in cancer treatment. Therapeutic drugs such as anti-microbial agents and anti-inflammatory drugs are commonly released from medical device surfaces. Anti-proliferative drugs are released from polymeric implants for treating cancerous tumors. The two prongs of this session will cover (a) a wide range of drug delivery platforms that are currently available for medical device surfaces. These include novel polymer/ceramic coatings, porous/textured/reservoir surfaces, molecular coatings, biological and biomimetic coatings; (b) the development of polymer implants for cancer therapy and the modeling of drug release from these implantable systems.

- **Advances and Challenges in Biomaterial-Associated Infection and Pathogenesis**

  **Contributing SIGs:** Drug Delivery, Implant Pathology, Nanomaterials, Ophthalmic Biomaterials, Orthopaedic Biomaterias, Proteins and Cells at Interfaces, Surface Characterization and Modification, Tissue Engineering
  **Session Co-Chairs:** Bingyun Li, Peter Yang
  Biomaterial-associated infection has been a significant clinical issue in orthopaedics,

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dental and cardiovascular clinics, and etc, and has been a major concern for biomaterial industries. The development of new antibiotics has met with challenges due to increasingly reported antibiotic resistance. Meanwhile, cases of chronic and recurrent infections have been increasing and the underlying pathogenesis has not been understood. This session will invite researchers in biofilms and infection pathogenesis from both academia and industry to present the advances and challenges related to infections. Abstracts will be sought from biofilm screening, diagnosis, and prevention, cellular and molecular studies of infection pathogenesis, and new biomaterial development (e.g. new antibacterial biomaterials, novel surface modifications) for infection prevention.

- **Advances in Three Dimensional Scaffolds for Tissue Regeneration II**

  **Contributing SIG:** Surface Characterization and Modification, Tissue Engineering
  **Session Co-Chairs:** Gulden Cami-Unal, Amol V. Janorkar, Sangamesh Kumbhar, Julie C. Liu
  The major challenges in tissue engineering include: 1) The difficulty in uniformly seeding cells throughout a scaffold; 2) The lack of vascularity in tissue engineering constructs; and 3) The inability to mimic complex three-dimensional (3D) cell-cell and cell-substrate interactions, in particular with multiple cell types. To address these issues, tissue engineering develops 3D scaffolds, where cellular in-growth into the scaffold is essential. The successful tissue regeneration relies on the development of functional 3D scaffolds mimicking the hierarchical structures of natural extracellular matrix (ECM). For example, the interaction of cells with pores, ridges, groves, fibers, nodes and their combinations has proven to be important in controlling cellular processes. This session will provide fundamental insights about cell-cell and cell-matrix interactions. The examples will highlight the importance of integrating these cues in 3D environments for engineering complex tissue systems. In addition, the uses of 3D biomaterial scaffolds made from or modified using ceramics, metals, polymers, proteins, and lipids will be reviewed in this session as well as their potential uses in the clinic.

- **Biomaterials Microenvironment for Stem Cells and Tissue Regeneration III**

  **Contributing SIG:** Engineering Cells & Their Microenvironments
  **Session Co-Chairs:** Peter Ma, Anshu Mathur
  Clinical use of biomaterials can be found in cardiovascular devices, nerve replacement therapy, critical sized defect reconstruction, and stem cell delivery via micro-catheters and scaffolds. For example, reconstruction to restore defects with large volumes of bone secondary to loss of tissue due debilitating diseases is treated with patient derived tissue (e.g. stem cells) and biomaterial therapy. The goal is to fully restore functional tissue or regenerate tissue by stimulating and guiding the body's capacity to regenerate using specially engineered and tissue integrating biomaterials that heal with and without stem cell delivery. Resident host tissues such as the periosteum and perichondrium and induced pluripotent stem cells can be combined for fabricating mechanically robust bone, trachea, musculofascia, and signal conducting nerves. Stem cells have high proliferation capability and can differentiate along multiple lineages. Therefore, stem cells have high

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potential for regenerative therapies. While recent discoveries have demonstrated that stem cell fate can be directed by certain material structures and properties, there are very limited understandings. This symposium will showcase new advancements in biomaterial microenvironment design and their interactions with stem cells.The idea is to have clinicians/ surgeon scientists of various specialties present in the same session as basic science researchers/ scientists to showcase stem cell -biomaterial therapy from lab to clinic.

- **Microenvironments for Osteogenesis and Vasculogenesis - Physical, Chemical, and Biological Perspectives**

  **Contributing SIGs:** Orthopaedic Biomaterials, Tissue Engineering
  **Session Co-Chairs:** Daniel S. Oh, Jin Whan Lee
  Bone regeneration following injury requires a close spatiotemporal coordination of multiple processes involving resident bone cells, marrow stromal elements, and associated vasculature. Although much of the advances have been made in tissue engineering regarding the use of cells, required growth factors, and a choice of scaffolds, with- or without bioreactors, the technical challenge of achieving bone regeneration in massive skeletal defects remains un-addressed. Physical-, chemical-, and biological-microenvironments play important role in the development and progression of osteogenesis and vasculogenesis of bone marrow stem cells. Chasing to gain a better understanding of stem cell fate on osteogenesis and vasculogenesis, we will investigate osteogenesis and vasculogenesis as well as related gene regulation on both by physical-, chemical, and biological-microenvironments perspective

- **Panel Discussion: Snatching Defeat from the Jaws of Victory: Is it Possible for New(er) Materials to Displace Current Ones in Established Clinical Applications?**

  **Contributing SIG:** Orthopaedic Biomaterials
  **Session Chair:** Lynne Jones
  Research is being conducted worldwide to develop new and improved biomaterials for human implants. While it is true that new applications produce needs for new materials, many existing biomaterials have been in use successfully in individual patients for decades. Long-term clinical studies prior to release of a new material are not feasible; therefore we place increased (perhaps unrealistic) reliance on preclinical and short term, small scale clinical results in making predictions of implant behavior. Topics that will be addressed by this panel include: 1) The challenge of preclinical testing: i.e. the inability (still) to predict and replicate in vivo service conditions in vitro; 2) Shortcomings of short term clinical results in prediction of long term implant performance; 3) The ethical challenges of randomized prospective studies to distinguish outcomes in the face of high

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**7:00 am – 12:00 pm** **Registration Open**

**7:00 am – 8:00 am** **ALL Special Interest Group Meeting**

**8:00 am – 10:00 am** **Concurrent Session VIII**

- **In-Situ Formed Biomaterials Translating to the Clinic and Marketplace**

  **Session Co-Chairs:** Thomas H. Jozefiak, Xiaohua Liu, Michael Riederer
  Advances in applied biomaterials science increasingly allow in-situ formation of biomaterial-based devices directly onto tissue in physiological environments. In-situ formation is attractive because it enables the application of biomaterials to irregularly-shaped surfaces and spaces, and is compatible with minimally invasive procedures. In-situ formed biomaterials can function as medical devices, provide depots for sustained drug delivery, or matrices for cell therapy. This session will focus on the recent developments in the area of solution-based biomaterials that form gels or films useful for tissue repair, tissue regeneration, drug delivery, and cosmetics applications. Specific attention will be given to novel biomaterials such as hydrogels, injectable microspheres, sealants, adhesion barriers, endovascular gels, and liquid bandages that have translated into clinical evaluation or commercial products. This session will bridge the gap between academic research, product development, and commercialization.

- **Biomaterials Microenvironment for Stem Cells and Tissue Regeneration II**

  **Contributing SIG:** Tissue Engineering
  **Session Co-Chairs:** Peter Ma, Anshu Mathur
  Clinical use of biomaterials can be found in cardiovascular devices, nerve replacement therapy, critical sized defect reconstruction, and stem cell delivery via micro-catheters and scaffolds. For example, reconstruction to restore defects with large volumes of bone secondary to loss of tissue due debilitating diseases is treated with patient derived tissue (e.g. stem cells) and biomaterial therapy. The goal is to fully restore functional tissue or regenerate tissue by stimulating and guiding the body's capacity to regenerate using specially engineered and tissue integrating biomaterials that heal with and without stem cell delivery. Resident host tissues such as the periosteum and perichondrium and induced pluripotent stem cells can be combined for fabricating mechanically robust bone, trachea, musculofascia, and signal conducting nerves. Stem cells have high proliferation capability and can differentiate along multiple lineages. Therefore, stem cells have high potential for regenerative therapies. While recent discoveries have demonstrated that stem cell fate can be directed by certain material structures and properties, there are very limited understandings. This symposium will showcase new advancements in biomaterial microenvironment design and their interactions with stem cells.The idea is to have clinicians/ surgeon scientists of various specialties present in the same session as basic science researchers/ scientists to showcase stem cell -biomaterial therapy from lab to clinic.

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- **Biologically Derived Materials from Natural Resources II**

  **Contributing SIGs:** Drug Delivery, Orthopaedic Biomaterials, Tissue Engineering
  **Session Co-Chairs:** Nuno M. Neves
  Biologically derived polymers and composites offer excellent opportunities in the biomaterials field. This versatile class of materials includes biopolymers (polyhydroxy alkanoates, hyaluronic acid), polysaccharides (starch, chitin/chitosan, alginate) or proteins (collagen, fibrin, silk fibroin) enabling developing engineered systems with enhanced biological performance. The innovative use of its characteristics, taking advantage of the similar structure or composition with respect to biological tissues, enables designing high performance solutions for biocompatibility, biodegradability and bioactivity of biomaterials. Also the advanced areas of tissue engineering, drug delivery and smart/active/adaptative systems may benefit from the wealth of natural polymers existing in nature.

- **Advanced Engineered Metal-Based Biomaterials**

  **Session Co-Chairs:** Ke Yang, Shuilin Wu, Bingyun Li, Kelvin Yeung
  The advancements of metallic biomaterials have been extended from the bulk mechanical properties e.g. elasticity and porosity to surface physical and chemical properties e.g. topography and coating in order to enhance their bio-functionalities for tissue repair. Specific surface patterns and coatings can even promote cellular functions or suppress bacterial adhesion. It is believed that these advancements will bring new insights to the development of next generation of metallic materials.

- **Benchtop Models to Support Medical Device and Pharmaceutical Development**

  **Contributing SIGs:** Drug Delivery, Tissue Engineering
  **Session Co-Chairs:** C. Lashan Simpson, Julie E. Leslie, Anita Shukla
  Biomaterials-based benchtop models can drive the healthcare industry into the future with leaner R&D costs and faster regulatory approvals of diagnostics and therapeutics. There is an ever-growing need to reduce costs in development of medical devices, pharmaceuticals, and drug delivery by using benchtop models of disease rather than animal models. Additionally, regulatory agencies in many countries are pushing for replacement of animal testing. Benchtop models can incorporate biological, electrical, chemical, mechanical, and environmental conditions. The biomaterials community has the opportunity to propel medical technology advancement by providing needed tools for testing and validating new medical treatments. These benchtop models should give industry and regulatory agencies confidence in translating technologies to human use. Therefore, the models must meet or exceed current gold standards in order to be adopted by industry users.

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- **Advances in Three Dimensional Scaffolds for Tissue Regeneration III**

  **Contributing SIG:** Surface Characterization and Modification, Tissue Engineering
  **Session Co-Chairs:** Gulden Cami-Unal, Amol V. Janorkar, Sangamesh Kumbhar, Julie C. Liu
  The major challenges in tissue engineering include: 1) The difficulty in uniformly seeding cells throughout a scaffold; 2) The lack of vascularity in tissue engineering constructs; and 3) The inability to mimic complex three-dimensional (3D) cell-cell and cell-substrate interactions, in particular with multiple cell types. To address these issues, tissue engineering develops 3D scaffolds, where cellular in-growth into the scaffold is essential. The successful tissue regeneration relies on the development of functional 3D scaffolds mimicking the hierarchical structures of natural extracellular matrix (ECM). For example, the interaction of cells with pores, ridges, groves, fibers, nodes and their combinations has proven to be important in controlling cellular processes. This session will provide fundamental insights about cell-cell and cell-matrix interactions. The examples will highlight the importance of integrating these cues in 3D environments for engineering complex tissue systems. In addition, the uses of 3D biomaterial scaffolds made from or modified using ceramics, metals, polymers, proteins, and lipids will be reviewed in this session as well as their potential uses in the clinic.

- **Panel Discussion: Successful Translation of Drug Delivery Products**

  **Contributing SIGs:** Drug Delivery
  **Session Co-Chairs:** Noelle Comolli, Thomas Dziubla
  Despite the clear innovations in biomaterials mediated drug delivery that have been made over the past several decades, there is still no obvious "easy" path to move an idea to an actual product. In this panel discussion, panelists who have successfully translated drug delivery product to clinical applications and to the market will share the experience and expertise. The speakers would be a mix of industry and academia. The focus would not be on intellectual property/venture capital/ logistics/, but rather on the science and what made their designs more readily translatable.

**10:15 am – 12:15 pm Concurrent Session IX**

- **Cellular and Molecular Responses of Biomaterials at the Biomaterial-Tissue Interface I**

  **Contributing SIGs:** Dental/Craniofacial Biomaterials, Drug Delivery, Nanomaterials, Proteins & Cells at Interfaces, Orthopaedic Biomaterials
  **Session Co-Chairs:** Bingyun Li, Jian Yang
  The interface of implant and the surrounding tissue is the key in the success of implantation. This session will address the critical interactions of advanced biomaterials (with or without drugs) with the host tissues and organs at the molecular and cellular levels. Biomaterials that are of interest may include but not limited to engineered hydrogels, self-assembled biomaterials, electro-spun biomaterials, photoactive biomaterials, biomimetic materials, nanobiomaterials, etc. The speakers will address the challenges and opportunites at the biomaterial-tissue interface from several perspectives including cell adhesion and signaling, cellular regeneration, extra- and intra-cellular

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environment, biosensing and imaging, implant/tissue integration, and related pre-clinical and clinical findings.

- **Engineering Biomaterial Surface Topography for Tissue Repair**

  **Contributing SIG:** Surface Characterization and Modification
  **Session Co-Chairs:** Gopinath Mani, Lei Yang, Chao Zhong
  Engineering and modification of biomaterial surfaces across several length scales have led to rich opportunities of enhancing cell functions and promoting tissue regeneration or growth. Such modified surfaces have applications in orthopedic, fracture fixation, craniofacial, dental, cardiovascular and neural implants and devices. This session will focus on the progress in engineering biomaterial surface topography for modulating cell/tissue behavior, promoting tissue regeneration and enhancing tissue-material interactions. The session aims to bring researchers in the interdisciplinary areas of bio-surface science and engineering to share their vision and expertise on the latest advances in fabrication, characterization and modification of biomaterial topography for the purpose of repairing soft and hard tissues. In addition, the development of next-generation surface characterization tools that provide new insights into the role of material surface topography in mediating tissue responses is also interested.

- **Cardiovascular Biomaterials and Blood Compatibility II**

  **Contributing SIG:** Surface Characterization and Modification
  **Session Co-Chairs:** Amol V. Janorkar, Gopinath Mani
  Thrombosis is often a major concern with cardiovascular medical devices such as stents, vascular grafts, heart valves, pacemakers, defibrillators, ventricular assist devices, cardiopulmonary bypass, and artificial heart. Although significant progress has been made in developing and using a wide variety of metallic, polymeric, ceramic, and natural biomaterials for making cardiovascular medical devices, still the blood compatibility of these devices remains an issue. This symposium will focus on (i) recent developments in cardiovascular biomaterials for improving blood compatibility; (ii) the development of novel biomaterials for cardiovascular medical device applications; (iii) novel coatings and surface modification technologies for improving blood compatibility; (iv) in vitro and in vivo evaluation of blood compatibility of biomaterials; (v) clinical evaluation of cardiovascular medical devices; (vi) novel approaches to improve endothelialization of cardiovascular implants and devices.

- **Targeting to Cellular and Pathological Microenvironments**

  **Contributing SIG**: Engineering Cells and Their Microenvironments
  **Session Chair:** Craig Duvall
  Drug targeting seeks to increase therapeutic efficacy while minimizing potential adverse effects. This session seeks abstracts focused on targeting of drugs (small molecules, biologics, and nanoparticle formulations) based on specific biological cues that enhance intermolecular interactions that drive accumulation, persistence, and

efficacy in pathological environments. This session will highlight the latest advances in targeted therapy via environmentally-activated nanocarriers and prodrugs, biological nanocarriers, and novel biomaterial scaffolds tuned for on-demand drug release.

- **Molecular Mechanisms Governing Protein-Surface and Cell-Surface Interactions**

  **Contributing SIG:** Protein and Cells at Interfaces
  **Session Co-Chairs:** Robert A. Latour, Christopher A. Siedlecki
  At a fundamental level, protein-surface and cell-surface interactions are governed by molecular interactions, which are still not well understood. This level of understanding is extremely important for the evolving field of molecular engineering, as well as for tissue engineering, regenerative medicine, drug delivery systems, and implantable medical devices. New and improved methods are needed and being developed to probe and understand these interactions. This proposed general session will look to present state-of-the art methods (both experimental and molecular simulation) that are being developed and applied to study, characterize, and understand the molecular basis governing protein-surface and cell-surface interactions and how these interactions may ultimately affect the success of a variety of device-based therapies.

- **Ceramics and Composites in Bone Tissue Engineering and Drug Delivery II**

  **Contributing SIGs:** Orthopaedic Biomaterial, Dental/Craniofacial Biomaterials, Nanomaterial
  **Session Co-Chairs:** Susmita Bose, Gautam Gupta
  The symposium on "Ceramics and Composites in Bone Tissue Engineering and Drug Delivery" aims to provide an international forum for scientists and engineers to report latest research findings, to exchange ideas and information to establish research links of the recent advances in ceramics at the nanoscale towards bone implant and drug delivery applications. Industry participation will be encouraged. This symposium will discuss general areas of Ceramics and composites in coatings, resorbable scaffolds, and drug delivery in both orthopaedic and dental applications. In specific, the symposium will focus on these general topics: a) Nanoscale calcium phosphates (CaP) in bone graft and drug delivery; b) Chemistry and grain size effects on properties of bioceramics towards tissue interactions; c) Surface modification of metallic implants; d) Bioceramics in antimicrobial coatings / applications; e) Resorbable CaPs scaffolds in bone tissue engineering and drug delivery; f) Ceramics in dental applications.

- **Tutorial: Understanding Implications of the New Patent Law**

  **Contributing SIGs:** Biomaterials – Tissue Interaction
  **Session Chair:** Howard Winet
  The patent law has changed. It is now much easier to file a patent than it has been for a century. Two consequences of the change have been 1) an individual with an idea but insufficient resources to develop a working model may "reserve" his/her right to the idea without fear of a "monolithic company with substantial resources swooping down

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to take it away" 2) an individual with no intention of developing a device may obtain ownership of the idea for the device with the sole purpose of selling this ownership for profit—"patent mining" These consequences have created challenges for the courts. A patent lawyer who is also a bioengineer, Arthur Hsieh, Ph.D., J.D. will present a tutorial on the legal aspects of the consequences of the new patent laws.