Keynote Address

Anthony Atala, MD
Director of Regenerative Medicine
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Anthony Atala, M.D., is the Director of the Wake Forest Institute for Regenerative Medicine, and the W.H. Boyce Professor and Chair of the Department of Urology at Wake Forest University. Dr. Atala is a practicing surgeon and a researcher in the area of regenerative medicine. His current work focuses on growing new human cells, tissues and organs.

Dr. Atala works with several journals and serves in various roles, including Editor-in-Chief of *Current Stem Cell Research and Therapy*, and *Therapeutic Advances in Urology*; as Associate Editor of *Tissue Engineering and Regenerative Medicine*, *The Journal of Rejuvenation Research*, *Nanotechnology in Engineering* and *Medicine*, *Gene Therapy and Regulation*, *and Current Reviews in Urology*; as Executive Board Member or Section Editor of the journal *Tissue Engineering and International Journal of Artificial Organs*, and as Editorial Board member of *Expert Opinion on Biological Therapy*, *Biomedical Materials*, *International Journal of Stem Cells*, *Stem Cell Review Letters*, *Tissue Science and Engineering*, *Journal of Surgical Radiology*, *the Journal of the American College of Surgeons*, *the Journal of Urology*, *BioMed Central-Urology*, *Urology*, and *Current Opinion in Urology*.

Dr. Atala is a recipient of many awards, including the US Congress funded Christopher Columbus Foundation Award, bestowed on a living American who is currently working on a discovery that will significantly affect society, and the Gold Cystoscope and Samuel Gross Awards for advances in his field. Dr. Atala was named by Scientific American as a Medical Treatments Leader of the Year for his contributions to the fields of cell, tissue and organ regeneration. Dr. Atala's work was listed as Time Magazine's top 10 medical breakthroughs of the year, and as Discover Magazine`s Number 1 Top Science Story of the Year in the field of medicine in 2007. A Time Magazine poll ranked Dr. Atala as the 56th most influential person of the year in 2007. In 2009 Dr. Atala was featured in U.S. News & World Report as one of 14 Pioneers of Medical Progress in the 21st Century, and his work in 2010 was listed by Smithsonian Magazine as one of 40 things to know about the next 40 years. Dr. Atala has led or served several national professional and government committees, including the National Institutes of Health working group on Cells and Developmental Biology, and the National Institutes of Health Bioengineering Consortium. He is currently a NIH "Quantum Grant" awardee. Dr. Atala heads a team of over 270 physicians and researchers. Ten applications of technologies developed in Dr. Atala's laboratory have been used clinically. He is the editor of nine books, including Minimally Invasive Urology, Methods of Tissue Engineering, Principles of Regenerative Medicine, and Foundations of Regenerative Medicine, and has published more than 300 journal articles and has applied for or received over 200 national and international patents.

Symposium

A Symposium is designed to focus our attention on a specific topic within the disciplines that make up the Society's membership. The symposium highlights a well-defined topic that is not addressed by the regular sessions of the Annual Meeting. The format includes a single lead speaker followed by related abstracts. The lead speaker either presents the current concepts of the topic or presents cutting-edge research within the area.

Biomaterials and Technologies for Cell Manufacturing

Contributing SIG: Cell/Organ Therapies
Invited Speaker: Anthony Frutos, PhD
TITLE: Synthetic Surfaces for Advanced Cell Culture
Co-Chairs: Todd McDevitt, PhD, Jon Rowley, PhD

The development of effective cell manufacturing processes is critically important for the ultimate realization of clinical cell therapies and in vitro cell-based diagnostics. Biomaterials play an integral role as substrates and molecular delivery vehicles for expansion and differentiation of large populations of somatic, progenitor and stem cells in adherent and suspension culture systems. In addition to the production phase, biomaterial technologies are also important in the downstream processing stages of cell populations in order to separate cells from culture components and purify and concentrate deliverable cell products. This session will highlight recent advances and promising biomaterials strategies that can significantly impact cell manufacturing.

Ceramics in Drug Delivery

Contributing SIG: Nano Materials
Invited Speaker: Matthias Epple, FRSC
TITLE: Calcium Phosphate Nanoparticles: Nanocrystalline Bone Substitution Materials and Carriers of Nucleic Acids into Cells
Co-Chairs: Susmita Bose, PhD, Thomas Webster, PhD

Ceramics in 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 towards bone implant and drug delivery applications. This symposium will focus on these general topics: a) Nanoscale calcium phosphate (CaP) systems in drug delivery; b) Chemistry, morphology and grain size effects on properties of bioceramic particles towards protein

/ drug delivery; c) Nanoscale surface modification; d) Nanoscale ceramics and composites in drug delivery.

Chemoselective Chemistry for Biomaterials

Invited Speaker: Joel Collier, PhD
TITLE: Chemoselective Chemistry in Biomaterials: Examples and Overview
Chair: Haeshin Lee, PhD

Recently developed chemoselective chemistries such as native chemical ligation, click chemistry, and others are enabling the design of biomaterials with a high degree of complexity without sacrificing chemical definition and purity. Similarly, high-affinity protein-protein interactions are likewise enabling the synthesis of complex biomaterials using interactions that are also highly specific. This session will focus on biomaterial designs and syntheses that employ chemoselective approaches such as these. Focus areas for this session will include: Novel biomaterial designs that are specifically made possible by chemoselective chemistries, development of new chemoselective chemistries, adaptation of existing chemoselective chemistries to biomaterials contexts, high-affinity protein-protein interactions for constructing biomaterials, biocompatibility of chemoselective syntheses, chemoselective surface chemistry, and related areas.

Engineering Instructive Cues into Biomaterials

Contributing SIGs: Cell/Organ Therapies, Proteins and Cells at Interfaces
Invited Speaker: Krishnendu Roy, PhD
TITLE: Incorporating Spatially- and Temporally-Varying Cues into Biomaterials: From Vaccines to Stem Cells
Co-Chairs: Brendan Harley, ScD, Elizabeth Lipke, PhD

The native ECM is instructive, providing a dynamic and spatially heterogeneous constellation of microstructural, mechanical, and compositional cues that can influence cell behavior. The next generation of cellular function and tissue regeneration experiments requires a versatile toolbox of similarly patterned, heterogeneous, and dynamic biomaterials that can provide a defined, instructive microenvironment. These instructive materials may ultimately contain an appropriate constellation of critical cues to allow specific regulation of key cell behaviors in fields as wide ranging as developmental biology, immunology, regenerative medicine, and stem cell biology. This session will encompass the development of biomaterial systems that enable spatial and/or temporal control over the presentation of insoluble (microstructural, mechanical, compositional) or soluble (biomolecule, genetic material release) cues, as well as the use of these 'animated' materials to modulate cell fate decisions at the individual and/or populational levels.

Industrial Solutions to Material Problems, Biomaterials and Processing Technologies for Industrial Applications

Contributing SIGs: Drug Delivery, Protein and Cells at Interfaces, Surface Characterization and Modification, Tissue Engineering
Invited Speaker: Suping Lyu, PhD
TITLE: Examples of Industrial Solutions to Material Problems
Co-Chairs: Shrojal Desai, PhD, Horst von Recum, PhD, Kai Zhang, PhD

There has not been an ideal biomaterial invented even though research has been done for many decades. However industrial scientists and engineers have been able to find ways to solve many challenging problems from product-based research developments. Adding steroids to pacing electrodes to reduce the pacing thresholds and coating anti-proliferation drugs to stents to prevent the restenosis are two well known examples. There are many more examples where no ideal material is available but industrial scientists and engineers have found creative solutions and achieved their goals. This session will include industrial scientists and engineers as well as academic consultants presenting their research work focusing on problem solving for product-based research and developments.

Macrophage-centered Host Response to Biomaterials and Wound Healing

Contributing SIGs: Protein and Cells at Interfaces, Surface Characterization and Modification, Tissue Engineering
Invited Speaker: Steve Badylak, DVM, PhD, MD
TITLE: Macrophage-centered Host Response to Biomaterials and Wound Healing
Co-Chairs: W. John Kao, PhD, Buddy Ratner, PhD

Monocytes/macrophages are critical in the host reaction to biomedical devices and are closely associated with our understanding of material biocompatibility. Recent discoveries have demonstrated that macrophages can exist in a pro-healing or a pro-fibrotic phenotype. This has huge implications for biomaterials, biocompatibility, tissue engineering and regenerative medicine. The focus of this symposium is to address the underlying mechanisms of macrophage response to current clinical materials as well as novel biomaterials that control macrophages for tissue engineering, nanotechnology, drug delivery, and other emerging technologies.

Propelling Materials Into The Clinic

Contributing SIGs: Biomaterials Education, Cardiovascular Biomaterials
Invited Speaker: Dinesh Patwardhan, PhD
TITLE: Biomaterials: A FDA Perspective
Co-Chairs: Vipul Davé, PhD, Elazer Edelman, PhD

The symposium on propelling materials into clinic will address the important area of bringing biomaterials from Bench to Bedside. There are several topics that will be presented during this symposium including existing and new materials; utilizing these materials to treat different cardiovascular disease states including coatings, devices, and drug delivery; and the methods to evaluate them in concept and product development for commercialization. The strategies, challenges and pitfalls to evaluate them from concept to clinical trial and post market surveillance will be highlighted.

Responsive Biomaterials: Exploiting Biological Signals

Contributing SIG: Cell/Organ Therapies
Invited Speaker: Patrick Stayton, PhD
TITLE: Biomimetic Drug Delivery Systems for Biologic Drugs
Co-Chairs: Thomas Barker, PhD, Harry Bermudez, PhD

Because cells sense and respond to multiple biochemical and biophysical cues, it becomes apparent that inert and "structural" materials are inherently limited to examine complex questions of differentiation, tissue engineering, etc. Advances in chemistry and materials science now hold promise for the emergence of biomaterials that fruitfully interact with their environment. Concepts borrowed from nature include force-sensitive materials (i.e., ECM) and pH-sensitive vehicles (i.e., endosomes). More broadly, new materials may also respond to externally-applied cues such as temperature and light. This symposium will highlight recent advances in biomaterials design toward interactive and responsive biomaterials, including fundamental materials development and applications in tissue engineering, drug delivery, and biosensors. The intent of the symposium is to bring together perspectives and strategies from chemistry, biology, and engineering disciplines.

Strategies to Promote Vascularization of Tissue Engineered Constructs

Contributing SIG: Tissue Engineering
Invited Speaker: Steven George, MD, PhD
TITLE: Vascularizing Engineered Tissues for In Vivo and In Vitro Applications
Co-Chairs: Edward Botchwey, PhD, Julie Liu, PhD

Achieving rapid and stable vascularization of tissue engineered constructs remains a major challenge in regenerative medicine. Biomaterials-based strategies seek to achieve rapid vascularization by engineering scaffolds to have appropriate porosity or degradability, growth factor release, and spatial or temporal cues that direct endothelial cell behavior. Networks of pores or cells can also be incorporated into scaffolds through patterning or microfabrication. Pre-vascularization strategies utilize pre-formed endothelial cell tubules (with a variety of support cells) to promote rapid vascularization via anastomosis of the tubules with the host's vasculature. Emerging strategies to create biomaterials that promote rapid in vivo vascularization will be highlighted in this symposium.

Valves and Stents

Contributing SIGs: Cardiovascular Biomaterials, Protein and Cells at Interfaces
Invited Speaker: Adam Groothius, MS, PhD
TITLE: Evaluation of Emerging Technologies (stents and valves) in Animal Models: Biological Responses, Time Points and Beyond
Chair: Vipul Davé, PhD

Treatment of cardiovascular diseases encompasses several areas of innovations such as metal scaffolds, drug coated device and stents, percutaneous valve repairs, and composite structures including covered grafts and stents. This session will include interdisciplinary topics on improved stent and valve leaflet designs, novel materials to prepare scaffolds and valves, pericardium repairs, graft and covered textile structures and surface geometry to improve endotheliazation.

General Sessions

A General Session is a topic that is familiar to the general membership. Abstracts reflect the most current research in that field.

Advances in Ophthalmic Biomaterials
Contributing SIGs: Implant Pathology, Ophthalmic Biomaterials

The 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-relate macular disease treatments) is growing at a rapid pace. The current need for a renewed focus on applied biomaterials is high. For the 2011 SFB meeting, the focus will be 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 including advanced biomaterials for functional replacements of ocular tissues; surface modification and protein adsorption of polymers used for refractive devices; synthetic corneas; next-generation contact lenses; vitreous replacement fluids; retinal tamponades; and glaucoma drainage devices for the regulation of intraocular pressure.

Alternative Platforms for Pharmacologic Administration
Contributing SIGs: Drug Delivery, Ophthalmic Biomaterials

Advancement in the development of novel platforms for pharmacologic administration is a rapidly growing area with wide-spread clinical applications. For the 2011 SFB meeting, the focus will be on the progress of biomaterials research and technologies that offer unique platforms for drug-delivery. Topics in this session will encompass novel drug formulation (molecular and biochemical bases for various degenerative ocular diseases), drug encapsulation, microspheres, targeted drug delivery, gene-therapy for a variety of clinical applications. Topics ranging from posterior segment microdialysis, latest technology in gene-therapy for retinal diseases, and development of drug/device combination products will also be covered.

Biologically Derived Materials

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. Those high end applications require increasingly complex and demanding architectures and properties. However, the processing and the characterization of biologically derived materials often has specific requirements and limitations that may hinder its use. This session will be the forum of choice to present and discuss cutting edge research on biomaterials obtained from biologic resources.

Biologically Inspired Biomaterials Approaches for Cancer Research
Contributing SIG: Tissue Engineering

Microenvironmental conditions play an important role in the development, progression, and therapy of cancer, and biomaterials may be invaluable in the generation of more appropriate culture models that will help to identify the underlying mechanisms and effects. This session will focus on the design and utilization of biologically inspired model systems to gain a better understanding of the pathology and treatment of cancer. It will highlight biomaterials in the context of cell and tissue engineering to evaluate tumorigenesis as a function of specific cell-microenvironment interactions including but not limited to cell-cell and cell-extracellular matrix interactions and mechanical cues. Additionally, it will provide a forum to evaluate tumor-mimetic culture models as drug testing systems for industrial applications. This session will provide a communication platform for biomaterials scientists and cancer biologists interested in the development and utilization of innovative and biologically relevant culture microenvironments.

Biomaterial Stem Cell Interactions

Stem cells have become a promising cell source in the tissue engineering field. Major advances have occurred in the isolation and characterization of stem cells derived from embryos, nonembryonic/adult sources, and more recently, adult somatic cells that can be genetically reprogrammed to become pluripotent stem cells. Intense studies have been focused at the cell and molecular biology levels on understanding the relationship between stem cell growth and terminal differentiation in an effort to control these processes. Recent discoveries have shown that the microenvironment can influence stem cell self-renewal and differentiation, which has had a tremendous impact on identifying potential strategies for using these cells effectively in the body. This session will feature presentations that describe studies examining the influence of biomaterials on stem cell behavior with an emphasis on biomaterials design that impart appropriate cues to stem cells to affect their behavior.

Biomaterials and Scaffolding for Neural Regeneration
Contributing SIG: Drug Delivery

Neuronal tissue regeneration has been a significant challenge in regenerative medicine. This session aims at highlighting the most recent advances in the novel biomaterial development including hydrogels and clinically relevant biomaterials for 3-D scaffold fabrication, surface modification, and delivery of therapeutics and stem cells relevant to neuronal tissue engineering. Research exploring strategies for repair of the peripheral nerve system, spinal cord and brain tissue will be emphasized. The nature of this symposium is multidisciplinary and able to attract academic, industrial and clinical researchers from materials science, chemistry, biochemistry, cell biology, orthopaedics and neurosurgery. Furthermore, a technology platform can be formed so as to promote the knowledge exchange between various disciplines and international collaboration.

Biomaterials-based Therapies Exploiting Immunological Processes
Contributing SIGs: Cell/Organ Therapies, Protein and Cells at Interfaces

Immunologically based strategies are rapidly being applied towards diseases and conditions that have not traditionally been treated through immune processes, and biomaterials are poised to play a central role in such developments. This session will focus on therapeutic applications involving biomaterials-directed immune processes. Examples of topics include novel adjuvants for immunotherapies, strategies for tolerizing biomaterials that would otherwise be pro-inflammatory or immunogenic, and the development of receptor-targeting biomaterials for the guided activation of specific immune cells such as dendritic cells (e.g., for cancer vaccines and other immunotherapies).

Biomimetic Materials for Tissue Engineering
Contributing SIG: Tissue Engineering

Recently, biomaterial scientists have added bioactivity to their design toolbox in the development of new materials for tissue engineering scaffolds. These advanced biomaterials add another dimension of guided interaction with the body by mimicking the native remodeling processes, e.g. biological recognition of adhesion sites, substrate-dictated differentiation, or cell-guided enzymatic degradation. This symposium will review current state of the art in the development of biomimetic scaffold materials and the fundamental studies that use these materials to identify key substrate characteristics that support desired cellular behavior in tissue engineering constructs (adhesion, migration, proliferation, differentiation).

Cancer Drug Delivery
Contributing SIGs: Drug Delivery, Nano Materials

This session will cover current efforts in the area of drug delivery including the development of targeted delivery in which the drug is only active in the target area of the body (for example, in cancerous tissues) and smart release formulations that respond to environmental signals (e.g. tumor acidic pH, cancer-specific enzyems). Types of drug delivery systems include drug-polymer conjugates, liposomes, polymer vesicles, polymeric micelles, and/or other supramolecular systems. Multifunctional systems that incorporate diagnostic and therapeutic functions are also included.

Cellular Responses to Biophysical Cues
Contributing SIG: Protein and Cells at Interfaces

Cells are influenced by their physical environment created in vivo by the extracellular matrix. Biomaterials can present biophysical cues to cells such as material modulus and topography that direct proliferation, migration, morphology and even differentiation into a certain phenotype. This session will focus on work that uses biological and physical material cues to influence cell attachment, adhesion, and function.

Ceramics in Orthopaedic and Dental Applications
Contributing SIGs: Dental/Craniofacial Materials, Orthopaedic Biomaterials

This session will focus on these general topics: a) Ceramics in coatings; b) Resorbable ceramics; c) Ceramics in drug delivery; d) Dental ceramics; e) Porous ceramic scaffolds. The importance of this session is due to the increasing demand for medical devices, especially for orthopaedic and dental applications for our ageing population and sports related injuries. Since inorganic materials are gaining attention due for repair and reconstruction of musculoskeletal defects, understanding their role in tissue engineering can be keys to develop next generation biomedical devices and improve the current ones.

Dental Materials
Contributing SIG: Dental/Craniofacial Materials

This session includes basic, applied, and clinical biomaterials research using approaches ranging from synthetic materials to biological mechanisms of therapy, and including materials/biological constructs and tissue structure-function analyses as biomimetic/design bases. Each of these approaches converge into the larger objective of restoring oral tissue structure and function. Specific topics may include synthesis, characterization, processing and application of any organic and inorganic materials used or having potential for use intra-orally or extra-orally for the restoration, fixation, replacement, or regeneration of hard and soft tissues in and about the oral cavity and craniofacial region.

Drug Delivery from Implant Surfaces
Contributing SIGs: Drug Delivery, Surface Characterization and Modification

This general session will focus on the recent advances in delivering drugs from implant surfaces. On-site drug delivery systems of biomedical devices allow drugs to be delivered at a specific anatomic site in therapeutic levels without systemic toxicity. These local drug delivery systems have tremendous applications in cardiovascular stents, orthopaedic implants, fracture fixation devices, dental implants, ophthalmology and neural devices. This session will cover a wide range of drug delivery platforms that are currently available for different implant surfaces. These include novel polymer coatings, physical modifications such as porous, textured, and reservoir surfaces, and chemical modifications such as molecular coatings and self-assembly methods. This session will also highlight the importance of different surface characterization techniques to analyze the drug delivery coatings.

Dynamically Responsive Biomaterials
Contributing SIG: Protein and Cells at Interfaces

Materials responding to a variety of stimuli (e.g. chemical, physical, biological) are being developed to enhance biomaterial performance or achieve dynamic functions. These stimuli-responsive materials have a wide variety of applications including biosensors, tissue engineering, drug delivery, and interactive medical devices. This session will focus on advances in the design, characterization and utilization of intelligent biomaterials that sense and respond to cellular processes or external stimuli.

Engineering Therapeutic Delivery from Biomaterial Scaffolds
Contributing SIG: Cell/Organ Therapies

This session will focus on the development of new materials or methods for the controlled delivery of macromolecular therapeutics and/or diagnostic molecules, including proteins, nucleic acids, and imaging probes from scaffolds. Appropriate topics include new chemistries/methods for controlled release (hydrolysis, light induced, pH induced, temperature induced, etc), layer-by-layer fabrication and release, cell-triggered release, and other triggered release technologies. Intended application areas are broad and would include in vivo and ex vivo regenerative therapies, diagnostics/imaging, and cell manipulation for other applications.

Imaging Biomaterials

Analysis techniques are continually being refined and improved to provide detailed chemical state information at a high spatial resolution to image biomolecules (cells, tissues, etc.). This session highlights some of these cutting edge techniques including novel instrumentation and methods as well as probes with applications from sub-cellular imaging to tissues.

Molecular Mechanisms Mediating Protein-Surface and Cell- Surface Interactions
Contributing SIG: Protein and Cells at Interfaces

While it is well recognized that biological responses to implanted biomaterials (e.g., inflammatory responses, platelet adhesion, and thrombus formation) are governed by proteins that adsorb on the biomaterial surfaces, relatively little is understood regarding the actual molecular mechanisms that control these types of interactions. Without a molecular level understanding of the factors that mediate these processes, biomaterials design to control them is essentially relegated to trial-and–error methods. Unfortunately, given the great complexity of protein-surface and cell-surface interactions, the probability of finding optimal conditions by such approaches is negligibly small. Therefore, although very challenging, increased efforts need to be made to study and understand the molecular basis for protein-surface and cell-surface interactions so that this knowledge can be applied for device design for improved biological performance. The objectives of this symposium are to spot-light this important area of research and provide a venue to present and discuss current research efforts in this area.

Novel Approaches to Cellular Therapies
Contributing SIG: Cell/Organ Therapies

There has been substantial progress in generating potentially therapeutic cells from stem cell sources such as iPS, ES, or even adult stem cells. One of the barriers preventing the translation of these cells to therapeutic application is their delivery. A successful method of delivery for one tissue or cell type might even be detrimental in another tissue. This session will cover novel approaches to cellular therapies from the aspect of how those cells will be delivered. Other areas include role of materials in delivery and also the use of the cells complex drug delivery vehicles.

Optimization and Characterization of Nanoparticle Biocompatibility
Contributing SIGs: Cardiovascular Biomaterials, Drug Delivery, Nano Materials, Ophthalmic Biomaterials, Protein and Cells at Interfaces

As nanoparticles, both organic and inorganic, for biomedical applications have become an intensively active area of research, the need for developing improved means of determining and controlling their biocompatibility has proportionally grown. Recently, major efforts have been spent modifying the surface of nanoparticles to elicit a desired biological response and, hence, enhance biocompatibility. This session highlights both current and emerging studies which provide insight into the mechanisms of potential toxicity and methods of controlling these mechanisms to optimize the biocompatible response.

Orthopaedic Alternative Bearing Surfaces: Laboratory Findings and Clinical Actualities
Contributing SIG: Orthopaedic Biomaterials

This session will objectively compare, contrast and discuss the key biomaterial properties and responses, related design features and clinical outcomes for bearing surfaces in total hip arthroplasty implants. This session's targeted bearing surfaces are ultra-high molecular weight polyethylene from conventional to enhanced and metal-on-metal. Themes for this bearing surface session include wear and functional testing, biological responses and metal ion release, clinical retrieval assessments, novel material enhancements, material or material processing comparisons through clinical outcome performance, material-design related evaluations and others. From this session, researchers and clinicians will have a better understanding of the laboratory and clinical knowns and unknowns for the biomaterials in total hip arthoplasty implants. This session will also include a few abstracts that are general orthopaedic biomaterials and not directly related to bearing surfaces.

Pluripotent Stem Cells in Engineered Microenvironments
Contributing SIG: Cell/Organ Therapies

The ability of pluripotent stem cells, such as embryonic stem cells, to continuously self-renew and differentiate into an array of mature cell types opens up new possibilities in fields ranging from drug screening to tissue engineering. However, pluripotent stem cells also present unique challenges to biomaterials scientists, as the fate of these cells can be strongly influenced, and perhaps controlled, by the physical and biochemical properties of their microenvironment. This session will describe new developments in pluripotent stem cell bioengineering, with an emphasis on approaches that are using engineered microenvironments to study and influence pluripotent stem cell behavior.

Polymeric Biomaterials - Synthesis, Characterization, Processing and Fabrication for Biomedical Applications
Contributing SIG: Surface Characterization and Modification

Custom polymer design and synthesis for medical device applications has surged in past couple decades; for example poly (styrene-co-isobutylene-co-styrene) (SIBS) for Stent coatings, Silicone-polyurethane copolymer (Elast-Eon) for lead insulations, Amino acid based Polycarbonates and Polyanhydrides, etc. Many more polymeric biomaterials (biostable as well as bioresorbable) are being designed and synthesized from natural and artificial monomers in both academia and industry to meet the growing needs of tissue engineering, medical devices, and long/short term implant applications. This session will focus on the Design, Synthesis, Characterization, Processing, and Fabrication of custom polymers – including smart polymers for the next generation of biomedical applications (eg. tissue engineering, cardiovascular, orthopaedic, ophthalmic, wound healing, drug delivery matix, etc).

Scaffold Assisted Bone Defect Repair / Regeneration
Contributing SIGs: Dental/Craniofacial Materials, Orthopaedic Biomaterials, Tissue Engineering

Biodegradable scaffolds have become a central part of the bone tissue repair and regeneration process. There have been many three-dimensional and porous scaffolds developed in the past using various biodegradable polymers, and their blends and composites via numerous fabrication techniques. Although the existing scaffold options have satisfied the basic requirements, there is still a strong need to develop better scaffolds that meet the clinical requirements. Essential features of a scaffold for bone defect repair are osteoinductivity, osteoconductivity, osteointegration, and bone compatible mechanical properties. Significant efforts in the field have been devoted to develop mechanically- and biologically-compatible scaffolds. This session will specifically focus on the scaffold design and fabrication aspects, surface modification, controlled osteogenic factor delivery approaches, and vascularization methods to attain porous grafts with enhanced osteogenic capability for effective bone defect repair/regeneration. The session will also focus on the scaffold evaluation with bone forming cells in vitro and their bone regeneration ability in vivo using a variety of bone defect models.

Scaffolds for Cardiovascular and Musculoskeletal Organ Regeneration
Contributing SIG: Tissue Engineering

Damage or injury to the cardiovascular and musculoskeletal systems affects millions worldwide. This session focuses on the design and evaluation of novel scaffolds for cardiovascular and musculoskeletal tissue engineering.

Self-Assembly in Cell and Tissue Engineering
Contributing SIG: Tissue Engineering

Recreating the hierarchical complexity of tissues is one of the major aims of tissue engineering. Some promising methods to achieve this include self-assembly or directed-assembly of materials and cells. This session will cover a variety of bottom-up approaches that are utilized to create tissue engineered constructs or in vitro tissue models. Self-assembly may occur at different length scales, from self- assembling peptides at the smaller end, to cell-laden microgels at the larger end. Materials that promote or enhance the self-assembly and organization of living cells are also of interest. The session will encompass areas such as modular tissue engineering, the production of microengineered scaffolds, and other emerging techniques in which the goal is to recreate the complexity of native tissue.

Spatially Patterned Biomaterials for Tissue Engineering
Contributing SIG: Tissue Engineering

Most biomaterial scaffolds developed for tissue engineering applications are relatively homogenous and lack the complexity and organization of the in vivo cellular microenvironment. While these homogeneous scaffolds have enabled remarkable progress in understanding cell responses to their microenvironment, elucidating the dynamic relationship between biomaterial properties and their influence on biological function may require more spatially and temporally complex scaffolds. This session will focus on state-of-the-art, biomaterial-based spatial and temporal patterning of structures, bioactive moieties, biomaterial properties, and cells.

Surface Fouling, Biofilms, and Their Impacts on Medical Devices
Contributing SIGs: Orthopedic Biomaterials, Protein and Cells at Interfaces

Surface fouling affects almost all tissue contacting medical devices such as vascular grafts, catheters, heart valves, orthopaedic implants, implantable diagnostic devices, and many more. Surface fouling can be caused by complicated processes such as bacterial colonization as well as simple things such as protein adsorption and cell adhesion. The former has been a significant clinical issue and the related mechanisms are still not well understood. The latter seriously inhibits long term uses of implantable sensors, drug delivery catheters, vascular grafts, etc. In the past decades, a lot of research efforts have been made to understand surface fouling and develop methods for prevention. Although a breakthrough to solve the problems is yet to come, good progresses have been made through combined drug delivery, surface modification, and other technologies.

Surface Modification for Sensors and Diagnostics

Surface modification is necessary to optimize performance of the latest generation of biosensors including implantable sensors, nanoparticles, protein chips and gene chips. From simple 1" x 3" microarray glass slides with hundreds of spots to higher density microarray chips (e.g. AffyMetrix®) with over 10,000 spots per cm^2, specific surface chemistry is required for automated oligonucleotide or peptide synthesis, maximizing signal to noise during binding and signal read-out via automated detection. For implantable sensors, biocompatible coatings can minimize capsule formation to extend in vivo use life. The immediate technology focus is molecular diagnostics but the methodologies to be discussed have relevance to any surface modification where retention of specific biomolecular activity is desired under a specific set of conditions. This session will bring together researchers in the biosensors field from academia and industry.

The Art of Falling Apart: Exploiting Biomaterial Degradation
Contributing SIGs: Cardiovascular Biomaterials, Dental/Craniofacial Materials, Drug Delivery, Orthopaedic Biomaterials, Tissue Engineering

The art of falling apart: a biodegradable clinical material must fall apart at the right time, at the right place, and in the right way. Non-homogenous biomaterial disintegration is a roadblock for applications that do not tolerate material fragmentation or otherwise require well-controlled erosion. Such applications can include vascular, drug release, tissue engineering, and load-bearing degradable devices in soft or hard tissues. Degradation has implications for cellular behavior as well as device persistence. This session provides insight into degradable material translational challenges such as degradation rate control and the impact of degradation on cellular behavior. Presentations include conventional wisdom as compared to data for tuning degradation in clinically important materials, cellular responses to degradation, and applications that take advantage of tailored degradation.

Tissue Engineering Scaffolds
Contributing SIG: Tissue Engineering

Tissue engineering and regenerative medicine seeks to integrate advanced materials science, stem cell science, and developmental biology to achieve the regeneration of complex tissues, organs, or organ systems. As the tissue engineering research progresses into creating three dimensional scaffold materials, the cellular in-growth into the scaffold will be deemed essential. Despite the enormous amount of success in tissue engineering, there are currently no successful tissue engineering strategies for repairing thick, vascularized tissues. This general session aims to showcase the recent advances in scaffolding/tissue construction strategies in tissue engineering. Abstracts focusing on methods to overcome challenges encountered when modifying and/or characterizing three dimensional scaffold materials compared to two-dimensional cell culture will be featured.

Translational Research in Nano-biomaterials
Contributing SIG: Nano Materials

New capabilities enabled by the unique performance enhancements of nanomaterials promise to revolutionize the biomedical field. This general session is committed to providing a fertile and stimulating forum for presentation and discussion on recent nanomaterials innovations which maximize the impact to the medical field. This session will include a comprehensive range of nanomaterials will be considered including nanoparticles, nanoporous substrates, nanofibers, nanocoatings, nanocomposites, etc. in various biomedical applications including as implants, tissue engineering materials, drug delivery devices, etc. for variety of areas such as orthopaedic, dental, vascular, neural, etc.

Tribocorrosion of Metallic Biomaterials
Contributing SIG: Orthopaedic Biomaterials

This session will present the latest research on tribocorrosion (the combined mechanical wear-corrosion interactions) of orthopaedic devices. The focus will be on the surface reactions related to fretting corrosion, surface triboelectrochemical mixing of surface layers. Specific biological issues, as for instance the effect of protein and biofilms during tribocorrosion, are discussed as well. Fundamentals of mechanically assisted corrosion behavior and development of novel hard coatings for resistance to tribocorrosion are provided.

Rapid Fire Sessions

Rapid Fire Sessions consist of a one hour long session with two half hour blocks, comprised of five 5-minute presentations, and a five minute Q&A.

- Mechanical Characterization of Biomaterials
- Polymeric Biomaterials - Synthesis, Characterization, Processing and Fabrication for Biomedical Applications
- Responsive Biomaterials and Therapeutic Scaffolds
- Thin-films Surface Modification of Biomaterials - Applications in Medical Devices

Workshops

The workshops provide an in-depth educational experience on topics relating to biomaterials with a significant amount of time dedicated to discussion, questions and answers.

Combination Medical Device Approval: FDA's Perspective

Contributing SIG: Surface Characterization and Modification
Session Co-Chairs: Shrojal Desai, PhD, Martin McDermott, PhD

Combination medical device approval process has remained a mystery to many in the industry and in the applied research, especially to those not working directly with the regulatory agencies. In this session representatives from the FDA and industry will shed light into the device approval process and share their perspectives. Attendees will learn how best to prepare for device approval and common mistakes to avoid.

Commercialization of Academic Biomaterials Research

Session Co-Chairs: Thomas Jozefiak, PhD, Newell Washburn, PhD

Commercialization of university technologies has become a critical issue, with biomaterials-related research being one of the most important areas in which new technologies are spun out from academic labs. This workshop will feature invited talks by faculty who are actively involved in translational research, either through entrepreneurial ventures or licensing technologies to existing companies. Speakers will share their experiences in commercializing their research, discussing the original research they were conducting, how they decided to pursue commercialization, and their experiences in the process. Topics will also include protection of intellectual property, university relations, collaborations, fundraising, balancing commercial and academic research, new venture formation and corporate partnerships. Attendees will have a unique opportunity to hear first-hand how high-impact biomaterials research moves from benchtop to bedside.

Data Acquisition and Data Interpretation for Conventional to Contemporary Surface Analytical Techniques
Contributing SIG: Surface Characterization and Modification

Session Co-Chairs: Dave Castner, PhD, Lara Gamble, PhD, Buddy Ratner, PhD

From the most conventional surface analytical technique like contact angle measurements to the state-of-the art time-of-flight secondary ion mass spectrometry, surface characterization has evolved over the years. However, the importance of good practices for data acquisition and data analysis as well as data interpretation is still unchanged. This workshop will cover parameters to use for data acquisition and data analysis to get the most from your instrument. Interpretation of the data will also be discussed including significance of the data and potential error as well as best practices and common mistakes to avoid when using surface analytical techniques. Surface plasmon resonance (SPR), electron spectroscopy for chemical analysis (ESCA) or XPS, and time-of-flight secondary ion mass spectrometry (TOF-SIMS) will be covered.

Writing an NIH Grant Application
Contributing SIG: Biomaterials Availability and Policy, Tissue Engineering

Session Chairs: Lynne Jones, PhD

This is an intensive workshop on grant writing to assist new investigators with writing a NIH, or other peer-reviewed, grant application. The workshop will include didactic lectures regarding the NIH structure: the various institutes and the Center for Scientific Review, the system of peer review, the types of grants (R01, R03, R21, K awards, SBIR, STTR, and others), and the different components of the newly revised grant applications. This will be followed by a mock study section to demonstrate how the review session operates. There will be a panel discussion regarding successful strategies and developing hypotheses, realistic research plans and budgets. Attendees are encouraged to bring questions for discussion by the panelists.

Panel Discussions

Panel discussions foster open debate on a topic. The invited guests include renowned experts in the area of focus and the chair allows time for open discussion with the audience.

Biomaterial Challenges of Battlefield Injuries
Contributing SIG: Orthopaedic Biomaterials

Session Co-Chairs: Lynne Jones, PhD, Michael Yaszemski, MD, PhD

With the global efforts of our military, there is an increasing need for advanced treatment options for severely injured servicemen and women. In recognizing this, the Department of Defense has created a new, federally-funded institution, the Armed Forces Institute of Regenerative Medicine (AFIRM). The AFIRM is comprised of two multi-institutional consortia, one led by Wake Forest University, Winston-Salem, N.C., and the University of Pittsburgh; and one led by Rutgers University, New Brunswick, N.J., and the Cleveland Clinic. The U.S. Army Institute of Surgical Research in San Antonio, Texas, is also a collaborative partner. The AFIRM team is committed to developing clinical therapies over the next five years focusing on the following five areas: 1) burn repair, 2) wound healing without scarring, 3) craniofacial reconstruction, 4) limb reconstruction, regeneration or transplantation, 5) compartment syndrome, a condition related to inflammation after surgery or injury that can lead to increased pressure, impaired blood flow, nerve damage and muscle death.
Most of the projects have a significant biomaterials component. In fact, several of our esteemed members are intricately involved in these projects. The aim of this panel discussion is to provide an overview of the AFIRM effort and a summary of the approaches that are being utilized.

Bridging Industrial-Academic Biomaterial Research Gaps
Contributing SIGs: Drug Delivery, Ophthalmic Biomaterials, Protein and Cells at Interfaces, Surface Characterization and Modification

Session Co-Chairs: Steven Little, PhD, Howard Winet, PhD

Each year, industry produces hundreds of millions of biomaterial-based formulations and devices to improve patient quality of life. While these companies have been extremely successful in delivering healthcare products, the scientific community may not fully understand the criterion used for material selection and processing. Likewise, there may be a lack of knowledge as to the critical manufacturing issues and how development of these products makes good business sense. These knowledge gaps would limit the contribution that can be made with respect to biomaterial translation from the side of academia.

To compound matters, an increasingly intense competition for funding forces many scientists, especially young professors, to only look at leading edge and hypothesis driven research topics. In order to bridge the knowledge gap, four leading scientists from both industry and academia will be invited to give a panel discussion. This panel discussion will provide a forum for leaders in the industry to share typical design criteria (with relevant examples) when developing biomaterials that would be attractive to the industry. This discussion will also shed light upon the types of IP industrial sources most likely to license in their respective fields and why. The ultimate goal of the panel would be to take a step toward bringing industry and academia closer together in terms of which projects they choose to pursue. Everyone is welcome.

Cagematch 2011: Natural Versus Synthetic Biomaterials in Tissue Engineering
Contributing SIGs: Biomaterials Education, Tissue Engineering

Session Co-Chairs: Jason Burdick, Jan Stegemann, PhD

This session will pit two teams of biomaterials scientists against each other to fight for their point of view. Team Natural will advocate for the use of naturally-derived biomaterials such as collagen, fibrin, chitosan, alginate, agarose, and others. Team Synthetic will promote the use of man-made polymers such as PLA, PGA, PEG, PU, HEMA, and others. The goal of the session will be to crown a winner based on the strength of their case. Vigorous discussion and audience participation will be encouraged.

Creating a Biomaterials Curriculum
Contributing SIG: Biomaterials Education

Session Co-Chairs: Yusuf Khan, PhD, William Reichert, PhD, Nicholas Ziats, PhD

SFB has been remiss in "owning" biomaterials education; i.e. there is currently no consensus in the biomaterials community about what constitutes a biomaterials curriculum, much less the essential content of a single class in biomaterials. The purpose of this panel is to start a serious dialog about "Creating a Biomaterials Curriculum." The panel and the ensuing discussion will be used to explore several topics that include: 1) necessary curricular content, 2) building a curriculum from scratch, 3) building a curriculum from pre-existing courses in other departments, 4) building a minor v. a major area of study, and 5) ABET accreditation. The primary outcomes of this panel will be: (1) to prepare a document that will serve as a road map for developing biomaterials curricula, and (2) establishing SFB as the primary organizational authority and clearing house for issues in biomaterials education.

International Biomaterials Symposium

Session Chair: Thomas Webster, PhD

Biomaterials' research is inherently international. This panel discussion will highlight current state-of-the-art research being conducted in each of the Society For Biomaterials' World Chapters. This panel discussion will include our international colleagues who will emphasize the current state of the art research and where resources are being used in their respective countries for unique areas of biomaterials' research.

Orthopaedic Alternative Bearing Surfaces: Laboratory Findings and Clinical Actualities
Contributing SIG: Orthopedic Biomaterials

Session Co-Chairs: Warren Haggard, PhD, Lynne Jones, PhD

The panel discussion's objective is to define the relationships between laboratory findings and clinical actualities in alternative bearing surfaces for total hip arthroplasty. The format of the presentation is uniquely constructed to allow laboratory and clinical outcomes to be objectively compared for each of these three bearing options. The construct of two podiums where points of view are made followed by a question and answer didactic from the moderators and audience has proven to be an optimal learning technique, minimizing learning gaps for the benefit of both the audience and presenters.

Tutorials

The purpose of a tutorial is to teach attendees about a specific technology or focus area. It includes up to two presenters and time for questions and answers. The invited speakers are selected for their experience in the field, as well as their ability to teach fundamental topics that are of increasing importance to a wide range of biomaterials scientists and engineers.

Immunohistology Techniques for Animal Tissues with and without Implants
Contributing SIG: Implant Pathology

Session Co-Chairs: Janson Emmanual, Howard Winet, PhD

The use of antibodies (monoclonal and polyclonal) for the detection of specific pathologies is common in cancer pathology delineating clearly the specific proteins involved. This technique of immunohistochemistry would greatly enhance detecting changes in biocompatibility of various implants with almost similar chemistries. With the advent of combinatorial chemistries in implant manufacture, it would be useful

to dissect and identify tissue response changes as a result of these implant prototypes.

Wet Tutorial for Scaffold Fabrication
Contributing SIGs: Protein and Cells at Interfaces, Tissue Engineering

Session Chair: Alireza Khademhosseini, PhD, Carl Simon, PhD

Use of scaffolds to serve as a 3D template for tissue regeneration is a central theme in the fields of tissue engineering and regenerative medicine. Many novel schemes for fabricating 3D tissue scaffolds have been developed. However, implementing these approaches by reading journal articles can be difficult and time-consuming. Seeing a live demonstration of a scaffold fabrication technique can make it much easier to replicate back in your own lab. In this tutorial, experts will perform live "wet" demonstrations of scaffold fabrication techniques. There won't be any PowerPoint presentations and everything will be done live! Any level of scientist from beginner to advanced is welcome. The only requirement is a desire to learn scaffold fabrication techniques.