2007 SFB Annual Meeting Highlights

KEYNOTE ADDRESS

Evolution of Drug Delivery Systems from Macro- to Micro- to Nano-DDS
Professor Allan S. Hoffman
Department of Bioengineering
University of Washington

Professor Hoffman studied at M.I.T., where he received B.S., M.S., and Sc.D. degrees in chemical engineering between 1953 and 1957. He taught on the faculty of M.I.T. Chemical Engineering Department for a total of 10 years. Since 1970 he has been Professor of Bioengineering at the University of Washington in Seattle, Washington. He is also an Affiliate Professor at Shanghai University, Shanghai, China.

He has more than 350 publications and is on the editorial advisory boards of six journals, including two American Chemical Society journals *(Bioconjugate Chemistry and Biomacromolecules)*.

SYMPOSIUM

A Symposium is designed to focus our attention on a specific topic within the large 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.

Biomaterial-based Bridges for Neural Regeneration
Co-chairs: Andrew T. Metters, Ken Webb

Invited Speaker: Scott R. Whittemore, Ph.D.
Title: The Reality of Stem Cell Grafting for CNS injury

Biomaterials are a fundamental component of growth-promoting bridges designed to direct and stimulate axonal regeneration across scars, gaps, and cavities resulting from traumatic injury to the central and peripheral nervous systems. Engineered biomaterial functionality includes fiber and channel-based topographic guidance and the incorporation of adhesion ligands, trophic factors, and recombinant DNA vectors targeted to regulate interactions with infiltrating astroglial cells and regenerating axons, as well as controlling the differentition and function of transplanted cell populations. This symposium will cover recent advances in neural scaffold fabrication, activation with bioactive molecules, elicited responses of transplant/endogenous cells, and in vivo testing in animal injury models.

Cell Function on Biomaterial Gradients and Arrays
Co-chairs: Matthew L. Becker, Deborah A. Leckband, Carl G. Simon, Jr.

Invited Speaker: Molly S. Shoichet
Title: Biology Inspired Design for Guided Axon Growth

Gradients and arrays are finding numerous applications in biomaterials research and many new methods for creating gradients and arrays of biomaterials have recently been developed. These gradients and arrays are being employed in a wide range of uses such as functional biomaterials, platforms for materials optimization, and tools to probe cell function. The innovators in this rapidly growing field come from diverse backgrounds and this symposium will bring them together to present, compare and discuss these exciting new approaches. The talks will focus on new techniques for creating biomaterials gradients and arrays and how they can impact regenerative medicine and tissue engineering.

Nano and Microparticulate Drug Delivery
Co-chairs: Mark Byrne, Steven Little

Invited Speaker: Mark Saltzman
Title: Nanoparticles for Treatment of Cancer

Nano and microparticulates may be one of the most widely used controlled and sustained release vehicles for small molecules, proteins, and nucleic acids due to their simplistic fabrication and attractiveness as minimally invasive therapeutics. Furthermore, these particles are also extremely desirable from the standpoint of targeted cellular delivery for applications ranging from vaccines to cancer therapy to regenerative medicine. Self assembling nanoparticles have become a mainstay in the testing of new cationic biomaterials for the delivery of anionic DNA in the quest to enhance non-viral gene therapy. This symposium will focus on current advances in the field of nano and microparticulate drug delivery in order to provide a forum where leaders in the fields of drug delivery, tissue engineering, and biomaterials can communicate the state of the art on this topic. Applications that will be highlighted include: controlled release of new biologically active agents, gene delivery, immunotherapeutics (including vaccines), particulate delivery for cancer, novel functional materials for particulates (polymers, lipids, micelles, dendrimers), advances in fabrication methods, methods of particle surface modification, particles in imaging strategies, and particulates for delivery in regenerative medicine including use in tissue engineering scaffolds

Surface Modification and Characterization of Orthopaedic and Dental Implants at the Nano/Micro Scale for Improved Osseointegration
Co-chairs: Erika Johnston, Sachin Mamidwar, Lakshmi Nair

Invited Speaker: Kevin Healy, Ph.D.
Title: Biomimetic Surface Engineering: Where do We go From Here?

The long-term successful performances of orthopaedic and dental implants greatly rely on the ability of implants to promote osseointegration while preserving their biomechanical properties. Surface engineering is an elegant way to improve implant performance as the nano/micro structure and chemistry of implant surfaces are known to significantly modulate bioactivity. An array of unique top down and bottom up approaches including laser and electron/ion beam assisted modifications, chemical deposition and biological surface modifications are currently being developed and investigated to improve implant performance. Equally as important is the evaluation of the physical, chemical and biological properties of the interface using TOF-SIMS, XPS, scanning probe techniques, solid state nuclear magnetic resonance, and confocal raman microscopy. This symposium will serve as a forum to discuss recent developments in surface modification and characterization of orthopedic and dental implants with an emphasis toward improving osseointegration.

Regenerative Medicine and Clinical Translation
Co-chairs: Mark Van Dyke, James Yoo

Invited Speaker: Stephen F. Badylak
Title: Strategies for Commericalization of Regenerative Medicine

This symposium will focus on the application of various biomaterials towards the clinical translation of tissue engineering and regenerative medicine technologies. Use of "intelligent scaffolds" through the integration of biological, chemical and pharmacological substances to enhance cell, tissue and organ functions would be covered in this symposium. Moreover, efforts to accelerate cell function, tissue formation and maturation using various preconditioning methods such as the bioreactor systems will fall into this category. This session will serve as a bridge between the basic materials sciences and clinical applications to repair and restore normal tissue function. Conceptual application studies, pre-clinical and clinical studies are the emphasis of the symposium. Utilization of progenitor and stem cells in applied studies are also encouraged.

Toll-like Receptor Interaction with Biomaterial Implants
Chair: Howard Winet

Invited Speaker: Julie Babensee
Title: Toll-Like Receptors and the Host Response to Biomaterials

As made clear in the 2006 SFB immunology panel, traditional concepts that innate immunity mechanisms do not interact with those of adaptive immunity and that only protein derivatives can act as epitopes are no longer valid. Complement components C3b and C3d – cases in point – not only interact with non-protein, but link innate and adaptive responses. It is also becoming evident that adaptive response cells such as dendritic cells can translate innate response signals to other adaptive immune cells via toll-like receptors. Toll-like receptors (TLRs) exist in both the plasma and nuclear membranes of at least two antigen presenting cells

Developing Best Practices in Tissue Engineering Education
Co-chairs: Stephanie Bryant, Jan Stegemann

Invited Speaker: Mark R. Saltzman
Title: Teaching Tissue Engineering: One Professor's Experience at Three Institutions

This symposium addresses the content and educational strategy of current tissue engineering courses and curricula, with a focus on the integration of biomaterials and related disciplines. It will bring together educators, scientists and students to discuss their experiences, current trends and best practices in tissue engineering education at both the undergraduate and graduate level. The topics to be covered include effective teaching strategies, course content, laboratory experience, and industry needs as related to tissue engineering courses and curricula.

Biological Modification of Cardiovascular Biomaterials for Medical Devices: Translation from the Laboratory to the Clinic

This is a collaborative symposium with the International Society for Applied Cardiovascular Biology [ISACB]

Co-chairs: Frederick J. Schoen, Naren Vyavahare

Invited Speaker: Buddy Ratner
Title: The Application of Bioinspired Surface Treatments to Cardiovascular Biomaterials: *In Vitro* and *In Vivo* Considerations and Comparisons

The focus will be on preclinical and clinical testing of biologically-modified biomaterials (containing proteins, genes or cells), micro-fabricated or nanodevices, and tissue engineered products with potential medical application in diagnostics or therapeutics.

Speakers will address topics such as: Evaluation of Chemical and Mechanical Properties of Modified Biomaterials; In-vitro Assessment of Biological Activity; Evaluation of Cell Phenotypes and Tissue Quality In-vitro and In-vivo; Animal Models for Evaluation of Biologically-active Biomaterials and Medical Devices, Novel Challenges Engendered by Testing These Biomaterials Devices to Demonstrate Mechanisms of Tissue-biomaterial Interactions; Effect of Patient Variability of Safety and Efficacy; and Novel Regulatory Challenges.

The symposium will enhance understanding and communications among basic scientists, clinicians and translational researchers, which will contribute to more effective and efficient research and development.

Translational Research in Nanomedicine: It Is Happening Now
Co-chairs: Diane Hoffman-Kim, Thomas J. Webster
Invited Speaker: Ed Ahn, Ph.D.
Title: Securing FDA Approval and Commercializing a "Nanomedical Device"

Recently, fundamental research in nanotechnology (the use of materials with constituent length scales in the nanometer regime) has led to the development of medical products necessary for the improved diagnosis, prevention, and treatment of numerous diseases. Oral presentations will demonstrate the successful bridging from fundamental research to the development of a nanomedicine-related product benefiting human health. Examples of recent translational nanomedicine research currently being used clinically and/or have made it to the marketplace appropriate for this symposium include (but are not limited to) nanostructured implants, tissue engineering materials, drug delivery devices, bioseparation devices, membranes, and imaging tools.

Self-Assembling Biomaterials
Co-chairs: Joel Collier, William L. Murphy

Invited Speaker: Ashutosh Chilkoti
Title: Temperature Triggered Self-Assembly of Elastin Like Polypeptides

Several emerging approaches to biomaterials design rely on substrates or matrices that assemble via non-covalent interactions. This symposium will address key issues related to the design, synthesis, characterization, and application of self-assembling biomaterials. Talks will describe approaches that use non-covalent inter- and intra-molecular interactions to build materials, including self-assembly of model substrates for cell biology, bio-inspired self-assembly of tissue engineering matrices, and assembly of drug and gene delivery systems.

Advances in Biomaterials Science: A Symposium by the Leaders of Biomaterials
Co-chairs: Anne E. Meyer, Michael V. Sefton

Invited Speakers:
Nicholas A. Peppas
Title: Nanotechnology and Intelligent Response: What Have They Done for Biomaterials Lately?

Frederick J. Schoen, M.D., Ph.D.
Title: Heart Valve Tissue Engineering and Regeneration – A Pathologist's Point of View

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Stuart L. Cooper
Title: Blood-Material Interactions of Polyurethanes

Arthur J. Coury
Title: Surgical Adhesion Prevention: Current Therapies and Beyond

Paul Ducheyne
Title: Bioactive Ceramics and Glasses: Reactivity, Biological Effects and Tissue Engineering Use

Alastair J.T. Clemow
Title: Challenges in Spinal Repair and Regeneration

The objective of the Tutorial Symposium will be to examine the impact of biomaterials in biology and medicine. This is a continuation of the successful 2006 symposium. All featured invited speakers of this two-day symposium will be past presidents of SFB who have kindly agreed to participate without any support of their expenses or honorarium. In recent years, there has been considerable work in preparing materials and finding new uses for hybrid structures based on biomaterials. Uses such as modified surfaces, stents, carriers for controlled and targeted drug delivery, and microdevices have shown the versatility of these biomaterials.

Why do we observe such explosion in the field now? In one scenario, medical devices now have reached a stage of dimensions comparable to those of biological macromolecules. This raises exciting possibilities for combining microelectronics and biotechnology to develop new technologies with unprecedented power and versatility.

While molecular electronics use the unique self-assembly, switching and dynamic capabilities of molecules to miniaturize electronic devices, nanoscale biosystems use the power of microelectronics to design ultrafast/ultrasmall biocompatible devices, including implants that can revolutionize the field of bioengineering.

For example, polymer surfaces in contact with biological fluids, cells, or cellular components can be tailored to provide specific properties or to resist binding depending on the intended application and environment. The design of surfaces for cellular protection or adhesion, and surface passivity encompasses a number of techniques such as surface grafting (ultraviolet radiation, ionizing radiation, electron beam irradiation). Certain techniques can change the chemical nature of surfaces and produce areas of differing chemistry as well as surfaces and polymer matrices with binding regimes for a given analyte. In addition, biomimetic methods are now used to build biohybrid systems or even biomimetic materials (mimicking biological recognition) for drug delivery, drug targeting, and tissue engineering devices.

The 2006 tutorial symposium was developed around the theme "What We Have Learned from Our Mistakes," including the requirement to better understand the biological systems and disease etiologies that we endeavor to repair, replace, or regenerate with biomaterials. The 2007 tutorial symposium continues on this track, focusing on micro- and nanoscale phenomena and tissue engineering.

The Program Committee extends its deepest appreciation for the dedication of our past presidents in organizing and donating their time and energy to this very special session.

Biomimetics and Nanoscience: Advances in Protein/peptide-based Biomaterials
Co-chairs: Bingyun Li, Sidney Sit

Invited Speaker: Mehmet Sarikaya, Ph.D.
Title: Molecular Biomimetics: Genome-based Materials and Systems for Technology and Medicine

Protein- and peptide-based biomaterials, using the whole or part of the protein as basis for biomaterial construction, have attracted attention in recent years because they are a great alternative to their synthetic counterparts. This symposium is designed to provide updated information and to discuss current trends on protein/peptide-based biomaterials. This symposium will highlight novel research and development strategies, the use of protein/peptide in nanobiotechnology, recent development related to the construction of protein/peptide-based implant materials, the host response after implantation, and compatibility assessment.

GENERAL SESSIONS

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

Surface Modification and Characterization of Biomaterials

The modification of the outermost surface of biomaterial constructs continues to drive the evolution of implant functionality. Such treatments include those that regulate the elution of therapies, reduce the inflammatory response, resist thrombus or biofilm formation, and those that induce specific biological responses such as cell anchoring and tissue in-growth. Development of ever more sophisticated treatments demands the ability to characterize ever subtler structures within the top nanometers of a surface. Today's new surface characterization methods permit the biomaterial scientist to probe the orientation and structure of proteins and other molecular features with ever greater detail. Presenters are encouraged to highlight developments in such characterization methods as Electron Spectroscopy for Chemical Analysis (ESCA), Time-Of-Flight Secondary Ion Mass Spectrometry (TOF-SIMS), scanning probe microscopies (AFM, SNOM), Near Edge Absorption for Fine Structure (NEXAFS), Sum Frequency Generation (SFG), Surface Plasmon Resonance (SPR), etc.

Advances in Drug Delivery

This session will highlight recent advances in the field of drug delivery and focus on novel materials and methods to rationally produce biomaterials for the controlled delivery of therapeutics. Topics will emphasize innovative materials and devices for various routes of delivery such as transdermal, implantable, and oral drug delivery systems.

Polysaccharide-based Biomaterials

Polysaccharide-based biomaterials have wide-ranging applications, including use as tissue engineering scaffolds, drug delivery vehicles, and tissue bulking agents. This class of materials includes numerous molecules such as hyaluronic acid, alginate, chondroitin sulfate, dextrans, and chitosan. Polysaccharides have been used to generate coatings, films, hydrogels, microspheres, and sponges; their chemical modification has allowed for numerous crosslinking methods and combination with a wide variety of other molecules to create

composite biomaterials. Furthermore, polysaccharide-based biomaterials can be inherently bioactive, regulating cell behavior and initiating specific intracellular signaling cascades. This session cuts across multiple biomaterial-related disciplines to provide a forum for investigators to present their recent developments in the synthesis, characterization, and application of polysaccharide-based biomaterials.

Tissue Engineered Products for Clinical Applications

The tissue engineering field has matured during the last few decades, and the technology has been at the forefront of transforming the laboratory technology into clinical applications. This section deals with the current state-of-the-art tissue engineered products that have been used and that are ready for clinical applications.

Orthopaedic SIG: Total Joint

This session was organized by the Orthopaedic SIG from abstracts submitted

Biomaterials and Microscale Technologies for Biomedical Applications

Micro- and nanoscale technologies are useful for a number of biomedical applications since they can be used to fabricate small features at a low cost and in a reproducible manner. Novel biomaterials have been instrumental in advancing the functionality of these microscale technologies. For example, novel photocrosslinkable materials and polymers are instrumental in the development of microscale devices for tissue engineering and lab-on-a-chip applications. In addition, microscale technologies such as microfluidics and molding technologies have led to the generation of new, custom-designed biomaterials with desired chemical or structural properties. This session aims to present the state-of-the-art research in the merger of micro- and nanoscale technologies with novel biomaterials in applications related to surface patterning, drug delivery, diagnostic or screening tools, microdevice fabrication, microfluidics, micro- and nanomaterials synthesis and tissue engineering.

Drug/biomedical Device Combination Products

The fields of biomaterials and drug delivery have been advanced separately and only recently the two fields started to merge to produce new drug/biomedical device combination products. The combination products ranges from antibiotic releasing catheters to drug-eluting stents, and this section examines what have been done and what need to be done to develop more clinically useful combination products.

Nanoparticles for Imaging and Drug Delivery

Molecular imaging has been critical in diagnosis of various diseases, and the technologies that are suitable for targeted delivery of imaging agents are very similar to those of drug targeting. This section examines how the nanoparticle technologies can be used for both molecular imaging and drug targeting.

Cardiovascular Biomaterials SIG

This session was organized by the Cardiovascular Biomaterials SIG from abstracts submitted

Tissue Engineering SIG

This session was organized by the Tissue Engineering SIG from abstracts submitted

Ophthalmologic Biomaterials

Ophthalmologic biomaterials continue to evolve to meet the needs of patients and surgeons. Current challenges include the development of materials that can be implanted through smaller incisions, restore accommodation and filter UV and blue light while avoiding complications such as posterior capsular opacification and calcification. The treatment of diseases such as glaucoma, retinal diseases, and cataract represent growing opportunities for ophthalmic drug delivery. Devices intended to deliver drugs to the various segments of the eye must address challenges such as drug metabolism, overcoming the blood-aqueous and blood-retina barriers and ultimately improve the ocular penetration of drugs.

This session will highlight the latest research dealing with materials used for ophthalmologic devices. Such topics include new materials for devices such as foldable, accommodating or injectable IOLs, contact lenses, glaucoma shunts and viscosurgical devices. Topics may also include drug delivery strategies for glaucoma, chronic dry eye and age related macular degeneration as well as approaches to alleviating pathological complications such as posterior capsular opacification, implant calcification and infection.

Protein and Cells at Interfaces SIG

This session was organized by the Protein and Cells at Interfaces SIG from abstracts submitted

Urological Tissue Engineering and Biomaterials

The aim of this session is to introduce the attendees of the biomaterials community to the current clinical needs and issues associated with reconstruction and tissue engineering of the urinary tract. The scope, however, will not be limited to research on tissue engineering, but include various biomaterials and devices used for the treatment of urological complications such as urinary incontinence and pelvic organ prolapse. Submission of abstracts from both academic and industry laboratories is encouraged for discussion and exchange of ideas on the topics of: bladder/urethra tissue engineering scaffold materials, stem-cell therapy, biologically-derived and synthetic biomaterials for incontinence and female prolapse treatments, biomechanical evaluation of urological tissues, etc.

High Throughput Screening Methodologies for Biomaterials

Development of novel biomaterials has been limited for a long time, and one of the reasons is the lack of suitable methods that can screen potentially useful biomaterials. High throughput screening allows examination of a very large number of candidate materials fast, increasing the chances of finding new biomaterials.

Protein Adsorption on Microdevice

Protein adsorption has been the key in controlling the fate of biocompatibility of biomaterials, and it becomes even more important when the biomedical devices are made in the micrometer scale. This section examines how the micropatterns on the surface affect the protein adsorption behavior and subsequent functions of the microdevices.

Implant Pathology SIG and Dental Craniofacial SIG

This session was organized by the Implant Pathology and Dental/Craniofacial SIGs from abstracts submitted.

Orthopaedic SIG: Cell/Tissue Interactions

This session was organized by the Orthopaedic and Cell/Tissue Interactions SIGs from abstracts submitted

Controlled Interactions of Proteins and Peptides with Biomaterial Surfaces

Cell responses to surfaces are mediated by specific interactions with biomolecules present at the tissue-implant interface. Multiple factors, including the type, amount, orientation, and conformation of the molecules, play important roles in determining how the cells behave. For example, a surface bound protein can be bioactive or bioinactive depending on conformation or orientation of the molecules. Uncontrolled or non-specific interactions generally lead to a repair response rather than regeneration of the native tissue. Significant previous work has explored nonfouling surfaces and nonspecific protein adsorption. This session focuses on experimental and computational research directed at developing, characterizing, and understanding biomimetic surfaces that bind protein/peptide molecules in a controlled manner and/or orientation to direct specific cell and tissue responses.

WORKSHOPS

The purpose of a workshop is for the presenters to provide an in-depth educational experience on topics relating to biomaterials with a significant amount of time dedicated to discussion and questions and answers.

Recent Developments in Rapid Prototyping of Biomaterials
Session Chair: Roger Narayan

Direct writing technologies, including microcontact printing, fused deposition modeling, selective laser sintering, inkjetting, and laser direct writing, involve layer-by-layer growth of three-dimensional structures. These technologies have traditionally been used in the microelectronics, defense, and automotive industries. More recently, direct writing technologies have been used to process cells and materials for use in medicine and dentistry. This workshop will review recent developments in rapid prototyping technologies for fabrication of tissue substitutes, biosensors, drug delivery devices, and medical instruments. Speakers will discuss various aspects of the rapid prototyping process, including processing of radiographic images, development of computer models, novel direct writing processes, and biocompatible materials for use in direct writing. This symposium aims to create collaboration 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.

Carry the Torch: Understanding Typology, Leadership and Communication Styles to Become a Dynamic and Effective Leader in the Field of Biomaterials

Whether preparing for a career in academia or industry, leadership skills are required to succeed in the field of biomaterials. In order to become a leader, it is important to understand the various personality types and communication styles of the people around you, and how your own personal traits shape your leadership style and how others see you.

This program will examine the major factors that impact our abilities to lead by evaluating how personality and behavior affect communication power and how these factors influence your perception in a work environment. The workshop will offer techniques and skills necessary to help recognize and develop effective interpersonal skills, such as motivating others and efficient conflict resolution. Individual and group activities will be used to teach effective ways to cultivate leadership skills and build strong and effective leaders. The three-module workshop sheds light on the preparation necessary to move towards leadership positions and will also serve to assess personal leadership development. Generic leadership, behavioral, and communication concepts will be presented in the first module. The second module will focus on the needs for these skills in industry. In the third module, emphasis will be made on the special considerations of leadership required in both the academic and industry side of the biomaterials field.

Spine Pain: Origins and Treatment Strategies
Session Chair: Michele Marcolongo

This program has been approved by the University of Illinois at Chicago for 6 hours of Category 1 CME credit.

UIC UNIVERSITY OF ILLINOIS AT CHICAGO

This workshop is designed in two parts for a full day program.

Part I: Session I of the workshop will focus on the origin and mechanisms associated with lower back pain, in particular with pain associated with the intervertebral disc. While several recent studies have revealed the presence of nerve fibers in the disc in different regions, there is no conclusive association of patient's pain to a location in the spine. This symposium is aimed at addressing these issues and leading pain researchers and clinicians from the region will participate in lectures as well as an open panel discussion on the topic.

Part II: Session II of the workshop will address different treatment strategies for alleviating disc pain including drug delivery concepts, synthetic and protein-based injectable nucleus replacement strategies, total disc replacement strategies as well as biological strategies such as genetic engineering, cellular and tissue engineering approaches.

Learning Objectives: Upon completion of the activity, participants should be able to:

1. List the origin of and describe the mechanism associated with lower back pain, especially that associated with the intervertebral disc
2. Explain how the presence of nerve fibers in the disc in different vertebral regions could be associated with a specific pain location in the spine
3. Formulate a treatment plan for each of the following strategies used to alleviate disc pain:
   - drug delivery concepts
   - synthetic and protein-base
   - injectable nucleus replacement
   - total disc replacement and biological strategies.

PANEL DISCUSSIONS

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

Biomaterials and Biocompatibility: Theories and Clinical Relevance

Research work in the areas of biomaterials has been marching fast with various new concepts such as biomimetic, stem cells, nanotechnology, and so on. However, in the real world, what we did not know decades ago are still there and we still do not know them today; we still do not have fouling-free surface, we still do not have the materials for small diameter vascular grafts, and we still do not have the orthopedic implant materials that can last longer than 10 years.

New concepts may provide opportunities to get new insights into the old problems from different angles, provided that we

understand the situations. However, if we ask ourselves the question of how well we understand the old problems, the answer may not be very satisfactory. It is necessary at this moment to review "what the major reasons are for device failure" and "what prevents us from getting breakthroughs in technology developments." Are they caused from material stability, compatibility, lack of required properties, or lack of nanotechnology? It is also necessary to vision the potentials of both the old-fashioned research and the research driven by the new concepts.

Where Have We Been and Where are We Going – Traditional Approaches Versus Nanotechnologies

The purpose of this panel will be to review what we have learned about the old problems and to provide some vision of the potential of both the "old" and "new" research. We invited experts to review the basics we have learned about the protein adsorption, cell adhesion, calcification, degradation of the materials.

Why Adsorption Seems Unavoidable? Clinical experts to review what are the main reasons for device failure? Materials failures, calcification, foreign body reaction/ fibrosis encapsulation, infection, or others? Experts active in nano-science, self-assembly, and other new areas to provide vision as to what and why these new sciences are promising.

TUTORIALS

The purpose of a tutorial is to teach attendees about a specific technology or focus area. 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.

Getting to Phase I: Preclinical Studies

Preclinical studies are those in which a drug, device, combinational or tissue engineered product is tested using in vivo animal models, in vitro model systems, cadaveric specimens, and retrieval analyses of explants. All researchers involved in the field of biomaterials should appreciate the science, government regulations, and role of these types of projects in evaluating current products as well as in bringing a new drug or device to market.

Cellular Signal Transduction

Responses to implants by cells and tissues are critically dependent on their ability to recognize the chemical and physical structure of the implant material. Moreover, the type and magnitude of a response is modulated by the biomechanical environment. Cellular recognition of materials involves the transduction of signals from outside the cell to inside the cell, which may result in alterations in cell survival, proliferation, differentiation, metabolism, and function. This tutorial addresses the study of genes, molecules, and pathways that transduce signals from materials to cells and tissues. It will focus on state-of- the-art techniques to evaluate signal transduction mechanisms and predict cell responses to biomaterials.

2007 Technology & Training Forums

These forums will be technically-based educational opportunities hosted by SFB corporate supporters.

Lakeshore Biomaterials: "Tailoring of Poly(lactide-co-glycolide) to Control their Properties"

IonBond LLC: "Coatings for Medical Device Applications"

Polymer Technology Group: "New Technology for Polymer Surface Modification: *Self Assembling Monolayer End Groups* (SAME™)"

Lakeshore Biomaterials: "Tailoring of Poly(lactide-co-glycolide) to Control their Properties"

Description:
The focus will be on the effects of composition, molecular weight, initiator types and polymer microstructure on the physical and mechanical properties of poly(lactide-co-glycolide) bioresorbable polymers including degradation. An overview of processing, sterilization and storage of bioresorbable polymers will be covered. We will summarize the applications of these polymers as matrices for drug delivery systems and as medical devices. If time allows, we will briefly touch on the bioresorbable polymers other than poly(lactide-co-glycolide) systems.

Agenda:
Introduction and Overview of Poly(lactide-co-glycolide)
- Idealized Bioresorbable Biomaterial
- A Brief History of Poly(lactide-co-glycolide)

Polymer Customization
- Effects of Composition
- Effects of Molecular Weight
- Effects of Initiator
- Effects of Microstructure

Processing, Sterilization and Storage of Bioresorbable Polymers
Applications
- Matrices for Drug Delivery Systems
- Medical Devices including Stents
- Tissue Engineering

A Brief Summary of Other Bioresorbable Polymers (if time allows)
Summary and Conclusion
Questions

Goals:
This subject will be approached from a polymer science perspective explaining fundamental concepts such as molecular weight, glass transition temperature and microstructure. The goal is to educate scientists to enable them to make better informed decisions when selecting or designing a bioresorbable polymer for their application.

Who Should Attend?
The ideal attendees are students, scientists, and engineers who have not been trained as polymer scientists, but are developing drug delivery systems or devices based on bioresorbable polymers. This course will provide a basic understanding of important concepts relating to polymer science and how they apply to bioresorbable polymers.

IonBond LLC:
"Coatings for Medical Device Applications"

Description:
Surface enhancement technologies are a viable, cost effective solution for the improvement of the physical properties of biomedical materials. This forum will summarize the capabilities, products and services of the IonBond, LLC Medthin Medical Group. It is intended to stimulate thought and discussion about potential applications for commercialization.

Physical Vapor Deposition (PVD), Chemical Vapor Deposition (CVD) and Plasma Assisted Chemical Vapor Deposition (PACVD) describe a group of surface enhancement technologies used to deposit wear and abrasion resistant thin film coatings with excellent adhesion. Medical and dental applications include orthopedic implants, cardiovascular implants, dental implants, catheters, surgical and dental instruments.

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Various PVD deposition technologies are discussed together with product features and applications for medical grade coatings. More recent additions to the Medthin portfolio are a variety of diamond-like carbon (DLC) based coatings, a solid lubricant film and a 'patented' nano-textured biologic growth surface (TST).

Agenda:

- Advantages of IonBond® Coatings as Biomaterials
- PVD and PACVD Coating Deposition Technologies
- Implant and Surgical Instrument Applications
- New Coating Developments
- Medical Business Unit Capabilities

Goals:
Surface enhancement technologies can provide biocompatibility, wear and abrasion resistance and reduced costs through improved performance for the Medical Device Industry. The goal of this corporate forum is to provide a foundation for all participants to learn about the technologies, products and applications possible through the use of coating surface enhancement technologies.

Coating deposition technologies and practical application examples that take advantage of the properties offered by thin film coatings are presented. In addition, newly developed carbon based films, solid lubricant films and biologic in-growth nano-structured surfaces are discussed.

Who Should Attend?
Individuals involved in the development, design, or improvements of medical devices are invited to attend to learn how this powerful technology can be utilized to improve the performance and properties of accepted biomaterials. Members of Research and Development teams and product development team design engineers and application specialists are invited to attend and afterwards discuss application-related items with our experienced team.

Polymer Technology Group:
"New Technology for Polymer Surface Modification: Self Assembling Monolayer End Groups (SAME™)"

Description:
Self-assembling monomers (SAMs) are useful in *research* because they form well-defined monolayers for optional attachment of biologically-active molecules. However, their use in *applications* is limited by their fragility due, in part, to their monomolecular dimensions. Polymers with 'Self-Assembling Monolayer End Groups' (SAME) are designed to spontaneously form robust surfaces analogous to self-assembling monomers. Components can be manufactured by useful processing methods; e.g., molding, extrusion and spraying. Bulk properties are determined by the selection of polymer mid-block, while surface properties are dominated by the *SAME* moieties. This versatile architecture offers the potential for a seamless transition from R&D results with SAMs, to manufacturing new polymeric devices optimized for biomedical applications.

Agenda:

- Parallel optimization of devices and materials
- Nature of polymer surfaces: recent findings
- A versatile polymer structure for separately tailoring bulk and surface properties
  a) Similarities between SAMs and SAME polymers
- Enhancing existing biomaterials with SAME technology
  -Surface modification
  -Molecular weight control
  -Improved processing
- Future potential in biomaterials development and applications

a) Control of surface chemistry and nanostructure

b) Surface characterization for applications

1. Sum Frequency Vibrational Spectroscopy

Goals:
To review progress in the science and technology of high-performance biomaterials, and to instruct device developers in the optimization of materials for new/demanding applications.

Who Should Attend?
Physicians, scientists, engineers, and technicians involved in the design or manufacturing of medical devices who desire to learn more about state-of-the-art materials and their optimization.