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BIOMATERIALS FORUM



Second Quarter 2007 • Volume 29, Issue 2

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News**

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BIOMATERIALS FORUM



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Book Review

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The Society For Biomaterials meets in Chicago April 18-21.

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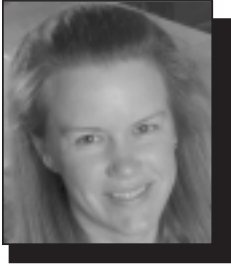
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I recently attended the National Science Board meeting in Washington D.C., at which a hot topic of discussion was “transformative research.” Although “innovation” has been the buzz word of late, it is abundantly clear that one can be quite innovative, but not transformative. Innovation refers to “wise” creativity, while transformational or transformative refers to the ability to elicit change.

Transformative research often requires extended periods of innovation and its full effect is often not realized until well after the fact and in hindsight. The recent National Academies Rising Above the Gathering Storm report noted that “reducing the risk for individual research projects increases the likelihood that breakthrough, ‘disruptive’ technologies will not be found.” It is clear that basic scientific research is mandated to develop the next generation of transformational discoveries. Transformative research often crosses disciplines and challenges the status quo...and often elicits negative reactions from scientific review panels who cite the research as “without basis” or “farfetched.” Thus, we ourselves, as reviewers for funding agencies, may be the largest block to transformative projects.

In the world of biomaterials, an application intensive field, it is certainly difficult to judge that which is transformative versus that which is fanciful thinking. It is easier to simply discard those ideas that do not have substantive evidence of success or are not similar to our current mode of thinking rather than apply imagination to extrapolate long-term potential. Those of us who have been trained as engineers have been trained to, for the most part, look carefully at facts and figures and make careful decisions based on these quantitative values, without using the right brain to muddy the waters with “what if” style thinking. Although I believe in building a solid case to avoid misuse of money and time, I also aspire to allow my mind to freely think about what might be, given a bit of research latitude.

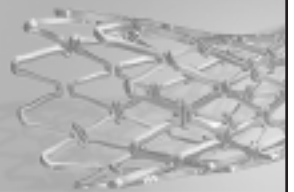
So the challenge for us, the researchers, is to seek to maintain a high bar of research excellence while facilitating the stimulation and growth of transformative research. If we do not take risks to nurture disruptive medical technologies (i.e., transformational technologies), we will miss enormous opportunities to serve the healthcare community in the best possible manner.

*Karen J.L. Burg
Hunter Endowed Chair & Professor of Bioengineering
Clemson University*



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Staff Update From Headquarters

The Torch

By Dan Lemyre, Executive Director

Headquarters staff has been busy preparing for the Annual Meeting.

The following is an update on staff activities in support of the various committees, Council and Board, as well as some important notices to members.

Awards Ceremonies and Nominations Committee -

Each year the SFB honors the achievements of members through a variety of awards such as the Clemson Awards, the Founders Award, the C. William Hall Award, the Young Investigator Award, the Technology Innovation and Development Award, and Student Awards for Outstanding Research. 2007 Award recipients are listed on page 6 in this issue. The nomination submission page of the SFB website will be live in July 2007. The 2008 award nominations deadline is in September.

At the time of this writing, the 2007-2008 SFB Officer Elections are ongoing. Results will be announced at the Annual Business Meeting on Friday, April 20, 2007, at the Sheraton Chicago Hotel & Towers.

Bylaws Committee - The Bylaws Committee considered several issues for possible bylaws amendment in 2007, and has concluded that only one could not be handled through the legislative process within the SFB Council. An amendment addressing the issue of establishing a quorum at the Annual Business Meeting was mailed to all members on Wednesday, March 21, 2007, and a vote on the amendment will be conducted at the Annual Business Meeting.

Education and Professional Development Committee -

The committee again worked with the Special Interest Groups to offer Student Travel Achievement Recognitions (S.T.A.R.s) for abstracts submitted to the Annual Meeting. The committee continues to receive requests from numerous organizations seeking SFB endorsement of their meetings and is considering changes to the endorsement guidelines that it will recommend to Council for approval.

The Committee also worked with the National Student Section to organize the second Career Fair at the Annual Meeting. In addition, a full-day student workshop titled, "Carry the Torch: Understanding Typology, Leadership and Communication Styles to Become a Dynamic and Effective Leader in the Field of Biomaterials," will be held on Wednesday, April 18, 2007.

Finance Committee - The Finance Committee has implemented the Board-approved Finance and Investment policies by creating a reserve investment account. The investment policy is a very conservative and socially responsible policy that will ensure the security of SFB's reserves.

As of this writing, a full audit of the 2006 financial statements is being drafted and will be submitted to the Audit Committee for review, and then to the Board of Directors for acceptance.

Long Range Planning Committee - The Branding Task Force of the Long Range Planning Committee is distributing a pilot survey to all SIG members that will be rolled out to all SFB Members shortly after the Annual Meeting. The results of this survey will be used to improve membership services and to glean insight into members' perceptions to craft a new brand identity for the Society.

Meetings Committee - The committee has recommended and the Council has approved the selection of Buckhead, Ga., as the location of first choice for the 2008 Fall Annual Meeting. The Program Chair for the 2008 Fall Meeting will be Andres Garcia from the Georgia Institute of Technology. The meeting program will be focused on translational research. Staff also continues to work with the Meetings Committee and 2009 Program Chair, Karen Burg, to organize the 2009 Annual Meeting, which will be held in San Antonio, Texas.

Program Committee - Staff would like to extend a note of gratitude to the 2007 Program Committee and its Chair, Kinam Park, for their creativity and dedication in organizing the 2007 Annual Meeting program. As we enter the final phase of preparation for the meeting, we are excited about the program and the amount of scientific content being presented this year.

Publications Committee - All SFB Members are encouraged to submit entries for "Biomaterial of the Week" to SFB web editor Thomas Webster (Thomas_webster@brown.edu). In addition, thanks go out to Jeff Karp of MIT for the enhancements to the Surgical Video Library, including the Lectures and Seminars series. Special Interest Group web pages featuring bulletin boards and other areas of interest are also available on the website to enable ongoing interaction with peers in your specialty throughout the year.

Special Interest Groups - Ballots for 2007-2008 SIG Officers were issued on March 30, with a voting deadline of April 13th. Results will be announced at the Annual Meeting and a new SIG representative to Council will be elected at the All SIG Meeting on Saturday, April 21, 2007.

If you are interested in knowing more about a particular issue, policy or committee activity, or if you have any suggestions for improved membership services, please contact SFB headquarters office directly:

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A New Journal Dedicated to the Integration of Biology and Engineering

The Torch

By Guigen Zhang, Education Editor

A new peer-reviewed online journal, *Journal of Biological Engineering* (JBE), has just been launched to provide a forum for engineering advances in the context of biology. This new journal will address the foundational questions that unify all applications of biological engineering and that integrate engineering with life sciences using theoretical or applied approaches to design, optimize, and use biological systems ranging in scale from molecules, cells, organisms, to ecosystems. Topical areas include, but are not limited to: synthetic biology and cellular design, engineering of biomolecular and cellular devices, bioproduction and bioproduct engineering, whole organism studies, ecological and environmental engineering, and biological engineering education and the biodesign process.

Biological Engineering is an emerging engineering discipline that encompasses engineering theory and practice connected to and derived from the science of biology, just as mechanical engineering and electrical engineering are rooted in physics

and chemical engineering in chemistry. Biological Engineering is thus a science-based engineering discipline with fields of application ranging from molecules to ecosystems. The grounding in biology, regardless of application, distinguishes Biological Engineering from application-oriented engineering fields.

This new journal is sponsored by The Institute of Biological Engineering (IBE), and is published as an online journal through BioMed Central. All original research articles published by BioMed Central are made freely and are permanently accessible online immediately upon publication, which is viewed as essential to ensure the rapid and efficient communication of research findings.

To read more about this new journal or to make a contribution, please visit www.biomedcentral.com/info/authors/instructions.

Members in the News

The Torch

From Press Releases

Congratulations to:

Dr. Ravi Bellamkonda, Professor of Biomedical Engineering at the Georgia Institute of Technology and Emory University, who was one of 13 scientists recently named as a Georgia Cancer Coalition Distinguished Cancer Scholar for 2007. One of only two professor-level awardees, Ravi will receive \$150,000 in funding annually for five years to support his research efforts. The Coalition selects scientists engaged in the most promising areas of cancer research; Bellamkonda's area of interest is nanotechnology for cancer imaging and therapy.

Professor Thomas Webster, of the Divisions of Engineering and Orthopaedics at Brown University, who is the founder and scientific consultant for a new start-up company, Nanovis. Dr. Webster's nanotechnology innovations serve as the foundation for Nanovis, including a collection of nanostructured surfaces, materials, patented, and patent-pending devices designed to promote the integration of implants with bone, soft tissue, nerves, bladder, and cardiovascular cells and diminish infection rates. Team members include CEO Brian Emerick (who has four prior startup ventures), Matt Hedrick (a former Lilly executive with startup experience), and Dr. Janice McKenzie (a Society For Biomaterials member). The company will soon be based in Columbia City, Indiana.

Professor Antonios (Tony) Mikos, who has been named recipient of the 2007 Edith & Peter O'Donnell Award in

Engineering by the Academy of Medicine, Engineering and Science of Texas. The Edith and Peter O'Donnell Awards were established in 2005 to give recognition and visibility to outstanding up-and-comers and their work. The recipients must be within 15 years of a first faculty appointment, or 15 years from a first appointment in industry. The award consists of a \$25,000 honorarium, a citation, and an inscribed statue, which will be presented during the Academy's Annual Conference. Professor Mikos was nominated for his pioneering contributions to the field of biomolecular and biomedical engineering through the use of chemical engineering principles.

Professor Nicholas Peppas of the University of Texas at Austin, who is the recipient of this year's University of Texas Career Research Excellence Award, an honor given in recognition of his outstanding body of work and contributions to bioengineering and chemical engineering. This award is the highest research recognition at the University of Texas.

Dr. Jeffrey Karp of MIT and **Professor Thomas Webster** of Brown University for creating the Video Surgical Library on the Society For Biomaterials web site, which was recently named by the Biomaterials Network (biomat.net) as a "Top Site."

Editor's note: Do you have member news to share? If so, please send your news to kburg@clemson.edu.

Feature

By Dan Lemyre, SFB Executive Director,
and Jason Rivkin, AIMBE Assistant Executive Director

SFB and AIMBE:

Leading Biomaterials Research and Advocacy Efforts!

There is a great synergy between the missions of AIMBE and the Society For Biomaterials. While our missions are closely aligned, AIMBE activities vary significantly from those of the Society. While SFB's mission focuses on advancing materials research and development, AIMBE's mission is geared more toward public outreach, public policy, lawmaking, and inter-societal cooperation. Both of these aspects are fundamentally important to the advancement of the field.

The Society For Biomaterials is in fact a member of AIMBE's Council of Societies. AIMBE's Council of Societies is a mechanism to coordinate and enhance interaction among 16 scientific organizations in medical and biological engineering. Specifically, the Council of Societies:

- Provides a collaborative forum for the establishment of society member positions on issues affecting the field of medical and biological engineering;
- Fosters intersociety dialogue and cooperation, providing a cohesive public representation for medical and biological engineering;
- Provides a way to coordinate activities of member societies with the activities of academia, government, the health care sector, industry, and the public and private biomedical communities.

The challenges facing medical and biological engineering grow more complex each year. The Council of Societies meets these challenges by assuring that resources from throughout the field – particularly the scientific and management talents of key individuals – are brought together most efficiently in pursuit of critical common goals. The Council, in fact, helps set those goals by identifying and assessing important issues from within their own membership.

It was noted recently that the close relationship shared by the AIMBE and the SFB lie not only in their missions, but also in their leadership and governance. At the AIMBE Annual Event held February 27 – March 2, 2007, the following prominent members of the Society For Biomaterials were installed as AIMBE officers:

- Dr. Linda Lucas (SFB President 1997-1998), new AIMBE President.
- Dr. Anne Meyer (SFB President 2004-2005), Chairperson of AIMBE's Council of Societies.
- Dr. Nicholas Peppas (SFB President 2003-2004), Chairperson of AIMBE's College of Fellows.
- Dr. Cato Laurencin (Recipient of the 2006 Clemson Award for Contributions to the Literature), Chair-Elect of the College of Fellows.
- Dr. Joseph Salamone (Recipient of the 2006 Clemson Award for Applied Research), Chairperson of the AIMBE Industry Council.

Our congratulations, and our thanks, go out to all those who work to advance the field of biomaterials research! The Society For Biomaterials is an official member of AIMBE's Council of Societies. For more information on AIMBE, please visit their website: www.aimbe.org.

Advances in Tissue Engineering

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- Nanobiotechnology



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Society 2007 Award Winners

Feature

Announcing the Society For Biomaterials award recipients for 2007.



Founder's Award

David Franklyn Williams, PhD
Awardee Address: The Concept of Metastable Biocompatibility
Saturday, April 21, 2007
Plenary Session II • Sheraton Chicago Ballroom Center • 10:25 am– 10:45 am



Young Investigator Award

Krishnendu Roy, PhD
Awardee Address: Engineering Immunotherapy through Biomaterials: From Stem Cells to Vaccines
Saturday, April 21, 2007
Plenary Session II • Sheraton Chicago Ballroom Center • 11:40 am – 12:00 pm



C. William Hall Award

Stanley Brown, D Eng, and Katharine Merritt, PhD
Awardee Address: Yes Dear, That Is the Logical Next Step
Saturday, April 21, 2007
Plenary Session II • Sheraton Chicago Ballroom Center • 10:50 am – 11:10 am



Outstanding Research by a Hospital Intern, Resident or Clinical Fellow

Dominique Andre Rothenfluh
Awardee Address: Targeted Poly (Propylene Sulfide) Nanoparticles For Intra-Articular Drug Delivery
Thursday, April 19, 2007
Advances in Drug Delivery (General Session) • Sheraton 2 • 10:30 am – 10:45 am



Clemson Award for Basic Research

David Grainger, PhD
Awardee Address: Fluorinated Biomaterials: A Tale of Two Cell Types
Thursday, April 19, 2007
Plenary Session I • Sheraton Chicago Ballroom Center • 9:00 am – 9:20 am



Student Award for Outstanding Research – Ph.D. Candidate Category

Danielle S.W. Benoit
Awardee Address: Identifying Chemical Moieties to Control hMSC Differentiation Using a High-throughput Methodology
Friday, April 20, 2007
High-throughput Screening Methodologies for Biomaterials (General Session) • Chicago 9 • 12:15 pm– 12:30 pm



Clemson Award for Applied Research

Roy Drake Bloebaum, PhD
Awardee Address: Applied Research in the Fields of Cartilage, Bone, Biomaterials, and Skeletal Attachment
Thursday, April 19, 2007
Plenary Session I • Sheraton Chicago Ballroom Center • 8:35 am – 8:55 am



Student Award for Outstanding Research – Masters Degree Category

Mark James Butler
Awardee Address: A poly(butyl methacrylate-co-methacrylic acid) Tissue Engineering Scaffold with Proangiogenic Potential In-vivo
Friday, April 20, 2007
Translational Research in Nanomedicine: It Is Happening Now (Symposium) • Chicago 9 • 2:45 pm – 3:00 pm



Clemson Award for Contributions to the Literature

David L. Kaplan, PhD
Awardee Address: Bioengineered Fibrous Proteins to Control Cell and Tissue Function
Thursday, April 19, 2007
Plenary Session I • Sheraton Chicago Ballroom Center • 8:10 am – 8:30 am



Student Award for Outstanding Research – Undergraduate Category

Margaret Tripodi
Awardee Address: Integrin Linked Kinase Expression Prevents Anoikis in Human Mesenchymal Stem Cells
Saturday, April 21, 2007
Implant Pathology and Dental Craniofacial SIG (General Session) • Chicago 8 • 8:00 am – 8:15 am



Technology Innovation and Development Award

Arthur J. Coury, PhD
Awardee Address: Medical Device Development: Some Biomaterials Principles Confirmed
Saturday, April 21, 2007
Plenary Session II • Sheraton Chicago Ballroom Center • 11:15 am – 11:35 am

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 differentiation 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 Commercialization 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 “Nanomaterial 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

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/ultraslow 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 range 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.

Tunable Surface Chemistry Gradients That Passively or Actively Modulate Cell Adhesion and Response

Feature

By Joy Dunkers, Government News Contributing Editor,
Nathan D. Gallant, Matthew L. Becker,
Carl G. Simon, Jr., and Eric J. Amis

Polymers Division, National Institute of Standards and Technology, Gaithersburg, Md., 20899, USA

Combinatorial approaches increase throughput in screening cell response to biomaterial properties such as surface energy, modulus, crystallinity, roughness, surface chemistry, and ligand density. These methods increase the speed of research and enable one to cover large and multidimensional parameter spaces on single substrates.¹ Furthermore, continuously variable gradients can identify thresholds or transitions in behavior that can often be missed or obscured in data sets composed from only discrete samples. For example, threshold concentrations of a particular functional ligand are often

necessary to support adhesion or trigger signals that encourage differentiation and tissue formation.

We have developed numerous combinatorial methods to screen biomaterial properties that influence cell-material interactions.²⁻⁷ The primary mechanism by which surface properties are communicated to cells is through their influence on protein adsorption from solution, and thereby the specific protein-protein interactions that control cell adhesion and direct cell function. In these studies we focused primarily on

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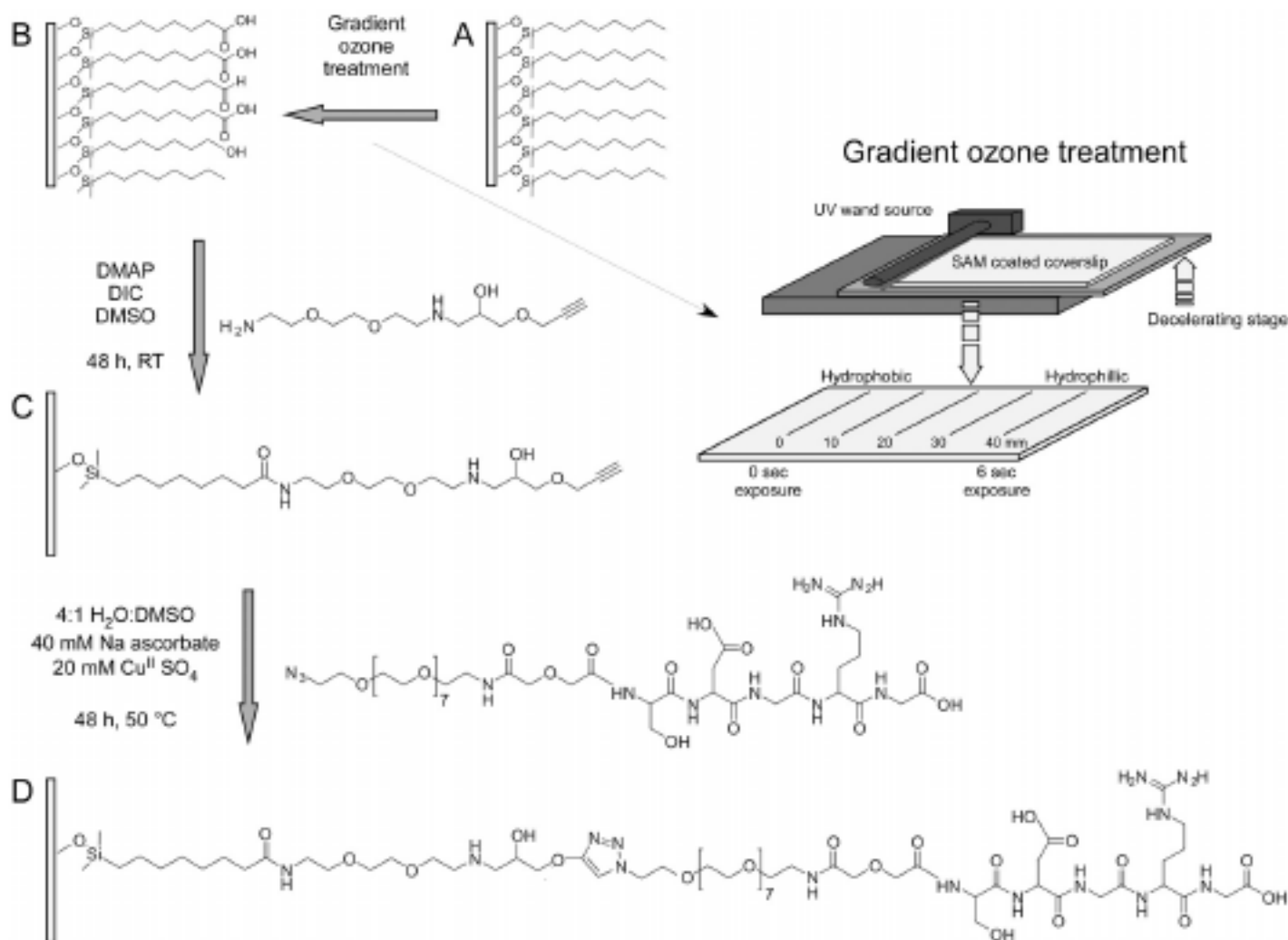


Figure 1. Fabrication of substrates with gradients in surface energy that are subsequently converted to “Universal Gradient Substrate for Biofunctionalization” flowed by GRGDS peptide immobilization. (A) A hydrophobic SAM is subjected to variable UV-ozone treatment to generate a (B) continuously variable surface energy gradient. (C) A difunctional linker converts the carboxylic acid species into an alkyne gradient for biofunctionalization by click chemistry. (D) An RGD azido-peptide is covalently immobilized into the gradient by triazole cycloaddition.

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cell adhesion because adhesion to synthetic surfaces is critical to numerous biomedical and biotechnological applications. Typically, proteins rapidly adsorb from physiological fluids onto material surfaces, mediating cell attachment and modulating the inflammatory response. Cell adhesion to adsorbed proteins or engineered bioadhesive motifs provides mechanical attachment to the underlying substrate and triggers signals that direct subsequent cellular responses, including proliferation and differentiation. Therefore, engineering surfaces in order to control cell adhesion has become an important area of biomaterials research. Biomimetic surfaces are engineered to present covalently bound ligands that actively control cell-materials interactions to elicit a desired cell response, either in lieu of, or in addition to protein adsorption.⁸

This report highlights two innovations we have developed recently to study cell-biomaterial interfaces. The first is a method to fabricate substrates possessing a large surface energy gradient, and the second is a novel application of a recently popularized scheme to immobilize biomolecules in a controlled manner. Moreover, this surface conjugation scheme can be built upon the underlying chemistry of the variable surface energy substrate to create concentration gradients of immobilized ligands for specific cell surface receptors.

We fabricated surface energy gradients by using ultraviolet ozone (UVO) exposure to alter the surface chemistry of hydrophobic self-assembled monolayers (SAM) (Figure 1 A-B).⁵ Surface energy is a fundamental material surface property

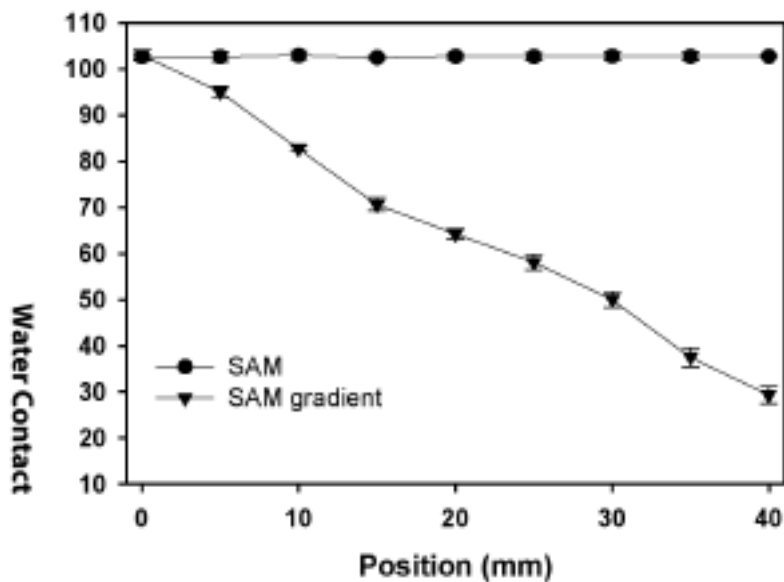


Figure 2. Surface energy varies as a function of position along the gradient. Deionized water advancing contact angle (mean \pm S.D., $n=6$) is shown before and after linearly increasing UVO exposure time (0 sec to 6 sec). Lines connecting contact angle data are only used for clarity.

that modulates the way proteins adsorb and, in turn, influences cell behavior. Briefly, SAMs of *n*-octyldimethylchlorosilane were vapor deposited on glass slides and placed on a computer-controlled stage beneath a UV lamp with a slit aperture. Variation of the UVO exposure time, achieved by moving the stage, determines the extent of oxidation and alters the surface energy (Figure 2). The UVO method alters surface chemistry of SAMs and allows us to generate linear gradients as reported

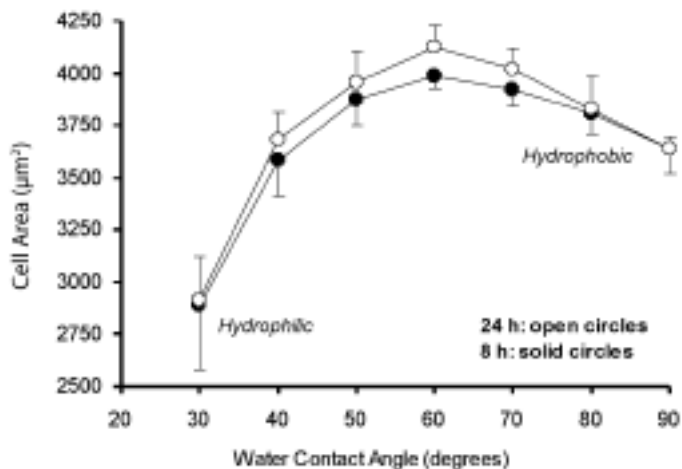
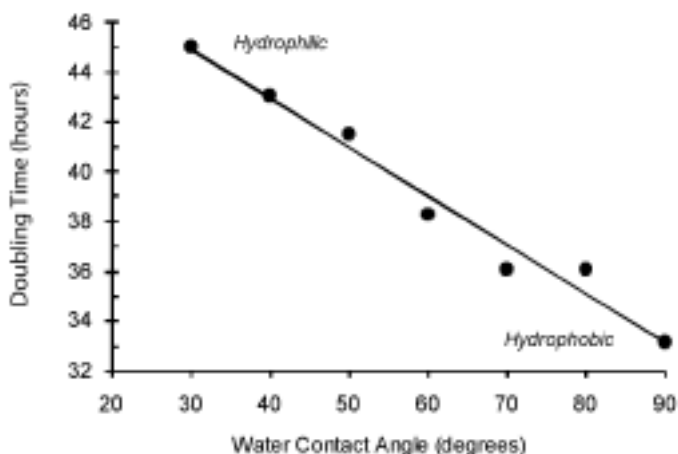


Figure 3. Cells attached uniformly to FN coated surface energy gradients had varied proliferation and morphology characteristics related to the underlying surface chemistry. (A) MC3T3-E1 doubling time as a function of contact angle is shown. The line is fit by linear regression and the Pearson correlation coefficient is 0.987. Doubling time decreases by 2.0 h for every 10° increase in water contact angle. (B) Mean cell area as a function of contact angle after 8 h (solid) and after 24 h (open) is shown. For each data point, “*n*” equals 4. Error bars are standard deviation of the mean. Only the top (24 h) or bottom (8 h) error bar on each point is shown for clarity. The lines connecting the data points are also only for clarity. Pairwise comparisons of the 8 h and 24 h data at each contact angle did not yield any statistically significant differences ($P < 0.05$).

here, but the method is completely tunable and could be used to create spatial patterns as well.

In a study using this technique, fibronectin was adsorbed to surface energy gradients, and cell adhesion, spreading and proliferation were assessed.² Surface energy modulated fibronectin adsorption did not affect initial cell adhesion, however the rate of proliferation was linearly dependent on the underlying surface energy and increased with increasing hydrophobicity (Figure 3 A). Cell spread area was unaffected by changes in surface energy over most of the gradient but cells were significantly smaller on the most hydrophilic region (Figure 3 B).

In a more recent study we built upon the notion of combinatorial screening biomaterial surface properties by creating biomimetic gradients that actively modulate cell adhesion and can be used to measure the ligand density dependence of cell responses.⁴ The technology described by Gallant and coworkers is two fold: first is a versatile method to attach biomolecules to surfaces; and second is the exploitation of variable surface chemistry substrates as a source of chemical handles that can be used to immobilize biomolecules with defined spatial and concentration profiles. Taken together, these techniques provide a high-resolution statistical platform for measuring ligand density dependent effects.

Specifically, the concentration of carboxylic acid groups increases linearly with UV exposure, as previously described, and this gradient is easily modified by carbodiimide chemistry with a difunctional linker to produce a gradient of alkyne groups (Figure 1). This alkyne functional substrate has numerous advantages for bioconjugation. Alkyne and azide groups can be coupled by the highly efficient Huisgen triazole cycloaddition reaction also known as “click chemistry.”⁹ Therefore any molecule with an azide group can be tethered to the surface with biocompatible reactants and products under aqueous conditions. Neither alkynes nor azides occur naturally in biological materials, making it possible to engineer highly specific, stoichiometric and controlled conjugation schemes for biomolecules.

This technique is particularly amenable to peptide immobilization because the azide functionality can be incorporated during synthesis as simply as another amino acid. The end result is a substrate with tunable surface concentration of the biomolecules of interest. We have dubbed these alkyne surfaces “universal substrates for biofunctionalization” because they are versatile; any molecule possessing an azide group can be conjugated, and in gradients

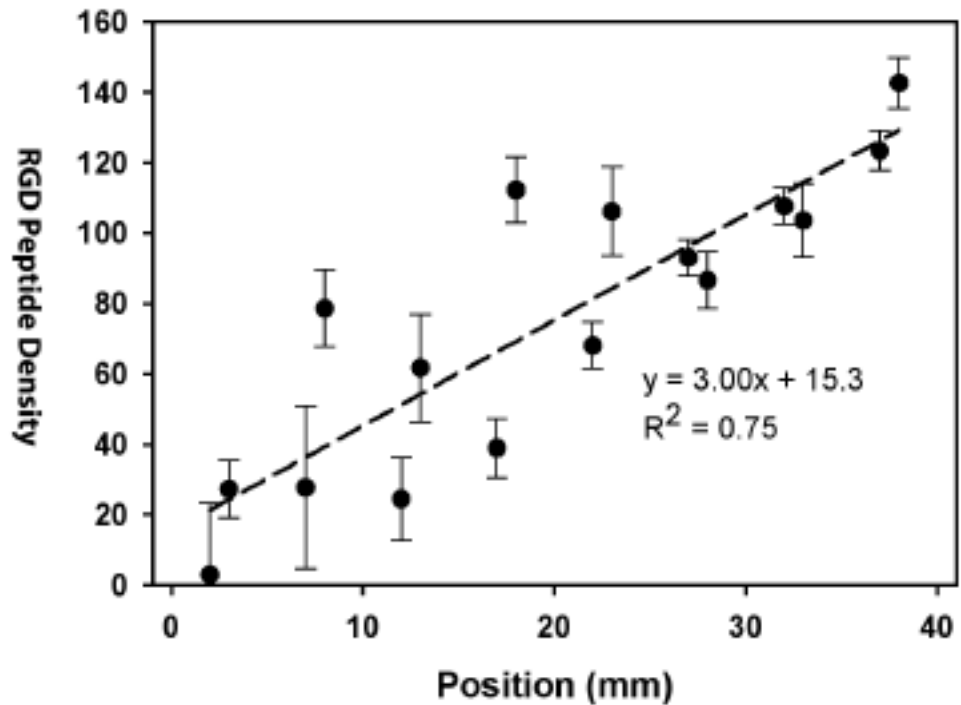


Figure 4. Surface immobilized RGD peptide density (mean ± S.E., n=5) varied as a function of position along the gradient substrate. The dashed line is the linear regression of peptide density versus position.

they can be used as reference materials or screening tools for ligand density with controlled orientation.

We demonstrated these methods by fabricating a substrate with monotonically increasing glycine-arginine-glycine-aspartate-serine (GRGDS) peptide density. The range of concentration covered more than two orders of magnitude reaching 140 pmol/cm² (Figure 4). At short adhesion times (6 hr) we observed a concomitant increase in cell adhesion with GRGDS density (Figure 5 A). In addition we observed opposing trends in spread area and cell aspect ratio, with maxima and minima, respectively, occurring at approximately 50 pmol/cm² (Figure 5 B). Thus we were able to generate gradients of an adhesive peptide and measure surface concentration dependent cell adhesion and morphology. This was a simple process using an RGD adhesion peptide to demonstrate the fabrication and utility of these methods. Many more sophisticated uses can be imagined, ranging from basic research hypotheses of cell response to micro-environmental cues to clinical therapies such as functional surface coatings for implanted devices and tissue engineered medical products.

Continuously variable gradient substrates increase measurement throughput and reduce the need for interpolation of data from discrete sample sets. The technologies described in this report can be used to monitor cell response to small differences in substrates properties that modulate cell adhesion by passively influencing protein adsorption or by actively displaying specific adhesive motifs. These tools can contribute to the understanding of cell-material interactions and may lead to improved biomaterial performance and device design.

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As a final point, the demand for these types of technologies was emphasized recently. In a particularly insightful letter to Nature, Igor Medintz described the need for a “universal” set of tools to systematically attach almost any biomolecules to any surface” for nanotechnology to deliver on the promise of networks of sensors and devices.¹⁰ We believe such a set of tools would have an even broader impact, reaching beyond sensors to the entire spectrum of biological, chemical and environmental sciences. The versatility of using click chemistry to functionalize surfaces with biomolecules is a significant step toward this goal. And coupling this innovation with the gradient surface methods provides the capability to begin probing the numerous biological applications where ligand density and orientation need to be controlled.

Acknowledgement

We benefit greatly from a highly productive relationship with the NIST Combinatorial Methods Center (www.nist.gov/combi) within the Polymers Division. NDG gratefully acknowledges a postdoctoral fellowship from NRC/NIST. The authors are affiliated with the Biomaterials Group in the Polymers Division of the National Institute of Standards and Technology in Gaithersburg, Md.

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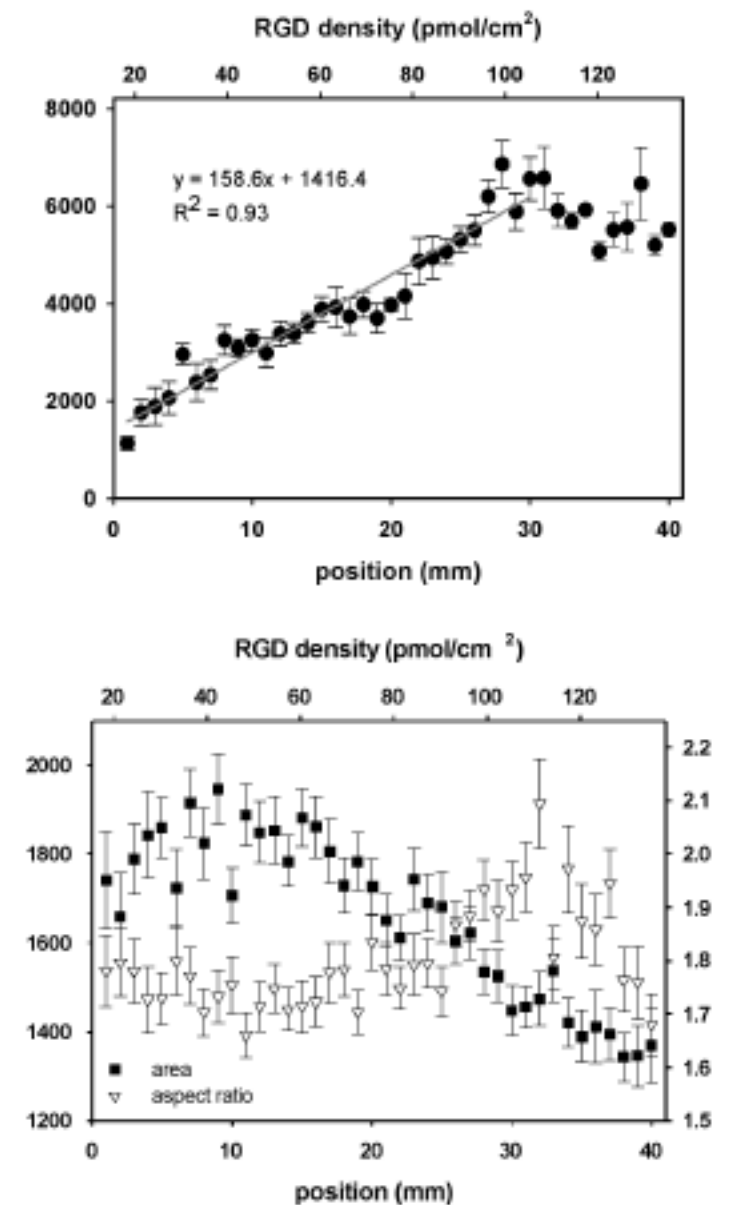


Figure 5. A-10 smooth muscle cell adhesion and morphology vary with surface conjugated RGD peptide density. (A) Cells were fluorescently labeled and automated microscopy combined with image analysis software was used to count the number of cells and quantify area and aspect ratio. (B) The number of cells adhering to RGD peptide-conjugated gradients (mean \pm S.E., $n=4$) increased with position. The line fit equation is given as a function of position; a second axis (top) was derived from the linear regression in Figure 4 and added to indicate cell adhesion as a function of approximate RGD density. (C) Cell area (closed symbols) and aspect ratio (open symbols, mean \pm S.E., $n>45$) versus position and RGD concentration (top axis, derived from linear regression in Figure 4) show different trends.

The 10 Volume Series:

Nanotechnologies for the Life Sciences

Book Review

By Liisa Kuhn, Assistant Professor, University of Connecticut Health Center, Center for Biomaterials, Farmington, CT

Edited by Challa Kumar

Copyrights 2005-2006, Wiley-VCH, Weinheim, Germany. Each volume is approximately 400-500 pages. \$1,500 for the entire series or \$175/volume.

Description

If you are interested in nanotechnology (and what biomaterials scientist isn't and hasn't been, even before there was such a buzz about nano?), there is a series of books published in 2005 and 2006 by Wiley VCH on Nanotechnologies for the Life Sciences, edited by Dr. Challa Kumar that is a "must-have" for your university or corporate library because of its comprehensive, single-source nature. The 10 volume titles of the complete series are:

- Biofunctionalization of Nanomaterials
- Biological and Pharmaceutical Nanomaterials
- Nanosystem Characterization Tools in the Life Sciences
- Nanodevices for the Life Sciences
- Nanomaterials – Toxicity, Health and Environmental Issues
- Nanomaterials for Cancer Therapy
- Nanomaterials for Cancer Diagnosis
- Nanomaterials for Biosensors
- Tissue, Cell and Organ Engineering
- Nanomaterials for Medical Diagnosis and Therapy

Each volume can be considered an encyclopedia on nanotechnological approaches utilized within the specialty indicated within the volume title. Importantly, the size-dependant chemical and biological activity of nano-materials is contrasted with that of micro-materials, so that the reader can appreciate the revolutionary impact that precise molecular control during fabrication has made on various aspects of the specialty being addressed within the volume. The two volumes reviewed were Vol. 7: Nanomaterials for Cancer Diagnosis and Vol. 9: Tissue, Cell and Organ Engineering. An abbreviated table of contents for each is shown below. The reader will immediately be struck by the exceptional quality of the publication in terms of the authors selected to write the chapters, as well as more tactile and visual qualities such as the weight of paper used, the typesetting, and the quality of the illustrations. Colored panels are included. The clarity of the Scanning Electron Microscopy and Transmission Electron Microscopy micrographs are appropriate and required, given the nature of the technology being discussed.

The volume titled *Tissue, Cell and Organ Engineering* focuses on biomimetic nanofibrous creations of extracellular matrix analogs. Various fabrication methods are described, such as phase separation and electrospinning of resorbable polymers, and self-assembly of amphiphilic peptides. The fabrication methods and the types of scaffolding materials commonly used are fully detailed. I was impressed by the comprehensive nature of the chapters and found myself learning some new things about subjects in which I am already well-versed.

The volume titled *Nanomaterials for Cancer Diagnosis* focuses on the diagnostic aspects of the fight against cancer, and also covers combined diagnostic-therapeutic strategies. Oncology and nanotechnology have recently converged, resulting in improved imaging and tumor detection systems, many of which offer subsequent therapeutic opportunities and capabilities. Methods for producing the nanoparticles as well as the biological targeting mechanisms that lead to the location and imaging of the cancer cells are described. The various types of nanoparticles now being investigated for various clinically relevant applications, such as liposomes, superparamagnetic nanoparticles, iron oxides, dendrimers, fullerenes, quantum dots, and polymer nanoparticles are described and discussed. Particularly impressive about this volume is the depth to which the various technologies are described. The latest understandings of the mechanisms of cell uptake or cell interaction with the nanoparticles are well explained. The reading of these two volumes has made the reviewer eager to read the other volumes, particularly *Nanomaterials – Toxicity, Health and Environmental Issues*. As the description on the back cover of the volumes indicates, *Nanotechnologies for the Life Sciences (NtLS)* is truly comprehensive, and notably across all fields, covers the convergence of materials and the life sciences on the nanoscale.

Audience

NtLS is essential reading for all scientists working in the nanotechnology field from medicine to biology through chemistry, materials science and physics to engineering. This series would make an exceptional addition to university or corporate libraries due to its comprehensive, encyclopedic nature. Individual volumes are another option for those on a tighter budget.

From the Contents

Vol. 7 Nanomaterials for Cancer Diagnosis

- Dendrimers in Cancer Treatment and Diagnosis
- Nanoparticles for Optical Imaging of Cancer
- Nanoparticles for Magnetic Resonance Imaging of Tumors
- Nanoprobe-based Affinity Mass Spectrometry for Cancer Marker Protein Profiling
- Imaging and Quantification of Pericellular Proteolytic Activity

Vol. 9 Tissue, Cell and Organ Engineering

- Polymeric Nanofibers in Tissue Engineering
- Electrospinning Technology for Nanofibrous Scaffolds in Tissue Engineering
- Nanofibrous Scaffolds and their Biological Effects
- Hydroxyapatite Nanocrystals as Bone Substitutes
- Nanoparticles and Nanowires for Cellular Engineering

By Steve T. Lin, Industrial News Contributing Editor, From Press Release

Biomet (Warsaw, Ind.) announced that Jeffrey Binder has been hired as CEO. He will replace Daniel Hann, Biomet's former General Counsel and most recently its Interim CEO. Hann will stay with the company as EVP of Administration and a board member. Excluding his most recent post, Binder has been in the orthopedics industry for the past 15 years. Binder comes from Abbott, where for the past year he has been SVP of Diagnostic Operations. Before that he ran Abbott Spine and its predecessor, Spinal Concepts. Before he was President and CEO of Spinal Concepts, he was president of large joint and trauma at Depuy, J&J's orthopedics division.

Celera (Rockville, Md.), an Applera Corp. business, announced the publication of data from its research studies identifying several candidate genetic markers associated with late-onset Alzheimer's disease (LOAD), including markers in multiple genes that have never been associated with LOAD. Two of these genes are PCK1, a gene that regulates blood glucose levels, and GALP, a gene that is modulated by insulin and regulates food intake, suggesting a link between Alzheimer's disease and irregular glucose/insulin levels.

Genentech Inc. (San Francisco, Calif.) announced recently that a patent protecting a key drug-making process in the biotechnology industry has been rejected by the U.S. Patent and Trademark Office, opening the door for dozens of companies - including Gaithersburg-based MedImmune Inc. - to use the technology without having to pay millions in royalties. Genentech said it added about \$105 million to its bottom line last year from Cabilly royalties, a significant chunk of which came from Maryland's largest biotech business. Companies use the Cabilly technology to make treatments such as Synagis, MedImmune's blockbuster baby drug.

Osteotech (Eatontown, N.J.) received 510(k) approval for Plexur™ P, an osteoconductive, bone/polymer biocomposite that can be used to fill bony voids of the pelvis and

extremities. Plexur P will initially be available as granules and cylindrical plugs, but will be expanded to other forms including blocks, wedges and sheets.

Syneron Medical Ltd. (Israel) and **The Procter & Gamble Company** (Cincinnati, Ohio) announced the signing of an exclusive joint development and supply agreement for the commercialization of patented, elos™ based, home-use devices and compositions for the enhancement of skin appearance through the treatment of fine lines, wrinkles, age and sun spots and cellulite. Procter & Gamble selected elos technology as its preferred, non-invasive, energy-based solution for home-use aesthetic treatments in this field. Under the terms of the agreement, Syneron will lead the research, development and manufacturing while Procter & Gamble will focus on the development of the compositions, marketing, and distribution. The home-use devices will be marketed under the Procter & Gamble family of skin care products and will be co-branded with Syneron's elos technology.

Wright Medical (Arlington, Tenn.) signed an agreement with Regeneration Technologies to develop advanced xenograft implants for use in foot and ankle surgeries. Wright Medical will design and distribute the implants under its Cancellor-Pure™ brand, while RTI will develop, manufacture and supply Wright's designs. The contract is effective immediately.

Zimmer (Warsaw, Ind.) and **ISTO Technologies** have initiated a clinical trial for Neocartilage, a living tissue-engineered graft under investigation for the restoration of cartilage defects, reestablishment of joint function and relief of pain in the knee. The study is being conducted under an IND (Investigational New Drug) application. Zimmer plans to market the product as DeNovo® ET Engineered Tissue Graft.

ATP to Schedule Competition For New Technology R&D Awards

Biomaterials Community

From Press Release

The NIST Advanced Technology Program (ATP) will conduct a new competition this fiscal year for cost-shared awards to support high-risk industrial R&D.

The ATP provides partial support to single companies or to industry-led joint ventures to accelerate the development of innovative technologies for broad national benefit through partnership with the private sector. ATP projects are selected in a competitive, peer-reviewed process.

Further details will be available when the competition is formally announced in the Federal Register this spring;

proposals will not be accepted before that time. Notices will also be posted to www.atp.nist.gov and www.grants.gov. These notices will provide information about the specific ATP competition, including funding availability, selection criteria, guidelines for submitting proposals, proposal deadlines, and dates and locations of proposal conferences.

Additionally, all those on the ATP mailing list will receive a competition announcement and the ATP Proposal Preparation Kit. Those interested may register for the ATP mailing list at www.atp.nist.gov/atp/atpform.htm.

Community Calendar

ASAIO's 53rd Annual Conference

June 7-9, 2007
Chicago, IL
www.asaio.com

TERMIS North America

June 13 - 16, 2007
Toronto, Canada
www.regenerate-online.com/agenda_wed.php

ESF-EMBO Symposium

Biological Surfaces and Interfaces
July 1-6, 2007
Sant Feliu de Guixols, Spain
www.esf.org/conferences/07222

International Congress on BioHydrogels

November 14-18, 2007
Viareggio (Lucca), Italy
Congress Centre 'Principe di Piemonte'
www.biohydrogels2007.it

2007 BMES Annual Meeting

September 26-29, 2007
Los Angeles, CA
www.bmes.org

3rd International Conference on Tissue Engineering

September 21-26, 2008
Aldemar Paradise Village
Rhodes, Greece

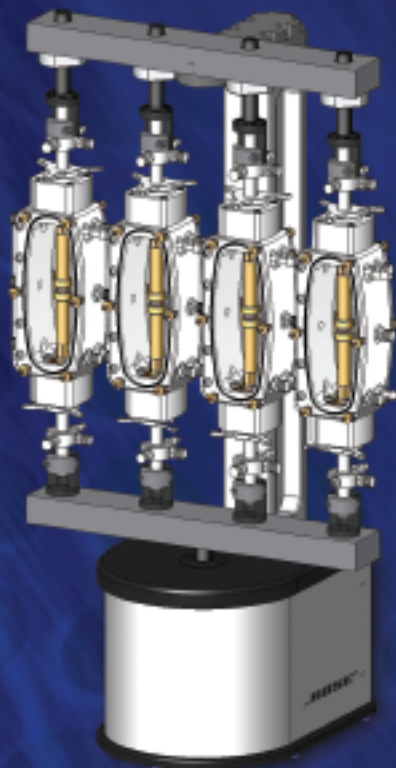


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