

SFB OFFICER NOMINEES, SFB AWARDEES
UPDATES FROM THE P&CI AND SC&M SIGS

BIOMATERIALS

FORUM!



OFFICIAL NEWSLETTER OF THE SOCIETY FOR BIOMATERIALS

First Quarter 2017 • Volume 39, Issue 1

ALSO INSIDE

AN INTERVIEW WITH
DR. SPIRO MEGREMIS, ADA

THROMBIN-RESPONSIVE
TRANSCUTANEOUS PATCH

BIOMATERIALS FORUM!

The official news magazine of the **SOCIETY FOR BIOMATERIALS** • Volume 39, Issue 1

Biomaterials Forum, the official news magazine of the Society For Biomaterials, is published quarterly to serve the biomaterials community. Society members receive *Biomaterials Forum* as a benefit of membership. Non-members may subscribe to the magazine at the annual rate of \$48. For subscription information or membership inquiries, contact the Membership Department at the Society office (email: info@biomaterials.org) or visit the Society's Website, biomaterials.org.

It is the policy of the Society For Biomaterials that all articles reflect only the views of the authors. Publication of articles or advertisements within *Biomaterials Forum* does not constitute endorsement by the Society or its agents of products, services or views expressed herein. No representation is made to the accuracy hereof, and the publication is printed subject to errors and omissions. Articles that do not have an author byline may originate from press releases. The Society For Biomaterials retains press releases on file for a period of one year from the date of publication.

Editorial contributions to *Biomaterials Forum* are always welcome. Contributions should be sent to the Executive Editor and are subject to the terms and conditions of the Editorial and Publication Release. Authors should refer to the Author Guidelines, which are available on the Society's website, when writing submissions. The publisher accepts no responsibility for return or safety of artwork, photographs or manuscripts. Submission of editorial content does not guarantee acceptance or publication.

Address corrections should be sent to *Biomaterials Forum*, 1120 Route 73, Suite 200, Mt. Laurel, NJ 08054.

Requests for advertising information should be directed to Sarah Black at sblack@ahint.com or 856-380-6905. Information is also available on the Society's website, biomaterials.org.

Unauthorized reproduction of this magazine in whole or in part is prohibited without the permission of the publisher. Requests for permission should be directed to the Managing Editor.

Scientific photos may be submitted for cover consideration in future issues. Submit color photo, no larger than 4" x 6", along with credit information and scientific description, to the Executive Editor.

Copyright© 2016 • ISSN 1527-6031
Society For Biomaterials
All rights reserved

Executive Editor Guigen Zhang, Clemson University
301 Rhodes Engineering Research Center
Clemson, SC 29634-0905
Phone: (864)-656-4262 • Fax: (864) 656-4466
Email: guigen@clemson.edu

Managing Editor Sarah Black, Society For Biomaterials
1120 Route 73, Suite 200, Mt. Laurel, NJ 08054
Phone: 856-380-6905 • Fax: 856-439-0525
Email: sblack@ahint.com

**Government News
Contributing Editor** Carl G. Simon Jr., NIST
Biosystems & Biomaterials Division
Email: carl.simon@nist.gov

**Industrial News
Contributing Editor** Steve T. Lin, Exactech Inc.
Email: steve@exac.com

**Society Business & Membership
News Contributing Editor** Andres J. Garcia, Georgia Tech
Email: andres.garcia@me.gatech.edu

**Special Interest Group News
Contributing Editor** Brendan Harley, University of Illinois at Urbana-Champaign
Department of Chemical and Biomolecular Engineering
Email: bharley@illinois.edu

Book Review Editor Lynne Jones, Johns Hopkins University
Department of Orthopaedic Surgery
Email: ljones3@jhmi.edu

AIMBE News Contributing Editor Lynne Jones, Johns Hopkins University
Department of Orthopaedic Surgery
Email: ljones3@jhmi.edu

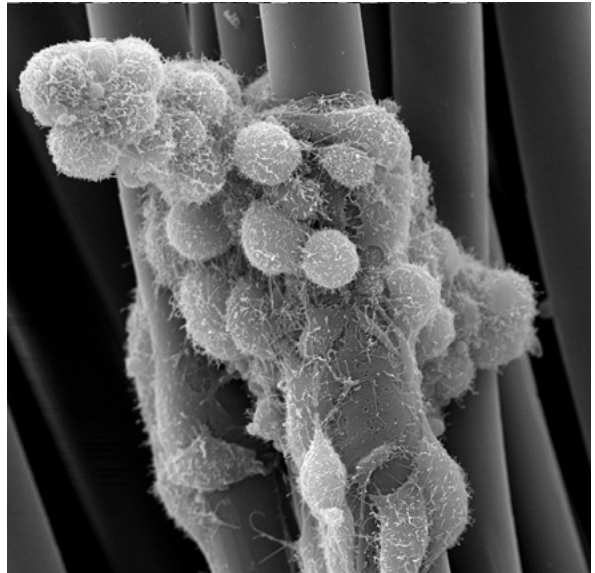
Education News Contributing Editor Yusuf Khan, UCONN Health
Department of Orthopaedic Surgery
Email: ykhan@uchc.edu

Historical Flashback Editor Guigen Zhang, Clemson University
Email: guigen@clemson.edu

Student News Contributing Editor Christopher Gehrman, University of Memphis
Email: cjghrmnn@memphis.edu

Special Interest Group Reporters

Biomaterials & Medical Products Commercialization	Rahim Jindani • rjindan@ncsu.edu
Biomaterials Education	Erin McCave • emccave@clemson.edu
Biomaterial-Tissue Interaction	Howard Winet • hwinet@ucla.edu
Cardiovascular Biomaterials	Rami Tzafirri • tzafirri@cbset.org
Dental/Craniofacial Biomaterials	Scott A. Guelcher • scott.guelcher@vanderbilt.edu
Drug Delivery	Brent Vernon • brent.vernon@asu.edu
Engineering Cells & Their Microenvironments	Daniel Alge • dalge@bme.tamu.edu
Immune Engineering	Jai Rudra • jarudra@utmb.edu
Nanomaterials	Daniel Siegwart • daniel.siegwart@utsouthwestern.edu Huinan Liu • huinanliu@enr.ucr.edu
Ophthalmic Biomaterial	Yasushi Kato • ypkato@innovia-llc.com
Orthopaedic Biomaterial	Roche C. de Guzman • roche.c.deguzman@hosftra.edu
Protein & Cells at Interfaces	Stephen Florczyk • stephen.florczyk@nist.gov
Surface Characterization & Modifications	Gopinath Mani • gopinath.mani@usd.edu
Tissue Engineering	Abby Whittington • awhit@mse.vt.edu



Contents

The Torch

- 2 From the Editor
- 3 From the President
- 4 2017 Award Recipients Announced
- 7 Officer Nominees

News & Updates

- 13 Members in the News
- 14 Staff Updates
- 16 An Interview with Dr. Spiro Megremis
- 30 Proteins & Cells at Interfaces SIG
- 32 Student Chapter News
- 33 Surface Characterization & Modification (SC&M) SIG/Government News
- 34 Industry News
- 36 Highlights of the Latest Biomaterials Research from the Journal *Advanced Materials*
- 37 Book Review

On the cover: The cover image, provided by Xiaoqi (Suki) Tang of Prof. Martin W. King's Laboratory in the Department of Textile Engineering, Chemistry and Science, College of Textiles at the North Carolina State University, shows 3D growth of 3T3 cells on PLA filament. The pore size of the PLA filament is designed based on the cell size. In each filament yarn, there are 128 to 132 fibers. These cells are possibly in their proliferation status. Neighboring fibers jointly support the growth of cells, forming 3D connections among the fibers.



Guigen Zhang

A lot has happened in the past couple of months.

As you may know, the Clemson football team won the national championship on January 9, 2017. Yeah, go Tigers! For some of you, this may not be a big deal; for people at Clemson, it is BIG. It took Clemson 35 years to get this second title. Well, football aside, it is also intriguing to see how Clemson football's head coach and his team have demonstrated that the right people and mindset can make a big difference in elevating us from good to great.

Speaking of national, our nation has just gone through a bitter fight in a presidential election. No matter which side you are on, one thing we probably all agree on now is that it is true that every vote counts. This leads me to make my point to encourage all members to participate in the SFB's election to cast votes for the leaders of the Society for the coming year. In this issue you will read about candidates' ideas and plans to elevate our Society.

This is also a time when we honor the most accomplished members of our Society in both scientific contributions and services. Hence, you will read in this issue about the award recipients celebrated for their accomplishments, contributions and leadership for many prestigious SFB awards, including the Founders Award, Clemson Awards, William Hall Award, SFB Service Award, Technology Innovation & Development Award, Young Investigator Award and Student Awards, among others.

In her Letter from the President, Dr. Liisa Kuhn shares with us the intricate operations of the SFB. In addition you will read about member and staff news, and student updates. In the SIG section you will read updates from the Protein & Cells at Interfaces SIG and the Surface Characterization & Modification SIG. Additionally, we highlight for you a recent work published in *Advanced Materials* on "Thrombin-Responsive Transcutaneous Patch for Auto-Anticoagulant Regulation." In a special interview, you will get some unique career perspective from Dr. Spiro Megremis from the ADA. In our regular columns, you will find the latest industry news from Steve Lin, government news from Carl Simon and a book review from Lynne Jones. I especially encourage our student members to spend some time reading these regular columns as they surely will broaden your educational experience and horizon.

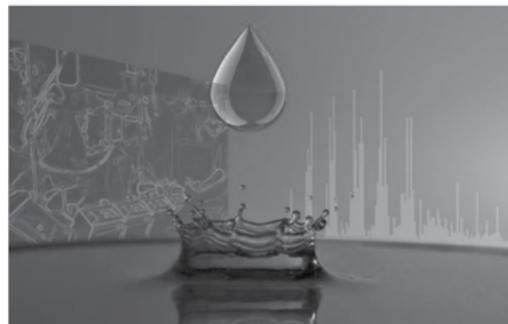
Best wishes from Clemson to all for a happy and prosperous year in 2017!

Guigen Zhang | Executive Editor, Biomaterials Forum

BloodSurf 2017

Blood-Biomaterial Interactions
Abstract Submission Deadline: March 31, 2017

Website: www.ireviakine.net/Bloodsurf



September 17 – 20, 2017

Madren Conference Center, Clemson, SC

Organizers:

Ilya Reviakine (Univ. Washington)

Robert A. Latour (Clemson Univ.)

Limited understanding of the mechanisms underlying adverse reactions to foreign materials upon contact with blood continues to hinder the development of new clinical devices and advanced treatment options for cardiovascular disorders. Addressing this problem requires the efforts of practitioners from diverse fields—clinicians, engineers, biologists, and physicists. The goal of this second *BloodSurf* meeting is to bring these groups together for three days of focused presentations and discussions on the important issues controlling biomaterials hemocompatibility.

Confirmed Invited Speakers:

John Brash (McMaster U.), Lawrence Brass (U. Pennsylvania), Steffen Braune (Helmholtz-Zentrum Geesthacht, Germany), Scott L. Diamond (U. Pennsylvania), Larry Frelinger (Harvard Medical School), Lara Gamble (U. Washington), Maud Gorbet (U. Waterloo), Hitesh Handa (U. Georgia), Lisa Jennings (U. Tennessee), Gene Langan (Greenville Hospital System, SC), Tomas Lindahl (Linköping U., Sweden), Qijin Lu (FDA), Buddy Ratner (U. Washington), Chris Siedlecki (Penn State College of Medicine), Mike Wolf (Medtronic).

SPONSORS:

NIH NHLBI, IUPAC, and Clemson University

SOCIETY FOR BIOMATERIALS: A GLOBAL COMMUNITY IMPACTING HUMAN HEALTH



Lisa Kuhn

Soon I'll be passing the gavel to the next president of the Society For Biomaterials (SFB) at our Annual Meeting in Minneapolis. During my time as President-Elect and President, I've become familiar with the way the Society works and I'd like to share my understanding of that with you

because knowledge is power. With this knowledge I hope it makes it easier for you to take advantage of the leadership opportunities offered by our professional Society "to promote advancements in all aspects of biomaterial science and technologies, education and professional standards to enhance human health and quality of life" (SFB Mission Statement).

The SFB is large enough that we hire a management firm, Association Headquarters (AH), to provide a professional executive management team led by Executive Director Dan Lemyre and Assistant Executive Director Deb Dupnik. The management team runs our annual meetings together with extensive input from the Annual Meeting Program Committee. AH also oversees and provides continuity in all aspects of Society operations. The SFB has a Board of Directors that is composed of volunteers: the President, the President-Elect, the immediate Past President, the Second Past President, the Secretary-Treasurer, the Secretary-Treasurer-Elect, the Member-at-Large and the Special Interest Group Representative. The Society For Biomaterials Council—also volunteers—is composed of the Officers, the Board of Directors and the Chairpersons of each Standing Committee, and is responsible for selecting the content and general direction of the programs of the Society with approval from the Board. Information about each of the committees can be found on the SFB website (www.biomaterials.org/committees-overview).

The Society's income is generated from member dues, royalties from our scientific publications and journals, Annual Meeting registration fees and sponsorship. Over the years, SFB has gained sufficient wealth kept in long-term reserves that were intensified by good investments and interest income. Thus, over the past three years, rather than operating with a balanced budget, the Board made a decision to use the reserve fund to support a variety of activities with price tags that have exceeded SFB's annual income. Every fourth year a World Biomaterials Congress is held in a different country around the world, and that year no SFB Annual Meeting is held. For example, in 2016 the World Biomaterials Congress was held in Montreal and SFB filled the void of no U.S.-based SFB Annual

Meeting by sponsoring activities at other conferences with complementary research interests. Many SFB members attend other scientific professional society meetings every year, which allows them to stay connected to their biomaterials colleagues and to share the value of SFB to their non-SFB member colleagues. During the last World Biomaterials year, SFB also hired a public relations firm called Schneider Associates to help put our members in the news through their media contacts and promote the SFB. The rapid burn rate over the past three years has led to a more conservative list of outreach activities for 2017 along with a shift from an outside PR firm to utilizing AH's marketing and communication department for increasing SFB growth through digital content marketing initiatives.

SFB aims to recognize outstanding researchers in our field as a means of promoting advancements in the field and increasing the visibility of SFB. My thanks go to the Awards Committee for their time-consuming work this year spent selecting SFB awardees and presenting us with nominations for next year's SFB officers. Remember to vote for our next SFB President and other officers! Another committee that I'd like to bring to your attention is the Education and Professional Development Committee. This committee advises and makes recommendation to the Council concerning professional standards and education in the field of biomaterials and is concerned with helping members, including students, with their professional development. Student chapters have flourished under the support of this committee. Seven Biomaterials Days proposed by student chapters are approved for 2017 with one coming up near me: the Mid-Atlantic Biomaterials Day in New York City. During my term as President of SFB, I've helped to initiate a new sub-committee under the purview of the Education and Professional Development Committee called the Young Scientists Committee with founding leadership by Assistant Professor Cole DeForest. The European Society For Biomaterials has a Young Scientist Forum (www.esbiomaterials.eu) which organized a number of fun activities at the World Congress and that motivated me to find out more and implement our own version. The Young Scientists Committee provides leadership and training opportunities for all early career researchers from both industry and academia.

One last goal I have to accomplish before handing over the gavel to our President-Elect David Kohn is the creation of an SFB webpage that provides a centralized location for information about U.S. and foreign research exchange

(continued on page 15)

2017 Award Recipients Announced

The following professionals are recognized for their outstanding achievements in and contributions to the biomaterials field. Each award recipient will be honored during the Opening Ceremony at the Society For Biomaterials Annual Meeting and Exposition in Minneapolis, Minn., April 5, 2017.



Founders Award

Jeffrey Hubbell, PhD, University of Chicago

The Founders Award is based upon long-term landmark contributions to the discipline of biomaterials. Jeffrey Hubbell is a Professor in the Institute for Molecular Engineering of the University of Chicago. Previous to moving to Chicago, he was on the faculty of the Swiss Federal Institute of Technology Lausanne, where he served as Director of the Institute of Bioengineering and Dean of the School of Life Sciences. He was elected to the US National Academy of Engineering in 2010 and the National Academy of Inventors in 2014. Professor Hubbell uses biomaterials and protein engineering approaches to investigate topics in regenerative medicine and immunotherapeutics. In regenerative medicine, he focuses on biomaterial matrices that mimic the extracellular matrix and on growth factor – extracellular matrix interactions, working in a variety of animal models of regenerative medicine. In immunotherapeutics, he focuses on nanomaterials in vaccines that target lymphoid-resident antigen presenting cells and on protein engineering approaches to deliver antigen to the spleen and liver for inverse vaccines to induce tolerance to protein drugs and in autoimmunity.

The Clemson Awards reflect the strong traditional ties between the Society For Biomaterials and Clemson University since the Society's formation in 1974.

Clemson Award for Applied Research

The accomplishment of the awardee will consist of significant utilization or application of basic knowledge in science to accomplish a significant goal in the biomaterials area. The achievement will be evidenced by the development of a useful device or material which has achieved widespread usage or acceptance, or expanded knowledge of biomaterials/host tissue relationships which have received widespread acceptance and resulted in improvements in the clinical management of disease.



Samir Mitragotri, PhD,

University of California – Santa Barbara

Dr. Samir Mitragotri is a Professor of Chemical Engineering at the University of California, Santa Barbara (UCSB). He is also the founding Director of the Center

for Bioengineering at UCSB. Professor Mitragotri's research is focused on drug delivery. He has developed innovative technologies for needle-free drug delivery via skin patches and oral pills which are easy-to-use and patient-friendly. In addition, Professor Mitragotri has also developed new methods of targeted drug delivery for the treatment of cancer and vascular diseases. Professor Mitragotri has published over 210 papers and is an inventor on over 150 issued/pending patents. He was named a Thomson Reuters Highly Cited Researcher in 2015 and 2016. Professor Mitragotri has been elected to the National Academy of Engineering (NAE) and National Academy of Medicine (NAM). He is also an elected fellow of the National Academy of Inventors (NAI), American Association of Advancement of Science (AAAS), Controlled Release Society (CRS), Biomedical Engineering Society (BMES), American Association of Pharmaceutical Scientists (AAPS) and American Institute of Medical and Biological Engineers (AIMBE). Professor Mitragotri has placed a strong emphasis on converting his discoveries into clinically usable technologies for the benefit of patients.

Clemson Award for Basic Research

The awardee will have contributed to the basic knowledge and understanding of the interaction of materials with tissue. The contribution may employ a new theoretical concept, new material development or original study of the functioning or interactions of a material in the biological environment. The contribution will be evidenced by significant research, important original publications in the literature and/or frequent reference to and reliance on this work by subsequent researchers.



Shelly Sakiyama-Elbert, PhD, University of Texas

This award recognizes significant contributions to the basic knowledge and understanding of the interactions of materials with tissue. Professor Sakiyama-Elbert has developed pioneering approaches to affinity-

based drug delivery systems for controlled release of growth factors in response to cell-activated enzymes for regenerative medicine. She has done important work on three-dimensional in vitro studies of biomaterial systems, and shown that the results can vary significantly in two and three dimensions. Her studies demonstrate the importance of the use of biomaterials for stem cell transplantation, which will be key for the success of many regenerative medicine strategies.

Clemson Award for Contributions to the Literature

The awardee will have made significant contributions to the literature on the science or technology of biomaterials. The importance of the contributions will be evidenced by systematic publications in technical journals, significant critical analyses and/or reviews, the frequent citations and referencing of the contributions by independent writers, and/or the publication of major works such as monographs, textbooks, bibliographies and edited communications.



**Ali Khademhosseini, PhD,
Harvard Medical School**

This award recognizes significant contributions to the literature on the science or technology of biomaterials. Ali Khademhosseini is a Professor at Harvard Medical School (HMS) and a faculty member at the Harvard-MIT's Division of Health Sciences and Technology (HST) and Brigham and Women's Hospital (BWH), as well as an associate faculty member at the Wyss Institute for Biologically Inspired Engineering. He is also a Junior Principal Investigator at Japan's World Premier International Advanced Institute for Materials Research (WPI-AIMR) at Tohoku University where he directs a satellite laboratory. In addition, he is an eminent scholar at Konkuk University in Korea, as well as a Hi-Ci Professor at King Abdulaziz University in Saudi Arabia. His research is based on developing micro- and nanoscale biomaterials to control cellular behavior with particular emphasis in developing engineered materials and systems for tissue engineering. He is also developing 'organ-on-a-chip' systems that aim to mimic human response to various chemicals in vitro. He has been cited ~27,000 times and has an H-index of 86. In 2014, 2015, and 2016 he was also selected by Thomson Reuters as one of the World's Most Influential Minds.



**C. William Hall Award
Jim Burns, PhD, Casebia Therapeutics**

The C. William Hall Award honors members who have made a significant contribution to the Society and have an outstanding record in establishing, developing, maintaining and promoting the objectives and goals of the Society. In industry, Dr. Burns has had numerous leadership roles including Senior Vice President of Product Development for Genzyme Biosurgery Division, Senior Vice President of Biomaterials Research and Development for Genzyme, Senior Vice President and Head of Drug and Biomaterial R&D for Genzyme, and Head of the Sanofi North America R&D Hub. He has helped develop, foster and oversee numerous products, technologies and concepts to the marketplace during the current burst in biomaterials, biologics, and drug

delivery science. Jim served on numerous SFB committees, including the Board of Directors, Liaison Committee, Awards and Nominations Committee, Industrial News Editor for "Biomaterials Forum" and as SFB President from 2002-2003.



**Society For Biomaterials Award for Service
Joel Bumgardner, PhD, University of Memphis**

The Biomaterials Award for Service is presented to an individual, corporate or government entity who has provided significant service to the Society, by establishing, developing, maintaining and promoting its objectives and goals. In 1990, Professor Bumgardner co-founded and served as the leader of the National Student Section of the SFB. He served as Chair of the Membership Committee from 1995-1996, Member-at-Large for 2002-2003, Chair/Program Chair of the Dental/Craniofacial SIG from 2002-2006, and a member of the Awards and Nominations Committee for 2005-2006 and again for 2008-2009. He served as Chair of the Bylaws Committee from 2007-2010, member of the Education and Professional Development Committee from 2000-2007, 2009-2010 and served as the Chair from 2003-2004. Professor Bumgardner served on the Long Range Planning Committee during 2004-2006 and 2011-2012. He was the Annual Meeting Program Chair in 2005 and a member of the Program Planning Committee from 2005-2009. He served as President of SFB from 2012-2013.



**Technology, Innovation & Development Award
Lenoard Pinchuk, PhD, Innovia, LLC.**

The Technology, Innovation & Development Award recognizes an individual or team who provided key scientific and technical innovation and leadership in a novel product in which biomaterials played an important and enabling role. The award was developed to acknowledge novel breakthrough products as well as products that are significant improvements over state-of-the-art. Dr. Leonard Pinchuk has 115 issued U.S. patents, 80 publications and 10 companies that he co-founded. His major accomplishments include the invention or co-invention of the world's most used angioplasty balloon catheters, the helical wire stent, the modular stent-graft, a drug-eluting stent (TAXUS®), several biomaterials (polycarbonate urethanes and poly[styrene-*block*-isobutylene-*block*-styrene]), a novel glaucoma shunt (InnFocus MicroShunt®) and the next generation intraocular lens material. Dr. Pinchuk founded Innovia LLC (2002), which incubated eight new companies working in the fields of intraocular lenses, glaucoma shunts, radiation oncology catheters, urinary catheters and futuristic biomaterials.



SFB Young Investigator Award
Ankur Singh, PhD, Cornell University

The Young Investigator Award recognizes an individual who has demonstrated outstanding achievements in the field of biomaterials research. Candidates for the SFB Young Investigator Award must be within 10 years of receipt of their terminal degree (PhD or equivalent) and, if they work in an academic institution, must not be tenured at the time of nomination. Professor Singh discovered and characterized the 'adhesive signature' of human pluripotent stem cells as well as fibroblastic parental cells and feeder layer cells. He then established a microfluidic platform to isolate and purify (>95%) both human ES and iPS cells from contaminating parental and spontaneously differentiated cells in a rapid, label-free and flexible manner. This technology has been spun out into a start-up company, CollectCell, which has raised approximately \$800K in investment and is scheduled to launch its first product in the first quarter of 2017.



Student Award for Outstanding Research, Undergraduate
Colleen O'Connor, University of Texas

Colleen's research focuses on how protein therapeutics can be used to treat, prevent and cure a variety of diseases ranging from diabetes to certain forms of cancer. pH responsive hydrogels take advantage of the natural pH gradient of the gastrointestinal (GI) tract, remaining collapsed at low pH and swelling at neutral pH. This pH-responsive behavior allows for protection of the carrier through the stomach and targeted release to the absorptive upper small intestine.

The Student Awards for Outstanding Research are being awarded to two PhD candidate individuals who have demonstrated outstanding achievement in biomaterials research.



Student Award for Outstanding Research, PhD Candidate
John Clegg, University of Texas

John's research focuses on how recognition polymer networks, synthesized by molecular imprinting, offer an environmentally robust,

cost-efficient alternative to antibodies for applications in biosensing and drug delivery. John applied virtual screening to effectively evolve and engineer peptides that can be specifically recognized by target proteins (e.g., trypsin or EGFR) and incorporated into the imprinted hydrogel network to enhance protein recognition. He successfully carried out the modeling and simulation studies and designed several high affinity peptide sequences that he subsequently characterized in the lab.



Student Award for Outstanding Research, PhD Candidate
Ricardo Londono, University of Pittsburgh,

Ricardo's research focuses upon the mechanisms by which cell:matrix interactions result in constructive remodeling of tissues. Particularly, characterizing the host response to implantable biomaterials, including those composed of extracellular matrix, synthetic polymers and hybrid materials. During his graduate work, Ricardo authored 15 peer-reviewed manuscripts and three book chapters. One of these publications in which Ricardo was first author, appeared in the Annals of Biomedical Engineering, titled "Biologic Scaffolds for Regenerative Medicine: Mechanisms in In vivo Remodeling." It was the most highly cited paper during the past year in that journal.



Outstanding Research - Hospital Intern, Resident or Clinical Fellow
Mary Lyvers, University of Illinois

Mary's research focuses on the evaluation of tribocorrosion kinetics and biocompatibility of electrochemically induced tribolayer for hip implants. She was chosen as the recipient of the Craig Fellowship which allowed her to gain research experience in the Regenerative Medicine and Disability Research lab. She gained knowledge in the fields of biomaterials, tribocorrosion, and orthopaedic implants, and the research resulted in an abstract submitted to the Orthopaedic Research Society. Mary will be continuing her research as a James Scholar, characterizing degradation of the surfaces of the trunnion of the implant in patients.

President-Elect

The President-Elect shall become familiar with the duties of the President and shall, at all times, cooperate and assist with the duties of that office. In the absence of the President, the President-Elect shall preside at the meetings of the Society, the Council and the Board of Directors, and perform the duties and exercise the powers of President. The term of office is for a period of one year without succession. The President-Elect is the chairperson of the Long Range Planning Committee.

Nominees for President-Elect



Peter Edelman, PhD
Boston Scientific

Biographical Sketch: Peter Edelman, PhD, is currently a Research Fellow at Boston Scientific. Dr. Edelman received his PhD in Polymer Chemistry at the University of Connecticut on synthesis and characterization of various polymer systems. After his PhD, Dr. Edelman did a postdoc in Seattle at the University of Washington with Professor Buddy Ratner exploring biomaterial surface modification and surface characterization. Dr. Edelman has worked at several companies both large and small. After his postdoc, he went back to the Boston area and worked for 10 years at Bayer Diagnostics on in vitro diagnostic biosensors for a point of care instrument that could measure sodium, potassium, calcium, chloride, oxygen, carbon dioxide, pH, glucose, lactate and hematocrit all from a 70 microliter drop of whole blood with a 60-second time to result.

Next, he started as the fourth employee at a Boston-area startup called Confluent Surgical. Confluent Surgical developed a platform technology based on *in situ* polymerizing resorbable hydrogels for several applications including prevention of post-surgical adhesions, femoral access site closure, ophthalmic drug delivery, uterine fibroid embolization and a neurosurgical sealant that obtained FDA approval and was sold under the trade name DuraSeal™. In 2001, Dr. Edelman went back to Seattle and worked at two DNA microarray companies (CombiMatrix and Nanostring Technologies) in addition to hanging his own shingle as a biomedical polymer consultant.

In 2005, the lure of the Midwest brought Dr. Edelman to the Twin Cities where he started at Boston Scientific. His 11 years at BSC has been working with various teams on polymer science projects from exploratory R&D to failure analysis of field complaints and everything in between.

He has really enjoyed 29 years in an industrial setting developing new products based on polymer technology,

new polymers and surfaces for various medical devices, biosensors, neurosurgical sealants, microarray technologies and minimally invasive implants.

He is an inventor or co-inventor on 70 issued and published U.S. patents and applications and has 96 publications/presentations in the field of biomedical materials.

Dr. Edelman continues to demonstrate a life-long commitment to supporting the ongoing growth, development and education in the biomaterials field by serving multiple leadership roles in the SFB and in 2012 was the President of the Surfaces in Biomaterials Foundation.

Dr. Edelman also serves on the editorial board for the *Journal of Biomedical Materials Research* and was inducted into the 2015 class of the College of Fellows of the American Institute of Medical and Biological Engineers as well as the 2016 class of Fellows of Biomaterials Science and Engineering.

When not stuck on polymers, Dr. Edelman enjoys being with his wife of 30 years and text messaging his 21-year-old daughter at Brown and 19-year-old daughter at Seattle University.

Vision Statement: Hi, my name is Peter Edelman. I am running for President-Elect of the Society for Biomaterials. I am asking for your vote.

I have been attending SFB meetings since 1987. I'll never forget my first meeting. We stayed at the Waldorf in NYC. I shared a room with my postdoc advisor, Buddy. The hotel meeting halls were filled with a buzz and excitement.

I'll also never forget the post-bash 5K race around the site of the 1964 World's Fair in Queens. The start was rough, but I eventually got into my stride. There was this lanky guy in front of me, didn't know who he was, but I was gaining on him and we were nearing the finish. So I lit the after burners and tried to blow by him but he heard me coming and that was all she wrote. It turns out that was Dave Grainger.

Through the SFB I've gotten to know great people like Dave and Buddy and so many more of you. This is a hugely important part of what makes the SFB great. It's the people—you are what makes the SFB great.

So why should you vote for me? Because I want to preserve and strengthen the things that make the SFB a great society.

What makes the SFB great for you? During my time in office, together we will work to strengthen and preserve what makes the SFB great for you as well.

Coming from industry I see real value in the SFB as a place to get to know the scientists and the science.

Some things I have accomplished recently to try and attract more industry members by making the SFB more significant to industry include:

- » Created the Industry Representative position for all SIGs
- » Championed a name change to “Industrial Affairs Committee” from “Materials and Devices Committee” to better reflect mission/vision
- » Selected to be the first industry co-chair for flagship program committee co-chair system with each co-chair from either industry or academia, with Helen Lu
- » Biomaterials Technology in Industry: New session type created to reflect the needs of and try to attract more participation from industry

For me personally, as a guy from industry, one huge benefit of this society is access to thought leaders like yourselves. You share your knowledge and experience willingly.

What industry can ultimately provide is a conduit for your students and your ideas. I work for a company that likes to translate technology invented at your bench and bring it to bedsides. My company, Boston Scientific is a great place to work. I’m going on 12 years there. BSC probably won’t be the company to bring your technology to the first 10 patients. But it can be the company to bring your technology to 10 million patients. It’s what we do.

Great memories and friends, outstanding science and passion for what we do. These are what make the SFB great for me. I want to serve you, our society, to preserve and strengthen these things for the future.



Andrés J. García, PhD
Rae S. and Frank H. Neely Chair and
Regents’ Professor
George W. Woodruff School of Mechanical
Engineering
Georgia Institute of Technology

Biographical Sketch: Andrés J. García is the Rae S. and Frank H. Neely Endowed Chair and Regents’ Professor in the Woodruff School of Mechanical Engineering and the Petit Institute for Bioengineering and Bioscience at the Georgia Institute of Technology. He earned a B.S. in mechanical engineering with honors from Cornell University in 1991, and MSE (1992) and PhD (1996) degrees in bioengineering from the University of Pennsylvania. He completed a postdoctoral fellowship in cell and molecular

biology at the School of Medicine of the University of Pennsylvania and then joined the faculty at Georgia Tech in 1998. Dr. García’s research program integrates innovative engineering, materials science and cell biology concepts and technologies to create cell-instructive biomaterials for regenerative medicine and generate new knowledge in mechanobiology. This cross-disciplinary effort has resulted in new biomaterial platforms that elicit targeted cellular responses and tissue repair in various biomedical applications, innovative technologies to study and exploit cell adhesive interactions, and new mechanistic insights into the interplay of mechanics and cell biology. Dr. García is recognized as an international leader in bioengineering as demonstrated by his prestigious scholarly publications, invited presentations at conferences and research programs world-wide, research funding from NIH, NSF and private foundations, and membership on the editorial boards of leading biomaterial and regenerative medicine journals, including serving as Associate Editor for the *Journal of Biomedical Materials Research Part A* and *Biomaterials*. In addition, his research has generated intellectual property and licensing agreements with start-up and multi-national companies, demonstrating the translational potential and impact of this work. He has received several distinctions, including the NSF CAREER Award, Arthritis Investigator Award, Young Investigator Award from the SFB, Georgia Tech’s Outstanding Interdisciplinary Activities Award and the Clemson Award for Basic Science from the SFB. He has been recognized as a top Latino educator by the Society of Hispanic Professional Engineers. He is an elected Fellow of Biomaterials Science and Engineering (by the International Union of Societies of Biomaterials Science and Engineering), Fellow of the American Association for the Advancement of Science and Fellow of the American Institute for Medical and Biological Engineering

Vision Statement: I am deeply honored to be nominated for the position of President-Elect. I have been an active member of SFB for more than 20 years as a student, post-doc and faculty member. In addition to regularly organizing sessions at the Annual Meeting, I have provided leadership within SFB and our community as SIG Chair, Executive Board and Council Member (2005-2007); Vice-Chair (2005) and Chair (2007) of the Gordon Research Conference on Biomaterials; Program Chair of the SFB Fall Symposium (2008); member of the Program Committee for the Annual Meeting (2007, 2008, 2011, 2015); member of the Awards and Nomination Committee (2008-2009, 2014-2015); and currently Member-at-Large. In addition to outstanding diverse professional opportunities for scientific discussions, networking and interactions with academia, industry and government, the Society has provided a nurturing environment where I have developed many good and lasting collaborations and friendships.

My vision for SFB is for the Society to be a thriving, international community of leaders, researchers, experts and educators from academia, industry and government with far-reaching and lasting impact on all aspects of biomaterials science, engineering and policy. If elected, I will focus my efforts on three major areas:

Increase Value to Members. Through strategic and managerial activities, I will work with other Council and Board officers to increase the value that the Society provides to our members as related to scientific excellence, educational and professional development and broader societal impact.

Foster Scientific Excellence and a Nurturing Environment. The annual and regional meetings (e.g., Biomaterial Days) provide ideal convergence points for the exchange of scientific ideas and community building efforts. I will work with the leadership and program committees to enhance the scientific context and networking aspects of these critical meetings.

Expand the Impact of SFB. To truly contribute and improve human health, our activities must extend beyond our Society. I will work to expand our sphere of influence including broadening marketing and visibility, highlighting positive impact and contributions of the biomaterials community and reaching out to other professional groups where biomaterials expertise is important. We must also engage the public as ambassadors for our field.

If elected for this position, it will be my honor to continue serving SFB and I will work diligently and vigorously to improve the SFB community.

Secretary–Treasurer-Elect

The Secretary-Treasurer-Elect shall become familiar with the duties of the Secretary-Treasurer, cooperate and assist in carrying out the duties and prepare for eventual succession to that office. In the temporary absence of the Secretary-Treasurer, the Secretary-Treasurer-Elect will perform the duties and exercise the duties of the office. The term of office shall be for a period of two years without succession. The Secretary-Treasurer-Elect shall be the chairperson of the Finance Committee.

Nominees for Secretary–Treasurer-Elect



Elizabeth Cosgriff-Hernandez, PhD

Associate Professor, Texas A&M University
Biomedical Engineering

Biographical Sketch: Dr. Elizabeth Cosgriff-Hernandez is an Associate Professor of Biomedical Engineering at Texas A&M

University. Her laboratory specializes in the development of polymeric biomaterial scaffolds for tissue engineering

applications. Dr. Cosgriff-Hernandez has been an active member of the SFB since 2001 and served on numerous committees over the past 10+ years. She served on the SFB Board of Directors as the Member-at-Large (2015-2016) and is currently serving on the Council as Chair of the Education and Professional Development Committee (2016-2017). Dr. Cosgriff-Hernandez has been active in the Tissue Engineering Special Interest Group (SIG) for many years, including serving as the Program Chair (2011-2013), Vice Chair (2013-2015) and Chair (2015-2017). Other committees of the Society that she has served on include the Program Committee (2014-2015), Long Range Planning Committee (2013-2015), Education and Professional Development Committee (2010-2014) and the Awards, Ceremonies and Nominations Committee (2014-2015). Dr. Cosgriff-Hernandez was instrumental in starting the SFB Women's Networking Luncheon and has been very active in programming at the annual meetings including the popular Biomimetic Materials for Tissue Engineering sessions (2009-2012, 2015). Her most recent efforts have focused on increasing programming relevant to industry partners with a panel on polyurethanes and a workshop on degradation testing at the 2015 Annual Meeting in Charlotte, North Carolina. She has also chaired and served on the steering committee of the Texas Biomaterials Day over the past five years and is the faculty advisor of the Texas A&M SFB Student Chapter. She is an Associate Editor of the *Journal of Biomedical Materials Research, Part B Applied Biomaterials* and on the Editorial Board of the *Journal of Biomaterials Science, Polymer Edition* and *Journal of Biomedical Materials Research, Part A*. She also serves the community as a standing member of the National Institutes of Health study section on Musculoskeletal Tissue Engineering (MTE).

Vision Statement: It is an honor to be nominated for the position of SFB Secretary-Treasurer-Elect. SFB is the first scientific meeting that I attended as a student and it has been an incredible support community throughout my career. The Society serves many roles for its membership: a venue for scientific discourse, a training ground for students, network and support at all stages and a common ground for academia, industry and the clinic to interact. I have always valued the training and opportunities that I have received here, and, if elected, I would take this opportunity to enthusiastically work with the Board and Council to improve our Society for its members. First, in the role of Secretary-Treasurer-Elect, I will learn from the Secretary-Treasurer how to manage the operating and reserve budgets to achieve our fiscal goals. This will prepare me as Secretary-Treasurer to make fiscal recommendations and prioritization to the Board that both serve our membership and promotes the long-range financial stability of the Society.

The Society rises and falls by the participation of its members and the diversity of our membership is one of our strengths. I will work to make sure that the value proposition for SFB membership is strong for each sector of the biomaterials community (industry, academia and governmental agencies) and each level, from undergrad to senior scientist. My variety of roles in the society have prepared me to succeed in this position and I would be honored to continue to serve the society.



Elizabeth Lipke, PhD

Assistant Professor, Auburn University
Chemical Engineering

Biographical Sketch: Dr. Elizabeth Lipke is the Mary and John H. Sanders Associate Professor in the Department of Chemical Engineering at Auburn University. Dr. Lipke earned her B.S. in biomedical engineering from Johns Hopkins University and her PhD in chemical engineering in 2005 from Rice University. Following a postdoctoral fellowship at Johns Hopkins School of Medicine, Dr. Lipke joined the faculty in Chemical Engineering at Auburn University in 2008. Her research focuses on designing materials for directing stem cell differentiation and tissue engineering applications.

Having published numerous papers and several book chapters, Dr. Lipke has been recognized with a NSF CAREER award, a 3M Nontenured Faculty Award and an American Heart Association Scientist Development Grant. She was invited to participate in both the National Academy of Engineering U.S. Frontiers of Engineering Symposium (2014) and the Frontiers of Engineering Education Symposium (2014). Her honors include Outstanding Graduate Mentor (2012), the Engineering Council Junior Faculty Research Award (2014), the Mark A. Spencer Creative Mentorship Award (2014), the William F. Walker Merit Teaching Award (2015) and the Provost's Award for Faculty Excellence in Fostering Undergraduate Research and Creative Scholarship (2015).

Dr. Lipke has been actively involved in the SFB since 2002, when she attended the Annual Meeting for the first time as a graduate student. Over the years, she has organized sessions and symposia and served as an officer for the Engineering Cells & Their Microenvironments SIG and on the SFB Finance Committee (2015-2017). Dr. Lipke also has leadership experience through her involvement in AIChE, including serving as the Biomaterials Area Vice-chair (2011) and Chair (2012), as a Materials Engineering & Sciences Division (MESD) Director (2013-2015) and currently as the MESD 2nd Vice-chair (2017). Dr. Lipke is also active in BMES and ISSCR and was a co-organizer of a joint session between SFB and ISSCR last summer,

highlighting the important role of biomaterials in advancing stem cell research.

Vision Statement: It is an honor to be nominated for the position of SFB Secretary-Treasurer-Elect. The SFB has been an important force in shaping my career, providing me with invaluable opportunities for professional growth and scientific discussion, as well as mentorship and networking. SFB has long been my academic society home. My vision for the SFB is to continue to support the long-term career development of members, to provide expertise in biomaterials-related scientific policy decisions and to facilitate advances in our field by bringing together members of the biomaterials community from industry, academic and government agencies and fostering scientific discourse.

Long-term planning and responsible stewardship of our financial resources is critical to the SFB continuing to provide benefits to members and leadership to our field. Having served on the Finance Committee since 2015, I know the considerations involved in managing the SFB's finances, including balancing meeting expenses and revenues, membership fees, programming initiatives and Society activities that provide added value to members. As a member of SFB, I have seen the hard work that previous Secretary-Treasurers have done over the years to insure that our Society is financially solid. As Secretary-Treasurer-Elect, I will continue to learn from the current Secretary-Treasurer. As Secretary-Treasurer, I will strive to provide careful stewardship of our financial resources and transparent communication to members. I will work with the SFB Board of Directors and Council to use our funds effectively to achieve the SFB's goals. The opportunity to contribute to our society in this role would be a privilege; I am excited about the prospect of taking on this serious responsibility and working to ensure SFB's scientific and policy leadership and long-term value to members in today's changing research and policy environment.

Member-at-Large:

The Member-at-Large shall serve as an unencumbered representative of the membership at meetings of both the Board of Directors and Council. The Member-at-Large shall serve for a period of one year.

Nominees for Member-at-Large



Helen Lu, PhD

Columbia University
Biomedical Engineering

Biographical Sketch: Dr. Helen H. Lu received her undergraduate and graduate degrees in bioengineering from the

University of Pennsylvania. She completed her first postdoctoral fellowship at Drexel University with Dr. Cato Laurencin, and a second postdoctoral fellowship at Tufts University with Dr. David Kaplan, before joining the Columbia University faculty in 2001. Dr. Lu is currently a Professor of Biomedical Engineering and the Director of the Biomaterials and Interface Tissue Engineering Laboratory. She also received tenure at the Columbia College of Dental Medicine, and is a founding member of the Columbia Stem Cell Initiative and the Center for Craniofacial Regeneration.

Dr. Lu's research focuses on interface tissue engineering and the formation of complex or composite tissue systems. She has been recognized as an international leader in the field of soft tissue-to-bone integration, which is highly relevant for the treatment of many musculoskeletal injuries and dental conditions. Additionally, her research group is active in the design of novel composite biomaterials for orthopedic and dental applications. Dr. Lu's work has been supported by both private foundations as well as state and federal agencies, and her group has published extensively on biomaterial/scaffold design and tissue engineering. Additionally, Dr. Lu is the inventor and co-inventor of more than a dozen patents and applications, several of which are being actively pursued for clinical translation. Dr. Lu has served on the editorial board of leading journals in the field, including currently the *Journal of Biomedical Materials Research A*, *Journal of Orthopaedic Research*, *Regenerative Biomaterials*, *Regenerative Engineering* and *IEEE Transactions on Biomedical Engineering*.

Her research has been recognized with many awards, including the Early Faculty Career Awards in Translational Research (Phase I and Phase II) from the Wallace H. Coulter Foundation and the Young Investigator Award from the SFB. Dr. Lu was honored with the Presidential Early Career Award for Scientists and Engineers (PECASE) at the White House in 2010, and was elected as a Fellow of the American Institute for Medical and Biological Engineering (AIMBE) in 2011.

Vision Statement: I am truly honored to be nominated for the position of Member-at-Large. Since my first SFB meeting as a graduate student more than 20 years ago, I have continued to be an active member of the Society. In addition to chairing and organizing sessions at the Annual Meeting, I have also served the community as a member of the Membership Committee (2008-2010), the Long Range Planning Committee (2009-2011), Council Member (2015) and member of the Program Committee for both the Annual Meeting (2014-2016) and the World Biomaterials Congress (2011-2012). Working closely with our newly

funded student chapter, I chaired and organized the Northeast Biomaterials Day Conference (2010), and, more recently, served as Co-Chair of the Program Committee for the SFB Annual Meeting (2015). To me, the SFB stands out as a unique organization because in addition to being the premier platform for highlighting cutting-edge advances in biomaterials research, the Society also provides a positive, nurturing environment for its members to build productive collaborations and form lasting friendships, and to engage in diverse professional activities that extend beyond the confines of our respective institutions.

Therefore, it is essential for the Society to grow and maintain a thriving community of leaders, experts, innovators and educators that will shape and drive the future of biomaterials research, medical device design and translation. To this end, if elected Member-at-Large, I will dedicate my efforts to three focus areas:

1. Effectively Engaging and Representing the Membership:

The diverse membership of SFB, which ranges from students and research fellows to faculty, with representation from industry, academia and government institutions, makes up the backbone of the Society and is the driving force for innovation and translation in biomaterials worldwide. It is thus essential to engage the community effectively by establishing regular and modern communications between membership and leadership, with the goal of working collectively to identify target areas for improvement and emerging directions relevant to our community.

2. Encouraging Scientific Excellence and Program Relevance:

The annual SFB and regional Biomaterials Days meetings are excellent platforms for the exchange of current and future concepts in biomaterials research. I will work with the leadership and program committees to maintain programmatic excellence. In addition, I will actively communicate with the membership (academic and industry) in order to help to identify the current and relevant biomaterials-related topics that should be highlighted or explored in-depth at these meetings.

3. Enhancing Community Building:

The annual and regional meetings are also ideal settings for community building and promoting biomaterials education. To this end, I plan to work closely with the SIGs and student chapters to ensure resources are directed towards mentoring and networking events that target students and fellows, as well as junior to mid-career faculty,

thereby extending the Society's tradition of fostering a nurturing environment for all members. Moreover, I will work with SFB leadership and membership to promote societal awareness of biomaterials and their importance in improving human health and quality of life.

In closing, it will be my honor to continue to serve SFB. I am committed to being an effective representative of our membership, and will strive to ensure that we can all work together to foster biomaterials innovation and build a thriving SFB community.



Roger Narayan, MD, PhD

Professor, University of North Carolina and North Carolina State University
Department of Biomedical Engineering

Biographical Sketch: Dr. Roger Narayan has been a Professor in the Joint Department of Biomedical Engineering at the University of North Carolina and North Carolina State University since 2009. He works on the use of laser techniques such as pulsed laser deposition, laser micromachining, matrix-assisted pulsed laser evaporation and laser-based additive manufacturing techniques for processing of biomaterials. Many types of laser-processed biomaterials have enhanced functionality over conventionally processed materials and have potential applications in drug delivery, biosensing and tissue engineering. Dr. Narayan is an author of over 100 publications as well as several book chapters on processing, characterization and modeling of laser-processed biomaterials. He has taught biomaterials science to undergraduate students and graduate students since 2003. In addition, Dr. Narayan has developed nanobiotechnology certificate programs at the University of North Carolina and at North Carolina State University. Dr. Narayan has given numerous invited research presentations and tutorials on laser-processed biomaterials at international materials engineering and medical device conferences. He has organized workshops on additive manufacturing at SFB annual meetings since 2007. He is also a member of the Education SIG. Earlier in his career, Dr. Narayan received a National Science Foundation Faculty Early Career Development (CAREER) Award and an Office of Naval Research Young Investigator Award. His work is currently funded by the National Institutes of Health, the National Science Foundation and industry. Dr. Narayan was elected as Fellow of the American Institute for Medical & Biological Engineering in 2012.

Vision Statement: Members expect the SFB to continuously work toward enhancing the value of their memberships.

If elected as Member-at-Large, I plan to work with the Society's members and leadership to enhance the value of Society membership through initiatives that span the career of a biomaterials scientist, including:

1. The development of new mechanisms for more undergraduate students and graduate students to become more involved with the society. Many universities have yet to develop student chapters. I would like to work with colleagues in the society to develop electronic resources and seminars (both recorded and live) that help students and faculty members form and grow student chapters.
2. The development of a newsletter for students and young professionals. Information about summer training programs, graduate programs, postdoctoral opportunities, job placement and networking activities that focuses on the biomaterials community would help young people find research, educational and career opportunities outside of their immediate networks.
3. The development of more robust conference activities in the fall. Regional meetings such as Biomaterials Days do an excellent job of bringing together students and researchers at various sites around the country but there is still room for a larger fall event where ideas can be exchanged and networking can occur. In order to differentiate a fall event from the Annual Meeting, the fall event could focus on presentations (both oral and poster) from young professionals and be a focus of networking between young professionals and potential employers.
4. The development of the society as a platform for international networking in the field of biomaterials. The horizons of biomaterials students are more international than in previous years, with more students participating in study abroad programs and international research collaborations than ever before. In particular, I would like to continue the initiatives with the European Society for Biomaterials that were started by SFB President Liisa Kuhn. The Society can facilitate international networking through activities focused on international research and collaboration at the Annual Meeting, webinars featuring international collaboration opportunities and dissemination of information on international research and training opportunities via newsletters.
5. I have been involved with programming of workshops and symposia on 3D printing at annual meetings

and World Biomaterials Congresses since 2007. The interdisciplinary topic of 3D printing is ripe for partnering with other societies (e.g., the Society of Manufacturing Engineers and the American Society of Mechanical Engineers) to develop joint workshops and other joint activities.

6. The development of mechanisms for the Society and its members to reach out to the wider community. Many Society members visit schools and partner with museums. I would like to work with colleagues in the Society to develop a mechanism to convey best practices related to biomaterials outreach, including enhanced support of the Biomaterials Education Outreach Challenge as well as webinars from leaders in science outreach and outreach workshops at the Annual Meeting.

7. The cultivation of older members as a resource for the Society and its members. As the “baby boom” generation retires, the Society is potentially losing the expertise of our most experienced and accomplished members. It is crucial that the Society develops mechanisms to keep these individuals engaged and involved in the SFB’s future. Mechanisms that facilitate mentoring of young people via mentoring events at the Annual Meeting or electronic pairing of mentors and mentees are only one possibility.

Most important, I will reach out to everyone—students, young professionals, as well as those in academia, government and industry—to improve the Society and enhance the value of SFB membership if elected.

Members in the News

News & Updates

ANDRÉS J. GARCIA



Happy New Year! I am honored to serve as your 2016-2017 Member-at-Large representative. As Member-at-Large, I serve as YOUR representative on both the Board of Directors and the council of SFB. I also serve as your representative on other committees

(e.g., Long Range Planning Committee) so that members have a clear voice for the direction of SFB. I plan to focus my efforts on three areas: (1) Be a voice for all the members, (2) Foster scientific excellence and a nurturing environment and (3) Expand the impact of SFB. I encourage all members to send me your ideas and feedback about SFB (andres.garcia@me.gatech.edu). With your help, we can continue to improve SFB and increase the value for all members. I also write this column highlighting member news and accomplishments.

Joel Bumgardner (University of Memphis) was an invited keynote lecturer at the Asia Polymer Association International Conference on Advanced Polymers, Biomaterials Bioengineering and Nano Drug Delivery held in Mauritius in September. The conference involved researchers, thought leaders and governmental and private investors from Mauritius, India and Africa, and highlighted

advanced polymer systems, development and commercial opportunities. The title of his talk was “Development of Modified Chitosans for Guided Bone Regeneration.” This work is part of the Smart Biomaterials Center and is supported by a grant from the FedEx Institute of Technology. Bumgardner was also a plenary keynote speaker at the 11th Asia Pacific Chitin and Chitosan Symposium and 5th Indian Chitin and Chitosan Society Symposium held in Kochi, India. His colleague **J. Amber Jennings** was an invited lecturer at this Symposium. The Asia Pacific Chitin and Chitosan Symposium meets every other year and draws leaders and companies involved in chitin-chitosan materials research, development and applications in medicine, agriculture, cosmetics, water quality and the environment from Japan, China, Southeast Asia, Australia, India and Europe.

Bikramjit Basu (Indian Institute of Science, Bangalore) was awarded the Shanti Swarup Bhatnagar Award, India’s most coveted scientific award. This award is considered as the highest recognition in the Indian scientific community. He is the first and only biomaterials scientist to receive this prestigious award.

Staff Update

BY DEB DUPNIK, ASSISTANT EXECUTIVE DIRECTOR



Hello from the Society For Biomaterials headquarters! As we gear up for 2017, the Board of Directors, governing council, committees, task forces and SIGs are working on the initiatives established at the November Board and Council meeting.

AWARDS, CEREMONIES AND NOMINATIONS

CHAIR ANTONIOS G. MIKOS, PhD

The 2017 award recipients have been selected and notified. The full article can be found starting on page 4 in this issue. In addition, the slate of officer candidates is on page 7. The 2017-18 election website will open in January, please remember to vote!

BYLAWS

CHAIR BENJAMIN G. KESELOWSKY, PhD

After careful review of all SFB standing committee roles and responsibilities, the Bylaws Committee recommended the following amendments to the bylaws:

Amendment 1- Changing the name of the Devices and Materials Committee to Industrial Affairs Committee

Amendment 2- Eliminate Long Range Planning Committee giving charges to the Council as coordinated by the President-Elect.

Amendment 3- Eliminate the Meetings Committee, giving charges to the Board.

DEVICES AND MATERIALS COMMITTEE

CHAIR SPIRO J. MEGREMIS, PhD

The committee is actively supporting the third SFB Business Plan Competition which was developed by the Biomaterials and Medical Products Commercialization SIG, and is working to develop and evaluate other opportunities for industry members in Minneapolis, including a possible site visit/facility tour. A proposal to change the name of the Devices and Materials Committee to the "Industrial Affairs Committee" will be presented as a bylaws amendment to the membership at the Annual Meeting. More effort will be made to involve academics in industry standards and the committee will focus its efforts on the following initiatives for 2017:

- Selecting tracks or topics pertinent to industry for the Annual Meeting
- Increasing industry participation and dental clinician participation
- Increasing interaction with appropriate standards groups
- Collecting input from industry members about how they deal with standards development in relation to research on biomaterials

- Providing "Standards Methods" tracks
- Producing webinars

EDUCATION & PROFESSIONAL DEVELOPMENT

CHAIR ELIZABETH COSGRIFF-HERNANDEZ, PhD

Seven Biomaterials Days grants were approved for 2017. More information about these events will be published as it becomes available. The committee is reviewing nominations for the 2017 Cato T. Laurencin Travel Fellowship and the 2017 C. William Hall Scholarship.

FINANCE

CHAIR SHELLY SAKIYAMA-ELBERT, PhD

SFB made a decision in 2013 to strategically invest in programs for members. Some of these programs include the Biomaterials Day grant programs, the new website, the public relations initiative, the outreach to other societies during the WBC year and including one free SIG with each SFB membership. As expected, since 2016 was a WBC year, membership and meeting revenue is down. The 2017 budget was developed to deliver a modest net income, and includes nominal increases in dues and registration rates, and cessation of providing a free SIG with every membership. Reserves remain healthy, and the 2017 budget was approved by the Board of Directors.

LIAISON

CHAIR TIM TOPOLESKI, PhD

The Liaison Committee is investigating a proposed South American meeting in the Fall of 2017. The meeting would focus recruitment efforts on Biomaterials Scientists in South America, specifically: Chile, Argentina, Brazil and Columbia. There is a significant contingent there that is not affiliated with SLABO (Latin American Society of Biomaterials and Artificial Organs) though it should be noted that SLABO is an IUSBSE member. 2017 is an "off year" for SLABO, which holds its meeting bi-annually. The European Society For Biomaterials and the US Society For Biomaterials are planning a 2018 summer school in Bordeaux, France with a focus on 3D printing and post-implantation histopathology evaluation. Please contact Liisa Kuhn if you are interested in being a faculty member. The committee is also initiating a student exchange program that would help students locate laboratories that would be receptive for short and mid-length exchange stays around the world to learn new techniques. A new SFB website page will be set up with more information about exchange opportunities in the coming months.

MEMBERSHIP

CHAIR LIJIE GRACE ZHANG, PhD

The committee is working to develop strategies to increase membership, especially in industry and clinical sectors. Board

members approved modest increases in dues and registration for 2017.

PRESIDENT'S ADVISORY

CHAIR THOMAS WEBSTER, PhD

The committee will review the code of ethics for SFB and advise the council about any matter requested by the President. The committee will work with the Education Committee to put together a panel on ethics for 2017.

PROGRAM

CO-CHAIRS REBECCA CARRIER and SUPING LYU

The theme for the 2017 Annual Meeting is Where Materials Become Medicine. In keeping with that theme, the Program Committee is developing a program which focuses on biomaterial research specifically oriented to clinical application with commercial impact. Major themes will include: 3D Printing, Cells, Drug Delivery, Immune Response, Regulatory/Standardization Issues, and Translation.

Details of the meeting can be found in the online meeting program, and in the registration brochure, included in this issue.

PUBLICATIONS

CHAIR SACHIN S. MAMIDWAR, MBBS, MS

The Publications Committee continues its work with the bi-weekly e-newsletter, *Biomaterials Bulletin*. Wiley would like to develop new book ideas with our Special Interest Groups and is actively soliciting authors from the SIGs.

NATIONAL STUDENT CHAPTERS

PRESIDENT CHRISTOPHER J. GEHRMANN

The national student section officers are making efforts this year to help improve the value of membership

through increasing volunteering, networking and training opportunities for our students. The officers this year are excited to utilize all of the resources our organization provides such as the Special Interest Groups (SIGs) and Biomaterials Days events to use current member benefits in more proactive ways. The full article can be found on page 20.

SPECIAL INTEREST GROUPS

REPRESENTATIVE BRENDON HARLEY, PhD

The SIG budgets were approved for 2017. In addition, an all SIG mixer is planned during the Exhibit/Poster reception on Thursday.

NEW! YOUNG SCIENTIST COMMITTEE

CHAIR COLE DEFOREST

This new sub-committee will fall under the purview of the Education & Professional Development Committee and will provide a melting pot for career development ideas, where senior members guide grads, postdocs and junior faculty on the path towards impactful research and outreach, fulfilling an unmet need within the Biomaterials community. If you are just starting out in your career, are less than 10 years from your terminal degree, and want to be part of this exciting new group. Please contact SFB headquarters at info@biomaterials.org.

If you have any questions, require any information or have suggestions for improved services, please feel free to contact the Society's headquarters office:

SOCIETY FOR BIOMATERIALS

1120 Route 73, Suite 200
Mount Laurel, NJ 08054
Phone: 856-439-0826
Fax: 856-439-0525
info@biomaterials.org
biomaterials.org

From the President (continued from page 3)

The Torch

opportunities. There are many excellent opportunities for U.S. students and faculty to participate in international research that often have funding available to support some aspects of the exchange. As an SFB liaison activity with the European Society For Biomaterials, a European summer school is being planned for 2018 in Bordeaux, France to promote global exchange of biomaterials knowledge with a focus on biofabrication/bioprinting. If you'd like to participate please contact me. I'm sensitive to the fact there are many different summer schools offered by SFB members already and will work hard to minimize overlap. I'm

looking forward to seeing you at the SFB Annual Meeting in Minneapolis to continue this conversation in person!

All the best,



Liisa Kuhn
SFB President

An Interview with Dr. Spiro Megremis

BY GUIGEN ZHANG, EXECUTIVE EDITOR OF *BIOMATERIALS FORUM*



In what subject area did you get your undergraduate and graduate degrees?

My undergraduate degree is in mechanical engineering, and my M.S. and PhD are both in biomedical engineering.

Where did you get those degrees and what made you chose those places?

For my freshman year I went to the University of Evansville on a football scholarship. In my mind, I had visions of playing pro football and not much else. However, upon the suggestions of my high school teachers, who thought that I had a gift for math, I also registered for engineering classes as a back-up plan in case the whole pro football thing didn't work out, though without really knowing what an engineer does. After I got injured playing football at Evansville, I decided to transfer to Rose-Hulman Institute of Technology (RHIT), knowing that RHIT is one of the best schools in the country for engineering, according to my high school math and science teachers.

When I got to Rose, as Rose people call it, there was a note in my mailbox to see the President of Rose, Dr. Sam Hulbert, a founding member of the SFB. This would be the first interaction with a man that ended up having a great influence on my professional life. When I got to Sam's office, he picked up my transcript from his desk, looked it over, and said, "Why aren't you playing football at Rose?" Sam earnestly told me that a good engineer was a well-rounded engineer, and by the time I left his office, I was on the football team and later went on to be captain of the wrestling team. Rose-Hulman is an excellent technical school with knowledgeable instructors, but the most valuable thing that I learned at Rose-Hulman was to be a problem solver and how to systematically break down a problem and attack it. Sam exemplified this problem-solving mindset.

After I left Rose, I started working at Bethlehem Steel in their management program, which included working in the different areas of steel making (hot mill, cold mill, etc.). It was while working on my first major project that I realized that I might actually really want to be an engineer. After I realized this, an article by Dr. Hulbert in my Rose-Hulman alumni magazine about some of his innovative work on orthopedic and dental implant materials inspired me to go back to Rose-Hulman and get my master's degree in biomedical engineering. When I showed up on campus, I sought out Dr. Hulbert. I registered for Sam's biomaterials class and asked him if he had any projects to work on. He didn't right away, but I kept bugging him until he told me that he had a project with an orthopedic company to evaluate the effect of different sterilization techniques on the properties of ultra-high molecular weight polyethylene for orthopedic implants. Sam ended up being my thesis advisor and convincing me to go on to get my PhD.

When I was applying to schools to get my PhD, one of my master's thesis committee members was a new faculty member named Dr. Christine Buckley who had just received her PhD from Northwestern University (NU) in biomedical engineering. She encouraged me to apply to NU and try to work with her former advisor, Dr. Jeremy Gilbert, who ended up being a future president of SFB. I was fortunate enough to get accepted to NU with a Murphy Fellowship and have Dr. Jeremy Gilbert as my thesis advisor and an all-star cast of SFB award winners on my thesis committee, including Dr. Eugene Lautenschlager (Dr. L), Dr. Phil Messersmith and Dr. Kevin Healy.

Can you give examples of the kinds of things you learned after your formal education was over?

When I was working in the machine shops at Bethlehem Steel, I was told by my foreman to come up with a more efficient manor to unload trucks carrying materials and transport those materials to the machines. He gave me that job and a steel shack in the shops to work in and said he didn't want to see me until I had a solution to the problem. So, after about a month, I came back to him with a proposal and engineering drawings for a monorail system, similar to the kind used at Disney World. He looked it over, and to my surprise, said, "It looks good; now build it." He gave me two mechanics, a welder and a deadline and told me to get started. The whole project was kind of an initiation by fire. However, by the time I finished it and saw something that I designed and built being used by others, I was sold on being an engineer. In general, a fully integrated steel mill like Bethlehem Steel was a great place to learn how to take the engineering education that I had received at Rose-Hulman and learn how to apply it.

What attracted you to your present position?

When I graduated with my PhD, I was fortunate enough to have several job offers. In determining which one to take, I got some good advice from Dr. L. During my ADA interview, I learned that the ADA had a long history in both biomaterials research and standards development. The first polymer-composite restorative materials were invented by Dr. Ray Bowan of the ADA, and after World War I, the U.S. government came to the ADA and asked them to work on standards for dental materials. One of the biggest problems in WWI was U.S. recruits enlisting who were not prepared to fight, including some with serious dental problems. Therefore, the U.S. government needed standards to have requirements for purchasing dental materials. The U.S. government gave the ADA space at the National Bureau of Standards (now the National Institute of Standards and Technology, NIST) to develop standards, resulting in the first national standard for dental materials ANSI/ADA Standard

No. 1 on Dental Amalgam. When I spoke with Dr. L about a job at the ADA Science Institute, he felt that there was real potential to have an influence on dental materials research and standards. He was correct. Our group has three patents on equipment used to evaluate dental materials, and one of the goals of our group is to be innovative in the development of scientifically sound, clinically relevant test methods.

Also, it didn't hurt that I moved down the street from 311 East Chicago (NU lab) to 211 East Chicago (ADA lab), which is one block east of the Magnificent Mile in downtown Chicago. Not a bad place to have a research laboratory!

What different positions have you held at the company you currently work for?

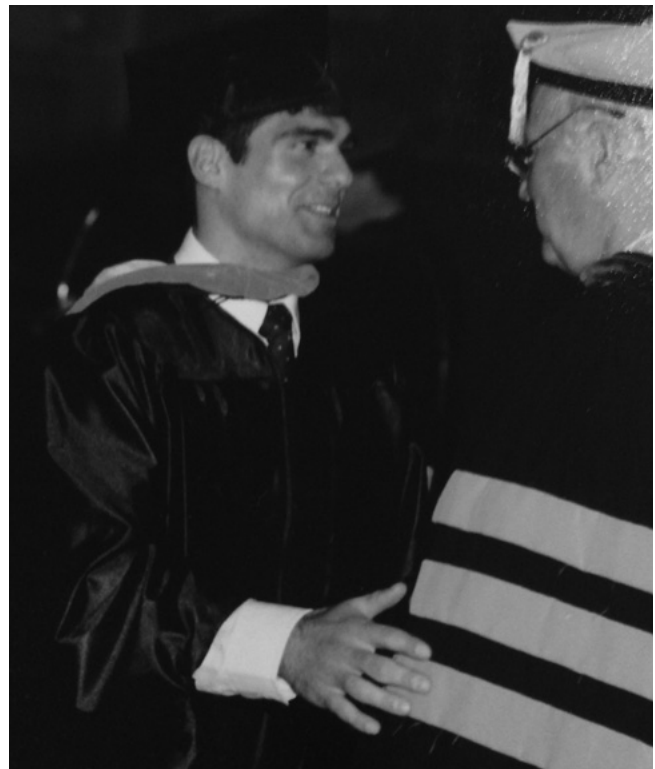
At the ADA, I started off as a research associate, then moved to manager, test method development followed by assistant director of research and laboratories and, currently I am the director of research and standards. All of these jobs have been within the Science Institute of the ADA. I am also an adjunct clinical associate professor of biomaterials in orthodontics at the University of Illinois at Chicago, College of Dentistry, which involves graduate students working in our laboratory on graduate thesis projects.

Can you provide a website that others can read to find out more about your corporation, including job openings?

The main website for the American Dental Association is www.ada.org/en. There are tabs for Science/Research and Education/Careers.

What courses or activities would you recommend that college students take to be prepared for a job like yours?

I know that it sounds a little cliché, but it is true that the better you know your fundamentals, the more innovative you can be in your career. For example, when our group was working on our latest patent, the answer to the problem ended up being energy. We were working on developing some equipment to evaluate the power output of dental air-turbine handpieces. Ultimately, by focusing on the fundamentals of "where does the energy go?" we were able to successfully design and fabricate a solution. Whenever we were stuck, we went back to the drawing board (literally, we have a white board in the middle of our lab) and looked at energy input and output and the basic equations of motion. So, the application of basic math and physics answered the problem for us. One of the keys ended up being that our device was dissipating too much energy through friction. Specifically, the mandrels that we used in our device needed to be polished to a "mirror-like," or sub-micron, finish. Once you understand this basic concept, then you can get into the specifics of how you create a "mirror-like" finish on carbide tool steel, which is something I learned from Dr. Gilbert's biomaterials class when evaluating



Spiro Megremis receiving his MS Degree from President Sam Hulbert (right) of Rose-Hulman in 1996

the microstructure of Co-Cr-Mo implants. As someone who hires young engineers, I feel that if someone has a good understanding of fundamental science and engineering concepts, I can help them to understand the specific questions that we are trying to answer and direct them in how to use those fundamental concepts to answer those questions. As Drs. L and Gilbert used to say, it is very easy to push a button on an expensive piece of equipment, or black box, and get lots of data. However, if you do not understand the fundamentals of how that black box works, you may not know when it is giving you the wrong data.

What influence has the SFB had on your life and career?

The SFB has had a significant influence on my professional career. It was Sam Hulbert's reflections that inspired me to continue my advanced studies, and it was the association with people like Gene Lautenschlager, Jeremy Gilbert and many others that shaped me who I am today. Sam Hulbert used to talk about the early days of SFB being engineers like him sitting down with practitioners like Dr. C. William Hall to discuss clinical problems that physicians were seeing every day and the possible solutions that engineers could provide. I think the Society still inspires this type of innovative biomaterials research with the goal of solving problems physicians see in clinical practice and, in turn, helping patients.



SOCIETY FOR
BIOMATERIALS

2017 ANNUAL MEETING & EXPOSITION
MINNEAPOLIS, MINNESOTA · APRIL 5-8, 2017

WHERE
MATERIALS
BECOME
MEDICINE



REGISTRATION BROCHURE

2017.BIOMATERIALS.ORG

ABOUT THE SOCIETY

The Society For Biomaterials is a professional society that promotes advances in biomedical materials research and development by encouragement of cooperative educational programs, clinical applications, and professional standards in the biomaterials field. Biomaterials scientists and engineers study cells, their components, complex tissues and organs, and their interactions with natural and synthetic materials and implanted prosthetic devices, as well as develop and characterize the materials used to measure, restore, and improve physiologic function, and enhance survival and quality of life.

PROGRAM OVERVIEW

Where Materials Become Medicine

The theme for the Society For Biomaterials 2017 Annual Meeting & Exposition is **"Where Materials Become Medicine"**, a recognition that the Society, perhaps more than any other in the world, works to translate findings in materials science to clinical application to improve human health and quality of life. We are excited to host its 2017 Annual Meeting and Exposition in the heart of Medical Alley, and have tailored the scientific program to be of interest and relevance to the medical device industry community that is so prevalent in the Minneapolis area. There is an entire track geared towards "Biomaterials Technology in Industry" that runs through the program. There are dedicated tracks of interest to the SFB community, including Drug Delivery and Cell & Tissue Regeneration. In addition, for the first time, SFB is pleased to present a series of "Thought Leader Symposia" that will allow thought leaders from across the breadth of disciplines represented in the Society to share their perspectives on current research and future directions of the field.

2017 KEYNOTE SPEAKER

Ryan Egeland, MD, PhD, MBA

Ryan Egeland is Senior Director of Business Development & Licensing at Medtronic, in the Early Technologies Group, where he is focused on strategic mergers and acquisitions. Ryan is responsible for identifying novel intellectual property, technologies, and companies that fulfil Medtronic's mission of contributing to human welfare by the application of biomedical engineering to alleviate pain, restore health, and extend life. The Early Technologies group is the highest growth business in all of Medtronic. Ryan delights in building lasting relationships between Medtronic and early startups as well as with scientists, students, and leadership at academic institutions such as Caltech.

Prior to joining Medtronic, Ryan practiced medicine after training as a plastic and reconstructive surgeon at Northwestern. He received his MD with honors from Harvard Medical School. Prior to his medical career, Ryan co-founded Oxford Gene Technology; as a result he was named one of the top 100 innovators in the world by MIT Technology Review in 2006. Ryan holds a PhD in a biochemistry and engineering from the University of Oxford, where he also completed an MBA as a Rhodes Scholar.

Ryan began his scientific career in the laboratory of Sir Edwin Southern, who invented the "Southern Blot" and DNA fingerprinting. In that laboratory Ryan designed the first electrochemical method of DNA microarray fabrication on silicon dioxide wafers (commonly known as "DNA chips"). He attributes his early scientific success to intensely multidisciplinary scientific work. He describes the laboratory as formative to his entire career. He now is applying that experience to the "bench to bedside (to big business)" transformation now known as "precision" medicine.

SFB 2017 PROGRAM COMMITTEE CHAIRS



Rebecca Carrier, PhD
Northeastern University
Email: r.carrier@neu.edu
Committee Chair



SuPing Lyu, PhD
Medtronic Inc.
Email: suping.lyu@medtronic.com
Committee Chair

Johnna Temenoff, PhD
Georgia Tech/Emory

Peter G. Edelman, PhD
Boston Scientific

Christopher A. Siedlecki, PhD
Pennsylvania State University

William Murphy, PhD
University of Wisconsin

Wei Shen, PhD
University of Minnesota

COMMITTEE MEMBERS:

SFB President
Liisa Kuhn, PhD
University of Connecticut

Natalie Artzi, PhD
MIT, HMS

Art Coury, PhD
Northeastern University

Brendan Harley, ScD
University of Illinois at Urbana-Champaign

Robert Hastings, MS, PE
Depuy Synthes Joint Reconstruction

Carl G. Simon Jr., PhD
NIST

SFB STAFF

Executive Director
Dan Lemyre, CAE
Email: dlemyre@biomaterials.org

Assistant Executive Director
Deb Dupnik, CAE
Email: ddupnik@biomaterials.org

Meeting Manager
Melanie Ryan
Email: mryan@biomaterials.org

Meeting Coordinator
Allison Leyh
Email: aleyh@biomaterials.org

Membership Coordinator
Rebecca Riedesel
Email: riedesel@biomaterials.org



HIGHLIGHTS OF THE 2017 MEETING WILL INCLUDE:

PLENARY SPEAKERS:

In addition to our traditional keynote address and two plenary speakers, two additional plenary speakers are being scheduled. The speakers were selected to provide a breadth of academic, industrial, and regulatory insight into the future of the field of biomaterials research.



DAVE GRAINGER, PHD

Distinguished University Professor and
Chair, Department of Bioengineering
University of Utah



BARBARA HUIBREGTSE, DVM

Vice-President of Pre-clinical Sciences
Boston Scientific



ROBERT T. TRANQUILLO, PHD

Distinguished McKnight University
Professor and Head of the Department
of Biomedical Engineering
University of Minnesota



TERRY WOODS, PHD

Solid Mechanics Laboratory Leader
*FDA Center for Devices &
Radiological Health*

Thought Leader Symposia

In an effort to infuse the program with input and perspective from recognized leaders in their fields, the Program Committee has invited several thought leaders from various disciplines to contribute sessions of their own design to the 2017 Annual Meeting.

- Anna Belu, PhD (Medtronic) & Nathan Lockwood, PhD (University of Minnesota): Industrial Applications of Biosurface Modification and Analysis
- Joachim Kohn, PhD (Rutgers University): Opportunities for Biomaterials Science in the Era of Materiomics
- Cato Laurencin, MD, PhD (University of Connecticut) – Regenerative Engineering
- Buddy Ratner, PhD (University of Washington): New Technology and Research Trends in Surface Modification and Characterization
- Fred Schoen, MD, PhD (Harvard Medical School): Understanding, Reacting to, and Preventing Medical Device Failure
- Molly Shoichet, PhD (University of Toronto): Neural Regeneration

BIOMATERIALS TECHNOLOGY IN INDUSTRY (*BTI*)

In recognition of the fact that speakers from industry need to protect their intellectual property, it is understood that some technical details cannot be disclosed. SFB is introducing "Biomaterials Technology in Industry" sessions that will relax some of the typically rigorous scientific requirements for these specific sessions.

- Translation of Tissue Engineering Technologies
- Measurements and Standards for Advancing the Development of Tissue-Engineered Medical Products
- From Benchtop to Clinical Trial: Examples of Technology Development
- Commercialization of Biomaterials and Medical Products



- Translational Orthopaedic Biomaterials
- Panel Discussion: Benchtop to Bedside: We'll Get You There! - Translating Bench Studies into First in Man Clinical Trials
- Panel Discussion: Benchtop to Bedside: We'll Get You There! - Packaging and Sterilization Methods that Withstand Regulatory Scrutiny
- Panel Discussion: Benchtop to Bedside: We'll Get You There! - How do Industry Standards fit into your Regulatory Strategy?

Workshops

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

Each workshop requires separate registration, the fees for which are detailed on the registration form.

US / CHINA WORKSHOP: REGULATION, STANDARDS, AND INNOVATION IV

Wednesday, April 5; 8:00am - 12:00pm

The workshop is a continuation to the series that began in SFB 2013 to promote discussions between innovation, testing, standards, and regulation for medical devices and biomaterials between US and China. The session will encompass presentations on the topic of regulation, standards, and innovations between the two nations by opinion leaders from academia, regulatory bodies, and industry. The workshop will serve as a forum for discussions in developing a medical device from conception to commercialization between the two countries.

WORKSHOP 1: BIOMACROMOLECULAR AND CELLULAR CARRIERS BREAKING THROUGH BIOLOGICAL BARRIERS

Wednesday, April 5; 8:00am - 10:00am

Biomacromolecules and "living" cells are being extensively studied as new generation of medicine that can potentially cure a series of chronic and malignant diseases. However, efficacy of molecular and cell therapies is significantly reduced by limited biotransportation through tissue barriers (e.g., blood-brain barrier, epithelium) or biofilms formed by infection within wounds. Therefore, this workshop is going to bring experts in these fields, hear past and current strategies

to overcome these barriers using advanced biomaterial systems, and further discuss future directions that can take the quality of molecular and cell delivery to a next level.

WORKSHOP 2: RECENT ADVANCES IN 3D PRINTING OF BIOMATERIALS

Wednesday, April 5; 10:00am - 12:00pm

Industrial and academic researchers have recently examined the use of 3D printing technologies to overcome the limitations associated with conventional manufacturing processes. These technologies involve fabrication of three-dimensional structures through additive joining of materials in a layer-by-layer manner. This workshop will review recent developments in 3D printing technologies for processing biomaterials into artificial tissues as well as biosensors, drug delivery devices, and medical instruments. Several topics related to 3D printing, including processing of radiographic images, development of computer models, novel 3D printing technologies, and novel materials for use in 3D printing, will be discussed. This workshop will create collaboration and discussion among the many groups involved in the development and use of 3D printing technologies, including biomaterials engineers, medical device manufacturers, and clinicians. We anticipate that this workshop will facilitate future research activities, including industry-university collaborations, involving 3D printing of biomaterials for use in medicine, surgery, and dentistry.

WORKSHOP 3: PRACTICAL DESIGN OF MATERIALS: COMMUNICATING ACROSS THE GAP BETWEEN ACADEMIA, INDUSTRY AND CLINIC

Wednesday, April 5; 10:00am - 12:00pm

The Biomaterials Expert (e. g., Biomedical Engineer, Chemical Engineer, Synthetic Chemist, etc) speaks a language nearly entirely different than the language spoken by the end user (e. g., a Spine Surgeon, Neurosurgeon, Orthopedic Surgeon, etc). This creates a gulf which can impede in the design of novel materials and implants. For example, the Biomaterials expert thinks in terms of strength of materials, porosity, modulus, surface hydrophobicity, polymer degradability, biocompatibility etc. while the Spine Surgeon thinks in terms of implant dimensions, fusion rates, expense, ease of use in the operating room, and complication rates. The Product Development person thinks in terms of practical upscale, production, and marketing. Successful design requires the language be translated so that appropriate questions and needs can be ascertained and met. In



this workshop, a speaker from the realms of Academic, Industry, and Clinic will discuss and demonstrate how to communicate across specialties while discussing a novel biomaterial scaffold.

Panel Discussions

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

- Panel Discussion: Ethical Challenges and Issues in Biomaterials Research, Development and Practice
- Panel Discussion: Preventing Implant-Associated Infection
- Panel Discussion: Veterinary Bioengineering: Partnering with Clinicians to Translate Biomaterials Technologies
- Panel Discussion: Benchtop to Bedside: We'll Get You There! - How do Industry Standards fit into your Regulatory Strategy?
- Panel Discussion: Benchtop to Bedside: We'll Get You There! - Packaging and Sterilization Methods that Withstand Regulatory Scrutiny
- Panel Discussion: Benchtop to Bedside: We'll Get You There! - Translating Bench Studies into First in Man Clinical Trials
- Panel Discussion: Functional Osseointegration

Competitions

3RD ANNUAL SFB BUSINESS PLAN COMPETITION

This session challenged participants to consider the commercialization of their research. Participants in this session submitted abstracts that contained an Executive Summary that included information on technology, the market, and the commercialization strategy. The participants will give a ten minute pitch followed by Q&A "shark tank" style from judges and the audience. The participants will be judged by experts from investing, industry regulatory, and academia on the strength of their commercialization plans. Prizes will be awarded to the top teams, including audience's choice.

STUDENT EDUCATION DESIGN COMPETITION

The Biomaterials Education Challenge will encourage SFB student chapters and other student clubs or groups to develop innovative and practical approaches to biomaterials education. Student teams will be challenged to develop an educational module for middle school

(6th-8th grade) science classes. Each educational module will demonstrate fundamental biomaterials concepts, with scientific principles that are understandable to a middle school audience and designed for a 45 minute class period. The education modules should have hands-on components, should be easily incorporated to typical middle school science courses, and should have materials easily obtained with clear educational and learning objectives. Winners will be identified based on their potential for educational impact, and judges will emphasize innovation, practicality, and likelihood of widespread adoption and dissemination of the educational projects. The goals of this competition are to improve widespread understanding of biomaterials-related science and careers in the middle school population; to encourage SFB student chapters to participate in K-8 outreach efforts; and to reward the communication skills and creativity of the next generation of biomaterials researchers and educators. Submission guidelines are available on the website. An application and an abstract should be submitted to dlemyre@biomaterials.org by March 1, 2017.

UNDERGRADUATE BIOMATERIALS RESEARCH COMPETITION

This competition will highlight biomaterials researchers at the undergraduate level through short poster presentations judged by industry and academic representatives. Participants will give a brief (~10 minute) presentation during the designated competition time, followed by 5-10 minutes of questions. Interaction with drivers of innovation and translation will provide valuable educational and networking experience for biomaterials students at an early stage in their careers. Prizes for 1st, 2nd, or 3rd place will include a free membership for the following year and travel stipends. Abstract authors were to have self-nominated upon abstract submission. Those selected to be part of the competition's presentations will be notified by March 1, 2017.

SITE TOURS

On Wednesday morning, April 5th, we are offering attendees an opportunity to visit local companies that are leaders in the field of biotechnology. There is a nominal fee of \$10 to secure your spot. The tours will begin around 8:30 AM and end around 1:00 PM. Transportation will be provided to and from the hotel. Registration is available thru the online registration portal. Just select the company you wish to visit to assure yourself one of the limited opportunities to visit one of the following companies: Medtronic, Boston Scientific. Space is limited and will be filled first come, first served.



PRELIMINARY PROGRAM

(Tentative and Subject to Change)

WEDNESDAY, APRIL 5, 2017

- 7:30 am – 7:00 pm** **Registration Open**
- 8:00 am – 12:00 am** **Workshop:**
- US/ China: Regulation, Standards, and Innovation IV
- 8:00 am – 10:00 am** **Workshop:**
- Workshop 1: Biomacromolecular and Cellular Carriers Breaking through Biological Barriers
- 10:00 am – 12:00 pm** **Workshops:**
- Workshop 2: Recent Advances in 3D Printing of Biomaterials
 - Workshop 3: Practical Design of Materials: Communicating Across the Gap between Academia, Industry and Clinic
- 1:00 pm – 3:00 pm** **Concurrent Session I**
- *BTI* Translation of Tissue Engineering Technologies
 - Acellular Biomaterials for Myocardial Repair 1
 - Biomaterials for Regenerative Engineering 1
 - Biomaterials with Dynamic Properties
 - Cell Migration and Biomaterials
 - Emerging Applications in Engineering Cells and Their Microenvironments
 - Nucleic Acid Delivery
 - Thought Leader Symposium - Buddy Ratner, PhD: New Technology and Research Trends in Surface Modification and Characterization

3:15 pm – 4:45 pm

Concurrent Session II

- *BTI* Measurements and Standards for Advancing the Development of Tissue-Engineered Medical Products
- Dental Implants
- Device- and Implant-based Drug Delivery
- Immunomodulation 1
- Regulating Stem Cell Differentiation
- Tissue Engineering Scaffold Fabrication
- Panel Discussion: Functional Osseointegration
- Thought Leader Symposium: International College of Fellows Debate: In vitro Test Systems can Replace Animal Studies as Predictors of Human Clinical Outcomes

5:00 pm – 6:30 pm

Opening Ceremony

- **Keynote Address:** Ryan Egeland, MD, PhD, MBA, Medtronic, Inc.

6:30 pm – 8:30 pm

Opening Reception (In the Exhibit Hall)

THURSDAY, APRIL 6, 2017

7:00 am – 5:30 pm

Registration Open

7:00 am – 7:45 am

Special Interest Group Meetings (at Hilton Minneapolis)

8:00 am – 10:00 am

Plenary Session I – Clemson Awards

- Clemson Award for Basic Research: Shelly Sakiyama-Elbert, PhD



- Clemson Award for Applied Research: Samir Mitragotri, PhD
- Clemson Award for Contributions to the Literature: Ali Khademhosseini, PhD

10:00 am to 10:30 am Break

10:30 am to 12:00 pm Concurrent Session III

- *BTI* Panel Discussion: Benchtop to Bedside: We'll Get You There! - Translating Bench Studies into First in Man Clinical Trials
- 3D Bioprinting for Medical Applications
- Degradable Metal Biomaterials
- Drug Delivery
- Engineering Cells and Their Microenvironments
- Orthopaedic Biomaterials 1
- Supramolecular Materials for Biomedical Applications
- Thought Leader Symposium - Joachim Kohn: Opportunities for Biomaterials Science in the Era of Materiomics

12:00 pm to 1:00 pm Lunch on own (Women's Lunch at Hilton Minneapolis)

1:15 pm to 2:15 pm Invited Plenary Talks

- Dave Graiger, PhD, University of Utah
- Robert T. Tranquillo, PhD, University of Minnesota

2:30 pm to 4:30 pm Concurrent Session IV

- *BTI* Panel Discussion: Benchtop to Bedside: We'll Get You There! - Packaging and Sterilization Methods that Withstand Regulatory Scrutiny
- Biomaterials for Therapeutic Drug Delivery 1
- Cardiovascular Biomaterials
- Design, Fabrication and Characterization of Multiscale and Multifunctional Biomaterials 1

- Engineered Biomaterials for Neural Applications 1
- Orthopaedic Biomaterials 2
- Tissue Engineering and Organoid Development
- Thought Leader Symposium - Fred Schoen, MD, PhD: Understanding, Reacting to, and Preventing Medical Device Failure

4:30 pm to 5:00 pm Break in Exhibit Hall

5:00 pm to 6:30 pm Concurrent Session V

- *BTI* Panel Discussion: Benchtop to Bedside: We'll Get You There! - How do Industry Standards fit into your Regulatory Strategy?
- 3D Printing and its Impact on Biomedicine
- Biomaterials for Therapeutic Drug Delivery 2
- Cancer Nanotechnology
- Immunomodulation 2
- Multifunctional Biomaterial Design for Regenerative Tissue Engineering
- Surface Characterization and Modification
- Thought Leader Symposium - Cato Laurencin, MD, PhD: Regenerative Engineering

6:30 pm to 8:00 pm Poster & Exhibit Reception

FRIDAY, APRIL 7, 2017

7:00 am - 5:00 pm Registration Open

7:00 am - 7:45 am Special Interest Group Meetings (at Hilton Minneapolis)

7:45 am - 8:00 am Coffee Break



8:00 am – 10:00 am

**Plenary Session II –
SFB Awards**

- Founders Award: Jeffrey A. Hubbell, PhD, University of Chicago
- Technology Innovation and Development Award: Leonard Pinchuk, Ph.D., D.Sc. (h.c.), NAE, Innovia, LLC
- Young Investigator Award: Ankur Singh, PhD

10:00 am – 10:30 am

Break

10:30 am – 12:00 pm

Concurrent Session VI

- *BTI* From Benchtop to Clinical Trial: Examples of Technology Development
- 3rd SFB Business Plan Competition
- Biomaterial-Tissue Interaction
- Engineering Materials and Delivery Systems for Modern Vaccines
- Immunomodulation 3
- Panel Discussion: Preventing Implant-Associated Infection
- Regeneration of Craniomaxillofacial Tissue
- Thought Leader Symposium - Molly Shoichet, PhD: Neural Regeneration

12:00 pm – 1:00 pm

Lunch on own (Student Luncheon at Hilton Minneapolis)

1:15 pm to 2:15 pm

Invited Plenary Talks

- Barbara Huibregtse, DVM, Boston Scientific
- Terry Woods, PhD, FDA Center for Devices and Radiological Health

2:15 pm – 3:45 pm

Poster Session II in Exhibit Hall

3:45 pm – 5:45 pm

Concurrent Session VII

- *BTI* Commercialization of Biomaterials and Medical Products
- Acellular biomaterials for myocardial repair 2
- Advances in Antimicrobial Biomaterials
- Biomaterials for Regenerative Engineering 2
- Biomaterials for Therapeutic Drug Delivery 3
- Design, Fabrication and Characterization of Multiscale and Multifunctional Biomaterials 2
- Panel Discussion: Ethical Challenges and Issues in Biomaterials Research, Development and Practice
- Thought Leader Symposium - Anna Belu, PhD & Nathan Lockwood, PhD: Industrial Applications of Biosurface Modification and Analysis

5:45 pm – 6:45 pm

**SFB Annual Business Meeting
SFB National Student Chapter Meeting**

7:00 pm – 9:00 pm

SFB BASH at the Hilton Minneapolis

SATURDAY, APRIL 8, 2017

7:00 am – 12:00 pm

Registration Open

7:00 am – 7:45 am

ALL SIG Meeting at Hilton Minneapolis

7:45 am – 8:00 am

Coffee Break



8:00 am – 10:00 am

Plenary Session III – Acta Biomaterialia Gold Medal

- Alan Hoffman, PhD
- Thomas Webster, PhD
- Buddy Ratner, PhD
- Pat Stayton, PhD
- Rena Bizios, PhD

10:00 am – 10:15 am

Break

10:15 am – 12:15 pm

Concurrent Session VIII

- *BTI* Translational Orthopaedic Biomaterials
- Active Wound Dressings for Advanced Wound Care

- Biomaterials for Cardiovascular Regeneration
- Engineered Biomaterials for Neural Applications 2
- Evaluation of Tissue Engineering Constructs
- Injectable Biomaterials for Delivery of Cell, Gene and Protein Therapy
- Panel Discussion: Veterinary Bioengineering: Partnering with Clinicians to Translate Biomaterials Technologies
- Tutorial: Navigating funding from the NSF & NIH

Now Online-Only



Journal of Biomedical Materials Research Part A

Editor-in-Chief: James M. Anderson
www.wileyjbma.com

Impact Factor
3.263*



Journal of Biomedical Materials Research Part B: Applied Biomaterials

Editor-in-Chief: Jeremy L. Gilbert
www.wileyjbmb.com

Increased Impact Factor
2.881*

*2015 Journal Citation Reports® (Thomson Reuters)

Sign up now for free e-alerts!

Save valuable research time by signing up to receive free e-alerts from **JBMA** and **JBMB**. E-mail alerts of the very latest articles will be sent straight to your in-box.

Three simple steps

- 1 Register on Wiley Online Library www.wileyonlinelibrary.com (skip to step 2 if already registered)
- 2 Login (top right)
- 3 Go to the journal website. Click on **Get New Content Alerts**





GENERAL INFORMATION

ABSTRACT PUBLICATION

All abstracts will be published online on the first day of the meeting, April 5, 2017. If you would like a printed copy of all the abstracts, you may pre-purchase a Transactions Book through online registration. You will be given the Transactions Book upon check-in at the registration desk.

This offer is only available to those who register by March 17, 2017. The transactions book is also available for purchase after the meeting.

BADGES

Please pick up your conference badge at the registration desk (*Minneapolis Convention Center, Level 1, Atrium*) upon your arrival to conference. You must wear your badge throughout the conference as it is to identify you as a SFB 2017 Annual Meeting & Exposition attendee. If you misplace your badge, please go to the registration desk for a replacement.

BIOMATERIALS BASH

Join your colleagues at the Minneapolis Hilton Marquette Ballroom for the 2017 Biomaterials Bash being held on Friday, April 7, 2017 from 7:00 pm – 9:00 pm.

CERTIFICATE OF ATTENDANCE

You may pick up a Certificate of Attendance on-site at the registration desk.

CURRENCY EXCHANGE

MINNEAPOLIS ST. PAUL AIRPORT

Terminal 1-Lindbergh

Travellex is located between Doors 5 & 6 in the Ticketing Lobby. A currency exchange office and ATM also are located at the entrance to Concourse G.

Hours: Open every day, 6 a.m. to 9 p.m.

Phone: 612-713-7483

Terminal 2-Humphrey

Travellex is located pre-security in the Ticket Lobby. A currency exchange ATM is also located inside the secure area near gate H6, which handles euros, pesos and pounds.

Hours: Vary seasonally; please call 612-726-5187 for more information on hours

Phone: 612-725-6000

The Minneapolis Convention Center and the Hilton Minneapolis do not offer international currency exchange.

DRESS CODE

Business casual is the recommended dress for the meeting.

PASSPORTS AND VISAS

All persons travelling by air outside of the United States (U.S.) are required to present a passport or other valid travel documentation to enter or re-enter the U.S. You can find more information on U.S. Customs and Immigration at www.dhs.gov.

Before traveling to the U.S., a citizen of a foreign country must generally obtain a nonimmigrant visa for temporary stay. If a visa is required, please contact Society For Biomaterials' Meeting Coordinator, Allison Leyh at aleyh@biomaterials.org to receive documentation explaining your intended purpose of travel to the U.S. Visa applicants should apply well in advance of your travel departure date.

For more information on passports and visas, please visit <http://travel.state.gov/>

The official language of the meeting is English.

REGISTRATION

All attendees are encouraged to pre-register for the meeting. By registering early, attendees can benefit from a reduced rate much lower than that offered on-site. To take advantage of this economic offer, register by March 17, 2017 as part of our Early Bird Registration. Attendees can register via the SFB Conference website, 2017. biomaterials.org, or by using the paper form attached to this brochure.

All registration fees include: admittance to all scientific sessions, tutorials, panel discussions, exhibits, opening reception, poster and exhibition reception, breaks and



the BASH. Additional fees apply to Wednesday workshops and luncheons.

MEMBER RATES

Member rates apply to members of the Society For Biomaterials, USA, and other world biomaterials congress societies such as Australian Society for Biomaterials, European Society for Biomaterials, the Japanese Society for Biomaterials, and Korean Society for Biomaterials and TERMIS. Members of TERMIS or world biomaterials congress societies must upload a photocopy of a current dues receipt or membership card during the registration process to qualify for the member discount. Probationary Special Interest Group members do not qualify for member rate.

Full-time students and Post-graduates receive a discounted registration rate. To qualify for discounted registration rates, proof of full-time student or post-graduate status must be uploaded during the online registration process or sent via e-mail to Society For Biomaterials' Membership Coordinator, Rebecca Riedesel at riedesel@biomaterials.org.

REFUNDS

To cancel your registration and receive a refund, a written request must be received by March 27, 2017. Cancellations can be made by contacting Society For Biomaterials' Meeting Coordinator, Allison Leyh at aleyh@biomaterials.org or at 856-642-4439. Cancellation requests received by this date will receive a refund less a \$75 processing fee. Requests will be processed upon notification. All requests received after March 27, 2017, will forfeit 100 percent of monies paid.

SESSION LOCATIONS

All sessions of the meeting, including exhibits, posters and oral presentations will take place at the Minneapolis Convention Center. Additional committee meetings, board and council meetings and luncheons will take place at the Hilton Minneapolis.

SPECIAL NEEDS

The Society For Biomaterials wishes to take steps to ensure that no disabled person is excluded, denied services, segregated, or otherwise treated differently than other individuals because of the absence of auxiliary aids and services. If you require any auxiliary aids or services identified in the Americans with Disabilities Act, please

contact Society For Biomaterials' Meeting Manager, Melanie Ryan at mrryan@biomaterials.org or (856) 380-6895.

SPONSORSHIP AND EXHIBITS

Each year, the Society For Biomaterials Annual Meeting & Exposition serves as the central gathering point for the entire biomaterials field. This year's Annual Meeting in Minneapolis promises to offer an exciting interaction between meeting registrants and exhibitors.

In order to provide exhibitors with steady exposure to meeting attendees, all coffee breaks and poster sessions will be held exclusively in the exhibit area. This format encourages frequent contact and dialogue between biomaterials scientists in industry, academia and the exhibiting companies.

For more information on exhibiting and sponsorship opportunities, please visit the Exhibitor page of the society's annual meeting website (2017.biomaterials.org) and download the Exhibitor and Sponsorship Prospectus or contact:

Dan Lemyre, Executive Director
(856) 642-4201 • dlemyre@biomaterials.org

EXHIBIT HOURS

Wednesday April 5, 2017

Set-Up: 12:00 pm – 5:00 pm

Poster Set-Up: 3:00 pm – 5:00 pm

Opening Reception with Posters: 6:30 pm – 8:30 pm

Thursday, April 6, 2017

Exhibits Open: 10:00 am - 2:30 pm; 4:30 pm - 8:00 pm

Exhibit Reception & Poster Session I: 6:30 pm - 8:00 pm

Friday, April 7, 2017

Exhibits Open: 10:00 am - 3:45 pm

Poster Session II: 2:15 pm - 3:45 pm

Tear Down: 3:45 pm - 11:59 pm

TRANSPORTATION

MINNEAPOLIS-ST. PAUL INTERNATIONAL AIRPORT

Minneapolis-St. Paul International Airport (MSP) is located approximately 12 miles from the Hilton Minneapolis, which is right next door to the Minneapolis Convention Center. The airport serves most major airlines. For more information regarding airport transfers and local attractions visit 2017.biomaterials.org.

REGISTRATION FORM (Please print or type)

First Name _____ Surname/Last Name _____
 Title _____ Degree _____
 Speciality or Discipline _____
 Affiliation _____ Department _____
 Address _____
 City _____ State/Province _____ ZIP/Postal Code _____ Country _____
 Telephone _____ Facsimile _____
(For international numbers, please include country and city codes.)
 Email _____ Special Requests (ADA, Dietary, Etc.) _____
 Member in which Society? Society For Biomaterials, USA Other WBC Society (list) _____ Member Number _____

3 OPTIONS TO REGISTER: 1. www.biomaterials.org 2. Fax form to 856-439-0525 3. Mail to 1120 Route 73 • Suite 200 Mt. Laurel, NJ 08054	ON OR BEFORE MARCH 17, 2017								AFTER MARCH 17, 2017							
	Registration for Paid Members				Registration for Non-Members'				Registration for Paid Members				Registration for Non-Members'			
	Member	Post Grad	Student	Retired Senior	Non-Member	Non-Member Post Grad	Non-Member Student	Retired Senior	Member	Post Grad	Student	Retired Senior	Non-Member	Non-Member Post Grad	Non-Member Student	Retired Senior
Meeting & Exhibit Registration	<input type="checkbox"/> \$550	<input type="checkbox"/> \$380	<input type="checkbox"/> \$215	<input type="checkbox"/> \$160	<input type="checkbox"/> \$830	<input type="checkbox"/> \$555	<input type="checkbox"/> \$320	<input type="checkbox"/> \$160	<input type="checkbox"/> \$700	<input type="checkbox"/> \$430	<input type="checkbox"/> \$225	<input type="checkbox"/> \$195	<input type="checkbox"/> \$990	<input type="checkbox"/> \$605	<input type="checkbox"/> \$350	<input type="checkbox"/> \$195
Wednesday April 5th • 8:00 AM –12:00 PM Workshops																
US/ China: Regulations, Standards, and Innovation IV	<input type="checkbox"/> \$50	<input type="checkbox"/> \$30	<input type="checkbox"/> \$20	<input type="checkbox"/> \$50	<input type="checkbox"/> \$50	<input type="checkbox"/> \$30	<input type="checkbox"/> \$20	<input type="checkbox"/> \$50	<input type="checkbox"/> \$50	<input type="checkbox"/> \$30	<input type="checkbox"/> \$20	<input type="checkbox"/> \$50	<input type="checkbox"/> \$50	<input type="checkbox"/> \$30	<input type="checkbox"/> \$20	<input type="checkbox"/> \$50
Biomacromolecular and Cellular Carriers Breaking through Biological Barriers	<input type="checkbox"/> \$50	<input type="checkbox"/> \$30	<input type="checkbox"/> \$20	<input type="checkbox"/> \$50	<input type="checkbox"/> \$50	<input type="checkbox"/> \$30	<input type="checkbox"/> \$20	<input type="checkbox"/> \$50	<input type="checkbox"/> \$50	<input type="checkbox"/> \$30	<input type="checkbox"/> \$20	<input type="checkbox"/> \$50	<input type="checkbox"/> \$50	<input type="checkbox"/> \$30	<input type="checkbox"/> \$20	<input type="checkbox"/> \$50
Recent Advances in 3D Printing of Biomaterials	<input type="checkbox"/> \$50	<input type="checkbox"/> \$30	<input type="checkbox"/> \$20	<input type="checkbox"/> \$50	<input type="checkbox"/> \$50	<input type="checkbox"/> \$30	<input type="checkbox"/> \$20	<input type="checkbox"/> \$50	<input type="checkbox"/> \$50	<input type="checkbox"/> \$30	<input type="checkbox"/> \$20	<input type="checkbox"/> \$50	<input type="checkbox"/> \$50	<input type="checkbox"/> \$30	<input type="checkbox"/> \$20	<input type="checkbox"/> \$50
Practical Design of Materials: Communicating Across the Gap between Academia, Industry and Clinic	<input type="checkbox"/> \$50	<input type="checkbox"/> \$30	<input type="checkbox"/> \$20	<input type="checkbox"/> \$50	<input type="checkbox"/> \$50	<input type="checkbox"/> \$30	<input type="checkbox"/> \$20	<input type="checkbox"/> \$50	<input type="checkbox"/> \$50	<input type="checkbox"/> \$30	<input type="checkbox"/> \$20	<input type="checkbox"/> \$50	<input type="checkbox"/> \$50	<input type="checkbox"/> \$30	<input type="checkbox"/> \$20	<input type="checkbox"/> \$50
Include Dues Renewal	<input type="checkbox"/> \$205	<input type="checkbox"/> \$110	<input type="checkbox"/> \$40	<input type="checkbox"/> \$0					<input type="checkbox"/> \$205	<input type="checkbox"/> \$110	<input type="checkbox"/> \$40	<input type="checkbox"/> \$0				

**Student-Young Scientist Lunch – Navigating Life as a Young Academic:
Preparing for Academic and Industrial Careers**
(Friday, April 7, 1:00 pm - 2:00 pm)

Women's Networking Luncheon *(Thursday, April 6, 1:00 pm - 2:00 pm)* Lunch will be provided and you must check this box if you intend to participate as this is a ticketed event, limited to the first 100 women members only.

Optional Transactions

Transactions Book Quantity: \$100; Member \$125; Non-Member

Site Tours (Wednesday, April 5, 2017, 8:30 AM to 1:00 PM)
 Boston Scientific (\$10) Medtronic (\$10)

Guest Registration *(includes Opening Reception, Exhibition Reception and Bash)*

Extra tickets for Accompanying Guests (#) _____ X \$75 each (name of guest):

*Student and Post-Graduate status verification required.

I attest the named individual is a full-time, degree-seeking student.

I attest the named individual is a post-graduate, degreed individual in training at an academic institution, e.g., a resident or post-doc.

Signature of advisor or department chair _____

Advisor's printed name _____

Advisor's telephone _____ Advisor's email _____

Method of Payment:

Check enclosed *(Checks must be in U.S. dollars, drawn on a U.S. Bank and made payable to the Society For Biomaterials)* MasterCard VISA American Express

Name (as it appears on card) _____ Card # _____

Expiration date _____ Cardholder signature _____

New & Renewing Members ONLY:

Add Membership including Journal of Biomedical Materials (E-Journal)

Active \$205 Post-Grad \$110 Student (with Subscription) \$75 Student (No Subscription) \$40

Additional Publications (Optional)

Acta Biomaterials \$160 PLUS VAT where applicable
 Biomaterials \$301 PLUS VAT where applicable
 The Journal of Biomaterials Science \$344 (print) \$172 (online)
 Polymers Edition
NEW! Biomedical Materials \$110

Special Interest Group (\$10 for each, free for students)

Biomaterials and Medical Products Commercialization
 Biomaterials Education
 Biomaterials Tissue Interaction (formerly Implant Pathology)
 Cardiovascular Biomaterials
 Engineering Cells and Their Microenvironments
 Dental/Craniofacial Materials
 Drug Delivery
 Immune Engineering *NEW*
 Nano Materials
 Ophthalmic Biomaterials
 Orthopaedic Biomaterials
 Protein & Cells at Interfaces
 Surface Characterization and Modification
 Tissue Engineering

Registration Subtotal: _____

Transaction & Social Registration Subtotal: _____

TOTAL DUE: _____

Proteins & Cells at Interfaces SIG

BY STEVE FLORCZYK, DEPARTMENT OF MATERIALS SCIENCE & ENGINEERING, UNIVERSITY OF CENTRAL FLORIDA AND PRANAV SOMAN, BIOMEDICAL ENGINEERING DEPARTMENT, SYRACUSE BIOMATERIALS INSTITUTE, SYRACUSE UNIVERSITY

Mechanical forces play an essential role in various cellular processes, including cell spreading, migration and differentiation. The mechanical forces influence cell functions through mechanotransduction, or the conversion of mechanical forces into biochemical information by cells.¹ This is a developmentally significant process, as cells respond to their environments as they are dynamically changing during development. Additionally, tissues in the body maintain mechanical homeostasis, or active remodeling to maintain consistent tissue properties. Disregulation of mechanical homeostasis is manifested in aging and disease. Mechanotransduction and mechanical homeostasis are some of the topics studied in the field of mechanobiology, or understanding how forces impact cellular processes, using tools developed to measure forces at the cell-matrix interface.

How Cells Sense Substrate Mechanical Properties

Cells begin to interact with their *in vitro* microenvironment after they are seeded into or encapsulated within a biomaterial scaffold: one of the key factors in the cell-material interaction is the mechanical forces provided by the extracellular matrix (ECM). Cell adhesion to the ECM is regulated by integrins, which cluster together to form focal adhesions (FA) upon cell interaction. FA serve as anchorage points for the cells, mechanically linking ECM to the cytoskeleton and associated signaling molecules that drive cell migration, signaling, and tissue morphogenesis and malignant transformation. The forces applied through integrins and the cytoskeleton lead to altered gene expression in the nucleus, resulting in cell fate decisions. Cells have greater amounts of FA in stiffer matrices, allowing the cell to generate greater forces and driving signals that promote osteogenic differentiation. One of the principal pathways involved in mechanotransduction is the Rho/ROCK pathway. The Hippo pathway is a recently discovered pathway that is involved in mechanotransduction, which is activated in stiff environments.

Mechanotransduction in Stem Cells

There have been numerous papers studying mechanotransduction, but a few key papers highlight major findings in this field. The first paper demonstrated the influence of cell density and island size on cell morphology and mesenchymal stem cell (MSC) differentiation.² This study demonstrated that cytoskeletal tension induced by substrate constraints influenced MSC cell morphology and differentiation when cultured in mixed osteogenic and adipogenic differentiation media, with spread cells differentiated to osteoblasts, while restricted cells differentiated to adipocytes. Another paper demonstrated that the substrate stiffness corresponding to the native tissue stiffness could direct MSC differentiation between neurogenic, myogenic and osteogenic lineages.³

A recent article on mechanotransduction demonstrated the ability of matrix stiffness and integrin presentation to direct MSC differentiation in 3D gels.⁴ This paper demonstrated that stiff gels promoted osteogenic differentiation, while softer gels promoted adipogenic differentiation without significant changes in cell morphology. Another recent paper demonstrated that MSCs experience mechanical dosing and retain a memory of previous culture substrates; this was demonstrated by modulating the substrate stiffness between stiff and soft.⁵ This study examined the translocation of YAP, a Hippo pathway marker, and RUNX2 in response to the substrate properties, with YAP and RUNX2 activated and localized to the nucleus on stiff substrates and deactivated on soft substrates.

Tools to Study Mechanotransduction

Since traction forces have been demonstrated to dynamically regulate FA composition and intracellular signaling, several force measurement tools have been developed to assess how cells exert forces on their microenvironment and its relation to cell function.

One of simplest methods is to replace glass or plastic cell culture substrates with a thin, elastic, gel-like silicone that can deform under cellular forces. Marker beads embedded in the elastic gel are used to record displacements as cells apply forces. The most commonly used system is traction force microscopy (TFM), which utilizes polyacrylamide (PAA) linear elastic gels with embedded beads to obtain displacement maps as cells apply forces. PAA properties can be precisely tuned to a range of elastic modulus and cellular traction forces can be calculated by solving the inverse problem of elastic theory. To increase accuracy, two different fluorescent bead markers have been put inside the gel to increase bead density, and obtain a richer sampling of the displacement field, with improved force resolution. Although computationally intensive, this method is inexpensive, adaptable and convenient to utilize.

A simpler alternative to TFM is the use of soft elastic pillar array, typically fabricated using silicone, as local decoupled strain gauges. The micropillars are typically functionalizing with ECM adhesive protein. The deflection of pillars as cells apply forces is calculated using Euler-Bernoulli beam theory. The sensitivity of pillars to a specific cell type is an important variable, with soft posts deflecting in a non-linear manner, while stiff posts deflect too little to accurately visualize using experimental techniques. A significant advantage of this approach is the easy and reliable way to quantify forces, due to one force field per pillar displacement. Both TFM and micropost approach have been extensively used to evaluate biomechanical interactions using variety of cell types.

Another promising approach utilizes molecular force sensors, which consists of two molecular domains connected by a calibrated elastic link. Using fluorescent monitors both intra- and extracellular stretching and direct read-out of molecular forces can be calculated. Some challenges in this approach are the interpretation of results due to signal dependence on the local environment, relative orientation and separation of domains and the accuracy of the number of sensors; therefore, it may not be adaptable to all cell types.

To date, a lot of progress has been achieved in understanding 2D traction forces using variety of cell types, however little is known about how cells generate traction forces in 3D environment. As compared to endothelial and epithelial cells that typically exist in monolayer form in vivo, cells such as stem cells, cancer cells and fibroblasts, when cultured in 3D conditions significantly differ in their cytoskeletal and FA structure as compared to 2D culture (Figure 1). To understand how cells generate forces in a 3D environment, biological matrices such as collagen or fibrin gels continue to be used. Although such gels give a qualitative measure of cell traction forces in 3D, precise measurement of forces is not possible due to the high non-linearity of the gels. Alternatively, synthetic polyethylene glycol (PEG) gels, with tunable linearly elastic property have been also used for quantification of 3D traction forces by encapsulating marker beads along with cells within the PEG matrix. Cell traction forces can be quantified by monitoring bead displacements with the matrix, although as compared to 2D TFM, this approach has several challenges. Besides being computationally intensive, the constraints used in these calculations could be subjective, with individual marker bead displacement field leading to multiple traction force maps, thereby increasing uncertainty. Similar to PAA gels used in 2D TFM, PEG mechanical properties can be tuned by altering its composition and crosslinking process, however this potentially alters the gel structure which would influence cell response. Although challenging, this approach is versatile and can be adaptable to a wide range of cell types to investigate cell mechanics in a physiologically relevant context. Another recent approach is to utilize subcellular structures such as stress fibers as markers for cell deformation; however, interpretation of results is challenging as the subcellular structure are typically dynamic with their own modes of movement.

Cell morphology is another tool to study mechanotransduction. Recent research conducted at the National Institute of Standards and Technology (NIST) examined the influence of a variety of biomaterial scaffolds including fibrous scaffolds, natural hydrogels and 3D porous sponges on cell morphology for MSCs. While the cellular response to mechanical properties of the matrix was not directly examined in this research, the research

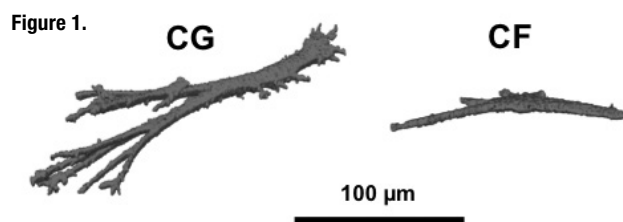


Figure 1. 3D renderings of bone marrow mesenchymal stem cells cultured in collagen gels (CG) or on collagen fibrils (CF) demonstrating the difference in cell morphology in response to 2D or 3D formats of the same material.

defined a characteristic cell shape for each scaffold type, potentially allowing the variation from a characteristic cell shape to be assessed to characterize response to different mechanical forces. The data for this research and a 3D online viewer is available at isg.nist.gov/deepzoomweb/data/stemcellmaterialinteractions.

Summary

Mechanotransduction is a research area in biomaterials science and tissue engineering that is attracting more attention. Controlling and manipulating biomaterial stiffness can direct stem cell differentiation, conferring an instructive role to the biomaterials, opposed to just a structural role.

The response of cells to the mechanical properties of the substrate should be considered when designing novel biomaterial scaffolds. The microscopy techniques and microengineered substrates provide a means to study and quantify mechanotransduction. The previous research provides valuable insights into cellular behavior in response to mechanical forces and indicates new areas to explore. Key insights into how cells transduce forces from its environment into biochemical signals have been gained using the above described techniques, deeper understanding of mechanotransduction of cell-substrate interactions is still challenging as these platforms do not represent the native ECM. While we have focused on mechanotransduction in this brief article, there are many other influences on cell fate, including cell-cell interaction and signaling molecules. Understanding the interplay between mechanical forces and these factors on cell fate will allow for further progress in tissue engineering.

REFERENCES

- Humphrey JD, Dufresne ER, Schwartz MA. Mechanotransduction and extracellular matrix homeostasis. *Nature Reviews Molecular Cell Biology*. 2014;1-11.
- McBeath R, Pirone DM, Nelson CM, Bhadriraju K, Chen CS. Cell shape, cytoskeletal tension, and RhoA regulate stem cell lineage commitment. *Developmental Cell*. 2004;6(4):483-495.
- Engler AJ, Sen S, Sweeney HL, Discher DE. Matrix Elasticity Directs Stem Cell Lineage Specification. *Cell*. 2006;126:677-689.
- Huebsch N, Arany PR, Mao AS, et al. Harnessing traction-mediated manipulation of the cell/matrix interface to control stem-cell fate. *Nature Materials*. 2010;9(6):518-526.
- Yang C, Tibbitt MW, Basta L, Anseth KS. Mechanical memory and dosing influence stem cell fate. *Nature Materials*. 2014;13(6):645-652.

BY CHRISTOPHER GEHRMANN, STUDENT NEWS EDITOR, WITH RAHIM JINDANI, NORTH CAROLINA STATE UNIVERSITY, NATIONAL STUDENT CHAPTER SECRETARY-TREASURER-ELECT



When performing research, students are often working on projects in a university lab. But the transition of their work to industry scaling-up and clinical applications requires different knowledge and experience. By educating students and young scientists with awareness of the industrial and clinical translation needs, we can help smooth the transition from bench to industry and possibly expedite its journey to the bedside. By utilizing the opportunities provided by the SFB's national organizations

and student chapters, students interested in biomaterials can maximize their learning experiences and research potential.

One of the unique opportunities to SFB members is Special Interest Groups (SIGs), which address specific research interests in biomaterials. For example, the Biomaterials Medical Product Commercialization (BMPC) SIG provides graduate students and trainees (PhD and postdoc) opportunities to interact with people from industry and academia. Interactions between researchers, business entities and many other groups allow the enhancement of understanding with regards to the opportunities biomaterials can provide. SIGs have also invested and collaborated with other SIGs, SFB National Chapter and related industries to further develop opportunities to help translate research from lab scale to industries.

Young researchers often neglect obstacles along the path such as scaling up a technology to an industrial level. Many factors such as investments, marketing, IP protection and feasibility must be addressed while scaling up these technologies. Questions like these need to be answered when translating from lab technology or experiment to industry devices. The BMPC SIG has planned a symposium called Biomaterials Technology in Industry (BTI) that will be taking place for the first time during the SFB Annual Meeting, April 5-8, 2017, in Minneapolis, Minn. The BTI symposia will provide opportunities for participants to observe and learn from research groups and industries on how challenges regarding the commercialization and translation of research from laboratory scale to industry scale can be performed.

Another opportunity that allows students and trainees to learn from and share their work is with the individual SFB student chapters across the nation. Student chapters are developed by students and faculty at research universities. Currently there are 24 student chapters registered with the SFB. Student chapters can highlight the work being done by researchers on campus or can even have researchers and industries share their experiences and challenges regarding current medical devices and products. The SFB encourages development of chapters to allow for various research groups to learn.

A recent example is the North Carolina student chapter, which organized a student chapter meeting where Bruce Anneaus, Corporate Director, Research and Development at Zeus Performance Extrusions Inc., shared his experience with the development of ePTFE membranes and catheters as medical devices that are utilized to perform minimally invasive surgeries for neurovascular, cardiovascular, GI endoscopy and peripheral complications. The impact of polymeric components, their properties and changes in their braiding processes were discussed in his talk. Bruce also discussed the importance of communicating with doctors, nurses and clinicians to ensure the device meets the practitioners' needs. This interaction allowed students and researchers attending the SFB student chapter meeting at NCSU to understand the complexities involved in constructing and engineering what may be viewed by many as a simple catheter device.

Student chapters also organize events such as Biomaterials Days and exciting talks given by industry and academia leaders during a student chapter meeting. These local events can provide industrial insight directly to the university. Nationally we also offer the SFB Annual Meeting where opportunities to learn from industry and academia to bring back the attained knowledge for dissemination at each university. By having annual conference attendees communicate the science and research from the conference to fellow members locally, our chapters can encourage the advancement of industry focused research objectives that would avoid repetitive work during the translation of research in a much more efficient manner.

BY CARL G. SIMON JR.



ASTM International held the fall meeting of “Committee F04 Division IV on Tissue Engineered Medical Products” in Orlando, Fla., on Nov. 15-17, 2016. Many relevant documents have been published and are being composed.

New Standard in Press:

- Standard Guide for Autologous Platelet-Rich Plasma for Use in Tissue Engineering and Cell Therapy

Recently Revised:

- F2739-16 Guide for Quantitating Cell Viability Within Biomaterial Scaffolds
- F2149-16 Standard Test Method for Automated Analyses of Cells—the Electrical Sensing Zone Method of Enumerating and Sizing Single Cell Suspensions

New Standards Being Balloted:

- Standard Guide for Using X-Ray Microcomputed Tomography to Assess Tissue-Engineering Scaffolds
- Standard Guide for Assessing Medical Device Cytocompatibility with Delivered Cellular Therapies

New Standards Under Development:

- Standard Guide for Assessing In Vitro Differentiation of Multipotent Stem Cells Toward Skeletal Myocytes
- Standard Guide for Evaluating Biomaterial Decellularization Processes
- Standard Guide for the In Vivo Assessment of Bone Inductive Materials
- Standard Guide for Characterization and Assessment of Vascular Graft Tissue-Engineered Medical Products

The new “Subcommittee F04.90.02 on Absorbable Metals” has become very active with many standards under development and “Committee F42 on Additive Manufacturing Technologies” has made a lot of progress with 13 published standards. If you are interested in identifying the best approaches for evaluating new medical products and work with a unique mix of colleagues from industry, government, academia and non-profit, please contact Carl Simon.

The FDA approved the first autologous cellularized scaffold for the repair of knee cartilage defects, MACI, in the U.S. The MACI treatment involves taking a biopsy from a healthy region of the patient’s femoral condyle and shipping it to the FDA-licensed Genzyme manufacturing facility in Massachusetts. Autologous chondrocytes are isolated from the biopsy, expanded in vitro and seeded into a collagen scaffold at 1 million cells per cm². The scaffold is composed of resorbable, porcine Type I/III collagen. The cell-scaffold construct is shipped back to the surgeon for implantation into the patient several weeks later. MACI is manufactured by Vericel that also produces Carticel, one of the first cell therapies to reach the market receiving FDA licensure in 1997. MACI and Carticel are similar in that both use autologous chondrocytes to treat knee cartilage defects, but differ in that the chondrocytes are seeded onto a scaffold for MACI.

Note: Certain equipment and instruments or materials are identified to adequately specify the experimental details. Such identification does not imply recommendation by NIST, nor does it imply the materials are necessarily the best available for the purpose.

Surface Characterization & Modification SIG

BY GOPINATH MANI, PHD, SENIOR BIOCOMPATIBILITY SCIENTIST, ABBOTT

The primary goal of the Surface Characterization & Modification (SC&M) Special Interest Group (SIG) is to promote learning and networking opportunities for the researchers in the field of SC&M of biomaterials and medical devices, and to develop a compelling scientific program in SC&M in SFB annual meetings. The two major research topics emphasized by SC&M SIG are (1) improving understanding of biomaterial surface structure and its relationship to biological performance, and (2)

developing surface modification strategies for biomaterials. Some research areas that fall under these topics include spectroscopic, microscopic and biochemical surface characterization; thin film deposition; chemical and ion surface modification; lubrication; passivation/corrosion; biological films; and quality assurance of device surfaces.

We currently have over 100 members in our SIG from various academic, industrial, business and government

(continued on page 23)

Industry News

BY STEVE LIN, EXACTECH



The European Commission has approved a \$25 billion merger of **Abbott Labs** and **St. Jude Medical**, contingent on Abbott selling two cardiovascular devices. Abbott and St. Jude compete on vessel closure devices and devices used in electrophysiology

procedures, in particular transseptal introducer sheaths. A combined company's ownership of these devices could lead to price rises, given the insufficient competitive pressure from the remaining players on the market, the commission said in a statement. Abbott and St. Jude last month agreed to sell their vascular closure portfolio and other assets to Japanese multinational **Terumo** for \$1.12 billion. The sale includes St. Jude's **Angio-Seal** and **FemoSeal** vascular closure products, as well as Abbott's **Vado Steerable Sheath**, developed to compete with St. Jude's market-leading devices. The divestitures promised by Abbott and St. Jude satisfied the commission's concerns about competition, although its decision is conditional upon full compliance with the commitments.

The FDA needs more information, according to the **CDRH** progress report. The percent of PMA applicants receiving a major deficiency letter on the first review cycle spiked to 87 percent in the first nine months of CDRH's 2016 fiscal year, topping a previous high of 86 percent in 2010. That's up from 60 percent in 2015. For the second year in a row, the percent of 510(k) applicants receiving an additional information request on the first review cycle grew. This year, more than three-quarters of 510(k) submitters received a request for additional information. The total average days it takes to reach a 510(k) clearance decision increased by more than a week since 2014, with the FDA's review time increasing by a day and submitters' preparation time by a week more. Of the original PMAs accepted for filing as of Sept. 30, 2016, 89 percent won approval — down from 98 percent for the same period in 2015. Of the 510(k)s accepted for review as of Sept. 30, 83 percent were determined to be substantially equivalent to a predicate device, down a bit from the 85 percent that received a substantially equivalent decision during the same period in 2015.

Vericel Corporation announced that the FDA has approved **MACI**® (autologous cultured chondrocytes on porcine collagen membrane) for the repair of symptomatic single or multiple full-thickness cartilage defects of the knee with or without bone involvement in adults. The approval of MACI is based on the **SUMMIT** study (Superiority of MACI implant versus Microfracture Treatment in patients with symptomatic articular cartilage defects in the knee), a

two-year prospective, multicenter, randomized, open-label, parallel-group study which demonstrated a statistically significantly ($p=0.001$) greater improvement in KOOS pain and function (SRA) scores in the MACI group compared with the microfracture group at two years. A majority of the patients who completed the SUMMIT study also participated in a three-year follow-up study. Overall efficacy data support a long-term clinical benefit from the use of MACI in patients with cartilage defects of the knee.

Just as **Zimmer Biomet Holdings** was returning most of its product lines to full capacity after unexpected shipping delays in the third quarter, the FDA hit the orthopedic device maker with a Form 483. The agency issued the form after a series of recent quality control inspections at the company's legacy Biomet manufacturing site in Warsaw, Indiana. The FDA listed a total of 14 observations on the form, but the 57-page-long report is quite unusual, according to a FDA legal consultant. Zimmer Biomet said it is preparing a written response and has developed a remediation plan to fully address the issues cited.

Merck was awarded \$2.54 billion in royalties by a federal jury in a patent lawsuit **against Gilead Sciences** over Gilead's blockbuster hepatitis C drugs **Sovaldi** and **Harvoni**. The jury reached the verdict following a nearly two-week trial, finding that a patent acquired by Merck in 2014 on hepatitis C treatments was valid. Gilead spokeswoman said the company disagreed with the verdict and would appeal it. She said it did not stop Gilead from continuing to sell its drugs. Harvoni and Sovaldi have drawn attention for their breakthrough success in curing hepatitis C in more than 90 percent of patients, and for their high cost. Harvoni's list price is \$1,125 per pill and \$94,500 for a 12-week regimen. Gilead, based in Foster City, California and one of the world's largest biotechnology companies, made nearly \$20 billion on the two drugs in 2015. The jury's award was based on a 10 percent royalty rate from the sales of both drugs through August.

Johnson & Johnson announced plans to create a new health technology center in Providence, R.I. and hire 75 employees in early 2017 to work in temporary space. The New Jersey-based company expects to seek about \$6 million in state incentives for its center, adjacent to the former Route 195 land. The company had considered other global locations but chose Rhode Island for its "world-class universities," the economic incentives approved last year by the state legislature and the state's proximity to T.F. Green Airport, Route 95 and Amtrak for trips to New York and Boston.

Stryker Corp. plans to build a \$130-million corporate campus on nearly 300 acres in Portage, Michigan, creating an estimated 105 new jobs over three years. The proposal for Stryker's medical instruments division involves 485,000 square feet of facilities that will include a customer experience center, functioning showroom, state-of-the-art research and development lab and a bio-skills lab for research and new product development. It will also include office space for sales, marketing and support functions. The new campus will be built on 288 acres of land zoned industrial that Stryker purchased in October from Pfizer Inc. for \$8.5 million, according to city documents. The land is undeveloped and is near other Stryker facilities and the company's world headquarters.

Codman Neuro, a global market leader in neurovascular and neurosurgery, announced the acquisition of **Pulsar Vascular Inc.**, a privately held company based in Los Gatos, California, with breakthrough platform technology for the neurovascular treatment of complex aneurysms. The

acquisition marks the latest expansion of its neurovascular portfolio and will complement a comprehensive portfolio of products for hemorrhagic and ischemic stroke. DePuy Synthes Products Inc., an affiliate of Codman Neuro, is the acquiring entity. Founded by Sanderling Ventures in 2005, Pulsar Vascular Inc. developed the PulseRider, a novel, minimally invasive, self-expanding nitinol implant that is used to bridge the neck of cerebral aneurysms during treatment of unruptured wide-neck intracranial aneurysms originating on or near a bifurcation. A patented "saddle" shape stent leaves minimal metal in the parent artery, enabling easy access to the aneurysm for coiling while maintaining support. According to the Brain Aneurysm Foundation, cerebral aneurysms claim nearly 500,000 lives worldwide each year and half the victims are younger than age 50. Many of these aneurysms develop in vascular bifurcations where the arteries branch, which may be difficult to treat with conventional devices.

Surface Characterization & Modification SIG (continued from page 21)

News & Updates

organizations. Our members regularly serve as session organizers, session moderators and abstract reviewers for the sessions sponsored/co-sponsored by SC&M SIG in the annual meetings. Also, several members of our SIG provide podium and poster presentations in the annual meetings every year.

At the recently concluded 2016 World Biomaterials Congress at Montreal, Canada, a number of sessions including workshops, symposiums, tutorials and general sessions related to surface modification and characterization were organized: New directions in biomedical surface analysis (workshop); *ACTA Biomaterialia* gold award session on biomimetic implant surfaces (general session); angiodynamics – engineering surface blood compatibility into catheter products: endexo technology into BioFlow catheters (tutorial); Anton Paar GmbH – the importance of the surface charge in biomaterials applications (tutorial); surfaces and interfaces: engineering (general session); and surfaces and interfaces: characterization (general session). The SC&M members played a vital role in organizing these sessions by reviewing the abstracts and chairing several of these sessions. All these sessions were well-received at the meeting.

Traditionally, the SC&M SIG has been very active in collecting students' resumes/CVs prior to the conference, putting them together on a CD and distributing the CD to potential employers who come to the annual meetings. We plan to continue doing this in the upcoming years as well to create job opportunities for students. Also, the SC&M SIG meetings are conducted with researchers from academia, industry and regulatory agencies. Several ideas are discussed in the meeting for the sessions to be organized in the upcoming SFB annual meetings. For the 2017 SFB Annual Meeting and Exposition, the following sessions are organized/co-organized by the SC&M SIG: (1) advanced bioinks for 3D printing of tissues and organs; (2) cell migration and biomaterials; (3) advances in antimicrobial biomaterials; (4) UHMWPE, is it good enough? (5) biomaterials for regenerative medicine; (6) printing and patterning of cell microenvironments; (7) device and implant based drug delivery; (8) local drug delivery to cardiovascular targets; (9) evidence for calcium phosphate coatings; (10) biomaterials for immunotherapy; and (11) engineering tissue and materials interfaces.

Highlights of the Latest Biomaterials Research from the Journal *Advanced Materials*

Topic

Zhang Y, Yu J, Wang J, et al. *Thrombin-Responsive Transcutaneous Patch for Auto-Anticoagulant Regulation*. *Adv Mater*. Nov 2016. doi:10.1002/adma.201604043.

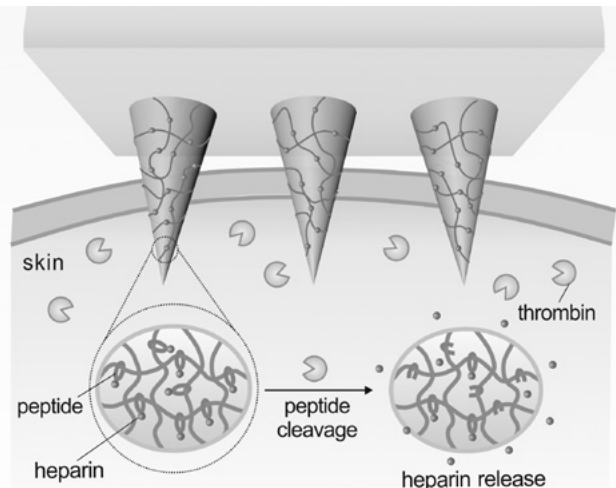
An interdisciplinary team of researchers has developed a smart patch designed to monitor a patient's blood and release blood-thinning drugs as needed to prevent the occurrence of dangerous blood clots – a condition known as thrombosis. In an animal model, the patch was shown to be more effective at preventing thrombosis than traditional methods of drug delivery. The work was done by researchers at the University of North Carolina at Chapel Hill and North Carolina State University.

Thrombosis occurs when blood clots disrupt the normal flow of blood in the body, which can cause severe health problems such as pulmonary embolism, heart attack or stroke. Current treatments often rely on the use of blood thinners, such as Heparin, which require patients to test their blood on a regular basis in order to ensure proper dosages. Too large a dose can cause problems such as spontaneous hemorrhaging, while doses that are too small may not be able to prevent a relapse of thrombosis.

“Our goal was to generate a patch that can monitor a patient's blood and release additional drugs when necessary; effectively, a self-regulating system,” said Zhen Gu, co-corresponding author on a paper describing the work. Gu is an associate professor in the joint biomedical engineering program at UNC and NC State.

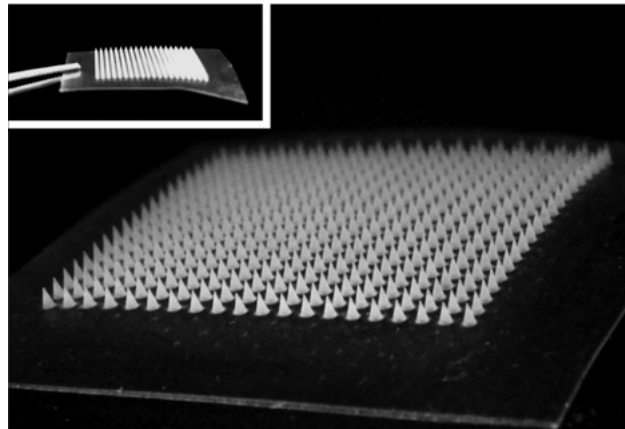
“Two years ago, I spoke with Zhen Gu about the significant clinical need for precise delivery of blood thinners,” said

Figure 1.



Schematic of Thrombin-Responsive Patch that Releases Heparin in Response to Thrombin

Figure 2.



The Thrombin-Responsive Microneedle Patch is Made of Heparin-Modified Hyaluronic Acid

Caterina Gallippi, a co-corresponding author and associate professor in the joint biomedical engineering program.

“We, together with Professor Yong Zhu in the mechanical engineering department at NC State, assembled a research team and invented this patch.”

The patch incorporates microneedles made of a polymer that consists of hyaluronic acid (HA) and the drug Heparin. The polymer has been modified to be responsive to thrombin, an enzyme that initiates clotting in the blood. When elevated levels of thrombin enzymes in the bloodstream come into contact with the microneedle, the enzymes break the specific amino acid chains that bind the Heparin to the HA, releasing the Heparin into the blood stream.

“The more thrombin there is in the bloodstream, the more Heparin is needed to reduce clotting,” said Yuqi Zhang, a PhD student in Gu's lab and co-lead author of the paper. “So we created a disposable patch in which the more thrombin there is in the blood stream, the more Heparin is released.”

“We will further enhance the loading amount of drug in the patch. The amount of Heparin in a patch can be tailored to a patient's specific needs and replaced daily, or less often, as needed,” said Jicheng Yu, a PhD student in Gu's lab and the other co-lead author of the paper. “But the amount of Heparin being released into the patient at any given moment will be determined by the thrombin levels in the patient's blood.”

The research team tested the HA-Heparin smart patch in a mouse model. In the experiments, subjects were injected with large doses of thrombin, which would result in fatal blood clotting of the lungs if left untreated. In the first experiment, mice were either left untreated, given a shot of Heparin or given the HA-Heparin smart patch. The mice were injected with thrombin 10 minutes later. Fifteen minutes after the thrombin injection, only the mice who received no treatment died.

In the second experiment, the thrombin was injected six hours after treatment. Fifteen minutes after the thrombin injection, all of the mice with the HA-Heparin smart patch were fine, but around 80 percent of the mice that received the Heparin shot had died.

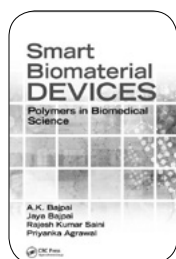
“We’re excited about the possibility of using a closed-loop, self-regulating smart patch to help treat a condition that affects thousands of people every year, while hopefully

also driving down treatment costs,” Gu said. “This paper represents a good first step, and we’re now looking for funding to perform additional preclinical testing.”

The work was supported by the Alfred P. Sloan Foundation; NC TraCS, NIH’s Clinical and Translational Science Awards, under grant 1UL1TR001111; and the National Science Foundation through the ASSIST Engineering Research Center at NC State (EEC-1160483) and grant EFRI-1240438.

Book Review

BY LYNNE JONES, BOOK REVIEW EDITOR



Smart Biomaterial Devices. Polymers in Biomedical Sciences
AK Bajpai, Jaya Bajpai, Rajesh Kumar Saini, Priyanka Agrawal, Atul Tiwari
Boca Raton, FL: CRC Press, 2017, pp. 227;
ISBN-13:978-1-4987-0698-8

Recently, I wanted to learn more about the use of smart polymers for biomaterial applications. I first started by reviewing the topic in the SFB-endorsed textbook, *Biomaterials Science. An Introduction to Materials in Medicine, 3rd ed.* As defined by Hoffman, smart polymers are “stimulus-responsive, ‘intelligent’ polymers are polymers that respond to small changes in physical or chemical conditions near a critical condition with sharp and relatively large phase or property changes.”¹ Wanting to learn even more about its application to orthopaedic surgery after reading the subchapter on smart polymers, I searched for more information in PubMed as well as on the Internet. I came across the book, *Smart Biomaterial Devices. Polymers in Biomedical Sciences*.

This book has nine chapters that can be loosely stratified as an introduction to the topic, specific discipline-based applications and a concluding chapter on marketing issues facing smart polymers.

- Chapter 1. Smart Biomaterials in Biomedical Applications
- Chapter 2. Polymers in Dental Applications
- Chapter 3. Polymers in Orthopaedic Devices
- Chapter 4. Smart Biomaterials in Drug Delivery Applications
- Chapter 5. Wound-Dressing Implants
- Chapter 6. Smart Biomaterials in Tissue-Engineering Applications
- Chapter 7. Ocular Implants
- Chapter 8. Polymers in Cardiovascular Implants
- Chapter 9. Market Scenario of Biomaterial-Based Devices

The first chapter lays the foundation for the topic of smart biomaterials. It outlines the scaffold requirements, types of smart polymeric materials, types of biomedical applications and challenges to address in the future. Chapters 2 through 8 can each serve as stand-alone reviews for each medical application. While each chapter addresses the use of polymers in their field, the authors place it into the proper context for each specific application. For example, the chapters regarding dental, orthopaedic, ocular and cardiovascular implants as well as wound dressings examine the biomaterial requirements for their medical application including a review of the physical and mechanical properties required and the types of materials and devices that have been used in the context of the challenges for their fields. Both drug delivery and tissue engineering span the gamut of biomedical applications. In many ways, these fields have been impacted the most by the introduction of smart polymers, and their associated chapters reflect this. Of particular note is Chapter 9 on the global biomaterials market and related issues. This chapter addresses each of the medical disciplines separately, providing information about practical uses for R&D for each field. Each of the chapters is well-referenced and well-illustrated.

The field of polymeric biomaterials is rapidly evolving. While this textbook provides a great entry point for our quest to learn more about smart polymers in biomedical sciences, it is also important to supplement this text with a current review of academic manuscripts specific to the field of interest to gain a full appreciation of each specific application.

REFERENCE

1. Hoffman AS. Applications of “Smart Polymers” as Biomaterials. In: Ratner BD, Hoffman AS, Schoen FJ, Lemons JE, eds. *Biomaterials science: An introduction to materials in medicine*. 3rd ed. Boston, MA: Elsevier/Academic Press;2013:247-58.



SOCIETY FOR
BIOMATERIALS

2017 ANNUAL MEETING & EXPOSITION

MINNEAPOLIS, MINNESOTA • APRIL 5-8, 2017

WHERE
MATERIALS
BECOME
MEDICINE



WWW.BIOMATERIALS.ORG