OFFICER CANDIDATES AND 2016 AWARDEES

BIOMATERIALS FORUM

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BIOMATERIALS
FORUM

The official news magazine of the **SOCIETY FOR BIOMATERIALS** • Volume 38, Issue 1

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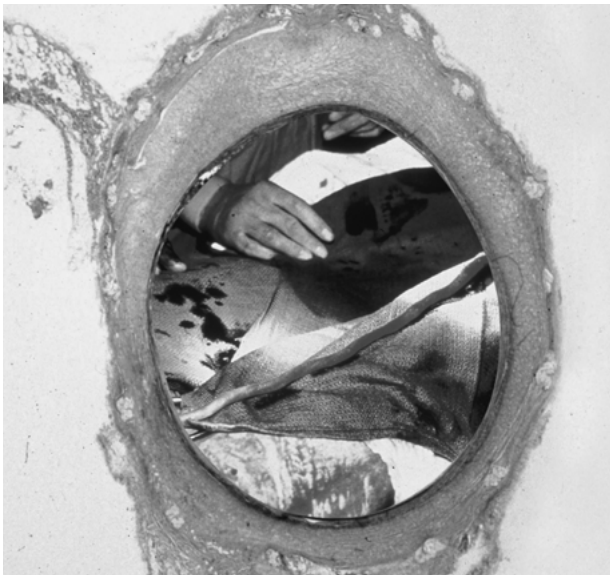


Contents

The Torch

News & Updates

On the cover: A histological image of a human umbilical cord vein graft with a center insert showing surgical placement. On May 25, 2005, manufacturing of the umbilical vein graft (UVg) ceased in compliance with establishment of new Food and Drug Administration (FDA) guidelines governing infectious disease testing of combination-tissue medical devices. During the product lifetime more than 70,000 limbs were saved from amputation (based on Biovascular, Inc. product sold). The performance of this product was second only to gold standard autologous saphenous vein for patients requiring lower-extremity limb salvage. The company's inability to track donor history for each UVg graft led to product shutdown despite the outstanding performance.

Professor Robert Baier, SUNY Buffalo, was part of the team that put through the FDA PMA for this product in January 1979. "Imagine all the FDA-stimulated barriers that will be added for live tissue engineering products," Dr. Baier said.

Reference

Dardik H, Baier RE, Meenaghan M, et al. Morphologic and biophysical assessment of long-term human umbilical cord vein implants used as vascular conduits. *Surg Gynecol Obstet.* 1982;154:17-26.

Photos submitted by Robert Baier and edited by Liisa Kuhn.

Liisa Kuhn

Greetings Biomaterial Scientists and Engineers,

Time to vote! And I don't mean for our next United States President. I mean for our Society For Biomaterials (SFB) President and also our Member-At-Large. You can vote by sending in the ballot in this issue or by visiting biomaterials.org. The **officer candidates' biographies and vision statements** are in this issue and online. Many thanks to our Nominations and Award Committee for critically selecting top choices for us to consider. Please take the time to complete your ballot. It only takes a few minutes.

Here are some other highlights from this issue of the Forum:

Congratulations are due to our 2016 SFB Awardees that have been selected for recognition by the awards committee for their outstanding achievements in, and contributions to, the biomaterials field. The **Awards Announcement** article in this issue lists the names and awards which will be formally presented at the World Biomaterials Congress in Montreal, Quebec, Canada this May. Read the Member News column for other announcements of your colleagues business and academic successes and recognitions.

In case you have not heard, sadly, Dr. Larry Hench, known in large part for his work on Bioglass, passed away late last year. As a bioceramist, I am particularly saddened by the loss of someone who was very influential, successful, kind and encouraging to junior scientists. To remember and honor him, this issue contains an **obituary for Dr. Hench** written by his friend and colleague, Dr. Frederick Schoen.

Another biomaterials pioneer, Dr. Sam Hulbert, also recently passed away (late January 2016). This news was received mid-production of the Biomaterials Forum and so the next issue will feature a memoriam for Dr. Hulbert, who served as former president of Rose-Hulman for 28 years. Please visit the Rose-Hulman Institute of Technology web page (rose-hulman.edu) for more information.

Our SFB student members at the University of Memphis are inspiring a new generation of kids interested in biomaterials through a middle school outreach program they developed – a bioengineering club. Chris Gehrmann and Josh Herwig used the money from the SFB education challenge award they received to perform a materials demo to middle school students and it blossomed into a club offering many different hands-on biomaterials experiments. Did you know that a couple of our nominees for officers this year started out as student members and have stayed with SFB for their entire professional career to date? Next time you see Chris or Josh from the University of Memphis, please encourage them to keep up the good work. They are showing great potential to be our future SFB leaders!

Dr. David Williams recollects early days within the SFB in the **Flashback Column** and explains how he has enjoyed collectively promoting the best of biomaterials science throughout the world.

Learn about the Materials Genome Initiative in the **Government News** column that has the maxim "from atoms to airplanes," reflecting the importance of structure-function relationships for predicting materials properties.

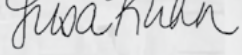
Have you heard about the flipped classroom technique in which the lecture is viewed online before the students come to class, and then assignments are done in class? It's one of the latest crazes in education and the data presented in the Educational News column indicates that there are reasons to consider the approach: improved assignment and test scores!

There is a short technical article from the Dental SIG and an announcement about a new student award program offered by the Drug Delivery SIG in this issue. Participating in SIGs is a great way to obtain informal expert advice about your projects, to participate in scientific programming at the annual meetings and to learn about how the Society is run. The SIG Officer positions, including the Forum reporter position, change every year and becoming an officer is a great way to increase your visibility, your network and your administrative training. This is one of the great benefits of participating in SFB.

SFB has hired a PR firm to further promote the Society and its members. Contact President Tom Webster for more info about how your research of note can be broadcast to a wider community.

I, and the many volunteers who work to make this Forum possible, thank you for taking the time to browse through this issue. We hope it's been useful to you!

Best wishes,



LIISA KUHN, PhD
Biomaterials Forum Executive Editor
Associate Professor
University of Connecticut Health Center

PR STANDS FOR MORE THAN JUST PUBLIC RELATIONS

Thomas J. Webster

In this competitive world for prominence in biomaterials' research, education and industry translation, I am pleased to announce that **Society For Biomaterials (SFB) has contracted its first PR firm, Schneider Associates (SA), a Boston-based agency with a long history in working with education and academic societies.**

The objective for hiring SA is to propel SFB into a position of global prominence in all issues related to biomaterials. We are currently living in a world with frequent changes in biomaterials regulation, government funding, research, education and commercialization that requires our constant active involvement. As our partner, SA will increase the visibility of all efforts undertaken by our membership, from our coveted Biomaterials Days to individual efforts members are undertaking to revolutionize biomaterials research and education. SA will also position our U.S. SFB talks at the World Biomaterials Congress in Montreal, QC, Canada (and subsequent annual meetings) on the global stage to increase the visibility of not only our SFB annual awards, but all awards our members receive. Such efforts should increase the quality and quantity of our membership. It will also aid in establishing new collaborations since we will learn more about what each other does.

Although SA was only hired last November, we have already seen the rewards of this coordinated effort. Specifically, our members have appeared on NBC's Today Show, NBC Nightly News and NPR, as well as in the *Boston Globe* and numerous other regional media outlets representing our widespread SFB network, emphasizing our work and industry expertise. Further, we have engaged a number of our SIGs to work with SA on telling the world about our ground-breaking research and education so that they can promote those stories globally, nationally, regionally and, where applicable, locally.

The success of this effort depends heavily on keeping SA appraised of our collective latest news, research and published articles. So please inform us about what we can publicize for you, and do not be shy.

You can email our PR team anytime at sfb@schneiderpr.com.

THOMAS J. WEBSTER, PhD, PRESIDENT OF SFB
The Arthur W. Zafiropoulo Department Chair
Professor of Chemical Engineering, Northeastern University
Boston, Massachusetts

Staff Update

BY DEB DUPNIK, ASSISTANT EXECUTIVE DIRECTOR

Hello from Society For Biomaterials (SFB) headquarters! As we gear up for 2016, the Board of Directors, Governing Council, Committees, Task Forces and SIGs are working on the initiatives established at the November Board of Directors and Council meeting.

AWARDS, CEREMONIES AND NOMINATIONS
CHAIR JOEL D. BUMGARDNER, PhD

The 2016 award recipients have been notified and a press release announcing their selection has been issued. The full article can be found starting on page 9 in this issue. In addition, the slate of officer candidates begins on page 12. The 2016-17 election website is now open; please remember to vote!

BYLAWS
CHAIR BENJAMIN G. KESELOWSKY, PhD

The Bylaws Committee presented their recommendations to Council after they reviewed some suggestions concerning changes in the Society's governance structure, including consolidation of some standing Committees and identifying responsibilities currently relegated to Council that should lie with the Board of Directors.

DEVICES & MATERIALS
CHAIR PETER G. EDELMAN, PhD

The Chinese SFB held its 2015 national meeting in Haikou, Hainan, China Nov. 19-23, 2015. The committee's recommendation to Council for adding a job board to the website was approved. SFB members can now post ads for available positions for free for 30 days. For more information, visit biomaterials.org/employment-opportunities.

EDUCATION & PROFESSIONAL DEVELOPMENT
CHAIR HUINAN LIU, PhD

Five Biomaterials Day grants were approved for 2016 and the committee is requesting additional information from two other applicants before making a final decision. SFB will

be supporting a total of seven Biomaterials Days in total in 2016. More information about these events will be published as it becomes available.

FINANCE
CHAIR SHELLY SAKIYAMA-ELBERT, PhD

The Finance Committee made several recommendations to the Board regarding reductions to the proposed 2016 budget. The Board of Directors decided to make several investments that will impact the 2016 operating budget including public relations, the website and commitments to support workshops and symposia at other organizations' meetings through the Liaison Committee's efforts. With 2016 being a World Congress year, dues revenues are expected to decrease, however with SFB following the Board of Directors' direction to invest in membership, expectations are that membership will increase in the years after the WBC.

LIAISON
CHAIR DAVE PULEO, PhD

The Liaison Committee continues its efforts to collaborate with other societies. This is especially important in World Congress years since SFB does not hold an annual meeting in those years. Board members approved satellite symposia at ACS, DMD, ISSCR, ORS and TERMIS. In addition, SFB will be sponsoring the New Jersey Center For Biomaterials Symposium at Rutgers University in this fall.

LONG RANGE PLANNING
CHAIR LIISA KUHN, PhD

The committee is continuing to work on developing a globalization strategy and increase collaboration with other organizations. SFB has engaged Schneider Associates, a public relations firm, to help make SFB the leading voice for biomaterials. Please see the President's letter on page 5 for more information about how Schneider Associates plans to help promote the Society, our members and the field of biomaterials!

MEETINGS
CHAIR THOMAS WEBSTER, PhD

The 2017 meeting will take place April 3-9, 2017 in Minneapolis, Minnesota. The 2018 meeting is scheduled for April 9-15, 2018 in Atlanta, Georgia. SFB leaders will be pitching for the 2024 WBC to be held in San Francisco, California, at the 2016 WBC in Montreal, Quebec, Canada.

MEMBERSHIP
CHAIR LIJIE GRACE ZHANG, PhD

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

PRESIDENT'S ADVISORY
CHAIR NICK ZIATS, PhD

Committee members will be meeting to review the code of ethics and discuss fundraising opportunities for SFB.

PROGRAM
CHAIRS CHRIS SIEDLECKI, PhD AND SUPING LYU, PhD

The committee worked alongside the Liaison Committee to finalize which 2016 satellite symposia would best serve the Society's members. Committee members are working with past committee chairs and the SIG representative to identify mechanisms for increasing the number of plenary sessions at the 2017 Annual Meeting and to also create new program formats.

PUBLICATIONS
CHAIR ALAN LITSKY, MD, ScD

The Publications Committee reviewed applications submitted for the positions of *Biomaterials Forum* editor and web editor. The board unanimously approved Guigen Zhang from Clemson University as the new *Biomaterials Forum* editor and Adam Ekenseair from Northeastern University as the new web editor.

NATIONAL STUDENT CHAPTERS
PRESIDENT EVELYN BRACHO-SANCHEZ

Student chapters have been setting up social networking sites including Facebook, Instagram, Twitter and inter-university engineering groups. There are currently 14 registered SFB student chapters. Board of Directors members agreed that Biomaterials Day grant recipients need to be official SFB student chapters before they receive grant funds.

SPECIAL INTEREST GROUPS
REPRESENTATIVE BRENDON HARLEY, PhD

The Orthopaedic Biomaterials, Tissue Engineering and Drug Deliveryidentify mechanisms for increasing the number of plenary sessions at the 2017 Annual Meeting and to also create new program formats.

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

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Internationalization of Biomaterials Science and SFB

BY GUIGEN ZHANG, CLEMSON UNIVERISTY

For this issue's historical flashback, Dr. David Williams reflects on his years of association with SFB, starting from his very first biomaterials meeting at Clemson University. David was the winner of the 1983 Clemson Award for Contribution to the Literature. His great contributions to the field of biomaterials and tissue engineering are marked by the numerous books about biomaterials science he authored from the days when the field was still in its nascent stage to the current days; by his leadership as Editor-in-Chief of *Biomaterials* in the past and Global President of Tissue Engineering and Regenerative Medicine International Society (TERMIS); and by his never-slowing efforts to promote the globalization/internationalization of the fields. In his own words:

The Beginning

A short while ago, Guigen Zhang persuaded me to write a short piece about my early SFB memories for the Historical Flashback section of the Forum. He provided me with a copy of Buddy Ratner's description of his memories that were published in a previous edition of the Forum as a guide. Buddy and I go back a long way. We met at the 1975 Biomaterials Symposium at Clemson University that he referred to, and if my memory serves me correct, we actually met on the transport that had been provided for us from Greeneville-Spartanburg airport to Clemson. It is interesting to reflect, in relation to the development of our understanding about biocompatibility, that Ratner, [first name] Anderson and [first name] Williams were present together, discussing their work, at a meeting 40 years ago. It was not my first visit to the U.S., since that had occurred in 1974 when I spent three weeks touring embryonic biomaterials laboratories. That tour also included my attending that year's Clemson biomaterials meeting, during which the formation of SFB was discussed. That tour was partly arranged for me to prepare for a sabbatical as a senior Fulbright Scholar at Clemson, starting in September that year, during which I attended the first SFB meeting outside Clemson, held in Philadelphia, Pennsylvania. It was not without significance that I returned to Clemson this year to give a seminar, all those years later.

Involvement in SFB

My involvement with the SFB has been much more sporadic than that of Buddy since, up until 2008, I was based in Europe and was equally responsive to the responsibilities of membership of the European Society for Biomaterials – founded a year after SFB and ESB held their first meeting in 1976. I also became profoundly involved with the World Congresses, being on the organizing committee of the first WBC in Austria in 1980 and attending all but one of the nine that have taken place since then. I have attended around 12 SFB meetings in all, from Seattle, Washington to San Francisco, California, and from Boston, Massachusetts to Tampa, Florida. Practices have changed, as Buddy pointed out, possibly because it was easier to get thoroughly and intimately involved with all aspects of a conference. There were fewer parallel sessions, hardly any committees, freedom of association around the bash, and I don't even remember poster sessions in the early days.

Not surprisingly, my memories of SFB have been more of an international than parochial dimension. For many years I was one of the only Brits, and one of a very small number of Europeans, at the meetings. Over time, these numbers increased and the advent of the World Congress series allowed a greater global dimension in biomaterials science to emerge. This was very important; major discoveries were being made in the U.S. in biomaterials science and medical technologies, but equal progress could be seen elsewhere. It is invidious to make claims about inventors and first-in-man, but the pioneering contributions of Sir John Charnley with hip replacements and Harold Ridley with IOLs in the United Kingdom; Otto Wichterle in the former Czechoslovakia with soft contact lenses; Graeme Clark in Australia with the cochlear implant; Per-Ingvar Branemark in Sweden with dental implants; Alain Carpentier in France with bioprosthetic heart valves; and, of course, Chris Barnard in South Africa with the world's first human heart transplant, had to be recognized. This globalization of biomaterials science has been embraced by members of SFB over the years, and the presence of overseas students and faculty at the meetings has become a significant part of maturity of the society. I have focused much of my work in recent years with this globalization, both through my editorial role with Biomaterials Forum *and as Global President of TERMIS. It is delightful to meet many of my SFB friends all over the world as we collectively try to promote the best of biomaterials science.*

George Bernard Shaw, in writing The Irrational Knot in 1905, said that "reminisces make one feel so deliciously aged and sad." But he was Irish and I am Welsh. I do not see sadness and try not to feel the aging. It is true that if your vision is confined to your memories, you have no future, but memories can be enjoyed and, after due reflection, can stimulate the future. The history of SFB can help shape its further evolution.

IN MEMORIAM
Dr. Larry L. Hench

BY DR. FREDERICK SCHOEN

Larry L. Hench, PhD, passed away on Dec. 16, 2015, in Ft. Myers, Florida, at age 77. Collectively (and for many of us personally), we have lost a wonderful and treasured friend, colleague, mentor and staunch supporter of the Society For Biomaterials (SFB) and the field of biomaterials and their applications more broadly. At the time of his death, Larry was university professor of biomedical engineering in the Florida Institute of Technology College of Engineering, and director of the Florida Tech Center for Medical Materials and Photonics.

Born in Ohio in 1938, Larry received his bachelor's degree in 1961 and doctoral degree in 1964 in ceramic engineering from the Ohio State University. After 32 years on the faculty, he retired from the University of Florida as emeritus professor to join the Imperial College, University of London, as chair of ceramic materials. There, he co-founded and co-directed the Tissue Engineering and Regenerative Medicine Centre for 10 years.

Larry made many and seminal contributions to the field of bioceramics. In 1969, he discovered Bioglass, the first man-made material to bond to living tissues, which is now clinically used throughout the world to repair bones, joints and teeth. Discoveries made by Hench and his colleagues in the 1980s and 1990s resulted in numerous Federal Drug Administration (FDA) approvals. In the mid-'80s, the FDA approved the use of bioactive glass devices to reconstruct the ossicular chain (part of the middle ear) and restore hearing. A subsequent FDA approval led to bioactive glass implants to replace teeth, maintain jaw stability and repair maxillo-facial bone defects. In the '90s, the FDA approved the use of a particulate form of bioactive glass that led to regenerating new bone to repair bone defects caused by periodontal disease. Numerous other FDA-approved applications were in orthopedic surgery, including repair of bone defects following revision surgery of failed hip and knee prostheses, and spinal repair.

Twelve companies have been founded based upon technology created in Hench's laboratories, and the commercial products have led to numerous advanced technology awards. A person with a great sense of humor, and also the ability to relate science to lay audiences, he authored a series of children's books featuring Boing-Boing the Bionic Cat and educational materials such as workbooks, experiment books and hands-on kits to stimulate interest in science, technology, engineering and mathematics (STEM).

Larry Hench was a founder and Past-President of SFB (1979-80). He served and had leadership responsibilities on many committees. He also received SFB's Clemson Award for Basic Research in 1977 and the Founders Award in 1998.

Larry earned many international awards, published 800 research papers, 30 books and has 32 U.S. patents. He was a member of the National Academy of Engineering (NAE). He was also a member of the World Academy of Ceramics and a fellow of numerous professional societies including the American Ceramic Society, Society of Glass Technology and Institute of Materials. He was a Distinguished Life Member of the American Ceramic Society, the society's highest award, and has been awarded an Honorary Doctorate of Engineering by the Rose Hulman Institute of Technology. Most recently, he was awarded the highly acclaimed international 2014 Acta Biomaterialia Gold Medal Award, which recognizes lifetime excellence in research and development in the field of biomaterials.

From left: Larry Hench, William Hall, Fred Schoen and Jonathan Black at an SFB meeting in 1985.

2016 Award Recipients Announced

The Society For Biomaterials (SFB) proudly announces its 2016 award recipients. These Society professionals are recognized for their outstanding achievements in, and contributions to, the biomaterials field. Each award recipient will be honored during a special SFB Awards Plenary Session at the 10th World Biomaterials Congress in Montreal, Quebec, Canada on May 18, 2016.

Founders Award

Cato T. Laurencin, MD, PhD, University of Connecticut

The Founders Award is based upon long-term landmark contributions to the discipline of biomaterials. Dr. Laurencin is responsible for the development of many new discoveries in biomaterials and transitioning many of these discoveries to clinical use for which he was previously awarded the Technology, Innovation & Development Award. His fundamental and seminal contributions in materials science have influenced our understanding of biomaterials while easing human suffering. Dr. Laurencin pioneered the use of polymer-ceramic composites designed for the regeneration of bone. Starting with fundamental studies on polymer-ceramic interactions with cells, he designed one of the first matrices useful for bone regeneration. The work culminated in his landmark paper on sintered polymer-ceramic based matrices suitable for bone regeneration. The work was specifically cited by the American Institute of Chemical Engineers in naming him one of the "100 Greatest Engineers of the Modern Era" at its centennial celebration in 2009. Dr. Laurencin pioneered the use of polymeric nanofibers for use in tissue regeneration. Starting in the 1990s, Dr. Laurencin worked with textile scientists and biologists on the application of nanofibers for musculoskeletal regeneration.

Clemson Award for Applied Research

Justin Hanes, PhD, Johns Hopkins School of Medicine

Dr. Hanes's application of basic science is seeing widespread use. Dr. Hanes has an outstanding record of research and creative scholarships in both drug delivery to mucosal barriers, new biomaterials science and particle-tissue interactions in the context of tissue engineering. His cumulative record in research is highlighted by nearly 90 full-research papers published, as well as multiple book chapters and other literature contributions, including nearly 40 patent applications. His work has amassed over 5,600 citations to date, most in the past five years, reflecting the dramatic increasing appreciation of his work. Professor Hanes has produced a significant body of original biomaterials research, especially toward the nanoparticle-based controlled drug and gene delivery systems and is an active advocate in the biomaterials community.

The Clemson Awards reflect the strong traditional ties between SFB and Clemson University since 1974.

Clemson Award for Basic Research

Molly Stevens, PhD, Imperial College of London

Dr. Stevens is being recognized for her contributions to basic knowledge and understanding of the interaction of materials with biological molecules, cells and/or tissues. Molly has made incredible advancements in developing biomaterials for applications in tissue engineering and regenerative medicine. Molly has published several landmark papers in Nature Materials and Nature Nanotechnology. She recently reported nanoneedles capable of delivering nucleic acids to cells and tissue non-invasively in *Nature Materials* in 2015, which was featured on the front cover. Other notable reports focus on her development of innovative nanoscopic biosensors capable of detecting specific disease biomarkers, enabling early and facile diagnosis of a number of disease states, such as cancer and HIV. In 2013, she reported the discovery of biomineralized particles present in human aortic tissues, which may have huge implications in cardiac disease aetiology.

Clemson Award for Contributions to the Literature

Rocky Tuan, PhD, University of Pittsburgh School of Medicine

This award recognizes significant contributions to the literature on the science or technology of biomaterials. Dr. Tuan has been published in more than 450 in peer reviewed, archival journals and book chapters and review articles. The impact of his research is apparent with 30,000 citations and an h-index of 86. In addition, he has notable productivity with 19 patents issued or disclosed. Dr. Tuan's research has addressed many areas, but focused on a multitude of orthopaedic issues. His success in managing the fusion of fundamental biology and biomaterials science has resulted in an advanced understanding of cellular mechanisms and cell-material interactions. These results have guided many researchers in the field as we seek to improve the quality of care for orthopaedic patients.

C. William Hall Award

Jim Curtis, Dow Corning

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 its objectives and goals. Mr. Curtis is currently a Senior Application Engineering and Technical Service Specialist at Dow Corning Corporation and has been with them since 1986. He has published a significant number of documents in biomaterials research, particularly in the area of silicone materials and medical applications over the past 30 years. He has been an active member of SFB since 1990. Jim was a founding officer of the Biomaterials Availability and Policy (BAP) Special Interest Group – now the Biomaterials and Medical Products Commercialization SIG. Since the founding of the SIG, he has been an officer almost every year. Jim has provided an industry perspective on topics such as product liability, changes in patent law, availability of biomedical materials, regulatory pathways/ problems and commercialization of products. Jim embodies the objective of the C. William Hall Award "to honor industry and government."

Society For Biomaterials Award for Service

Alan Litsky, MD, ScD, Ohio State University

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. Dr. Litsky's service has supported nearly every aspect of the Society. He has actively participated in abstract reviews, workshops and plenary sessions. He has also supported the SIGs and served as the chair of the Orthopaedic Special Interest Group from 2000-2001. Alan has been a member of the Board and Council, serving in the following capacities: Program Committee (1989, 1993, 2013-2014); Education and Professional Development Committee (Chair, 2001-2003); Ad Hoc Ethical Issues Committee (2000-2002); By-Laws Committee (2012-2014); Audit Committee (2011-2012); Meetings Committee (2011-2012); Long-Range Planning Committee (2011-2012); Publications Committee (chair, 2012-2016); Finance Committee (2009-current); and Representative to AIMBE Council of Societies (2009-2012). Alan was elected by the Society's membership to the Awards, Ceremonies and Nominating Committee (2003-2004; 2013-2014); to the Membership Committee (2003-2005; chair, 2004-2005); and as Secretary Treasurer-Elect (2005-2007), Secretary Treasurer (2007-2009) and Member-at-Large (2011-2012). Dr. Litsky has been one of the pillars of our Society since 1989, and for the past 25 years he has provided extraordinary service to our Society, not only in his active duty roles, but also as an advisor to our many presidents, members, students and staff.

Technology, Innovation & Development Award

Joseph Salamone, MD, PhD, Rochal Industries, 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. According to the U.S. Patent and Trademark Office, Joseph Salamone has some 112 issued U.S. patents and some 171 current published applications since 1978. Stemming from these documented, validated (by patents) inventions, numerous commercial and trademarked products have resulted over decades. Dr. Salamone has invented and translated some five contact lens families bearing trade names such as Biotrue, PureVision and SofLens59; contact lens solutions, cleaners and anti-fog formulations with trade names such as Boston Cleaner and FogShield number at least six families. Soft (SofPort), surface modified and phakik intraocular lens amount to at least three marketed product lines. Bausch and Lomb, Zeiss and Ophthalmic Innovations, International, Inc. are companies that have marketed Dr. Salamone's innovations. Altogether, with the trade name variants, there are some 50 different ophthalmic products bearing Dr. Salamone's mark. In the area of wound treatment, 3M has been a major licensee of his product innovations. These include liquid adhesive bandages, skin barrier films, sprays and wipes using 3M's trade names, such as Cavilon and NexCare. He has produced a veterinary wound dressing family (Epi-Heal) marketed by Meridian Animal Health. Dr. Salamone's recent innovations in wound care are truly "breakthrough products and significant improvements over state-of-the-art."

SFB Young Investigator Award

Fan Yang, PhD, Stanford University

Dr. Yang has made many important contributions to the development of novel biomaterials platforms for studying stem-cell matrix interactions or cell-cell interactions, and applying such findings to improve the treatment of musculoskeletal diseases, cardiovascular diseases and cancer. Within the past six years, Dr. Yang has published 43 journal articles (60 in total) from her independent research group. She has five U.S. patents, spoke at 46 invited talks and has over 200 conference proceedings. Her research has been funded by 20 grants from NIH (R01), NSF, California Institute of Medicine and various private foundations focusing on human diseases including bone

defects, cartilage loss and cancer. The findings from her research have been published in high impact journals in a broad range of disciplines including Advanced Materials, Biomaterials, PNAS, Tissue Engineering, ACS Nana and Molecular Therapy, etc. Fan's research group at Stanford University developed microribbons used as building blocks, to demonstrate that the resulting 3-D scaffolds exhibited cartilage-mimicking shock-absorbing capacity when subject to cyclic mechanical loading, and supported robust stem cell proliferation and extracellular matrix deposition. Fan and her research team at Stanford University recently demonstrated the potential for catalyzing articular cartilage tissue formation using a minimal number of neonatal chondrocytes (NChons) by co-culturing them with adipose-derived stem cells (ADSCs) in 3-D biomimetic hydrogels. Her accomplishments have been recognized by numerous awards including NSF CAREER award, the MIT TR35 honoree and Tools and Technologies Development award by California Institute of Regenerative Medicine.

Student Awards for Outstanding Research, Undergraduate

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

Abigail Loneker, University of Pittsburgh

Loneker was accepted as a researcher in Dr. Stephen Badylak's laboratory during the fall 2014 semester through a competitive selection process. Lonekerl's research project focused on developing novel methods for seeding hepatocytes onto a 3-D scaffold composed of extracellular matrix and she continued this work throughout the summer 2015. She was awarded a Bioengineering Summer Research Fellowship from the University of Pittsburgh for this project, investigating the effect of solubilized liver extracellular matrix derived from different species and their effect on hepatocyte function. Preliminary results from this study will be presented at the 2015 Annual Meeting of the Biomedical Engineering Society in Tampa, FL (Abstract Title: "Enhancing Hepatocyte Function Using Liver Extracellular Matrix Derived from Various Species").

Veronica Ibarra, Illinois Institute of Technology

Ibarra is studying the inflammatory response to alginate based islet encapsulation systems in order to identify potential failure mechanisms. She has developed a number of new immunohistohemical protocols in the lab for the identification of various macrophage phenotypes. She is co-author on a manuscript that we will be submitted to PNAS, and she is preparing a first-author manuscript based on her work. Ibarra performed additionalstudies with collaborators in Taiwan, at Chang Gung Memorial Hospital in the Tissue Engineering Center, one of the world's top microsurgery centers. In this research, she has further examined the performance of alginate-based cellular therapies in small animal models.

Student Award for Outstanding Research, PhD Candidate

Jose Garcia, Georgia Institute of Technology

For his PhD thesis project, Garcia is focusing on engineering a new class of synthetic hydrogels presenting bioactive molecules (cell adhesive ligands, growth factors and protease-degradable cross-links) to promote local tissue vasculature in order to enhance the survival, engraftment and function of transplanted human adult mesenchymal stem cells. This project integrates engineering principles and approaches (hydrogel synthesis and characterization) and bioscience techniques (molecular biology, cell culture and animal implantation studies) to engineer new classes of biomaterials for regenerative medicine. An innovative aspect of this project is the use of integrin specific ligands developed in combination with vasculogenic factors to promote stem cell engraftment and function. For the next phase of his thesis project, Garcia will focus on delivering human mesenchymal stem cells using these engineered hydrogels to the non-healing segmental bone defects. In addition to the imaging techniques used in the first paper, Garcia will track transplanted cells in vivo using mesenchymal stem cells expressing luciferase and perform gene expression and cytokine arrays to gain mechanistic insights into differences in cell engraftment and bone repair.

Outstanding Research by a Hospital Intern Award

Yalini Vigneswaran, MD, The University of Chicago

Dr. Vigneswaran is currently participating in a two-year research fellowship studying the immunologic properties of biomaterials for wound healing and pursuing a Master of Public Health Sciences. Her work has investigated the influence of anti-biomaterial immune response on wound healing responses. Her hypothesis was that there are immune phenotypes that are consistent with good healing in cutaneous wound models. She found that even when mice were induced to raise strong anti-biomaterials immune responses using self-assembling peptides, wound healing was not affected. This is an important contribution to the biomaterials literature because the current conventional wisdom is that any anti-biomaterial immune response is necessarily harmful. Yalini shows that even when mice are undergoing quite vigorous anti-biomaterial immune responses, wound healing proceeds normally.

Presidential Candidates

David H. Kohn, PhD
Professor
Departments of Biologic and Materials Sciences and Biomedical Engineering
University of Michigan

Vision Statement: My first Society for Biomaterials (SFB) meeting was in 1984. I have made life-long friends and colleagues through SFB. I am honored to have been nominated for the position of President-Elect and to have the opportunity to help guide the Society and give back to an organization that has meant so much to me professionally and personally.

The field of biomaterials has undergone significant growth in the last 20 years, and SFB should be at the forefront of this expansion. We are the most comprehensive society in the field and our comprehensive excellence is unmatched. Being this comprehensive, we need to balance breadth and depth, and create synergies across our breadth. If elected, I will strive to ensure that our members from all sectors see the value of membership, meetings and publications, and that this value is provided in a cost-effective manner.

As President, it will be my responsibility to lead the Society and help set goals to enable the Society to advance excellence in biomaterials science. I view my role as one of leadership and strategic direction management. The process of making clinically relevant and efficacious biomaterials is lengthy and interdisciplinary. Basic, applied, clinical, industrial and regulatory expertise is required, and is best integrated in a parallel fashion, but often implemented in series. SFB is uniquely suited to facilitate a paradigm shift toward a more parallel approach of translating biomaterials research. Since the process can be lengthy, it is also incumbent to mold the next generation of biomaterials scientists and engineers, and SFB is a unique agent of this training.

I will use my experience and understanding of the Society's structure and operations to increase the value of membership so it is unambiguous why someone would join SFB or renew their membership. I will work to 1) improve the quantity and quality of educational and professional development; 2) improve the visibility and impact of the Society; and 3) evaluate our governance and operations to streamline achieving our goals.

I believe it is vital to increase our educational and professional development activities. I will work to advance a mentoring program for members at all levels. I would also like to introduce a grants review program. Leveraging our successful Biomaterials Days, the Society can strengthen interactions between basic researchers, clinicians and industry by introducing challenge grants.

Increasing the visibility and impact of the Society is critical to helping the Society fulfill its vision of promoting human health. I will therefore work toward integrating SFB with other societies, so that our members are point people for providing biomaterials expertise, and SFB increases its branding, but does not lose its identity. A public relations plan is needed, as well as outreach to promote biomaterials awareness and visibility of SFB.

I believe in investing in people and processes as a means of accomplishing these goals. I will engage you and listen to your ideas on what we do well and what we can do better. I believe that the Board and Council, in concert with all of you, need to be operationally successful, but to also place emphasis on setting a bold vision and direction for the Society. If the Society can better serve its members and provide a structure and excitement for its members to want to belong, we will be able to provide a forum for your recognition in the field of biomaterials. If we think in a bold manner, the quantity and quality of our endeavors will improve.

I look forward to the opportunity to continue to serve the Society.

Biographical Sketch: David is a Professor at the University of Michigan in Biologic and Materials Sciences, and Biomedical Engineering. He received his BS in Biomedical Engineering from Tulane University (1983) and his MS (1985) and PhD (1989) in Bioengineering from the University of Pennsylvania, and joined the faculty at Michigan in 1989. David served as graduate chair in biomedical engineering, is director of an NIH Training Program in Tissue Engineering and co-director of a new Regenerative Medicine Center.

David's research has progressed from top-down investigations of synthetic biomaterials at the macroscopic and microstructural-levels to the bottom-up synthesis and characterization of biomaterials at smaller levels of scale. In parallel, he has a research program in tissue mechanics across length scales. David's research program now focuses on biomineralization, which is investigated by establishing structure-function relations in mineralized tissues and utilizing this information to develop strategies to engineer tissue. His work has provided insight into mechanisms of bone fragility and mechanically mediated tissue adaptation. His lab has also developed organic/inorganic hybrid materials that can communicate with their biological microenvironment leading to better control of cell function in vitro and tissue formation in vivo. David has been continually funded throughout his career, including support from NIH, NSF, DoD and industry. He has published over 125 peer reviewed papers and book chapters, holds five patents and has over 100 invited presentations. David is the recipient of a Whitaker Foundation Biomedical Research Award, NSF Research Initiation Award, NIH IPA award, and a Distinguished Scientist Award from IADR. David is a Fellow of the International Union of Biomaterials Scientists and Engineers, AIMBE and AAAS.

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Steve Little
William Kepler Whiteford Endowed Professor
Chair, Department of Chemical Engineering
University of Pittsburgh

Vision Statement: Of all the Societies, SFB has had the biggest impact on my career. Since my time as a graduate student, SFB has been the place where I have developed the strongest and most meaningful relationships with collaborators, mentors and friends. It has also been a place where I have been privileged to with the opportunity to give back, which began in the SIGs. In no other Society can its young members find the opportunities to become involved and serve in a Society like they can in the SIGs of SFB. It has been my continued vision and mission to promote the SIGs to a position of prominence in the Society, and with the help of our past presidents, our SIGs now have more resources and more members than ever before. It would be my continued commitment to provide the SIGs with the resources necessary to provide excellence in programming for our annual meetings as well as increased opportunities for its members to engage in the Society through networking and exchange of ideas.

It will also be my commitment to always look for ways to increase the value of your membership. Every effort needs to be made to keep the cost of membership and attendance at the annual meeting as low as possible while ensuring that the location of the annual meeting is accessible and attractive. I also want to explore ways to produce more value to the many individuals that attend the annual meeting each year who are recruiting new talent (and to those who wish to be recruited). I would envision specific poster sessions (or a specific location in the poster sessions) for those searching for a faculty position or industrial position. It would also be helpful if those recruiting had a demarcation on their nametag stating that they were hiring (or likewise a demarcation that someone is looking to be hired).

Finally, we also must make every effort to advance SFB's prominence and leadership in the field of Biomaterials globally. I envision that we would benefit greatly from an increased public-relations presence in order to get the word out to the community at large as well as to the public that our members are indeed the global leaders in the field of Biomaterials. It should be the case that when a media outlet wishes to write a story on a remarkable surgical procedure or the sale of a company that specializes in Biomaterials, that the Society headquarters is contacted to identify members to quote as experts in the field. It should also be the case that the public is regularly made aware of the extraordinary accomplishments of our members, increasing our visibility and putting us in a greater position to educate and advocate.

During my time in leadership of the SIGs and then serving on the Board of Directors, I witnessed the impact that several, extremely gifted Presidents had on the Society. In addition, these Presidents listened to me, they supported me, and they championed my ideas. It is for this reason that I am deeply honored for the nomination to serve as President-Elect for SFB so that I might be in a position to listen to you, support you and champion your ideas in the same way as those who came before me.

Biographical Sketch: Steve Little is the William Kepler Whiteford endowed professor and chair of the department of chemical engineering at the University of Pittsburgh. He is also a professor of bioengineering, pharmaceutical sciences, immunology, ophthalmology and the McGowan Institute for Regenerative Medicine. Steve has been an active member of the Society for Biomaterials (SFB) from his days as a graduate student and since that time he has served in a number of roles including the Vice Chair of the Drug Delivery SIG from 2009-2011, the Chair of the Drug Delivery SIG from 2011-2013, and the SIG Representative on the Board of Directors from 2013-2015. He also has organized a large number of sessions, symposiums and panel discussions for the Society and has served on committees including the website-redesign committee. Steve was also the 2012 recipient of the Society for Biomaterials' Young Investigator Award.

Little's research focuses on next generation drug delivery formulations that mimic the spatial and temporal presentation of biological stimuli observed *in situ*. His work on the fundamentals of controlled release has also led to the founding of Qrono, Inc., the first custom controlled release formulation startup company based in Pittsburgh, Pennsylvania. Qrono has received a number of national accolades including CNBC's 15 Promising New Startups, one of the Kauffman Foundation's most promising ventures from around the world, and a number of Phase I and II STTR/SBIR contracts from the NIH, the DoD and the U.S. FDA.

Steve has received a number of awards for his work in the area of Biomaterials including, but not limited to:

- The American Association for Advancement of Science's Excellence in Research Award
- The American Heart Association's Career Development Award
- The NIH K Award
- The Beckman Young Investigator Award from the Arnold & Mabel Beckman Foundation
- Both the Phase I and Phase II Coulter Translational Research Awards from the Wallace H. Coulter Foundation
- The University of Pittsburgh's Chancellor's Distinguished Research Award
- The University of Pittsburgh's Chancellor's Distinguished Teaching Award
- Named a "Camille Dreyfus Teacher-Scholar" by the Camille & Henry Dreyfus Foundation
- The Carnegie Science Award for Advanced Materials
- The Carnegie Science Award for University Educators
- Research to Prevent Blindness' Innovative Ophthalmic Research Award
- Named a Fellow of the Biomedical Engineering Society (BMES)

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Member-at-Large Candidates

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

Vision Statement: I am deeply honored to be nominated for the position of Member-at-Large. I have been an active member of Society For Biomaterials (SFB) for more than 20 years as a student, post-doc and faculty member. While I have regularly organized sessions at the annual meeting, I have provided significant 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) and member of the Awards and Nomination Committee (2008-2009, 2014-2015). In addition to outstanding diverse professional opportunities for scientific discussions, networking and interactions with 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 Member-at-Large, I will focus my efforts on three major areas:

Be a voice for all the Members: It is crucial to engage our diverse membership in existing and new activities during and outside the annual meeting to increase membership value. A key aspect of this effort is to establish and maintain good communication between students, academicians, industry, government and the Council and Executive Board of the Society. Through this improved communication, we will identify targets and allocate resources to maximize membership value and grow SFB.

Foster scientific excellence and a nurturing environment: The annual and regional meetings (e.g., Biomaterials 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 social 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.

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.

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 BS 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 post-doctoral 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.

Joo L. Ong, PhD
USAA Distinguished Professor of
Biomedical Engineering
Associate Dean of Administration,
College of Engineering
University of Texas at San Antonio

Vision Statement: My vision as a Member-at-Large is to improve the strength of the Society's membership. I will act as a liaison between the student members and academician and industry members, and will listen and hear your needs and concerns with regards to Society-led activities. One of the most important members are our very own students, and their membership is crucial to the Society. These students are the pipeline for ensuring that our Society membership remains strong as they graduate to becoming active members. As important as having academician and clinician members in the Society, memberships from the industries are also key to our success. With the many biomedical industries around the nation, increasing members from the industry is critical since many of our research are translational.

Additionally, the Society provides many activities and roles for all members to participate, including organizing its annual meeting every three years for networking, to learn new and the latest technologies and discoveries, and to catch up with old friends. By participating in Society-led activities, all members are provided the opportunity to learn about its governance at different levels, either through the SIG, Council or Board of Directors. As such, my role as the Member-at-Large will be to serve as the spokesperson for the Society members as a whole to address your needs and concerns. In this role, my priorities will be:

1. To encourage members to participate in the different roles available in the Society, either through election or by volunteering for specific committees. This allows members to understand and be part of the Society rather than to view the Society as an annual event to present their work.

2. To work with the national student chapter on means to increase student involvement in the Society. As a pipeline to increase our membership strength, I want to ensure that their needs in the Society are being addressed.

3. To work with the industry members and to enhance its membership through different SIG activities and program involvements. Interacting with the biomedical industries is key for translating technologies and discoveries found in research laboratories; and increasing membership from the industries allows the Society members to increase their network and to foster discussions in basic science as well as translational research.

It is an honor to be nominated for this position, and if elected, I will work to represent your views and concerns to the Council.

Biographical Sketch: Joo L. Ong, PhD, is currently the USAA distinguished professor of biomedical engineering and the associate dean of administration for the College of Engineering at the University of Texas at San Antonio. He is also an adjunct professor in the Department of Comprehensive Dentistry at the University of Texas Health Science Center at San Antonio. He received his BS degree from the University of Iowa in 1987, and his MSBME and PhD degrees from the University of Alabama at Birmingham in 1990 and 1994, respectively.

His primary research interests focus on the regeneration of bone for large critical-sized defects, surface modifications and characterization of the implant biomaterials for dental and orthopedic applications, modifications of tissue-engineered ceramic scaffolds, protein-biomaterials interactions and cell-biomaterials interactions in vitro and in vivo using small and large animal models. His work has been funded by the National Institute of Health, National Science Foundation, the Whitaker Foundation, Implant Dentistry Research and Education Foundation, Academy of Prosthodontics, American Association for Dental Research and the U.S. Army, as well as numerous biomedical industries. At present, Dr. Ong has authored/co-authored one biomaterials textbook, 13 book chapters, 141 peer-reviewed papers and over 200 conference abstracts in dental, orthopaedic and tissue-engineering biomaterials. In addition, he has given invited lectures and keynote lectures at national and international meetings and has served as a manuscript reviewer for several biomedical engineering related scientific journals. He has also served as a grant reviewer for the National Institutes of Health, National Science Foundations, Department of Defense and European and Canadian funding agencies, as well as state-based agencies.

In addition to being active in other professional societies, Dr. Ong is also an active member of the Society for Biomaterials (SFB). He has served many roles within the Society, including being on the Membership Committee, Long Range Planning Committee, Meetings Committee and the Program Committee. He served as the Chair for the Program Committee for the 2014 Annual Meeting for the SFB in Denver. Dr. Ong is currently one of the Associate Editors for the Journal of Biomedical Materials Research, Part B.

Presidential Candidate Kohn (continued from page 12)

Nominations

David has taught biomaterials and tissue engineering courses to undergraduate and graduate engineering students, as well as clinical students and residents. He has trained 37 graduate students, 7 post-docs, 40 undergraduates, 14 residents and 5 visiting scholars.

David has been an active member of SFB for almost 30 years. He was Chair of the Oral/Craniofacial Biomaterials SIG (1996-1999), and has served on the Program Committee (1997-2002, 2007, 2015), Awards, Ceremonies and Nominations Committee (2003-2004), and the Education and Professional Development Committee (2005-2006 and 2009-2010 as Chair). David was Member-at-Large in 2006-2007 and served on the Long Range Planning Committee. As Member-at-Large, he brought concerns of members to the Board and Council and was able to create a forum for having members' concerns better addressed. As EP&D Chair, the committee helped expand the quantity and quality of Biomaterials Days, implemented student chapter awards and helped launch a mentorship program. David served as Secretary-Treasurer (2013-2015). He helped guide the Society during times of financial concern, declining membership, and competition from other societies, managing its resources and helping the Society grow its assets, enabling the Society to add value to your membership. As Secretary-Treasurer, David was involved in all aspects of society operation and governance. These experiences have provided David a depth and breadth of understanding of critical issues facing the Society and a vision of how to best advance the Society.

Presidential Candidate Little (continued from page 13)

Nominations

- Named one of *Pittsburgh Magazine's* "40 under 40"
- Named one of only five individuals in Pittsburgh who are "reshaping our world" by Pop City Media
- The Curtis W. McGraw Research Award from the American Society for Engineering Education (ASEE)

Steve's research has been funded by the NIH, NSF, DoD, AHA, the U.S. FDA, the Wallace Coulter Foundation, the Camille and Henry Dreyfus Foundation, the Arnold and Mabel Beckman Foundation, Johnson and Johnson, the Commonwealth of Pennsylvania and a number of other private foundations and industrial sources.

Finally, Steve is very active in educational charity and serves on the board of directors for EduNations, an organization that establishes educational infrastructure by building schools, training teachers and provides children with free education in Sierra Leone, Africa (consistently rated as the worst place to live on the planet).

Materials Genome Initiative

Government News

BIOMATERIALS AND BIO-ENABLED MATERIALS

BY CARL G. SIMON JR.

The Materials Genome Initiative (MGI) aims to help businesses develop new materials in "half the time at half the cost" by assembling multidisciplinary teams from academia, industry and government to generate predictive models of material structure-function relationships.[1,2] Core to this effort is analysis and modelling at multiple length-scales, which has spawned the MGI maxim "from atoms to airplanes." A workshop was held June 5-6, 2014 at Georgia Tech (Atlanta, Georgia) to discuss possible key elements of an interdisciplinary MGI research network and to establish a path toward its construction.[3] A breakout session on biomaterials and bio-enabled materials was held, which generated a report that identified key technology gaps, needed infrastructure and a road-mapping strategy. A white paper to document the findings of the workshop is available for download.[4] Critical issues that were identified for MGI biomaterials included standard test methods to enable comparability of results; collection of large data sets of comparable data for use in modelling; high-throughput methods for screening of protein/cell/bacteria/tissue interactions with materials; resources for sharing data to facilitate collaboration; predictive modeling directed at biomaterials (long length and time scales); interdisciplinary MGI biomaterials educational offerings; establishment of laboratories for collecting data and training (vertical); establishment of interdisciplinary pipeline laboratories (horizontal, cross-cutting); and a high-performance computing center for modeling and the establishment of a center for fabrication of advanced biomaterials.

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The Flipped Classroom at the Undergraduate and Graduate Level: A Brief Literature Review

BY YUSUF KHAN, EDUCATION NEWS CONTRIBUTING EDITOR

Some time ago the concept of active learning and the flipped classroom was discussed in this column. To remind you, a flipped classroom is a method of teaching in which the content that would typically be delivered during the class lecture is viewed online as a video presentation by the student prior to coming to class, giving the student the opportunity to become familiar with the content on their own time, and reserving class time for interactive learning, problem solving and quizzes to enforce the lessons within the lecture or any other strategy the instructor may use to reinforce the content. Much has been written about whether active learning and the flipped classroom is indeed successful. While the idea for a flipped classroom may have originated at the college level, it took strong hold in high schools where in some instances entire high school curricula were transformed so every class became a flipped classroom, and with great success. Less discussed, however, has been the efficacy of the flipped classroom at the undergraduate and graduate levels. Recent studies have begun to evaluate this more closely through assessment of student performance and also what specific aspects of this teaching style made the strongest impression on the participants.

The Studies

In 2013, Dove et al evaluated a statistics class at a community college that used the flipped approach and noted an increase in student grasp of content and the ability to control the pace of learning by having control over the pace of the lecture.[1] The students overall preferred the flipped approach over the conventional approach. In 2012, Stone et al compared the flipped classroom to a conventional teaching approach within the science curriculum at the University of Missouri-Columbia.[2] Two courses, general biology and a course on genetic diseases, implemented a flipped classroom and found increases in exam scores in both courses and an increase in assignment scores in general biology.[2] While not all data supports this trend, enough does to warrant consideration of the approach. Others have found similar trends and an overall agreement from students that the flipped approach helped them absorb the course material.

A Different Approach

In 2015, McCallum et al went beyond student performance as a metric and investigated why this approach was effective at the undergraduate level.[3] She published a study in 2015 that used student polling to better understand what it was about the flipped classroom that was enhancing student learning. Her data indicated that students become more engaged in the class and its content through enhanced academic involvement (viewing the recorded lectures with control over pace and review, enhanced note taking, collaboration during class through discussion, feedback and in-class activities), peer-to-peer involvement (course material discussion, group projects and problem sets during lecture) and greater student-faculty involvement (faculty more aware of students' knowledge of material, faculty more approachable and students more likely to ask questions).[3] So it seems like a good idea at the undergraduate level because in part it encourages the student to focus more on the class given the enhanced engagement with the material, fellow classmates and the instructor.

This requires the question: how successful would this approach be at the graduate level? It may be safe to say that graduate students, by virtue of being accepted into a graduate program, were already performing well at the undergraduate level and by applying to a graduate program they have self-selected programs in which they are already interested and more likely to focus their efforts. Further, student-faculty interactions are generally more common and facile at the graduate level, so one may ask whether the benefits of the flipped classroom seen at the undergraduate level would continue at the graduate level.

Flipped Classrooms for Graduates

Moraros et al addressed this question by evaluating the efficacy of the flipped classroom in master's-level graduate students in an introductory Epidemiology course.[4] The students were 60 percent female, 50 percent under age 25, 90 percent with bachelor's degrees as their highest level of previous education, 62 percent were North American and 90 percent felt comfortable with the use of computers. The flipped classroom content consisted of a video lecture and corresponding textbook chapter to be absorbed outside of class, in-class quizzes based on the lectures and readings, instructor-led questions and open discussion forums and class presentations. Results of the survey indicated that at least 50 percent of the class found the approach somewhat effective in promoting a better understanding of the topic, but interestingly, more international students (100 percent) found it helpful than North American students (67 percent). One particular reason for this was the ability for international students, some of whom may not have been

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3-D PRINTING IN DENTISTRY AND ORAL AND MAXILLOFACIAL SURGERY

BY SCOTT A. GUELCHER, PhD, VANDERBILT UNIVERSITY AND F. KURTIS KASPER, PhD, UNIVERSITY OF TEXAS HEALTH SCIENCE CENTER AT HOUSTON, SCHOOL OF DENTISTRY

Additive manufacturing (AM), the process by which an implant is built layer by layer followed by fusion of the layers, is emerging as a transformative technology for the manufacturing of custom implants for craniofacial surgery. The combination of 3-D modeling based on computed tomography (CT) or magnetic resonance imaging (MRI) with 3-D printing technologies, such as fused deposition modeling (FDM) or stereolithography (SLA), has enabled the fabrication of patient-specific, custom implants.[1] 3-D printing in biomedical applications utilizes polymers, ceramics, metals or transplanted cells. Due to their simplicity of manufacturing and relatively low cost, polymers comprise the largest market segment, with an estimated revenue of $190 million in 2014 and a forecasted growth rate of 13 percent by 2020.[2] In the dental and craniomaxillofacial surgery markets, 3-D-printed implants offer the advantages of anatomic conformity to the implantation site, enhanced cosmesis and shorter surgical times, and consequently have been actively adopted by surgeons and dental laboratories.[1] With a commercial value of $175 million, dental implants represented the largest share of the 2014 biomedical 3-D printing market, which is anticipated to continue to grow due to increasing demand for dental and craniomaxillofacial surgeries.[2]

The rapid evolution of 3-D printing and medical imaging technologies has been embraced in dentistry for a variety of applications, ranging from orthodontics to prosthodontics. The introduction of intraoral scanning devices and desktop scanning instruments has enabled 3-D digital representations of the surfaces of teeth to be generated either directly from the mouth of the patient or from a surface scan of a traditional cast dental model. In either case, the resulting digital file supports a rapid and efficient digital workflow to meet the unique treatment needs of the patient.[3,4] For instance, some orthodontic treatment approaches involve sequential manipulation of the positions of teeth in the digital file from the original position to a desired position, followed by 3-D printing of a polymer model of each iteration. The printed models, in turn, support the fabrication of a series of vacuum formed aligners for orthodontic tooth movement.[5,6] Similarly, a digital impression can be manipulated to facilitate the fabrication of dental restorations, such as bridges. A 3-D-printed wax or polymer positive of the planned restoration can be used in a lost wax casting process to fabricate the desired part.[4] Alternatively, emerging approaches seek to fabricate the restoration directly from the digital file though additive manufacturing techniques such as direct metal laser sintering.[7] Early adoption of 3-D printing technologies in dental applications has paved the way for broader medical applications, including craniomaxillofaical reconstruction.

3-D-printed dental model from the laboratory of Dr. Kurt Kasper. (Photo courtesy of Dr. Austin Ledingham)

Due to the complex anatomy of the face, reconstruction of craniomaxillofacial defects is challenging. Restoration of both form and function is critical for patient well-being. While autograft tissue is the current standard of care for craniomaxillofacial reconstruction, its use is limited by donor site morbidity, increased surgical time and expertise and the availability of donor tissue. These limitations have prompted investigation into alloplastic grafts for tissue reconstruction. Computer-assisted design (CAD) and computer-assisted manufacturing (CAM) techniques have enabled surgeons to visualize and design patient-specific implants pre-operatively.[1] The development of 3-D printing technologies has enabled the direct conversion of these 3-D models into custom patient-specific implants, which improves the conformity of the implant to the defect site, reduces surgical times and enhances cosmesis. Technologies such as FDM, SLA, selective laser melting (SLM), selective laser sintering (SLS) and electron beam melting (EBM) have been utilized with a variety of biomaterials, including titanium, poly(methyl methacrylate) (PMMA), hydroxyapatite (HA) and poly(ε-caprolactone) (PCL). Applications include cranioplasty,[8] reconstruction of the mandible[9] and mid-face[10] and dental implants.[11] The recent development of open-source 3-D printing systems further enables the fabrication of custom-designed implants with defined porosity and pore morphology.[12]

In addition to fabrication of alloplastic grafts, 3-D printing is also emerging as a novel approach for fabricating scaffolds with tunable mechanical and topological properties for investigating mechanisms of tissue restoration and repair or

the cellular response to therapeutics.[13,15] 3-D printing offers the advantage of precise control over topological properties, such as surface curvature, pore size, pore shape and porosity, which are known to influence cell fate. Thus, the features of the microenvironment that are specific to the tissue under investigation can be recapitulated in vitro.

Growing demand for 3-D-printed dental and CMF implants is anticipated to present new opportunities for innovation. The choice of materials, either for indirect applications (such as 3-D printed models to support the fabrication of orthodontic aligners) or direct application (such as implants), is a key element of the design. A broader range of materials that can be printed, particularly for resorbable devices, would facilitate the fabrication of implants with more tunable mechanical and degradation properties. Continuing improvements in digital work-flow will increase the efficiency of treatment planning and delivery. As 3-D-printed dental implants and appliances become more prevalent, regulatory considerations, particularly regarding direct contacting materials, will become increasingly important.

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Education News (continued from page 17)

100 percent fluent in English, to pause, stop and rewind the lecture content on their own time. This control over the pace of the lectures allowed them to revisit the content as many times as necessary to fully comprehend it. The authors of the study felt that this served to "level the playing field" and overcome language barriers, an important consideration with today's international pool of students.

Conclusion

It appears that the idea of a flipped classroom has benefits at both the undergraduate and graduate level. While it is an interesting idea, it is important to accept that this approach requires considerable time on the part of the instructor, but can also be implemented in pieces rather than all at once. For instance, one can provide a shorter lecture to the students outside of class, initiate the in-class activity based on that lecture and then provide short lectures during class to prepare the student for the next in-class activity. An abbreviated approach like this may be more realistic for those curious about the idea but unable or unwilling to fully adopt it. Have you flipped your classroom? I welcome your experiences so feel free to contact me (ykhan@uchc.edu).

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Undergraduate Student Accomplishments

SIG News

BY BRENT VERNON, ASSOCIATE PROFESSOR OF BIOMEDICAL ENGINEERING, ARIZONA STATE UNIVERSITY

During the 2015 Annual Meeting of the Society for Biomaterials (SFB), the Drug Delivery Special Interest Group (DD SIG) established The Society For Biomaterials Drug Delivery Special Interest Group Student Awards, a new initiative to build SIG recognition and to encourage students conducting drug delivery research to join the SFB and the DD SIG. This new program is to recognize student research accomplishment at both the undergraduate and graduate levels for research excellence demonstrated by work presented at the university, regional or national levels. These students will receive an award plaque from the DD SIG, recognition in the Forum and recognition on the SFB DD SIG webpage.

Eligibility

These awards are open to all undergraduate and graduate students at colleges and universities within the U.S. Students who attend university-wide and regional student research symposia where biomaterials and drug delivery research is presented are nominated by faculty members of the SFB DD SIG. The nominated student must have presented his or her research within the field of biomaterials and drug delivery either as a poster or oral presentation at the symposia. Active SFB DD SIG faculty members may nominate one student per event by submitting their nomination to green@jhu.edu within one month of the event. Nominees must be (or agree to become) SFB and DD SIG members if chosen as award recipients.

The Recipients

The first three recipients of this recognition are undergraduates Ayako Ohoka, James Shamul and Evan Chen. They were chosen based on their outstanding drug delivery research presented at the 2015 Biomedical Engineering Society (BMES) Annual Meeting in Tampa, Florida.

Ayako Ohoka presenting "Vibrational Spectroscopy and Imaging Reports Concurrent Cellular Trafficking of Co-Localized Doxorubicin and Deuterated Niosomes" at the 2015 Biomedical Engineering Society (BMES) Annual Meeting.

James Shamul presenting 'Amphiphilic Poly(β-amino ester)-Polyethylene Glycol Block Copolymer Micelles for Anti-Tumor Drug Delivery' at the 2015 Biomedical Engineering Society (BMES) Annual Meeting.

Evan Chen presenting "Optimization of Polymeric Nanoparticles for Intracranial Delivery of Radiosensitization Agents" at the 2015 Biomedical Engineering Society (BMES) Annual Meeting.

BY STEVE LIN, EXACTECH

On Dec. 18, the U.S. Congress provided final passage for a roughly **$1 trillion spending measure** and more than **$600 billion in tax breaks** that include a two-year suspension of the medical device tax and much more. The suspension of the **2.3 percent medical device excise tax** has been described as a jobs killer since it went into effect at the start of 2013. Other provisions worth noting include the R&D credit becoming permanent and the National Institutes of Health funding increasing $2 billion – to $32 billion – in fiscal year 2016.

A recent recall involving roughly 96,800 **InSync** III pacemakers has been given Class 2 status by the Food and Drug Administration (FDA). The recall, which covers three different models of the pacemakers, relates to a potential battery defect. The recall relates to more than 9,300 devices in the U.S. The battery problem could cause a variety of problems including the unexpected loss of pacing capture, erratic behavior, fluctuations in longevity estimates and inaccurate lead impedances.

Wright Medical was dealt a stinging blow in its courtroom battle over its metal hip implant devices, as a jury awarded a plaintiff $11 million in a bellwether trial over the products. An Atlanta jury found after a two-week trial and three days of deliberations that the plaintiff had a defective hip implant and that Wright misrepresented the device's safety, *Lawyers and Settlements* reports. The $11 million verdict, which includes $1 million in compensatory damages and $10 million in punitive damages, marks an early loss for Wright in federal multidistrict litigation over its implants.

The FDA has approved 98 percent of **PMA applications** during its most recent fiscal year – that ended Sept. 30 – marking the highest approval rate in at least 15 years and the first time the approval rate has been 90 percent or above since 2005. The percentage has been on the rise over the past five years. From a low point of 59 percent in 2010, it rose to 70 percent in 2011, 71 percent in 2012, 85 percent in 2013 and 86 percent in 2014, according to a recent FDA report. The average time to clear 510(k) submissions has also been trending downward, from a 2010 peak of 154 days to a projected 95 days in 2016. The 510(k) process is used to clear the vast majority of non-Class I medical devices whereas PMAs account for roughly 1 percent of device submissions to the FDA.

Dow and DuPont have agreed to merge in what the two companies term a "highly synergistic transaction" that will ultimately result in billions of dollars of cost savings and will create roughly $30 billion of market value. The plan was unanimously approved by the boards of directors at the two companies, and is scheduled to close in the second half of 2016, subject to customary closing conditions including approvals by regulators and both of the companies' shareholders. The $130 billion union is expected to produce triplets: The plan post-merger is to split **DowDuPont** into three companies — an agriculture company, material science company and a specialty products company that would be an electronics products leader.

The FDA has granted a PMA supplement approval to **Medtronic** for use of the Infuse synthetic bone graft with the spinal cages made of PEEK. The approval will enable the company to market Infuse for use in lateral and lumbar interbody fusion procedures, enabling its Clydesdale and Perimeter cages to be used with Infuse. Medtronic now faces thousands of injury claims related to the alleged off-label promotion of the Infuse product. In May 2014, Medtronic agreed to settle the claims of an estimated 950 plaintiffs for a total payment of $22 million.

The India health ministry has agreed to separate schedule M III of **India's Drug Rules**, which regulates medical devices, from schedule M, which controls pharmaceuticals, according to a report in the *Times of India*. The new regulations would also require efficacy and safety testing, and would seek to ensure that products made in India would be produced according to internationally recognized standards. The Indian medtech market is estimated to grow more than 10 percent in the next five years. Big players like **Becton, Dickinson & Co** and Siemens have made big investments in medical device manufacturing facilities in the country. The U.S.-India Business Council also expects India's medtech industry to grow sharply, from its current $4.4 billion in sales to $7 billion in 2016.

The FDA has received nearly 6,000 reports of problems related to **Essure**, a nickel and titanium coil contraceptive device made by Bayer. Many list multiple health problems. They include pain/abdominal pain (3,353), menstruation irregularities (1,408), headache (1,383), fatigue (966) and weight fluctuations (936). **Erin Brockovich** has helped lead a protest against the product and the **FDA advisory panel recommended** more limited use of Bayer's Essure contraceptive device amid complaints of health problems.

Here are the top 10 **Medtech States** based on a report by Qmed editors who weighed such factors as overall employees in the medtech sector, VC funding, annual patents granted and business friendliness: 1) California; 2) Minnesota; 3) Massachusetts; 4) Florida; 5) Indiana; 6) Pennsylvania; 7) New York; 8) Texas; 9) New Jersey; and 10) Utah. If you are interested in the entire report, visit directory.qmed.com/did-you-know-that-california-attracts-more-life-file059809.html.

Members in the News

BY ELIZABETH COSGRIFF-HERNANDEZ, MEMBER-AT-LARGE

Happy New Year. As a brief overview of my role as your 2015-2016 Member-at-Large, I serve as an unencumbered representative of the members on both the Board of Directors and the Council of the Society. In addition, I serve as your representative on other committees (e.g., Long Range Planning Committee) so that members have a clear voice in the direction of the Society. I would like to encourage all members to send me your ideas and feedback about the Society. With your help, we can continue to improve the Society and increase value for all of our members.

The University of Texas at Austin launched the university's first health care engineering institute dedicated to developing technologies and treatments that will transform healthcare. The **Institute for Biomaterials, Drug Delivery and Regenerative Medicine** led by **Professor Nicholas Peppas** brings together leading researchers in chemical and biomedical engineering who are investigating new ways to alter and improve the body's systems, repair failing organs and administer drugs and vaccines. The founding members of the institute include **Hal Alper, Aaron Baker, Amy Brock, Jennifer Maynard, Nicholas Peppas, Jeanne Stachowiak, Laura Suggs** and **Janet Zoldan.**

Robert Langer, David H. Koch Institute professor at the Massachusetts Institute of Technology, was awarded the Benjamin Franklin Medal in Life Sciences for his design and implementation of multiple innovative drug delivery systems, and for his founding work in the field of tissue engineering. Professor Langer was also awarded the Queen Elizabeth Prize for Engineering, a global prize that celebrates engineers responsible for a ground-breaking innovation that has been of global benefit to humanity.

Rena Bizios, Peter T. Flawn professor of biomedical engineering at the University of Texas at San Antonio, was elected to the National Academy of Medicine, one of the highest honors in the fields of health and medicine that recognizes individuals who have demonstrated outstanding professional achievement and commitment to service.

Kristi Anseth, Tisone Distinguished professor of chemical and biological engineering and a Howard Hughes medical investigator at the University of Colorado in Boulder; **Tony Lowman**, dean of engineering at Rowan University; and **Gary Bowlin** Herber Herff chair of excellence and professor of biomedical engineering at the University of Memphis, were elected to the National Academy of Inventors (NAI). Election to NAI Fellow status is a high professional distinction awarded to academic inventors who have demonstrated a prolific spirit of innovation in creating or facilitating outstanding inventions that have made a tangible impact on quality of life, economic development and the welfare of society.

Tony Mikos, Louis Calder professor of bioengineering and chemical and biomolecular engineering at Rice University, was awarded the Lifetime Achievement Award by Tissue Engineering and regenerative Medicine International Society – Americas. This award recognizes an individual who has contributed immensely to the tissue engineering and regenerative medicine field.

Ali Khademhosseini, professor at Harvard Medical School, was awarded the Kavli Early Career Award in Nanoscience from the Materials Research Society. This award recognizes significant novel contributions to materials science by a young researcher in early stages of his career. Professor Khademhosseini was also appointed as a Fellow within the Royal Society of Chemistry.

Cato Laurencin, university professor at the University of Connecticut and the Albert and Wilda Van Dusen distinguished endowed chair professor of orthopaedic surgery in the School of Medicine, was elected to the India Academy of Sciences and the Chinese Academy of Engineering.

Ahmed El-Ghannam, associate professor of tissue engineering and biomaterials in the department of mechanical engineering and engineering science at the University of North Carolina at Charlotte, was elected president of the International Society for Ceramics in Medicine.

Stuart L. Cooper, Professor of Chemical and Biomolecular Engineering at The Ohio State University, was voted in as president-elect of Sigma Xi and will serve as president beginning July 1, 2017.

The following SFB members were elected to the American Institute for Medical and Biological Engineering (AIMBE) College of Fellows. AIMBE's College of Fellows comprises around 1,500 individuals who have made significant contributions to the medical and biological engineering (MBE) community in academia, industry, government and education that have helped transform the world.

SFB MEMPHIS CHAPTER ADDS BIOMATERIALS TO PRIMARY SCHOOL EDUCATION

BY CHRISTOPHER J. GEHRMANN, STUDENT SECTION PRESIDENT-ELECT, UNIVERSITY OF MEMPHIS AND JOSHUA D. HERWIG, UNIVERSITY OF MEMPHIS


Christopher J. Gehrmann


Joshua D. Herwig

While the phrase STEM Education is ubiquitous and the appeal for members of the scientific community to engage in local outreach is a cliché, it is surprising that middle and high school students in some areas still receive little exposure to STEM careers. For example, 30 percent of the population of Memphis, Tennessee1 lives below the poverty line, and, as a result, many schools are ill-equipped to provide the education necessary to encourage students to pursue STEM careers. It is this community in which we saw the opportunity to establish an outreach program where Biomedical Engineering students could present general science and engineering principals through the lens of Biomaterials applications. The most recent success of our outreach effort has led to the establishment of the Bioengineering Club which aims to cultivate a genuine scientific curiosity in the minds of young students in the Memphis community.

Community Outreach

Our initial project was funded through an award from Society For Biomaterials (SFB) education challenge, which helped our group obtain the funds necessary for a Nitinol biomaterial demonstration aimed at middle school students. Although the single activity was a success, we began to search for other funding options to help increase our outreach opportunities and, subsequently, secured STEM education grants from the University of Memphis. With new funding we began testing small activities as part of outreach events on the university's campus and throughout the community at career fairs and other interactive forums with primary school students. Once we had enough activities to build a semester-long program, we reached out to a nearby middle school and began to hold club meetings where we led middle school students through hands-on biomaterials experiments.

The fall 2015 semester was our initial test of this curriculum, and through effective assessment of these activities we have found that our students have gained new interest and knowledge in biomaterials and the related engineering careers. Our final activity culminated the knowledge throughout the semester, which had students creating and crosslinking various hydrogels derived from food products in the classroom to understand the variations in biomaterial properties that can be achieved using simple chemistry. The success of this recent outreach activity has allowed us to expand to additional schools.

Beginning this spring semester, we will be starting a club at a local high school and more schools have reached out to us, expressing their interest in starting outreach programs at their school.

The Benefits of Outreach

The benefits of these biomaterials outreach activities are two-fold in that they not only help educate the community, but also help improve the teaching and communication abilities of our SFB chapter members who participate. Through these outreach opportunities, SFB stays active in learning new biomaterials applications and constantly connects with our community throughout the year. Our members are learning how to take complex ideas and understand them so well they can clearly explain them to students as young as 12 years old. The ability to reach audiences of various knowledge bases is invaluable in continuing to improve our scientific knowledge at the rate of discovery. In holding true our dedication to educating our community about biomaterials, we have presented our methods and results at the most recent SFB national meeting in Charlotte, North Carolina and will also be presenting our long-term work at the World Biomaterials Congress in Montreal, Quebec, Canada this year.

We hope that the successes and benefits we have achieved through our outreach serves as a model for other SFB student chapters as they seek to improve their community and to build their own proficiencies. What started out as a single, small activity with minimal funding, has flourished into a well-funded, continuous outreach program that is slowly reaching an entire city. People want to learn about science and engineering, and student members of the SFB can be the shepherds of the next generation of biomaterials scientists.

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- RT-2 CLINICAL ENTRY OF BIOMATERIALS AND BIOMATERIALS RELATED TECHNOLOGIES
- RT-3 LIFE-LONG LEARNING
- RT-4 AVENUES OF SCIENTIFIC INFORMATION DISSEMINATION

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