

**SFB OFFICER NOMINEES, SFB AWARDEES
UPDATE FROM DENTAL/CRANIOFACIAL
AND CARDIOVASCULAR SIGS**

BIOMATERIALS FORUM



OFFICIAL NEWSLETTER OF THE SOCIETY FOR BIOMATERIALS

FIRST QUARTER 2020 • VOLUME 42, ISSUE 1

ALSO INSIDE

**HISTORICAL FLASHBACK: OUR
COLLECTIVE LIVES IN SCIENCE**

BIOMATERIALS FORUM!

The official news magazine of the **SOCIETY FOR BIOMATERIALS** • Volume 42, Issue 1

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

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

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

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

Requests for advertising information should be directed to Amy Chezem at achezem@ahint.com or 856-439-0500. Information is also available on the Society's website, biomaterials.org.

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

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

Copyright © 2020 • ISSN 1527-6031
Society For Biomaterials
All rights reserved

Executive Editor Guigen Zhang, University of Kentucky
Phone: 859-323-7217 • Fax: 859-257-1856
Email: guigen.bme@uky.edu

Managing Editor Amy Chezem, Society For Biomaterials
1120 Route 73, Suite 200, Mt. Laurel, NJ 08054
Phone: 856-439-0500 • Fax: 856-439-0525
Email: achezem@ahint.com

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

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

**Society Business & Membership
News Contributing Editor** Cherie Stabler, University of Florida
Email: cstabler@bme.ufl.edu

**Special Interest Group News
Contributing Editor** Danielle Benoit, University of Rochester
Email: danielle.benoit@rochester.edu

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

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

**Education News
Contributing Editor** C. LaShan Simpson, Mississippi State University
Agricultural and Biological Engineering
Email: clsimpson@abe.msstate.edu

Historical Flashback Editor Guigen Zhang, University of Kentucky
Email: guigen.bme@uky.edu

Student News Contributing Editor Jason Guo, Rice University
Email: JLG19@rice.edu

SPECIAL INTEREST GROUP REPORTERS

**Biomaterials & Medical Products
Commercialization** Puneeth Shridhar • pus8@pitt.edu

Biomaterials Education Sarah Rowlinson • sarcorow@gmail.com

Biomaterial-Tissue Interaction Antonio Merolli • antonio.merolli@rutgers.edu

Cardiovascular Biomaterials Chris Bashur • cbashur@fit.edu

Dental/Craniofacial Biomaterials F. Kurtis Kasper • Fred.K.Kasper@uth.tmc.edu

Santiago Orrego • sorrego@temple.edu

Drug Delivery Eun Ji Chung • eunchung@usc.edu

Engineering Cells & Their Microenvironments Scott Wood • scott.t.wood@gmail.com

Immune Engineering Yaoying Wu • yw195@duke.edu

Nanomaterials Eno Ebong • e.bong@northeastern.edu

Ophthalmic Biomaterials Frances Lasowski • lasowsfj@mcmaster.ca

Orthopaedic Biomaterials Roche C. de Guzman • roche.c.deguzman@hosftra.edu

Protein & Cells at Interfaces Rafael Ramos • ramos.rafael93@gmail.com

Surface Characterization & Modifications Shaunak Pandya • pandyasg21@gmail.com

Tissue Engineering Abby Whittington • awhit@mse.vt.edu

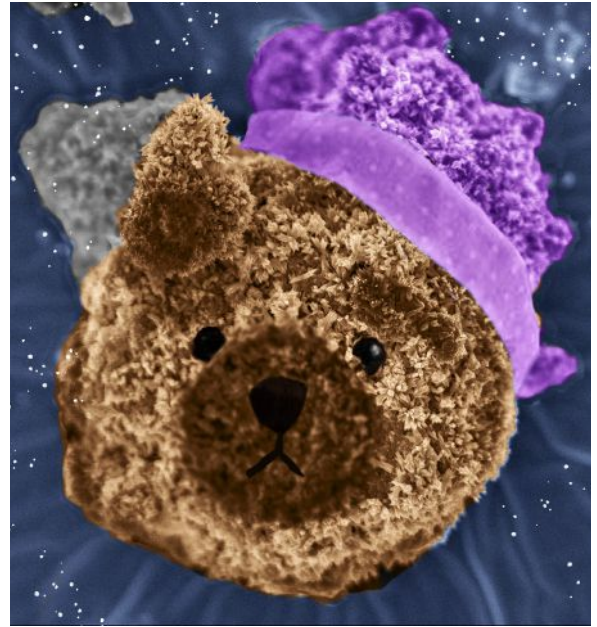
Contents

THE TORCH

- 4 FROM THE EDITOR
- 5 FROM THE PRESIDENT
- 6 HISTORICAL FLASHBACK
- 8 2020 AWARD RECIPIENTS
- 13 2020 OFFICER NOMINEES

NEWS & UPDATES

- 18 MEMBER NEWS
- 19 STAFF UPDATE
- 21 DENTAL/CRANIOFACIAL SIG UPDATE
- 23 CARDIOVASCULAR SIG UPDATE
- 25 INDUSTRY NEWS
- 26 GOVERNMENT NEWS



ON THE COVER

The cover image, provided by PhD student Natalia Pajares of Dr. Chatzistavrou's group at Michigan State University, shows an SEM image of the aggregate of biological hydroxyapatite crystal needles. These crystals were grown on the surface of silicate bioactive glass nanoparticles during immersion in simulated body fluid. The shape of the aggregate, and the texture and the size of the needles in the image resemble an adorable stuffed teddy bear.

From the Editor

THE NEW CLASS WAR

By Guigen Zhang, SFB Forum Editor



Recently, I read an article in the *Wall Street Journal* by Michael Lind (January 10, 2020) with the title "Saving Democracy from the Managerial Elite." The article attributed the ongoing turmoil in U.S. politics and in North America and Western Europe to the result of a new class war

between the managerial class or elites (represented by corporate managers, politicians, university professors and the like) and working-class people with no college education. I found the article relevant to many of the discussions surrounding us in academia, hence highlighting some of these arguments below. You are welcome to read it in its entirety to have a better sense of what the article is about.

Many elites in history have justified their largely hereditary privileges by a doctrine of noblesse oblige, which imposes special military or economic obligations on members of the ruling class. But today's managerial elite is different. The pretense that it springs solely from "merit" — from individual talent and hard work — creates a false sense of superiority for its members, stoking resentment among their fellow citizens, who are defined as failures in fair competition.

...

In the U.S. and Western Europe after World War II, the power of the managerial minority in the economy, the culture and politics was limited by a variety of extra-governmental checks and balances. Unions checked the power of private sector managers. Influential churches and civic organizations, through mass organizations like the National Legion of Decency, limited the cultural power of the commercial mass media. And parties accountable to ordinary voters through local political machines checked the power of national politicians and elite bureaucrats.

...

Successful populists can channel legitimate grievances. But populism is a symptom of a sick body politic, not a cure. History shows that populist demagogues are less likely to reform the system than to sell out to the existing establishment or build corrupt personal political machines, steering government patronage to supporters. When a society is trapped in a vicious circle in which patronizing oligarchs alternate with populist hucksters, economic growth and the rule of law are endangered.

...

Ending the new class war in the U.S. and Europe will require a new era of genuine power-sharing by today's power-hoarding managerial overclass. The trade unions, powerful religious organizations and local political machines of the 20th century

will not return. Their 21st-century equivalents are needed, in the form of mass membership organizations accountable to working-class people rather than to elite donors or granters. Only genuine bottom-up institutions can allow working-class citizens to exercise countervailing power against the elite by pooling the only resource they have: their numbers.

...

To reduce the sense of powerlessness that populist demagogues exploit, conservatives must acknowledge the legitimacy of collective bargaining, in the private sector if not in the public sector, while progressives must accept that religious diversity requires respect for fellow citizens who belong to traditional religious and moral subcultures. In a modern economy that is naturally dominated by large firms, it is absurd to pretend that working-class employees have any bargaining power as individuals.

...

Today's angry voters do not need handouts or diversionary culture wars. They need power and respect.

To close, let me briefly tell you what we have prepared for you in this issue. You will read the Letter from the President by Horst von Recum, Members in the News by Cherie Stabler, Staff Update by Shena Seppanen, Student News by Jason Guo and updates from the Dental/Craniofacial Biomaterials SIG and Cardiovascular Biomaterials SIG. In our regular columns, you will read Industry News by Steve Lin and Government News by Carl Simon. In this issue, we also feature for you a historical flashback piece by Anne Meyer, past SFB President.

This is also the time for SFB members to elect the next slate of SFB leaders, including President-Elect and Member-At-Large. To help you cast your votes, we provide in this issue a biographical sketch and vision statement for all candidates. The Society also celebrates the accomplishments of our members by recognizing some of them with prestigious awards. In this issue, you will read more about these award winners and their accomplishments.

I would encourage all SFB members to share with us any thoughts, ideas and stories you might have.

All the best,

Guigen Zhang

From the President

By Horst von Recum, SFB President



Dear Society,

We have now passed the halfway point in my term as your President. It has been a good year with many changes and improvements, hopefully leading to a Society with a strong, positive trajectory.

This past quarter, Johns Hopkins University held its 4th Annual Biomaterials Day. There are nine Biomaterials Day events planned to take place by the end of the year. If you are in a region served by a Biomaterials Day, please make a strong effort to attend. These events have hands-down been amazing successes and have opened the door to new generations of biomaterials colleagues. If you haven't had a Biomaterials Day in your region, please consider working with colleagues to submit a grant application to host one in our next funding cycle.

Exciting changes have been afoot at Association Headquarters and in the administrative leadership of our Society. Many of you may remember Brittany Noll, who served as our Assistant Executive Director and worked capably in many areas, including helping with our SIGs. We are sad that Brittany is no longer working with our Society and has moved on to another position; we wish her the best. We are very fortunate to have Shena Seppanen step up to take Brittany's former role and more! Shena previously served in the Society as our Membership Coordinator and has been working with me leading several initiatives to help ensure that membership remains positive and strong. If you have a chance, please congratulate Shena on her new position. We hope for many productive years together.

A quick reminder that it is currently election season. Please remember to (1) pay your membership dues and (2) vote for your Board members, including President and Member-at-Large, in that order. Having served in both positions, I can testify firsthand the importance of these positions in the leadership of the Society and toward the future of the field of biomaterials. Fortunately, we have an excellent slate of candidates, so our future is guaranteed to be in good hands.

Lastly, don't forget to register for the World Biomaterials Congress in Glasgow from May 19 – 24, 2020. It seems like I have been talking about it for a while, but this meeting is just around the corner, and based on the program I have seen, it looks to be another excellent meeting thanks to the efforts of the European Society For Biomaterials and others. As a reminder, this year we will not hold our own Annual Meeting but rather will hold our Annual Business Meeting at the World Congress. If you are unable to join us in Scotland, make plans to attend our joint symposium in Hawaii from December 11 – 13, 2020, held in conjunction with the Japanese Society For Biomaterials, where sessions will be focused on implant pathology, polymers, hard materials and tissue engineering.

Otherwise, continue to carry on leading your own biomaterials communities at home!

Look forward to seeing you in Glasgow.

Best Wishes,
Horst von Recum

CALL FOR COVER ART

WE WANT TO FEATURE YOUR EXCITING BIOMATERIALS ARTWORK ON THE COVER OF BIOMATERIALS FORUM.

Deadline: Accepted on a rolling basis.

Instructions: Please email artwork (digital images, artistic creations, etc.) to the Executive Editor of the *Biomaterials Forum*, Guigen Zhang, guigen.bme@uky.edu. All artwork with biomaterials relevance that have not appeared as a *Forum* cover are welcome. Multiple submissions are permissible.

Description: Selected artwork will appear as the cover of a future issue of *Biomaterials Forum* along with a brief "On the Cover" description of the subject and name/affiliation of the creator.

Format: High-resolution electronic version in .gif, .tiff or .jpeg file format.



Historical Flashback

OUR COLLECTIVE LIVES IN SCIENCE

By Anne Meyer, SFB Past President, 2004 – 2005



Editor's Notes: For this issue of the Historical Flashback column, I asked Dr. Anne Meyer (pictured left) of the University at Buffalo to share with us her journey into biomaterials science and her experience with SFB. Dr. Meyer is a Fellow of the American Institute of Medical and

Biological Engineering and a Fellow of Biomaterials Science and Engineering. She has been an SFB member since 1985 and has served SFB in many important roles, including on the SFB Council for 14 years and as Member-at-Large (1998 – 1999), Secretary-Treasurer (2000 – 2002) and President (2004 – 2005), to name just a few. She has been recognized with the prestigious SFB C. William Hall Award (2002) and the SFB Award for Service (2014). Below you will read in her own words.

I think that it is fair to say that each of us approaches new and continuing challenges within the context of our life experience, curiosity and our appreciation (i.e., knowledge) of the talents of the people around us. For example, early life experience is often crystallized by repeated guidance from family members — phrases and admonitions that we carry with us for many years and

that, like it or not, are usually the first mental yardsticks against which we measure new situations and challenges. In my case, the ringing phrases of childhood and adolescent years were my mother's "Don't make blanket statements!" and my father's "Do you think that's wise?" Well, it was no big surprise that I headed in the direction of a life in science — cautiously, of course.

Later, I was fortunate to work with Bob Baier at Calspan Corporation (formerly the Cornell Aeronautical Lab in Buffalo, New York) and the University at Buffalo for a total of 42 years. Bob, who passed away early in March 2019, was a founding member of SFB and our President from 1992 – 1993. Throughout his lifetime, he was an avid reader, not only in widely diverse areas of science and engineering but also in the great literature of the world's religions and history. I bet that many of you have similar reading habits. Good! Bob's curiosity drove his overwhelming goal to answer questions, small and large, using the approach that "everything is connected to everything else." This was his mantra, which he repeated often in our lab, during meetings with students and colleagues and in the classroom. It stuck and gave all of us the freedom to explore. In the midst of



Bob Baier and Anne Meyer together in the seminar room holding very large barnacle shells recovered from a wooden pier. (Now THAT's bioadhesion!)

Historical Flashback (continued)

exploration, many of you, as current and former students (do we ever stop being students?), may have felt relieved when a mentor or teacher used the familiar statement, "There are no stupid questions; sometimes there are stupid answers." Bob Baier occasionally used the statement, but he expected us to make progress with the context and quality of our questions. When frustrated by someone he was mentoring, Bob would say, "Don't work hard; work smart!" It was clear, however, that he did both.

Due to new construction and planned renovations on University at Buffalo's three campuses in and near the city, the building that housed the office and seminar space for our Center for Biosurfaces and the biomaterials graduate program is slated to be turned over to another decadal unit within the coming year. Displacement and change can be difficult, but it has given me the opportunity to see the benefits of consolidation of teaching, administration and lab/research activities in one building; on the other hand, I will miss the dedicated thinking time that walking from one side of campus to the other provided. The pending move also has forced the pace on working through more than 40 years of paper and electronic files, slides, journals, books, samples, fish tanks and other research and work-related memorabilia collected by my departed colleague and me. An early challenge was learning how to humanely kill the many small fish in three aquaria that we used for preliminary biofouling experiments over the years. The Australian SPCA website came to my rescue on that one. Our research group moved and decluttered in the past, but the "everything is connected to everything else" mantra was always somewhat of a curse when it came to making a major dent in what remained. Another benefit of this consolidation of old files is the opportunity to revisit all the hard (and smart) work that was done in collaboration with numerous students and colleagues in the U.S. and around the world. Much of the research was inspired and brought to fruition by conversations at and follow-up after

national and international conferences. SFB Annual Meetings and quadrennial World Biomaterials Congress (WBC) meetings were key sources of that inspiration.

Like many conferences, the SFB and WBC meetings provide opportunities to exercise your curiosity in several venues: in the podium, poster and exhibit sessions, yes, but also in meeting hallways, at break sessions and meals, and in the bars. At the 2020 WBC in Glasgow, if you are relatively new to this, remember that there are no stupid questions. Which brings me to the importance of knowing about the talents of the people around us. Actively listening in the sessions is critical, much like a journalist's approach to following a news story: WHO? (connect the talent with the work), WHAT? (obviously), WHERE? (context of research in a particular area of the world), WHY? (obviously), WHEN? (context of progress of research toward reaching a goal) and HOW? (this makes a big difference when comparing data and results from different sources).

I have participated in several WBC meetings over the years and enjoyed them all. The abstract collections for many of them were thick paper volumes, which required some creative problem-solving when it was time to pack the suitcase and head home. For the 2000 WBC in Hawaii, part of the shipment of the multivolume abstract books never arrived in Hawaii, leaving conference organizers to scramble and arrange to send the missing volume to many attendees in the weeks after the meeting. It did, however, make for a lighter load on the way home for some of us. I will admit to being one of the people who still prefer paper to electronic abstract collections, mainly because I have a tendency to put the USB drive from the meeting in a "good place" and then lose track of it. As you might guess, my colleague, Bob, was an over-achiever in many ways; one of which was to finish reading the entire set of abstracts (every darn page) either by the time the plane landed in Buffalo or within a few days after. This is one way that he kept up with what people were doing in the field. Then the phone, fax (remember that?) and email contacts would begin. The science is important, but who can forget the training we received on moose calls during the 2016 WBC in Montreal? That's a special talent, and I still practice as a rank amateur from time to time. You may have your own favorite recollection from a past meeting, or you will be especially impressed by something at the Glasgow meeting this year. I encourage each of you to keep the lessons and good stories in your head and your heart and share them with your own students and colleagues as we move forward in our collective lives in science.

I want to thank Guigen Zhang for inviting this retrospective and congratulate him on keeping the *Biomaterials Forum* informative and relevant during his years as Editor.



Bob Baier and Anne Meyer having fun with students using a macro-contact angle measurement device that someone built for Bob.

Society For Biomaterials 2020 Award Recipients

The following professionals are recognized for their outstanding achievements in and contributions to the biomaterials field. Each award recipient will be honored at the World Biomaterials Congress (WBC) during SFB's Annual Business Meeting in Glasgow, Scotland, on Thursday, May 21, 2020, at 12:30 pm. We are also working with WBC organizers to allow Founders; Technology, Innovation & Development; Mid-Career; and Young Investigator Award recipients to deliver full award addresses during the WBC.

FOUNDERS AWARD

The Founders Award is based upon long-term, landmark contributions to the discipline of biomaterials.



Kristi S. Anseth, PhD

University of Colorado at Boulder

Dr. Kristi Anseth is the Tisone Distinguished Professor of Chemical and Biological Engineering and head of academic leadership of the BioFrontiers Institute at the University of Colorado at Boulder. Her research interests

lie at the interface between biology and engineering, where she designs new biomaterials for applications in drug delivery and regenerative medicine. Dr. Anseth is an elected member of the National Academy of Engineering, the National Academy of Medicine, the National Academy of Sciences, the National Academy of Inventors and most recently the American Academy of Arts and Sciences. She is the youngest to be elected to all of these academies and one of only two women. Dr. Anseth has been active in the Society For Biomaterials for her entire career, is a past recipient of the Clemson Award for Basic Research and is currently a Fellow. Dr. Anseth also serves the broader biomaterials community through her service on the Board of Governors for the Acta journal series, which supports the Acta Biomaterialia Gold Medal and Acta Biomaterialia Silver Medal awards; as President of the Materials Research Society; and as the current Vice Chair and Chair-Elect of the National Academy of Engineering's Bioengineering Section. Dr. Anseth is also a Fellow of the American Association for the Advancement of Science (AAAS), the International College of Fellows of Biomaterials Science and Engineering, the American Institute for Medical and Biological Engineering (AIMBE), the American Institute of Chemical Engineers and the Materials Research Society. She currently serves on the Board of Directors of the American Institute of Chemical Engineers, the Board of Trustees for Gordon Research Conferences and on the Scientific Advisory Board of the Allen Institute. Dr. Anseth currently serves as an Editor for *Biomacromolecules* and *Progress in Materials Science*.

CLEMSON AWARD FOR APPLIED RESEARCH

This award is given for the development of a useful device or material that has achieved widespread usage or acceptance or expanded knowledge of biomaterials/host tissue relationships that has received widespread acceptance and resulted in improvements in the clinical management of disease.



Jeffrey M. Karp, PhD

Brigham and Women's Hospital

Through working at the interface of material science, biology, engineering and medicine, Dr. Jeffrey Karp's highly interactive and collaborative group engages outstanding scientists and clinicians at MIT, Harvard,

Brigham and Women's Hospital, Boston Children's Hospital, Massachusetts General Hospital and surrounding hospitals and institutions to develop technology for addressing major unmet needs in healthcare. His group has developed a new tissue glue that works inside a beating heart, followed by a device for its minimally invasive placement. Dr. Karp's group has also been studying degradable prodrug-based self-assembled hydrogels as controlled drug delivery systems and has recently identified agents on the U.S. Food and Drug Administration's (FDA) generally recognized as safe list that can be self-assembled into targeted, controlled release drug delivery hydrogels for treatment of tissue and organ transplants and ulcerative colitis. For this work, Dr. Karp received the 2011 Society For Biomaterials Young Investigator Award. He has extensive expertise in the development of bioengineered stem cell therapies to treat a wide range of diseases and has significant expertise with the manipulation and modification of cells to enhance control following transplantation and in providing new perspectives in the area of cell therapy and cell homing. Dr. Karp's group also recently developed a culture technology to expand Lgr5+ intestinal stem cells in near pure form in vitro.

"WE ARE PROUD TO HONOR THESE
EXTRAORDINARY MEMBERS OF SFB.
THEIR RESEARCH TRULY EMBODIES THE
INTERSECTION OF BASIC AND APPLIED
RESEARCH THAT IS THE FOCAL POINT OF
OUR SOCIETY."

—HORST VON RECUM, PHD, SFB PRESIDENT

Society for Biomaterials 2020 Award Recipients (continued)

CLEMSON AWARD FOR BASIC RESEARCH

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



Joyce Y. Wong, PhD

Boston University

Dr. Joyce Wong is professor of biomedical engineering and materials science and engineering at Boston University. Her research focuses on developing biomaterials for early detection and treatment of disease by

understanding cell-material interfaces. Current projects include bioengineered patches to treat congenital heart defects in pediatric patients, targeted ultrasound theranostic agents to treat abdominal surgical adhesions, and targeted nanoparticle magnetic resonance imaging contrast agents for early detection and treatment of cardiovascular disease. More recently, her research has broadened to focus on women's health, investigating and mitigating endocrine-disrupting environmental effects (e.g., from high-performance polymers) on maternal health. Her research spans basic science and engineering to translational research. Her efforts in translational research have been informed by her teaching courses in biomaterials science and engineering and in diagnostic device design, as well as being a graduate of the National Science Foundation's (NSF) Innovation Corps program. She is an NSF CAREER and Hartwell Foundation Individual Biomedical Research awardee. Her contributions to science have been recognized by her being named a Fellow of AAAS, AIMBE and the Biomedical Engineering Society (BMES).

CLEMSON AWARD FOR CONTRIBUTIONS TO THE LITERATURE

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



John P. Fisher, PhD

University of Maryland

Dr. John Fisher is the Fischell Family Distinguished Professor and Department Chair in the Fischell Department of Bioengineering at the University of Maryland. Dr. Fisher is

also the director of the newly established National Institute of Biomedical Imaging and Bioengineering/National Institutes of Health (NIBIB/NIH) Center for Engineering Complex Tissues, which aims to create a broad community focusing on 3D printing and bioprinting for regenerative medicine applications. As the director of the Tissue Engineering and Biomaterials Laboratory, Dr. Fisher's group investigates biomaterials, stem cells, bioprinting and bioreactors for the regeneration of lost tissues, particularly bone, cartilage and cardiovascular tissues. His group has also developed strategies for the 3D printing of a variety of tissue engineering biomaterials and scaffolds, developed an innovative perfusion bioreactor that consists of a tubular reactor chamber that contains a population of millimeter-scale engineered tissue grafts, and established one of the first tissue-engineered models of the human placenta. Dr. Fisher has been elected Fellow of both AIMBE and BMES.

Dr. Fisher is currently the Co-Editor-In-Chief of *Tissue Engineering* and has co-edited six texts in the field of tissue engineering. In 2014, Dr. Fisher was elected Chair of TERMIS-AM and in 2018 started his term as Chair of the society after serving three years as Chair-Elect.

C. WILLIAM HALL AWARD

The C. William Hall Award honors industry and government members who have made a significant contribution to the Society and have an outstanding record in establishing, developing, maintaining and promoting the objectives and goals of the Society.



Carl Simon, PhD

National Institute of Standards and Technology

Dr. Carl Simon is a biologist and project leader in the Biomaterials Group at the National Institute of Standards and Technology (NIST). He earned a BS in biology from Bucknell University in 1992 and a PhD in biochemistry from the University of

Virginia in 1998, where his thesis focused on signal transduction during human platelet aggregation. He trained as a postdoctoral fellow in the NIST Polymers Division and became a staff scientist at NIST in 2003. He has led projects on tissue engineering and biomaterial scaffolds with a focus on cell-material interactions since 2007. Dr. Simon is Chair of ASTM Committee F04.43, "Cells and Tissue Engineered Constructs for TEMPs," where documentary standards are being developed to support the development of medical products. Dr. Simon is active in the Society For Biomaterials, the International Organization for Standardization, TERMIS, CASSS and Phacilitate and is on the editorial board for *Biomaterials* and the *Journal of Biomedical Materials Research Part B: Applied Biomaterials*.

Society for Biomaterials 2020 Award Recipients (continued)

BIOMATERIALS AWARD FOR SERVICE

The Biomaterials Award for Service is presented to an individual or corporate or government entity who has provided significant service to the Society by establishing, developing, maintaining and promoting its objectives and goals.



Jeremy Gilbert, PhD

Clemson University

Dr. Jeremy Gilbert is Principal Investigator, Hansjörg Wyss Endowed Chair for Regenerative Medicine, and Director, CU-MUSC Bioengineering Program at Clemson University.

He is currently Editor-In-Chief of the *Journal of Biomedical Materials Research Part B: Applied Biomaterials* and Past-President of the Society For Biomaterials. Dr. Gilbert was elected as a Fellow of AIMBE in 2004. He is the founder of the Syracuse Biomaterials Institute at Syracuse University. Dr. Gilbert has served on numerous national and international panels and editorial boards, including chairing the National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS) special study section for the SBIR/STTR program; as a panel member for the NIH/NIAMS special emphasis panel on musculoskeletal tissue engineering; and serving on several other ad hoc panels for NIH, NIBIB and NIAMS. He has also participated in the NIH Consensus Development Conference on Total Hip Replacements in 1994 and the FDA panel on orthopedic and rehabilitation devices. Dr. Gilbert previously served as an Assistant Editor for the *Journal of Biomedical Materials Research Part A*, twice chaired the organizing committee for ASM International's Materials and Processes for Medical Devices Conference (2007 and 2009), served as a peer reviewer for the National Sciences and Engineering Research Council of Canada and served as a reviewer for over 25 scientific journals.

TECHNOLOGY, INNOVATION & DEVELOPMENT AWARD

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.



National ESCA and Surface Analysis Center for Biomedical Problems (NESAC/BIO)

University of Washington

- Buddy Ratner, PhD, University of Washington
- David Castner, PhD, University of Washington
- Lara Gamble, PhD, University of Washington

Under the leadership of Profs. Buddy Ratner (director, 1983 – 1996), David Castner (director, 1996 – 2017; co-director, 2017 – present) and Lara Gamble (assistant/associate director, 2004 – 2015; co-director 2017 – present), NESAC/BIO has for 35 years been the world's premier biomedical surface analysis center. During this time, NESAC/BIO has made significant advances in the state-of-the-art of biomedical surface analysis by developing new tools and methodologies for characterizing the surface composition and structure of biomaterials and biomedical devices. These advances and developments have been disseminated to the biomaterials community through numerous collaborations, publications, invited lectures and workshops (including several workshops at SFB conferences), benefiting researchers developing novel biomaterials and optimizing the performance of existing biomaterials.

MID-CAREER AWARD

The Mid-Career Award recognizes an individual SFB member who has demonstrated outstanding achievements in and/or contributions to the field of biomaterials research.



Natalie Artzi, PhD

Brigham and Women's Hospital and MIT

Dr. Natalie Artzi is an assistant professor at Brigham and Women's Hospital, Harvard Medical School. She is a principal research scientist at the Institute for Medical Engineering and Science at MIT and is an associate member

of the Broad Institute of Harvard and MIT. Leveraging material science, chemistry, imaging and biology, Dr. Artzi's group is dedicated to designing smart material platforms and medical devices to improve human health. Her multidisciplinary team works on developing materials for diagnosis and therapy and exploiting the toolkit available for material scientists to create multifaceted medical devices. Dr. Artzi served as part of the Scientific Advisory Board of *Science Translational Medicine*, and as a dedicated mentor, she initiated a student exchange program between ORT Braude College in Israel and MIT that provides undergraduate students with the opportunity to perform a year of internship under her supervision.

Society for Biomaterials 2020 Award Recipients (continued)

YOUNG INVESTIGATOR AWARD

The Young Investigator Award recognizes an individual who has demonstrated outstanding achievements in the field of biomaterials research.



Cole A. DeForest, PhD

University of Washington

Dr. Cole DeForest is a formally trained chemical engineer with additional expertise in material science, organic synthesis, polymer chemistry, bioengineering, biophysics, protein engineering and photochemistry. He is currently

the Dan Evans Career Development Assistant Professor in the Departments of Chemical Engineering and Bioengineering at the University of Washington and a core faculty member of the Institute for Stem Cell & Regenerative Medicine. His research establishes multidisciplinary methodologies to mimic, exploit and quantify biology's 4D complexity, ultimately paving the way to new therapeutic targets and treatments of disease through a fundamentally transformed knowledge of basic cell physiology. Dr. DeForest served previously as a postdoctoral research fellow with Prof. David Tirrell in the Division of Chemistry and Chemical Engineering at the California Institute of Technology. His research in the Tirrell lab focused on the development of a novel class of engineered protein therapeutics whose delivery profile can be dictated precisely with light, offering promising new avenues in needleless treatment of chronic illness and early stage detection of disease. Dr. DeForest obtained his PhD in chemical engineering from the University of Colorado Boulder in 2011. As a graduate student in Prof. Kristi Anseth's laboratory, he developed novel polymer-based hydrogel materials for use in regenerative medicine and tissue engineering applications, for which he received graduate student research awards from the Society For Biomaterials, the American Chemical Society and the Materials Research Society. His graduate work was funded through NIH, the U.S. Department of Education, and University of Colorado fellowships and has appeared in journals including *Nature Materials*, *Nature Chemistry* and *Angewandte Chemie*.

STUDENT AWARDS FOR OUTSTANDING RESEARCH

The Student Awards for Outstanding Research recognize individuals who have demonstrated outstanding achievements in the field of biomaterials research. It should be noted that each year, the Society plans to make three Student Awards for Outstanding Research. However, this year, the committee felt so strongly that all four candidates were worthy of this recognition that committee members voluntarily contributed the funds necessary to make a fourth award. The Society is very lucky to have such an amazing group of volunteers and extends our thanks to Awards, Ceremonies and Nominations Committee members for their generous support!

STUDENT AWARD FOR OUTSTANDING RESEARCH — PHD



Erika Cyphert

Case Western Reserve University

Erika Cyphert, a graduate research assistant in the Center for Delivery of Molecules and Cells, has received two fellowships: an American Heart Association Predoctoral Fellowship and an NSF Graduate Fellowship. Cyphert works under the tutelage of Horst von Recum, professor of biomedical engineering and principal investigator in the Center for Delivery of Molecules and Cells, which focuses on creating polymers for drug delivery for a wide range of diseases. Her main focus has been the development of refillable antibiotic poly(methyl methacrylate) bone cement delivery system, optimization of broad-spectrum antimicrobial bone cement and parametric analysis of mechanical properties of bone cement and refilling based on preparation technique. Cyphert is also a Fulbright Research Scholar who worked on the development and characterization of biodegradable sponges for cisplatin delivery for osteosarcoma and the development of blend sponges for long-term refillable cisplatin delivery systems.

STUDENT AWARD FOR OUTSTANDING RESEARCH — PHD

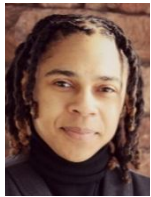


Jason Guo

Rice University

Jason Guo is currently a PhD candidate at Rice University. He received his BS in biomedical engineering from Northwestern University. His research is focused on developing modular, injectable hydrogels for the repair of bone and cartilage tissue in the lab of Dr. Antonios Mikos. Guo has published his graduate research in high-impact journals such as *Science Advances*, *Biomaterials* and *Materials Today*. He has also co-authored three book chapters and received several university- and national-level awards for his academic research. Guo currently serves as President of the Society For Biomaterials' National Student Chapter and has also served as President of his university's Graduate Student Association. Guo has received several competitive awards and fellowships for his accomplishments in the lab, and he has been recognized as a Rice University Future Faculty Fellow, Smalley-Curl Institute STAR Fellow and TERMIS Student Scientist Award recipient. Furthermore, he has demonstrated significant achievement in sharing his scientific research with the broader academic community, and he has presented at nine academic conferences, including a recent rapid-fire oral presentation at the 2019 SFB Annual Meeting.

Society for Biomaterials 2020 Award Recipients (continued)

STUDENT AWARD FOR OUTSTANDING RESEARCH — MASTERS**Aundrya Montgomery**

University of Connecticut

Aundrya Montgomery received her BS in biology from Alabama State University and graduated with honors, including both magna cum laude and W.E.B. DuBois Honors Program distinctions. Montgomery

is a current scholarship awardee in the Young Innovative Investigator Program at the Connecticut Institute for Clinical and Translational Science at UConn Health and studies under Dr. Cato T. Laurencin. She received her MS in biomedical science while conducting research at the Institute for Regenerative Engineering, where she was primarily focused on developing bioengineered strategies geared toward the regeneration of a human finger.

STUDENT AWARD FOR OUTSTANDING RESEARCH — MASTERS**Tinke De Witte**

Delft University

Tinke De Witte studied biomaterials and tissue biomechanics in Delft University of Technology's biomedical engineering program, led by Dr. Amir A. Zadpoor. She also performed her graduate research project under joint

supervision of Dr. Zadpoor and Dr. Nicholas A. Peppas. De Witte is the recipient of the James McGill Scholarship and the International Entrance Award. She completed her MS thesis on bone tissue engineering via growth factor delivery, which was published in *Regenerative Biomaterials*.

STUDENT TRAVEL FELLOWSHIP AND SCHOLARSHIPS**CATO T. LAURENCIN TRAVEL FELLOWSHIP**

The Cato T. Laurencin Travel Fellowship, named in honor of a distinguished member of the Society For Biomaterials, supports underrepresented minorities in the field of biomaterials. For more information about the Cato T. Laurencin Travel Fellowship, please visit the SFB [webpage](#).

**Alessia Stewart**

North Carolina A&T State University

Alessia Stewart attends North Carolina A&T State University as an undergraduate research lab assistant in the Department of Biomedical Engineering and the NSF Research Center for Revolutionizing Metallic Biomaterials.

Under the direction of Dr. Narayan Bhattarai, she is focused on optimizing nanofiber technology. Stewart also has prior experience working as an undergraduate research lab assistant in North Carolina A&T's Biomaterials & Tissue Engineering Research Lab. She is a Secretary of the BMES e-board and was

selected as a participant of the Global Leaders in Engineering Program. Currently, she is conducting an individual research project focused on the preparation and characterization of polycaprolactone nanofiber meshes.

**Helena Freire Haddad**

Northwestern University

Helena Freire Haddad is an undergraduate student at Northwestern University working under the direction of Prof. Guillermo Ameer in the Center for Advanced Regenerative Engineering. Growing up

in Brazil, she witnessed many epidemics of infectious diseases, such as dengue fever and the Zika virus. The devastation caused by these disasters inspired her to pursue a degree in biomedical engineering so that she could make an impact in medicine and healthcare technologies. Under the supervision of Dr. Ameer, she is exploring how antibody production in response to previous exposure to poly(ethylene glycol) affects poly(ethylene glycol)-based therapeutics, including PEGylated islet transplantation.

C. WILLIAM HALL TRAVEL SCHOLARSHIP

The C. William Hall Travel Scholarship honors the memory of the Society's first President, C. William Hall. The travel fellowship supports a junior or a senior undergraduate pursuing a bachelor's degree in bioengineering or a related discipline. For more information about the C. William Hall Travel Scholarship, please visit the SFB [webpage](#).

**Tran Ngo**

University of Florida

Tran Ngo is a biomedical engineering undergraduate student at the University of Florida, working under Dr. Christine E. Schmidt. Ngo's research is focused on fabrication and characterization of hyaluronic acid (HA)-based hydrogel scaffolds for peripheral nerve regeneration. She is exploring the use of HA-based hydrogel scaffolds as potential bioinks for 3D printing, aimed at developing new bioink for preparing 3D-printed hydrogel scaffolds for neural tissue engineering. Currently, Ngo has designed experiments and 3D-printed the cells together with an HA-collagen hydrogel. She has also received numerous awards and scholarships, including the DAAD RISE Scholarship, the McNair Scholars Program, the Inez Culp Goodrum Scholarship and the Machen Florida Opportunity Scholars Program.

A special thank you to the Awards, Ceremonies and Nominations Committee members: Chair Liisa T. Kuhn, PhD; Susan Napier-Thomas, PhD; Robert Hastings; Rena Bizios, PhD; Peter G. Edelman, PhD; and Clemson representative Delphine Dean, PhD, for their time and volunteer efforts selecting these prominent scientists to receive these prestigious awards.

Officer Nominees

PRESIDENT-ELECT

The President-Elect shall become familiar with the duties of the President and shall, at all times, cooperate and assist with the duties of that office. In the absence of the President, the President-Elect shall preside at the meetings of the Society, the Council and the Board of Directors and perform the duties and exercise the powers of President. The term of office is for a period of one year without succession. The President-Elect shall coordinate the duties of Council regarding the long-range direction and future of the Society.



L.D. Timmie Topoleski (Tim), PhD

University of Maryland, Baltimore County

Biographical Sketch

Dr. L.D. Timmie Topoleski is a professor in the Mechanical Engineering Department at the University of Maryland, Baltimore County (UMBC). He joined UMBC faculty in the fall of 1990 after earning his PhD in bioengineering from the University of Pennsylvania. He received his BS, MEng and MS from Cornell University. His research interests are in the mechanics of materials for both manufactured implant materials and biological tissue. He has been awarded the Outstanding Teaching and Outstanding Research awards from UMBC's College of Engineering and Information Technology, was named a UMBC Humanities Teaching Fellow and the UMBC Honors College Faculty of the Year, and was listed as one of UMBC's "Professors Not to Miss" by the Office of Undergraduate Education. He was elected to two terms as the President of the UMBC Faculty Senate (2009 – 2011) and was named the UMBC Presidential Teaching Professor (2008 – 2011). He recently served as the Interim Chair for his department. He has been actively involved in promoting and supporting diversity at UMBC and beyond; he has served as an advisor for the Meyerhoff Scholars Program, is the faculty advisor to the UMBC chapter of the National Society of Black Engineers and sits on the Internal Advisory Board of UMBC's Center for Women in Technology. In his local community, he is currently an appointed member of his county school board's Ethics Review Panel.

Dr. Topoleski has been an active member of the Society For Biomaterials since he was a graduate student. He has been a member of the SFB Council in several roles, serving as Member-At-Large (2007 – 2008), Chair of the Bylaws Committee and parliamentarian (2002 – 2007), Chair of the Orthopaedic Biomaterials SIG (1999 – 2000), orthopaedic biomaterials organizer for the 6th World Biomaterials Congress (WBC) (2000), member of the Long-Range Planning Committee (2013 – 2014), Chair of the Education & Professional Development Committee (2014 – 2015) and Program Chair for the 2013 SFB Annual Meeting in Boston (2012 – 2013). He helped to organize the initial China-US Joint Forums on innovation and regulation

of biomaterials and has been actively involved in joint US-China initiatives since. Since 2016, he has served as the Chair of the Liaison Committee, where he has helped to foster collaborative initiatives between SFB and other societies, both domestic and international. He received a Mark B. Coventry, MD Award for Basic Science from the Knee Society. He joined the College of Fellows for the American Institute for Medical and Biological Engineering (AIMBE) in 2008 and was recently elected as a Fellow of the International College of Fellows of Biomaterials Science and Engineering, to be inducted at the WBC in Glasgow in 2020. He served on the editorial board for the *Journal of Biomedical Materials Research Part A* and currently serves as an Associate Editor for the *Journal of Biomedical Materials Research Part B: Applied Biomaterials*. He was a member of the Board of Directors/Leadership Board of the Maryland chapter of the Arthritis Foundation (2007 – 2011). He is a visiting scientist at the U.S. Food and Drug Administration (FDA), engaged in regulatory science within the Office of Science and Engineering Laboratories.

Vision Statement

It is an honor to be nominated for the position of President-Elect of the Society For Biomaterials. SFB is my professional home and has been since I was a graduate student. It has been an extraordinary forum for developing and maintaining collegial relationships, interacting with mentors and collaborators, and stimulating discussions and is an amazing source of education. SFB is the preeminent leader in promoting education and research in biomaterials science, and my overall vision is that we will continue in this role and enhance our reputation as prominent contributors to human health and quality of life.

If I am elected, one of my main priorities will be to provide increased value to SFB members. For example, I will work to increase the quality and value of our Annual Meeting. In addition, I will continue to promote and support venues beyond the Annual Meeting, such as our regional Biomaterials Days, and to foster interactions between members throughout the year.

I am especially invested in continuing the growth of the educational mission of SFB, in both formal scientific training and professional development. I believe that one of our priorities is working with and supporting our student and early career members and providing opportunities for mentoring and professional growth. To that end, I am committed to advocating and ensuring that SFB will continue to be a welcoming environment for all members. I will continue to champion diversity and inclusion, which will encourage networking opportunities and provide a welcoming forum for presenting and discussing cutting-edge research and emerging science in biomaterials.

Officer Nominees (continued)

Another of my goals will be to continue to foster relationships between academics, industry and government/regulatory agencies to increase the visibility of SFB and to promote our role in improving healthcare. I will use my experience as Liaison Committee Chair and as a visiting scientist at the FDA to continue to build bridges between the different stakeholders in the biomaterials community. SFB members have made significant and outstanding contributions toward improving human health and quality of life, and I will work to increase the visibility of those contributions. I will continue to work with other societies and professional groups to expand our interactions and open new venues for sharing our research and knowledge.

I have worked with the UMBC Meyerhoff Scholars Program for many years, and one of its main tenets is "from those to whom much is given, much is expected." I have been privileged to develop my career within the Society For Biomaterials and to work with the Society members, the Board of Directors and Council in various capacities. If elected, I would be honored to "give back" to SFB and continue to represent and work to achieve the expectations and goals of Society members.



Guigen Zhang, PhD

University of Kentucky

Biographical Sketch

Dr. Guigen Zhang is the Halcomb Endowed Chair, professor and Department Chair (2017 – present) of the F. Joseph Halcomb III, MD Department of Biomedical Engineering at the University of Kentucky. Prior to that, he was professor (2008 – 2017) and Associate Chair (2015 – 2017) of the Department of Bioengineering at Clemson University, director (2014 – 2017) of Clemson's Institute for Biological Interfaces of Engineering, and director (2014 – 2017) of Clemson's Call Me Doctor underrepresented minority (URM) graduate Fellows program. While at Clemson, Dr. Zhang spearheaded the effort by the Provost's Office and launched Clemson's Tiger Talents URM postdoctoral Fellows program in 2015, which has become an effective means to advance faculty diversity at Clemson. Dr. Zhang is currently working with colleagues at the University of Kentucky on similar programs.

Dr. Zhang holds a BS in solid mechanics, an MS in mechanical engineering and a PhD in bioengineering. After receiving his PhD from Clemson in 1994, he went to Northwestern University for postdoctoral training and was promoted to research assistant professor in 1997. In 2001, Dr. Zhang joined the faculty of the University of Georgia and was promoted from assistant to associate professor in 2005. During his years at Georgia (2001 – 2008), Dr. Zhang played a crucial role in laying the foundation for the establishment of the College of Engineering.

Over the years, Dr. Zhang has pursued research to advance biomedical innovation through integrated experimentation and computation. He has published extensively in the areas of biosensors, biomechanics, biological materials and composite biomaterials. His research has been funded by diverse funding sources, ranging from the National Institutes for Health (NIH), the National Science Foundation (NSF) and the Bill and Melinda Gates Foundation to venture groups, state-level startup funds and the Kentucky Horse Racing Commission, as well as industry. Dr. Zhang holds numerous patents and has authored and edited three books, among them an *Introduction to Integrative Engineering* textbook. Dr. Zhang has been the keynote and invited speaker at numerous international conferences, including the Venture Biomed Conference in Verbier, Switzerland, and the Organisation for Economic Co-operation and Development Conference in Paris, France.

Dr. Zhang has served the Society For Biomaterials in various leadership roles, including on the SFB Council (2016 – present) and in numerous SIGs and committees: the Surface Characterization and Modification SIG (Chair, 2017 – 2019); the Awards, Ceremonies and Nominations Committee (2017 – 2018); the Publications Committee (2016 – present); the Liaison Committee (2016 – 2018); and the Program Committee (various years). He has also served as the *Biomaterials Forum's* Education Editor (2006 – 2011) and Historical Flashback Editor (2014 – present). Dr. Zhang is currently Editor-In-Chief of the *Biomaterials Forum* (2016 – present) and one of the four new editors for the *Biomaterials Sciences* textbook, 4th edition, which supports SFB through textbook royalty donations. Dr. Zhang has also held leadership positions in other societies. He was President (2017 – 2018) of the Institute of Biological Engineering; a founding society member of AIMBE, of which he has been a Fellow since 2014; and the Founding President (2015 – 2019) of the Chinese Association for Biomaterials, a worldwide association of Chinese scholars in the fields of biomaterials for promoting the advancement of biomaterials science and education through international collaboration.

Vision Statement

I am deeply honored to be nominated for the position of President-Elect of the Society For Biomaterials. Since my first SFB Annual Meeting in 1993 as a graduate student, SFB has become my professional home for over 25 years and a critical source of mentorship, friendship and collaboration throughout my career. Having the opportunity to serve SFB in this role would provide me the opportunity to give back and contribute to an organization that has meant so much to me, both professionally and personally.

Officer Nominees (continued)

If elected President-Elect, I will work diligently with the President, Past-Presidents, Editors, SIG officials, student representatives and all members to ensure that SFB continues to thrive in a fiscally responsible way as (1) the primary home for biomaterialists in academia, clinical practices, industry and government representing diverse experiences, cultures and backgrounds; (2) the community for networking and collaborating for the development of biomaterials-enhanced technologies that make impactful results in improving patients' lives; and (3) the international leader in promoting biomaterials research and education and nurturing future cadres in our profession.

I will focus my efforts on these areas:

Pursuing Scientific Excellence and Inclusion. I will work to enhance the scientific quality of our meetings, programs and various publications. Taking on such challenges will require a community of experts with diverse cultural, social and technical backgrounds and active participation of constituents from academia, clinical practices, industry, regulatory agencies and standards bodies, among others. Hence, I will also work to expand diversity and inclusion in SFB's leadership and encourage broad participation in shaping the future of our Society.

Enhancing the Viability of SFB. Each of us can attest to the fact that the life and blood of our Society is our students. Aside from expanding successful programs such as Biomaterials Days and the Mentoring Program, I will work to bring more tangible benefits to students/trainees attending Annual Meetings by working with SFB members and leaders to implement strategies to encourage our active members to provide constructive feedback during student/trainee oral and poster presentations. I will work with senior members to preserve wisdom, historical stories, accidental discoveries and inventions in biomaterials that have brought impactful results to improving millions of lives and compile them into books with royalties donated to help expand SFB's student activities and awards.

Expanding SFB's Visibility and Global Reach. We must remain relevant beyond our own scientific community. I will reach out to other societies for joint scientific events to address health challenges through convergence of diverse disciplines, work with SFB leadership and international colleagues toward hosting the 2028 WBC to frame the future of biomaterials research and education in a global context, and partner with advocacy groups (e.g., AIMBE) to share SFB's successes and expertise with policymakers to inform new policies on biomedical research and education.

I believe that my past professional experiences, my long-term commitment and my active involvement will serve as guiding forces as I work with SFB members to achieve the goals outlined above.

MEMBER-AT-LARGE

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



Christopher A. Siedlecki, PhD

Pennsylvania State University

Biographical Sketch

Dr. Christopher Siedlecki is the Jane A. Fetter Professor of Surgery and a professor of biomedical engineering at the Pennsylvania State University College of Medicine in Hershey, Pennsylvania. Dr. Siedlecki received his BS in biomedical engineering from the Milwaukee School of Engineering and his MS and PhD in biomedical engineering from Case Western Reserve University, where he worked with Dr. Roger Marchant developing methods to use scanning probe microscopies for studying blood-materials interactions. Dr. Siedlecki carried out postdoctoral work at Eli Lilly Pharmaceuticals in Indianapolis studying mechanisms of aggregation of insulin, where he was also an Industrial Fellow in the Center for Interfacial Engineering at the University of Minnesota. In 1999, Dr. Siedlecki joined the faculty at Pennsylvania State University, where his group carries out research in the Cardiovascular Biomaterials Laboratory and the Division of Applied Biomedical Engineering (formerly the Artificial Organs Division). In 2009, Dr. Siedlecki was awarded the Case Western Reserve University Biomedical Engineering Alumni Distinguished Early Career Award as part of the university's Biomedical Engineering Department's 40th anniversary celebration. In 2011, Dr. Siedlecki was named the Jane A. Fetter Professor of Surgery at the Pennsylvania State University College of Medicine.

Dr. Siedlecki's research interests include blood-biomaterial interfaces, hematology in medical devices, thrombogenesis, the prevention and treatment of infection in medical devices, applications of nanotechnology in medical devices, and biomaterials surface science. Dr. Siedlecki has studied both the basic science of blood coagulation and blood interactions with materials as well as applied biomaterials development in the realm of ventricular assist devices and other blood-contacting medical devices. This research has been funded by NIH, NSF and the American Heart Association, in addition to private foundations and industrial support. Dr. Siedlecki's former postdocs and students can be found in faculty positions in U.S. and international academic institutions, in leadership positions in industry and in direct medical care.

Dr. Siedlecki has previously served as Chair, Vice Chair and Secretary-Treasurer for the Protein and Cells at Interfaces SIG and was the SIG representative to the Board of Directors from 2009 – 2011. Dr. Siedlecki has been a member of the SFB

Officer Nominees (continued)

Program Committee five times, and in 2016 he was co-program coordinator for SFB Satellite Meetings. In addition, Dr. Siedlecki has served on SFB's Membership Committee and the Awards, Ceremonies and Nominations Committee. Dr. Siedlecki is the current Section Editor for biomaterials and tissue engineering with the *ASAIO Journal* and was previously an Associate Editor for the *Journal of Biomedical Materials Research B: Applied Biomaterials*. Dr. Siedlecki is on the editorial boards for the *Journal of Biomedical Materials Research A*, the *Journal of Biomedical Materials Research B: Applied Biomaterials* and *Colloids and Surfaces B: Biointerfaces*. Dr. Siedlecki has served on a wide variety of NIH, NSF, international, state and foundation grant review groups and has been Chair for the Hematology Small Business Study Section, Biomaterials, Drug Delivery and Nanotechnology Small Business Study Section, and the Biomaterials and Biointerfaces Study Section Trailblazer Review Panel.

Vision Statement

I am honored to be nominated for the Member-At-Large position for SFB. I believe that my experience and background in basic science and device development while located in a hospital setting will allow me to represent the Society's academic, industrial, government and clinical membership.

This Society has been my home since my first Annual Meeting in Birmingham, Alabama, in 1993, and the friendships I have made in this Society have been invaluable to my career. My experience with the Society has given me the opportunity to observe our strengths and areas for growth. SFB relies on the enthusiastic participation of our membership. We must continue to offer value to our members and encourage them to become active in the Society, whether as contributors to SIGs, members of our committees, abstract reviewers or eager attendees to the Annual Meeting. This means not only encouraging our current members to take advantage of the opportunities we offer but also expanding our community. If elected, I envision working with our members on the following emphasis areas:

Encourage Trainees to Continue in SFB. At each meeting, we witness junior scientists giving presentations, attending sessions to learn about new areas and developing their own professional networks. Biomaterials Days across the country offer these trainees the opportunity to organize a meeting and to engage with high-level speakers. Too often, though, these trainees lose contact with the Society upon graduation, particularly those who move to industry. We can develop strategies to ensure that our enthusiastic junior scientists transition to enthusiastic senior scientists. This could include increased opportunity for early career member participation in Society committees, opportunities to retain engagement with postdocs as they explore areas outside the traditional biomaterials experience and increased mentoring of junior scientists as they transition from school to permanent positions.

Strengthen Our Bridges to Industry. Ultimately, our biomaterials science is intended to treat patients and improve the health of our world. Industry is the link from our basic science studies to the clinic. For too long, industry was not emphasized strongly enough in our Society. The past few years have seen a dramatic increase in industry recognition through the Biomaterials Technology in Industry tracks at the Annual Meeting and Program Committee Co-Chairs encompassing both academic and industry representation. We need to continue to increase our value to our industry colleagues by ensuring that the critical component they play in our Society continues to be recognized.

Engage Our Clinical Colleagues. The members of our Society engaged in clinical research and patient care represent our link to treating patients. These members bring a distinctive knowledge set to the Society, and we have opportunities to learn the unique and difficult challenges they face in treating patients with our science. Increased emphasis on the role that clinical scientists play in our Society can be an effective way to understand the important aspects and potential pitfalls in bringing our work to those we seek to help.



Joyce Y. Wong, PhD

Boston University

Biographical Sketch

Dr. Joyce Wong is professor of biomedical engineering and materials science and engineering at Boston University. Her research focuses on developing biomaterials for early detection and treatment of disease by understanding cell-material interfaces. Current projects include bioengineered patches to treat congenital heart defects in pediatric patients, targeted ultrasound theranostic agents to treat abdominal surgical adhesions, and targeted nanoparticle magnetic resonance imaging contrast agents for early detection and treatment of cardiovascular disease. More recently, her research has broadened to focus on women's health, investigating and mitigating endocrine-disrupting environmental effects (e.g., from high-performance polymers) on maternal health. Her research spans basic science and engineering to translational research. Her efforts in translational research have been informed by her teaching courses in biomaterials science and engineering and in diagnostic device design, as well as being a graduate of the NSF Innovation Corps program (2015).

Dr. Wong has published more than 110 peer-reviewed publications, has five pending or issued patents and has mentored more than 100 trainees. She is an NSF CAREER and Hartwell Foundation Individual Biomedical Research awardee. Her contributions to science have been recognized by her being named a Fellow of the American Association for the

Officer Nominees (continued)

Advancement of Science (AAAS), AIMBE and the Biomedical Engineering Society (BMES). She has extensive service and leadership experience in the area of biomaterials. She was Chair of the Gordon Research Conference in Biomaterials and Tissue Engineering (2009), Conference Co-Chair of the 90th American Chemical Society Colloid & Surface Science Symposium (2016) and is Chair-Elect of the AIMBE College of Fellows. From 2011 – 2014, she served on the Board of Directors of BMES and is currently a council member of TERMIS-AM. She currently serves as Associate Editor (Americas) of the journal *Drug Delivery and Translational Research*. She also serves on the editorial advisory boards of several journals (*Scientific Reports*, *Cellular and Molecular Bioengineering*, *Biointerphases*, *Polymer Reviews*, *IEEE Open Journal of Engineering in Medicine and Biology*, *Regenerative Therapy*, and *Matter*). She was Section Editor of biomaterials in “Biomedical Engineering Fundamentals” in the CRC Press *Biomedical Engineering Handbook* and a 2017 volume organizer for the Materials Research Society Bulletin.

Dr. Wong is highly committed to diversity and inclusion. Since 2014, Dr. Wong was appointed the inaugural director of a Boston University Provost initiative promoting women in STEM at all levels at the university: ARROWS (Advance, Recruit, Retain and Organize Women in STEM). ARROWS promotes community building and provides programming for all career levels, spanning from undergraduate to graduate to postdoctoral to faculty. In 2018, she received the Advocate of the Year Award from Boston University’s Graduate Women in Science and Engineering. She was Co-Chair of AIMBE Women (2016 – 2018), where she invited Dr. Richard Nakamura (NIH Center for Scientific Review) to share his efforts to detect bias in peer review and representatives from NSF and the National Academies to share their policies and findings, respectively, regarding sexual harassment in the academy. In 2019, she led Boston University’s team in receiving an AAAS STEM Equity Achievement (SEA) Change Bronze Award. Boston University’s SEA Change Bronze Action Plan focuses on effecting institutional change to increase the number of women and URM women in STEM faculty.

Vision Statement

I am honored to be considered for the Member-At-Large position. If elected, I will work hard to continue SFB’s tradition of providing high value to its members. As an SFB member since 2002, I participated in Annual Meetings, organized sessions, presented a tutorial and reviewed abstracts. I also served on the International Advisory Board for the European Society For Biomaterials and chaired a session for the Chinese Society

For Biomaterials. I held leadership positions in other scientific societies intersecting with biomaterials and thus accumulated a broad perspective in biomaterials science and engineering.

Entering the new decade, it is constructive to reflect on our field’s history within the context of SFB’s mission. First, the 2010 Panel on the Biomaterials Grand Challenges laid out key scientific and engineering knowledge gaps in developing biomaterials and medical devices addressing patient needs. While advancing significantly since 2010, much work remains. Second, integrating recent advancements (e.g., data science, digital health, rapid manufacturing, synthetic biology) into biomaterials science and engineering can enable novel technological breakthroughs (e.g., wearables, smart implants). Achieving this still requires basic understanding of how biomaterials interact with the human body. Third, SFB’s mission is “to enhance human life and quality of life.” Patients lack agency in healthcare, yet in the classroom, we engage patients as stakeholders. Examples include undergraduate device/diagnostics design courses, such as the one I teach at Boston University, and other design courses taught in similar biomaterials undergraduate and graduate programs. SFB could partner with patient advocacy groups as some scientific societies do (e.g., American Heart Association) to better understand and address unmet needs through biomaterial design, manufacturing and implementation.

When addressing these grand, new challenges for the next decade, we must ensure a diverse membership: We simply cannot lose any talent. Diversity of thought is vital when solving large, complex problems; lack of this stagnates science. Diversity not only refers to race, ethnicity and gender, but also to discipline. For example, early substantive interactions with clinicians accelerates the clinical translation process. SFB membership sectors include academia, industry, government and clinic. However, increased collaborative efforts between clinicians, scientists and engineers can improve clinical translation. This can be facilitated by gathering granular data of our member demographics, which currently lacks a specific category for clinicians. For race, ethnicity and gender, collecting and de-identifying demographic data would enable benchmarking and assessing efficacy of programmatic efforts, ensuring diverse membership. Furthermore, by focusing on relatable problems and solutions enhancing quality of life, we can attract the best members to SFB.

Member News

By Cherie Stabler, Member-at-Large



I am so honored to serve as your 2019 – 2020 Member-at-Large representative! In this role, I strive to provide your collective voice to the SFB Board and Council. I am actively working to support and expand our supportive and engaging community with broad and diverse membership engagement. Please feel free to share your ideas and concerns with me directly at cstabler@bme.ufl.edu.

Some of this quarter's exciting member news and accomplishments:

Kristi Anseth, a distinguished professor and Tisone professor in the department of chemical and biological engineering at the University of Colorado Boulder, was recently awarded the *L'Oréal-UNESCO For Women in Science Award*. Dr. Anseth was recognized for her "outstanding contribution in converging engineering and biology to develop innovative biomaterials that help tissue regeneration and drug delivery". She was one of only five women in the world to receive this award and the only one from North America.

Rena Bizios, the Lutcher Brown Chair and professor of biomedical engineering University of Texas at San Antonio, was recently elected a *Corresponding Member of the Academy of Athens*, which is the national academy of Greece.

Leslie Chow, assistant professor in material science and engineering and in bioengineering at Lehigh University, was recently named a *National Science Foundation (NSF) Faculty Early Career Development (CAREER) Program Award Winner* from the Biomaterials Program on the project entitled, "CAREER: Developing Spatially Organized Biomaterials to Engineer Complex Tissue Interfaces."

David Kohn, professor in biomedical engineering, **Jan Stegemann**, professor in biomedical engineering, and **Lonnie Shea**, William and Valerie Hall Chair and Steven A. Goldstein Collegiate Professor in biomedical engineering, received a \$12.5 million award from the University of Michigan Biosciences Initiative to establish a center for Engineering Cell Programmable Biomaterials for Dental and Musculoskeletal Health. This initiative, established by the President of the university, is aimed at creating interdisciplinary solutions to critical problems in the life sciences. The center will focus on the development of advanced materials that control the programming of cells and the

resulting development and spatio-temporal organization of tissue to organize cells in 3-D, and be bolstered by new faculty hires.

Cato Laurencin, Albert and Wilda Van Dusen Distinguished Professor of orthopaedic surgery and chemical, materials and biomedical engineering at the University of Connecticut School of Medicine, and his co-author **Aneesah McClinton**, surgical resident recently published an article in the journal *Regenerative Engineering and Translational Medicine* that proposes a systematic method to assess potential cell-based therapies in regenerative medicine to enhance the clarity and consistency in the regulation of these products. doi.org/10.1007/s40883-020-00147-1.

Chelsea Magin, assistant professor of pulmonary sciences and critical care medicine, and medicine and bioengineering at CU Denver and the CU Anschutz Medical Campus, has been named a *National Science Foundation (NSF) Faculty Early Career Development (CAREER) Program Award Winner*. This award, funded by the NSF Division of Materials Research is entitled "Spatiotemporally addressable hydrogel biomaterials as tools for investigating fibroblast mechanobiology."

Antonios "Tony" Mikos, the Louis Calder Professor of Bioengineering and of Chemical and Biomolecular Engineering at Rice, was awarded the 2020 Founders Award of the Controlled Release Society (CRS). This award acknowledges Mikos' "seminal contributions and 35-year leadership for drug and protein advanced controlled release systems and for pioneering studies on cell delivery for regenerative medicine." Dr. Mikos will receive this award at the annual CRS meeting (Las Vegas, NV) in June 2020.

The 4th edition of *Biomaterials Science: An Introduction to Materials in Medicine*, edited by **William Wagner**, director of the McGowan Institute for Regenerative Medicine and Distinguished professor of surgery, bioengineering and chemical engineering, University of Pittsburgh; Shelly Sakiyama-Elbert, Departmental Chair and professor, Fletcher Stuckey Pratt Chair and Cockrell Family Chair at the University of Texas Austin; Guigen Zhang, Departmental Chair and professor, F. Joseph Halcomb III Endowed Chair; and Michael Yaszemski, professor of orthopedics and biomedical engineering, was recently released by Elsevier.

Staff Update

By Shena Seppanen, Assistant Executive Director



Greetings from the Society For Biomaterials headquarters! Following is a summary of the actions and plans for the Board, Council, committees and task forces.

BOARD/COUNCIL — PRESIDENT: HORST VON RECUM, PHD

The Council has created a Diversity and Inclusion Task Force. Charges were reviewed at the recent Council meeting, and the current plan is to codify this task force as a permanent committee with a bylaws amendment to be voted upon at the 2021 Annual Meeting. The Board also recently approved proposals to host the 2023 Annual Meeting in San Diego, California, and to hold the Bash for the 2021 Annual Meeting in Chicago at the Adler Planetarium.

AWARDS, CEREMONIES AND NOMINATIONS COMMITTEE — CHAIR: LIISA KUHN, PHD

Officer candidate information and award announcements are being featured in this issue of the *Forum*. All active and retired members are eligible to vote. The deadline to vote is Thursday, April 16, 2020.

Please start thinking about possible nominations for next year — especially those who may have interest in serving on the Society's Board of Directors as President-Elect, Secretary-Treasurer-Elect, and Member-at-Large.

BYLAWS COMMITTEE — CHAIR: ASHLEY CARSON BROWN, PHD

The committee will be reviewing the bylaws and discussing amendments, including the addition of a Diversity and Inclusion Committee, as mentioned above.

EDUCATION & PROFESSIONAL DEVELOPMENT COMMITTEE — CHAIR: ANIRBAN SEN GUPTA, PHD

The committee has reviewed and funded all 2020 Biomaterials Days grants. All are in the process of being scheduled and developed. Students and postdocs who register for a Biomaterials Day event will be eligible to receive a promotion code for a discount on their 2020 membership dues.

Anirban Sen Gupta worked with SIG Representative Danielle Benoit to reach out to SIG Chairs and solicit topics for webinars for their individual SIGs. Topics are currently being developed, and a webinar schedule is being created for 2020. The first webinar, "Making Scientific Presentations," was hosted on Thursday, February 27, 2020, at noon Eastern. This recording, and all previous webinar recordings, are available at www.biomaterials.org/webinars.

FINANCE COMMITTEE — CHAIR: SARAH E. STABENFELDT, PHD

After the success of the 2019 Annual Meeting in Seattle, 2019 projections indicate a healthy net income for 2019. The retained earnings should stabilize resource requirements for the 2020 World Biomaterials Congress (WBC) year. The SFB 2020 budget was approved with investments in Biomaterials Days, a new marketing initiative and a breakeven budget for the Fall Symposium being held in Hawaii in December 2020, which is jointly sponsored by the Japanese Society For Biomaterials.

INDUSTRIAL AFFAIRS COMMITTEE — CHAIR: SUPING LYU, PHD

The committee is co-sponsoring a Biomedical Engineering Materials and Applications Roundtable on March 8 and 9 in Washington, DC, with the National Academies titled "Issues and Opportunities Regarding the Availability of Biomaterials and Services for the Medical Device Industry." The committee also plans to organize a panel discussion for device companies, suppliers and government agencies to harmonize regulatory efforts and stabilize supply chains at the 2021 Annual Meeting.

LIAISON COMMITTEE — CHAIR: TIM TOPOLESKI, PHD

At this year's WBC event, SFB will be pitching to host the 2028 WBC. The committee also continues to evaluate endorsement requests, with nine endorsements awarded since April 2019.

MEMBERSHIP COMMITTEE — CHAIR: C. LASHAN SIMPSON, PHD

Current membership stands at 1,468, with 716 active, 97 post-grad, 50 retired and 605 student members. The committee continues to develop strategies to increase membership, especially focusing on industry and clinical sectors. The committee will be distributing a two-part member needs assessment survey to gauge satisfaction of SFB's benefits to current members and to ask for ideas and feedback to improve and add value. In addition, the committee will be sending an exit survey to members who chose not to renew their 2020 dues so that the Society can better focus efforts to retain and engage.

PROGRAM COMMITTEE — CHAIRS: ELIZABETH COSGRIFF-HERNANDEZ, PHD, AND NICHOLAS P. ZIATS, PHD

The 2020 Society For Biomaterials Fall Symposium will take place in Honolulu, Hawaii, December 11 – 13, 2020. The call for abstracts will be issued in the first quarter of 2020.

SPECIAL INTEREST GROUPS — REPRESENTATIVE: DANIELLE BENOIT, PHD

An All-SIG Mixer has been planned for the WBC in Glasgow on Saturday, May 23, 2020, at the Kelvingrove Art Gallery and

Staff Update (continued)

Museum. All SFB members are welcome to attend. Many SIGs will also be sponsoring student awards at the WBC. The Protein and Cells at Interfaces SIG recently voted to change its name to the Biointerfaces SIG, and this change was approved by the Council.

NATIONAL STUDENT CHAPTER/YOUNG SCIENTIST GROUP — JASON GUO (STUDENT CHAPTER PRESIDENT) AND BRIAN AGUADO, PHD

The SFB National Student Chapter and the Young Scientist Group will be co-sponsoring a joint mixer on Thursday, May 21, 2020, at the WBC in Glasgow. The event will be held at the Glasgow Science Centre. All SFB student members, Young Scientist Group members and young investigator groups from the European and Canadian societies are welcome to join.

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

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

Student News Update

By Jason Guo, National Student Chapter President



Greetings, SFB student members and young scientists! For those of you attending the upcoming 2020 World Biomaterials Congress (WBC), I'd like to share two events hosted by SFB's [Young Scientist Group](#) (YSG).

STUDENT AND YOUNG SCIENTIST EVENTS AT WBC 2020

- Workshop 9: Communication and Networking for Young Biomaterials Investigators (Tuesday, May 19, 2020, 1 – 5 pm); sign-ups available during the WBC registration process
- Young Scientist Mixer hosted with the European Society For Biomaterials' Young Scientist Forum and the Canadian Biomaterials Society (Thursday, May 21, 2020, Glasgow Science Centre)

The workshop will be a great chance to learn new strategies for communicating your science in oral and written form! It's also a unique opportunity to strengthen your networking skills in an international forum with other young scientists and professionals. The mixer is guaranteed to be loads of fun, and we hope to see you there.

CONNECT WITH US!

All students and young scientists are welcome to join the YSG! If you'd like to join, simply email info@biomaterials.org. Stay tuned to [@SFBiomaterials](#) on Twitter for the latest updates on WBC 2020 and more!

Have any ideas for the National Student Chapter? Interested in participating or taking on a leadership position? Contact me at JLG19@rice.edu. You can also find SFB and its members on social media, including Facebook, LinkedIn and Twitter. More information on these social media outlets can be found on [SFB's Social Media page](#). Have an enjoyable and productive semester!

If you have any questions,

need any information or have suggestions for improved services, please feel free to contact the Society's Headquarters office:

SOCIETY FOR BIOMATERIALS

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

Dental/Craniofacial Biomaterials SIG Update

MULTIFUNCTIONAL DENTAL BIOMATERIALS FOR ORAL HEALTH

By Santiago Orrego, PhD, Department of Oral Health Sciences, Kornberg School of Dentistry, Bioengineering Department, College of Engineering, Temple University



Restoring human teeth continues to involve 50% – 60% of dental care practice.¹ In the United States, about 50% of adults have reported losing one permanent tooth due to an accident, a failed root canal, periodontitis or tooth decay.² A major limitation of dental hard tissues is their inability to self-regenerate. In contrast, other natural materials, like bone and skin, are capable of autonomously self-healing and adapting properties in response to external stimuli.³ Therefore, dental biomaterials remain a necessary instrument to reconstruct the form and function of dental tissues to reestablish proper oral function.

Current restorative dental materials are mostly bioinert, as they offer biocompatibility and nonharmful effects to patients.⁴ While still relevant and necessary, this class of biomaterials will no longer be considered sufficient in the future of dental practice.⁵ A new generation of dental biomaterials is expected to be bioactive or bioresponsive, with the ability to have a positive interaction with the surrounding environment and biological tissues. The ideal bioactive dental material will not only be able to withstand occlusal (mastication) forces and develop low polymerization stress/shrinkage but also have antifouling, antibacterial, antifungal, remineralizing and/or tissue regeneration effects.⁶ These therapies will benefit clinical outcomes and tooth preservation by preventing and repairing the degradation of dental tissues caused by the oral microbiota or restorative practices.

Dental biomaterials with antibacterial/antifungal therapies are in high demand in restorative dentistry.⁷ Our oral cavity harbors pathogenic species that threaten not only the longevity of dental restorations but our overall health.⁸ Pathogenic microorganisms can invade the bonded interface through gaps caused by poor sealing.⁹ In these shielded micro-environments, with difficult access for mechanical/chemical removal, pathogenic species have an increased opportunity to create dental diseases.¹⁰ For example, secondary caries result from bacteria formed at the biomaterial-tooth interface, which is the weakest link of the dental restoration.¹¹ Bacteria (i.e., *Streptococcus mutans*) produce acid that degrades the dental tissue, weakening the strength of the bond while increasing the risk of developing oral and systemic diseases.¹⁰

Two popular approaches to prevent biofilm formation on material surfaces include biomaterials incorporated with antibacterial agents and anti-biofouling (non-adhesive) surfaces.¹² Antibacterial agents include leachable drugs and nano-fillers

(e.g., chlorhexidine, silver, zinc)¹³ and polymerizable monomers (e.g., quaternary ammonium methacrylates, zwitterion). Leachable antibacterial agents are most frequently used despite their potential short-lived efficacy as a result of their characteristic burst effect and potential dark coloration of their metal particles.⁷ Anti-biofouling surfaces include electrical charge, chemical composition, nano-roughness and wettability.¹⁴ These surface qualities are aimed to repel bacteria and limit the adhesion and formation of biofilms. Two significant limitations of these technologies are the inability of antibacterial materials to repair existing gaps and promote tissue regrowth at the bonded interface to improve sealing and the potential of saliva pellicle coating attenuating the delivery of the antibacterial effect.

Bioactive dental materials tailored to replenish lost mineral content (i.e., remineralization) and neutralize acidic pH levels found at the interface of the dental restoration have been proposed.^{15,16} Bioactive agents include nano-fillers (e.g., calcium phosphate, calcium fluoride, bioactive glass) and polymerizable acidic monomers (e.g., pyromellitic glycerol dimethacrylate).^{6,17} Calcium phosphates are most frequently used despite the need of a mineral seeding site, slow release rates and discontinuous remineralization distribution. Repairing existing gaps at the tooth margin with the new minerals are expected to reinforce the bond and extend the longevity of the restoration.

Commercial products with bioactive therapies available in dentistry include pulp capping materials, bonding agents, resin composites, resin cements, glass-ionomer cements and sealants. For example, GLUMA 2Bond, Clearfil SE Protect and Peak Universal Bond are dental adhesives incorporated with antibacterial agents containing glutaraldehyde, methacryloyloxydodecylpyridinium bromide and chlorhexidine, respectively. Etch-37 and Cavity Cleanser are phosphoric acid etchants containing bioactive glasses and chlorhexidine, respectively, for antimicrobial purposes.¹⁸ Endodontists are taking advantage of the unique properties of bioactive cements and sealers with the aim of providing antimicrobial effects and eliminating gaps between the sealer and tissues. Several commercial products with different mechanisms are currently available.^{19,20} For example, EndoSequence BC Sealer, ProRoot Endo Sealer and Sankin Apatite Root Sealer use agents of calcium silicate, mineral trioxide aggregate and calcium phosphate, respectively. Further evidence is needed to substantiate any benefits of these formulations. Specifically, clinical studies are necessary to validate efficacy when exposed to a more complex environment, as well as long-term effects.

Dental/Craniofacial Biomaterials SIG Update (continued)

Multifunctional dental materials aim to combine the effect of multiple bioactive agents for synergistic effects. For example, the use of both protein-repellent and antibacterial agents has been shown to result in a much greater reduction in biofilm growth than using a single agent alone.²¹ To provide antibacterial and remineralizing effects, resin composites incorporated with nanoparticles of silver, calcium phosphates and dimethylaminohexadecyl methacrylate showed improvement on the bonding strength after exposure to acidic environments.²² Despite their great potential, dental composites with multi-agents are expensive with complicated formulations that dampen the tunability of physical and mechanical properties for clinical use.

Sophisticated bioresponsive biomaterials capable of responding to specific biological signals and targeting pathological abnormalities are beginning to emerge. Common applications of these biomaterials include controlled drug delivery, controlled release of antibacterial effects and directed tissue engineering.²³ Bioresponsive biomaterials could be activated by environmental signals including temperature, pH levels and light, among others.^{24,25} In dentistry, therapeutic agents have been tailored to respond to specific pathogenic microenvironments.^{26,27} For example, functionalized nanoparticles selectively release antibacterial therapies when triggered by pathogenic microenvironments with acidic pH or low oxygen levels.²⁸ This “smart pH-sensitive” biomaterial simultaneously kills bacteria and dismantles the biofilm matrix only when needed.²⁹ Other antibacterial bioresponsive therapies include temperature-responsive switchable bactericidal and anti-fouling surfaces using polymers and hydrogels.³⁰

Recent technological breakthroughs and emerging concepts in engineering, materials science, physical science and biology are providing unlimited resources to design a new generation of dental materials to improve oral health. Still, many questions remain unanswered. There is an urgent need to standardize tests to evaluate the interaction between oral biofilms/species and biomaterials.³¹⁻³³ The tools and assays available to evaluate bacteria activity are not generalized, optimized and validated for all species. Antimicrobial efficacy is not consistent across all bacteria and can vary significantly from one bacteria species to another. More importantly, the effects of indiscriminately eliminating all microorganisms from the local microenvironment are relatively unknown. As a result, the comparison of the antibacterial effects of different biomaterials is difficult and inconsistent.³¹ Another significant limitation of these bioactive technologies is the lack of evidence on long-term clinical performance. The clinical translation of these technologies is being deterred by current

regulatory requirements, causing unnecessary patient suffering, doctor frustration and costs to healthcare payers.³³ Regulatory requirements of antimicrobial combination implants and devices should be thoroughly revisited.³³

According to the European Commission report on nanotechnology,³⁴ the global market for smart biomaterials reached \$47 billion in 2009 and will rise to \$113 billion by 2025. Smart dental biomaterials are a transformative tool for the development of novel strategies for the creation and expansion of more effective and less invasive treatment options. The areas of prosthodontics, orthodontics, pediatric and preventive dentistry, endodontics, oral surgery, restorative biomaterials and periodontics could highly benefit from smart tools and bioresponsive biomaterials.

There is national interest in developing technologies to accelerate the development of oral biodevices. The National Institutes of Health’s National Institute of Dental and Craniofacial Research Strategic Vision Through 2030³⁵ encourages research in transformative solutions that significantly improve the evaluation, monitoring and management of oral and overall health using multifunctional oral biodevices. Smart dental biomaterials will enable the design of oral devices to diagnose disease and deliver local and systemic treatments. Imagine a biofeedback device embedded inside an implant or restorative biomaterial, such as an orthodontic appliance, that would sense changes in temperature, pH, salivary flow rates, biofilm or sleep cycles. Another possibility for the future is a patch that senses dysregulated oral microbiota, alerting patients on health risks and, at the same time, delivering drugs and signals to promote a balance in the microbiome to restore oral health.

It’s the perfect time for a profitable collaboration between industry, academia and government to develop a new generation of smart dental biomaterials. These three sectors must align to generate translational research that leads to dental innovation, boosting the growth of the national economy and improving overall health.

REFERENCES:

1. Mitchell C. *Dental Materials in Operative Dentistry*. Batavia, IL: Quintessence Publishing USA; 2019.
2. Centers for Disease Control and Prevention, National Center for Health Statistics. NHANES 2011-2012 overview. <https://wwwn.cdc.gov/nchs/nhanes/ContinuousNhanes/Overview.aspx?BeginYear=2011>. Updated October 30, 2018. Accessed February 17, 2020.
3. Fratzl P, Weinkamer R. Hierarchical structure and repair of bone: deformation, remodelling, healing. In: van der Zwaag S, ed. *Self Healing Materials: An Alternative Approach to 20 Centuries of Materials Science*. Basel, Switzerland: Springer Nature Group; 2007:323-335.
4. Cheng L, Zhang K, Zhang N, et al. Developing a new generation of antimicrobial and bioactive dental resins. *J Dent Res*. 2017;96(8):855-863.

(continued on page 24)

Cardiovascular Biomaterials SIG Update

BIOMATERIAL-INSPIRED APPROACHES TO PERIPHERAL ARTERY DISEASE

By Chris A. Bashur, PhD, Florida Institute of Technology, and Mazen S. Albaghdadi, MD, Massachusetts General Hospital



The cardiovascular biomaterials sessions at the 2019 Society For Biomaterials Annual Meeting included presentations on topics ranging from blood compatibility to biomaterials for cardiovascular regeneration.

An important unmet need in cardiovascular medicine is the development of small-diameter vascular grafts, which was a topic that was addressed by several abstracts at the SFB Annual Meeting. Given the importance of this topic, the SFB Cardiovascular Biomaterials SIG would like to elaborate on the importance of biomaterials in the development of novel small-diameter arterial grafts with academic, industry and clinical representation in this *Forum* article. Thus, this article focuses on the clinical status of the different surgical and minimally invasive options to treat small-diameter arteries and discusses some potential areas of future research, with a focus on lower extremity peripheral artery disease (PAD).

WHAT IS PAD?

PAD is a condition characterized by the accumulation of atherosclerotic plaque in the arteries supplying blood to the lower extremities. As the accumulation of plaque progresses, PAD can lead to a reduction in blood supply to the lower extremities. For many patients, PAD is a debilitating disease that can lead to exertional leg discomfort. In the later stages, PAD may produce ischemic lower extremity ulceration that may culminate in amputation in the absence of prompt recognition and revascularization (or restoration of blood flow to the affected limb).

TREATMENT FOR PAD: BIOMATERIAL ADVANCES AND LIMITATIONS

Options to treat patients with advanced stages of PAD are limited, especially for those with small-caliber and diffusely diseased vessels. The two main revascularization options are endovascular repair using balloon angioplasty and stents or open surgical bypass grafting. Various biomaterial innovations have led to the development of U.S. Food and Drug Administration-approved devices, including biocompatible stent coating and drug-coated balloons, that are in widespread clinical use and have led to significant improvements in patient outcomes following endovascular revascularization. Despite these advances, the rates of restenosis, or arterial re-narrowing after revascularization, remain unacceptably high, with 40%–60% of patients exhibiting restenosis. Thus, new therapies are

desperately needed, especially in the realm of surgical bypass grafting, where little technological innovation has translated to clinical care for small-caliber arteries in the past few decades.

One major limitation in patients with PAD treated with drug-coated balloon angioplasty is the limited durability of the polymer excipient-drug coating, which limits the amount of anti-restenotic drug actually delivered to the vessel wall. This is due to the effect of arterial blood flow and tortuous arterial anatomy, which results in loss of the coating. Once the balloon reaches the target atherosclerotic plaque, the transfer of the drug from the balloon to the vessel is suboptimal due to the material properties of the coating and lack of retention in the vessel wall. In patients treated with stents, in-stent restenosis may result from stent fracture due to the dynamic forces of leg movement on the lower extremity arteries. In addition, there are limited options for the use of drug-coated balloons and stents in small arteries.

In patients with PAD treated with arterial bypass, a variety of limitations exist, including lack of hemocompatibility of the non-degradable synthetic graft and high stenosis rates in small-caliber vein grafts. These limitations have motivated the development of degradable tissue-engineered vascular grafts (TEVGs) as an alternative. While progress has been made with clinical trials of TEVGs for arterio-venous shunts, these approaches have yet to be translated to the small-caliber arteries in PAD patients. Thus, new biomaterial approaches to address these challenges are needed. For degradable vascular grafts, new strategies need to be developed to provide grafts that avoid stenosis while also maintaining their mechanical integrity, which is currently a challenge for the field.

Another emerging option that has been explored for decades but without a clinically viable therapy is the regeneration of blood vessels in the muscle of the affected limb in patients with PAD. A variety of angiogenic growth factors and stem cells have been infused and injected into the lower extremity muscles of patients with PAD. Unfortunately, none of these therapies have demonstrated clinically significant improvements. Thus, a number of investigators are exploring biomaterial-based approaches to improving their efficacy.

NOVEL TECHNOLOGIES FROM SFB 2019

At the last SFB Annual Meeting, a number of abstracts highlighted novel stent designs and materials undergoing preclinical testing that hold exciting prospects for translation to clinical uses. This included a modification of a metallic stent

Cardiovascular Biomaterials SIG Update (continued from previous page)

with CD47, with the goal of reducing restenosis. Another group investigated using a resorbable stent produced from poly(α -dioxanone) and polycaprolactone. In addition, a variety of tissue-engineered approaches to generate vascular bypass grafts were presented. These included investigating the benefits of a peritoneal pre-implantation step as well as controlled porosity in polyurethane materials.

CONSIDERING RELATED FUTURE PROGRAMMING

The Cardiovascular Biomaterials SIG is excited about these emerging biomaterial-inspired solutions to addressing unmet needs in caring for patients with PAD and considers these topics vital subject matter for abstracts and sessions at future SFB

meetings. In addition to the topics described above, another interesting question that may impact clinical outcomes is the relationship between the small-caliber arteries in the legs (e.g., the popliteal artery) and the microvasculature in the affected muscle tissue in the legs. For example, if the microvasculature is also diseased, will that reduce the potential improvement from grafting at the small-caliber artery? The SFB Annual Meeting is an excellent venue to both understand later-stage research, translating different strategies to treat small-diameter vessels, as well as more basic research to better understand remodeling and outcomes for the different techniques. The SIG looks forward to future abstract submissions on these and other cardiovascular topics.

Dental/Craniofacial Biomaterials SIG Update (continued from page 22)

- Ferracane J, Bertassoni L, Pfeifer C. *Dental Biomaterials, An Issue of Dental Clinics of North America*. Vol 61-4, 1st ed. Cambridge, MA: Elsevier Health Sciences; 2017.
- Fugolin APP, Pfeifer CS. New resins for dental composites. *J Dent Res*. 2017;96(10):1085-1091.
- Zhou X, Huang X, Li M, et al. Development and status of resin composite as dental restorative materials. *J Appl Polym Sci*. 2019;136(44). <https://onlinelibrary.wiley.com/doi/full/10.1002/app.48180>. Accessed February 17, 2020.
- Lu M, Xuan S, Wang Z. Oral microbiota: a new view of body health. *Food Sci Hum Wellness*. 2019;8(1):8-15. <https://www.sciencedirect.com/science/article/pii/S2213453018301642>. Accessed February 17, 2020.
- Busscher HJ, Rinastiti M, Siswomihardjo W, van der Mei HC. Biofilm formation on dental restorative and implant materials. *J Dent Res*. 2010;89(7):657-665. https://pubmed.ncbi.nlm.nih.gov/20448246-biofilm-formation-on-dental-restorative-and-implant-materials/?from_single_result=Biofilm+formation+on+dental+restorative+and+implant+materials+Busscher. Accessed February 17, 2020.
- Øilo M, Bakken V. Biofilm and dental biomaterials. *Materials (Basel)*. 2015;8(6):2887-2900. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5455733>. Accessed February 17, 2020.
- Nedeljkovic I, De Munck J, Vanloy A, et al. Secondary caries: prevalence, characteristics, and approach. *Clin Oral Investig*. 2020;24(2):683-691.
- Wang Z., Shen Y, Haapasalo M. Dental materials with antibiofilm properties. *Dent Mater*. 2014;30(2):e1-16.
- Greenhalgh R, Dempsey-Hibbert NC, Whitehead KA. Antimicrobial strategies to reduce polymer biomaterial infections and their economic implications and considerations. *Int Biodeterior Biodegrad*. 2019;136:1-14. <https://www.sciencedirect.com/science/article/pii/S0964830518308345>. Accessed February 17, 2020.
- Song F, Koo H, Ren D. Effects of material properties on bacterial adhesion and biofilm formation. *J Dent Res*. 2015;94(8):1027-1034.
- Sauro S, Pashley DH. Strategies to stabilise dentine-bonded interfaces through remineralising operative approaches—state of the art. *Int J Adhesion Adhesives*. 2016;69:39-57.
- Vallittu PK, Boccaccini AR, Hupa L, Watts DC. Bioactive dental materials—do they exist and what does bioactivity mean? *Dent Mater*. 2018;34(5):693-694.
- Zhang L, Weir MD, Chow LC, Antonucci JM, Chen J, Xu HHK. Novel rechargeable calcium phosphate dental nanocomposite. *Dent Mater*. 2016;32(2):285-293.
- Chan DC, Chung AK, Paranjpe A. Antibacterial and bioactive dental restorative materials: do they really work? *Am J Dent*. 2018;31(B, special issue):3B-5B.
- Al-Haddad A, Ab Aziz ZAC. Bioceramic-based root canal sealers: a review. *Int J Biomater*. 2016;2016:9753210.
- Raghavendra SS, Jadhav GR, Gathani KM, Kotadia P. Bioceramics in endodontics—a review. *J Istanb Univ Fac Dent*. 2017;51(3 suppl 1):S128-137.
- Zhang K, Zhang N, Weir MD, Reynolds MA, Bai Y, Xu HHK. Bioactive dental composites and bonding agents having remineralizing and antibacterial characteristics. *Dent Clin North Am*. 2017;61(4):669-687.
- Melo MA, Orrego S, Weir MD, Xu HHK, Arola DD. Designing multiagent dental materials for enhanced resistance to biofilm damage at the bonded interface. *ACS Appl Mater Interfaces*. 2016;8(18):11779-11787.
- Lu Y, Aimeetti AA, Langer R, Gu Z. Bioresponsive materials. *Nature Reviews Materials*. 2016;2:16075.
- Tibbitt MW, Rodell CB, Burdick JA, Anseth KS. Progress in material design for biomedical applications. *Proc Natl Acad Sci U S A*. 2015;112(47):14444-14451.
- Kowalski PS, Bhattacharya C, Afewerki S, Langer R. Smart biomaterials: recent advances and future directions. *ACS Biomater Sci Eng*. 2018;4(11):3809-3817.
- Liu Y, Ren Z, Hwang G, Koo H. Therapeutic strategies targeting cariogenic biofilm microenvironment. *Adv Dent Res*. 2018;29(1):86-92.
- Zhang K, Wang S, Zhou C, et al. Advanced smart biomaterials and constructs for hard tissue engineering and regeneration. *Bone Res*. 2018;6(31).
- Paula AJ, Koo H. Nanosized building blocks for customizing novel antibiofilm approaches. *J Dent Res*. 2017;96(2):128-136.
- Horev B, Klein MI, Hwang G, et al. pH-activated nanoparticles for controlled topical delivery of farnesol to disrupt oral biofilm virulence. *ACS Nano*. 2015;9(3):2390-2404.
- Li X, Wu B, Chen H, et al. Recent developments in smart antibacterial surfaces to inhibit biofilm formation and bacterial infections. *J Mater Chem B*. 2018;6:4274-4292.
- Kreth J, Ferracane JL, Pfeifer CS, Khajotia S, Merritt J. At the interface of materials and microbiology: a call for the development of standardized approaches to assay biomaterial-biofilm interactions. *J Dent Res*. 2019;98(8):850-852.
- Konai MM, Bhattacharjee B, Ghosh S, Haldar J. Recent progress in polymer research to tackle infections and antimicrobial resistance. *Biomacromolecules*. 2018;19(6):1888-1917.
- Busscher HJ, Alt V, van der Mei HC, et al. A trans-Atlantic perspective on stagnation in clinical translation of antimicrobial strategies for the control of biomaterial-implant-associated infection. *ACS Biomater Sci Eng*. 2019;5(2):402-406.
- Queipo P, Gonzalez D, Reinhardt A, et al. NANO*future*s, the European technology integrating and innovation platform: nanotechnologies—essential part of sustainable development. In: Leal Filho W, Übelis A, Bêrzina D, eds. *Sustainable Development, Knowledge Society and Smart Future Manufacturing Technologies*. World Sustainability Series. Basel, Switzerland: Springer; 2015:73-79.
- National Institute of Dental and Craniofacial Research. NIDCR 2030. <https://www.nidcr.nih.gov/research/research-priorities-nidcr-2030>. Reviewed April 2018. Accessed February 19, 2020.

Industry News

By Steve Lin, Industry News Editor



Stryker (Kalamazoo, Michigan) announced a definitive agreement to acquire all of the issued and outstanding ordinary shares of **Wright Medical Group N.V.** (NASDAQ: WMGI) for \$30.75 per share, or a total equity value of approximately \$4 billion and a total enterprise value of approximately \$5.4 billion (including convertible notes). Wright Medical, which was founded in 1950, is a global medical device company focused on extremities and biologics. Wright Medical brings a highly complementary product portfolio and customer base to Stryker's trauma and extremities business. With global sales approaching \$1 billion, Wright Medical is a recognized leader in the upper extremities (shoulder, elbow, wrist and hand), lower extremities (foot and ankle) and biologics markets, which are among the fastest-growing segments in orthopedics.

With President Trump's signature, the **medical device tax** is officially history. The medical device excise tax, which [studies have shown](#) chills innovation, reduces employment, slows hiring plans and freezes capital investments, has been fully repealed by Congress just days before it was slated to come back into effect. The tax had been suspended twice for a total of four years since 2016, but its continued existence kept medical device innovators from making plans with longer or unclear payback periods.

NPXe Limited (Buffalo, New York), a Phase III pharmaceutical and drug delivery device company developing XENEX (xenon gas for inhalation) for neuro- and cardio-protection and improvement in survival for post-cardiac arrest syndrome patients, has filed a voluntary petition to reorganize under Chapter 11 of the Bankruptcy Code in the U.S. Bankruptcy Court for the District of Delaware. NPXe has also filed a motion seeking authorization to pursue an auction and sale process under Section 363 of the U.S. Bankruptcy Code. The proposed bidding procedures would allow interested parties to submit binding offers to acquire substantially all of NPXe's assets, which would be purchased free and clear of the company's indebtedness and liabilities.

InventHelp introduces BladderVoid, a medical device designed to provide deep, soothing heat to the muscles and nerves of the male genital area. Developed by doctors from Newtown, Pennsylvania, the invention is a safe treatment that helps stimulate the urge to urinate and helps empty a bladder completely. This invention has a U.S. patent.

CryoLife, Inc. (Atlanta, Georgia), a leading cardiac and vascular surgery company focused on aortic disease, has entered into an exclusive U.S. commercialization agreement with **Misonix**

for CryoLife's NeoPatch product to treat a broad range of indications outside of cardiac and vascular surgery. NeoPatch is a dehydrated and terminally sterilized chorioamniotic allograft derived from human placental membrane. It will add an additional product offering in the wound biologics market for Misonix. The estimated market opportunity for skin substitutes in advanced wound care in the United States exceeds \$2 billion.

Motus GI Holdings, Inc. (Fort Lauderdale, Florida), a medical technology company dedicated to improving clinical outcomes and enhancing the cost-efficiency of colonoscopy, announced the first commercial placements of its Pure-Vu System as part of its initial U.S. market launch targeting early adopter hospitals. Insufficient bowel prep is a universal issue that has consequences for both patients and providers, including costly extended hospitalizations. The Pure-Vu System has given GI doctors a new way to improve visibility and bowel preparation scores during colonoscopies on hospitalized or poorly prepped patients.

Shares of **Flexion Therapeutics Inc.** (Burlington, Massachusetts) soared 14% after the company said the U.S. Food and Drug Administration has approved an update to the label on its Zilretta treatment for osteoarthritis knee pain, which analysts said should help it get reimbursement from insurers and boost sales. Flexion said the updated label will remove language that said Zilretta, its key product, was not intended for repeat administration, a step the company said will help doctors and patients who found the previous labeling confusing.

Arthroscopy, also known as arthroscopic or keyhole surgery, is a minimally invasive surgical procedure on a joint. In an arthroscopic surgery, an arthroscope, a device with a camera, is inserted into the joint through a small incision. Increasing R&D in bioinductive implants and the growing geriatric population are expected to boost growth of the market. The global arthroscopy procedures and products market is estimated to reach \$8,621.3 million in value by the end of 2027.

IF YOU HAVE INDUSTRY NEWS TO SHARE
WITH *BIOMATERIALS FORUM* READERS,
SEND IT TO STEVE@EXAC.COM.

Government News

By Carl Simon, Government News Editor



ENGINEERING BIOLOGY ROADMAP

An engineering biology roadmap sponsored by the National Science Foundation (NSF) was published in June 2019.¹ Eighty scientists and engineers contributed to the roadmap through a series of six workshops. It contains four technical themes that represent a “bottom-up” approach focusing on technology innovations to move the field forward:

- 1) Gene editing, synthesis and assembly
- 2) Biomolecule, pathway and circuit engineering
- 3) Host and consortia engineering
- 4) Data integration, modeling and automation

Five impact sectors also represent a “top-down” look at how engineering biology could help overcome global challenges:

- 1) Industrial biotechnology
- 2) Health and medicine
- 3) Food and agriculture
- 4) Environmental biotechnology
- 5) Energy

The word “biomaterial” occurs four times in the roadmap. Two of the occurrences are in reference to using biological systems to produce improved biomaterials. One is about creating biodegradable or edible scaffold biomaterials for engineered meat. The fourth is to “enable incorporation of photosynthetic pathways into infrastructure biomaterials (such as for the production of carbon-negative bio-concrete).”

UPDATED CELL MANUFACTURING ROADMAP

An updated roadmap for cell manufacturing was published in November 2019 by the NSF-sponsored Engineering Research Center for Cell Manufacturing Technologies.² The roadmap addresses needs for achieving large-scale, cost-effective, reproducible manufacturing of high-quality cells. The report is segmented into five key cell manufacturing activity areas:

- 1) Cell processing and automation
- 2) Process monitoring and quality control
- 3) Supply chain and transport logistics
- 4) Standardization, regulatory support and cost reimbursement
- 5) Workforce development

The word “biomaterial” does not appear in the report. However, ancillary materials and raw materials for cell processing and bioreactors are the most relevant thrusts for the biomaterials scientist.

ROADMAP FOR AI RESEARCH

A roadmap for artificial intelligence (AI) research was published in August 2019 with support from NSF.³ AI systems have created a trillion-dollar industry that is expected to triple in three years. AI has the potential to significantly change manufacturing in all sectors and is expected to significantly impact new materials discovery. However, there is a need to make AI systems “fair, explainable, trustworthy and secure.” Three main recommendations were put forth:

- 1) Create and operate a national AI infrastructure
- 2) Re-conceptualize and train an all-encompassing AI workforce
- 3) Develop critical core programs for basic AI research

Further, six primary impact areas have been identified:

- 1) Boost health and quality of life
- 2) Provide lifelong education and training
- 3) Reinvent business innovation and competitiveness
- 4) Accelerate scientific discovery and technical innovation
- 5) Expand evidence-driven social opportunity and policy
- 6) Transform national defense and security

"AI HAS THE POTENTIAL TO SIGNIFICANTLY CHANGE MANUFACTURING IN ALL SECTORS AND IS EXPECTED TO SIGNIFICANTLY IMPACT NEW MATERIALS DISCOVERY."

REFERENCES:

1. Engineering Biology Research Consortium. Engineering biology: a research roadmap for the next-generation bioeconomy. <https://roadmap.ebrc.org>. Accessed February 17, 2020.
2. National Cell Manufacturing Consortium, NSF Engineering Research Center for Cell Manufacturing Technologies, Georgia Tech Marcus Center for Therapeutic Cell Characterization and Manufacturing. *Cell Manufacturing Roadmap to 2030*. http://cellmanufacturingusa.org/sites/default/files/Cell-Manufacturing-Roadmap-to-2030_ForWeb_110819.pdf. Published November 2019. Accessed February 17, 2020.
3. Computing Community Consortium, Association for the Advancement of Artificial Intelligence. *A 20-Year Community Roadmap for Artificial Intelligence Research in the US*. <https://arxiv.org/pdf/1908.02624.pdf>. Published August 2019. Accessed February 17, 2020.

DECEMBER 11–13, 2020

ON WAIKIKI BEACH • HONOLULU, HAWAII

www.Biomaterials.org

The Society For Biomaterials (US) and the Japanese Society for Biomaterials are hosting a joint symposium that will highlight the seminal work of four pioneers in the biomaterials field! The three-day program will feature addresses by our honorees and other sessions of interest in their respective areas of expertise:



James M. Anderson, MD, PhD
Case Western Reserve University
Implant Pathology and the Foreign
Body Reaction



Art Coury, PhD
Northeastern University
Biomaterials Evolution: Commercial
to “Designer” Polymers – A 50 Year
Perspective



Tadashi Kokubo, PhD
*Kyoto University and
Chubu University*
Driving Force for Promoting
Innovation of Biomaterials: from
Bioglass to Bioactive Metals



Teruo Okano, PhD
*Tokyo Women’s Medical University
and the University of Utah*
Design of Intelligent Surfaces for
Cell Sheet Tissue Engineering

