LETTER FROM THE NEW PRESIDENT

UPDATES FROM THE ECTM SIG

BIOMATERIALS FORUM

OFFICIAL NEWSLETTER OF THE SOCIETY FOR BIOMATERIALS

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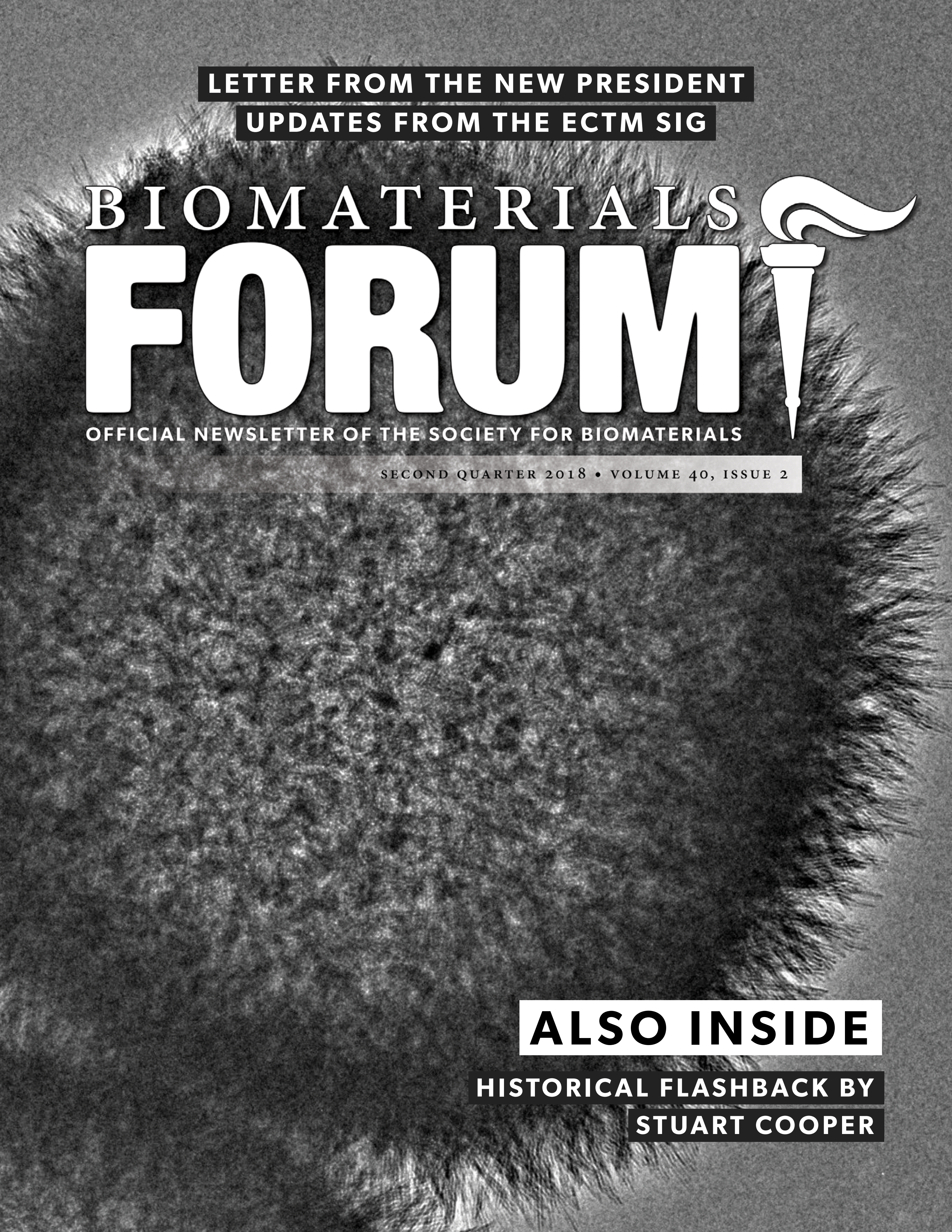

ALSO INSIDE

HISTORICAL FLASHBACK BY STUART COOPER

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.

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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.

BIOMATERIALS FORUM

The official news magazine of the **SOCIETY FOR BIOMATERIALS** • Volume 40, Issue 2

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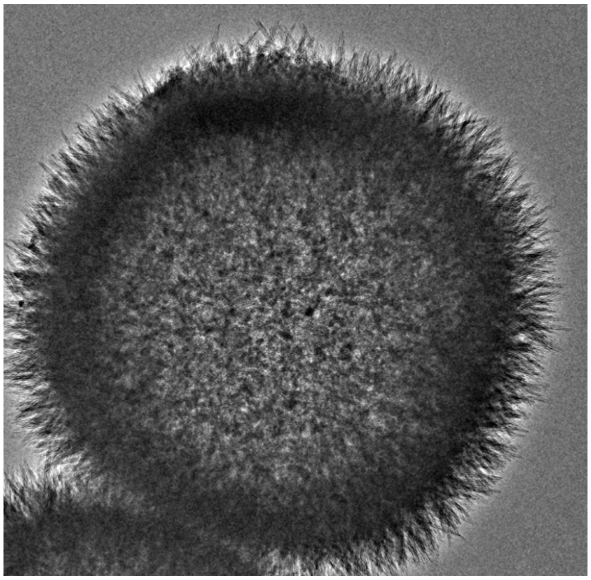
NEWS & UPDATES



ON THE COVER

The cover image, provided by Prof. Chengtie Wu of the Shanghai Institute of Ceramics, Chinese Academy of Sciences, shows a TEM image of copper silicate hollow microspheres (CSO HMSs) displaying the interior hollow and external nanoneedle microstructure. CSO HMSs have inner hollow cavities ~800nm in diameter and spherical shells of ~50nm thickness, which are covered with nanoneedles ~200nm in length.

From the Editor

By Guigen Zhang

Recently, I came across the interesting conversations that Nicolaj Siggelkow and Harbir Singh had with authors Lawton R. Burns, Mark Pauly and Philip Rea on their new book, *Managing Discovery in the Life Sciences: Harnessing Creativity to Drive Biomedical Innovation*. You may read the whole conversations at knowledge.wharton.upenn.edu/article/unlocking-the-creativity-or-serendipity-the-key-to-life-science-breakthroughs.

Here are some highlights that I hope you enjoy:

On the role of serendipity:
"A major player … is serendipity — getting answers to questions that were never posed but that turn out to be of incredible therapeutic value." "The serendipity part is, first you're doing experiments, you have a hypothesis in mind, you are looking for some expected findings, and then they don't turn out." "And then [you] pursue a new line of inquiry or investigation, which leads to some really fundamental discoveries."

On managing innovation:
"We need more time; we need more research funding; we need more students." "It's not something you can engineer and just do top down. A lot of this stuff is bottom up, individual investigators driven by a passion, driven by a curiosity, with a hypothesis that is unusual, and pursuing it even in the face of Doubting Thomases."

On leadership:
"A major player into that is an appreciation that some of the best leadership — ***when creativity is the key determinant, not productivity*** *— often comes from individuals who have a very deep understanding of science. They came out of science themselves, and then they acquitted themselves of the requisite skills in order to administer science if you will, and make calls on which projects to carry forward, which ones maybe are long-term objective projects and which projects are maybe shorter time but could provide funds to support the longer-term project."*

On being ridiculed and being maverick:
"Balloon angioplasty was one of the 10 most significant medical innovations of the 20th century. [Its invention] turned out to be one serendipity after another. [What] was particularly interesting about this innovation is the fact that the pioneers were experimenting on themselves." "These were people who obviously believed in what they were doing, because they were willing to risk their lives for it. And they're mavericks … it sometimes takes mavericks to pull things off."

"One of them actually got the Nobel Prize 20 years after being ridiculed for what he was doing. That's just how maverick some of these people are." "Andres Grunzeg, who is recognized as the pioneer, was ridiculed by almost all of his colleagues, and it took a couple of innovation champions, people who are superior in the hierarchy who recognize that he may be on to something, to support him, to protect him from all of the other colleagues who just wanted to torpedo his research."

On the rising cost of new products:
"The bad news is that the cost per new drug developed has increased substantially over time. … some estimates suggest it's as high as $2 billion per new drug that actually makes it to market." "… most of that money is not actually money that was spent on the drug that made it to market. It's payment for all the dry holes and the attempts that failed. And a big chunk of it also is the cost of capital, because the time period between investment and return is so greatly delayed."

"… [other] explanations for this, like scientists just want to get grants and they don't really want to make their products available to the commercial market …"

"So, if you really want to know who is responsible for the increasing cost of new products, I tell people to look in the mirror. If only you were as poor or as poorly insured as you were 20 or 30 years ago … then it wouldn't pay to bring these new drugs to market."

In closing, I will briefly tell you what we have prepared for you in this issue. You will hear from Andrés García, SFB's new president (2018 – 2019), on his vision for the Society and read member news prepared by our new member-at-large, Rebecca Carrier. You will also get caught up with staff updates, student news and a SIG update. In our regular columns, you will read industry news, government news and education news. In the Historical Flashback column, we provide you some reflections by Stuart Cooper on his challenges and excitements in the field of biomaterials over the years. In the book review, you will read a review by Lynne Jones on *Chitosan Based Biomaterials*. We also highlight for you some recent developments in copper silicate hollow microspheres-incorporated scaffolds for chemo-photothermal therapy of melanoma and tissue healing published in *ACS Nano*. Last, but not least, we feature an SFB member's journey from wondering how to teach to winning a top teaching award.

With best wishes,

From the President

By Andres Garcia

I am deeply honored and thankful for the opportunity to serve as president of SFB (2018 – 2019). I have been an active member of SFB for more than 20 years as a student, postdoc and faculty member. In addition to outstanding diverse professional opportunities for scientific discussions, networking and interactions with academia, industry and government, SFB has provided a nurturing environment where I have developed many good and lasting collaborations and friendships. I thank Dave Kohn for his exceptional leadership on behalf of our Society and his guidance and patience with me during the past year. I also recognize the Board and Council as well as the staff of Association Headquarters, in particular Dan Lemyre, for all their important contributions and hard work.

Our Society continues to thrive, as clearly demonstrated by the huge success of the Annual Meeting in Atlanta. The more than 1,200 attendees, 950 poster and oral presentations, workshops, panels and other activities reflect our vibrant and dynamic community. I thank all the sponsors and exhibitors for making the meeting possible. Special thanks to Johnna Temenoff, Bob Hastings and the rest of the Program Committee for organizing a scientifically stimulating, balanced program. I also appreciate all the session chairs and organizers and all reviewers for their fruitful work. My personal highlights were the ethics in biomaterials panel, industry versus academia Cage Match, the Young Scientists mixer (where I was the oldest person!) and the Bash at the Georgia Aquarium. I look forward to next year's meeting in Seattle.

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

Increase value to members.
Through strategic and managerial activities, I will work with other Council and Board officers to increase the value that the Society provides to our members as related to scientific excellence, educational and professional development, and broader societal impact. The Young Scientists group and the women's networking lunch are excellent examples of increased value to our members. The newly established mentoring program provides a meaningful opportunity to prepare the next generation of leaders and contributors to our Society.

Foster scientific excellence and a nurturing environment.
Annual and Regional Meetings (e.g., Biomaterials Days) provide ideal convergence points for the exchange of scientific ideas and community-building efforts. I will continue working with leadership and program committees to enhance the scientific context and networking aspects and assess and increase the impact of these meetings.

"MY VISION FOR SFB IS FOR OUR SOCIETY TO BE A THRIVING, INTERNATIONAL COMMUNITY OF LEADERS, RESEARCHERS, EXPERTS AND EDUCATORS FROM ACADEMIA, INDUSTRY AND GOVERNMENT WITH FAR-REACHING AND LASTING IMPACT ON ALL ASPECTS OF BIOMATERIALS SCIENCE, ENGINEERING AND POLICY."

Expand the impact of SFB.
To truly contribute to and improve human health, our activities must extend beyond our Society. I will work to expand our sphere of influence, including broadening branding, marketing and visibility; highlighting the positive impact and contributions of the biomaterials community; and reaching out to other professional groups where biomaterials expertise is important. The joint session with the American Society for Matrix Biology at the Annual Meeting in Atlanta highlights opportunities to work with other groups to expand the impact of SFB. We must also engage the public as ambassadors for our field.

In closing, our Society is a thriving and nurturing community at the forefront of scientific excellence and societal impact. I challenge and encourage each of you to be engaged in the diverse activities that we support and to continue enhancing and increasing our impact. I welcome your ideas, suggestions and criticism — please email me at andres.garcia@me.gatech.edu.

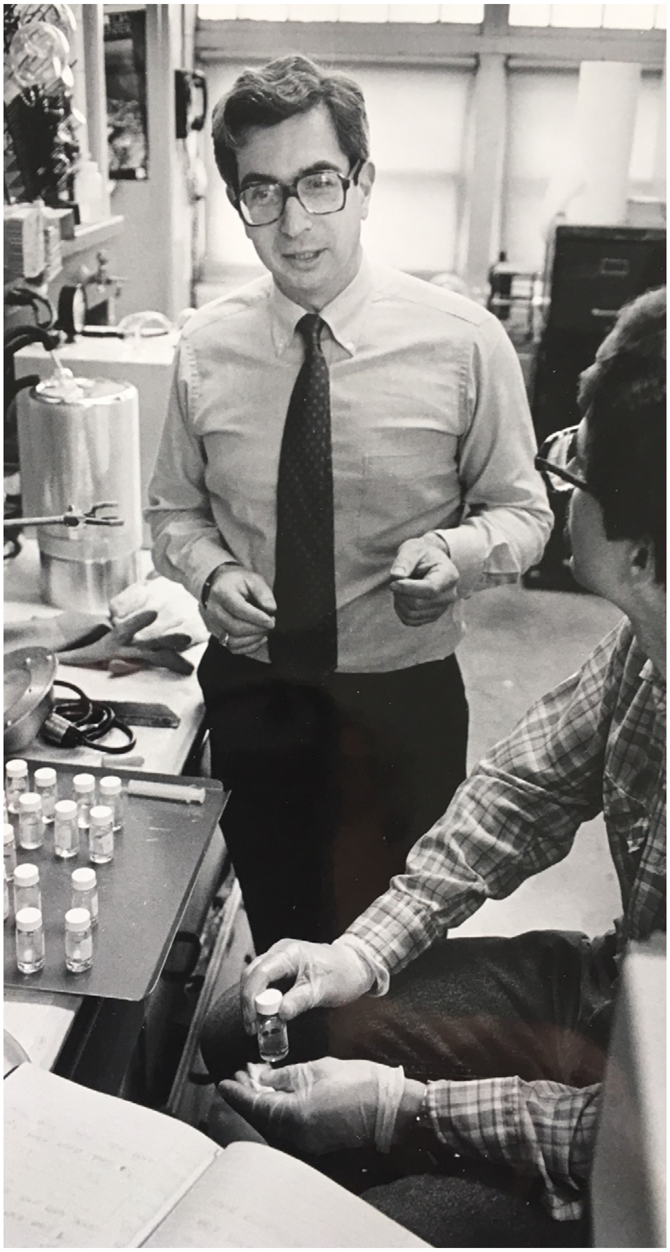
Historical Flashback

By Stuart Cooper

Editor's Note: *For this Historical Flashback column, I asked Prof. Stuart Cooper (pictured, right) of The Ohio State University to share with us the challenges and excitements he experienced in the field of biomaterials over the years. Prof. Cooper is a member of the National Academy of Engineering. He served SFB as the 1996 – 1997 president and was the recipient of the 1987 Clemson Award for Basic Research and the 2010 Founders Award. Below, you will read his flashback in his own words. Aside from the fact that he, as an engineer, collaborated closely with surgeons to advance the biomaterials field, I would particularly like to draw your attention to the fact that he graduated at an excellent for finding a faculty job, but "startup fund" was not part of the vocabulary for faculty — a true reflection of changing environments in academic research.*

I graduated from MIT in 1963 with a degree in chemical engineering. My undergraduate thesis, "The Effect of Pre-orientation on the Ductility of Polystyrene," was written under the direction of Rodney D. Andrews, a professor in mechanical engineering. My interest in polymers led me to graduate study at Princeton University as a Chemical Engineering Textile Institute Fellow. I did my graduate research on polyurethanes under the guidance of Arthur V. Tobolsky, a polymer physical chemist in the Chemistry Department. My research in the Chemistry Department was facilitated by the chair of chemical engineering, Richard Wilhelm, allowing me to obtain an interdisciplinary experience. I ultimately received my PhD from the Department of Chemical Engineering.

My graduation year, 1967, was an excellent year to be searching for a faculty position in chemical engineering in the "polymers" area. I received several offers, but after Bob Bird from the University of Wisconsin called Dr. Wilhelm about an opening in his department, Dr. Wilhelm strongly suggested I interview at Madison. Wisconsin was ranked no. 1 at the time, and department chairs love to have their students placed in highly ranked departments. I interviewed, received an offer and accepted the position.



Dr. Cooper working in his laboratory at Wisconsin in 1985 with graduate student Timothy Grasel.

"AS THERE WERE NO STARTUP FUNDS AT THAT TIME, I HAD TO BUILD EQUIPMENT, FIND GLASSWARE IN THE DEPARTMENT STOREROOM AND USE INSTRUMENTATION IN THE CHEMISTRY AND MATERIALS SCIENCE DEPARTMENTS."

"IN THE MID-1970S, I RECEIVED A CALL FROM JAMES WHIFFEN, CHAIR OF THE DEPARTMENT OF SURGERY, WHO WAS IMPLANTING PLASTIC RINGS IN THE VENA CAVA OF CANINES. HE WAS INTERESTED IN BLOOD COMPATIBILITY AND ASKED FOR HELP IN FINDING ALTERNATIVE MATERIALS TO TEST BESIDES THE MOLDED POLYCARBONATE RINGS. I WAS HAPPY TO COAT THESE RINGS WITH A VARIETY OF POLYURETHANES THAT HAD BECOME INTERESTING AS BIOMATERIALS DUE TO THE EARLY OBSERVATIONS OF BIOSTABILITY BY JOHN BORETOS AT THE NATIONAL INSTITUTES OF HEALTH (NIH)."

In January of 1967, the year of the first Super Bowl, Madison experienced typical low temperatures of -10°F, but the faculty were warm and welcoming. As there were no startup funds at that time, I had to build equipment, find glassware in the department storeroom and use instrumentation in the Chemistry and Materials Science departments. The department had an abundance of outstanding graduate students, about one-third of whom had their own fellowships. Thus, I had excellent help starting my lab. I began working on the chemistry and polymer physics of polyurethane elastomers. My first grant from NSF came after three years, and I received tenure in due course.

In the mid-1970s, I received a call from James Whiffen, chair of the Department of Surgery, who was implanting plastic rings in the vena cava of canines. He was interested in blood compatibility and asked for help in finding alternative materials to test besides the molded polycarbonate rings. I was happy to coat these rings with a variety of polyurethanes that had become interesting as biomaterials due to the early observations of biostability by John Boretos at the National Institutes of Health (NIH). I also had a graduate student, Jay Ihlenfeld, who was interested in a thesis on blood compatibility. Together, we visited with medical school faculty and brainstormed as to how we could proceed. Stuart Updike, a nephrologist, was particularly helpful in suggesting a blood flow experiment by constructing a canine arteriovenous shunt and using radiolabeled platelets and proteins to study thrombus deposition. Soon we were also collaborating with Dean Mosher, a hematologist known for his early work on fibronectin, thrombospondin and vitronectin. Jay perfected the arteriovenous shunt model, with a major innovation being to periodically clamp the blood flow and flush out the blood going to the detector with saline so we could accurately count the protein and platelets on the shunt's surface. This was a good model to observe thromboembolism, generating similar data to that observed by Harker and Hanson using a primate model at the University of Washington. Jay, who ultimately became chief technology officer at 3M, was a hardworking, outstanding student, and much flowed from these experiments. Eventually this led to Michael Lelah's innovation of an arteriovenous series shunt model that increased productivity in testing different polyurethane compositions. During this time, we received almost continuous funding from NIH, AHA and industry to study blood–material interactions.

My other work at Wisconsin included studies of ionomers and novel polyurethane compositions. We synthesized extensive polyurethane variations, including inclusion of silicone rubber and other hydrophobic segments and incorporation of ionic functionality. I left Wisconsin in 1993 to become dean of engineering at the University of Delaware. There, I continued in research studying biomaterial-related infection and inflammation. This work involved in vitro studies of bacteria and leukocyte adhesion to polymer surfaces conditioned with various proteins.

All told, I was advisor to 62 PhD and 24 MS students and had a good number of visiting professors and postdocs in my laboratory over the years. Space limitation precludes my mentioning the many individuals who contributed to my research. Indeed, they deserve most of the credit for what was accomplished in my laboratory. After stints as chief academic officer at IIT in Chicago and North Carolina State University (where I helped inaugurate departments of biomedical engineering at both institutions), I came to The Ohio State University in 2004, where I chaired the Department of Chemical and Biomolecular Engineering for 10 years and have since returned to teaching.

FEATURE

From Wondering How to Teach to Winning a Top Award for Teaching

By Garry Pettus

Years ago, Dr. Amol Janorkar was a graduate student in chemical engineering trying to sniff out the secret of a mysterious formula: how to teach.

"I realized that I needed to learn how to be a teacher," said Dr. Janorkar, "so I asked my mentors if there was any way I could find out if I would be any good at it at all."

What his mentors at Clemson University did next may go a long way toward explaining what happened some 15 years later: During the Nelson Order luncheon, Dr. Janorkar, a professor of biomedical biomaterials science, was named the recipient of the 2018 Regions Toward Educational Advancement in Care and Health (TEACH) Prize.

During the May 7, 2018, ceremony, he accepted one of the University of Mississippi Medical Center's (UMMC) top awards for educators. Dr. Janorkar became one of 20 inductees into the Norman C. Nelson Order of Teaching Excellence, created in 2004 by the Office of Academic Affairs to toast the Medical Center's best teachers, as nominated by students from each UMMC school.

Dr. Janorkar, left, speaks with Bhuvaneswari Gurumurthy, graduate student.

Dr. Janorkar was one of six finalists chosen from the Nelson Order inductees by fellow faculty members and recommended by their deans. Their educational portfolios were scrutinized by a panel of administrators, faculty and students before one was selected for the TEACH Prize, sponsored since 2013 by Regions Bank. The Regions TEACH Prize lifts up the winner with a $10,000 award and the knowledge that students had a say in selecting the person deemed the year's most outstanding educator at UMMC. Dr. Janorkar accepted a ceremonial check from Dr. LouAnn Woodward, vice chancellor for health affairs and dean of the School of Medicine, and Alon Bee, city president at Jackson Regions Bank.

When Dr. Janorkar was called to the front of the room, his first thought was, "There is still so much for me to learn," he remembered. "But I am definitely grateful to my students who nominated me."

"That means the world to me," he said. "That's essentially what I'm here for."

For confirmation, consider the words of Bhuvaneswari Gurumurthy, a graduate assistant earning her PhD under Dr. Janorkar's mentorship.

"He cares about his students and will answer any questions we have, even a simple one," she said. "We can go to him without hesitation. He always puts us first, and I believe that's why he deserves the award.

"He gives us freedom to explore different research ideas. Before asking him what to do when we encounter a problem, he encourages us to think through all the possible solutions. It's a special quality he has."

His knack for getting students to come up with their own solutions also struck Dr. Kendra Clark soon after she chose Dr. Janorkar as her mentor. A fourth-year dental student with a PhD, Dr. Clark said that Dr. Janorkar also has the "ability to convey a vast amount of complicated information in an easy-to-understand format."

"He encourages and inspires," she said.

Dr. Janorkar was a student himself when he realized there was a glaring gap in his own education. "I didn't know if I could teach," he said. "I did not want to go into a teaching research job without knowing how to do it. That would be a disservice to the students."

He learned how much teachers meant to those they taught while growing up in Nasik, India. His father, now retired, was in government service, while his mother stayed home to raise Dr. Janorkar and his sister. On his mother's side of the family, though, teaching was the lure: His grandfather, some uncles and a few cousins are, or were, professional educators. "I saw students come to my relatives and say how much they had helped them," Dr. Janorkar said.

While pursuing his PhD in chemical engineering at Clemson University, Dr. Janorkar realized that no formal program existed to teach graduate students how to be teachers. "So, I asked my mentors, Dr. Douglas Hirt and Dr. David Bruce, to help me," he

Dr. Janorkar is framed by a ceremonial check and a congratulatory poster.

said. "They did something that had never been done before at Clemson; they let me teach a class in chemical engineering. They watched me for a semester, telling me what I did right or wrong.

"The general consensus was I could do it," he said.

It would be at least a couple more years before Dr. Janorkar would find out how well he could do it in Mississippi. He completed a two-year fellowship at Harvard Medical School in the Center for Engineering in Medicine before joining UMMC faculty in 2007, finally settling in Madison with the two people who "really drive me to do my best," he said: his wife, Dr. Deepti Janorkar, a UMMC assistant professor of dentistry, and their school-age daughter, Sanika.

"My personal growth since I came here, it's like night and day," he said, crediting his own mentors at UMMC and the valuable clinician's perspective he has gained. This perspective is really important for an engineer like Dr. Janorkar, who has served as chair of the Tissue Engineering SIG. "This is also the theme that the Society For Biomaterials puts a big emphasis on. What makes working at a medical center unique is that there are a lot of clinicians here," he said, "but the easiest one to talk to is my wife!"

Dr. Janorkar strongly acknowledges the support he has received from the graduate school and the dental school, which allowed the growth of graduate programs in biomedical materials science and a summer student research program called the Undergraduate and Professional Student Training in Advanced Research Techniques (UPSTART) program. He serves as director of both programs. The UPSTART program allows many dental students to participate in hands-on research. "Healthcare professionals getting research experience and working with researchers: That is what SFB encourages. Since its inception 10 years ago, 113 dental and undergraduate students have benefitted from the UPSTART program!" Dr. Janorkar said.

Acknowledging such contributions to the field of dentistry, Dr. Janorkar was recently inducted into the Omicron Kappa Upsilon (OKU) Dental Honor Society. OKU is an academic national honor society for dentists; occasionally, faculty members with no dental degree (like Dr. Janorkar) are inducted for their contributions to the field of dentistry and related basic sciences.

The Teaching Excellence tribute "makes tangible the Medical Center's claim that education is our first mission," said Dr. Rob Rockhold, professor of pharmacology and toxicology and deputy chief academic officer, who led the program.

Part of Dr. Janorkar's own philosophy for heeding that mission is "to recognize that each student is different from me," he said. "I don't have to make them be like me. When they bring up a research idea, that is their inner passion, and I usually don't tell them to back away from it. I may say, 'OK, but let's make it better.' "

Asked how he hit upon that formula, he said, "That is a tough one. Maybe it was observing all the teachers in my life, including my family, my colleagues and all my mentors. They are much better at this than I am."

Credits: Joe Ellis (photography), courtesy of the Office of Public Affairs, UMMC.

Dr. Janorkar, center, accepts a plaque and certificate pronouncing him recipient of the 2018 Regions TEACH Prize from Dr. LouAnn Woodward, left, vice chancellor for health affairs and dean of the School of Medicine, and Alon Bee, city president at Jackson Regions Bank.

Member News

By Rebecca Carrier, Member-at-Large

Society For Biomaterials members,
I am honored to serve as your 2018 – 2019 member-at-large. I will represent and promote the interests of SFB membership on the SFB Council. I plan to focus my efforts on three areas: (1) ensuring representation of all SFB membership, (2) ensuring that the Society provides benefits of maximum significance to the membership and (3) strengthening Society membership. I will work to make certain that SFB membership has a clear voice for SFB's direction, so together we can help SFB grow and maximize the value of your SFB membership. **Please email me at r.carrier@northeastern.edu with any ideas and feedback you would like to share!**

This quarter's exciting member news and accomplishments include the following:

Induction into the 2018 AIMBE Class of Fellows
Congratulations to the SFB members who were inducted as American Institute for Medical and Biological Engineering (AIMBE) Fellows: **Stephanie Bryant**, University of Colorado; **Craig Duvall**, Vanderbilt University; **Melissa Grunlan**, Texas A&M University; **Benjamin Keselowsky**, University of Florida; **Patrick Kiser**, Northwestern University; **Liisa Kuhn**, University of Connecticut Health Center; **Crystal Leach**, University of Georgia; **Hai-Quan Mao**, Johns Hopkins University; **Kristyn Masters**, University of Wisconsin at Madison; **Abhay Pandit**, National University of Ireland at Galway; **Rui Reis**, University of Minho; **Carl Simon**, National Institute of Standards & Technology; **Malcolm Snead**, University of Southern California; **Cherie Stabler**, University of Florida; and **Mei Wei**, University of Connecticut.

Josephine Allen, associate professor in the Department of Materials Science and Engineering at the University of Florida (UF), was selected for the Space Research Initiative at the Florida Space Institute to conduct research aboard the International Space Station U.S. National Laboratory. The award is supported by the joint UF–Center for the Advancement of Science in Space initiative to support space-related research. Dr. Allen's work is motivated by data that has shown a link between space flight, vascular dysfunction and cardiovascular disease (CVD). With the underlying contributing factor in CVD being dysfunctional vascular cells, it becomes important to study these cells under altered growth conditions. The goal of her work is to elucidate the mechanism of vascular cell damage in the space environment by exposing vascular cells to space flight. In the initial phases of these studies, her team will assess changes in transcriptomics of vascular cell types in space compared to those in a ground-based study. The insight that will be gained will contribute to a greater understanding of vascular cell heath and repair mechanisms and will open new lines of research in regenerative medicine and tissue engineering. Dr. Allen has teamed up with implementation partner, Space Technology and Advanced Research Systems, Inc., to provide advanced flight hardware. The project is expected to be flown on the International Space Station in November 2018.

A student of **Corey J. Bishop**, assistant professor of biomedical engineering in the Department of Biomedical Engineering at Texas A&M University, **Yong-Yu Jhan**, has been awarded a fellowship to the Taiwan Ministry of Education. Jhan is currently in the second year of her doctoral program. Students are selected for the fellowship based on academic achievement, research experience, research proposals and letters of recommendation. Jhan has been working in Dr. Bishop's Pharmacoengineering Laboratory since last September, focusing her research on developing a stable and convenient drug delivery platform for pulmonary delivery. The lab's goal is to explore combinational therapeutic formulations for cancer and infection diseases, including small molecules and gene therapy. (See more at tees.tamu.edu/news/2018/03/26/biomedical-engineering-student-awarded-fellowship-to-taiwan-ministry-of-education).

Guohao Dai, associate professor of bioengineering at Northeastern University, and **Yi Hong**, assistant professor of bioengineering at the University of Texas at Arlington, have developed elastic hydrogels useful for bioprinting. 3D bioprinting has tremendous potential in tissue engineering and regenerative medicine applications. However, the availability of printable hydrogels for soft tissue bioprinting is still limited. Current hydrogels for bioprinting are usually brittle and unstretchable due to lack of flexibility and elasticity and therefore do not mimic soft tissues' mechanical behavior of softness, stretchability and elasticity. To overcome this challenge, Profs. Hong and Dai have developed a highly elastic, biodegradable hydrogel system for bioprinting. The hydrogel system uses a single network, therefore greatly simplifying the printing process. The elastic hydrogel system can be used in bioprinting human soft tissues such as skin, skeletal muscle, blood vessels and heart muscles. This work has been published in *ACS Applied Materials & Interfaces* and was selected as an ACS Editors' Choice article. (See more at pubs.acs.org/doi/abs/10.1021/acsami.8b01294).

Chemical engineering undergraduate students **Elizabeth Fink** and **James Sinoimeri**, working with **Sidi A. Bencherif**, assistant professor of chemical engineering at Northeastern University, were recently awarded the Undergraduate Early/Advanced Research and Creative Endeavors Awards. Fink's research project is titled, "Developing a New Technique for the Formation of Uniform Multicellular Tumor Spheroids," and Sinoimeri's project is titled, "Developing Hypoxia-Inducing

Cryogels (HIC) to Produce More Realistic 3D Tumor Models." The Northeastern Office of the Provost grants this award to support compelling undergraduate projects. Fink's research explores a new way for creating multicellular tumor spheroids, a type of 3D tumor model currently used in drug screening, from a low number of cells quickly and simply while having good control over their size, morphology and uniformity. Sinoimeri's research explores designing a biomaterial that can accurately mimic various facets of the tumor microenvironment, including inducing a temporal and spatial oxygen gradient using hypoxia-inducing cryogels.

David Castner, professor of bioengineering and chemical engineering at the University of Washington, was selected by the American Vacuum Society to receive the 2018 Medard W. Welch Award "for leading advances in rigorous and state-of-the-art surface analysis methods applied to organic and biological samples."

The Ebong Mechanobiology Lab at Northeastern University, led by Assistant Professor of Chemical Engineering **Eno Ebong**, has accomplished a tremendous amount throughout this year. Prof. Ebong is a recent recipient of the prestigious National Institutes of Health Mentored Research Career Development Award (K01) for her research project on "Atheroprotective vs. Atherogenic Glycocalyx Mechanotransduction Mechanisms." She also recently received a Carl Storm Underrepresented Minority Fellowship to support her participation in the 2017 Tissue Repair & Regeneration Gordon Research Conference. Moreover, her students have recently received multiple honors: **Ming Cheng** received the 2018 American Institute of Chemist Award; **Solomon Mensah** received the NSF i-Corp award; and **Ian Hardin** received the prestigious American Heart Association Pre-Doctoral Fellowship, as well as the Outstanding Teaching Award from the College of Engineering at Northeastern University.

Steve Florczyk, assistant professor of materials science and engineering at University of Central Florida (UCF), was named the 2017 – 2018 Mentor of the Year by the UCF Office of Undergraduate Research. He was nominated by his undergraduate research assistants for the award, which recognizes outstanding mentoring and support of undergraduate research. Dr. Florczyk received his award following the UCF Showcase of Undergraduate Research Excellence, where three of his undergraduate research assistants presented projects. One of his undergradaute mentees, **Minh-Chau N. Le**, a mechanical engineering major and materials science and engineering minor student, was selected to the UCF Order of Pegasus Class of 2018, UCF's highest student honor.

Jeff Karp, associate professor at Brigham and Women's Hospital and Harvard Medical School and principal faculty at the Harvard Stem Cell Institute, has developed a novel biomaterial-based approach to targeting arthritis flares — the unpredictable and often sudden worsening of arthritis symptoms. A team of investigators at Brigham and Women's Hospital, led by Karp, and their collaborators have found that flares may represent an important opportunity for improving treatment options for patients. They have developed a hydrogel that can be loaded with arthritis drugs and injected locally into an inflamed joint. Instead of delivering the drug continuously at a steady rate, the hydrogel is designed to respond to increased disease activity during flares, releasing the drug when symptoms worsen. The team's laboratory-based findings were published in *Nature Communications*, and investigators are working on next steps to bring their technology closer to the clinic.

Shelly Sakiyama-Elbert, professor and chair of the Department of Biomedical Engineering at the University of Texas at Austin, was inducted to the National Academy of Inventors (NAI). Election to NAI Fellow status is the highest professional distinction accorded to academic inventors who have demonstrated a prolific spirit of innovation in creating or facilitating outstanding inventions that have made a tangible impact on quality of life, economic development and the welfare of society.

Christopher Bowman of University of Colorado at Boulder was elected to the National Academy of Medicine.

Robert S. Ward of ExThera Medical Corporation was inducted to the National Academy of Engineering.

A team led by **Dr. Joachim Kohn**, director of the New Jersey Center for Biomaterials and Board of Governors Professor of Chemistry and Chemical Biology at Rutgers University, has made significant advances in developing artificial axons delivering electrical impulses in vitro. The study of myelination on artificial axons can help in discovering mechanisms that glial cells can use to perform this process in the absence of neuronal molecular signals. Outcomes of such studies may in the future provide the means to restore myelination when it has been impaired by diseases like multiple sclerosis or Alzheimer's. In 1984, Althaus and colleagues cultured oligodendrocytes (the cell that myelinates axons in the central nervous system) on carbon fibers (Althaus et al, *Naturwissenschaften* 1984;71:309-315). At the end of their paper, they noted that the electroconductive property of the carbon fibers could be used to simulate the presence of an electrical-firing natural axon in vitro. Thirty years later, in 2017, Dr. Kohn's team at Rutgers University delivered a controlled pattern of electrical impulses to human Schwann cells (the cells that myelinate peripheral nerves) that were cultured

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on a suspended single carbon fiber. A 3D-printed support for the carbon fiber and the electrical contacts were built based on the "Suspended Wire Model" developed by **Antonio Merolli**, **Yong Mao** and **Joachim Kohn** (Merolli et al, *J Mater Sci Mater Med* 2017;28[4]:57). Patterned electrical impulses (PEIs) were generated by software developed by **Gregory Voronin** using an Arduino 101 microprocessor. The experiment was repeated three times with varied patterns of impulses administered. It showed that human Schwann cells can wrap around the carbon fiber and withstand the administration of impulses for up to three hours (the maximum duration tested). High-definition confocal laser microscopy and helium-ion scanning microscopy showed evidence of a complete ensheathment of the carbon fiber by some of the human Schwann cells in the presence of PEI. This research has been funded in part by a grant from New Jersey Health Foundation.

Anirban Sen Gupta and his former doctoral researcher **Dr. Christa Pawlowski** (past NSF GRFP Fellow and past president of Case Western SFB Chapter) co-founded a company, Haima Therapeutics LLC, with a vision for clinical translation of platelet-inspired technologies. The company recently received a Phase I SBIR grant from NSF to carry out CMC and quality control analysis on a liposome-based platelet surrogate nanoparticle technology named SynthoPlate. The company has also received a SMARTT award from NHLBI that will enable pharm/tox studies in rats, as well as regulatory consultation for a potential clinical translation pathway. In other exciting news from the lab, new collaborative work led by researchers at Case School of Medicine with Dr. Sen Gupta's laboratory at Case Biomedical Engineering has established a unique role of the coagulation factor zymogen FXII in signaling and activation of neutrophils, leading to persistent neutrophil extracellular trap formation in nonhealing wounds. These findings may lead to unique strategies to treat chronic wounds via inhibiting FXII-mediated neutrophil hyperactivity. The findings were reported in the March 2018 issue of the *Journal of Clinical Investigation*.

Christine Schmidt, currently the J. Crayton Pruitt Family Endowed Chair and department chair of BME at UF, will serve as president of AIMBE, 2018 – 2020. AIMBE Fellows represent the top 2 percent of those working in the areas of medical and biological engineering. In addition, another product from her Schmidt Lab is now commercially available and being used in patients. The VersaWrap tendon protector is a hydrogel membrane product from Alafair Biosciences, a startup from Austin, Texas, that is based on Schmidt Lab IP from the University of Texas. The first Schmidt Lab translation success was the Avance Nerve Graft commercial product from AxoGen, which licensed IP for nerve decellularization from the Schmidt Lab while Dr. Schmidt was at the University of Texas.

Technology developed by **Thomas Webster**, Chemical Engineering Department chair at Northeastern University, has led to a U.S. Food and Drug Administration (FDA)–approved product. Nanovis announced the successful FDA clearance of its FortiCore TLIF and PLIF interbodies featuring a nanosurface-enhanced deeply porous titanium scaffold intermolded with a PEEK core. Dr. Webster and Chang Yao, PhD, were early pioneers in the use of nanosurfaces to enhance bone growth. Nanovis' foundational FortiCore interbody fusion platform is well proven with more than 4,250 implanted to date. FortiCore interbodies have deeply porous interconnected titanium scaffolds intermolded with a PEEK core, giving surgeons important fixation and imaging advantages. Data comparing the osseointegration

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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 SFB headquarters and the Executive Editor of the *Biomaterials Forum*, Guigen Zhang, info@biomaterials.org, guigen.bme@uky.edu. All artwork with biomaterials relevance that have not appeared as a Forum cover are welcome. Multiple submission is permissible.

SELECTION PROCESS: All submissions will be reviewed by the *Biomaterials Forum* Executive Editor. 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.

Staff Update

By Pam Gleason, Assistant Executive Director

Hello from Society For Biomaterials headquarters! Our thanks and appreciation to Atlanta (and Georgia Tech), the hub for multidisciplinary materials research and applied solutions for healthcare, for hosting the 2018 Annual Meeting! With the beginning of a new program year, the Society's Board of Directors, Council, committees, task forces and SIGs will be working to advance the Society's mission as described below.

ANNUAL BUSINESS MEETING

The Society's Annual Business Meeting took place April 11, 2018, in Atlanta. Results of the spring election were announced. Congratulations to the following new Board officers:

2018 – 2019 President-Elect
Horst von Recum, PhD, Case Western Reserve University

2018 – 2019 Member-at-Large
Rebecca Carrier, PhD, Northeastern University

Members present approved the recommendation from the Bylaws Committee to amend the bylaws to allow the President's Advisory Committee to provide input to the incoming president.

ELECTION OF 2018 – 2019

Awards, Ceremonies & Nominations Committee

The following were elected by the members present: Thomas Webster, PhD, Northeastern University; Karen Burg, PhD, University of Georgia; Helen Lu, PhD, Columbia University; Suping Lyu, PhD, Medtronic; and Susan Thomas, PhD, Georgia Institute of Technology.

NEW COUNCIL

The following members will serve as committee chairs and, along with the Board, will comprise the 2018 – 2019 Council:

COMMITTEE	CHAIR
Awards, Ceremonies and Nominations	Thomas Webster, PhD
Bylaws	Ben Keselowsky, PhD
Education & Professional Development	Jan P. Stegemann, PhD
Finance	Elizabeth Cosgriff-Hernandez, PhD
Industrial Affairs	Peter Edelman, PhD
Liaison	Tim Topoleski, PhD
Membership	Anirban Sen Gupta, PhD
President's Advisory	David Kohn, PhD
Program	William Murphy, PhD Gopinath Mani, PhD
Publications	Sachin Mamidwar, MBBS, MS
Student Chapter President	Margaret Fettis, MS

Members elected or appointed to committees will be posted on the Society For Biomaterials website at biomaterials.org.

THE COMMITTEES ADVANCE THE SFB MISSION IN THE FOLLOWING WAYS IN THE FIRST QUARTER OF 2018:

Awards, Ceremonies & Nominations Committee

Chair: Nicholas P. Ziats, PhD

Results of the 2018 election were announced, and the following awards were presented during the Annual Meeting:

Founders Award
Andreas F. von Recum, PhD, The Ohio State University

Founders Award
Thomas Horbett, PhD, University of Washington

C. William Hall Award
Michael F. Wolf, MS, PE, Medtronic, Inc.

SFB Service Award
Howard Winet, PhD, UCLA, *retired*

Technology Innovation and Development Award
Harold Alexander, PhD, Orthogen, LLC, and John Ricci, PhD, New York University

Clemson Award for Applied Research
Mark W. Grinstaff, PhD, Boston University

Clemson Award for Basic Research
Jason A. Burdick, PhD, University of Pennsylvania

Clemson Award for Contributions to Literature
J. Paul Santerre, PhD, University of Toronto

Young Investigator Award
Susan Thomas, PhD, Georgia Institute of Technology

Student Award for Outstanding Research, Undergraduate
Justin X. Zhong, University of Texas at Austin

Student Award for Outstanding Research, PhD
Alysha P. Kishan, Texas A&M University

Student Award for Outstanding Research, PhD
Leo Wang, University of Pennsylvania

C. William Hall Scholarship
Jenna Mosier, Mississippi State University

Cato T. Laurencin Travel Fellowship
Mary Omotoso, North Carolina A&T University

Cato T. Laurencin Travel Fellowship
Timothy Mason, University of Connecticut

[CONTINUED ON PAGE 12]

Bylaws Committee

Chair: Ben Keselowsky, PhD

The Bylaws Committee presented an amendment to the membership to allow the President's Advisory Committee to provide input to the incoming president, which was adopted at the Annual Business Meeting.

Education & Professional Development Committee

Chair: Jan Stegemann, PhD

Since the fall Council meeting, the Education & Professional Development Committee has evaluated nominations for the C. William Hall awards, the Cato T. Laurencin Travel Fellowship, the STAR program and Student Chapter travel grants.

Finance Committee

Chair: Elizabeth Cosgriff-Hernandez, PhD

Income and expenses are in line with projections for 2018. SFB received an unqualified opinion ("clean") audit report for 2017. The financial position of the Society For Biomaterials as of Dec. 31, 2017, and the changes in its net assets and cash flows for the year were prepared in accordance with U.S. generally accepted accounting principles.

Meetings Committee

Chair: Nicholas Ziats, PhD

The following meeting locations have been approved by the Council: 2019, Washington State Convention Center, Seattle, Washington; 2020, World Congress year; and 2021, Hilton Chicago, Chicago, Illinois. 2022 locations are being considered.

Membership Committee

Christopher Gehrmann

Current membership stands at 1,246, which is up from the last two years. At this time last year, we were only at 1,055 members, and in 2016, we were at 869 members.

Program Committee

Chairs: Robert Hastings, MS, and Johnna Temenoff, PhD

The 2018 Annual Meeting closed on April 14, 2018, after three and half days of active meetings and interactions in Atlanta. Atlanta is a hub of medical technology, which was reflected in this year's Annual Meeting. Translational research and meaningful innovation were brought to new heights with the three-day Biomaterials Technology in Industry track and number of sessions, panels, workshops and plenary speeches involving the U.S. Food and Drug Administration, National Institutes of Health and industry speakers. Four Thought Leader Symposia were presented by invited speakers on leading-edge research. In total, 1,250 people registered for the conference, with 490 posters, 120 Rapid Fire presentations and 343 oral presentations. Thanks to the 2018 SFB Program Committee, especially Robert Hastings and Dr. Johnna Temenoff, for putting this program together. Abstracts from the meeting have been posted online at 2018.biomaterials.org/program.

Publications Committee

Chair: Sachin Mamidwar, MBBS, MS

The next edition of the preeminent textbook in the field, *Biomaterials Science,* published by Elsevier, is in the works with a new team of editors. Updates are expected on that in the near future. The journals continue to do very well in electronic format.

National Student Chapters

President: Daniel Hachim

The 2018 Student Luncheon in Atlanta was joined by a panel that focused its talks on presenting students with skills to help prepare them for a career in industry. The interactive discussion helped students gain skills to find the best methods for attacking job postings. With a new perspective on the job application process, we hope to see our student members succeeding professionally during these difficult transitional periods. Students who join SFB continue to receive complimentary membership to all SIGs they choose.

SIGs

Representative: Sarah Stabenfeldt, PhD

Officers for 2017 – 2019 held SIG sessions at the Annual Meeting. The SIG representative to the Board of Directors (Sarah Stabenfeldt) has established the following priorities for each SIG: Submit budget proposals by Aug. 15, 2018.

Appoint student, web, forum and industry representatives (all SIGs).

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 • URL: biomaterials.org

Student Chapter Update

By Daniel Hachim and Margaret Fettis, Student News Editors

The Student Luncheon was a success! Students and trainees gained valuable knowledge for preparing for a diverse set of careers from our panel of speakers, including Dr. Megan Jamiolkowski, Biomedical Engineering Staff Fellow at the U.S. Food and Drug Administration; Dr. Johnna Temenoff from Georgia Tech and Emory University; and Dr. Christine Horejs, associate editor of *Nature Reviews Materials*. Each of these invited speakers provided an overview of how she prepared for her career, what her normal work day is like, and her advice on how to apply and network for the best positions. Students were given the opportunity to ask questions to the panelists. The luncheon was moderated by Michaela (Mertz) McCrary and chaired by Dr. Cole DeForest, Daniel Hachim and Margaret (Maggie) Fettis.

As our period as student officers has come to an end, we would like to thank all of you for this incredible experience. We have established successful events at the Annual Meeting, better communication and many professional opportunities for students, many of them thanks to the Education & Professional Development Committee.

We wish the best to our new student officers. Results of the election were announced at our student chapter meeting, which was well attended. Results were:

- President-Elect: Jason Guo
- Secretary/Treasurer-Elect: James Shamul
- Bylaws Chair: Michaela (Mertz) McCrary

Students in attendance provided feedback on a number of SFB's programs and brainstormed ideas for programming for the upcoming year. Biomaterials Day events were summarized and upcoming events were advertised. Thank you to all student chapters for their efforts on these events! It is a point of pride for our student chapter to host these student-run Biomaterials Days.

We would also like to introduce you our new student president, Maggie Fettis, a doctorate candidate in biomedical engineering at the University of Florida (UF). Maggie comes from an established and active SFB student chapter. UF SFB held its 7th Annual Biomaterials Day in 2018, continues to offer biweekly research seminars and facilitates regular STEM/biomaterial outreach activities. At UF, Maggie has served as the student chapter secretary and president. At the national level, she has served as the student representative for the Biomaterials Education SIG and has competed in the Biomaterials Education Challenge. Maggie's visions for the student chapter are to improve student and community engagement in biomaterials. Her previous experiences in interdisciplinary research underlines the value of engaging students, trainees and seasoned researchers in biomaterials. Biomaterials can be an intimidating and seemingly inaccessible topic to researchers in other fields, or students beginning their education. Having access to resources to discuss, share and learn about biomaterials is invaluable for the advancement of the field. Continuing events such as Biomaterials Day and the Biomaterials Education Challenge are excellent ways to introduce students, as well as experienced researchers in neighboring fields, to the advantages of biomaterials. Maggie would like to implement more chances for networking and, more importantly, facilitate mentor-mentee opportunities. She is interested in forwarding SFB's initiative of creating an accessible, interactive community to promote excellence in the field of biomaterials to help students become effective researchers themselves. Maggie is always open to questions, comments or any other feedback pertaining to the student chapter. Contact her at mfettis@ufl.edu.

PAST STUDENT CHAPTER MEETINGS

Feb. 23, 2018: University of Florida
March 2, 2018: University of Tennessee Health Science Center, the University of Memphis (held at the University of Memphis)
March 3, 2018: Mid-Atlantic (held at Johns Hopkins University)

UPCOMING BIOMATERIALS DAYS

Sept. 21, 2018: North Carolina State University
Nov. 19, 2018: University of Pittsburgh and Carnegie Melon (held in Pittsburgh)
TBD November 2018: Southeast, Clemson University, Georgia Institute of Technology and Vanderbilt University (location TBD)

Update from the Engineering Cells and Their Microenvironments SIG

By Daniel L. Alge, PhD

The 2018 SFB Annual Meeting in Atlanta was a great one for the Engineering Cells and Their Microenvironments (ECTM) SIG! We had an excellent turnout for our 7 am SIG meeting (20 people), and we sponsored 17 sessions at the conference. We also recognized 20 student presenters with awards, including five ECTM SIG poster awards, three STAR awards and 12 STAR honorable mentions, to recognize outstanding work by student trainees.

Of course, many ECTM SIG members were active at the conference, too. Danielle Benoit (ECTM SIG chair) and Shilpa Sant chaired a session titled, "Engineered Microenvironments to Model Disease." This topic remains highly significant in our field because of the critical need for better in vitro models of diseases to advance fundamental research and provide better testbeds for novel therapeutics. Adam Feinberg (ECTM SIG vice chair) and my colleague from Texas A&M University Akhilesh Gaharwar chaired an excellent session on "Fabrication and 3D Printing of Tissue Engineering Scaffolds." Their session was one of several on 3D bioprinting at the conference, which is a testament to the explosion of interest in this area within the biomaterials community. Our SIG also contributed a guest symposium sponsored by the American Society for Matrix Biology titled, "Harnessing Matrix Biology to Control Cell Fate," which was chaired by Thomas Barker and Dwight Chambers. This session featured an outstanding invited talk by Michael Smith on how the mechanical and biological functions of the extracellular matrix are coupled and influence cell fate.

I had the privilege of co-chairing a session titled, "Engineering Cells and Their Microenvironments" along with Scott Wood of South Dakota School of Mines (ECTM SIG program chair). A theme of the talks in our session was advanced chemical strategies for engineering cell microenvironments. I have previously worked on light-responsive hydrogels as user-programmable cellular microenvironments, so I was excited to see the talks on recent innovations in this area from the groups of Adrianne Rosales and Chien-Chi Lin. Another theme in our session was understanding how the biomaterial microenvironment affects cell behavior. Along these lines, I particularly enjoyed the talk Carl Simon gave on image processing methods being developed at NIST to better quantify the shape and polarization of cells cultured within 3D scaffold materials. In my opinion, advancements like this are needed to help us better understand the effects of dimensionality and biophysical cues on cells within engineered microenvironments.

An emerging topic relevant to engineering cellular microenvironments that was highlighted at the conference was the use of hydrogel microspheres as building blocks for tissue engineering scaffolds. This topic was prominently featured in Jason Burdick's plenary talk on "Engineering Hydrogel Properties Through Macromer Design" after he received the Clemson Award for Basic Research. His group has made numerous contributions to the development of hydrogel platforms over the years, and they are currently focusing on constructing scaffolds from hydrogel microspheres,[1] including through bioprinting.

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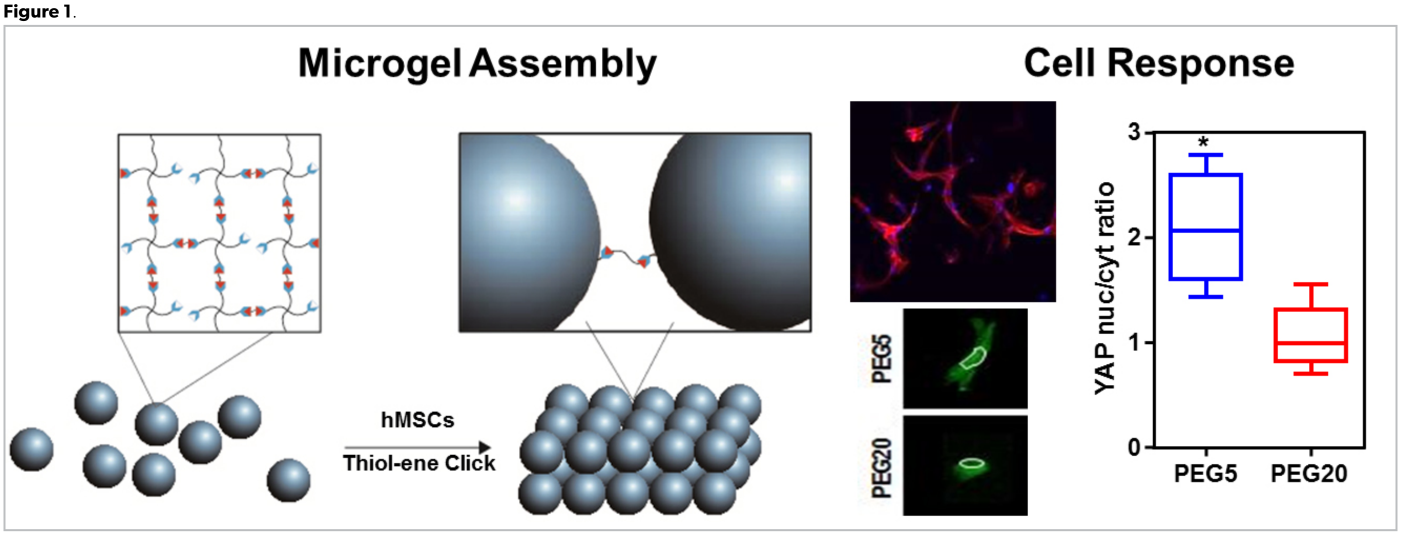
Figure 1.



Cell-instructive hydrogel scaffolds were prepared by assembling PEG hydrogel microspheres into a porous 3D structure via thiol-ene click chemistry. The interconnected micropores provide a permissive environment for hMSCs incorporated during assembly, which were able to spread and proliferate when the number of crosslinks between microspheres was low (fluorescence image is representative for a low amount of crosslinker). The hMSCs also responded to higher modulus microspheres (PEG5 ~36kPa, PEG 20 ~8kPa), as demonstrated by increased nuclear YAP staining (shown in green). Adapted from Xin et al.[4]

Education News

BEST PRACTICES FOR A TEACHING ASSISTANT

By C. Lashan Simpson, Education News Editor | Contributed by Allison N. Goins


C. Lashan Simpson


Allison N. Goins

As a graduate student, you can be assigned a teaching assistantship during your tenure. If you were never a teaching assistant (TA) during your undergraduate program, this new role can be intimidating. Below are several best practices from one graduate student to another that I learned throughout the four semesters that I served as a TA for lecture- and lab-based courses.

Although you may be close in age, you must maintain a professional distance and set boundaries with students early. Often when you are a TA, especially for a senior class, the lines can be blurred because the students are not much younger than you. While your first instinct may be to have a social relationship with students because you want to be "cool" or "approachable," it is important to remain professional and establish social and professional boundaries with students at the beginning of the semester.

A rule of thumb I always tell students is that they can send me a friend request on social media, but I will not accept it until they are no longer in my class. This rule was passed down to me by a more senior graduate student, and it has worked for me through all of my TA assignments. If students feel that you are more their friend than an authority figure, they can ask you compromising questions ("What's on the exam?" "Can I have an extension?" "Could you talk to the professor for me about additional points to bump my grade?"), which can create an uncomfortable situation for you and the student.

In addition, I am still very particular with my social media and very restrictive in what I post. If this is not how you are on some or all platforms, I would recommend waiting until students graduate to add them, or not adding them at all. It is important for the students to respect you, and limiting the out-of-classroom interactions you have with them to professional or controlled settings is important.

If you don't know the answer to a student's question, do not feel ashamed or unwilling to say, "I don't know." Once you are given a TA assignment, you may feel like you have to know all of the information in the course. You should be staying abreast on the material that is being covered, but if a student asks a question that you do not know the answer to, refer him or her to the professor, ask the professor to explain the material, or read the textbook to get a grasp of the material and then follow up with the student. A good approach to making sure you can address most of the questions that students will have is to work through any handouts or homework the professor assigns without the key. If there are any problems you are unable to solve, make time to meet with the professor teaching the course to get clarity so you can explain any questions students have. If a question is difficult for you, it will also probably be difficult for the students.

Be approachable ...within limits. Your role as the TA is to supplement the availability of the professor, and it is important to be available to students. During your office hours, make sure that there is space available for multiple students to come and ask questions. You do not want to seem preoccupied with research, data analysis or answering emails because this can make students feel like a burden. Although office hours may take time away from your studying or research, it is contractual. You should strive to carry them out to the best of your ability.

Lastly, being approachable within limits is important. Students will email you and expect answers from you at all hours, but you must remember that you are a human being who needs to sleep, and you have your own deadlines and exams. A good rule of thumb is to answer students' questions until 5 pm. Make this clear to students by posting it on the class page, making an announcement at the beginning of the semester or asking the professor to make an announcement.

Don't hold office hours in your student office. This tip is important because it affects your lab mates. Depending on timing during the semester (office hours are always busiest on the day before or day of homework or exams), you will have a high volume of students coming in and out during your office hours. If you hold office hours in your student office, it can be distracting for your colleagues and prevent them from making progress. It's also more tempting to pull out your own work and get distracted. As opposed to holding office hours in your student office, you should speak with the person in charge of scheduling rooms in your department and reserve a conference room or small area for the semester. This will give you favor with your fellow graduate students and allow you to be more focused on students and their questions. Because it is hard to avoid working for an extended period of time, I recommend bringing papers to read. You can annotate papers and highlight things to come back to after your office hours without being so consumed by the task that you make errors or neglect students.

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Lab-based courses are more time-consuming and require patience. The work load associated with lab-based courses versus lecture-based courses is very different. Typically for lecture-based courses, you grade and hold office hours; however, for lab-based courses, you typically will have to attend the lab and help students through the modules. While the professor may not require you to go through the lesson ahead of lab time, request the handout and read through it. If possible, walk through the lab and time yourself for each step. Doing this can help you estimate how long the lab will take students (usually multiply your time by two or three), and it can identify steps that may take longer. For longer steps, you can assist students to prevent the lab from running over time. Finally, in preparation for the lab meeting, you should go into the lab and assess the supplies that student groups will have to share. This is very important because groups will typically get to the same steps within five to 10 minutes of each other, and you do not want to cause a traffic jam of students waiting to use one piece of equipment. Stagger groups to avoid the traffic jam by having them start at different steps that will not impede their progress.

If you implement these best practices, you may still run into some issues. Find a mentor (a more senior graduate student, the professor of the course or your research mentor) who can help you when challenges arise.

Update from the Engineering Cells and Their Microenvironments SIG (continued from page 14)

This approach has some important advantages, such as the ability to mix multiple microsphere formulations into one construct to create cell-instructive materials with heterogenous but defined physicochemical properties. The inherent microporous structure that is produced when the microspheres are fused together is also an important advantage. Recent work from Tatiana Segura's group has shown that this microporosity significantly improves in vivo tissue regeneration in dermal wound healing and stroke models compared to conventional hydrogels, which are nanoporous in nature.[2,3] They are continuing to innovate in this area and presented an interesting talk on generating gradients in injectable microsphere formulations.

My lab has also been working in this area and recently published a paper in *Advanced Healthcare Materials* on the assembly of poly(ethylene glycol) (PEG) hydrogel microspheres into tissue engineering scaffolds via thiol-norbornene photoclick chemistry (Figure 1).[4] In our paper, we used a bifunctional PEG liker to investigate how the extent of crosslinking between the hydrogel microspheres affects the ability of human mesenchymal stem cells (hMSCs) seeded in the micropores to spread and proliferate. Importantly, we found that a low number of crosslinks was critical to provide a microenvironment that was permissive to hMSC spreading and proliferation. This result was somewhat surprising given that the linker molecule was only nanometers long and was, thus, incapable of bridging the micropores. We also investigated the effects of PEG hydrogel microsphere modulus, which was controlled by modulating the PEG molecular weight used during microsphere synthesis. We specifically compared Young's moduli of approximately 36kPa and 8kPa, as measured by atomic force microscopy, and found that the higher modulus resulted in increased hMSC spreading as well as increased nuclear Yes-associated protein (YAP). These results were exciting to us as they are the same as what is known to occur in 2D cultures but are distinctly different from what has been reported for hMSCs encapsulated within conventional 3D hydrogels. With the generous support of the National Institute of Arthritis and Musculoskeletal and Skin Diseases of the National Institutes of Health, we are now investigating whether we can build on this work to engineer osteoinductive microenvironments for hMSC delivery and bone regeneration (R21 AR071625). Hopefully, we will have some exciting results to present at the next SFB Annual Meeting!

REFERENCES

1. Mealy JE, Chung JJ, Jeong HH, et al. Injectable granular hydrogels with multifunctional properties for biomedical applications. *Adv Mater*. 2018;30(20):e1705912.
2. Griffin DR, Weaver WM, Scumpia PO, Di Carlo D, Segura T. Accelerated wound healing by injectable microporous gel scaffolds assembled from annealed building blocks. *Nat Mater*. 2015;14(7):737-744.
3. Nih LR, Sideris E, Carmichael ST, Segura T. Injection of microporous annealing particle (MAP) hydrogels in the stroke cavity reduces gliosis and inflammation and promotes NPC migration to the lesion. *Adv Mater*. 2017;29(32). doi:10.1002/adma.201606471
4. Xin S, Wyman OM, Alge DL. Assembly of PEG microgels into porous cell-instructive 3D scaffolds via thiol-ene click chemistry. *Adv Healthc Mater*. 2018:e1800160. doi:10.1002/adhm.201800160

Industry News

By Steve Lin, Industry News Editor

The Advanced Medical Technology Association (AdvaMed) announced that it has closed a transaction to fully own and operate **The MedTech Conference**, the premier global gathering of the medical technology industry. Under the transaction, the association will acquire all outstanding interests in MedTech Conference Partners, LLC, currently owned by the Life Sciences Conference Group LLC, which has managed the conference for AdvaMed since 2011. Going forward, The MedTech Conference will be fully integrated into the association's existing events and education capacity. The association plans to take a new strategic and comprehensive approach to the delivery of a full range of events, networking, education and partnering opportunities.

Global investment firm **Platinum Equity** has submitted a binding offer to acquire Johnson & Johnson's (J&J) diabetes unit, **LifeScan**, for about $2.1 billion. LifeScan generated a net revenue of around $1.5 billion in 2017. Based in Chesterbrook, Pennsylvania, LifeScan produces blood glucose monitoring systems under the OneTouch brand, which are used by more than 20 million patients across 90 countries. With around 3,000 employees, LifeScan operates manufacturing facilities in Puerto Rico and Scotland. Platinum Equity said the acceptance period for the offer will end on June 15, 2018, and consultations with relevant works councils are planned during the same period. If the offer is accepted by J&J, the deal is expected to be completed by the end of this year, subject to the satisfaction of customary closing conditions.

India's **National Pharmaceutical Pricing Authority** (NPPA) set the price hike for all medical devices except for stents, condoms and intrauterine devices to a maximum of 10 percent in a year. The drug price regulator also clarified that all medical devices notified as drugs under the Drugs and Cosmetics Act, including stents, orthopaedic implants, catheters and intra-ocular lenses, will have to mandatorily carry their maximum retail price on their packs. While the government has notified 22 medical devices as drugs under the Act, the prices of stents, condoms and intrauterine devices are capped by NPPA directly, and companies manufacturing or selling these products have to take permission from the regulator before implementing any hike.

Apax Partners has agreed to acquire remaining stake in respiratory solutions company **Vyaire Medical** from Becton, Dickinson and Company (BD) for $435 million. In October 2016, BD and Apax Partners established Vyaire Medical as a new global respiratory solutions company. The move followed Apax's acquisition of 50.1 percent stake in BD's respiratory solutions business. BD owned 49.9 percent stake in the new company. Based in Chicago, Vyaire Medical is engaged in the manufacturing and distribution of both respiratory and anesthesia/surgical consumables, as well as capital equipment for respiratory diagnostics and ventilation. The company manufactures and markets more than 27,000 products for the diagnosis, treatment and monitoring of respiratory conditions.

German firm **Natural Dental Implants** has developed a 3D-printed version of the Replicate tooth. The new 3D-printed tooth will also feature a titanium root portion and a zirconia abutment portion similar to the already available Replicate tooth that is made by 5-axis CNC milling. According to the company, the Replicate tooth is an immediate and minimally invasive alternative to traditional dental implants and three-unit bridges. The Replicate tooth is an anatomical copy of the patient's natural tooth. Based on data submitted by the dentist, the company will design and manufacture a Replicate tooth for the specific patient. The Replicate system is already marketed in the EU, while it is yet to receive approval from the U.S. Food and Drug Administration (FDA).

U.S.-based **Precision Therapeutics** has signed a letter of intent to acquire the remainder of equity in **Helomics**. Under the agreement, a newly formed subsidiary of Precision Therapeutics will merge into Helomics, increasing Precision's stake from 25 percent to 100 percent. Precision Therapeutics focuses on applying artificial intelligence (AI) to personalized medicine and drug discovery. The all-stock transaction will allow Precision Therapeutics to access Helomics' suite of AI and precision diagnostic and integrated contract research organization capabilities, as well as develop innovative clinical products and technologies for the treatment of cancers. The deal will also establish Precision Therapeutics as a major player in the precision oncology market and create a more diverse and balanced portfolio.

Italian company **Medical Microinstruments** (MMI) has secured €20 million in series A funding to speed up the development of its robotic platform for microsurgery. The round aims at completing product and clinical development, obtaining the CE mark and launching in European markets. MMI said that while robotics has penetrated laparoscopic surgery and more recently orthopedic surgery, microsurgery used in reconstructive, lymphatic and eye surgeries and others has remained mostly unserved by robotics. The market opportunity for robotic microsurgery exceeds $2.5 billion annually.

[CONTINUED ON PAGE 18]

Boston Scientific has acquired medical devices maker **EMcision** for an undisclosed sum. With operations in the UK and Canada, EMcision is engaged in the development of medical devices based on radiofrequency (RF) technology for the surgical community. EMcision produces the Habib EndoHPB probe, an endoscopic bipolar RF device that coagulates tissue in the gastrointestinal (GI) tract. The device secured approval from the FDA and received the CE mark in the EU. The endoscopic bipolar RF device will help physicians treat patients with pancreaticobiliary cancers. Patients with pancreaticobiliary cancers will get jaundice due to tissue ingrowth, which blocks ducts that enable bile to drain out of the GI tract. The Habib EndoHPB probe coagulates this tissue to help drain the fluids and improve the patient's quality of life.

Government News

By Carl Simon, Government News Editor

An Early Feasibility Study (EFS) is a small, clinical investigation conducted at an early stage of device development.[1–3] The U.S. Food and Drug Administration's (FDA) Center for Devices and Radiological Health (CDRH) set up the EFS program to bring EFSs for medical devices back to the United States. In the past, medical device manufacturers that wanted to gain early clinical experience with their new devices often went overseas to conduct first-in-human or small clinical studies.

An EFS typically enrolls a small number of subjects (10 or fewer) and may evaluate device design in regard to safety and functionality. An EFS is appropriate when this information cannot practically be provided through nonclinical assessments or when appropriate nonclinical tests are unavailable. Results from the studies may be used to guide improvements to device design.

Fifty-seven EFSs were submitted to CDRH/FDA in fiscal year 2017. In fiscal years 2016 and 2017, 75 percent of the EFS investigational device exemptions (IDEs) that were submitted were approved or approved with conditions within a 30-day review cycle.

A key component of the EFS program is the opportunity for an interactive review: The sponsor may request assistance in submission preparation from an EFS program representative. These collaborations between the sponsor and the FDA's review team are crucial for success. The EFS experience may be particularly important for small manufacturers. Many EFS IDEs are submitted by "small companies for whom early clinical experience is crucial for obtaining financial resources," according to the FDA.[1]

"A KEY COMPONENT OF THE EFS PROGRAM IS THE OPPORTUNITY FOR AN INTERACTIVE REVIEW: THE SPONSOR MAY REQUEST ASSISTANCE IN SUBMISSION PREPARATION FROM AN EFS PROGRAM REPRESENTATIVE."

Disclaimer: Certain equipment and instruments or materials are identified to adequately specify experimental details. Such identification does not imply recommendation by NIST, nor does it imply that the materials are necessarily the best available for the purpose. This article, a contribution of NIST, is not subject to U.S. copyright.

REFERENCES

1. Dreher ML, Farb A, Faris O. Bringing early feasibility studies for medical devices back to the United States. FDA Voice. https://blogs.fda.gov/fdavoice/index.php/2017/12/bringing-early-feasibility-studies-for-medical-devices-back-to-the-united-states. Published December 12, 2017. Accessed May 22, 2018.
2. Early Feasibility Studies (EFS) Program. U.S. Food and Drug Administration website. https://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/HowtoMarketYourDevice/InvestigationalDeviceExemptionIDE/ucm572934.htm. Updated December 23, 2017. Accessed May 22, 2018.
3. U.S. Food and Drug Administration. Investigational device exemptions (IDEs) for early feasibility medical device clinical studies, including certain first in human (FIH) studies: guidance for industry and Food and Drug Administration staff. https://www.fda.gov/downloads/medicaldevices/deviceregulationandguidance/guidancedocuments/ucm279103. Published October 1, 2013. Accessed May 22, 2018.

Members in the News (continued from page 10)

strength of the FortiCore scaffold, PEEK and allograft to the strength of trabecular host bone was published in *Spine* in late 2016. (See more at orthoworld.com/knowent/nanovis_032918.pdf).

Aleo BME, a biomaterials and medical device company co-founded by **Jian Yang**, professor of biomedical engineering at The Pennsylvania State University, has received notification from the FDA that it has been approved for the sale and licensing of ElaSkinTM as a liquid bandage for the protection and treatment of a broad set of skin conditions and injuries. Aleo BME is a startup developing nature-inspired biomaterials to address unmet challenges in the fields of biology, medicine and the environment. Aleo BME's foundational technology is comprised of novel biomaterials and devices developed by its medical R&D program in addition to technology licensed from Yang's lab. Aleo BME is currently partnering for scale-up and distribution of the ElaSkinTM liquid bandage and expects to make it available for both prescription and over-the-counter use by 2019 or sooner. (See more at biomaterials.org/publications/news/sfb-member-jian-yang-phd-gets-fda-approval-elaskin).

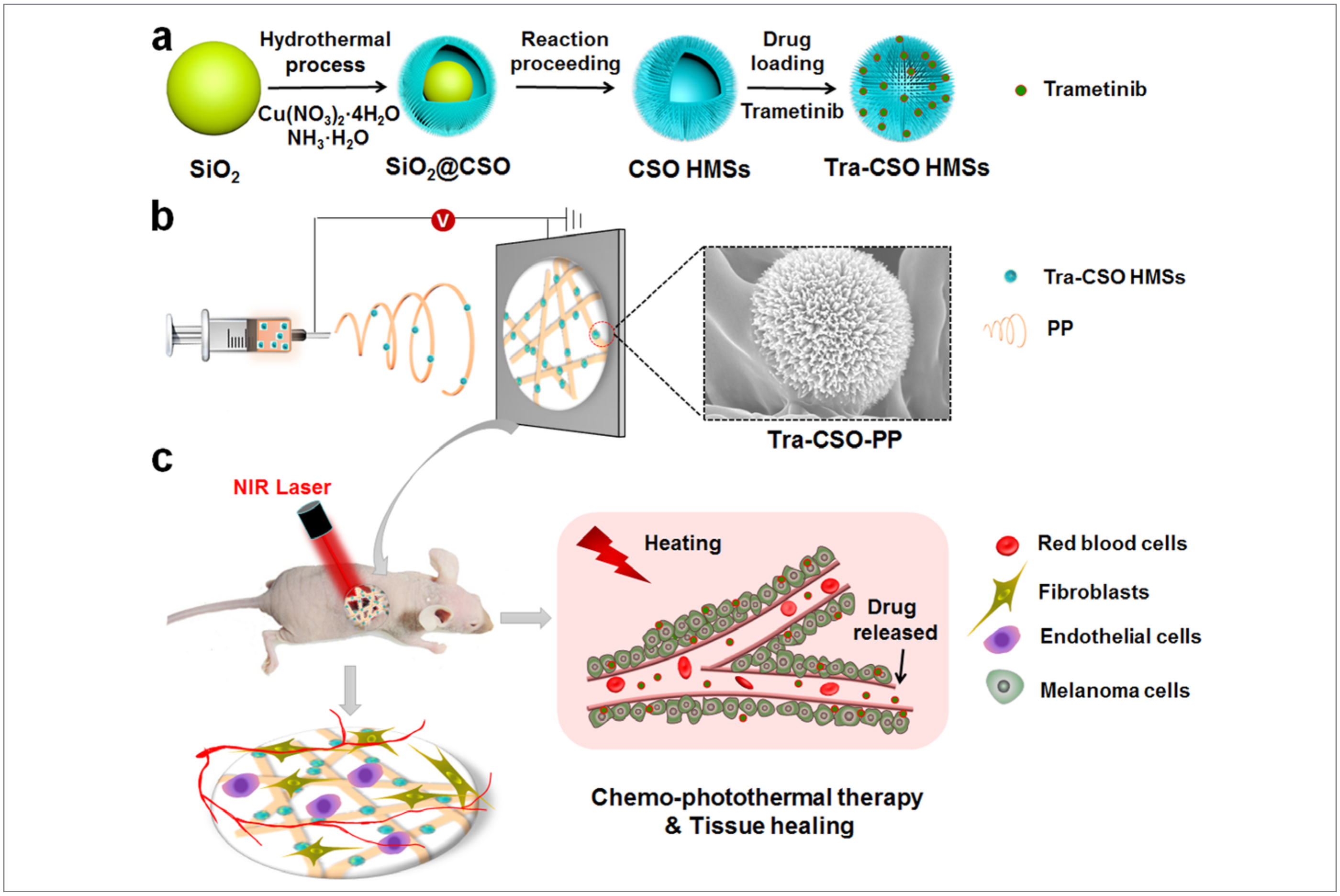
Highlights of the Latest Biomaterials Research from ACS Nano

COPPER SILICATE HOLLOW MICROSPHERES-INCORPORATED SCAFFOLDS FOR CHEMO-PHOTOTHERMAL THERAPY OF MELANOMA AND TISSUE HEALING

An interdisciplinary team of researchers led by Dr. Chengtie Wu of the Shanghai Institute of Ceramics, Chinese Academy of Sciences, has successfully fabricated copper silicate hollow microspheres (CSO HMSs)-incorporated electrospun scaffolds, using CSO HMSs as drug-loaded PTAs for melanoma therapy and as the source of therapeutic elements (Cu and Si) for localized wound healing.[1]

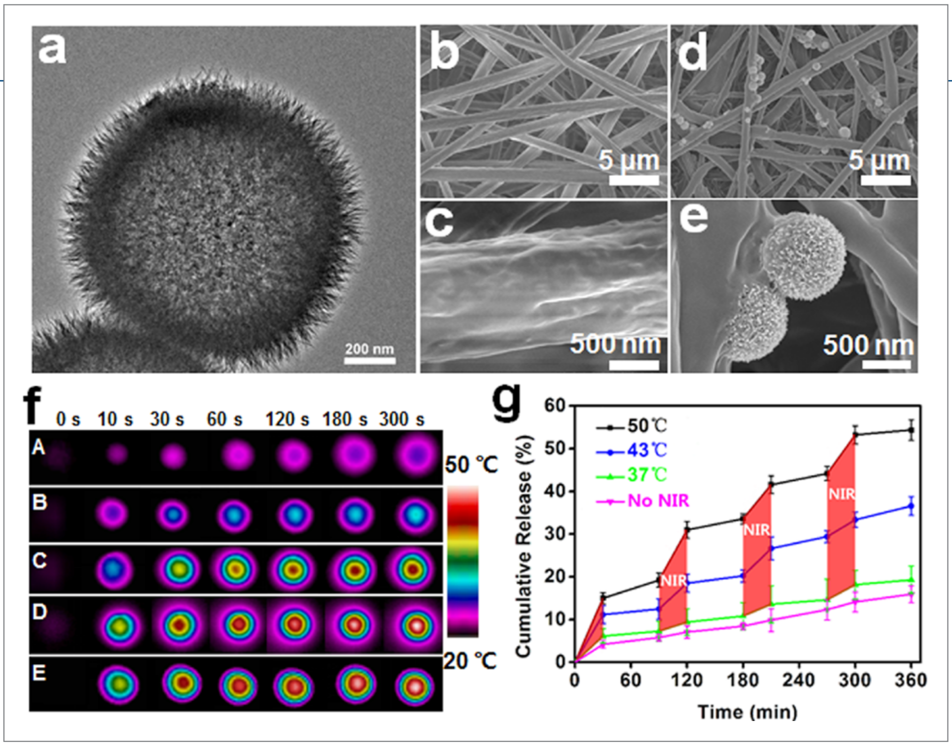
The treatment of melanoma requires complete removal of tumor cells and simultaneous tissue regeneration of tumor-initiated cutaneous defects. Herein, CSO HMSs-incorporated bioactive scaffolds were designed for chemo-photothermal therapy of skin cancers and regeneration of skin tissue (Scheme 1). CSO HMSs were synthesized with an interior hollow and external nanoneedle microstructure (Figure 1a), showing excellent drug-loading capacity and photothermal effects. With incorporation of drug-loaded CSO HMSs into the electrospun scaffolds, the composite scaffolds (Tra-CSO-PP) exhibited excellent photothermal effects, and the NIR laser could effectively control the drug release from scaffolds (Figures 1b – g). Tra-CSO-PP scaffolds exhibited significantly synergistic effects on killing skin tumor cells both in vitro (Figure 2a) and in vivo (Figure 2b), as compared to single photothermal treatment or chemotherapy. Furthermore, such scaffolds could accelerate tissue healing in both tumor-bearing and diabetic mice (Figures 2c – d). Therefore, CSO HMSs-incorporated scaffolds may be used for eradication of remaining tumor cells after surgery and subsequent tissue healing, offering an effective strategy for tumor therapy and regeneration of tumor-initiated tissue defects.

Scheme 1.



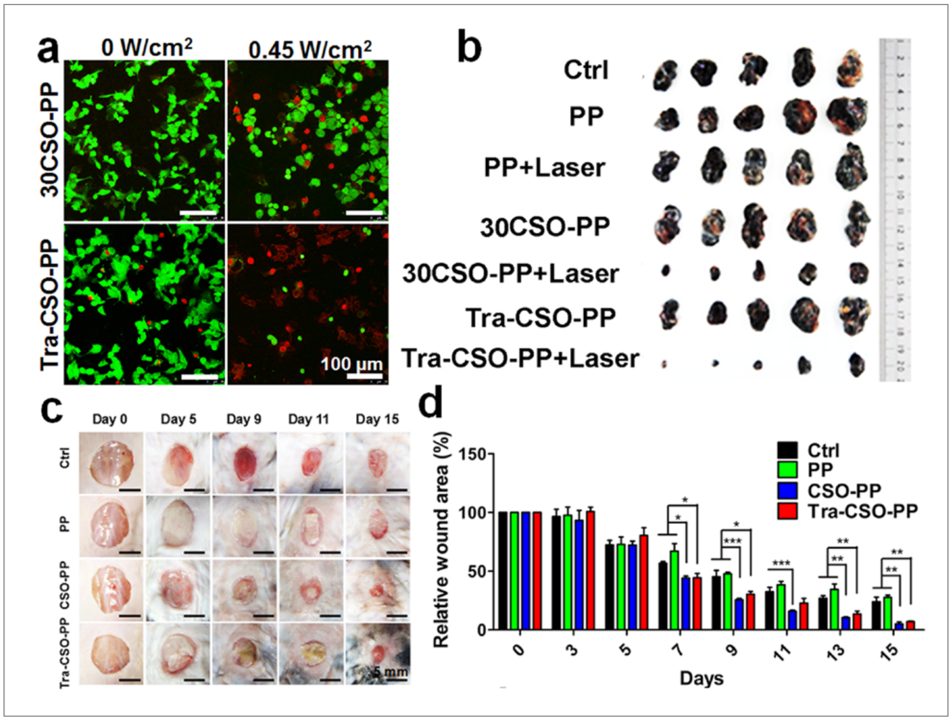
Schematic illustration of the design and application of Tra-CSO-PP scaffolds. (a) Synthesis of CSO HMSs and the subsequent anti-cancer drug loading (Tra-CSO HMSs). (b) Fabrication of Tra-CSO HMSs-incorporated Poly(ε-caprolactone)/Poly(D, L-lactic acid) (PP) fibrous scaffolds (Tra-CSO-PP) by electrospinning. (c) Chemo-photothermal therapy of melanoma skin cancer and healing of skin tissues.

Figure 1.



(a) TEM image of CSO HMSs. SEM images of (b, c) PP and (d, e) Tra-CSO-PP scaffolds. (f) Infrared thermal images of various scaffolds (A: PP, B: 10CSO-PP, C: 20CSO-PP, D: 30CSO-PP, E: Tra-CSO-PP) under irradiation (808 nm, 0.45 W/cm^2, 5 min). (g) NIR-triggered drug release profiles from Tra-CSO-PP scaffolds at 37°C, 43°C or 50°C.

Figure 2.



(a) In vitro antitumor study. Live/dead staining images of B16F10 cells treated with 30CSO-PP and Tra-CSO-PP scaffolds with or without irradiation (green: live cells; red: dead cells). (b) In vivo antitumor study. Photographs of the excised tumors on day 14. In vivo diabetic wound healing study. (c) Representative skin wound photographs. (d) Wound closure rates of the control, PP, 30CSO-PP and Tra-CSO-PP groups.

REFERENCE

1. Yu Q, Han Y, Wang X, et al. Copper silicate hollow microspheres-incorporated scaffolds for chemo-photothermal therapy of melanoma and tissue healing. *ACS Nano*. 2018;12(3):2695-2707.

Book Review

By Lynne Jones, Book Review Editor

Chitosan Based Biomaterials, edited by J. Amber Jennings and Joel D. Bumgardner, Cambridge, MA: Woodhead Publishing (Elsevier), 2017. ISBN: 978-08-100228-5 (print); ISBN: 978-08-100256-8 (online)
Two volumes:
Volume 1: Fundamentals
Volume 2: Tissue Engineering and Therapeutics

Chitosan Based Biomaterials is a two-volume textbook of 21 chapters written by 53 contributors that is dedicated to the characterization and exploration of medical applications of chitosan-based biomaterials.

Volume 1, Fundamentals, is focused on the chemical, physical and biological properties of medical-grade chitosans. Part 1 begins with an introduction to the topic, with Chapter 1 informing us that chitosan is a natural polysaccharide obtained from partial or full deacetylation of chitin, the most naturally abundant polysaccharide after cellulose.[1] Chitosan can be easily modified to alter specific features that can be exploited for certain medical applications. Part 2 describes how certain properties of chitosan can be modified by deacetylation (Chapter 5) or by modifying the molecular weight (Chapter 6). Chitosan has been shown to be biocompatible, biodegradable with nontoxic degradation products, easy to modify and able to be manufactured into different forms.[2] The immunological responses to chitosan are well described in Chapter 3 and reinforce that it is important to characterize the biomaterial (Chapter 4) that you are using, as well as its purity. The different properties of chitosan result in expanding the number of potential medical applications. Production techniques are often overlooked in textbooks but are a vitally important aspect of biomedical applications. The inclusion of five chapters in Part 3 regarding production techniques is invaluable and distinguishes this book from many others regarding biomaterials.

"SO WHY DO WE NEED ANOTHER PUBLICATION ON CHITOSAN? I WOULD ARGUE THAT THIS TWO-BOOK SERIES PROVIDES A RESOUNDING RESPONSE TO THIS QUESTION."

Volume 2, Tissue Engineering and Therapeutics, dives deeper into the medical applications of chitosan. Chapter 1 begins with a basic description of nanotechnology and how chitosan lends itself easily to this application. Parts 1 and 2 describe the use of chitosan in musculoskeletal engineering (bone and cartilage [Chapter 2] and tendon [Chapter 3]), the pancreas (Chapter 4) and cardiac tissue (Chapter 5). I also believe that the discussion on using chitosan hydrogels for vascularization (Chapter 4) will have broad interest to individuals from different fields. Volume 2 also contains chapters on drug (Chapter 6) and growth factor (Chapter 7) delivery, as well as for DNA and gene therapy (Chapter 8). The chapters on the antibiotic properties and the delivery of antibiotics (Chapters 2, 6 and 9) illustrate the utility of using chitosan as implants, delivery systems and coatings for many medical applications.

A Pubmed search on “chitosan and tissue engineering” yields 2,300 articles since 1997 and 10x more if you just search on “chitosan.” So why do we need another publication on chitosan? I would argue that this two-book series provides a resounding response to this question. Each chapter provides an excellent review of the literature with a deep look into the subject matter. The extensive list of references at the end of each chapter is a resource in and of itself. Each chapter interprets the findings with respect to their application to medical applications. I particularly like the inclusion of experimental methods at the conclusion of most chapters. The books will prove invaluable long after the classroom experience. There is some redundancy between the chapters, especially as most chapters begin with the basics and expand into more detailed information. I found that this redundancy reinforced the principles being discussed.

Also, certain chapters can be used to introduce various topics, such as nanotechnology, hydrogels and delivery systems in general. In fact, the books can be used as a foundation to describe the process of introducing a new material to the biomedical community. Importantly, the chapters are written in a style that makes them accessible to upper-level undergraduate and graduate students.

VOLUME 1, FUNDAMENTALS

Part 1

Chapter 1: Fundamentals of chitosan for biomedical applications
Chapter 2: Antibacterial properties of chitosan
Chapter 3: Immunological responses to chitosan for biomedical applications
Chapter 4: Characterization of chitosan matters

Part 2

Chapter 5: Deacetylation modification techniques of chitin and chitosan
Chapter 6: Modifying the molecular weight of chitosan
Chapter 7: Controlling chitosan degradation properties in vitro and in vivo

Part 3

Chapter 8: Production of micro- and nanoscale chitosan particles for biomedical applications
Chapter 9: Production of electrospun chitosan for biomedical applications
Chapter 10: Lyophilized chitosan sponges
Chapter 11: Production of chitosan coatings on metal and ceramic biomaterials
Chapter 12: Production of chitosan-based hydrogels for biomedical applications

VOLUME 2, TISSUE ENGINEERING AND THERAPEUTICS

Chapter 1: The role of nanotechnology and chitosan-based biomaterials for tissue engineering and therapeutic delivery

Part 1

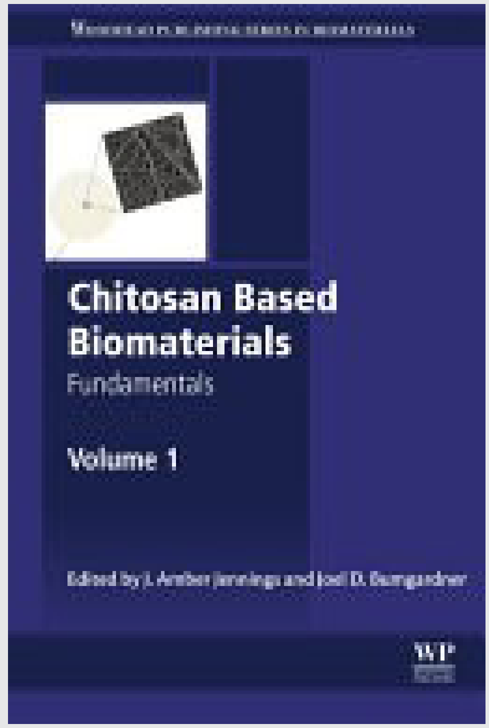
Chapter 2: Chitosan for bone and cartilage regenerative engineering
Chapter 3: Chitosan for tendon engineering and regeneration

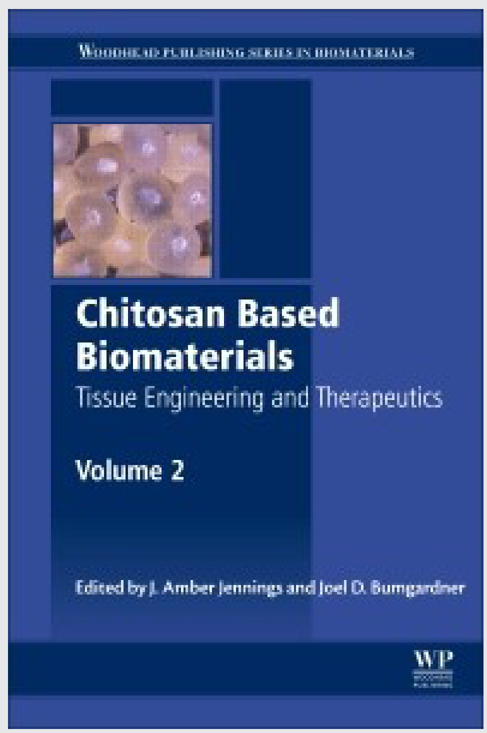
Part 2

Chapter 4: Chitosan-based biomaterials for treatment of diabetes
Chapter 5: Chitosan for cardiac tissue engineering and regeneration

Part 3

Chapter 6: Chitosan for the delivery of antibiotics
Chapter 7: Chitosan-based scaffolds for growth factor delivery
Chapter 8: Chitosan for DNA and gene therapy
Chapter 9: Antimicrobial applications of chitosan





REFERENCES

1. Vunain E, Mishra A, Mamba B. Fundamentals of chitosan for medical applications. In: Jennings J, Bumgardner J, eds. *Chitosan Based Biomaterials Fundamentals*. Cambridge, MA: Woodhead Publishing; 2017:3-30.
2. Bumgardner J, Murali V, Su H, et al. Characterization of chitosan matters. In: Jennings J, Bumgardner J, eds. *Chitosan Based Biomaterial Fundamentals*. Cambridge, MA: Woodhead Publishing; 2017;81-114.

Award and Officer Nominations

SFB 2019 AWARD AND OFFICER NOMINATION — LETTER OF INTENT — JULY 16

The Awards, Ceremonies and Nominations Committee is soliciting nominations for the 2019 awards (biomaterials.org/awards/awards-descriptions) and Officer Nomincations listed below:

2019 AWARDS:

- Founders Award
- C. William Hall Award
- SFB Award for Service
- Technology Innovation and Development Award
- Mid-Career Award
- Young Investigator Award
- Clemson Award for Basic Research
- Clemson Award for Applied Research
- Clemson Award for Contributions to the Literature
- Student Award for Outstanding Research (PhD, Masters and Undergraduate)
- Outstanding Research by a Hospital Intern, Resident or Clinical Fellow Award

2019 OFFICER NOMINATIONS:

- President-elect (one year term) who then becomes President the following year
- Member-at-large (one year term)
- Secretary/Treasurer-elect (two year term), who then becomes Secretary/Treasurer for the following two years

APPLICATIONS WILL BE ACCEPTED FOR THE FOLLOWING STUDENT AWARDS BEGINNING IN AUGUST:

- Cato T. Laurencin Travel Fellowship (biomaterials.org/awards/cato-t-laurencin-travel-fellowship) (applications due November 30, 2018)
- C. William Hall Scholarship (biomaterials.org/awards/c-william-hall-scholarship) (applications due November 30, 2018)

The 2019 award nomination deadline is Friday, September 14, 2018; however, nominators are encouraged to submit a letter of intent to nominate to Headquarters by July 16. Although a letter of intent is not required and is not binding, the information that it contains will permit the Awards, Ceremonies and Nominations Committee to identify awards and positions for which apparent nominations are not forthcoming and to solicit specific nominations as needed. Nominations will be accepted in September regardless of the receipt of a letter of intent.

To submit a letter of intent to nominate, please include your contact information, the name of the candidate and the award or position for which the nomination will be made in an email to info@biomaterials.org.

PLEASE CONTACT

Society For Biomaterials Headquarters directly with any questions or concerns.

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