

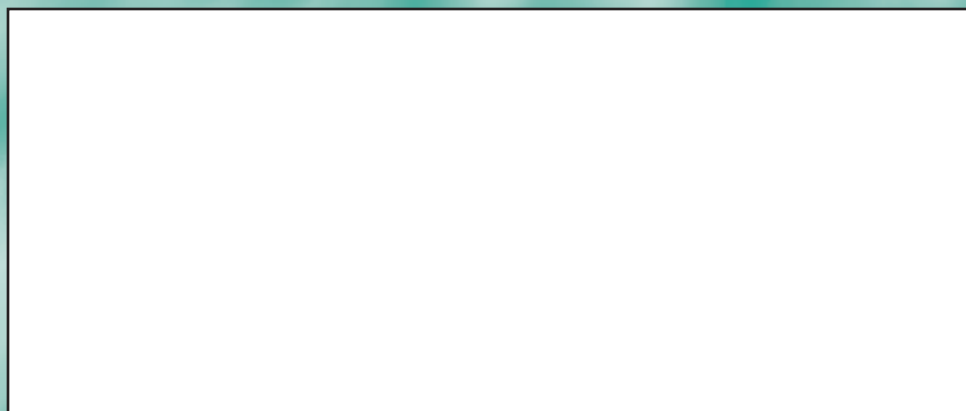
2008 Award Winners

BIOMATERIALS FORUM



First Quarter 2008 • Volume 30, Issue 1

Considerations for Carbon Nanotubes in Biomaterials Research



**Society
Officer
Nominees**

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 (e-mail: info@biomaterials.org) or visit the Society's Web site, www.biomaterials.org.

It is the policy of the Society For Biomaterials that all articles reflect only the views of the authors and that 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 as 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 Web site, 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*, 15000 Commerce Parkway, Mt. Laurel, NJ 08054.

Requests for advertising information should be directed to Frank Scussa at fscussa@ahint.com or (856) 439-0500, ext. 4427. Information is also available on the Society's Web site, www.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© 2008 ISSN 1527-6031
Society For Biomaterials
All rights reserved

BIOMATERIALS FORUM



The official news magazine of the **SOCIETY FOR BIOMATERIALS** • Volume 30, Issue 1

Executive Editor

Karen Burg, Clemson University, Department of Bioengineering
501 Rhodes Engineering Research Center, Clemson, SC 29634
Phone: (864) 656-6462 • Fax: (864) 656-4466
E-mail: kburg@clemson.edu

Managing Editor

Frank Scussa, Society For Biomaterials
15000 Commerce Parkway, Mt. Laurel, NJ 08054
Phone: (856) 439-0500 • Fax: (856) 439-0525
E-mail: fscussa@ahint.com

Government News Contributing Editor

Joy Dunkers, National Institute of Standards and Technology
100 Bureau Dr., Stop 8541, Gaithersburg, MD 20899-8541
Phone: (301) 975-6841 • Fax: (301) 963-9143
E-mail: joy.dunkers@nist.gov

Government News Contributing Co-Editor

Christine A. Kelley, National Heart, Lung and Blood Institute
National Institutes of Health
6701 Rockledge Dr., Suite 9180, Bethesda, MD 20892-7940
Phone: (301) 435-0513 • Fax: (301) 480-1336
E-mail: ck53r@nih.gov

Industrial News Contributing Editor

Steve T. Lin, Exactech Inc.
2320 NW 66th Court, Gainesville, FL 32653
Phone: (352) 377-1140 • Fax: (352) 378-2617
E-mail: steve.lin@exac.com

Society Business & Membership News Contributing Editor

Tim Topoleski, University of Maryland Baltimore County
Department of Mechanical Engineering
1000 Hilltop Circle, Baltimore, MD 21250
Phone: (410) 455-3302 • Fax: (410) 455-1052
E-mail: topoleski@umbc.edu

Special Interest Group News Contributing Editor

Lynne C. Jones, Johns Hopkins University
Department of Orthopaedic Surgery
Good Samaritan Professional Building
5601 Loch Raven Blvd, Suite 201, Baltimore, MD 21239-2905
Phone: (410) 532-5906 • Fax: (410) 532-5908
E-mail: lcjones@jhmi.edu

University and Research Institution News Contributing Editor

Guigen Zhang, The University of Georgia, Faculty of Engineering
501 Driftmier Engineering Center
The University of Georgia, Athens, GA 30602
Phone: (706) 583-0994 • Fax: (706) 542-8806
E-mail: gzhang@engr.uga.edu

Book Review

Liisa Kuhn, University of Connecticut Health Center
Center for Biomaterials
263 Farmington Avenue, Farmington, CT 06030-1715
Phone: (860) 679-3922 • Fax: (860) 679-4889
E-mail: Lkuhn@uchc.edu

Graphic Designer

Justin Fennelly

Special Interest Group Reporters

Biomaterials Availability & Policy

Biomaterials-Cell/Organ Therapies

Biomaterials Education

Cardiovascular Biomaterials

Dental/Craniofacial Biomaterials

Drug Delivery

Implant Pathology

Ophthalmologic Biomaterials

Orthopedic Biomaterials

Proteins & Cells at Interfaces

Surface Characterization & Modification

Tissue Engineered Products

Carl R. McMillin, carl@syntheticbodyparts.com

Jon Rowley, jrowley@aastron.com

Howard Winet, hwinet@laoh.ucla.edu

Trevor Snyder, snyderta@upmc.edu

Yunzhi Yang, yyang19@utm.edu

Mark E. Byrne, byrneme@eng.auburn.edu

Michelle A. Tucci, mtucci@orthopedics.umsmc.edu

Margaret W. Kayo, m.kayo@biosensors.com

Rui L. Reis, rgreis@dep.uminho.pt

Christopher A. Siedlecki, csiedlecki@psu.edu

Erika Johnston, erika.johnston@genzyme.com

Laura J. Suggs, laura.suggs@mail.utexas.edu

Features

14 **Society Officer Nominees**

The Society For Biomaterials introduces the 2008-2009 slate of nominees for President-Elect and Member-at-Large. Voting members are urged to cast their ballots for the candidates of their choice.

16 **2008 Society Award Winners**

Announcing the recipients of the annual Society For Biomaterials awards.

18 **Considerations for Carbon Nanotubes in Biomaterials Research**

Single wall carbon nanotubes (SWCNTs) have been highlighted repeatedly as a unique and versatile material that could revolutionize numerous industries in the coming decades. Potential applications in electronic, mechanical and thermal devices as well as biomedical agents have led to great excitement in the basic and applied research communities.

Departments

The Torch

- 2 From the Editor
- 3 From the President
- 4 Staff Update from Headquarters
- 6 SIG Reports
- 8 SIGs – Strategic Planning
- 9 Shaping the World for the Better Through Integrative Thinking
- 9 A Letter from the Chair of the Devices and Materials Committee

Industry News

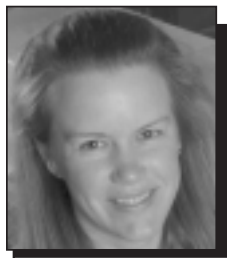
- 21 BioInk

Book Review

- 22 Bioregenerative Engineering: Principles and Applications

Member News

- 17 Members in the News



I use the beginning of each calendar year as a handy excuse to reflect on the previous year's accomplishments and failures (both individual and collective) and to plan the following year accordingly. The death of research giant Dr. Judah Folkman on January 14 caused me to reflect further, to consider beyond the obvious technical and professional landmarks to my own

attitude and general demeanor. I do not intend this editorial to be a tribute to one person nor to attempt to formulate your opinion of one individual, but rather as a means of paying tribute to, and deliberately learning from, the many individuals who serve as positive role models and help shape our lives.

I did not formally meet Judah until a few years ago, but I informally met him many years ago through various collaborations with several of his many former mentees. So, three years ago, I was ecstatic to finally meet him in person at a PI's meeting for the Department of Defense Era of Hope Scholars and Innovators programs for breast cancer research. He had every excuse to potentially be aloof, self-absorbed, and impatient, but in reality had thought of every reason to be exactly the opposite. I gave a presentation highlighting our work in the area of biomaterials; the audience, which was comprised entirely of biologists, clinicians, and cancer survivors, was completely silent following the presentation, until one voice opened the floodgates. Judah enthusiastically asked me questions about our research, marveling, or at least pretending to marvel in a very genuine manner for my benefit, at our work and, more importantly, at the exciting potential of biomaterials. We continued the conversation after the formal Q&A period and the discussion drifted from the technical to the non-technical. At the time, one of my family members had recently been diagnosed with a serious medical condition – I do not generally discuss my personal crises with strangers or even with friends, but Judah's warm manner lead easily into a conversation about family and subsequently to that particular concern. He immediately connected me with his vast network of former surgical and clinical mentees and assured me that if I had any further concerns or issues, I was to contact him immediately. It was truly amazing and a huge relief to my family and to me.

What also struck me about Judah's attitude was the enthusiasm and warmth he displayed to my students and other students at subsequent research meetings and conferences, asking them about their plans and ambitions, and encouraging them to stick to their dreams in the face of adversity. I laughed and laughed as he told his story of applying to the NIH for funding in the early 1970s, and being shot down by a panel of reviewers for his "fanciful" ideas, the same ideas that are now touted as revolutionary, and which have even been cited as potential keys to curing cancer (he was very resistant to the media claims that were placed on his discoveries and was very vocal in providing emphatic cautionary footnotes). I also marveled at his attention to mentoring and to people in need; interestingly, the Folkman mentees who I have had the good fortune to interact with have displayed exactly the same qualities: persistence, kindness, competitiveness, innovation, creativity, enthusiasm, and most of all, humility. Judah wrote

“ Although I've learned as much from negative role models, there is no question that the humble, generous, successful, tenacious individuals are the ones who have had far greater impact on me and whose names I remember in the long term. I am fortunate to have had many such role models and mentors. ”

detailed letters of support for me as I applied for various research opportunities, and was a cheerleader for me and for countless others beyond the immediate bounds of his own research laboratories. He simply gave unselfishly of his time.

So why do I mention all of this? Dr. Folkman was not a member of SFB, but was a great research leader and spokesperson, and a biomaterials innovations enthusiast. The results of his mentoring include a "lineage" of biomaterials giants. Although I've learned as much from negative role models (e.g., "note to self: don't regard people as transparent and/or nameless"), there is no question that the humble, generous, successful, tenacious individuals are the ones who have had far greater impact on me and whose names I remember in the long term. I am fortunate to have had many such role models and mentors. I'm sure that each of you have had one or more "Judah Folkmans." I hope that as you define your own goals for 2008 you include an attitudinal evaluation. Whether you are a student, a clinician, a professor, a research associate, a project director, or other, consider the following question: are you perceived as a positive or negative role model? Each of us has or is developing the potential for influencing other fields, each of us has or is developing the potential for training new researchers. We have opportunities to magnify the effects of our own small, technical worlds in an incredibly positive manner by considering carefully our actions and interactions. Seize the opportunity – it's never too early and it's never too late!

Best wishes from Clemson,

Karen J.L. Burg

Hunter Endowed Chair & Professor of Bioengineering
Interim Vice Provost for Research & Innovation
Clemson University

From the President

The Torch

By Martine LaBerge



Council and Board members met last October in Philadelphia to review, discuss and approve reports submitted by standing committees and task forces.

I am very proud to report that many accomplishments were made at both meetings. If you recall, leadership accountability has been the working platform for 2007-2008. In the past months, chairs and committee members

have acknowledged and assumed their responsibilities with great commitment. The energy that exists in the Society is incredible. It is challenging and motivating, and it is the driving force for an exciting future for SFB.

Success stories are endless, as you will appreciate browsing through the committee reports and articles in this issue of the *Forum*. Many of those have a direct and positive impact on members. Among others, the Education and Professional Development Committee members have embraced the use of new technologies, such as webinars, as continuing education and training tools for members and others. Student activity is increasing with a K-12 outreach pilot program, and a T-Shirt promotion planned for 2008. The Branding Task Force has clearly provided a canvas for innovation and defining our future. A new torch design is on its way and will be unveiled before the end of the council year! Adding to the excitement is a new website to be launched in the coming spring. The Membership Committee has followed a tradition of dedication by seeking further opportunities to increase your membership value from membership renewal opportunities to outreach to students and authors of our journals. Through the leadership of the Publications Committee, our Society is honored to associate its name to Elsevier and the outstanding editors of *Biomaterials Science* for a third edition. A book series is also being negotiated by the Publications Committee with another publisher. The SFB is now a cooperating society of Acta Materialia, which will provide distinct benefits to our members. The 2008 Translational Biomaterials Symposium Program Committee has developed, with the support of Special Interest Groups, an exciting and innovative program that will serve as a turning point for the coming annual meetings. To better serve you and protect the interest of the Society, the Board and Council have approved a Conflict of Interest policy. The Special Interest Groups have clearly positioned themselves as pillars for science in the Society through many concrete actions that will improve their governance and accountability, a success story in progress.

Devices and Materials Committee members are actively pursuing material database sharing opportunities with ASMI. And, all the above with no increase in membership dues!

There is pride associated with SFB membership; it is a culture with a long and deep history and a bright and exciting future. As such, the Council endorsed the SFB History Summit that was held at Clemson University in mid-February 2008. Founding members and past-presidents of the SFB gathered to record anecdotal material regarding the Society's history, from its founding to the present. A monograph comprising this anecdotal material, supplemented by archival material from the C. William Hall Biomaterials Documentation Center, will be produced for the SFB. This event was sponsored in its entirety by Clemson University to recognize their long-standing support of the Society For Biomaterials.

As it is customary to make New Year's resolutions at the beginning of a New Year, here are some resolutions for 2008 that will help the Society build more success stories:

- Serve as an ambassador for the Society and recruit members
- Pay membership dues on time and yearly
- Enroll and actively participate in a Special Interest Group
- Nominate a deserving colleague or student for a Society award or Society membership
- Host a Biomaterials Day
- Attend the 2008 SFB Workshop on Translational Biomaterials in Atlanta
- Participate in an upcoming webinar
- Volunteer as a committee member for the Society

All members of the Society and friends are challenged to lead the above resolutions to success, individually and as a team, and make 2008 the greatest Biomaterials Participation Year. Board and Council members will pursue their goals to completion as well!

On behalf of the Board and Council members of SFB, I wish you a prosperous and stimulating 2008.

Martine LaBerge, PhD
President



SFB 2008 Planned Activities

In addition to the 2008 World Biomaterials Congress (May 28-June 1), the Society For Biomaterials will host a Fall Symposium in Atlanta, Ga., on Translational Biomaterial Research (September 11-13). The Society is also developing a webinar series to provide ongoing educational opportunities throughout the year. A publication survey is being designed to help improve all of the Society's publications, including the *Journal of Biomedical Materials Research* (Parts A & B), the *Biomaterials Forum*, and the Society's website.

Committee Reporting

Following up on the Committee reports from the last issue of the *Forum*, each of the Society's Committees are listed below with an update on their activities, specifically addressing the progress over the past quarter toward their published goals.

Awards, Ceremonies & Nominations Committee

The Awards, Ceremonies and Nominations Committee evaluated the nominations for officers and awards and presented their recommendations to Council at the October 27, 2007, council meeting in Philadelphia. Officer candidates are listed on page 14. The Committee believes that the officer nominations represent a strong slate for its membership and underscore excellence in leadership.

2008 Award recipients are listed on page 16. There were no nominations for the Technology Innovation and Development Award, Student Awards, nor Hospital Intern, Residence, or Clinical Fellow Award.

Council unanimously ratified all recommendations of the Committee. The committee would like to thank those who took the time to bestow these honors upon their colleagues, and sincerely appreciates the officer candidates' willingness to serve the Society For Biomaterials.

Bylaws Committee

The Bylaws Committee has been notified of a few inconsistencies in the current document. These inconsistencies have arisen due to a series of changes in the Bylaws that have been made during the past few years. A proposal outlining the inconsistencies and the suggested changes will be made available shortly to the membership for review. Additional discussion and voting on the proposed changes will occur during the Society's Annual Business to be held during the World Biomaterials Congress meeting in Amsterdam in May 2008.

Devices and Materials Committee

The Devices and Materials Committee has been engaged in discussions to advance the Society's ability to provide data and information on materials used in medical devices and to increase SFB's appeal and value to the medical device industry. Please see the letter from Devices and Materials Committee Chair Jeremy Gilbert on page 9.

Education and Professional Development Committee

The Education and Professional Development Committee is devoting time and effort in four main areas: the National Student Section (headed by Margaret Phillips), K-12 Outreach

Program (led by Shane Woods), Continuous Development for Professionals (co-directed by Ken Messier and Angela Au), and Student-Industry Liaison (headed by Gene Park). An action plan for the year and a budget were developed and presented to the Council and Board members on October 27 in Philadelphia, and most activities were approved. These approved activities include webinars on topics relevant for SFB members, the production of education kits that will demonstrate biomaterials technologies for those who are just beginning to think about their careers, and the creation of National Student Section T-shirts. The first biomaterials webinar for members will be advertised shortly. Stay tuned!

Finance Committee

The Finance Committee is overseeing the implementation of the Board-approved investment and reserve policies, and will be developing a draft policy on the solicitation of funds on the Society's behalf.

Liaison Committee

The Liaison Committee continues to interact and discuss possible joint meetings with other societies.

Long Range Planning Committee

The Long Range Planning Committee continues to focus its activities on analysis of the ranking and perception of the journals of the Society, namely the *Journal of Biomedical Materials Research* Parts A and B, relative to other peer journals in the field of biomaterials and related disciplines. Recommendations are being formulated regarding improving the perception and competitiveness of the journals.

Meetings Committee

The Meetings Committee members have worked diligently toward fulfilling four goals:

1. Analyze 2007 Annual Meeting survey data: Goal has been achieved. Results have been posted on the website in the "members only" section. Thirty-five percent of the survey participants said that this was the first SFB meeting they ever attended and 96 percent said they would attend another SFB meeting. Eighty-three percent rated the BASH as a "very important" or an "important" event to be held during the Annual Meeting, and more than 90 percent rated the BASH as either outstanding or very good in every category! Ninety percent of the survey participants stated that the Annual Meeting program helped them to meet their professional and personal objectives.
2. Evaluate proposals for the 2010 and 2011 meetings: Sites have been recommended to and approved by the Board for the 2010 and 2011 meetings. Very competitive and SFB-favorable contracts have been signed for both. The 2010 meeting will be held the week of April 19 at the Washington State Convention and Trade Center in Seattle with accommodations at The Sheraton Seattle Hotel. In 2011, the Annual Meeting of the Society For Biomaterials will be held at Disney's Contemporary Resort in Orlando, Fla., the week of April 11 with hotel accommodations at Disney's Contemporary Resort and Disney's Polynesian Resort.

3. Assess the feasibility and interest of hosting the 2016 WBC: The Committee discussed the issue and investigated hosting WBC 2016 as a combined event with the Canadian Biomaterials Society (CBS) or by itself. Pros and cons for both options were carefully assessed. Heather Sheardown, President of the CBS, was contacted and indicated that the CBS was considering submitting a proposal to host the 2016 WBC in Canada. In view of this indication by CBS, the Committee recommended to Council that the SFB bid to host the 2020 WBC and not compete with CBS for the 2016 WBC.
4. Assess the funding and sponsorship revenue of our annual meetings and provide recommendations for increasing these sources of revenue to better offset meeting attendee registration costs. Work is in progress to realize this goal. The Committee met via conference call in mid-December and developed a strategy to secure sponsorship for the 2008 Fall Symposium and the associated bash to be held in Atlanta. Substantial work will be accomplished in the next few weeks to secure sponsorship.

Membership Committee

The Membership Committee had conference calls in April, May, and July of 2007 and the major discussions have continued to address issues of recruiting new members into the Society as well as developing a retention plan for current, active members. In October, Chair Ziats attended the SFB Board and Council Meeting held in Philadelphia and gave a report on the Committee's activities. The Committee budget has been submitted and approved by the SFB Council for the 2008 calendar year. A major action of the Membership Committee was submission of a proposal to extend the membership renewal cycle beyond one year, which the SFB Council has approved. As of December 2007, SFB members now have the option of renewing for one year and up to three years. Another goal for the Committee was to encourage recruitment of new members to SFB from other national organizations. This year, SFB staff members managed recruitment booths at the Orthopaedic Research Society and Biomedical Engineering Society meetings. The Membership Committee is also working with other committees to enhance recruitment. For example, the Membership Committee is working with the Education and Professional Development Committee to improve SFB's visibility by sponsoring Biomaterials Days at universities, as well as to create more student chapters. The Committee is also working with the Special Interest Group chairs for the upcoming meeting in Atlanta and will be active in promoting this meeting to SFB and other societies.

Presidents Advisory Committee

The Presidents Advisory Committee is evaluating how the SFB may interact with other professional societies in the future. This evaluation includes a discussion of alliances and even mergers. Also, the Committee is considering how the Annual Meeting can be made more attractive and useful to attendees.

Program Committee

The Program Committee has spent considerable time in the planning and organization of the 2008 Fall meeting focusing on "Translational Biomaterials." The following milestones have been accomplished:

1. Session proposals were evaluated and appropriate proposals were selected. All applicants for sessions have been notified.
2. The general program for the meeting has been finalized, and consists of seven Clinical Application sessions (90 min), four Technology Rapid Fire sessions (60 min), two Panel Discussions, and two Workshops. Requests have been made to session chairs for abstract reviewers.
3. The Board approved complementary registrations for one invited speaker per Clinical Application session.
4. Proposals have been evaluated for a social bash at an off-site location.

Publications Committee

The Publications Committee, in addition to continuing efforts already reported, is in the process of developing a survey of the effectiveness and quality of all publications of the Society. The survey will be used to set future goals for our publications. Any suggestions and comments can be sent directly to the Committee Chair, Professor Rick Gemeinhart (rag@uic.edu).

Special Interest Groups

Special Interest Groups (SIGs) have been very active in 2007, and are planning even more activity in 2008. Please see the SIG article on page 6 for complete details on SIG Activities.

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

Sincerely,



Dan Lemyre, CAE
Executive Director

Society For Biomaterials
15000 Commerce Parkway, Suite C
Mount Laurel, NJ 08054
Phone: 856-439-0826
Fax: 856-439-0525
E-mail: info@biomaterials.org
www.biomaterials.org

Biomaterials Availability and Policy SIG

For the first time in many years, some major companies have started to again sell polymers for use in long-term implants. Several different e-mails were sent to SIG members to alert them of these new developments as they occurred. The most recent e-mail informed SIG members that Solvay Performance Materials has established a biomaterials subsidiary called Solviva Biomaterials. Solvay bought Gharda Chemicals in India, which had been making an electrophilic synthesized Gatone PEEK with better and better quality, partially with guidance of U.S. orthopaedic companies. Now Solvay is offering both non-implant grade PEEK, called KetaSpire, and a nucleophilic synthesized implant grade PEEK under the trade name Zeniva. These offerings will be terrific additions to implant grade poly(aryl ether ketones) Invibio PEEK and Oxford Performance Products PEKK. Note also that DSM recently changed its position and in addition to its linear UHMWPE fibers used in sutures, it is now supplying UHMWPE for hip and knee applications. The Biomaterials Availability and Policy SIG is planning a session at the Atlanta meeting in Fall 2008 with speakers on recent developments in patents, product liability, tort reform, and biomaterials availability.

Biomaterials Education SIG

The Biomaterials Education SIG has been quite active during the past few months with respect to the surgical video library. The SIG has submitted a proposal for additional funding to the Board with the goal of continuing the current efforts. SIG members are in the process of redesigning the website, using the Content Management System, Drupal. This effort will involve a slight redesign of database and file systems but will allow for better integration of videos, team members, comments, and other features. This revision will also provide more room for future expandability. Currently there are 44 surgical videos, 23 lectures/seminars, and six powerpoint presentations/posters. Currently the Biomaterials Education SIG members are looking for additional members to join the Video Library Committee and to help expand the library and offer new options. Please contact Jeff Karp if you are interested at jeffkarp@mit.edu.

Cardiovascular Biomaterials SIG

The Cardiovascular Biomaterials SIG is co-organizing an exciting and timely symposium for the 2008 SFB meeting in Atlanta, "What is the State of the Stent?" This session will be co-sponsored with the Protein and Cells at Interfaces, Surface Characterization and Modification, Drug Delivery and Implant Pathology SIGs. The symposium will include clinical perspectives, surface chemistry, and drug release coatings topics.

Additional activities for 2008 include plans to create a website with information about cardiovascular biomaterials. Help is needed; volunteers are encouraged to contact Naren Vyavahare (narenv@clemsun.edu).

Cell/Organ Therapies SIG

The Cell/Organ Therapies SIG currently has two projects in the works. The first project is a collaboration with the Education SIG to coordinate a Webinar on Cell Therapy for

Cardiac Regeneration, and the second one is to publish a quarterly newsletter highlighting topics that impact the SIG. The budgets have been recently approved, and as these projects take life and are scheduled, they will be reported in the Forum. The Cell/Organ Therapy SIG is also coordinating a *Journal of Biomedical Materials Research* review paper related to cell encapsulation biomaterials that is being spearheaded by SIG officer Hyunjoon Kong.

Interest items to the members of the Cell/Organ Therapy SIG include:

- A special issue of the journal *Tissue Engineering* that is being organized by SIG officers Eben Alsberg and Jon Rowley titled "Technologies for Enhancing Tissue Engineering: Materials and Environments for Guiding Stem Cell Function." Manuscripts will be online by mid-summer, and the hardcopy will be in press by late-summer or early autumn.
- A new blog called The Regeneration Station that highlights technology and industry developments in the world of regenerative medicine. The blog can be found at <http://regenerationstation.wordpress.com>.
- New rules in the patent world that impact inventors. The Patent Reform Act of 2007 is getting some bad press from big pharma, but may actually benefit the field of regenerative medicine. The patent reform is meant to move away from the classical "one invention, one patent, one product" model and into the present world of convergent technologies, where "one product is an innovative combination of several inventions/patents."
- An editorial by Chris Mason on Regenerative Medicine 2.0. The article, which can be downloaded at www.chrismason.com, draws parallels with regenerative medicine companies of today and the Web 2.0 transformation in the mid-90s.

Dental/Craniofacial Materials

During the year, Sachin Mamidwar, Vice-Chair of the Dental/Craniofacial Materials SIG, helped organize a special issue of the *Journal of Biomedical Materials Research Part B: Applied Biomaterials*. The deadline for submissions for this special issue was July 31, 2007, and the published issue will focus on dental and craniofacial biomaterials, including new dental implant materials, surface treatments to improve the success of implants, bone graft materials for dental applications, and composites used in dentistry. Furthermore, the Dental/Craniofacial Materials SIG worked with the Program Committee to develop a Clinical Application Session titled "Dental and Orthopaedic Implants" for the SFB 2008 Fall meeting on Translational Biomaterials. In addition, the Dental/Craniofacial Materials SIG is co-sponsoring a symposium at the meeting on the subject of "Current and Future Strategies for Repair and Replacement of Hard Tissues." The SIG members plan to distribute fliers at the 2008 American Association for Dental Research Meeting in Dallas, advertising the SFB Dental/Craniofacial Materials SIG.

Drug Delivery

The Drug Delivery SIG has been working to enhance member benefits and create value-added benefit for its members on a number of fronts. For the last few years, developing timely and

informative annual meeting programming and enhancing member networking opportunities have been major foci. This past fall, the SIG continued this success and has been busy with program development for the 2008 Translational Meeting, which will have a number of excellent sessions involving drug delivery. As per networking, we are building upon the successful dinner model and working to expand exposure and attract new members by pursuing networking events at sister societies. The first of these will occur at the Spring 2008 ACS/AICHE meeting in New Orleans. We are also working on an online, searchable member database with research areas. Member inclusion will be voluntary so please watch for correspondence regarding this topic in the Spring. We are also working on the collection and development of outreach materials/tutorials to be disseminated online within our member-only SIG website. We ask members to send K-12 outreach or professional outreach materials to any officer of the SIG. Also, in the near future, we will be producing two special journal issues dedicated to advanced drug delivery. Please let us know if you would like to get involved with the Drug Delivery SIG and help with any of these initiatives.

Implant Pathology

The Implant Pathology SIG is working to expand the traditional concept of implant pathology (as histology) in the service of biomaterial science. The purpose of such expansion is to increase understanding of the processes that lead to histological observations. These processes range from interfacial adsorption-desorption phenomena such as biofilms to Toll-like receptor modulation of Type IV hypersensitivity reactions. In order to encourage SFB members to incorporate the associated concepts into implant design, the IP-SIG seeks collaborative sponsorship with other SIGs to organize workshops, symposia and tutorials such as "Animal Models for Implant-associated Infection" and "Immunology for Biomaterial Scientists" being planned for the 2009 meeting. In addition, it maintains lines of communication with other societies via presentations such as the recent host-implant interactions session presented at the Medical Design and Manufacturing conference and publications such as the recent December 2006 issue of the *Journal of Histotechnology* titled "Biomedical Implantology" edited by Lynne Jones (IP program chair).

Ophthalmic Biomaterials

The Ophthalmic Biomaterials SIG has been actively preparing for the upcoming SFB Meeting on Translational Research by partnering with the Drug Delivery SIG to organize the Clinical Application Session on Ocular Comfort and Drug Delivery. In addition, the Ophthalmic Biomaterials SIG has designed an information flier intended to increase membership for the Society and SIG. This graphical flier highlights the breadth of technical issues faced by ophthalmic biomaterials scientists and states the SIG Mission: To share knowledge and research on the materials and devices needed for optimal vision. The flier, which also promotes the Fall 2008 SFB meeting, is already being circulated at associated scientific meetings.

Orthopaedic Biomaterials

In the context of our mission statement, the Orthopaedic SIG has initiated projects to 1) increase awareness of the Society and the SIG in the Orthopaedic community; 2) identify and educate concerning key issues relating to Orthopaedic

biomaterials; and 3) participate in the planning and provide content for the scientific program at the annual meetings. Once again, a workshop at the Orthopaedic Research Society's annual meeting will be co-sponsored by the SFB. Spearheaded by Warren Haggard, the topic of this workshop is "Wear Resistant Polyethylene for Joint Replacement: Current Status and Future Directions." We invite all SFB members to attend this workshop and show our support for this endeavor. We have initiated several education-related projects including the preparation of a survey of the SFB membership to determine the opinion of our membership as to what the key issues regarding orthopaedic biomaterials are today and what they think they will be in five years, a position paper on cartilage tissue engineering, and a project related to creating archived resources for educators and their audiences (undergraduate and graduate students, residents, practicing orthopaedists). The Orthopaedic SIG continues to be very active in the development of program content for our annual meetings.

Proteins and Cells at Interfaces

Since the SFB meeting in Chicago, the Proteins and Cells at Interfaces SIG has been active in submitting proposals for the upcoming meeting in 2008 in Atlanta. It will be participating with other SIGs in sessions concerning stents, inflammation/immunity, imaging/therapeutic delivery, and dental/orthopedic implants. In addition, Suping Lyu attended the SIG officers meeting held in New Jersey in July and our SIG submitted a budget for the upcoming year in August.

Surface Characterization and Modification

The Surface Characterization and Modification SIG contributed an article to the 4th quarter 2007 issue of the *Forum* summarizing happenings in the SIG as well as an overview of the XPS/ESCA technique. We hope to continue to share articles on surface analysis techniques as well as surface modification schemes to better inform the community about various techniques that are key to our group (including the advantages of using them in an industrial environment).

We have also been involved in organizing sessions for the upcoming SFB 2008 Translational Biomaterials meeting this September in Atlanta. Look for our tutorial session, "Genomic and Proteomic Chips in Translational Medicine," as well as surface characterization and modification components of the "Stents and Coronary Technologies" session and the "Dental and Orthopedic Implants" session.

In addition to the upcoming SFB Translational Biomaterials meeting, we have contributed to the upcoming World Biomaterials Congress by organizing two sessions (a "Surface Characterization" and a "Surface Modification" session) for the upcoming event in Amsterdam. We hope to have a get-together with other SIG members attending the WBC. Look for future details.

Tissue Engineering

Members of the Tissue Engineering SIG have been involved in proposing and organizing a number of sessions at the 2008 World Biomaterials Congress: Crossing Frontiers in Biomaterials and Regenerative Medicine, to be held in Amsterdam May 28-June 1, 2008. These sessions include "Natural-Based Polymeric Biomaterials and Composites for Tissue Engineering Scaffolding" (organized by Nuno Neves and Rui Reis), "Biologically Inspired Hydrogel-Based Materials for

Continued on page 24

Did you know that as of September 2007, 604 out of 1,263 SFB members were members of one or more Special Interest Groups (SIGs)? Clearly, with the support of members and since their inception, SIGs have grown and taken an important place in the Society.

During the past three years, the effectiveness of SIGs and their role within the existing structure of the SFB has received considerable attention. There have been two task forces and a poll to address this issue. In 2006, the Long Range Planning Committee made several recommendations concerning 1) defining the role of SIGs within the Society, 2) increasing autonomy of SIGs for programmatic matters and development, 3) increasing SIG accountability, and 4) increasing participation of the SIGs in outreach and programmatic activities of the Society.

As a result, the SIG leadership have taken action and rolled up their sleeves. A Strategic Planning meeting was held July 17, 2007, in Mt. Laurel, New Jersey. This was the first official act of the newly re-formed SIG Committee. SIG Chairs or their representatives attended this meeting along with several members of the Board of Directors. The primary goal of this meeting was to evaluate the 'state of the SIGs,' address the actions proposed by the Long Range Planning Committee — based on the previous task force reports on SIGs—and to make concrete recommendations for changes to the Society For Biomaterials' Board and Council. The end result was a Strategic Planning Report.

The meeting focused on where we have been, where we are now, and where we would like to be. Prior to the meeting, the SIG officers received copies of articles and reports written about the SIGs and participated in a SWOT (strengths, weaknesses, opportunities, threats) analysis. We began our meeting with a review of our history as told within the pages of the *Biomaterials Forum* and discussions with our members. Why were the SIGs established in the first place? In a 1995 issue of the *Biomaterials Forum*, Buddy Ratner and Grace Picciolo described SIGs as a home for 'closely related research communities' with a focus on "the common principles relating the interaction of living systems and synthetic materials." Since this time many SIGs were formed, some were modified, and some dissolved, yielding the current total of 12 SIGs:

- Biomaterials Availability and Policy
- Biomaterials Education
- Cardiovascular Biomaterials
- Cell/Organ Therapies
- Dental/Craniofacial Materials
- Drug Delivery
- Implant Pathology
- Ophthalmic Biomaterials (*newly renamed)
- Orthopaedic Biomaterials
- Proteins and Cells at Interfaces
- Surface Characterization and Modification
- Tissue Engineering

In addition to these topics, the SIG representatives created a mission statement, discussed critical issues impacting the

effectiveness of the SIGs, proposed bylaws changes, proposed organizational strategies, and developed a list of programmatic activities that the SIGs could develop to enhance the value of the SFB membership.

At the Fall Council meeting, the Mission Statement in the box below was presented to and approved by the SFB Council.

Special Interest Group Mission Statement and Statement of Coordination

A Special Interest Group is a group of Society members who share a common biomaterials interest. Special Interest Groups promote the mission of the Society by nurturing programs which will promote and enhance Society education in new and established focus areas. Special Interest Groups are bound by all policies referenced above in Committees and Officers.

In addition, Special Interest Groups:

- Provide a conduit for member input into annual meeting content within the focus area
- Uphold scientific rigor of the annual meeting program by providing an informed reviewer pool
- Facilitate networking among members of the Society with a common biomaterials interest
- Enhance communication with and among Society members
- Attract and retain Society members through national, regional and web-based activities related to the focus areas
- Publish a quarterly news update

The bulk of the Strategic Planning meeting addressed the autonomy and accountability issues facing the SIGs. Many members of SIGs have expressed concerns that they were unaware of what the SIGs are able to and not able to do. Of course, there are many factors that have contributed to this. However, by re-establishing the SIG Officers Committee and improving communication between members of SIGs, this issue can be resolved. One major role that SIGs can play within the Society is to act as advisors on key topics facing their discipline. This advisory role can and should have an impact on our governance, our annual meeting, our publications, our visibility within the scientific community, and—most importantly—our membership. A list was initiated as a work-in-progress of different programmatic activities that the SIGs can spearhead. Autonomy assignment and accountability go hand-in-hand. Accountability will now be approached from several fronts, including quarterly reports (verbal and written), reports within the *Biomaterials Forum*, the establishment of a SIG newsletter, and review of activity by the SIG Officers Committee. This discussion resulted in the following proposals/actions:

- Allow the SIGs to have more control over their budgets. A motion to council was formed requesting

Continued on page 24

Shaping the World for the Better Through Integrative Thinking

The Torch

By Guigen Zhang, Education Editor

The term “critical thinking” has become so important a buzzword lately that we all want to make it part of every class we teach. Do we really know what “critical thinking” entails?

We all think, for thinking is an intellectual response to a problem. But whenever we do, we tend to reduce the complex issues of a problem to small independent pieces by discarding as much as possible, because by doing so we can avoid complexity and ambiguity and gain the comfort of simplicity and clarity. Unfortunately, according to Roger Martin of the University of Toronto, the desire for simplicity often leads us to ignore opportunities to discover novel solutions to the problem.

As Martin suggests, instead of applying reduction, we should integrate when thinking. Converting from a reductive way of thinking to an integrative way of thinking can help transcend us from accepting the world as it is to shaping the world for the better.

So, what does integrative thinking mean exactly? In short, integrative thinking requires one to actively examine the entire architecture of a problem, seek less obvious but potentially relevant factors, embrace the mess that is inherent to the inclusive approach, welcome complexity, consider multidirectional and nonlinear relationships, hold all relevant pieces of information suspended in mind at once, and reason how one decision might affect another. With such a holistic rather than segmental way of thinking, one can creatively resolve the tension that launched the decision-making process, generate new options and innovative solutions, and create a sense of unlimited possibility.

If such an integrative way of thinking is not what you practice on a daily basis, don't worry. You are not alone. In Martin's words, great integrative thinkers are fairly rare. But the good news is that the trait of “integrative thinking is a habit-of-thought that all of us can consciously develop.” All we need is to start doing so.

A Letter from the Chair of the Devices and Materials Committee

The Torch

By Jeremy L. Gilbert, Chair,
Devices and Materials Committee

Dear Society For Biomaterials Members,

The Devices and Materials Committee of the Society has been engaged in planning and discussions to advance and enhance our Society's ability to provide data and information on materials used in medical devices and to increase our appeal and value to the medical device industry.

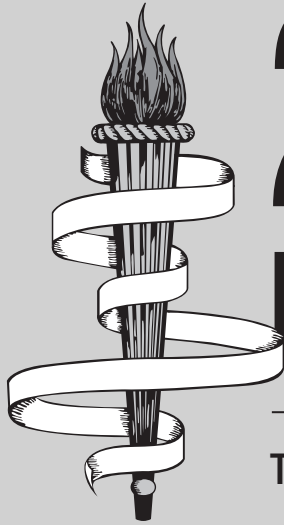
To these ends, I have been in discussions with the ASM International concerning ways in which SFB and ASM could partner in providing interactions of SFB with ASM's Materials for Medical Devices Database. ASM has, during the past few years, taken up the task of developing a database of currently used materials for medical devices. This materials database is very useful to those who want access to validated information on materials properties for the array of biomaterials used in medical devices. ASM has a cardiovascular database already deployed with an orthopedics database under development. One proposal being discussed is the possibility of SFB members helping to develop a “Research Materials” database that could be incorporated. There is also the possibility of having SFB members gain access to the ASM's database through the Society. These discussions are still very preliminary and any input from the membership would be greatly appreciated.

A second way in which SFB and ASM may interact to advance the goals of the Devices and Materials efforts of SFB is to co-locate and/or collaborate in hosting a meeting where

each group's constituency could convene in a single location. This could, for example, be at a fall meeting similar to the one under development for this year. The idea here is that each society has a differing, but overlapping, focus. ASM's Materials and Processes for Medical Devices conference (MPMD) has developed a growing segment of the industrial biomaterials research community, while SFB has focused less on industrial medical device research and more on tissue engineering-based biomaterials research. Co-locating or collaborating on a meeting could provide a venue that would be attractive to both basic biomaterials/tissue engineering researchers and currently used medical devices researchers.

Currently the Devices and Materials Committee is discussing these ideas and we are hoping to bring specific ideas and concepts to the Council of SFB in the near future. If you have any comments or questions on these ideas, please contact me and I will pass these along to the committee.

Jeremy L. Gilbert, PhD
Professor of Biomaterials and Associate Dean for Research and
Doctoral Programs
L.C. Smith College of Engineering and Computer Science
Syracuse University
Syracuse, NY 13244
(315) 443-2105
gilbert@syr.edu



2008 Buyer's Guide

The Society For Biomaterials presents its

2008 Buyer's Guide. This guide lists the

leading companies in the biomaterials

industry along with their areas of business.

Use this guide throughout the year to find

companies that are ready to provide you with

the products and services you need to

accomplish your professional endeavors.



Atrium Medical Corporation

Paul Martakos
5 Wentworth Drive
Hudson, NY 03051-4930
Phone: (603) 880-1433
Fax: (603) 880-0302
PMartakos@atriummed.com



Bose Corporation's ElectroForce© Systems Group manufactures ElectroForce© test instruments using proprietary linear motor technology. Bose offers instruments for the characterization of soft tissue, bones, biomaterials and medical devices including stents, endovascular grafts, and spinal implants. The new BioDynamicä test instrument provides characterization and stimulation of tissue constructs in a biological environment.

Bose Corporation – ElectroForce Systems Group

Evalina Klein
Marketing Communications Manager
10250 Valley View Road, Suite 113
Eden Prairie, MN 55344
Phone: (952) 278-3070
Fax: (952) 278-3071
electroforce@bose.com
www.bose-electroforce.com



Bose Corporation manufactures the ElectroForce© test instruments using proprietary linear motor technology. Bose offers instruments for the characterization of soft tissue, biomaterials, bones and a variety of medical devices including stents, endovascular grafts, and spinal implants. The BioDynamic™ test instruments provide characterization and stimulation of tissue constructs in a biological environment.

Concordia Medical

Art Burghouwt
4 Laurel Ave.
Coventry, RI 02816
Phone: (401) 828-1100
Fax: (401) 823-8361
aburghouwt@concordiamedical.com
www.concordiamedical.com

Concordia is an innovator in engineered fibers and a pioneer in biomedical textiles. Concordia's Biofelt is a leading porous non-woven tissue engineering scaffold ideal for cell seeding and regenerative therapy. Concordia is committed to the medical device industry and has achieved ISO13485:2003 certification and operates a medical clean room.

Elsevier

Amanda Cheung
The Boulevard
Langford Lane
Kidlington, Oxford OX51GB
UK
Phone: +44 1865 843105
Fax: +44 1865 843987
a.cheung@elsevier.com
www.elsevier.com



Elsevier publishes key books and journals in materials science, including *Materials Today*, *Materials Science & Engineering: R: Reports*, *Biomaterials*, and *Acta Materialia*, as well as new titles in the field such as the *Journal of the Mechanical Behavior of Biomedical Materials*. Visit www.elsevier.com/materials for a full list of our products.

Genzyme Biosurgery

Sandra Jennings
55 Cambridge Parkway, 6th Floor
Cambridge, MA 02142
Phone: (617) 591-5904
Fax: (617) 374-7263
sandra.jennings@genzyme.com
www.genzymebiosurgery.com



Genzyme is a worldwide leader in the manufacturing of HA (hyaluronan). Using a proprietary fermentation process and purification technology, Genzyme provides sterile/non-sterile EP medical grade material from our GMP, ISO compliant manufacturing facility. Our extensive resources include R&D, clinical/medical, manufacturing, marketing and regulatory expertise — all available to support our partners' needs.

IonBond LLC/Medthin

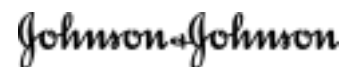
Global Medical Division
Raymond Fontana
200 Roundhill Drive
Rockaway, NJ 07866 USA
Phone: (973) 586-4700
Fax: (973) 586-4729
r.fontana@us.ionbond.com
www.ionbond.com



Medthin, the Global Medical Division of Ionbond LLC, combines extensive experience in thin-film coatings with the demanding quality and performance standards of the Medical and Dental Industries. Biocompatible coatings are designed to enhance implant/instrument life and performance. A comprehensive range of coating services include; technical consultation, application development, custom fixture design and coating development.

Johnson & Johnson

Laura Cahill
Corporate Office of Science & Technology
410 George Street, Room GS1149
New Brunswick, NJ 08901
Phone: (732) 524-2552
Fax: (732) 524-2549
lcahill1@corus.jnj.com



Lakeshore Biomaterials

Paul Spencer
756 Tom Martin Drive
Birmingham, AL 35211
Phone: (205) 917-2295
Fax: (205) 917-2291
pspencer@lakeshorebio.com
www.lakeshorebiomaterials.com



Lakeshore Biomaterials is a global commercial scale supplier of cGMP compliant polylactide-co-glycolide and other polymers with a focus on biodegradable and non-biodegradable excipients and biomaterials used for the pharmaceutical, regenerative medicine and medical device markets. Technical expertise: Polymer Synthesis (Ring Opening, Condensation, Addition), Characterization, Process Development, Scale-up, and Tech Transfer.

Lifecore Biomedical Inc.

Kipling Thacker
3515 Lyman Blvd.
Chaska, MN 55318
Phone: (952) 368-4300
Fax: (952) 368-4278
kiplingthacker@lifecore.com
www.lifecore.com

Lifecore's hyaluronan is a component in several commercial ophthalmic, orthopedic, and veterinary medical products. Lifecore supplies customers with either hyaluronan or finished products manufactured in its ISO 13485 and FDA certified aseptic filling facility. In addition, Lifecore's hyaluronan is supplied to academic and corporate researchers around the world for basic science and product development research.

Midwest Plastic Components

Mark D. Schaefer
7309 West 27th St.
Minneapolis, MN 55426
Phone: (952) 927-2414
Fax: (952) 929-1557
mschaefer@mpc-mn.com
www.mpc-medical.com



An FDA-registered, ISO9001, ISO13485 Certified Contract Manufacturer focused on injection molding of implantable devices, instruments to implant devices and thermoplastic components. Molding, assembly, packaging, and sterilization management (MAPS™) using bioresorbable, PEEK OPTIMA polymer from Invibio™ and other highly engineered polymers.

Medtronic Inc.

Rebecca Bergman
710 Medtronic Pkwy
MS LT120
Fridley, MN 55432
Phone: (763) 505-4510
Fax: (763) 505-4513
becky.bergman@medtronic.com



Medtronic

Ortec Inc. (Altasorb)

Larry Suggs
465 Old Pelzer Road
Piedmont, SC 29673
Phone: (864) 859-1471
Fax: (864) 859-8580
lsuggs@altasorb.com
www.altasorb.com



Altasorb is the highest quality glycolide and lactide available for the bioabsorbable material market. Altasorb world-class monomers are produced in a state-of-the-art facility located near Greenville, S.C. Our domestic manufacturing location ensures quick response and fast delivery times. Custom cGMP manufacturing services are also available.

PhaseX Corporation

Kara Williams
360 Merrimack Street
Lawrence, MA 01843
Phone: (978) 794-8686
Fax: (978) 794-9580
kara@phasex4scf.com
www.phasex4scf.com



Process development services using supercritical fluid technology. Laboratory scale (g to kg) for feasibility testing and process optimization, and toll production plant (1000s of kg) for product improvement, manufacturing and materials processing. Industries served include polymers, medical components, pharmaceuticals, and nutraceuticals since 1981. Supercritical fluids fractionate polymers and lubricants, extract residual monomers from medical and pharmaceutical polymers, concentrate products from botanical and biological substrates free of solvent residues, and purify reactive monomers eliminating degradation problems.

Polymer Technology Group

Lauri Bareilles
2810 7th Street
Berkeley, CA 94710
Phone: (510) 841-8800
Fax: (510) 841-7800
info@polymertech.com
www.polymertech.com



Your vertically integrated partner for bringing new specialty chemicals and polymer-based solutions to critical materials-intensive applications and in medical and related fields. PTC's combined experience in biomaterials and medical devices offers your company support in material design and selection, synthesis and characterization, prototype fabrication and manufacturing of components and medical devices.

Spire Corporation

Nader Kalkhoran
One Patriots Park
Bedford, MA 01730
Phone: (781) 275-6000 ext. 267
Fax: (781) 275-7470
nkalkhoran@spirecorp.com
www.spirecorp.com



Spire Biomedical is a leading provider of advanced surface modification services for implantable medical devices and biomedical instruments. The company offers customized biocompatible metal and ceramic coatings and surface treatments to meet a wide range of needs including, wear and friction reduction, enhanced bone in-growth, anti-microbial property, radiopacity, electrical conduction and insulation, hydrophilicity, surface functionalization, and surface engineering on the nanoscale.

SurModics

Nancy Hupfer
9924 West 74th Street
Eden Prairie, MN 55344
Phone: (952) 829-2700
Fax: (952) 829-2743
info@surmodics.com
www.surmodics.com



SurModics is a leading provider of surface modification and drug delivery technologies for medical device and biomedical applications, bringing innovation together to enhance and enable medical advancements for medical and biotechnology companies around the world. Their technologies provide many performance-enhancing characteristics such as drug delivery, lubricity, hemocompatibility, and tissue engineering.

Veeco Instruments

Marlene Carlyle
2650 East Elvira Road
Tucson, AZ 85706
Phone: (520) 741-1044
Fax: (520) 294-1799
info@veeco.com
www.veeco.com



Veeco's Wyko® NT Series Optical Profilometers provide rapid, non-contact, 3D measurements from 0.1 nanometer to 10 millimeters, with sub-nanometer resolution. The combination of resolution, repeatability, and speed enable unmatched performance for a wide range of biomaterials applications, as well as biomedical implant design, quality assurance, and failure analysis.

Wiley

Diane Imus
111 River Street
Mailstop 4-02
Hoboken, NJ 07030
Phone: (201) 748-6046
Fax: (201) 748-6617
imus@wiley.com
www.wiley.com



Founded in 1807, John Wiley & Sons Inc. is an independent, global publisher of print and electronic products. Wiley specializes in scientific and technical books, journals, textbooks and education materials, and professional and consumer books and subscription services.

Wright Medical Technology

Ann Burgess
5677 Airline Rd
Arlington, TN 38002
Phone: (901) 867-4426
Fax: (901) 867-4382
aburgess@wmt.com

Headquartered in Arlington, Tenn., Wright has been a designer, manufacturer and worldwide distributor of orthopaedic implants for over 50 years. Wright's products include large joint implants for the hip and knee; upper and lower extremity implants; and biologic products, including bone graft substitutes and soft tissue repair products.

Zimmer Inc.

Cheryl Blanchard
PO Box 708
Mailstop 5233
Warsaw, IN 46581-0708
Phone: (574) 372-4467
Fax: (574) 372-4266
cheryl.blanchard@bms.com



The task of selecting the slate of Officer Nominees for 2008 has been completed. Following are the nominees for President-Elect and Member-at-Large.

Following are brief descriptions of the responsibilities of each position, along with a description of the nominees' biographical background and their Society experience. Each nominee has also developed a vision statement for the Society that they would work to achieve should they be elected.

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, and the Council and the Board of Directors, and perform the duties and exercise the powers of President. The term of office is for a period of one year without succession. The President-Elect is the chairperson of the Long Range Planning Committee.

Nominees for President-Elect



Lynne Jones, PhD

Lynne Jones is an Associate Professor in the Department of Orthopaedic Surgery with a joint appointment in the Department of Materials Science and Engineering at the Johns Hopkins University (JHU). She is also Director of

JHU's Center for Osteonecrosis Research and Education, Technical Director of the Arthritis Surgery Bone Bank, Director of the Clinical Research Group, and JHU Orthopaedics Laboratory Manager at Good Samaritan Hospital (Baltimore, Md.).

Lynne's research focuses on bone physiology and biological responses to orthopaedic biomaterials (traditional materials as well as bone graft and bone graft substitutes). She has published more than 80 peer-reviewed articles and 130 abstracts, including the seminal work titled "Cement Disease" (1987), which brought increased awareness of the role of the biologic response to particulate debris in orthopaedic implant failures. During the past 30 years her research has been supported by government agencies, foundations, corporations, and other donors. In 1984, she established the Arthritis Surgery Bone Bank at JHU, and an implant retrieval program in 1987. She serves on several editorial boards and advisory councils relating to orthopaedic and biomaterial research.

Lynne became a member of the SFB in 1985. She has served in elected positions on the Board of Directors and Council as SIG Chair Representative (2000-2002, 2007-2009), Secretary-Treasurer-Elect (2003-2005), and Secretary-Treasurer (2005-2007). She also chaired the SIGs in Implant Pathology (1997-2002) and Orthopaedic Biomaterials (2007-2008). Lynne has served on several SFB committees including Finance, Awards and Nominations (elected twice), Meetings, Membership, Program, and Long-Range Planning. Lynne has been active at all levels of programming and content development for SFB's annual meetings for more than 20 years, serving as the Program Chair for the 2003 Annual Meeting; assistant Program Chair (2002); organizer of numerous tutorials/workshops/sessions; abstract reviewer; session chair; and presenter of original research in sessions. Lynne is also a Board Member of the Orthopaedic Research Society, the



Kinam Park, PhD

Kinam Park received his PhD degree in pharmaceuticals from the University of Wisconsin in 1983. After a postdoctoral training at the Department of Chemical Engineering of the same university for two years, he joined the faculty of Purdue University in 1986 and was promoted to

Full Professor of Pharmaceutics in 1994. Since 1998, he has had a joint appointment in the Department of Biomedical Engineering, and he became Showalter Distinguished Professor of Biomedical Engineering in 2006.

He is the Editor-in-Chief of the *Journal of Controlled Release*, and is a member of the editorial boards of a dozen of journals. He has received a number of awards, including the Clemson Award (the Basic Research Category) from the Society For Biomaterials in 2001. His research has been focused on applications of various polymers and hydrogels for biomaterials and drug delivery.

Vision Statement

I first attended a Society For Biomaterials (SFB) meeting in 1985. At that time, biomaterials research was at the height of the public's interest. The focus was a result of the many exciting developments occurring in this field, particularly the first implantation of a total artificial heart. Throughout the years, SFB has continued to maintain a high level of interest and excitement for biomaterials research. As a leading scientific organization, the society has continued to expose the public to the innovations in this field. With its rich history and motivated members, SFB can easily be run on autopilot in the future. I believe, however, that to achieve exponential growth in the coming years we must focus on one thing: cultivating the younger generation of biomaterials scientists.

If given the chance, I will make my top priority the task of enhancing the programs for nurturing the young members of the society. I will also work towards expanding the membership base of SFB by reaching out to a new generation of scientists. The future of SFB depends on them. We need to instill the same level of excitement about biomaterials that the world felt in the '80s into the upcoming scientists. Among other

Continued on page 23

Continued on page 23

Member-at-Large

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

Nominees for Member-at-Large



Julia E. Babensee, PhD

Julia E. Babensee is an Associate Professor in the Wallace H. Coulter Department of Biomedical Engineering at the Georgia Institute of Technology and Emory University in Atlanta. She is affiliated with the Petit Institute for Bioengineering and Bioscience and the Georgia

Tech/Emory Center for the Engineering of Living Tissue. Dr. Babensee's research program is focused on understanding host responses to combination products. Specifically, she is interested in how biomaterials affect antigen presenting cells, particularly dendritic cells, to affect their ability to stimulate an immune response to associated foreign antigen in the combination product (e.g., tissue engineered construct or polymeric vaccine delivery vehicle) as a means of controlling immune responses. She brings cutting-edge concepts in immunology into the biomaterials field to enable further understanding of the host response to biomaterials.

Dr. Babensee was educated at the University of Toronto, receiving a BAsC in 1990 and a PhD in 1996 in the Department of Chemical Engineering and Applied Chemistry. She was also a postdoctoral fellow in the Department of Bioengineering at Rice University from 1996-1999. She was awarded the "Student Award for Outstanding Research-Undergraduate, Masters or Health Science" from the Society For Biomaterials at the 1992 World Biomaterials Congress in Berlin, Germany. More recently, she received the SFB "Young Investigator Award" in 2005. Furthermore, she has been elected to the College of Fellows of the American Institute for Medical and Biological Engineering (AIMBE) in 2008. She is also the recipient of a Hulda Irene Duggan Arthritis Investigator Award from the Arthritis Foundation and a CAREER Award from the National Science Foundation (NSF). Other past and current research funding sources include a National Institutes of Health (NIH) RO1, Whitaker Foundation Biomedical Engineering Research Grant, and Wallace H. Coulter Clinical/Translational Research Grants. Dr. Babensee is an associate editor of the *Annals of Biomedical Engineering* and is a member of the editorial board of the *Journal of Biomedical Materials Research – Part A*. She also serves as a manuscript reviewer for various journals in biomaterials. She has served on various grant review panels for NSF, NIH and the Canadian Institute of Health Research (CIHR). She is also involved in teaching biomaterials and tissue engineering to undergraduate and graduate students at Georgia Tech.

Dr. Babensee is a regular attendee at SFB meetings and has been actively involved in many capacities. She has served, or serves, as a member of the SFB Strategic Planning Committee (2002-2003 and 2005), SFB Awards and Nominations Committee (2005-2006), SFB Strategic Planning Task Force on Annual Meeting (2005-2006), SFB Publications Committee (2005-2008) and as abstract reviewer, session chair and symposium organizer.

Continued on page 23



Jeffrey M. Karp, BEng, PhD

Jeffrey Karp obtained a PhD from the University of Toronto in Chemical Engineering, where he worked with Professor John Davies and Molly Shoichet. Upon graduation, he was awarded the Paul B. Madsen Award for the most innovative graduate student. He joined MIT as an

NSERC Postdoctoral Fellow working in Institute Professor Robert Langer's laboratory for three years in the areas of human embryonic stem cells, photocrosslinkable degradable elastomers, materials for influencing cell rolling, biomedical adhesives, and BioMEMS technologies. In 2005 he won first prize at an MIT Chemical Engineering Research Competition for his work on enhancing the differentiation efficiency of human embryonic stem cells. Since 2006 he has been a member of the Editorial Board for the *International Journal of Nanomedicine* and in 2007 he was invited as one of the top engineers in the country between the ages of 30-45 to attend the National Academy of Engineering U.S. Frontiers of Engineering Symposium at Microsoft in Seattle.

Dr. Karp is a tenure-track faculty member at the Harvard-MIT Division of Health Sciences and Technology, Department of Medicine at the Brigham and Women's Hospital, Harvard Medical School. He has published more than 25 peer-reviewed papers, eight book chapters, 35 abstracts, and has 15 issued or pending patents, three of which have been licensed by biotech companies. He has published first author or corresponding author papers in journals including: *Nature Nanotechnology*, *Lab on a Chip*, *Langmuir*, *Journal of Biomedical Materials Research*, *Biomaterials*, *Current Opinions in Biotechnology*, and in the Proceedings of the National Academy of Sciences. Dr. Karp has been quite active in the Society For Biomaterials, having founded the Education Special Interest Group and the Biomaterials Surgical Video Library, both of which he has chaired since their inception. He also has been an active member of the Education and Professional Development Committee for the past four years and has a great appreciation for the inner workings of the Society and its vision to be a leader in the dissemination of biomaterials research for the benefit of humankind.

Vision Statement

In order to survive and thrive as a productive and prestigious society, the Society For Biomaterials must strive to not only keep up new advances in the field, but to create a dynamic environment that is conducive to, and breeds, the state-of-the-art in innovation. This can only happen through concerted top-down (from the board) and bottom-up (from the members) efforts.

To address the difficult gap between classroom theory and clinical application I spearheaded the formation of the surgical video library (www.biomaterialsvideos.org), which I continue to develop to meet membership needs. To assess broad and specific areas of need for future development, I have interacted

Continued on page 23



Founder's Award

Michael Sefton, ScD – University of Toronto

In recognition of Professor Sefton's long-term, diverse and seminal contributions to the science of biomaterials in the fields of tissue engineering, drug delivery, and blood-material interactions.



C. William Hall Award

Paul Ducheyne, PhD – University of Pennsylvania

In recognition of Professor Ducheyne's significant contributions to the Society and for his outstanding record in establishing, developing, maintaining and promoting the goals of the Society For Biomaterials.



Clemson Award for Basic Research

Kristi Anseth, PhD – University of Colorado

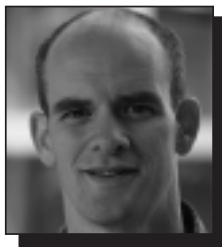
For Dr. Anseth's outstanding contributions to the basic knowledge of the interaction of materials with tissue and in the rationale design of novel biomaterials.



Clemson Award for Applied Research

Jeffrey O. Hollinger, PhD, DDS – Carnegie Mellon University

For Dr. Hollinger's many significant scientific contributions in bone healing and polymer/bone tissue interactions, which have led to the development of new technologies and expanded knowledge of biomaterials/host tissue relationships.



Clemson Award for Contributions to the Literature

David Mooney, PhD – Harvard University

For Professor Mooney's significant contributions to the scientific literature of biomaterials in the fields of drug delivery, tissue engineering, and new biomaterials.



Young Investigator Award

Helen Lu, PhD – Columbia University

For Dr. Lu's outstanding achievements in the design and development of multi-phased scaffolds for orthopaedic tissue engineering.

Congratulations to:

David W. Grainger, Professor and Chair of the Department of Pharmaceutics and Pharmaceutical Chemistry at the University of Utah, who is the newly appointed co-Editor-in-Chief of the *Drug Delivery* journal. *Drug Delivery*, published by Informa Healthcare, is a leading content provider of pharmaceutical science information for the academic and industrial communities with peer-reviewed coverage of basic research, development, and application principles at molecular, cellular, and higher levels.

Michael N. Helmus, who recently launched a consulting business focused on biomaterial, medical devices, drug delivery and nanotechnology. Michael also serves as Chair of ASM's Materials and Process for Medical Devices Database.

Cato T. Laurencin, University Professor, Professor and Chair of Orthopaedic Surgery, and Professor of Biomedical Engineering and Chemical Engineering at the University of Virginia, who has been named to the 2007 *Scientific American* 50 "SciAm 50" for his groundbreaking technology for regeneration of the anterior cruciate ligament using a bioengineered matrix. Assembled by *Scientific American's* Board of Editors, the list honors 50 outstanding people or teams for their achievements and leadership in shaping established and emerging technologies.

Nicholas Peppas, of the University of Texas at Austin, who is the 2008 winner of the Pierre Galletti Award, the highest honor bestowed annually by the American Institute for Medical and Biological Engineering. Dr. Peppas is recognized "for seminal contributions and visionary leadership in biomaterials science and engineering, and for pioneering work on drug delivery that has led to numerous biomedical products and devices." Dr. Peppas, Sc.D., holds the Fletcher Stuckey Pratt Chair in Engineering and is a Professor of Chemical and Biomedical Engineering in the University of Texas at Austin's Cockrell School of Engineering and Professor of Pharmaceutics in the College of Pharmacy. An AIMBE Founding Fellow, Dr. Peppas serves as the Chair of the College of Fellows of AIMBE this year.

Established in 1999 to honor AIMBE Founding Member and Past President Pierre Galletti, the award is presented to an individual in recognition of his or her contributions to public awareness of medical and biological engineering, and to promotion of the national interest in science, engineering, and education. Nominations are solicited by the AIMBE Awards Committee from the Fellowship and AIMBE's Councils, and approved by the Board of Directors.

Thomas Webster, Professor of Biomedical Engineering at Brown University, who was elected chair of the 34th Annual Northeast Bioengineering Conference, which will be held at Brown University in April.

New AIMBE Fellows Announced

The American Institute for Medical and Biological Engineering (AIMBE) announced the election of 82 new members of the College of Fellows. The newly elected Fellows were nominated and approved by current Fellows of the College, consisting of more than 900 engineers and scientists. Recipients of this honor are recognized for their outstanding achievements in medical and biological engineering. A formal induction ceremony was held during the Institute's Annual Event at the National Academy of Sciences building in Washington, D.C., on February 21, 2007. The College of Fellows leads the way in technological advancement, advocating for public policies facilitating progress in medical and biological research and development to benefit the public. Since 1991, AIMBE Fellows have helped to revolutionize medicine, engineering and related fields that enhance and extend the lives of people all over the world. Counting several Nobel Prize winners among them, through their work the Fellows also help protect the environment, lead to new national security safeguards and contribute to a better, healthier society in many other ways. Congratulations to the following SFB members, who are newly elected Fellows of the American Institute for Medical and Biological Engineering:

- **Julia E. Babensee, PhD**
Georgia Institute of Technology
- **James A. Davidson, PhD**
Edwards Lifesciences
- **Jennifer H. Elisseeff, PhD**
The Johns Hopkins University
- **George L. Grobe III, PhD**
Johnson & Johnson
- **Weiyuan J. Kao, PhD**
University of Wisconsin
- **Balaji Narasimhan, PhD**
Iowa State University
- **David A. Puleo, PhD**
University of Kentucky
- **James P. Runt, PhD**
Penn State University
- **Ann B. Salamone, PhD**
Rochal Industries
- **Shalaby W. Shalaby, PhD**
Poly-Med Inc.
- **Arthur J. Tipton, PhD**
Brookwood Pharmaceuticals
- **Richard W. Treharne III, PhD**
Active Implants Corp.

Considerations for Carbon Nanotubes in Biomaterials Research

Feature

Joy Dunkers, Government News Contributing Editor
By Matthew L. Becker

Polymers Division, National Institute of Standards and Technology

Single wall carbon nanotubes (SWCNTs) have been highlighted repeatedly as a unique and versatile material that could revolutionize numerous industries in the coming decades. Potential applications in electronic, mechanical and thermal devices as well as biomedical agents have led to great excitement in the basic and applied research communities. However, uncertainty over the potential long-term effects of engineered nanomaterials on human health and the environment, detrimental or otherwise, threaten to derail efforts to use these materials in new technologies and products.^{1,2} “Fear of the unknown,” coupled with a few highly publicized studies and strong responses from focused special interest groups, has fueled public debate and the push for additional regulatory oversight.² Furthermore, failure to establish long-term toxicity and liability risks have led corporate entities, both big and small, to pursue very conservative risk-averse investment policies. Current approaches or responses have not sufficiently served the health and safety interests of the average citizen, corporate economic interests or the well being of the environment.

Many of the challenges in addressing these issues arise because materials on single nanometer (1×10^9) length scales are very difficult to measure precisely. These classes of materials, in general, reside in a gray area between small molecules and bulk materials.³ Detailed assessments are even more difficult because many “nanomaterials” have heterogeneous distributions in physical properties such as size, charge, mass, and density. In addition, subtle structural, chiral, or compositional differences may have little effect on the apparent solution properties but make the common spectroscopic techniques utilized by most synthetic laboratories to measure these and other phenomena much more complicated.

The National Institute of Standards and Technology (NIST), an executive branch agency in the United States Department of Commerce, has responded to many of these challenges by hosting a series of workshops that have gathered the leaders in synthesis, characterization and device manufacturing from all sectors. The output from these workshops called for increased emphasis on quantitative characterization. We have placed significant resources into outlining a comprehensive characterization methodology package, which is being distributed openly to the wider community. The thrusts include purification, solution properties, spectroscopy, and biological interactions.

Purification became the initial focus of our effort as quantitative measurements in the other areas could not begin in earnest until well-defined starting materials could be reliably produced in meaningful quantities. The various SWCNT synthetic procedures each rely on transition metal catalyzed reactions, all of which yield heterogeneous materials with regard to length, chirality or degree of “twisting” and residual metal content. The first challenge in any fluid-based SWCNT purification protocol is to break up the ropes,

“
Uncertainty over the potential long-term effects of engineered nanomaterials on human health and the environment, detrimental or otherwise, threaten to derail efforts to use these materials in new technologies and products.”

eliminate the impurities and disperse the nanotubes into solution at the level of isolated tubes. While there are numerous recipes in the literature claiming “good” tube dispersion, our neutron scattering measurements show that the resulting dispersions frequently contain large aggregates, making them unsuitable for many applications.^{4,5} The dispersion efforts have continued to evolve steadily in the last decade from use of surfactants, small molecules, and various organic and bio-based wrapping polymers such as DNA and finally chemical derivatization.

When dispersed, nanotubes exhibit characteristics that will allow them to be separated by several different chromatographic approaches, including ion chromatography (IC), high performance liquid chromatography (HPLC), size exclusion chromatography (SEC), field flow fractionation, and affinity chromatography. However, dispersed carbon nanotubes have introduced size and structure anisotropies that are complicated and unprecedented in chromatography. Sorting by length was first demonstrated by Zeng et al. using size exclusion chromatography (SEC)⁶ and further sorted by chirality using ion-exchange (IC)⁷ and affinity-based chromatographies (AC). If longer tube fractions are required for a given application, porous media with sizes greater than presently available will need to be developed. Current commercially available columns limit the longest fractions to 600 to 700 nm. More recently, gel electrophoresis,⁸ field flow fractionation and ultracentrifugation⁹ have shown the ability to separate highly heterogeneous populations into well-defined chirality fractions.

Well-separated and contaminant free starting materials isolated from the chromatography efforts have enabled extensive research into the spectroscopy of SWCNTs. We, and others, have begun to apply all forms of spectroscopic analysis (Raman, UV-vis-NIR, fluorescence) to provide feedback in our efforts to develop increasingly pure materials of increasing quantity. In a particularly powerful example, we used size-exclusion chromatography to prepare length-separated

fractions of individualized DNA-wrapped SWCNTs, which we then characterized using a combination of absorption, fluorescence, and resonant Raman spectroscopy.¹⁰ We measured reproducible changes in the peak versus baseline optical responses measured over a (10 to 700) nm range of nanotube length fractions. The relative ratios were consistent regardless of tube synthetic method, all of which produce different distributions of tube lengths, diameters and chiralities. This led us to investigate further the intrinsic optical response of single wall carbon nanotubes, which possessed an approximately linear dependence on nanotube length to length scales approaching 1 μ m. The length dependent optical behavior findings were critical to our efforts internally to develop new purification and separation methods. The results suggest that the longest SWCNTs display the strongest optical features, which has profound implications for all potential applications that seek to exploit the unique optical characteristics of single-wall carbon nanotubes. The peak-to-baseline ratio also provided handles for online detection biological characterization efforts.

Our recent efforts have shown the importance of detailed measurements on accurate assessments of cell-material interactions.¹¹ SWCNTs are being used in biomaterial applications both in solid forms as composite materials and in solution as imaging agents, drug and gene delivery vehicles, etc. Critical to the success of these applications is the elucidation of mechanistic information regarding the interactions of the SWCNT with biological systems. This includes SWCNT-SWCNT interactions in biological fluids, aggregation and transport behavior and interactions with various biological membranes. Culling this information from the literature has been exceedingly difficult. The published data citing *in vitro* and *in vivo* toxicity are inconsistent, sometimes contradictory and widely-disputed.¹¹⁻²⁰ The underlying reasons for the discrepancies can be attributed to two causes: insufficient characterization of the starting materials and second, the use of non-uniform characterization methods and materials with different preparative protocols, viability assessment methods and cell/species populations. Unfortunately, few studies have addressed both issues simultaneously. Insufficient characterization of starting materials makes identification of the toxic parameter(s) exceedingly difficult. We chose to measure the concentration and length effects of DNA-wrapped SWCNT on cell viability in human lung fibroblast. Although simple in nature, the metabolic assays provide significant information for materials with limited quantity.

In the first experiment, a Wst-1 assay was used to look for reductions in metabolic activity (cell viability) of the cell populations upon exposure to the DNA-wrapped SWCNTs. Samples were serially diluted and incubated on adherent IMR90 human lung fibroblasts. The two highest solution concentration inoculations, (360 and 197) mg/mL, are significantly higher than we have found reported in the literature, and reduced cell viability by 75 percent and 72 percent, respectively. As shown in Figure 1, concentrations below 20 mg/mL did not significantly reduce cell viability. These cell viability measurements are consistent with the values found in the literature stating that metabolic inhibition occurs somewhere between (10 and 50) mg/mL.

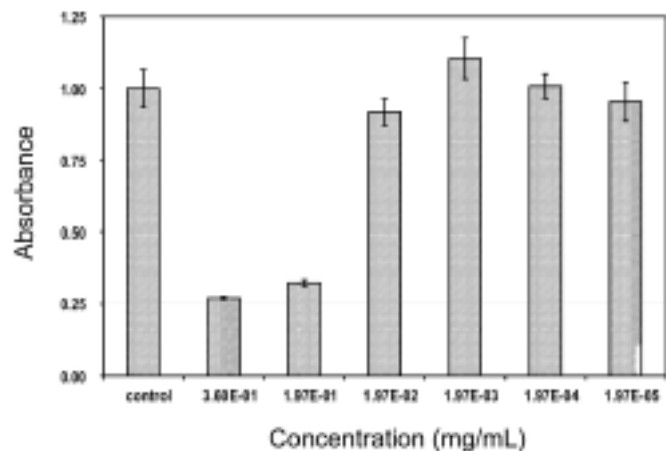


Figure 1. Concentration profile for DNA-wrapped SWCNT as measured by a Wst-1 metabolic assay indicates a toxicity threshold above 20 mg/mL for unfractionated materials.

We then chose to measure and isolate the effects of nanotube length. This portion of the study was designed to call attention to the importance of dispersion and concentration on cellular toxicity. Using size exclusion chromatography (SEC), the parent SWNT solution (9) was separated into multiple fractions. Twelve of the distinct fraction populations were collected and characterized. Using multiple runs, sufficient quantities were collected both for characterization as well as *in vitro* cell assessments at physiologically relevant concentrations. The concentrations and characterization data of dispersed SWNT fractions rather than pre-centrifuged parent concentrations are listed below in Table 1.

Sample Fraction	Rg (SEC) (nm)	Length (SEC) (nm)	Length (AFM) (nm)	Concentration (mg/mL)
1	113.5 ± 5.1	393 ± 18	-	0.031
2	96.8 ± 7.9	335 ± 27	367 ± 61	0.167
3	72.9 ± 7.4	253 ± 26	303 ± 11	0.180
4	54.6 ± 5.0	189 ± 17	210 ± 48	0.126
5	42.4 ± 3.4	150 ± 12	149 ± 43	0.266
6	34.7 ± 2.6	120 ± 9	138 ± 60	0.119
7	29.2 ± 2.0	101 ± 7	76 ± 27	0.191
8	25.8 ± 1.4	89 ± 5	-	0.134
9			distribution	

Table 1.

Again using a Wst-1 assay, we demonstrated that only length fractions of DNA-wrapped SWCNTs shorter than about 200 nanometers enter readily into human lung cells. Following characterization, Wst-1 experiments were performed on each on the length fractions. The longer fractions 2 and 3, (335 ± 27) nm and (253 ± 26) nm, respectively, did not affect the viability of the cells. However, the shorter SWNT fractions did affect the viability at similar concentrations. However, all the length fractions shorter than 3 exhibited decreased metabolic activity at similar concentrations. Live-dead staining of the individual fractions at these concentrations showed that

all cells below the dashed line were in fact dead after the allotted incubation times. The results suggest that the tube fractions retained in the supernatant were longer than 189 ± 17 nm. These results support the length dependent uptake hypothesis, and suggest that shorter tubes may therefore be more toxic to cells than longer SWNTs. Several different cell lines, including A549 (human alveolar basal epithelial cells), MC3T3-E1 (clonal murine calvarial) and A10 (embryonic rat thoracic aorta medial layer myoblasts) cells, were measured and exhibited similar results. Our results were confirmed microscopically by using fluorescently-labeled DNA on individual SWCNT fractions.

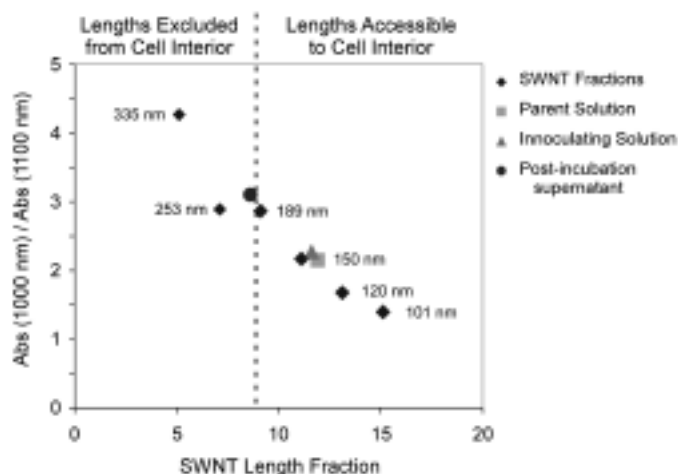


Figure 2. This plot depicts the trend of peak-to-baseline ratio for characterizing SWCNT length vs. the respective SEC fraction. The approximate lengths next to each fraction as well as the respective average lengths of the parent, inoculating and post-incubation solutions fit to the same ratios. The dashed line represents the measured threshold for SWCNT exclusion from human IMR90 cells.

While this study is not exhaustive or definitive, it does demonstrate that establishing a definitive toxicity framework is impossible without implementation of precise measurements, complete characterization, and the use of well-defined materials. In addition, caution should be exercised when trying to extrapolate these results to conclusively assess or predict the long-term health effects that acute or continuous exposure could present. How cell effects are measured against cells or tissues grown in labs (*in vitro*) and how toxic they actually are to live animals (*in vivo*) are very different particularly with regard to mode of exposure.

Our goals moving forward are not to conclusively map a material toxicity framework that covers multiple or even single classes of nanomaterials. This endeavor is bigger than any single entity or government agency and will require coordination and partnerships among parties in industry, government and academia. NIST's goal is to provide guidance and robust methods to separate SWCNT into well-defined lengths and chiralities, and to correctly measure important physical properties, including adsorption, fluorescence and impedance spectroscopies on broad classes of nanometer scale materials. These tools will serve as a foundation from which others may draw to make their own assessments.

Acknowledgements

We benefit greatly from a highly collaborative and focused effort on Carbon Nanotube Metrology, which has been funded through a NIST Innovation in Measurement Science Award.

Current Polymers Division team members include Dr. Barry J. Bauer, Dr. Jaehun Chun, Dr. Jeffrey A. Fagan, Dr. Eric K. Hobbie, and Dr. Kalman B. Migler. Contributions from Dr. Jeffrey A. Simpson and Dr. Angela Height-Walker, from the NIST Physics Laboratory, have been critical to the success of our efforts.

† Certain commercial materials and equipment are identified in this paper in order to specify adequately the experimental procedure. In no case does such identification imply recommendation by the National Institute of Standards and Technology nor does it imply that the material or equipment identified is necessarily the best available for this purpose.

*Official contribution of the National Institute of Standards and Technology; not subject to copyright in the United States.

References:

- Colvin, V. L. *Nature Biotechnology* 2003, 22, 1166-1170.
- Maynard, A. D.; Aitken, R. J.; Butz, T.; Colvin, V.; Donaldson, K.; Oberdorster, G.; Philbert, M. A.; Ryan, J.; Seaton, A.; Stone, V.; Tinkle, S. S.; Tran, L.; Walker, N. J.; Warheit, D. B. *Nature*, 2006, 444, 267-269.
- Nel, A.; Xia, T.; Li, N. *Science*, 2006, 311, 622-627.
- BJ Bauer, EK Hobbie, ML Becker, "Small Angle Neutron Scattering from Labeled Single Wall Carbon Nanotubes" *Macromolecules*, 2006, 39, 2637-2642.
- BJ Bauer, ML Becker, V Bajpai, JA Fagan, EK Hobbie, K Migler, CM Guttman, WR Blair, "SWNT Dispersion as Measured by Size Exclusion Chromatography" *J Phys Chem C*, 2007, 111(48), 17914-17918.
- Huang, X. Y.; McLean, R. S.; Zheng, M. *Analytical Chemistry* 2005, 77, 6225-6228.
- (a) Zheng, M.; Jagota, A.; Semke, E. D.; Diner, B. A.; McLean, R. S.; Lustig, S. R.; Richardson, R. E.; Tassi, N. G. *Nature Materials* 2003, 2, 338-342. (b) Lustig, S. R.; Jagota, A.; Khripin, C.; Zheng, M. J. *Phys. Chem B* 2005, 109, 2559-2566. (c) Zheng, M.; Jagota, A.; Strano, M. S.; Santos, A. P.; Barone, P.; Chou, S. G.; Diner, B. A.; Dresselhaus, M. S.; McLean, R. S.; Onoa, G. B.; Samsonidze, G. G.; Semke, E. D.; Usrey, M.; Walls, D. J. *Science* 2003, 302, 1545-1548.
- (a) Krupke, R.; Hennrich, F.; von Lohneysen, H.; Kappes, M. M. *Science* 2003, 301, 344-347. (b) Doorn, S. K.; Fields, R. E.; Hu, H.; Hamon, M. A.; Haddon, R. C.; Selegue, J. P.; Majidi, V. J. *Am. Chem. Soc.* 2002, 124, 3169-3174. (c) Heller, D. A.; Mayrhofer, R. M.; Baik, S.; Grinkova, Y. V.; Usrey, M. L.; Strano, M. S. *J. Am. Chem. Soc.* 2006, 126, 14567-14573.
- (a) Arnold, M. S.; Green, A. A.; Hulvat, J. F.; Stupp, S. I.; Hersam, M. C. *Nature Nanotechnology* 2006, 1, 60-65.
- JA Fagan, JR Simpson, BJ Bauer, SH Lacerda, ML Becker, KB Migler, AR Height-Walker, EK Hobbie, "Optical Measurements on Size Fractionated Single Wall Carbon Nanotubes" *J. Am. Chem. Soc.*, 2007, 129(34), 10607-10612.
- Becker, M. L.; Fagan, J. A.; Gallant, N. D.; Bauer, B. J.; Bajpai, V.; Hobbie, E. K.; Lacerda, S. H.; Migler, K. B.; Jakupciak, J. P. *Advanced Materials*, 2007, 19(7), 939-945.
- Warheit, D. B.; Laurence, B. R.; Reed, K. L.; Roach, D. H.; Reynolds, G. A. M.; Webb, T. R. *Toxicol. Sci.* 2004, 77, 117-125.
- Jia, G.; Wang, H.; Yan, L.; Wang, X.; Pei, R.; Yan, T.; Zhao, Y.; Guo, X. *Environ. Sci. Technol.* 2005, 39, 1378-1383.
- Carreor-Sanchez, J. C.; Elias, A. L.; Mancilla, R.; Arrellin, G.; Terrones, H.; Laclette, J. P.; Terrones, M. *Nano Letters* 2006, 6(8), 1609-1616.
- Dumortier, H.; Lacotte, S.; Pastorin, G.; Marega, R.; Wu, W.; Bonifazi, D.; Briand, J.-P.; Prato, M.; Muller, S.; Bianco, a. *Nano Letters* 2006, 6, 1522-1528.
- Hurt, R. H.; Monthieux, M.; Kane, A. *Carbon* 2006, 44, 1028-1033.
- Lam, C.-W.; James, J. T.; McCluskey, R.; Arepalli, S.; Hunter, R. L. *Critical Reviews in Toxicology* 2006, 36, 189-217.
- Magrez, A.; Kasas, S.; Salicio, V.; Pasquier, N.; Seo, J. W.; Celio, M.; Catsicas, S.; Schwaller, B.; Forro, L. *Nano Letters* 2006, 6, 1121-1125.
- Smart, S. K.; Cassady, A. I.; Lu, G. Q.; Martin, D. J. *Carbon* 2006, 44, 1034-1047.
- Sayes, C. M.; Liang, F.; Hudson, J. L.; Mendez, J.; Guo, W.; Beach, J. M.; Moore, V. C.; Doyle, C. D.; West, J. L.; Billups, W. E.; Ausman, K. B.; Colvin, V. L. *Toxicology Letters* 2006, 161, 135-142.

Five major orthopaedic companies that account for nearly 95 percent of the lucrative market in hip and knee surgical implants have avoided criminal prosecution over financial inducements paid to surgeons to use their products by agreeing to new corporate compliance procedures and federal monitoring under 18-month agreements with the Department of Justice, U.S. Attorney Christopher J. Christie announced. Zimmer Inc., Depuy Orthopaedics Inc., Biomet Inc., and Smith & Nephew Inc., have executed Deferred Prosecution Agreements (DPAs), which will expire in 18 months if they meet all of their respective reform requirements. Criminal Complaints were also filed against those four companies, charging them with conspiring to violate the federal anti-kickback statute. Those Complaints will be dismissed at the conclusion of the DPAs if the companies comply with their terms. The four companies have agreed to pay a total of \$311 million to settle government claims under the anti-kickback statute and the civil federal False Claims Act. They have also entered into five-year Corporate Integrity Agreements (CIAs) with HHS-OIG. Those agreements require additional reforms and monitoring under the supervision of HHS-OIG. The fifth company, Stryker Orthopedics Inc., voluntarily cooperated with the U.S. Attorney's Office before any other company. Due to its cooperation, Stryker executed a Non-Prosecution Agreement (NPA) with the government, under which Stryker is required to implement all the reforms imposed on the other companies under the DPAs, including 18 months of federal monitoring.

Amedica Corp. (Salt Lake City), an orthopedic implants company, announced that the FDA has granted a Special 510(k) marketing clearance for Amedica's Valeo™ ceramic VBR spinal implant. The Valeo VBR spinal implant is intended for vertebral body replacement to aid in surgical correction and stabilization of the thoracolumbar spine. The Valeo VBR incorporates Amedica's novel silicon nitride ceramic, which provides new functionalities compared to competing devices currently on the market. The implant is designed to restore the biomechanical integrity of the anterior, middle and posterior spine, even in the absence of fusion, for a prolonged period of time.

CircuLite Inc. (Hackensack, N.J.) launched the clinical development program for its Synergy pocket circulatory assist device with the successful implantation in the first patient in a European feasibility trial. Synergy is a miniature implantable blood pump that can be implanted superficially in a pocket, similar to a pacemaker. The device is designed to provide long-term, partial circulatory support in patients with chronic heart failure. The primary objective of the first-in-man trial is to assess the safety of the device in patients with chronic heart failure who are waiting to receive heart transplants.

Hologic Inc. (Bedford, Mass.) announced that the FDA Obstetrics and Gynecology Devices Advisory Panel recommended approval of the Adiana® Permanent Contraception device for female sterilization contingent upon several conditions, including long-term follow up of current pivotal trial patients, a new post approval study of new patients and physicians, and more specific labeling recommendations. Adiana is a minimally-invasive, non-

incisional alternative to bilateral tubal ligation. The procedure uses hysteroscopy, generally requires only local anesthesia, and can be performed in a physician's office. Patients are typically able to return to work or resume their everyday activities within a day.

FDA advisers rejected **Merck & Co.**'s (Whitehouse Station, N.J.) latest bid for over-the-counter sales of Mevacor, the granddaddy of the famed cholesterol-lowering drugs. The company argued that offering a low dose on open drugstore shelves, next to the aspirin, would persuade millions of people with moderately high cholesterol levels to take a pill that might help them avoid a first heart attack. But the FDA worries the seriously ill might self-medicate with a dose too low to help them, instead of seeing a doctor, and that people not sick enough to need a drug might take it anyway and risk unnecessary side effects.

Regeneration Technologies Inc. (Alachua, Fla.) a leading processor of orthopedic and other biologic implants, and **Tutogen Medical** Inc. (Alachua, Fla.), a leading manufacturer of sterile biological implants made from human (allograft) and animal (xenograft) tissue, announced that the boards of directors of both companies have unanimously approved a definitive agreement to combine the two companies in a tax-free, stock-for-stock exchange. The combined company will be the leading provider of sterile biologic solutions for patients around the world, with a diverse mix of implants and distributors. The merged company will benefit from cost synergies and enhanced opportunities for revenue growth and increased profitability.

Just days before the Medical Device User Fee and Modernization Act of 2002 (MDUFMA) was set to expire, Congress overwhelmingly passed and the President signed into law on Sept. 27, 2007, the FDA Amendments Act of 2007 (FDAAA), which reauthorized and expanded the agency's role in reviewing, approving, and monitoring medical devices. The legislation not only ensures the continuation of the medical device user fee program through 2012, but it also includes several new components and initiatives.

Venture capital funding for life sciences companies hit record levels during the first half of 2007, and the pace of investment shows no signs of slowing. In the second quarter, \$2.2 billion went into 223 life sciences deals, representing investments in both biotechnology and medical devices. Although down slightly in dollars from the first quarter—which was the highest quarterly dollar amount ever recorded for life sciences deals at \$2.6 billion—the life sciences sector's second quarter was its most active to date, with deal volume reaching an all-time high. Both biotechnology and medical devices saw a decrease in dollars but an increase in deals for the second quarter. Medical devices and equipment alone saw a total of \$2.1 billion in venture capital investment during the first half of 2007, an increase of more than 60% over the \$1.3 billion invested during the year-ago period. Combined, biotechnology and medical device ventures accounted for 33% of all venture capital dollars invested during the first half of the year.

Edited by KE Gonsalves, CR Halberstadt, CT Laurencin, and LS Nair

Wiley-Interscience, 2008, 507 pages. \$125 new

Biomedical Nanostructures is a book that provides reviews about how nanostructured materials are made (Part I), how cells interact with them (Part II), and how they have been clinically implemented thus far (Part II). The book covers a large research area from scaffolds to nanoparticles to imaging agents and presents concise, at times narrow, information with regard to the main conclusions of original research articles. More than fifty authors have contributed to the production of this book. Since it is a compilation of reviews, specific methodologies are not described and, at times, just enough detail is left out to be slightly annoying to those already familiar with the topic areas. For example regarding drug delivery, from p. 95: "Nanotechnology-based drug delivery systems can be controlled to deliver drugs to specific sites and target drugs to certain cells only, without affecting neighboring normal cells.17,18" A later sentence in this short, four sentence paragraph indicates two more references that describe the use of folate and antibodies to accomplish targeting, and this is the full extent of their discussion of localized and targeted delivery from nanostructured materials. There are hundreds of articles that could have been referenced to indicate the growing momentum behind this approach. From p.117, "Polymeric nanoparticles may represent a general and simple solution to the problem of delivery of poorly soluble drugs." This is not followed up with any references or further explanation of how nanoparticles accomplish this. From p.143, "The shape of the nanoparticle has an important bearing on the drug release mechanism." No reference, and no further discussion, leave the reader wanting more without knowing where to go.

On the other hand, Chapter 10: Cell Behavior Toward Nanostructured Surfaces, is well written and goes into suitable, meaningful depth. There is a detailed table in this chapter that summarizes the types of nanotopographic surfaces created using different fabrication techniques and observed cellular behavior compiled from nearly 100 articles. Chapter 15 on Nanostructures for Tissue Engineering/Regenerative Medicine is also filled with information. Techniques like electrospinning, temperature-induced phase separation, molecular self assembly and surface patterning, which can be used for fabricating nanofiber-based scaffolds for tissue regeneration, are briefly described. The ways in which these nanostructured materials mimic the ECM is discussed and specifically how they have been used for bone and cartilage, vascular, neural and cardiac tissue engineering is all covered in nine pages.

This book is written at a basic level and is therefore of most value to those new to the field. As such, this could be a useful addition to a university library or corporate library since it provides an overview of the field of nanostructures. This book

is timely in that interest in nanostructures continues to expand. For detailed coverage of this area, the 10 volume series: Nanotechnologies for the Life Sciences, Edited by Challa Kumar, copyrights 2005-2006, from Wiley-VCH, which was previously reviewed in this column, offers substantially more information since entire volumes are dedicated to the chapters of the present book under review.

From the Contents

Part I. Nanostructure Fabrication

1. Nanofabrication Techniques
2. Micro/Nanomachining and Fabrication of Materials for Biomedical Applications
3. Novel Nanostructures as Molecular Nanomotors
4. Bioconjugation of Soft Nanomaterials
5. Nanotechnology and Drug Delivery
6. Polymeric Nanoparticles and Nanopore Membranes for Controlled Drug and Gene Delivery
7. Development of Nanostructures for Drug Delivery Applications
8. Bioconjugated Nanoparticles for Ultrasensitive Detection of Molecular Biomarkers and Infectious Agents

Part II. Bio-Nano Interfaces

9. ECM Interactions with Cells from the Macro- to Nanoscales
10. Cell Behavior Toward Nanostructured Surfaces
11. Cellular Behavior on Basement Membrane Inspired Topographically Patterned Synthetic Matrices
12. Focal Adhesions: Self-Assembling Nanoscale Mechanochemical Machines that Control Cell Function
13. Controlling Cell Behavior via DNA and RNA Transfections
14. Multiscale Coculture Models for Orthopedic Interface Tissue Engineering

Part III. Clinical Applications of Nanostructures

15. Nanostructures for Tissue Engineering/Regenerative Medicine
16. Nanostructures for Cancer Diagnosis and Therapy
17. Clinical Applications of Micro- and Nanoscale Biosensors
18. Nanoscale Iron Compounds Related to Neurodegenerative Disorders
19. Application of Nanotechnology into Life Science: Benefit or Risk

Lynne Jones, PhD

nominee for President-Elect

Continued from page 14

National Osteonecrosis Foundation, and ARCO International (an international society for the study of bone blood flow).

Lynne Jones received her BS from Ursinus College (Collegeville, Pa.), MS from Towson State University (Towson, Md.), and PhD in Molecular Microbiology and Immunology from Johns Hopkins University. She was recognized as one of the "Outstanding Young Women of America" in 1984 and received the William Hathaway Award (Towson State University, 1986); the Eleanor Bliss Award (Johns Hopkins University, 1992), the Dean's Recognition Award (Towson University, 2003), and was selected for the Wall of Fame for her high school alma mater (Chichester High School, 2006).

Vision Statement

The Society For Biomaterials is a highly-respected, vigorous organization that has served its members and the larger biomaterials and healthcare community well for more than 30 years. SFB and its members are the key to the future of advanced materials and constructs of all types. There are, however, a number of issues that we must address. These issues include international regulation of medical products, biomaterials availability, standards, and research funding. SFB is in an excellent position to make significant, positive contributions to the solutions of these issues. As you know, SFB's members are an important resource of knowledge to industry and the government. And, many of our members are leaders of related professional societies. We must build on all of these relationships, and define specific strategies to address the items noted earlier.

Continued on page 24

Jeffrey M. Karp, BEng, PhD

nominee for Member-at-Large

Continued from page 15

extensively with members of the board and I recently surveyed the SFB membership. Results from this survey were published as a leading article in the SFB's flagship journal (JBMR). Results from this survey point to the following issues that must be immediately addressed: 1) Annual meetings need to be a place where breakthroughs are first reported, where the quality of presentations are consistently judged to be "outstanding," where academics, clinicians and industry reps are provided with proactive forums to engage in discussion and challenge existing paradigms, and where students' professional development is a primary focus. 2) The SFB needs to facilitate and have a presence in membership interactions between annual meetings. 3) The SFB needs to provide more leadership to assist the "teachers" in the field to better train their students to be prepared for productivity in highly interdisciplinary environments and appreciate regulatory and industry related hurdles required to get a product to market. 4) The impact factor of the Societies' *Journal of Biomedical Materials Research* needs to be significantly raised to compete with higher impact journals in the field. I have a deep vision for SFB that is founded on years of proactive service and I hope I am given the opportunity to bring this vision to reality.

Kinam Park, PhD

nominee for President-Elect

Continued from page 14

improvements, I will implement a program promoting communication to transfer the knowledge and wisdom of current hot topics and future perspectives from established scientists to younger researchers. After 23 years, I still find biomaterials research and SFB an exciting and worthwhile part of my scientific life. I will do my best to express the greatness of this society and to make SFB the place to come for all biomaterials scientists.

Julia E. Babensee, PhD

nominee for Member-at-Large

Continued from page 15

Vision Statement

My goals are to help make the Society For Biomaterials the premier biomaterials society and to make your membership in this Society most valuable. I am committed to excellence in biomaterials research and training. I am committed to supporting the translation of developments in biomaterials research from the bench to bedside. I will provide support for programs and activities that facilitate the translation of biomaterial developments to the public. I am committed to the Society For Biomaterials and am interested in ensuring that the Society For Biomaterials is prepared to address the biomaterials needs of the future. Being a part of the strategic planning process, I have become familiar with the running of the Society and its future issues. This participation has further strengthened my commitment to the Society. As the member-at-large is a Board member that interfaces directly with the membership and becomes your (our) representative, I am interested in being a conduit for input from the greater membership as the Society enters this critical stage in its development. I will gather input from all members in academia, industry and government using means such as the website, surveys and town hall meetings and take these ideas and comments to the Board and Council meetings as your representative.

SIG Reports

Continued from page 7

Tissue Engineering” (organized by Eben Alsberg and Kristyn Masters), “Cellular and Molecular Biology Techniques in the Development of Novel Biomaterials” (organized by John Fisher and Johnna Temenoff), “Injectable Biomaterial Systems for Enhancing Cellular Therapy” (organized by Jon Rowley and Hyun Joon Kong) and “Composite Scaffolds for Tissue Engineering” (organized by Min Wang and Jan Stegemann). Many of the sessions at WBC2008 are highly relevant to tissue engineering and regenerative medicine, and the full program can be viewed www.wbc2008.com.

The Tissue Engineering SIG also is co-sponsoring several sessions at the 2008 SFB Fall Symposium on Translational Biomaterial Research, to be held in Atlanta September 11-13, 2008. This slate includes clinical application sessions on “Dental and Orthopaedic Implants,” rapid fire sessions on “Cell Interfacing Technologies,” “Tissue Engineering Strategies,” and “Novel Biomaterials,” as well as a workshop on “Process Development and Manufacturing of Cells and Tissue Engineered Constructs. Program details for the SFB Fall Symposium can be found at www.biomaterials.org/Meetings/08AnnualMeeting/index.cfm.

Lynee Jones, PhD

nominee for President-Elect

Continued from page 23

During the past few years, our leadership has developed a strategy for change and improvement within SFB. Task forces examined several operational and mission-related aspects of the Society. We can now implement many of the proposed strategies to streamline the SFB government, improve our annual meeting, increase the profile of SIGs within the Society, enact new revenue streams, increase membership numbers, and define our ‘brand’ as a Society. We must continue to build on this momentum, and expand our influence to our partners in academia, industry, and the government. SFB needs an experienced, effective President to bring us to the next stage. I stand as a candidate for President-Elect because I have the experience, vision and demonstrated commitment to lead SFB.

SFB’s Annual Meeting has always provided an environment where we can learn about emerging technologies and cutting-edge research while networking with members from academia, industry, and government. It is now time to expand on our strengths and establish programs to foster additional educational and networking opportunities throughout the year. This can, and should, include exploiting our capabilities on the internet (webcasts, archives of videotapes and educational resources, chat rooms), publications (monographs, books), and meetings (workshops, courses). We must bring our Student Chapters

SIGs - Strategic Planning

Continued from page 8

that SIGs be able to carry over their assets (income from membership fees) from one year to the next.

- A mechanism was established for proposing name changes for SIGs.
- Formally establish the following relationships:
 - The SIG Chair representative or a representative from the SIG Officers Committee be a permanent member of the Program Committee.
 - Appoint at least one member of the Biomaterials Availability and Policy SIG to the Devices and Materials Committee.
 - Appoint at least one member of the Biomaterials SIG to the Education and Professional Development Committee.

Motions relating to these proposals were approved at the Fall Council meeting. Potential bylaws changes were also discussed at length. These changes will be submitted to the membership for their review and approval in the upcoming months.

The SIG leadership is excited about the path that we are about to undertake. We ask that if you are a member of a SIG, get more involved and expect more from your SIG. We ask that if you are not a member, consider joining a SIG. We need the mentoring from our established SFB members augmented with the enthusiasm of our younger members to move forward. SIGs clearly provide an added value to the SFB membership. We believe that the activities of the SIGs will benefit all of the Society’s members.

together with SFB members from the surrounding locales. We also must address the needs of young postgraduate investigators – providing the tools and mentoring for them to learn more about funding, networking, and leadership opportunities.

SFB needs a leader with a working knowledge of the past and present, a clear vision of the future of the Society, and a track record of “getting things done” to be able to inspire excellence at all levels of the Society’s governance. An effective President will navigate through the organizational structure, leading the Board and Council, while streamlining procedures. I submit that I have the experience with strategic planning, financial management, and operational management that will enable me to effectively direct the Society as its President. Vision, problem solving and decision making are important, but it is our collective “passion” for the Society and what it offers to its membership and the biomaterials community that inspires a shared vision. I believe in SFB’s mission, and have both the skills and passion to see our mutual goals materialize.

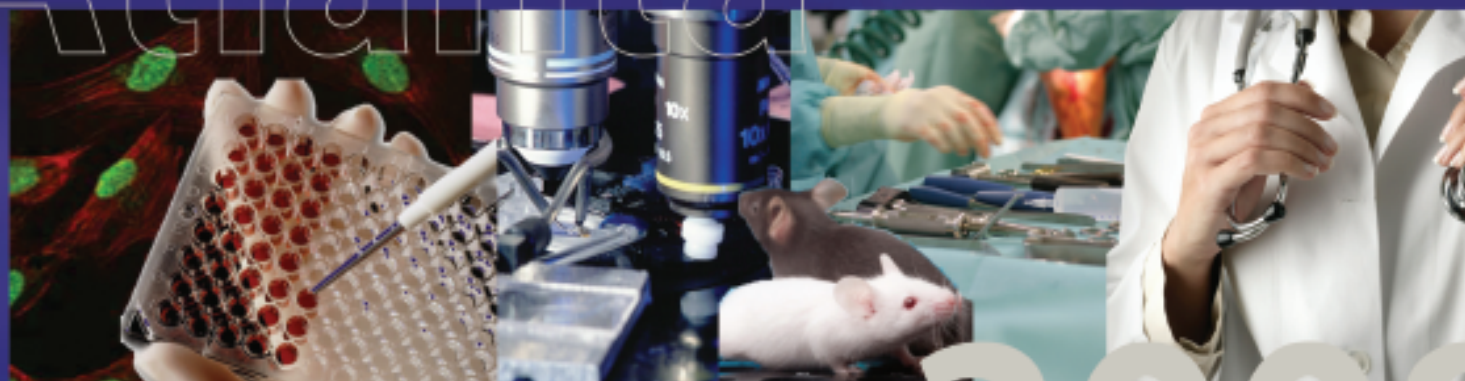
I look forward to serving you as SFB’s next President-Elect and am confident that, by working with you, the Society For Biomaterials will maintain and strengthen its position as the keystone in materials research for the 21st century.

Society For Biomaterials

Translational Biomaterial Research

Advancing Discoveries from the Laboratory to the Clinic

Atlanta



2008



September 11-13, 2008

Atlanta, Georgia

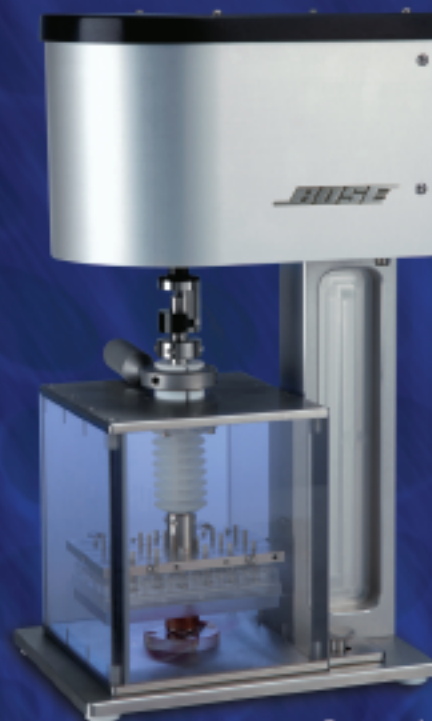
Hyatt Regency Buckhead

www.biomaterials.org

Discover the difference

Bose® technologies make for Tissue Engineering

- Mechanical testing and tissue stimulation in one instrument
- Compact frames compatible with incubator use
- Proprietary Bose® ElectroForce® linear motion system
- Compact, sterilizable chambers for vascular and orthopaedic tissues
- Advanced mechanical loading
 - cyclic hydrostatic pressure
 - axial extension/compression
 - pulsatile flow
 - perfusion flow
 - torsion



Compression of Disc Specimens
in Multiwell Culture Plates

Integrated tissue characterization and conditioning —
For single and multiple specimens



BioDynamic™ Test
Instrument for Spinal
Disc Tissue Engineering



Multi-Specimen
Compression of
Orthopaedic Tissues



Torsion and Compression
Instrument for
Orthopaedic Tissues

BOSE®
Better products through research.

Bose Corporation – ElectroForce® Systems Group
10250 Valley View Road, Suite 113, Eden Prairie, Minnesota 55344 USA • 952.278.3070
www.bose-electroforce.com • electroforce@bose.com