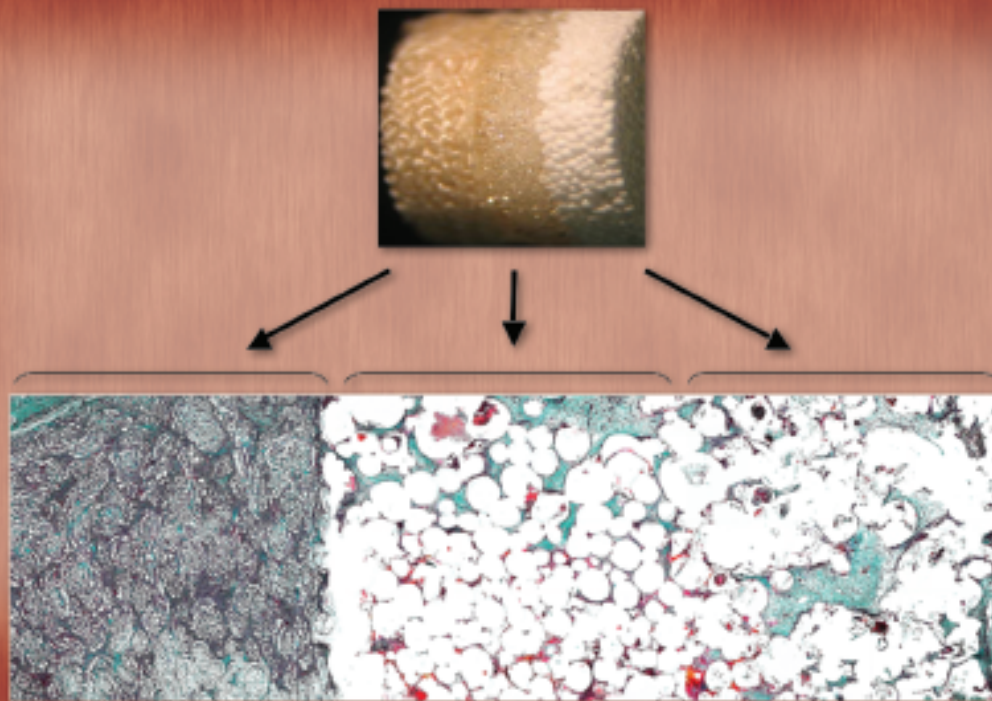


Inside: Staff Updates from Headquarters

# BIOMATERIALS FORUM



Third Quarter 2007 • Volume 29, Issue 3



**Effect of Chemical Structure and Composition of the Resin Phase on Vinyl Conversion of Amorphous Calcium Phosphate-filled Composites**

**SIGs Reaching  
Their Potential**

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# BIOMATERIALS FORUM



The official news magazine of the **SOCIETY FOR BIOMATERIALS** • Volume 29, Issue 3

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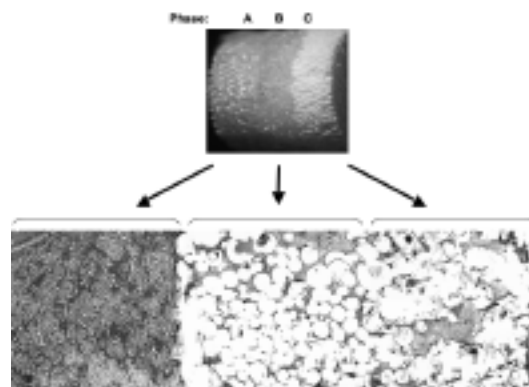
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## 8 Effect of Chemical Structure and Composition of the Resin Phase on Vinyl Conversion of Amorphous Calcium Phosphate-filled Composites

The objective of this study was to elucidate the effect of chemical structure and composition of the polymer matrix on the degree of vinyl conversion (DC) of copolymers derived from unfilled resins as well as their ACP composites after photo-polymerization. The DC can also be an indicator of the relative potential of these polymeric materials to leach out into the oral environment unreacted monomers that could adversely affect their biocompatibility.



In vivo evaluation of a stratified scaffold co-cultured with osteoblast (Phase A) and ligament fibroblasts (Phase C) for multi-tissue regeneration at the soft tissue-to-bone interface (Modified Goldner Masson Trichrome – Week 4, 5x).  
 - Spalazzi et al., SFB, 2007

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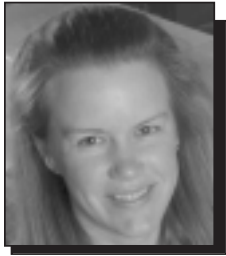
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# From the Editor

## The Torch

By Karen J.L. Burg



drivers? Who are these drivers?

Higher education organizations such as the National Association of State Universities and Land-Grant Colleges and the Association of American Universities have recently focused on the question of drivers – specifically, what level of influence should external constituents have in “driving” an institution of higher education? Why should one want any input from external

I point to the recent America COMPETES (America Creating Opportunities to Meaningfully Promote Excellence in Technology, Education and Science) Act as an external driver. I watched this summer as Congress approved legislation that would increase federal support for science education and research in an effort to increase American competitiveness globally. The America COMPETES Act is the legislative response to the recommendations contained in the National Academies’ Rising Above the Gathering Storm report, which noted that low risk, individual research projects would likely not lead to breakthrough, “disruptive” technologies. The main focus of the final bill is strengthening educational opportunities in science, technology, engineering, and mathematics (STEM), primarily at the K-12 level. The bill increases funding at the National Science Foundation, the Department of Energy’s Office of Science, and The Department of Education. The bill authorizes substantial financial input to establish a new National Institute of Standards and Technology initiative called the Technology Innovation Program, which would fund high-risk, high-reward, pre-competitive technology development, through small- and

medium-sized company partnerships with universities. Clearly this driver will affect the direction of academic biomaterials research.

SFB should consider itself an important driver. The potential for SFB-endorsed biomaterials research and education is enormous. As STEM experts with cross-disciplinary expertise we are poised to lead the charge and set the example. It intrigues me when academic “purists” adamantly charge that external involvement in the academy is tainted and can only lead to ill. In his recent book, “The University in Chains,” Henry Giroux suggests that institutions have become beholden to the military and corporate interests, and have lost independence as places of critical learning. He argues that the university is one of the few public spaces left capable of raising questions and educating students to be critical and engaged agents. As I think about “engaged agents” in the field of biomaterials, however, I think of students who receive a well-rounded education with industrial, clinical, and regulatory input. It is the exquisite blending of these areas and perspectives that give our students the real-world tools they need to succeed as leaders. While the rest of the higher education world struggles with the notion of drivers, we are in an ideal position to showcase multiple drivers at their best. By way of example of industrial input, Art Coury has generously taken the time in this issue to document his thoughts regarding a career in industry in our “Student Spotlight” section. I offer to you the sentiment that we must seek to collaboratively design educational programs that will have substantial global impact where success will require inclusivity.

Karen J.L. Burg  
Hunter Endowed Chair & Professor of Bioengineering  
Clemson University



Prof. D.F. Williams  
Editor-in-Chief

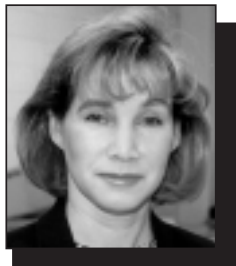


## Biomaterials

Elsevier would like to congratulate Professor David Williams, Editor-in-Chief of *Biomaterials*, for receiving the prestigious 2007 US Society for Biomaterials Founder’s Award in recognition of his lasting and seminal contributions in the field of biomaterials.

*Biomaterials* is the top-ranked journal in the ‘Materials Science, Biomaterials’ subject category with a 2005 Impact Factor of 4.698  
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Dear Members and Friends of the Society For Biomaterials,

From year to year, a new leadership team takes on the challenge to pursue the mission of the Society and to bring new ideas that will increase

membership value. In the past two years, under the leadership of Michael Sefton and Mauli Agrawal, we have been immersed in strategic planning, branding, and a membership drive with the main purpose of strengthening the identity of the Society and providing added value to the membership. Even though not explicitly stated, their efforts have been centralized around three questions: How do we honor our past, while focusing upon the needed benefits for the members of tomorrow? Is the Society For Biomaterials relevant to current needs, to the expectations of tomorrow, and prepared to address the issues of the future? How can we build a solid foundation for the professional development of our members?

The 2007-2008 Council has been charged with building on the momentum created by our predecessors and continuing to work on answering these questions. How will they carry the Torch?

### By being aware of the needs of SFB members

A Task Force on Outreach was initiated to determine the needs of members from industry, academia, government, and clinics and the benefits to be provided by SFB to enhance their continuing participation. The task force has been charged with teaming up with committees to assure responsiveness.

### By focusing on possibilities

Creativity, innovation, and a can-do, daring attitude have been endorsed by all committee members who view SFB as a living system able to adapt to needs and change.

### By assuring accountability through outcomes

Council members have accepted these leadership positions with a desire to build the image of the Society through active participation and concrete actions. They acknowledge their obligation to report, and to answer for resulting consequences, to SFB members.

The American Society of Association Executives (ASAE) recently published a report identifying seven measures of success (*7 Measures of Success: What Remarkable Associations Do That Others Don't*. 2006, ISBN 0-88034-272-2) that are essential for the vitality and sustainability of non-profit associations. From this study, remarkable associations:

- Ensure that their products and services are consistent with their mission

## “The 2007-2008 Council has been charged with building on the momentum created by our predecessors... How will they carry the Torch?”

- Nurture a culture that values dialogue and engagement
- Have an intense customer service culture
- Build and maintain strategic alliances to further their mission
- Support a data-driven decision-making process
- Have a CEO who serves as a broker of ideas
- Adapt to change without straying from their mission

Does the Society For Biomaterials have the potential to become a remarkable professional society? I sincerely believe so. While endorsing the list, we should also keep in perspective our changing professional surroundings that bring more issues to the table, including competition, consolidation, and globalization to name a few. We need to aspire to higher levels and provide the ultimate environment for our members to strive as professionals.

Overall, being proactive rather than reactive is a key to success. This attitude has been embedded throughout all committee goals that you can find in this issue of *Biomaterials Forum*. From branding to meeting program development, accountability and networking are emphasized.

We are the four-legged Society that includes industry, academics, clinics, and government. It is a unique set-up, a stable stool to sit on. Our diversity is a strength that we will capitalize on in 2007-2008.

It is an honor and a privilege for me and all Council members to take on these challenges and to work for you, and with you, in 2007-2008. We will proudly carry the Torch and we look forward to presenting you a report card in May 2008 that will meet your expectations.

Best regards,

Martine LaBerge

## Survey Results

As part of the Society's ongoing effort to improve member services, surveys will be regularly conducted at the Annual Meeting and throughout the year on various topics such as the Special Interest Groups (SIGs), website usage, and other programmatic and publication activity. In an effort to provide feedback on all of the Society's surveys, links to the raw survey data will be provided in the members-only sections of the SFB website. In addition, a brief executive summary, no more than a paragraph, will be published in the *Biomaterials Forum*. Upon request to headquarters, any member may receive a copy of the compiled results summary of any of our membership surveys. It is our sincere hope that you will participate in these surveys regularly so we may continue to improve on the services that you receive as an SFB member!

### 2007 Society For Biomaterials Annual Meeting Evaluations

Thirty-five percent of the survey participants said that this was the first SFB meeting they ever attended and 96% said they would attend another SFB meeting. Eighty-three percent rated the BASH as a "very important" or "important" event to be held during the Annual Meeting, and more than 90% rated the BASH as either outstanding or very good in every category! Ninety percent of survey participants stated that the Annual Meeting program helped them meet their professional and personal objectives.

## **AN OPEN LETTER TO THE SFB MEMBERSHIP FROM THE CHAIR OF THE DEVICES AND MATERIALS COMMITTEE**

Dear SFB Members,

As Chair of the Devices and Materials Committee of the Society I would like to provide a few comments on the tasks and efforts in which the committee will engage during the course of the year. This committee is in the process of establishing an agenda and focused set of goals. The primary areas where the committee is focused are: 1. on establishing stronger links with partner societies in the area of regulatory matters (ASTM F-4 committee) and medical device and materials research (ASM-MPMD), 2. on developing a strategic plan to connect more strongly with medical device companies that undertake biomaterials research to assure that the mission and direction of the Society aligns well with the current and future industrial efforts on materials and devices research.

The Devices and Materials Committee is in discussions with ASM International to help support and develop the Materials and Medical Devices Database as a tool to explore currently used materials and devices, as well as to partner with ASM International in their Materials and Processes for Medical Devices conferences.

It is critically important to the long-term health of the Society that we remain strongly connected with our industry partners. A strong medical device constituency is one of the signature elements of our Society that distinguishes SFB from other societies that are trying to expand into the realm of biomaterials. This is THE society for those who are looking to network with the medical device industry, find employment, and otherwise seeking to contribute to the advancement of medical device technology.

It is my hope that the Devices and Materials Committee will be reinvigorated and focused on this mission. If you, the members of this Society, have any insights, comments or ideas that you wish to provide, please let me know.

Jeremy L. Gilbert,  
Chair, Devices and Materials Committee  
gilbert@syr.edu

### SFB SIG Member Pilot Survey

Forty-two percent of survey participants reported that their SIG should more regularly collaborate with other professional societies through co-sponsored activities/meetings/publications. Fifty percent responded that scientific content is what draws them into registering for a conference or joining a new research society. Fifty-seven percent felt that their SIG provides them with opportunities for professional growth; however, 40% say SIGs could do a lot more.

## Committee Reporting

At the April 20, 2007, meeting of the Society For Biomaterials governing Council, Council approved a new reporting procedure for all committees. Each committee of the Society will report to the entire membership on a quarterly basis through publication in the *Biomaterials Forum*. This issue of the *Biomaterials Forum* represents the first of such reports. Each of the Society's committees is listed below, with the committee membership and the goals that the committee membership would like to reach during their one-year term.

### Awards, Ceremonies & Nominations Committee

Members include: Jim Burns, Genzyme (Chair); David Castner, University of Washington; Liisa Kuhn, University of Connecticut; William Wagner, University of Pittsburgh; Thomas Webster, Brown University; and Narendra Vyavahare, Clemson University (Ex-Officio). The goals of the 2007-2008 committee are to solicit and evaluate nominees for the Society's awards and officers, to present Council with recommended candidates for 2008 awards and officers, and to present a slate of officers to the membership for election in 2008. In addition, this year's committee will supervise the redevelopment of the award and officer nominations website.

### Bylaws Committee

Members include: Joel Bumgardner, University of Memphis (Chair); Barbara Blum, Wright Medical; Christopher Damien, Dentsply International; Shah Jahan, University of Memphis; and Jack Ricci, New York University. The goals of the 2007-2008 committee are to consider and report on questions and problems arising with respect to the bylaws of the corporation and to make recommendations for revisions to the Council.

### Devices & Materials Committee

Members include: Jeremy Gilbert, Syracuse University (Chair); Julie Hasenwinkel, Syracuse University; Mike Helmus, Advance Nanotech; Ebru Oral, Massachusetts General Hospital; and Nadim Hallab, Rush University Medical Center. The goals of the 2007-2008 committee are to establish stronger links with partner societies in the area of regulatory matters (ASTM F-4 committee) and medical device and materials research (ASM-MPMD); and to develop a strategic plan to connect more strongly with medical device companies that undertake biomaterials research. The Devices and Materials Committee Chair has included an open letter to the SFB Membership, which appears at left.

#### *Education & Professional Development Committee*

Members include: Julie Trudel, Medtronic (Chair); Angela Au, Nutramax Laboratories; Ken Messier, Genzyme; Gene Park, Medtronic; Shane Woods, Synthes; and Margaret Philips, University of Texas (National Student Chapter President).

The goals of the 2007-2008 committee are to assist the student chapter with program development for the WBC and the 2008 Fall Meeting, to reestablish as many student chapters as possible, to re-examine the Student Chapter Bylaws and to explore other opportunities for student programming. In addition, the committee will continue to evaluate endorsement requests from other organizations and will explore other opportunities for program activity.

#### *Finance Committee*

Members include: Antonios Mikos, Rice University (Chair); Aaron Goldstein, Virginia Polytechnic Institute; Lynne Jones, Johns Hopkins University; Johnna Temenoff, Georgia Tech and Emory University; and Alan Litsky, Ohio State University (Ex-Officio). The goals of the 2007-2008 Finance Committee include the implementation and oversight of the Board-approved investment and reserve policies, and the development of a draft policy on the solicitation of funds on the Society's behalf.

#### *Liaison Committee*

Members include: Nicholas Peppas, University of Texas at Austin (Chair); Kristi Anseth, University of Colorado; Ashutosh Chilkoti, Duke University; Warren Haggard, University of Memphis; Antonios Mikos, Rice University. Goals of the 2007-2008 committee include interacting with the 2008 & 2012 WBC Organizing Committees on programmatic and organizational matters, and identifying opportunities for collaboration with the Orthopaedic Research Society, Materials Research Society, Biomedical Engineering Society and other organizations.

#### *Long Range Planning Committee*

Members include: Jeffrey Hubbell, Ecole Polytechnique Federale de Lausanne (Chair); Ashutosh Chilkoti, Duke University; David Kohn, University of Michigan; Anne Meyer, University of Buffalo; and Tim Topoleski, University of Maryland Baltimore County. The goals of the 2007-2008 committee are to:

- 1) Monitor progress in implementation of the decisions reached based on the recommendations of four 2006-2007 Task Forces (Governance, Programmatic Vision, SIGs, and Revenue) and develop additional recommendations based on input from the 2007-2008 Branding and Outreach Task Forces.
- 2) Develop a strategy to enhance interactions with clinical societies with activities in the field of biomaterials.
- 3) Critically evaluate annual meeting programming, including a comparison with biomaterials programming of other societies. Develop recommendations to exploit the society's strengths and to reinforce programmatic weaknesses to offer the most timely and stimulating programming within the society's capacities.
- 4) Critically evaluate the content and standing of the *Journal of Biomedical Materials Research A and B*, including a comparison with other journals in the field of biomaterials. Develop recommendations to optimally position the journals to ensure continued leadership positions.

- 5) In the context of the above, and in concert with the efforts of the Membership Committee, develop a strategy to expand membership in the Society.

#### *Outreach Task Force*

Members include: Xuejun Wen, Clemson University (Chair); Carl G. Simon, National Institute of Standards and Technology; Joseph Zitelli, Stryker Inc.; and John Cuckler, University of Alabama at Birmingham. The goal of the Outreach Task Force is to evaluate the needs of members from industry, academia, government, and clinics and the benefits to be provided by SFB to enhance their continuing participation.

#### *Branding Task Force*

Members include: Gabi Niederauer (Chair); Anne Meyer, University of Buffalo; Chris Widenhouse, Ethicon Endo-Surgery; and Mike Ponticello, Interpore Cross International. The goal of the Branding Task Force is to develop, implement, and evaluate surveys of the SFB membership to refine the Society's brand identity; a new brand will be presented to Council in Fall 2007.

#### *Meetings Committee*

Members include: Martine LaBerge, Clemson University (Chair); Karen Burg, Clemson University; Lynne Jones, Johns Hopkins University; Alan Litsky, Ohio State University; Antonios Mikos, Rice University; and Tim Topoleski, University of Maryland Baltimore County. The goals of the 2007-2008 committee are to analyze 2007 annual meeting survey data; to evaluate proposals for the 2010 and 2011 meetings; to assess the feasibility and interest of hosting the 2016 WBC; to assess the funding and sponsorship revenue of our annual meetings, and to provide recommendations for increasing these sources of revenue to better offset meeting attendee registration costs.

#### *Membership Committee*

Members include: Nicholas Ziats, Case Western Reserve University (Chair); Todd McDevitt, Georgia Tech; Krishnendu Roy, University of Texas at Austin; Laura Suggs, University of Texas at Austin; and Julie Trudel, Medtronic. The goals of the 2007-2008 committee are to create a member recruitment and retention plan; to evaluate inclusion of associate membership in meeting registration; to remove barriers to membership by redefining the eligibility criteria, and to continue promotion of SFB membership.

#### *Presidents Advisory Committee*

The committee is comprised of all past presidents of the Society and is chaired by Immediate Past President C. Mauli Agrawal. The goals of the 2007-2008 committee are to review the annual meeting to determine how well the SFB and the intellectual field are currently served and to suggest changes, if any; to review the hard copy publications to determine how well the SFB and the intellectual field are currently served and to suggest changes, if any; to review the SIGs and determine which are the broadest in appeal, and to review the SFB governance structure.

#### *Program Committee*

Members include: Andres Garcia, Georgia Institute of Technology (Chair); Karen Burg, Clemson University; Elliot Chaikof, Emory University; Jeffrey Hubbell, Ecole

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# SIGs – Reaching Their Potential

The Torch

By Lynne Jones, Shelly Sakiyama-Elbert,  
and Chris Siedlecki

Special Interest Groups (SIGs) were first introduced to the Society For Biomaterials (SFB) in the early 1990s. The concept was to bring together individuals with similar research interests to allow an interaction not available to them at such a broad-based meeting. Several articles have been written in *Biomaterials Forum* describing different SIGs and their activities, both collectively and individually. However, have SIGs reached their full potential? Most SFB members would agree that they have not. What is holding them back? The issue can only be addressed through open dialogue and a thorough SWOT analysis — an honest assessment of the strengths, weaknesses, opportunities, and threats that exist for the SIGs.



In order to evaluate the SIG concept, we must first describe it. According to the Society's website, the Society's Special Interest Groups provide a forum for networking and new ideas within a focused environment. What does this mean? A more detailed description of the mission of the SIGs was included in the SFB Statement of Coordination and Communication Policies, and published in *Biomaterials Forum* in the September-October issue in 2000. Here are a few excerpts:

*"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 enhance Society education and increase Society enrollment."*

*"Special Interest Groups are encouraged to:*

- *Promote and enhance the education of Society members*
- *Enhance communication with and among Society members*
- *Facilitate networking among members of the Society with a common biomaterials interest*
- *Provide prospective member and annual meeting sponsor contact information to the Society office"*

So, have the SIGs achieved these goals?

**Education** – the SIGs have done a yeoman's job in supporting the annual meeting. SIG members have organized sessions, workshops, symposia, tutorials, and panel discussions. They have served as reviewers and session chairs. But, the SIGs can do so much more when it comes to education and the meeting itself. SIG members would like a more active role in determining the programming for their individual SIG interests. With this role comes the responsibility of leadership. They cannot afford to be passive or self-promoting — but must be proactive and determine the best topics to offer the SFB membership. Education can also take on other forms such as publications, libraries (video, slide, etc.), and courses outside the annual meeting.

**Communication** – there have been some signs of improvement in this area. The annual meeting, e-mails and conference calls have been the primary tools used to accomplish this function. However, this year, Bulletin Boards and electronic newsletters have been re-introduced. Most communications have focused on Society business. However, we can also disseminate other information that is relevant to the special interest — announcements of other relevant meetings or courses, grant deadlines, summaries of key articles in the field, video and slide libraries, issues in Washington, and so forth.

**Networking** – in the past few years, SIGs have made some progress with networking. Networking can be so much more than gathering once a year at the annual meeting. It can mean having a key speaker present at a luncheon, dinner, or other social event at the annual meeting. It can mean gathering at meetings of other Societies. It can mean providing mentorship to younger members — including students. This can be accomplished throughout the year and may involve the SFB Student Chapters.

**Membership** – one of the original goals was to develop SIGs that would encourage non-members to join the Society. SIGs, while providing value to their members, have not yet made a significant impact on increasing Society membership. The SIGs would like to work with the Membership Committee and the Council to explore potential program activities to accomplish this goal. By identifying this issue as a potential weakness, the SIG Chair Representative, Lynne Jones, and the SIG officers are making this issue a priority.

The SFB has recognized the importance of the success of SIGs to the Society. Task forces have been asked to evaluate the SIGs and make recommendations on changes that can be made to enhance their value to the Society. A recent survey of SIG members was conducted to gather the opinions of the SIG members regarding how well the SIGs function within the current system. The SIG officers are ready to take action. Based upon the reports of the task forces and the survey, the SIG officers will come together at a specially called strategic planning meeting this summer. The outcome(s) of this meeting will be published in a future issue of *Biomaterials Forum*.

The Special Interest Group Officers Committee will be significantly more active this year. The SIG concept has not yet demonstrated its true potential. In order to accomplish this, we need an open dialogue with all SFB members – both SIG members and non-SIG members. The SIG chair and officers would like to invite you to offer specific suggestions for how the SIGs can achieve their goals in education, communication, networking, and membership. Please submit your suggestions to [SIGs@biomaterials.org](mailto:SIGs@biomaterials.org). ■



# New Institute to Evaluate International Health Programs at the University of Washington

A new University of Washington research center, the Institute for Health Metrics and Evaluation, is to be formed to conduct independent, rigorous evaluations of health programs worldwide, thanks to a \$105 million grant from the Bill & Melinda Gates Foundation. The new institute will be directed by world-renowned health economist Christopher Murray. The Institute goal will be to help guide international policymaking by providing high-quality data and analysis on health needs and outcomes, and assessing the performance of health programs.

“Health policy must be based on evidence, not speculation,” said Dr. Tachi Yamada, president of the Gates Foundation’s Global Health Program. “There has been a huge increase in resources for global health in recent years, and it’s essential to evaluate the impact of these investments. With high-quality data, we can ensure resources go where they are needed most, and dramatically improve health care delivery.”

The institute will focus on three main areas:

- Health monitoring: Collecting and analyzing data on

- health indicators and trends, such as the prevalence of major diseases and the availability of health services
- Program evaluation: Conducting independent, rigorous evaluations of the results and effectiveness of health programs
- Dissemination: Making health data and information freely available to decision-makers, researchers, and the public



When fully operational, the Institute will consist of more than 100 faculty and staff; it will establish an international network of collaborating research centers, as well as provide training fellowships for junior researchers.

According to Murray, the Institute is to set the gold standard for scientifically rigorous evaluation in health. “Global health spending is on the rise, yet too often there are gaps in information about where these funds can have the greatest impact.” He also noted the Institute will play a critical role in helping achieve global health targets such as the Millennium Development Goals, which call for major improvements in health by 2015. “Health targets only work if we have a reliable way to track progress and measure success,” he says. ■

PENNSTATE



Milton S. Hershey Medical Center  
College of Medicine

## BIOENGINEERING ENGINEERING/SURGERY FACULTY POSITION AVAILABLE

The Pennsylvania State University College of Medicine of the Penn State Milton S. Hershey Medical Center invites applications for a full time tenure track position at the Assistant or Associate Professor level in the Department of Surgery, with a potential joint appointment in the Department of Bioengineering.

We are seeking a candidate with expertise in the area of thrombosis and cardiovascular biomaterials with application to the design of circulatory support devices and/or prosthetic vascular grafts. Research areas of interest include the development of improved blood contact materials using chemical, topographic or other means and the application of these materials in medical devices. Of particular interest is applicants also experienced in hematology measurements in medical device development and applications to clinical research studies of devices. The position also includes participation in the Bioengineering Graduate Program through teaching and supervision of graduate students. Exceptionally strong candidates in other areas of biomedical engineering will also be considered.

The position is in the Division of Artificial Organs, an internationally-recognized leader in ventricular assist and total artificial heart development. The successful candidate is expected to collaborate with faculty at the Hershey and University Park campuses in materials science, hematology, surgery, fluid mechanics, and bioengineering.

Applicants must have a Ph.D. in biomedical engineering or related areas, excellent verbal and communication skills, and the ability to conduct innovative research and to develop an independent, externally sponsored research program.

Applicants should send their resume and a one-page statement of professional interest to:

William J. Weiss, Ph.D., Director, Bioengineering Institute  
Penn State College of Medicine, Department of Surgery, 500 University Drive, MC H151, Hershey, PA 17033-0850

Penn State is committed to affirmative action, equal opportunity, and the diversity of its workforce. EOE-AA-M/F/D/V

# Effect of Chemical Structure and Composition of the Resin Phase on Vinyl Conversion of Amorphous Calcium Phosphate-filled Composites

## Introduction

For the last decade, our research has focused on utilizing the relatively high solubility of amorphous calcium phosphate (ACP) in water and its ready conversion to a stable apatitic mineral<sup>1</sup> to develop bioactive polymer-based composites for a variety of potential dental applications.<sup>2-5</sup> ACP is embedded as the filler phase in certain types of acrylic monomers that undergo ambient polymerization. When the resulting composites are then exposed to aqueous milieu, significant levels of calcium and phosphate ions are released in a sustained manner over long time periods. The potential bioactivity of ACP is seen as particularly advantageous in enhancing the prophylactic performance of such composites by both preventing tooth demineralization and actively promoting remineralization.<sup>6</sup>

The use of zirconia-hybridized ACP (Zr-ACP) rather than unmodified ACP yielded composites with moderately improved mechanical strength.<sup>3,5</sup> It was previously shown that the chemical structure and composition of certain types of resin matrices affected the ion release and water uptake of composites but had very little effect on the polymerization shrinkage and the mechanical stability of specimens upon aqueous exposure.<sup>4,5,7</sup>

The objective of this study was to elucidate the effect of chemical structure and composition of the polymer matrix on the degree of vinyl conversion (DC) of copolymers derived from unfilled resins as well as their ACP composites after photopolymerization. The DC can also be an indicator of the relative potential of these polymeric materials to leach out into the oral environment unreacted monomers that could adversely affect their biocompatibility.

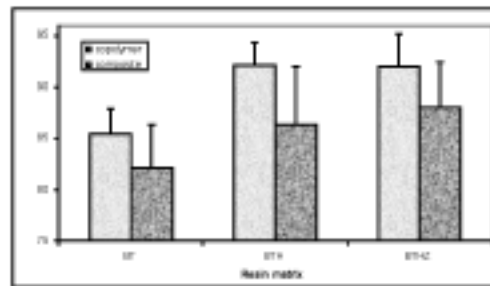


Figure 1. The 24 h DC of Bis-GMA specimens.

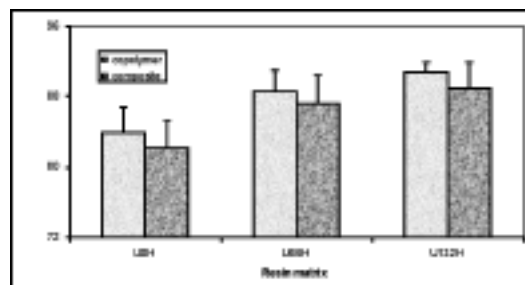


Figure 2. The 24 h DC of UDMA specimens.

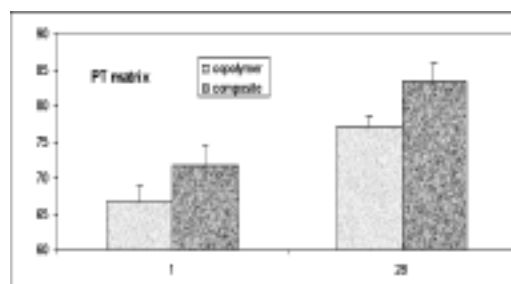


Figure 3. Effect of post-curing on PT specimens.

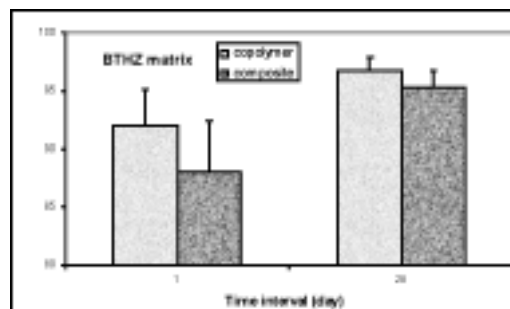


Figure 4. Effect of post-curing on BTHZ specimens.

## Experimental

The following resins were examined:

- 1) 2,2-bis[p-(2'-hydroxy-3'-methacryloxypropoxy)phenyl]propane (Bis-GMA)/triethylene glycol dimethacrylate (TEGDMA) (1:1 mass ratio; BT resin) combined with hydroxyethyl methacrylate (HEMA; BTH resin) and with HEMA and zirconyl dimethacrylate, ZrDMA [BTHZ] resin,
- 2) urethane dimethacrylate (UDMA)/HEMA [UH] resins, and
- 3) pyromellitic glycerol dimethacrylate (PMGDMA)/TEGDMA [PT] resin.

The monomers HEMA, ZrDMA and PMGDMA are noted for their surface active properties. All the resins were photoactivated for visible light polymerization. To make composite specimens, resins were mixed with a mass fraction of 40% zirconia-hybridized ACP. Copolymers and their composites were evaluated by near infra-red spectroscopy for DC after 1 d and 28 d post-cure at 23°C.

## Results and Discussion

The DC attained in copolymers derived from the various unfilled resins and their corresponding Zr-ACP composites strongly depended on the compositional makeup of the matrix, especially the chemical structure of the surface active monomers utilized to formulate the resin. DC results are summarized in Figures 1-4. The inclusion of HEMA, a surface-active, mono-functional, co-monomer of low viscosity, into the Bis-GMA/TEGDMA and UDMA resins aided in attaining higher levels of DC. The 24 h DC attained in the resins containing the surface-active PMGDMA and TEGDMA was lower than that of the Bis-GMA and UDMA resins due to the PMGDMA's high viscosity, rigid aromatic core structure, low side-chain flexibility and poor diffusivity due to the highly polar character of its carboxylic acid groups, especially in composites after interaction with ACP. The ability of the carboxylic groups of PMGDMA monomer to strongly

hydrogen bond during formation of the matrix and also

strongly interact with Zr-ACP probably accounts for the significant increase in DC after 28 d post-cure for both the copolymer and its composite. It is not understood at this point why the conversion of the PMGDMA/TEGDMA composite exceeded that of the unfilled copolymer but it may indicate that PMGDMA reacts with ACP to favorably align its methacrylate so that copolymerization and, therefore, DC is enhanced. A similar but less dramatic enhancement of DC with post-cure was observed for copolymers and their composites derived from a resin containing Bis-GMA, TEGDMA, HEMA with a small amount of the highly polar, surface-active ZrDMA.

## Conclusions

Degree of vinyl conversion in copolymers derived from various monomer systems and their corresponding ACP composites strongly depended on the compositional makeup of the resin matrix especially when the latter was modified with the surface active monomers.

## Acknowledgements

Reported work was supported by the National Institute of Dental and Craniofacial Research Grant 13169 to the American Dental Association Foundation (ADAF). The work is a part of the dental material research program conducted by NIST in cooperation with ADAF and supported by both institutions. Generous contribution of the Bis-GMA, UDMA, TEGDMA, HEMA and PMGDMA monomers from Esstech, Essington, PA, USA is gratefully acknowledged.

# Members in the News

*Congratulations to:*

**Professor Allan Hoffman** of the University of Washington, who is the recipient of this year's Founders Award of the Controlled Release Society (CRS). Allan is recognized as "... the leading authority on biomaterials and carriers for drug delivery but also as the most prominent ambassador of the field in the world." He was honored at the Annual CRS meeting in Long Beach, California in July.

**Dr. Joachim Kohn**, Director of the New Jersey Center for Biomaterials at Rutgers University, who was inducted into the 2007 New Jersey High-Tech Hall of Fame. The New Jersey High-Tech Hall of Fame honors distinguished leaders who have made and who continue to make significant contributions to the growth and prosperity of the technology industry in New Jersey. Professor Kohn was recognized for his pioneering role in "the use of combinatorial and computational methods for the optimization of biomaterials for specific medical applications."

**Professor Antonios (Tony) Mikos** of Rice University, who will receive this year's Alpha Chi Sigma Award from AIChE. Tony is recognized for insightful application of chemical engineering principles to biomolecular engineering as exemplified by pioneering contributions to tissue engineering, biomaterials science, bioadhesion and drug delivery systems.

**Professor David Williams**, Biomaterials editor and Director of the Department of Clinical Engineering of the University of

<sup>1</sup>Paffenbarger Research Center, American Dental Association Foundation and <sup>2</sup>Polymers Division, National Institute of Standards and Technology, Gaithersburg, MD 20899, USA

"This article is a US Government work and is in the public domain in the USA." ■

## References

1. Eanes ED, Amorphous calcium phosphate: thermodynamic and kinetic considerations, in *Calcium phosphates in biological and industrial systems*, ed by Amjad Z., Kluwer Academic Publishers, Boston, pp 21-39 (1998).
2. Skrtic D, Antonucci JM, Eanes ED, Eichmiller FC and Schumacher GE, *J Biomed Mat Res (Appl Biomater)* 53:381-391 (2000).
3. Skrtic D, Antonucci JM, Eanes ED and Brunworth RT, *J Biomed Mater Res* 59:597-604 (2002).
4. Skrtic D, Antonucci JM and Eanes ED, *J Res Natl Inst Stand Technol* 108:167-182 (2003).
5. Skrtic D, Antonucci JM, Eanes ED and Eidelman N, *Biomaterials* 25:1141-1150 (2004).
6. Skrtic D, Hailer AW, Takagi S, Antonucci JM and Eanes ED, *J Dent Res* 75(9):1679-1686 (1996).
7. Antonucci JM and Skrtic D, *J Bioact Comp Polym* 20:29-49 (2005).

## Original publication:

D. Skrtic and J.M. Antonucci: "Effect of Chemical Structure and Composition of the Resin Phase on Vinyl Conversion of Amorphous Calcium Phosphate-filled Composites". *Polym Int* 56:497-505 (2007)

## Member News

*Contributed from Press Releases*

Liverpool (UK), who is the recipient of this year's prestigious Chapman Medal from the Institute of Materials. The Chapman Medal is presented annually for distinguished research in the field of biomedical materials, particularly with respect to biomaterials innovation, which has produced benefits for patients and/or contributed to associated opportunities for industry.

**Dr. Thomas Webster**, Society For Biomaterials web editor and Associate Professor of the Divisions of Engineering and Orthopaedics at Brown University, who was elected as a Fellow of the American Academy of Nanomedicine (AANM). The AANM is the first United States society dedicated to the study of nanomedicine, i.e., the prevention, diagnosis, monitoring and treatment of diseases at the level of single molecules or molecular assemblies. The AANM serves as an environment for researchers to develop and present novel concepts and new ideas in nanomedicine research. Professor Webster was elected as a fellow of the AANM based on his "ground breaking research, innovation and leadership at the intersection of nanotechnology and medicine." Tom recently appeared on NBC Nightly News, predicting what will happen in the next 20 years in medicine – his interview may be found on YouTube at <http://www.youtube.com/watch?v=5933xrs3I0U>.

*Editor's note: Do you have member news to share? If so, please send your news to [kburg@clemsun.edu](mailto:kburg@clemsun.edu). ■*

# Biomaterials R&D Projects in Industry: Student Spotlight What to Expect During Your Career

*By Arthur Coury, VP,  
 Biomaterials Research, Genzyme Corp.*

## Introduction

This report is a summary of a presentation made at the 2006 Society For Biomaterials meeting to biomaterials students at the workshop: "What Fits You Best, Academia or Industry, and How Do You Get There?" These are solely my opinions based on 31 years in biomaterials and 41 years in industry. Since I did not begin my career in biomaterials, I cannot pass on personal experience from that career phase; I can only draw on my later experiences and my observations of technically-educated persons starting their industrial careers, some of whom were hired by me. An assumption is that, as a graduate entering an industrial work force, you are intending to work on biomaterials research-and-development projects. Biomaterials are used to produce medical devices and combination products such as drug delivery systems and materials-tissue constructs. Serious considerations include how these projects are chosen and assigned, your degree of independence in executing them, and the results of your efforts and other factors on career development.

## Project Selection and Execution

Table 1 lists important factors that direct the selection and status of industrial biomaterials R&D projects. Most of these factors should be considered a priori in order to justify work on a project.

Most of the time, in recruiting for R&D, corporate staff have specific programs in mind, so that a potential hire will not have much choice in determining the projects with which he/she will be involved. The recruiter may not even be free to state the specific project content. In evaluating a company as a potential employer, it is important to learn in some detail the product lines, R&D structure and strategic corporate direction, since, at the commencement of career, if a potential hire wishes to work on a specific project, they must select an employer accordingly.

Regarding industrial R&D structure, scientists and engineers can work for divisional or central departments. One or more projects can be assigned in either structure, but the variety of projects and interactions may be greater for central R&D investigators. Ability to fund and sustain projects will affect the entering experience in major ways. Generally, in going concerns, projects are funded by operating revenues. If central organizations perform R&D for a revenue-generating division, the division may be "taxed" or billed for the projects. Other divisions conduct projects within their organizations if they can afford to. Start-up divisions or corporations without adequate revenues for R&D can be funded in several ways. Revenues from other divisions, venture capital, government funding, funding from other companies, and funding from private foundations and institutions have been employed. Whatever the case, you will become aware very early of the need to "sell" the value of a project in order to justify funding and it will be wise to observe the techniques of the experts in achieving this. Adapting to project changes that are often due to uncontrollable factors will likely be a useful attribute.

TABLE 1. VARIABLES AFFECTING PROJECT SELECTION AND STATUS
Corporation, Division Charter, Vision, Culture
Corporation, Division "Health"
Corporation Maturity: Start-up or Mature
Product Mix, Adoption Curves
Market/Reimbursement Potential
Competition
Staff Capabilities (R&D)
Staff Availability
Project Champion
Project Costs/ Funding Sources
Timing Considerations
Liability Risk
Structural Issues: Regulatory, Manufacturing, Marketing, Sales, etc.

Experience gained with R&D projects assigned at commencement of your career is very important for several reasons. First, it is a determinant of your satisfaction with the company, the lines of investigation, the general field chosen and even with R&D itself. It should not take long after the "orientation" period to determine if your ambitions coincide with opportunities in the same areas. From the employer's perspective, your capabilities, dedication and satisfaction will also be evaluated. Therefore, whatever your eventual conclusion about your career direction, performing with passion to the best of your ability is indispensable. Since most projects ultimately do not survive as originally conceived, the success of the project is not as important as perceptions of your performance and your "fit" within the organization.

Regarding independence on the job, this should not be expected or desired immediately. The experience of supervisors, mentors and experts in their fields should be viewed as great sources of on-the-job training for entry-level scientists and engineers. I like to say that I learned as much during my first year on the job as I did in graduate school (I transitioned directly from graduate school to industry and did not pursue a post-doctoral fellowship). Finding the right

**TABLE 2. STAGES OF PRODUCT DEVELOPMENT**

Concept
Discovery Research
Preclinical Research
Preclinical Development
Clinical Development
Launch (Production, Sales, Marketing)
Post-market Support

mentor as soon as possible can be invaluable. In my case, my mentor was my supervisor, but this need not always be the case. Mentor and supervisor relationships must be mutually compatible; however, a person may have several mentors on the job. You will learn about the stages of product development and of your preferred emphasis (early stage or advanced stage). A typical product development protocol may involve the stages listed in Table 2. In terms of R&D, all the stages listed involve discovery except “launch,” which is the implementation stage. Even as you are learning, bear in mind that you were probably hired to bring cutting-edge science to the company, and you will be expected to add these capabilities to its technology base as part of the initial value you provide.

With skills, confidence and results growing, it is appropriate to become “weaned” from mentors who will normally show pride in your achievements. At this intermediate (getting established) stage in your career, a few years post hiring, if you remain committed to R&D, you should develop more independence in project selection and execution. If a set of approved projects exists, you should have some leverage in participating in those you choose, preferably seeking official assignment to the projects. Attempts to justify and initiate new projects may or may not succeed. Whatever new project you consider, consider the list of project determinants (Table 1) a priori, and satisfy enough of the considerations to justify the effort. Often you will be allowed to perform some preliminary research without full approval; however, this should never happen at the expense of assigned projects. Prospects may improve if an established investigator is recruited as a co-champion. You will likely become involved in supervision and mentoring of staff at this stage, with more responsibility for overall results. Adding to the complexity are choices you will need to make about the nature and level of external visibility (professional service, publications, presentations, etc.) relating to your career. You will need to draw on many sources to keep current in your field, and this will require planning, discipline and time away from the projects. These activities and other factors (products generated, personality, mobility, luck, etc.) can contribute to your career becoming fully-established within your organization.

With your career fully-established in stature and rank (as discussed below), you can be a major player in influencing corporate direction, and will likely be sought for conceiving, evaluating and justifying projects. You are a valued mentor and your R&D contributions can remain laboratory-based or can come through technical management. Your reputation and attendant responsibilities are established beyond the corporate walls. Your position will not excuse you from justifying projects appropriately, again employing Table 1. Full funding of your proposals for a specified term should be achievable, especially with the support of the interested business unit. As a seasoned veteran, you appreciate that financial circumstances change and technical setbacks often occur. You appreciate that a minority of projects will be funded to marketed products, but dedicated and excellent technical execution, even of unsuccessful projects, enhances your credibility and makes support for future projects more likely. Career satisfaction should be high under these circumstances.

If you decide at any stage of your career to change course, the experience gained during your R&D period will serve you well in many areas of corporate pursuit.

### Career Implications and Concluding Thoughts

In beginning a corporate career, a universal goal is to advance through promotions as well as to enjoy technical achievements. From the viewpoint of management, ratings and salary within a given position are based on merit. Promotions, however, involve new job descriptions and are based on achievement, potential, added responsibility and availability. Often, the objectives and timetables of management do not coincide with those of the staff member. My observation has been that this misalignment has led to much dissatisfaction and even to resignations. I believe the best match of ambition with reality comes through good communication between the individual and management. Communicate your career goals. Learn the requirements for advancement, work toward meeting them and make sure the evaluators are aware of your progress. Do not trust that they will know your ambitions, but understand that experience, personality and a successful track record as well as intelligence, education and capability come into play for promotion. If your current job description is viewed as critical, part of your plan for advancement may be to help train someone to “backfill” your position as you move on. An appreciation of the complex “big picture,” as management must consider it, is an aspect of the art of “managing up,” which involves acting in ways that mutually benefit your supervisory chain and yourself. This empathy can make any delays in achieving career goals more palatable and will make you a better leader when your time comes.

In conclusion, your choice of a biomaterials R&D career is a noble one of service to society. It has high potential for financial security as well as emotional rewards. It may require adjustments in approaches and timetables along the way. I feel so privileged to have served in this field for much of my career. ■

# Bioregenerative Engineering: Principles and Applications

Book Review

By Liisa Kuhn

by Shu W. Liu

John Wiley & Sons, Inc., Copyright 2007.

Hardcover, 1,088 pages. Cost is \$125.

Ordering information: <http://www.wiley.com/WileyCDA/WileyTitle/productCd-0471709077.html>

## Description and Critique

This is a hefty, more than one thousand page book, with color plates, on bioregenerative engineering, which, in case you were confused, is essentially another renaming of regenerative medicine or tissue engineering. As defined by the author, bioregenerative engineering is to induce, modulate and/or control regenerative processes by using molecular, cellular and tissue engineering approaches and thus improve the restoration of the structure and function of disordered or lost cells, tissues or organs. While it may sound familiar, the author takes a slightly different perspective that makes this book a complementary addition to your existing library on regenerative medicine. The author points out astutely in the preface that, while preliminary investigations have demonstrated the potential of stem cell transplantation for the treatment of degenerative disorders and cell injury, a simple transplantation of stem cells may not solve all the problems in regenerative medicine. Nature has established numerous barriers that prevent the transformation of stem and progenitor cells to specified cell types in developed adult systems. Therefore, he proposes that it is necessary to establish engineering strategies and technologies that alter the expression of specified genes and modulate the phenotypes of target cells to induce appropriate regeneration. This reference text is thus focused on providing examples of how to modulate the regenerative processes at the molecular, cellular, and tissue levels (although primarily molecular) through an understanding of the healthy normal processes.

Even after reading the author's delineation of bioregenerative engineering, it still sounds like tissue engineering to the reviewer. However, this book contains the combination of molecular cell biology and tissue engineering that the reviewer has been seeking; therefore, the reviewer does not mean to downplay the significance of the author's undertaking. What a reader can find in this book is a very good section on the molecular basis for bioregenerative engineering that includes: structure and function of macromolecules, regulation of gene expression, structure and function of cellular components, and extracellular matrix. This section is followed by an excellent coverage of regulatory mechanisms of regeneration, including: cell signaling pathways and mechanisms, and fundamental cellular functions. The next section covers developmental aspects of bioregenerative engineering, including embryonic organ development. These topics are covered in Part I of the text. In Part II, the principles of bioregenerative engineering at the (a) material level, (b) cell and tissue level and (c) biomaterial level are covered. But note that the section on biomaterials is 30 pages, including references, out of 1,088 pages. Biocompatibility, wound healing, inflammation and immunology are given a cursory mention, which the reviewer considers a shortcoming. Therefore, this book complements,

rather than replaces other biomaterials-centered books reviewed in this column, such as *Scaffolding in Tissue Engineering* by Ma and Elisseff, or *Biomaterials Science* by Ratner and co-authors.

Part II finishes with 13 chapters that are application (tissue) specific. In each case the structure and function of the system is described, followed by the pathogenesis, conventional treatments, and application of regenerative approaches to the treatment of the particular tissue disease. After reading the vascular regenerative engineering section, I understand what happens during hypertension now! The value of this book is in the thorough explanations of the disease process that leads to an understanding of it, and hence a more rationale approach to attempting to treat it. Because the author includes so many tissue/organ systems, the reviewer found the section on bone and cartilage regenerative medicine to be too brief and with a narrow focus on newer osteogenic agents (e.g. Vitamin D and parathyroid hormone) to the exclusion of more well-studied agents such as bone morphogenic proteins. The section on regenerative engineering for cancer is very poor and should have been left out of the book due to the misleading generalities. A minor annoyance was the inclusion of mini bibliographies in the middle of some of the chapters (e.g. Ch 6 and 13), which gave the appearance of finishing the chapter just when the reading was getting good.

## Audience/Recommendation

This textbook would make an excellent addition to university or corporate libraries due to its comprehensive nature. Many will be able to benefit in some way from reading this text because it contains applications to many tissue/organ systems. Chemists or materials scientists will benefit the most from reading this text because the emphasis is not on the chemistry or materials science of regenerative medicine, but instead on the promotion and control of molecular and cellular activities. Instead of buying that molecular cell biology reference, this textbook is recommended instead because the molecular cell biology is geared artfully to regenerative medicine.

## From the Table of Contents

### Chapter Outline

- Part I. Foundations of Bioregenerative Engineering**
- Section 1. Molecular Basis for Bioregenerative Engineering**
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- Chapter 2. Regulation of Gene Expression
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- Chapter 7. Fertilization and Early Embryonic Development
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continued on page 13

A new device from **Cleveland Medical Devices** (Cleveland, Ohio) may help pharmaceutical companies determine how well their Parkinson's disease drugs are working. The company received FDA clearance for Kinesia, a motor assessment system that monitors movement disorder symptoms like tremor, bradykinesia or dyskinesia. The wireless device is worn on the patient's wrist and finger, and uses accelerometers and gyroscopes to monitor three-dimensional motion. Motion and electrical muscle activity data is wirelessly sent to a computer for display and analysis. Kinesia also has a virtual doctor function — the system's software integrates videos, which guide the patient through tasks known to elicit symptoms, similar to instructions given by a physician when evaluating upper extremity motor symptoms.

**Generic Medical Devices** (Gig Harbor, Wash.) received its second 501(k) clearance for its GMD Universal Surgical Mesh product. The GMD Universal Surgical Mesh is a Class II, non-active implantable device intended to support tissue growth in open or laparoscopic procedures, which are common for hernia repair. Clearance of the device is based on it being substantially equivalent — having the same or equivalent materials, design specifications, technological characteristics, operation, intended use and performance — to pre-amendment devices and a product currently on the market.

A surgeon at Drexel University College of Medicine, used recently developed RealHand™ High Dexterity instrumentation by **Novare Surgical Systems** (Cupertino, Calif.) to successfully remove a woman's gallbladder through a single incision in the patient's belly button. RealHand instruments are the very first full range of motion hand-held

laparoscopic instruments. Developed with the EndoLink® mechanism, RealHand technology is designed to mirror the surgeon's hand direction with the added benefit of tactile feedback. As such, when the surgeon's hand moves in one direction, the instrument tip exactly follows.

**Geron Corp.** (Menlo Park, Calif.) reported that its scientists and collaborators at the University of Alberta have differentiated human embryonic stem cells (hESCs) into islet-like clusters (ILCs) that secrete insulin in response to elevated glucose levels. The studies, to be published in the August issue of *Stem Cells*, suggest the feasibility of producing therapeutic cell types from hESCs for the treatment of diabetes. Geron was granted U.S. Patent No. 7,033,831 in April 2006 covering the production of insulin-secreting cells from hESCs as well as two U.K. patents covering similar production methods. Geron also has a worldwide exclusive commercial license covering hESC-derived islets from the Wisconsin Alumni Research Foundation.

**Smith & Nephew** (London, United Kingdom) announced that it has agreed to buy **BlueSky** (Carlsbad, Calif.), which makes products for treating chronic wounds using negative pressure wound therapy (NPWT). NPWT, a technology used to treat chronic wounds such as diabetic ulcers, pressure sores, and post-operative and hard-to-heal wounds, is the fastest growing segment of the wound care market. NPWT has expanded rapidly in recent years, and in 2006, was estimated at \$1.2 billion. The market is reportedly growing at an annual rate of 12% in the U.S. and greater than 25% in markets outside the states. ■

### “Staff Update From Headquarters”, continued from page 5

Polytechnique Federale de Lausanne; Erika Johnston, Genzyme; Lynne Jones, Johns Hopkins University; Martine LaBerge, Clemson University; Kinam Park, Purdue University; Christopher Siedlecki, Pennsylvania State University; and Tim Topoleski, University of Maryland Baltimore County. The goals of the 2007-2008 committee are to develop and promote the Fall 2008 meeting on translational research, explore new presentation methods and education techniques, and foster engagement and collaboration with and between the Society's Special Interest Groups.

#### *Publications Committee*

Members include: Rick Gemeinhart, University of Illinois (Chair); Julia Babensee, Georgia Institute of Technology; Peter Jarrett, Genzyme; one additional member who has not yet been appointed; and the editors of the Society's publications: James Anderson, Case Western Reserve University (JBMR-A); Harold Alexander, Orthogen (JBMR-B); Karen Burg, Clemson University (Biomaterials Forum); and Thomas Webster, Brown University (website). The goals of the 2007-2008 committee include developing an agreement with a publisher for a book series; exploring the possibility of peer review on the ASMI database; redeveloping the SFB website; and continuing to review all Society publications. ■

### “Book Review”, continued from page 12

#### **Section 4. Principles of Bioregenerative Engineering**

Chapter 10. *Molecular Aspects of Bioregenerative Engineering*

Chapter 11. *Cell and Tissue Regenerative Engineering*

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Chapter 14. *Cardiac Regenerative Engineering*

Chapter 15. *Vascular Regenerative Engineering*

Chapter 16. *Pulmonary Regenerative Engineering*

Chapter 17. *Liver Regenerative Engineering*

Chapter 18. *Gastrointestinal Regenerative Engineering*

Chapter 19. *Pancreatic Regenerative Engineering*

Chapter 20. *Urinary Regenerative Engineering*

Chapter 21. *Skeletal Muscle Regenerative Engineering*

Chapter 22. *Bone and Cartilage Regenerative Engineering*

Chapter 23. *Ocular Regenerative Engineering*

Chapter 24. *Skin Regenerative Engineering*

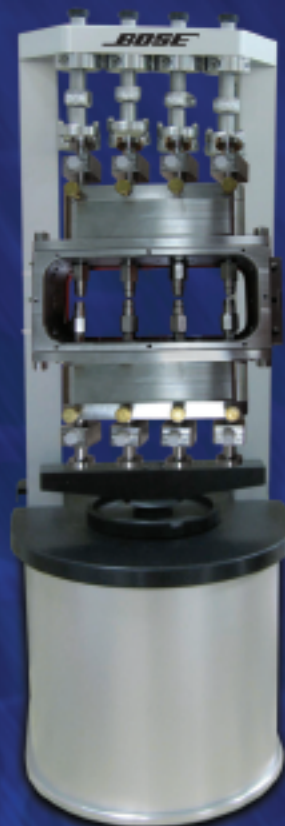
Chapter 25. *Regenerative Engineering for Cancer* ■

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