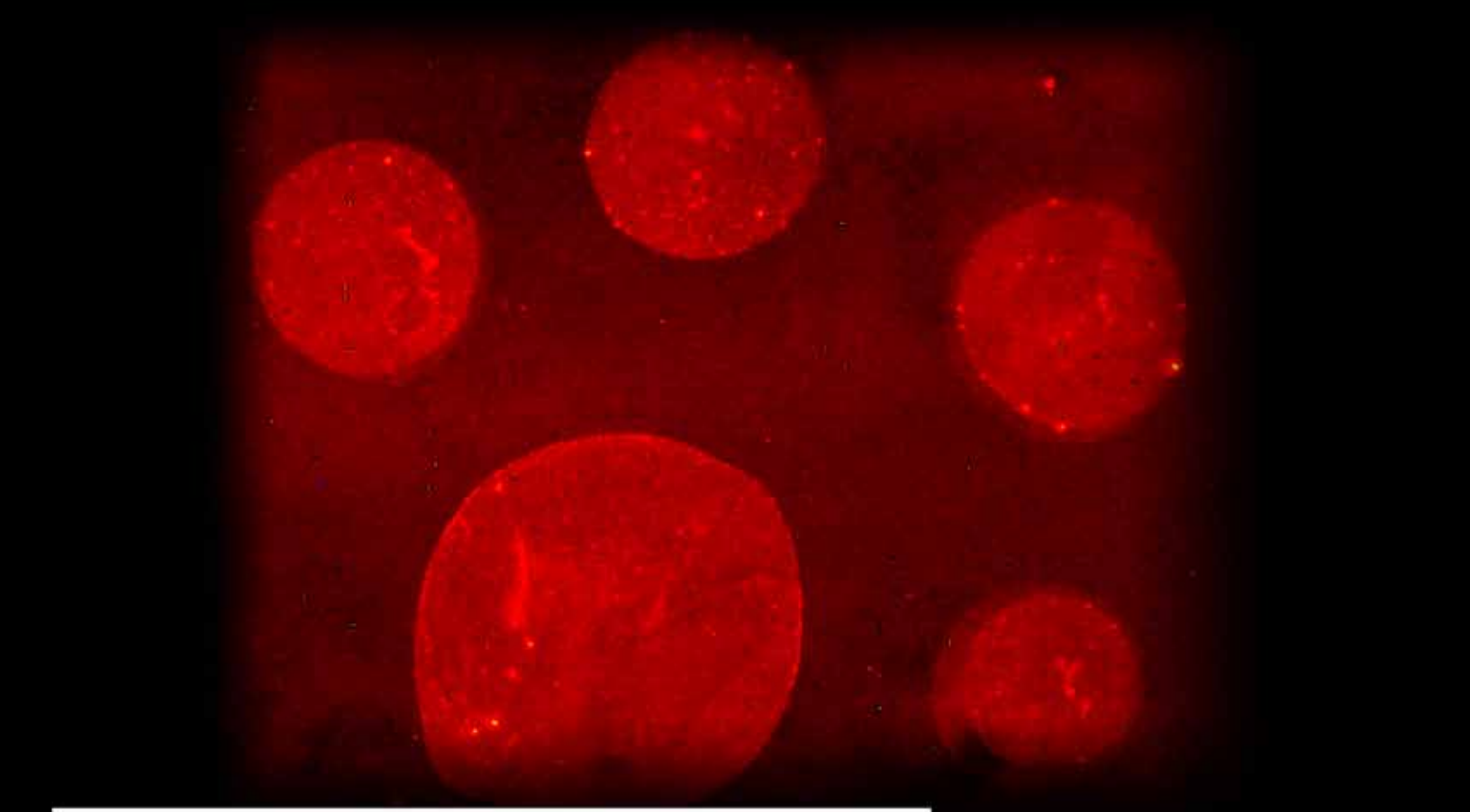
Re-Engineering Engineering Education

BIOMATERIALS FORUM

OFFICIAL NEWSLETTER OF THE SOCIETY FOR BIOMATERIALS

Third Quarter 2011 • Volume 33, Issue 3



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The official news magazine of the **SOCIETY FOR BIOMATERIALS** • Volume 33, Issue 3

Special Interest Group Reporters

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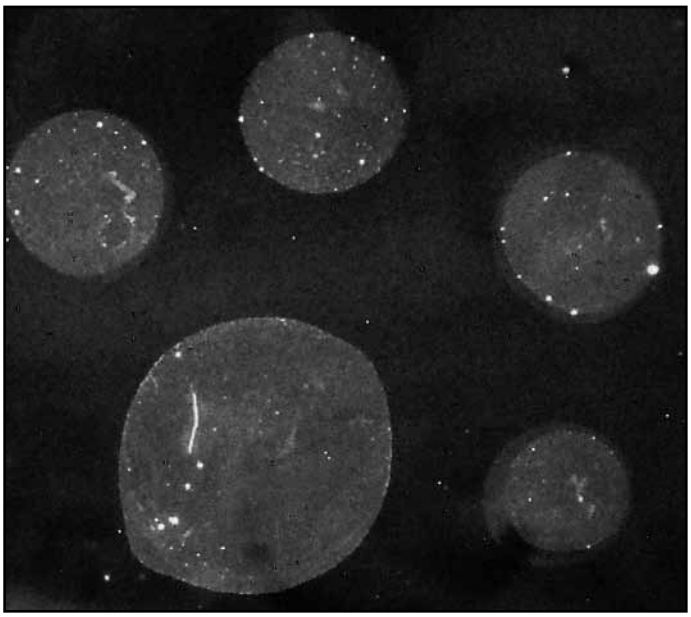


Spatial functionalization of a polylactide film for drug delivery and cell attachment applications. The spatial functionalization was selected to form a model of Clemson University's Tiger Paw.

By: Brittany Banik
Courtesy of Dr. Frank Alexis, Assistant Professor, Clemson University
Contributor contact: Frank Alexis, falexis@clemson.edu

From the Editor

Greetings,

I hope your summer has been filled with lots of sunshine and physical and mental activity. I live in Connecticut, so summertime is a particularly nice time to be outside and partaking in non-work activities that rejuvenate me and help stimulate creativity. As the new Executive Editor of *Biomaterials Forum*, I've been thinking of creative ways to make this newsletter a "must-read" for all of our members. The previous Executive Editor, Professor Karen Burg, did a wonderful job during her tenure and set up formalized procedures with our helpful staff at headquarters that make the publication seem like it occurs on autopilot, leaving me free to explore new directions for the *Forum*. Due to the change of Society officers, there is also a new set of reporters to provide input on new directions. This led to a conference call where we reviewed the current content and discussed what we like and don't like. We all like the news about other members, corporate activities, upcoming meeting announcements, the book review and information about education. While the mini-technical articles submitted by SIG members have been interesting, it was concluded that some of them resemble journal articles and are thus too specific and do not provide the succinct new information about general techniques of interest.

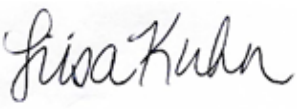
Based on the review of the pros and cons of the current content in *Biomaterials Forum*, we plan to increase the amount of personal member news by including stories about the career choices of our members and publishing results of questions we will pose to the members, such as "What has been the most exciting development in biomaterials over the past 10 years and why?" We also plan to make the *Forum* a resource of information about contract research organizations (CROs) to facilitate the translation of academic discoveries to clinical practice through the posting of advertisements for consultants and CROs. We'll also be conducting interviews with NIH program officers about the future of biomaterials within their institute and sharing their answers with you. Identifying someone from within the FDA who could be available for interviews remains a priority since that information will further help with the translation of basic science. With all this good information in the *Forum*, we're also working on a way to make it easier to search and electronically access archived articles from previous issues of the forum on the new Society For Biomaterials website.

I look forward to hearing your suggestions about what you'd like to see... and receiving your contributions to this news magazine.

I look forward to hearing your suggestions about what you'd like to see in the *Forum* and receiving your contributions to this news magazine. As always, we are on the lookout for biomaterials news and some nice images of biomaterials to use as cover artwork, so please send me your news and any possible images you have for consideration in future issues.

Lastly, it is time to think about submitting an abstract for the World Congress (due September 30, 2011). I encourage you to read the article by Professor Tim Topoleski, University of Maryland, Baltimore County, who has traveled extensively in China, to help you make up your mind about attending the meeting.

With my best regards,



Liisa Kuhn, PhD

From the President

This issue serves as the first during my term as President, Liisa Kuhn's first issue as Biomaterials Forum Executive Editor and Jeremy Gilbert's first issue without the pressure of compiling a presidential letter. Thank you, Liisa, for your energy and enthusiasm in your new role. Thank you, Jeremy, for providing leadership to the Society and guidance to me during my term as President-Elect.

As always, we are actively working to provide exciting opportunities for the upcoming meetings. Program Chair Monty Reichert and committee are busy planning content and format for our October 2012 New Orleans meeting. Please note that the 2013 annual meeting of the Society will be held in Boston. Meanwhile, we look forward to participating in the ninth World Biomaterials Congress in Chengdu, China, next June, and we will provide information soon regarding travel. Be sure to check the Congress website (www.wbc2012.com/) for the latest information about meeting content and related events. We are also compiling a proposal to host a World Congress in the United States.

The conversations and initiatives we continue to work on this year include SFB accessibility and visibility, membership value and educational opportunities. The publications committee will be investigating the value and issues related to offering our meeting abstracts online to nonmembers through search engines such as Google Scholar. We will also begin discussion of social networking and its role for SFB. Malcolm Gladwell, ("Small Change: Why the Revolution Will Not be Tweeted," "Does Egypt Need Twitter?" Gladwell, 2010, *New Yorker*), posed several controversial thoughts regarding social networking, postulating that "high risk" social activism requires deep roots and strong ties, but that it is our acquaintances (i.e. those who we do not know as well), not friends, who are the greatest source of new ideas and information. This raises an interesting point—perhaps social networking, if harnessed with SFB intent, can provide a means for biomaterials innovation. So many organizations sign on to social networking without really thinking about the purpose or value, just that it will somehow be the magic bullet. Our goal is to think strategically about the possible value added and how it might enhance our presence and function as a Society.

We will examine the membership process and evaluate whether or not we might streamline the membership application process to encourage new member applications while holding fast to relevant and necessary membership credentials. We must evaluate other organization's application processes and ask if our methods for evaluating potential new members are reasonable. This year we will begin to work with other organizations to influence education initiatives. Innovation is composed of knowledge capital, human capital and environment (National Academy of Engineering, "Rising Above the Gathering Storm, Revisited: Rapidly Approaching Category 5.") We have the exciting opportunity to influence knowledge capital and, therefore, biomaterials innovation. U.S. educational assessment practices have undergone a large shift from emphasis on prescribed course input to emphasis on learning output. With this shift comes increased difficulty in measuring output. As we wrestle with assessment and measurables, we must think about how to integrate biomaterials concepts in undergraduate and graduate level curricula, how to integrate biomaterials information into credentialing (e.g. the professional engineering exam) and how to integrate biomaterials content in pre-college curricula.

These challenges are complex and will require continued effort and conversation over the next years; however, we have begun to build a meaningful framework for discussion and action. I look forward to a productive year ahead.

Best wishes from Clemson,

Karen J.L. Burg
Hunter Endowed Chair & Professor of Bioengineering
Interim Vice Provost and Dean of the Graduate School
Clemson University

Staff Update

Hello from Society For Biomaterials headquarters! Your headquarters staff is pleased to report that the Annual Meeting in Orlando, Fla., April 13-16, very nearly tied the record turnout of 2010 with 1,386 attendees. The energy generated at this meeting was inspiring, and we hope more members will take an active role in the Society in the months ahead.

Annual Business Meeting

The Society's Annual Business meeting took place April 15, 2011. Among the items on the agenda were:

Election of Officers

Results of the spring election were announced, and the following have been elected as officers for the Board of Directors:

Joel Bumgardner, PhD, University of Memphis – President-Elect
David Kohn, PhD – University of Michigan – Secretary/Treasurer-Elect
Alan Litsky, MD, ScD, Ohio State University – Member-At-Large

New Council

These members will be serving as chairs of committees and, along with the Board, will comprise the 2011-2012 Council: Anne Meyer, Awards, Ceremonies & Nominations; Jiro Nagatomi, Bylaws; Bruce Anneaux, Devices & Materials; William Murphy, Education & Professional Development; David Kohn, Finance; Molly Shoichet, Liaison; Joel Bumgardner, Long Range Planning, Karen Burg, Meetings; Horst von Recum, Membership; Jeremy Gilbert, President's Advisory; Monty Reichert, Program; Ashtosh Chilkoti, Publications; Scott Cooper, Student Chapter President. Members elected or appointed to the committees are posted on the Society For Biomaterials website at www.biomaterials.org.

Election of Awards, Ceremonies and Nominations

The following members were elected to the 2011-2012 Awards, Ceremonies and Nominations Committee: Jason Burdick, University of Pennsylvania; Mariah Hahn, Texas A&M University; Jan Stegemann, University of Michigan; and Nicholas Ziats, Case Western Reserve University.

Election of Membership Committee

The following members were elected to the 2011-2012 Membership Committee: Eben Alsberg, Case Western Reserve University; Elizabeth Cosgriff-Hernandez, Texas A&M University; Benjamin Keselowsky, University of Florida; Julie Liu, Purdue University.

Bylaws Amendments

The members present approved the proposed changes to the SFB bylaws, which were distributed to all members prior to the meeting. Updated bylaws have been posted on the SFB website. Amendments passed included: 1. the addition of the Audit Committee as a standing committee; 2. specifying students as associate members, and giving the Educational & Professional Development Committee oversight of the student chapters; 3. providing for electronic balloting; 4. allowing Council more flexibility in determining the dates for the annual business meeting; 5. formally adding the Special Interest Group representative to the annual meeting program committee; and 6. correcting an inconsistency in Article IX.

Committee News

The Society committees are hard at work as always: Awards Ceremonies and Nominations - Nominations are being sought for Officers and Awards. Please see the Call for Nominations on the back cover for more details. To nominate a colleague or yourself for an award or position on the SFB board of directors, please visit the SFB website at www.biomaterials.org.

Devices & Materials

The committee is investigating ways to improve services to industry members and will be conducting a survey to help determine the wants and needs of this critical segment of the Society.

Education & Professional Development

The Biomaterials Day grant program continues its success. The 2012 application deadline is September 16, 2011. Please visit the website or contact Dan Lemyre (dlemyre@biomaterials.org) for more details. The Committee will also be soliciting applications for the 2012 C. William Hall scholarship in the near future, and will be working towards creating a mentorship program for young investigators.

Finance

As Dr. Mikos reported at the 2011 Annual Business Meeting, the Society's finances are healthy. The Finance Committee is beginning preparations for the 2012 budget, with an eye on improving and expanding member services.

Long Range Planning

This committee is evaluating and monitoring the implementation of the Society's strategic plan and will use results from membership surveys to help guide future efforts. All survey results are available on the SFB members-only website.

Meetings
The 2012 Annual Business Meeting will take place during the 2012 World Biomaterials Congress in Chengdu, China (June 1-5, 2012). For more information on the WBC2012, please visit www.wbc2012.com, or contact SFB headquarters directly. The Society will be hosting a small symposium in the fall of 2012 focusing on the grand challenges facing the biomaterials community in the coming decade. The SFB 2012 Fall Symposium will be held in New Orleans, October 4 – 6, 2012. The 2013 Annual Meeting will be held in Boston, MA, April 9-13. Locations for the 2014 and 2015 annual meetings will be considered later this year.

Membership
The committee plans to continue initiatives to increase membership; to re-invigorate existing Student Chapters and establish new ones; and to work with the Education and Liaison Committees to further collaborative programming with other societies.

Program
The Program Committee is considering ideas for the 2012 Fall Symposium, and issued a request for proposals in August 2011. Abstracts for these proposed sessions will be solicited in the spring of 2012, and the abstract deadline will be in late March 2012.

Publications
The Society is at work on a new book series with our publisher John Wiley & Sons. Please see the call for book authors and editors on page 7 for more details. The Society now has established groups on Facebook and LinkedIn and invites all members to join and participate. In addition, the Society will be developing a new website in 2012, and is soliciting your feedback to ensure that we provide the most useful tools possible. A survey has been distributed to the entire membership, but additional comments can be directed to the web editor Thomas Webster: webeditor@biomaterials.org.

Special Interest Groups
The Society's Special Interest Groups (SIGs) are encouraged to submit articles for the *Biomaterials Forum* and to contribute content to the website. Seven SIGs have created public websites, and all SIGs continue to be very active in assisting with the development of content for the Annual Meeting, and the review of submitted abstracts. In the spring of 2011, the SIG Chair Committee elected Jeff Schwartz as its representative to the Board of Directors.

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

Dan Lemyre, CAE, IOM
Executive Director
Society For Biomaterials
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Phone: 856-642-4201 • Fax: 856-439-0525

Government News

Towards Functional, Quantitative Longitudinal Imaging for TE/RM

A Joint NIST / NIH / FDA / NSF Workshop

October 11-12, 2011
National Institute of Standards and Technology
Gaithersburg, Maryland

Objective
To foster widespread adoption of cutting-edge imaging and image analysis tools to advance tissue engineering and regenerative medicine (TERM) therapies. Toward this goal, the Workshop will bring together leaders from the TERM and imaging communities for mutual cross-fertilization of ideas and practical approaches to solve problems.

Approach
The workshop aims to accelerate development and adoption of advanced imaging techniques and methodologies by identifying current needs of tissue engineers, from the molecular to the macroscopic scales, and consider approaches to meet those needs. The conference will primarily focus on functional, noninvasive methods appropriate for in vitro and in vivo TERM work, and for quality control and regulatory characterization of manufactured tissue engineered constructs.

Session Format
Each TERM speaker will be asked to present work that highlights needs related to their assigned topic that could be addressed by imaging. Each TERM speaker will be followed by an imaging speaker or speakers who will be asked to highlight capabilities being developed in their own and other labs that could meet specific TERM needs.

Workshop Co-chairs:
Marcus Cicerone
Project leader, CARS Microscopy
Polymers Division
National Institute of Standards and Technology

Gordana Vunjak-Novakovic
Vice-Chair, Professor of Biomedical Engineering
Columbia University

Ralph Weissleder
Director of the Center for Molecular Imaging Research at Massachusetts General Hospital
Imaging Program Leader, Harvard Stem Cell Institute
Professor, Harvard Medical School
Attending Interventional Radiologist at MGH

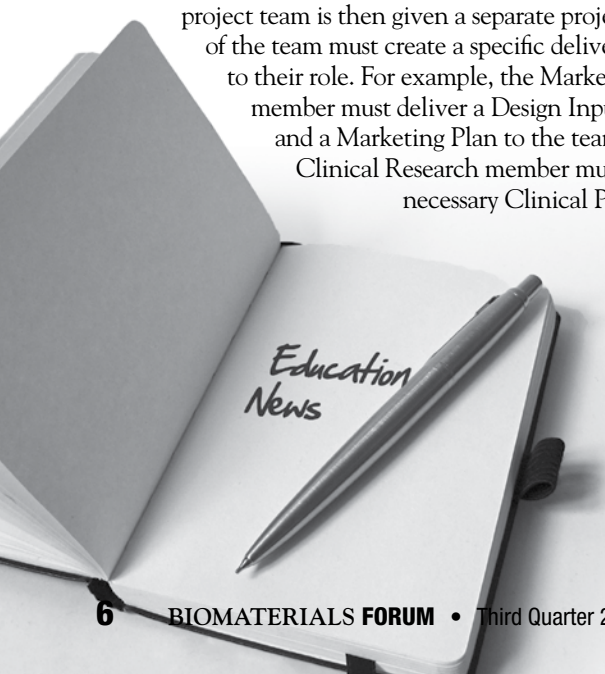
Simulations in Biomaterial Science and Biomedical Engineering Curriculums to Prepare Students for Industry

Josh Simon, Senior Product Manager, Biocoat Inc.

The challenge for academic programs in Biomaterials Science and Biomedical Engineering is to convey a large amount of material in a limited time, yet even as some programs successfully achieve this, they remain deficient in another important task: preparing the students for life outside of academia. Students that go onto academic positions as post-doctoral researchers or faculty are a severe minority compared to those that enter industry, yet courses that go beyond academics to show what happens in the real world are rare. Partially, this is because it is difficult to produce realistic conditions with academic material in the classroom, and also because some instructors from academia have limited experience in this area. Most graduating students (the author included) do not get any idea what Biomedical Engineers or Biomaterials Scientists do for jobs until after they land their first jobs. Fortunately, it seems there are workable solutions to this issue. The community can create and adapt a portion of the coursework to be more appropriate. A previous article in this publication detailed the use of case studies as one such option. This article gives an example of another format, Simulations, and presents an overview of how they work, how they are graded, and some reactions of students to past experience with this format.

Simulations can be constructed in a number of ways, and the author has experience with two specific layouts. The first method is currently used for the Medical Device Development course at the New Jersey Institute of Technology (NJIT). As the course name implies, the simulation's goal is to teach how medical devices are developed in corporations. For the first half of the semester, students receive information about various roles on a medical device project team and possible career options in those roles. In the latter half, the instructor divides the students into teams of six where each student plays one of six roles: Project Manager (PM), Regulatory, Pre-Clinical Research, Clinical Research, Marketing, or Quality Assurance/Control. Each project team is then given a separate project, and members of the team must create a specific deliverable intrinsic to their role. For example, the Marketing team member must deliver a Design Input Document and a Marketing Plan to the team, whereas the Clinical Research member must deliver any necessary Clinical Protocols needed to get the device to market. These documents, and others, are assembled into the beginnings of a Design History File (DHF) for the device, an actual document pivotal for all medical devices instead of an arbitrarily constructed report. Although project teams are not overtly interdependent, each team member is also a member of a department. For example, all of the Marketing team members among all the project teams in the class form the "Marketing Department". The job of the departments is to make sure that all of their members are completing their project work in a timely manner, and if a project team member falters, it is the task of the department to step in and see to the deliverable's completion. Department members are also allowed to collaborate on formatting and information gathering for their respective deliverables. Finally, the instructor acts as "Management" for the Simulation, arbitrating any difficulties that may arise and giving final approval to the assignment.

A second type of simulation is used for NJIT's Project Management for Medical Devices course. Unlike the first simulation, this type is designed to run more quickly, either over the course of one week online or during a single three-hour lecture. Perhaps with some shame, the author admits this type of simulation was inspired by the format of tabletop roleplaying games, whereby there is a storyteller who gives the players information and receives instructions from the players about what actions they would like to take before returning a narrative of what occurred as a result. In this case, the storyteller is the instructor, and he or she uses a loose script of a real situation that occurred with a device. The Simulation takes place in rounds. On the first round, with a general solution in mind, the instructor gives the students a set of information and then finds out what they would like to do in an attempt to solve the problem. In general, Simulations of this type work best when done in teams of at least four, and when the instructor has some real-world experience with the situation at hand, because student feedback can be unpredictable (and even ingenious), and the instructor needs to think nimbly to come up with simulated results. Responses to any round of the Simulation can take the form of more questions from the students about the problem, proposed workarounds, new design ideas, or further experiments that should be conducted to find out more. For example, one such Simulation detailed a



Education Quote of the Quarter:

"Experience is not what happens to you. It is what you do with what happens to you."

— Aldous Huxley

problem with an antibiotic-coated hip stem for a hip replacement. Initial information told of a conflict about whether to choose one antibiotic over another, and what sorts of specific antimicrobial claims should be made from a regulatory standpoint. Typical first round responses included proposals of experiments to find out which antibiotic had greater efficacy, and whether or not the indications and claims affected the specifications of that efficacy. In cases where the instructor receives experimental designs as a response, the instructor lays out an informed guess about the results and describes them to the Simulation team. The team then takes those results into account when deciding on what to do for the next round. Writing from experience, most students can figure out the problem within four to five rounds of close interaction with the instructor, and propose a workable solution. However, even if no solution is obtained, progress towards learning to solve a problem is the reward. After the Simulation is complete, students are required to write up a summary narrative about the entire sequence of events. Collaborative completion of these reports also works well.

Another important aspect of collaborative Simulations is the grading. Traditionally, assignments are graded individually. Even group assignments take into account the individual's contribution to the work. However, this too is not completely representative of industry where teams can fail and succeed as one. The Simulation described for Medical Device Development has a unique approach to grading based on the philosophy that success in the real world is not accomplished alone. People are in fact responsible for each other's actions, as well as the navigation of sociopolitical environments through the use of emotional intelligence and "people skills". Approximately 40% of each person's Simulation grade is determined via a survey that questions a team member's ability to work in a group and cooperate effectively. The PM for each group gets a grade partially determined by a survey filled out by his or her project team. Each team member other than the PM gets a grade partially determined by a survey filled out by the PM on that team member's (and the department's) contribution to the project. The remainder of the grade is determined by completeness, formatting, and a discretionary part for the instructor to award points. For the second type of simulation, the grading is less involved because the only deliverable is a summary report. Grading this report is similar to traditional group reports.

Student reactions to these Simulations reveal more about their utility. Primarily, students seem satisfied that they finally understand the role of a Biomedical Engineer or Biomaterials Scientist in industry. Moreover, they fully realize that individuals with those degrees can play one of several roles on a project team, and that they can choose medical device or biomaterials development as a career. An unintended side effect occurs for students that choose a role in the Simulation that does not suit them: they learn what they do not want to do for a career. This information is just as valuable to them as finding out what they like. Finally, recent feedback has shown cases where students land jobs due to knowledge and experience obtained in these Simulations, and that employers selected them over other candidates because of some basic knowledge imparted by the experience, such as knowledge of Design Controls and FDA regulations.

Having summarized the layout, grading, and student reactions to classroom simulations as a tool for Biomedical Engineering or Biomaterials programs, it is important to reiterate the challenges associated with implementation. Replacing even one course with a new one can alter the direction of a program. Adding a course as a requirement to a program causes other difficulties. Additionally, finding instructors with the proper experience for teaching courses designed to facilitate a person's introduction to corporate life is not always straightforward. Many strict academics do not possess the necessary skills. In situations like these, there is yet another reason for collaboration between academia and industry, and there should be no shortage of willing adjuncts to fill the role.

Call for Book Authors and Editors

The Society For Biomaterials is a professional society which promotes advances in biomedical materials research and development by encouragement of cooperative educational programs, clinical applications, and professional standards in the biomaterials field. Biomaterials scientists and engineers study cells, their components, complex tissues and organs and their interactions with natural and synthetic materials and implanted prosthetic devices, as well as develop and characterize materials used to measure, restore, and improve physiologic function, and enhance survival and quality of life.

The Society For Biomaterials (SFB) and John Wiley & Sons have teamed up as publishing partners, bringing together SFB's experience of serving biomaterials science and engineering students and professionals with Wiley's 200+ years of publishing expertise. A main goal of the partnership is to ensure that SFB members and the larger international biomaterials communities can access the highest quality content available, enabling professionals to conduct research, teach, and make advancements in their fields.

SFB-Wiley is currently seeking new authors or volume editors for textbooks, handbooks, or reference books on biomaterials science-related topics. Examples of book topics include, but are not limited to: biomaterials availability and policy, biomaterials education, cardiovascular biomaterials, cell and organ therapies, dental and craniofacial materials, drug delivery, implant pathology, nanomaterials, ophthalmic biomaterials, orthopedic biomaterials, protein and cells at surfaces, surface characterization and modification, and tissue engineering.

These are just a few examples, so please consider your professional interests and research, along with those of the SFB Special Interest Group with which you may participate to be of particular interest as publishing opportunities. Authors and editors of new, original books receive royalties on worldwide sales of their books, while editors of proceedings volumes receive complimentary copies of their books. In addition, all authors and editors are entitled to a discount on Wiley books.

If you are an interested author or editor, or simply have an idea that you wish to share, please contact:

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Calcium Phosphate-Mullite Composites for Hard Tissue Replacement

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Laboratory for Biomaterials,
Department of Materials Science and Engineering
Indian Institute of Technology Kanpur,
IIT Kanpur, INDIA.

Background

Hydroxyapatite (HA)-based biomaterials have been widely used in tissue replacement, bone reconstruction and bone regeneration applications without any long-term adverse effects. This is because hydrated calcium phosphate [$Ca_{10}(PO_4)_6(OH)_2$] is the main mineral composition of human bone and teeth and can bond easily with living tissues, hence showing enhanced osteointegration and bioactivity. However, HA is not suitable for load-bearing orthopedic applications because it has very poor mechanical properties (such as strength/toughness)[1, 2, 3, 4, 5, 6]. The major concern in introducing second-phase reinforcing material in HA matrix is that its biocompatibility may be greatly affected. However, by choosing a limited amount of second-phase material and optimizing process parameters, it is possible to achieve a good combination of physical and biological properties of HA-based composite. As part of our ongoing research in the area of biomaterials[7, 8, 9, 10, 11, 12], recently we have developed HA-mullite ($3Al_2O_3.2SiO_2$) composites that exhibit better mechanical properties without adversely affecting in vitro/in vivo biological properties[13]. It needs to be mentioned here that Mullite is a solid solution of alumina (Al_2O_3) and silica (SiO_2), and the chemical formula for mullite is $3Al_2O_3.2SiO_2$. The general formula for mullite solid solution is $Al_{(4+2x)}Si_{(2-2x)}O_{(10-x)}$, where x =0.17 to 0.59. Mullite has a lower density (~3.05 g/cc) than Al_2O_3 (~3.95 g/cc) and ZrO_2 (~6.1 g/cc). It has a good combination of structural properties like higher hardness of ~15 GPa, higher Young's modulus of ~240 GPa and a moderate fracture toughness of ~3 MPa $m^{0.5}$ [14] . This article briefly reports the physical, mechanical and biological properties of the CaP-Mullite composites being developed in our research group at IIT Kanpur, India.

Materials Processing

For the purpose of obtaining a better combination of physical properties, different amounts of mullite (10-30 wt %) were mixed with HA, and the powders were pressurelessly sintered. HA powder was synthesized in-house using commercially available chemicals, such as calcium oxide (CaO) and phosphoric acid (H_3PO_4), following a well-established suspension-precipitation route[15, 16]. The sintering of the composite was carried out at 1350°C for two hours, while sintering of pure HA was performed at 1200°C for 2 hours, both in a conventional pressureless sintering furnace. A recent study[17] demonstrated HA-Mullite composites with more than 90% theoretical density can be obtained by pressureless sintering in the temperature range of 1300-1350°C without sintering additives. Combining the results of XRD, TEM and dilatometer, it has been confirmed the densification of the newly developed composites occurs initially by solid-state sintering up to a temperature of 1150°C followed by liquid phase sintering at higher temperature. The presence of mullite needles and the residual microporosity is observed in the sintered microstructures (see **Fig. 1**). Based on the careful analysis of the sintering studies, an important observation was that the dissociation of HA to

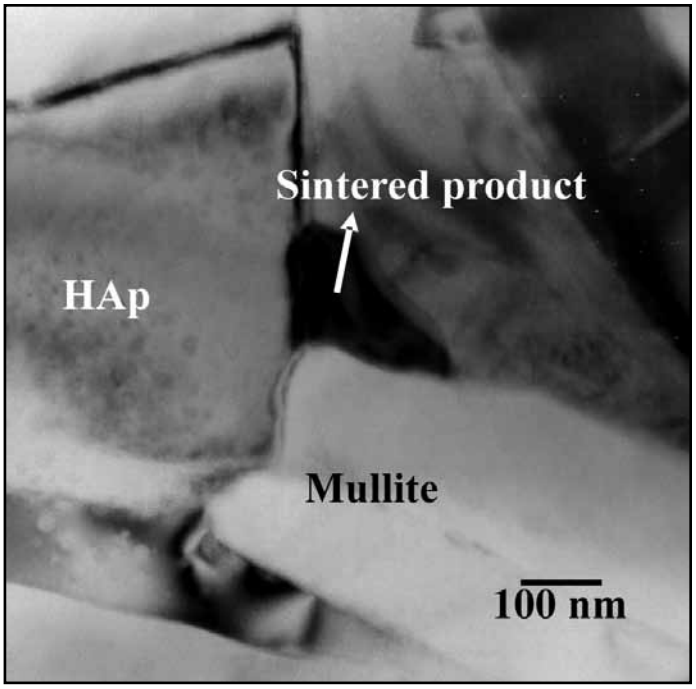

Figure 1: *Bright field Transmission electron micrograph showing the presence of sintered reaction phase at the mullite–HA interface after conventional sintering in air at 1350°C for 2 hours[22]. Selected area diffraction pattern as well as EDS compositional analysis shows the composition of sintered reaction product as Gehlenite ($2CaO.Al_2O_3.SiO_2$), which reveals the occurrence of the sintering reactions between HA and mullite.*

TCP depends on both sintering temperature and mullite content. Higher mullite containing composites are more prone towards dissociation to β and α-TCP.

Mechanical Properties

A detailed report on the mechanical properties of CaP-mullite system was presented in a recent paper.[18] The elastic modulus of the sintered CaP-mullite composites varied around 60-80 GPa, which is lower than the HA monoliths (~115 GPa). The nanoidnetation response of CaP-mullite composites is reported also in a recently published paper[19]. Fracture toughness measured by SEVNB method appears to provide lower estimate than indentation method and the maximum SEVNB toughness of 1.5 MPa $m^{0.5}$ was recorded for the composites with 20-30 wt% mullite addition. This toughness values are 2.5 times higher than pure monolithic HA. The presence of whisker-shaped mullite needles in the sintered composites is responsible for the enhanced toughness. The compressive strength of the developed composites (up to 350 MPa) for 30 wt% mullite addition) is by far better than pure HA. The combination of mechanical properties of the newly developed composites is better than earlier reported results and on the basis of physical properties, the investigated materials can be used for medium load-bearing implant applications.

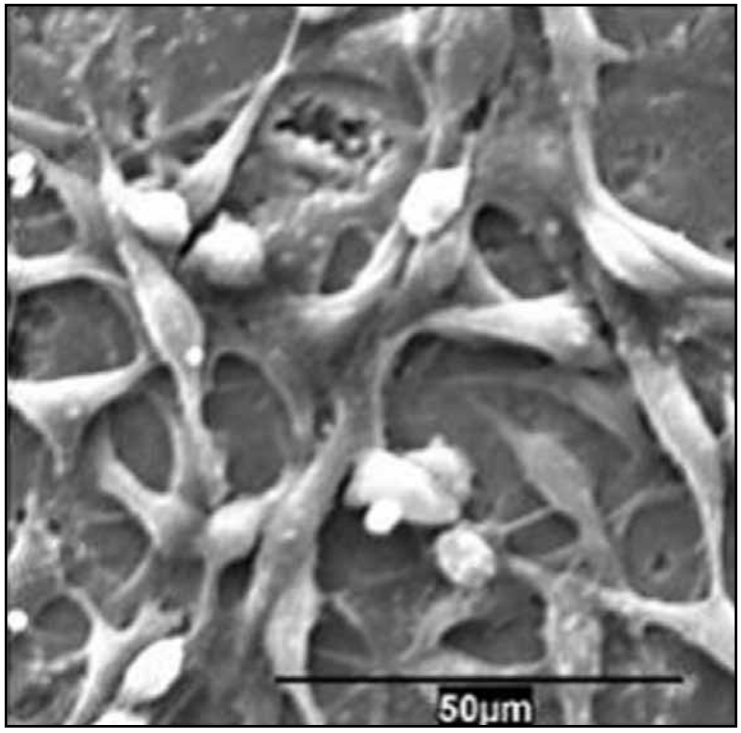

Figure 2: *(a) Representative SEM image illustrating the adhesion of L929 mouse fibioblast cell activity on Hydroxyapatite-mullite composite after 24 hours of culture. (b) Fluoroscence micrograph revealing the osteocyte and osteoblasts at the host bone-implant interface (arrow).*

Biocompatibility (in vitro and in vivo)

The *in vitro* biocompatibility assessment using multiple biochemical assays for a series of CaP–mullite (up to 30 wt. %) using human osteoblast-like MG63 and mouse fibroblast L929 cell lines has been carried out in a recent work[20]. In our study, *in vitro* cell adhesion experiment with both the cell lines were conducted to assay for cell viability and cell proliferation; while MG63 cells were used for *in vitro* tests to assay for osteocalcin (OC) gene expression and alkaline phosphate activity (ALP). The principal finding of our study is that the as-sintered CaP-mullite composites containing higher amount of -TCP phase favorably support cell attachment and proliferation of functional human bone cell line (osteoblast-like MG63) and L929 mouse fibroblast cells *in vitro* (see **Fig. 2a**). Also, such observations are independent of mullite content (up to 30 wt %). As far as the quantification of the cytotoxicity is concerned, MTT assay results with fibroblast and osteoblast-like cells did not reveal any statistically significant variation in terms of metabolically active cells after culturing with the mullite containing composites in comparison with pure HA. The combination of ALP activity and OC expression results indicates that CaP-based composites with 20% or 30% mullite composition exhibit superior combination of osteoinduction and bone mineralization property than baseline single phase HA ceramic. This aspect has been explained in terms of the difference in biological responses of microstructural phase assemblage and the presence of predominant -TCP phase is found to suitable to support better osteogenic differentiation behavior.

In a separate study[21], on the basis of qualitative analysis of histologic, radiographic, Scanning Electron and Atomic Force Microscopy observations of the bone/implant interface at various time scales during short term implantation study (up to 12 weeks) in rabbits, it was concluded that the investigated CaP-mullite biocomposite resulted in a consistent pattern of deposition of neobone, which appears to remodel over survival period. It is evident that new bone formation is present around HA-mullite at 12 weeks (Fig. **2b**). At twelve weeks post implantation, the bone deposition was increased around both the implant materials. No degenerative, necrotic changes or inflammation were observed at implant site. Neovascularization was also absent at bone material interface. Woven and lamellar bone deposition was observed along both sides of host cortical bone and partially across periosteal aspect of the cavity. Minimal fibrosis with fibrocytes and occasional macrophages separate the new bone-material interface. Collagen with foci of chondrogenesis and osteocytes were seen at the interface. As the collagen at the interface with HA-mullite is minimal, it may take few more weeks for complete direct contact. On the basis of the absence of inflammation, the presence of new bone formation and minimal collagen at the interface, confirm the suitability of the HA-mullite to be used as bone replacement material for orthopedic applications.

Acknowledgements

This work was supported by Department of Biotechnology (DBT) and Department of Science and Technology (DST), Government of India.

More information on the research activities is available on the following websites:

Laboratory for Biomaterials website:
http://www.iitk.ac.in/biomaterialslab/

Indo-US Center on Biomaterials:
http://www.iitk.ac.in/indo_us_biomaterials/

Indo-UK (UKIERI) project on Biomaterials:
http://www.iitk.ac.in/UKIERI_biomaterials/

Industrial News

A California jury awarded St. Jude Medical a $2.3 billion judgment, finding that a former employee and a Chinese firm were liable for stealing trade secrets. Pacesetter Inc., the cardiac rhythm management division of St. Jude Medical, won $947 million for past damages in its case against former employee Yongning Zou and his employer, Chinese medical device business Nervicon Co, a medical device business based in Suzhou, China. Pacesetter also won $868.5 million for future economic loss and $500 million for punitive damages against Zou, a shareholder in Nervicon Co. Pacesetter accused Zou, the company's former principal hardware design engineer, of stealing a document relating to a crystal oscillator unique to St. Jude's products after he had signed a nondisclosure agreement.

Cryolife Inc. (Kennesaw, Ga.) announced its BioGlue Surgical Adhesive will soon be available in Japan. The implantable biological medical device and cardiovascular tissue processing company got Japanese Ministry of Health, Labor and Welfare approval for the product in fall 2010 and will make it available starting in May. It estimates the annual Japanese market for the use of surgical adhesives in the repair of aortic dissection is $10 million and the total annual market for the use of adhesives and sealants in Japan is $150 million.

The study led by Dr. Peter Groeneveld of the University of Pennsylvania School of Medicine showed drug-eluting stents have added as much as $1.57 billion to U.S. health costs since their introduction in 2003. When they were first introduced to the U.S. market, they were approved mostly for use in previously untreated blood vessels, but their use quickly expanded. Now, according to some estimates, more than half of all drug-eluting stents are used in so-called off-label indications. The study did not account for increased drug costs, which may have added to the overall increase. Sanofi-Aventis' anti-clotting drug clopidogrel or Plavix is typically prescribed after a stent is implanted to keep patients from developing blood clots.

DePuy (Warsaw, Ind.), a Johnson & Johnson division, will combine with Synthes to create the world's largest orthopedic company. At 28 percent estimated market share, the new DePuy/Synthes combination would have twice the share of its nearest two competitors—Stryker at 14 percent share or Zimmer at 13 percent share. This merger affects 22,000 employees throughout the world. In terms of specific orthopedic markets, the new Super Power will be the No.1 or 2 supplier in every major orthopedic sector.

Medical device makers down under are concerned about a government plan to create a new joint regulatory agency for medical devices in Australia and New Zealand. The governments announced a five-year plan to create the Australia New Zealand Therapeutic Products Agency (ANZTPA), which will regulate medicines, medical devices and new medical interventions. The new agency will replace Australia's Therapeutic Goods Administration and New Zealand's Medical Devices Safety Authority. Currently, the Australian Therapeutic Goods Administration mirrors the European CE Marking system. The Medical Technology Association of New Zealand said it supported the move but was concerned that the new joint agency could create unnecessary costs. Currently, there are no regulatory costs for offering a medical device for sale in New Zealand.

Blood vessels grown in a laboratory at Cytograft Tissue Engineering Inc. (Novato, Calif.), were safely implanted in three kidney disease patients, enabling them to have regular dialysis without relying on traditional shunts that caused complications and failed, according to the report released by the American Heart Association. The foot-long vessels were engineered from donor skin cells, grown on sheets and rolled around temporary supports to form a cylindrical shape. The "off-the-shelf" vessels, which connected an artery to a vein in the arm, gave doctors access to the patients' blood so they could perform dialysis. The engineered vessels had about a two-month storage life before they were implanted in the patients.

The European Commission is proposing a big rise in research and innovation funding, to €80.2 billion for the 2014-2020 financial period, in an effort to harness innovation to produce more jobs and growth. The research proposal is part of a broader EU budget plan agreed by the Commission – but is likely to be a contentious issue. It falls short of the nearly €100 billion sought by some research advocates in the European Parliament. But it comes at a time of unprecedented austerity in most EU member-states. The final size of the budget will be debated among the Commission, Parliament and member-states over the next year. Presenting the draft budget, Commission President Jose Manuel Barroso emphasised the need to boost growth and jobs across the EU by "investing more in Europe's brains." As well as a 46 percent like-for-like increase in research and innovation funding, he also highlighted the €15.2 billion to be invested in education and vocational training, an increase of 68 per cent.

Medtronic Inc. (Minneapolis, Minn.) Chairman and CEO Omar Ishrak defended the data that his company submitted to federal regulators as part of the approval process for a bone-growth protein, saying they were sound and support the safe use of the spinal surgery product. The executive's statement came in response to a Spine Journal study that claims doctors on the medical device maker's payroll failed to disclose complications that came up during clinical trials of the bone-growth protein. Ishrak acknowledged that the study has raised questions about the conclusions the researchers arrived at in their published reports. But he stressed that the study didn't conjure similar questions about the data Medtronic submitted to the Food and Drug Administration during the bone-growth protein's approval process, nor on the information available to physicians using the product. The Wall Street Journal reported on Tuesday that 15 of the surgeons who conducted clinical trials on the bone-growth protein over the past decade received at least $62 million combined from Medtronic for unrelated work. The Senate Finance Committee is investigating whether the payments the surgeons received were a factor in their decision not to report the health complications.

More than 20 leading medical technology chief executives from across the country representing hundreds of thousands of

employees came to Capitol Hill to urge Congress to help preserve the industry's competitiveness and global leadership in the development of new medical devices and diagnostics. "America's medical technology companies large and small are engines of economic progress. With more than 2 million jobs supported by this industry, we need public policies in place that will encourage growth and job creation," said Stephen J. Ubl, president and CEO of AdvaMed (Advanced Medical Technology Association).

The legislative fly-in comes on the heels of the launch of the Association's "Competitiveness Agenda" – a six-point plan that would make it easier for American medical progress to thrive:

- Innovation in the life sciences must be a government priority, including requiring an innovation impact statement for significant new regulations that affect the health sector;
- The FDA review process must be reformed to reduce total review times. American patients should have as prompt access to new treatments as European patients do;
- Payment policies of Medicare, Medicaid and private insurers must support medical innovation and not penalize early adopters of new treatments and cures;
- A vigorous trade policy must support export growth and provide a level playing field for U.S.-based manufacturing;
- Strategic tax policies to level the playing field must be implemented, including improvements to the R&D tax credit to keep it competitive with other countries;
- The American research and development infrastructure must be sustained and improved. Special emphasis should be placed on creating research structures that support commercialization of the R&D.

Member News

Dr. Jindrich Henry Kopecek, Distinguished Professor of Bioengineering and Distinguished Professor of Pharmaceutics and Pharmaceutical Chemistry at the University of Utah was recently elected to membership in the National Academy of Engineering (NAE). Henry was cited for his "contributions to the design of hydrogel biomaterials and polymeric drug delivery systems."

Dr. Cato T. Laurencin stepped down, effective July 1, as Vice President for Health Affairs and Dean of the Medical School at the University of Connecticut to become CEO of the Connecticut Institute for Clinical and Translational Science (CICATS). He will remain on the UCONN faculty and continue his research and clinical care responsibilities. CICATS will help develop cross-university and translational research as part of a new state-wide initiative called Bioscience Connecticut.

Prof. Ali Khademhosseini, associate professor of medicine at Harvard Medical School and the Harvard-MIT Division of Health Sciences, will join The University of Texas at Austin's Department of Biomedical Engineering as the Donald D. Harrington Fellow and visiting scholar for the fall 2011 semester. Prof. Khademhosseini is a bioengineer whose research focus is in the area of biomedical microdevices and biomaterials, particularly micro- and nano-approaches to tissue engineered organs and the control of cell behavior.

Dr. Kristi Kiick, professor of materials science and engineering, has been named deputy dean of the University of Delaware's College of Engineering effective August 1. She joined UD in 2001 as an assistant professor of materials science and adjunct professor in chemical engineering, with an affiliation to the Delaware Biotechnology Institute. She served as associate professor in materials science in 2007 until her promotion to professor in 2011.

In Remembrance: A. Norman Cranin, DDS, DEng (1917 – 2011)

A. Norman Cranin, a pioneer in the field of implant dentistry passed away February 20, at age 83, while vacationing on Grand Cayman Island. Among a wide array of contributions to the field of biomaterials, Dr. Cranin served as president of the Society For Biomaterials (1988-1989) and as editor-in-chief of the *Journal of Biomedical Materials Research* (1979-1988).

After graduating from Swarthmore College (1947), and the New York University College of Dentistry (1951), Dr. Cranin shared a dental practice with his father from 1954 through 1982. Norman became inspired by the concept of implant dentistry early in his career and began a series of experiments to explore the concepts. He was one of the first to seriously study the possibilities of oral implants and became an early leader in this area. He expanded the family practice into the new area of implant dentistry and continued to pursue advancements in the field throughout his distinguished professional career. His commitment to the future of implantology and other advancements in dentistry led him to establish the Dr. Samuel Cranin Dental Center (named in honor of his father) at Brookdale University Hospital and Medical Center in Brooklyn, NY, where he chaired the dental and oral surgery program, simultaneously serving as implantologist-in-chief, for 37 years.

Dr. Cranin established the American Board of Oral Implantology in 1969 and served as editor-in-chief of the American Academy of Implant Dentistry's *Journal of Oral Implantology*. He authored the *Atlas of Oral Implantology* and served as editor for several subsequent

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Members News, continued from previous page

editions. Both the Journal and the Atlas remain at the forefront of implant dentistry.

He was recognized by the Society For Biomaterials in 1974 with the Clemson Award for Contributions to the Literature for his many contributions to our discipline. He held many positions within the Society including editor-in-chief of the *Journal of Biomedical Materials Research*. His service culminated in his election as president of the Society. Dr. Cranin made significant contributions to multiple other professional societies related to clinical dentistry and implantology. He was also certified as a fellow in the American Dental Society of Anesthesiology.

Cranin created and led a series of intensive courses in oral implantology that educated more than 1,000 dentists in emerging techniques and procedures. His life-long passion for teaching lead to professorships at multiple institutions including the University of Lille (France) and the University of Pennsylvania, as well as invitations to lecture worldwide. He was awarded a Doctorate in Engineering by the Rose-Hulman Institute of Technology.

In addition to his professional work, Dr. Cranin and his wife contributed generously to several civic and charitable organizations. His hobbies included skiing, sailing, tennis, dancing, and deep-sea fishing. He was a life-long dog lover.

The Society extends its sincere condolences to his wife of 57 years, Marilyn, his children, Jonathan, Andrew and Elizabeth, their spouses and his 6 grandchildren.

Deciding to Attend the 2012 World Biomaterials Congress

Timmie Topoleski, PhD
University of Maryland Baltimore County

I was originally going to start this article with something like "As I sit here during my 13-hour flight to Beijing, I've been thinking about the 2012 World Congress in Chengdu," but I really couldn't bring myself to take out my computer and work, especially with my daughters in the row behind us. Considering the effort already expended to get everything in order for work before leaving, I did *think* about the article, because 13 hours in one seat does give one time to think. I thought about it more today as I limped to the summit at the highest point along the Great Wall of China. It was my fourth visit to the Great Wall, and I thought this would be the ideal place to start a few paragraphs about attending the 2012 World Biomaterials Congress in Chengdu, PRC.

I'm sure many of my colleagues are far more travelled than I, and they would probably relish a long 13 hours of uninterrupted time to get some work done, but, for most of us, China is a long way from where we are, and the long flight is one of the first reasons the trip seems like it is so not going to happen. However, it is not really a difficult proposition to travel to China. We'll speak more of the specifics of travel later, but, for now, I want to give you a few more enticing reasons to get you thinking about the meeting in Chengdu.

The question you may be asking is, "Tim, why are *you* writing about Chengdu?"

Some of you may recall meeting my daughters in Orlando, and you will understand when I say that my current adventure will be our first family trip to China when we've not returned with a new daughter (at least that is the plan). Chengdu was the birthplace of our first little girl, Eliza Jade, and we have a true heart's link to Chengdu. We are looking forward to returning to meet old friends and renew our family's connections.

Before I turn sentimental, however, I need to finish the business of these paragraphs, which is to tell you why you should make the effort to come to the World Congress. Chengdu is the capital city of Sichuan province. Sichuan is the home to most of the world's wild pandas, spicy food and an amazing diversity of culture and natural beauty. In my two trips to Chengdu, I've climbed up and down the sides of the world's largest statue of Buddha carved in the side of the mountain at Leshan, seen the remarkable artifacts of a mysterious civilization that flourished 4,000 years ago at Sanxingdui and held baby pandas, among other things. All of this is within an hour or so of the World Congress venue. If you are looking for a longer side trip, Chengdu is the principal departure city for Lhasa, Tibet. Chengdu holds the old and new China. It is home to one of the last remaining towering statues of Chairman Mao, his arm raised in benediction over his country, ironically facing the McDonald's restaurant across the city park.

Finally, the reason we come to any of these meetings is for the personal connections that help us advance our science, to see and hear the vibrant new ideas in our field and share our recent discoveries with our colleagues. Chengdu may be a long way away, but it is where the very best of our science will be in 2012, and it will be a singular opportunity to share and learn from colleagues we may not see again for years. In addition to the science, the hospitality of our hosts will make this a meeting to remember, and the cultural and opportunities are unique and make for the adventure of a lifetime.

And when you come, it's not a bad idea to stop in Beijing to climb the Great Wall. Or you could stop in Xi'an to see the Terra Cotta Warriors. We'll be headed to Xi'an in a few days. It will be our third trip to see the Terra Cotta Army, but it's really the first time for our girls, and I wouldn't pass it by on any trip to China if I could help it.

See you in Chengdu.

Book Review

By Lynne C. Jones,
Associate Professor, Orthopaedic Surgery
Johns Hopkins University School of Medicine, Baltimore

The Immortal Life of Henrietta Lacks

written by Rebecca Skloot, Copyright 2006
Broadway Paperbacks, a division of Random House, NY.
382 pages, ISBN 978-1-4000-5218-9

Deborah Lacks wanted to find out more about her mother, who died when Deborah was just one year old. Rebecca Skloot wanted to find out more about the donor of the HeLa cells. The book *The Immortal Life of Henrietta Lacks,* written by Rebecca Skloot, accomplishes both. The book is a compelling story about poor tobacco farmers during the 1940s, '50s and '60s. It's about the medical care received by blacks during this time and the life and family of a young black woman raised in that era. Deborah Lacks states, "I know you gotta tell *all* the Lacks story, and there'll be good and bad in that because of my brothers. You gonna learn all that, I don't care. The thing I care about is, you gotta find out what happened to my mother and my sister, cause I need to know." If the book was just about this, it would be an interesting biography. But it is so much more than that. It is a book about the lives that Henrietta and her immortalized cell line have touched. It does not attempt to paint a rosy picture of anyone–it shows the strengths and character of the individuals as well as the flaws.

The book begins with a quote from Elie Wiesel (from *The Nazi Doctors and the Nuremberg Code*):

> We must not see any person as an abstraction. Instead, we must see in every person a universe with its own secrets, with its own treasures, with its own anguish, and with some measure of triumph.

Rebecca Skloot has captured the essence of this quote in her book about Henrietta Lacks–the woman, her family and her cells. This book is actually about the struggle between a family who seeks to personalize research and the research community that has depersonalized it. The aim of this book is to put a face on the HeLa cells that have been used extensively in medical research. Who was the donor and what does it matter? No small task, but Rebecca Skloot is up to the task.

We learn that Henrietta Lacks was a black woman born in Roanake, Va., August 1, 1920. She married a cousin, David "Day" Lacks and had five children: Lawrence, Elsie, David Jr., Deborah "Dale" and Zakariyya Bari Abdul Rahman (born Joe Lacks). She moved to Baltimore in 1941 and raised her family. She was diagnosed with cervical cancer in 1951, underwent radiation therapy, which was ineffective, and subsequently died October 4, 1951. Her family has struggled significantly, both financially and emotionally, during the years since she has passed away.

For scientists, 1951 marks the beginning of the HeLa cell line. From biopsies taken from a cervical tumor, researchers at Johns Hopkins, under the direction of Dr. George Gey, cultured the cells, and, for the first time, were able to maintain human-derived cells over extended periods of time. The cells were termed "immortal" because they could be re-cultured over and over again and continue to be viable. The HeLa cell line has had a significant impact on our understanding of how cells grow and has also been used to study their response to various treatments. Suffice it to say, it revolutionized cell culture.

So where is the story? The conflict? This book details the behavior of the clinicians and scientists involved with the development and utilization of this cell line. The behavior of this group has been questioned about its ethics and morality, and this story has been discussed in numerous ethics classes. Some of the questions include:

- How were blacks given different medical treatment in the 1950s and 1960s?
- The original tissues (tumor and healthy tissue) were removed without consent. What steps have been undertaken to resolve this issue since this time?
- Do scientists depersonalize their research? What other things may create bias for the scientist?
- Should for-profit companies be allowed to commercialize human cell lines?
- Lawrence Lacks states, "She's the most important person in the world, and her family is living in poverty. If our mother is so important to science, why can't we get health insurance?" Should patients and their families be permitted to benefit financially from donated tissue?
- Based upon a different case (Southam), the NIH concluded: "In the setting in which the patient is involved in an experimental effort, the judgment of the investigator is not sufficient as a basis for reaching a conclusion concerning the ethical and moral set of questions in that relationship." The question is how is an objective decision reached? Do clinicians and clinical researchers have to be two different people?
- What is involved in informed consent? Is it possible to obtain informed consent from individuals that may not have the capacity to understand the terminology (what is cancer, e.g.)?

The medical and scientific communities have attempted to address many of these issues. Institutional review boards have been established to review protocols and the handling of retrieved tissues. HIPAA (Health Insurance Portability

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Book Review, continued from previous page

and Accountability Act) has had a significant impact on the confidentiality issues raised in this book. Regarding medical care, there is a continued effort by the medical and research communities to create an environment where medical issues facing black patients are studied and addressed while providing equal medical care. However, access to care by the uninsured continues to be a problem.

I was struck by the text relating to one of the researchers, Christoph Lengauer. He was a young investigator who had developed fluorescence in situ hybridization (FISH) to study cancer cells. He wrote, "I want to tell them a little about what HeLa means to me as a young cancer researcher, and how grateful I am for their donation years ago." How many of us have used human cell lines in our research? Were they from healthy tissue or diseased tissue? Were they immortalized or primary cell lines? Have we thought about the donors and their lives? Have we thought about their contribution to our research?

I believe that this is a "must read" for anyone engaged in clinical research as well as anyone working with human cells. The text is rich in situations for discussion. This book has the potential to educate us and to change our perspective regarding what we do each day.

I believe that this is a "must read" for anyone engaged in clinical research as well as anyone working with human cells. The text is rich in situations for discussion. This book has the potential to educate us and to change our perspective regarding what we do each day.

Additional commentary about this book:
I'll bet the involved scientists curse the day they identified that cell line with a nickname that could be de-coded so easily.

There are conflicting trends in medical science today. On the one hand, investigators are required to keep subject identities confidential and use codes for blood/tissue samples. If there's a code-book, it must be secured well. On the other hand, doctor/scientists are urged to be personal and caring with their patients. Nowadays these two behaviors usually are based in two different people—the clinician who collects the samples and cares for the patient, and the scientist dealing with coded samples who can't care about the unidentified subject in any individual way. When my own career began in the early 1960s, the scientist/sample-collector/doctor was often the same person. That's unlikely nowadays, with multi-center collaborations for highly technical studies.

So should the heirs of Henrietta Lacks be rewarded? It probably would be wise, regardless of the merits of the argument, given that it's a one-off situation. No sample is likely to be so transparently "coded" again. The next profitable cell-line will be "12!!abCD&&," and it won't be easy to re-identify the subject given modern privacy protection.

Is such a situation unusual? Maybe not. Variant proteins are being discovered in patients, and some may be patented and prove useful. Can the issue be covered in an informed consent? It would be one more complicated issue in consents that are already far too long and complex. When I was a young investigator, consents often were verbal and were based on trust between the patient and doctor. Informed consents have grown and grown, until they are multi-page documents—even "simple" ones for a small sample of venous blood. We have a long multi-page informed consent for an observational study on de-identified samples from a group of our patients. Only one of my patients ever read it all the way through—a lawyer. I nearly always have to paraphrase it verbally for patients. I saw a written informed consent from South Africa, which was simple and short and far better than the multi-pager used for the same study in the USA.

Are informed consents worth the paper they're written on? For the odd lawyer/patient, maybe. Otherwise, they're too long and complex and scary, and the patient copy just winds up trashed. Do they make doctors stop and think about what they're doing? I doubt it, not much. I believe the most important protection of a subject is the integrity, judgment and mercy of the investigator. I don't think that any NIH training on research ethics, etc, takes the place of a scientist's inherent high ethical code of behavior. It can be boiled down to the Golden Rule.
Is there racial prejudice in medical care? I've heard occasional patients complain that racism must be responsible for their own poor outcomes. It's hard to tease out the multiple factors leading to poor outcomes in poor people, but I've never seen racially-prejudicial care in California.

Carol K. Kasper MD, Emerita Professor of Medicine
University of Southern California, Orthopaedic Hospital
Los Angeles, CA

Student News

The SFB 2011 Annual Conference and Exposition in Orlando, Fla., featured several student events, including a career fair and student luncheon. The career fair was held on Thursday and featured representatives from 14 companies, national labs and academic institutions. Representatives from industry also provided resume critiques and offered mock interviews. The hour-long event allowed students to network with employers and identify companies that are hiring.

SFB Student Officers '11-'12. (L to R)
Scott Cooper, Beth Pollot, and Susan Stoebner (Not shown: Vahid Serpooshan and Tyler Remund). Photo credit: Azadeh Goudarzi.

The student luncheon, held on Friday, focused on the topic "Exploring Alternative Careers in Biomaterials." The keynote speaker was Dr. Matthew Gevaert, co-founder and CEO of KIYATEC, a company specializing in 3D cell culture technology. Dr. Gevaert stated his experience with academic intellectual property management, startups and large companies taught him to never fear taking a previously unknown path in his career. His talk offered a jumping-off point for students to discuss their careers with members from industry and academia seated at each table.

Students also had a chance to mix, mingle and have some fun at the Bash. The Bash this year was held at Disney's Epcot park, where students enjoyed a fireworks show and after-hours access to the park.

National Student Chapter Officers Elected

As part of the Annual Meeting and Exposition, new officers of the national student chapter were elected. The national student chapter helps coordinate local chapters and plans events at the annual meeting such as the student luncheon and career fair. The newly-elected officers are: Beth Pollot, (University of Texas at San Antonio), Tyler Remund (University of South Dakota), and Susan Stoebner (University of South Dakota). Congrats new to our new officers!

2011-2012 Officers

President: Scott Cooper
scottcooper@ufl.edu
.
President-Elect: Beth Pollot
bepollot@gmail.com

Secretary/Treasurer: Vahid Serpooshan
vserpooshan@yahoo.com

By-laws Chair: Susan Stoebner
susan.stoebner@usd.edu

Secretary/Treasurer – Elect: Tyler Remund

UT/UTHSC San Antonio Chapter News

Last semester we started providing industry tours for our members. We have been to several companies including FaceKey, BoneBank, Entrigue Surgical, and KCI. We have also set up Journal Club meetings and have at least two or three each semester. This gives our members a great way of learning about different fields in a fun atmosphere.

Last semester our group activity was skydiving. Several of our members joined in, and let me tell you, it was definitely a bonding experience. We also have hopes of doing a cookout this semester for our current members and to attract new ones.

This past month we were also able to set up a viewing of a cardiac surgery implanting a mitral valve clip made of a biomaterial. This really gave our members an idea of how surgeons use the materials that we make. We worked with Texas A&M to help set up their Biomaterials Day in May. We car-pooled members from our society to support A&M and meet and greet our fellow biomaterials enthusiasts.

As far as community service goes, we have been at several events this year reaching out to kids ranging from middle school to high school to entering college! It is our hope that by showing them about biomaterials early, we will instill a passion for learning about and using biomaterials. Lastly, we have recently been working to raise funds for our society in the hopes of giving back to the community or providing a small scholarship. Needless to say, we have a lot going on!

Lauren Cornell
Public Relations Officer

Wake Forest University Chapter News

The purpose of the Wake Forest University chapter of the Society For Biomaterials (SFB) is to encourage the interdisciplinary development, dissemination, integration and

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Student News, continued from previous page

utilization of knowledge in biomaterials primarily among students, the Wake Forest University community, but also among other members in the field of biomedical and material sciences and research.
www.inwake.com/sfb

University of Michigan Chapter News

Our student chapter was just recently formed in the spring of 2011. We helped to organize the Upper Midwest Biomaterials Day at U of M, May 12-13, 2011 with the help of two faculty co-chairs, Dr. David Kohn and Dr. Jan Stegemann, and generous sponsorship by SFB. Organizing a conference has given us an opportunity to make connections within U.M. and around the region in academia and industry. Following this conference, we are looking forward to organizing more biomaterials-related events!

Melanie Gupte
Secretary-Treasurer

Case Western Reserve University Chapter News

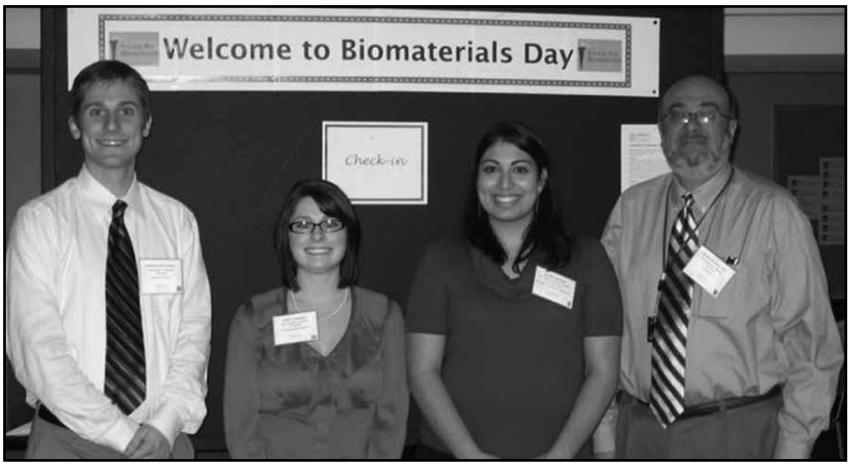
The Case Western Reserve University chapter wanted to thank all the members, donors and participating schools that came to our student-organized conference: Biomaterials Day research symposium November 6, 2010. Attendance included undergraduate students, graduate students, professors and members of industry from 11 institutions. The day started with a keynote address by Dr. William Landis of The University of Akron followed by six breakout sessions in the morning and afternoon. The session topics Drug Delivery I, Drug Delivery II, Materials, Cell-Materials Interactions, Orthopedics, Tissue Engineering/Nanotechnology were comprised of over 50 oral presentations and 60 posters. The day also included a luncheon industry panel with individuals from Depuy Inc., Steris Corporation, Oakwood Laboratories, SDG Pharmaceuticals and ASM International. Students were able to ask questions and learn about possible careers in industry and how to best prepare themselves. We really appreciated the phenomenal participation and look forward to the next regional conference being planned by the University of Michigan!

Andrew Shoffstall
Vice President

University of Rochester Chapter News

As for the University of Rochester Student Chapter of the Society for Biomaterials, I am pleased to announce that we are now up and running! We are currently focused on spreading interest and gathering new members as we begin to structure our quarterly meetings. Already have plans in the works for a student night this spring.

Michael Hoffman
President



Biomaterials Day Organizers (L to R)
Chapter VP Andrew Shoffstall, Secretary Christa Modery, President Alyssa Master and faculty advisor Dr. Nick Ziats

University of Kentucky Chapter News

We were JUST officially accepted for starting our chapter with SFB about 2 weeks ago. Other than officer elections, and winning a travel award, we are just starting up with activities and meetings. The only thing we have is a website, but it is still in the works of being updated.
http://sfb.engineering.uky.edu/

David Cochran
Vice President

University of South Dakota Chapter News

As the first President of the University of South Dakota Student Chapter of the Society for Biomaterials, I would like to announce our formation and acceptance into the organization in mid-February. Currently, our main focus as an organization is a journal club, but we look forward to informing our fellow students at USD about opportunities in the field of biomaterials.

Matthew Tanner
President

Columbia University Chapter News

The Columbia University chapter of the Society For Biomaterials organized a *Biotechnology Networking Session* which was held on February 21, 2011 in the university's historic Low Library. The event featured representatives from LifeCell, Covidien, NuVasive and L'Oreal Research & Development, who came to network with graduate students in the life sciences and provided them with insight on research opportunities in industry. The event was well-received and attended by over 60 M.S. and Ph.D. students from a variety of disciplines, ranging from Earth and Environmental Engineering to the Biological Sciences. The Columbia SFB chapter aims to make the event an annual occurrence and hopes to attract a larger and more diverse group of employers next year. More information regarding the event and additional photos are available on the chapter website http://www.columbia.edu/cu/sfb/

Sid Subramony
President

Student News,
continued from previous page

University of Memphis Chapter News

This past academic year, the University of Memphis SFB student chapter hosted Biomaterials Day 2011. With this event our goal was to increase collaborations between universities and companies that are interested in the field of biomaterials and biomaterials research by fostering networking and professional development. We had an overwhelming attendance of over 180 attendees. Ten universities were represented with 140 students and faculty attendees. Additionally, more than 40 biomedical industry representatives from Medtronic, Inc., Wright Medical Technology, Smith & Nephew, MB Venture Partners, Active Implants, Surmodics Pharmaceutical, Inc., Sandvik and Extremity Innovations were present at the day-long event.

***Kickball Social (L to R):** Heather Doty, Karen Sedacki and Lilia Rodriguez*

The student chapter organized company tours of Gyrus Acmi-ENT and Smith & Nephew. We have also volunteered twice for Le Bonheur Children's Medical Center, Memphis, Tenn. In doing so, we interacted with patients and their families in the play rooms, making arts and crafts projects for the activities cart and passing them out to the children. The student chapter also volunteered in the renovation of a local elementary school, KIPP Diamond Academy, Memphis, Tenn., so that the children may have a safe and interactive environment to study within. We have also had several social events including Laser Tag and Pizza Socials as well as a BBQ and Kickball Social for the SFB student members to socialize, have fun and relax.

We now have website which we are constantly updating with new information about our chapter.
http://sites.google.com/site/memphissfb/home-1

Marvin Mecwan
President

Congratulations to Chapters Receiving Travel Awards to the 2011 Annual Meeting!

- Case Western Reserve University
- University of Florida
- University of Kentucky
- University of Memphis

Travel awards of $500 are given to local chapters to increase student involvement at the annual meeting. If your chapter is interested, contact a national student chapter representative.

CALL FOR NOMINATIONS

Society For Biomaterials

The Society For Biomaterials is soliciting nominations for the 2012 Awards listed below, and for the following Board of Directors positions:

- President-Elect
- Member-At-Large

2012 Awards:

- Founders Award
- C. William Hall Award
- SFB Award for Service (NEW!)*
- Clemson Award for Applied Research
- Clemson Award for Basic Research
- Clemson Award for Contributions to Literature
- Technology Innovation & Development Award
- Young Investigator Award
- Student Award for Outstanding Research
- Outstanding Research by a Hospital Intern, Resident, or Clinical Fellow Award

Nominations Deadlines

Awards: September 16

Board of Directors: September 23

*The Society For Biomaterials Award for Service is a new award intended to honor significant service to the Society For Biomaterials. This award is open to any individual, corporate or government entity.

For more information on any of the awards, or to nominate someone for an award or position on the SFB Board of Directors, please visit:

www.biomaterials.org