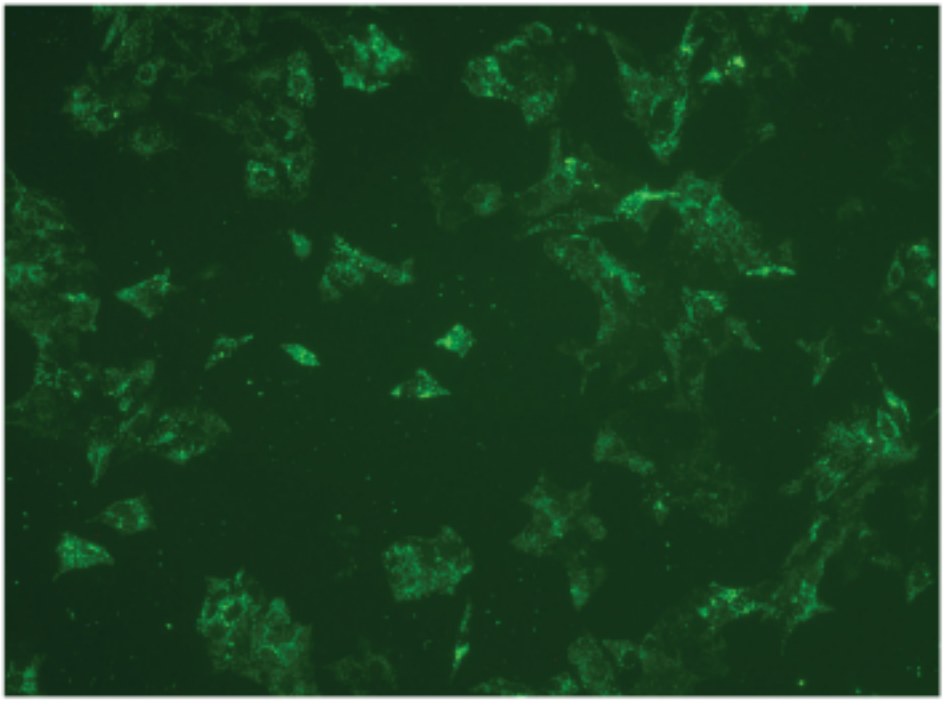
Re-Engineering Engineering Education

BIOMATERIALS FORUM

OFFICIAL NEWSLETTER OF THE SOCIETY FOR BIOMATERIALS

Third Quarter 2009 • Volume 31, Issue 3



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The official news magazine of the **SOCIETY FOR BIOMATERIALS** • Volume 31, Issue 3

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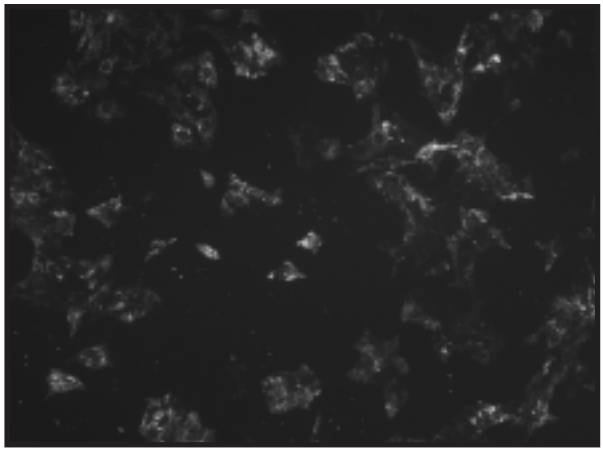

Calcium phosphate nanoparticles labeled with BSA-AlexaFluor 488 interacting with SKOV-3 ovarian cancer cells. Photograph courtesy of Drug Delivery Special Interest Group reporter Dr. Liisa Kuhn, faculty member at the Center for Biomaterials at the University of Connecticut Health Center.

From the Editor

By Karen J.L. Burg

The American Recovery and Reinvestment Act of 2009 (ARRA) is an economic stimulus package established by the United States Congress in February 2009. The Act was intended to provide a stimulus (approximately $787 billion of stimulus) to the U.S. economy in the wake of the economic downturn. The Act includes domestic spending in health care research, which is of high interest to those of us involved in biomaterials research in the U.S., and it is likely of interest/amusement to those involved in biomaterials research not in the U.S. So, do you think the American Recovery and Reinvestment Act (the trigger for "stimulus funds") will serve its intended purpose? I have asked myself this question many times, and I now find myself asking tougher questions about the short- and long-term costs and impacts of the program on biomaterials research.

What is the net cost of the program? Consider the time invested in proposal writing, the time invested by sponsored program offices across the country, the time invested in processing, reviewing and post-awards reporting (all massive tasks), and I start wondering if the "free" money isn't a very expensive proposition. Our recent SFB San Antonio meeting, in fact, coincided with an NIH Challenge Grant deadline (supported by ARRA funding); you may have noticed a large dip in session attendance corresponding with this deadline and with people fleeing to the quiet of their hotel rooms to make those last-minute revisions and upload their grant applications.

Has it undermined trust in the funding organizations? Even non-ARRA grants have been affected by the furor over this new-found "extra" money. I was mildly amused to find out NIH received so many applications in response to their TR01 (transformational research) call for proposals (which were not ARRA tagged, but were ARRA affected as they were submitted during the unfortunate mass demand for reviewers the recovery act proposals stimulated) the NIH was overwhelmed and simply performed a cursory, in-house review of the front page of submitted proposals to determine the ones to go to panel review. It does make me ponder if PIs would have invested the enormous amount of time (and therefore money) in compiling and processing a multiple-page, full proposal, if they had known it would only receive a scan of the first page. Hindsight suggests a better plan would have been to ask PIs to just submit a one-page concept paper. The perhaps mythical, nearly 1 percent funding rate for this program also gives me pause. The National Science Foundation has taken a different approach toward ARRA fever and provided supplemental funding to many of their programs but has been similarly caught in the non-trivial problem of providing high-quality processing and peer-review services in the midst of a deluge of proposals and the high demands for would-be reviewers. In the past, federal agencies have carefully sought reviewers with a track record and experience; in this very unique year, mass e-mail requests for reviewers have been sent and the criterion one must meet to serve as reviewer are almost nonexistent. The federal agencies simply were not ready to handle a deluge of paperwork and really had no time nor effective processes to strategize.

Have institutions been tricked into forgoing hard program decisions? But wait—there's more. I also believe that many already overburdened, cash-strapped universities will temporarily refocus their post awards systems to the rather massive accounting task required for ARRA money. Inspector Generals of the 28 federal agencies distributing ARRA funds are charged with reviewing the use and management of these funds. I would have a very hard time answering the question, "Were the ARRA funds awarded and distributed in a prompt, fair and reasonable manner?" in the affirmative. I do believe there will be a spike in temporary employees at the federal agencies to handle and process the vast amount of paperwork, but was this the intent of the money? According to government documents, "The ARRA includes unprecedented levels of reporting requirements beyond the traditional federal audit requirements." What most of us failed to see in the bright lights and the lure of easy money was the fine print of ARRA accounting. The goal is transparency, i.e., that the U.S. taxpayer must be able to see the impact of the stimulus dollars (see www.recovery.gov to better understand the goal of tracking dollars invested—this Web site tracks who received ARRA money, how and where it was spent). Therefore, ARRA grants must have distinctly separate accounts, and they also require quarterly reports until all money is spent. This means federal financial systems, grant- and contract-writing systems, reporting systems and payroll systems must all be adjusted to prevent co-mingling of ARRA funds with non-ARRA funds. PIs must be reprogrammed for continual report writing. University systems are simply not designed in the corporate image, and many do not have the real time response rate nor financial resources to quickly flex to accommodate this temporary but high surge in activities.

Before the stimulus, the trends towards reduced state funding of public universities and flat government funding (we will undoubtedly soon return to this) meant that universities were going to have to streamline their operations and focus to match the reality of these reduced funding levels. I believe most responsible organizations were poised to meet this challenge. However, the bolus of stimulus money has encouraged just the opposite thinking—build and expand. It seems the stimulus has pushed universities in a direction to make it even more traumatic to make the necessary cuts once the steady-state funding levels return. This suggests spikes in government funding are likely wasteful, since the surge projects are likely not sustainable, and perhaps irresponsible.

What do you think? Of course it's always easy to critique from the sidelines, but I am dismayed at what appears to be a huge opportunity lost. Please do not misunderstand, I am grateful for the new, energy efficient light ballasts, the laboratory renovation money, the extra NSF Career awards, the equipment and all the extra funds that my university has been awarded through the ARRA, but I just wonder if we are not simply creating new costs in other directions and will be surprised when the end result is a net zero gain (or worse). I liken the process to the usual zeal involved with the concept of recycling—it seems like a worthy plan on the surface, but when one calculates the energy input to the system (sorting, refurbishing, etc.) one realizes one has to be very specific about value added claims. I just question if we wouldn't see exactly

From the President

In 1969, William Hall and Sam Hulbert envisioned a group of biomaterials scientists who would meet together to share their experiences and knowledge. This vision has cascaded into what is now the Society For Biomaterials (SFB). Based on the original premise, the primary focus of SFB has been its annual meeting and associated networking. In fact, the addition of new members to the Society has been influenced primarily by the potential recruits' impressions of the annual meeting: Did they participate through oral or poster presentations? Was the science and education of the meeting outstanding? Who did they meet? What was the networking experience like? Therefore, one of the primary foci of the SFB has been to strengthen the content and networking opportunities of the annual meeting, with the result that the most recent annual meeting in San Antonio, Texas, had an outstanding program with numerous keynote presentations, panel discussions, tutorials, workshops and symposia to complement the oral and poster presentations. It also afforded numerous networking opportunities, including a "fun" venue at the BASH Reception at the Institute of Texan Cultures and the Special Interest Group (SIG) mixer to honor the Clemson Awardees.

The SFB, however, is much more than the annual meeting. It provides editorial leadership and reviewers for two scientific journals—*The Journal of Biomedical Materials Research* A & B. Leaders in the Society have also been responsible for one of the most comprehensive textbooks used in the field, *Biomaterials Science*, and the SFB has been recognized as a sponsor of that endeavor. The SFB has now endorsed a new book series to be published by Wiley, which will address key topics in the field and provide another collaboration opportunity for our membership. The SFB is a place where colleagues are introduced and friends and colleagues made—not only at the annual meeting but also throughout the year by contact with fellow Special Interest Group members, committee members, Biomaterials Days and get-togethers at other professional meetings. Another major role of the SFB is to act as an advocate in Washington for SFB members. For example, many members are very active in the American Institute of Medical and Biological Engineering (AIMBE). For the past three years, AIMBE has organized groups to meet with U.S. Senators and Representatives to advocate for our interests, including increased funding and improved regulation relating to biomaterials.

What can the SFB do to transition into a "year-round" society? One approach would be to hold smaller meetings throughout the year. This year, the SFB is endorsing five Biomaterials Days and providing a small but substantial amount of financial support (our stimulus package, so to speak). These gatherings are opportunities for students, faculty and SFB members in the surrounding areas to meet and discuss cutting-edge research and network. The SFB will be initiating the Hall Scholarship, which will provide an educational opportunity for undergraduate students. We are also exploring other social networking opportunities—a presence on Facebook, YouTube and LinkedIn has been discussed, as have Webinars and K-12 outreach. One of our past presidents, Martine LaBerge, encouraged us to focus on the possibilities. Doing so is more important now than ever.

I would like to thank our immediate past president, Jeffrey Hubbell, for his strong leadership during the past year. He oversaw the transition in editor-in-chief of *JBMR-B*, was instrumental in making substantive upgrades to the format of the journals and has taken the position that our journals need to be recognized as the top journals in our field. He also has encouraged us to make sure we keep the scientific content rigorous at our meetings and continues to believe the SFB must take a proactive role in cementing its leadership position in the biomaterials community.

I am excited about the possibilities for this year. The SFB committees are actively working to continue to provide value to our membership. I encourage each of you to communicate with these committees about your professional needs and desires (see our Web site for contact information: www.biomaterials.org/volunteer_leadership.cfm). The most important advice I can give is to get involved. The SFB is not only a society that allows for membership involvement—it encourages it.

From the Editor

Karen J.L. Burg

Continued from page 2

the same stimulus response by sprinkling money out of an airplane or assigning grants via random number generator.

Best wishes from Clemson,

Karen J.L. Burg
Hunter Endowed Chair & Professor of Bioengineering
Interim Vice Provost for Research & Innovation
Clemson University

Staff Update

The Society For Biomaterials is pleased to report a record 1,056 abstracts have been submitted for the 2010 Annual Meeting. The theme for the 2010 Annual Meeting of the Society For Biomaterials, *Where Materials Meet Biology*, reflects the central position of the biomaterials discipline in fostering development of new implant materials and devices for improvement of the human condition. Accomplishing this, both in the past as well as in the future, requires integration of the latest advances in the physical and biological sciences and engineering. The goal of the 2010 meeting will be to describe the latest innovations in materials science, molecular and cell biology and engineering and identify new opportunities and mechanisms for translation of these findings into new or improved medical treatments for traumatic injury and disease. The program will include Symposia, General Sessions, Workshops, Panel Discussions and Tutorials covering all aspects of basic, applied and translational biomaterials science.

“The goal of the 2010 meeting will be to describe the latest innovations in materials science, molecular and cell biology and engineering and identify new opportunities and mechanisms for translation of these findings into new or improved medical treatments for traumatic injury and disease.”

Committee Reporting: Each of The Society's committees is listed below, along with progress against the goals that each committee would like to accomplish during their year term.

- **Awards, Ceremonies and Nominations Committee:** Jack Lemons, University of Alabama at Birmingham (Chair). The Awards, Ceremonies and Nominations Committee received 35 award nominations for the 2010 Awards. The Committee made a recommendation to Council for the 2010 Awardees and the 2010 slate of officers at the October 23 Council meeting.

- **Bylaws Committee:** Lisa Friis, University of Kansas (Chair). Horst Von Recum is spearheading an effort to revise Article IX on the Special Interest Groups in its entirety. A proposal is expected for membership approval at the 2010 Annual Meeting.

- **Devices and Materials Committee:** Gabriele G. Niederauer, ENTrigue Surgical (Chair); Jeremy L. Gilbert, Syracuse University; Kristine Kieswetter, Kinetic Concepts; Paul Spencer, Surmodics Pharmaceuticals Inc.; Warren O. Haggard, University of Memphis; Ann B. Salamone, Rochal Industries and Bruce Anneaux, Zeus Inc. In 2009-2010, the Devices and Materials Committee will focus on four objectives: establishing an industry advisory board to assist with setting programs to meet the needs for corporate professional and leadership development; creating an exhibitor/sponsor consultative group to provide input on meeting exhibits and similar venues; providing input to the Liaison Committee on representatives to standards organizations such as ASTM and ISO; and developing programs for the Annual Meeting to provide clinical relevance to biomaterials product development.

- **Education and Professional Development Committee:** David Kohn, University of Michigan (Chair). The committee has evaluated several endorsement requests, and has implemented the launch of a new Biomaterials Day grant program with grants being awarded to Clemson University, Johns Hopkins University/Penn State University/University of Maryland, University of Kentucky/Case Western Reserve University, Texas A&M University, and Columbia University. The committee continues its work on improvements to the Web site, a mentorship program, and a webinar series.

- **Finance Committee:** Laura J. Suggs, University of Texas at Austin (Chair). The committee continues to monitor the Society's long-term reserve investments and is working on the development of the 2010 budget. Budget priorities for 2010 include the success of our Annual Meeting, the productive relationship with our publishing partner, John Wiley and Sons, and on recruiting and maintaining the Society's sponsors. Current efforts for the committee are focused on sponsor recruitment strategies and sponsorship opportunities.

- **Liaison Committee:** Molly Shoichet, University of Toronto (Chair). The committee continues to seek opportunities for collaboration with the Orthopaedic Research Society, Materials Research Society, Biomedical Engineering Society and other organizations at the Society's Annual Meeting and throughout the year.

- **Long Range Planning Committee:** Jeremy Gilbert, Syracuse University (Chair). The committee has reviewed the long-range plans prepared by previous committees and started with asking the questions: Why do we exist? What are the core activities and unique characteristics of the Society around which we should shape our future plans and efforts? The creative and focused answers to these questions should direct and shape what we do and how we do it as a Society. Given the significant generational changes and research focus changes the Society (and biomaterials community) has experienced, it is essential to plan and carry out activities that will preserve the important and unique aspects of

our Society while seeking to continually attract the most relevant and the highest quality scientists and engineers to our community. Please send us your thoughts!

- **Meetings Committee:** Lynne Jones, Johns Hopkins University (Chair). The Committee has re-evaluated the Society's abstract submission processes, and has evaluated a proposal from headquarters staff for a new meeting Web site. The new Web site will likely premiere with the 2011 Annual Meeting. The committee continues to investigate the potential of jointly sponsored meetings with other societies, to assess the funding and sponsorship revenue of our annual meetings, and is developing recommendations for increasing these sources of revenue to better offset meeting attendee registration costs. The committee will also be evaluating social event options and future meeting locations in the near future. Lynne Jones is also soliciting suggestions for a community based service project in Seattle during the 2010 Annual Meeting. Please forward any information on worthwhile local organizations or events to Lynne Jones (ljones3@jhmi.edu) for consideration.

- **Membership Committee:** Nicholas Ziats, Case Western Reserve University (Chair). The committee met by phone conference in June and discussed a number of issues including our decline in membership and potential ideas for solving this concern. These ideas were sent to the Council for consideration. We have also submitted a budget for the upcoming year. The Committee plans to work with the Education & Professional Development committee to set up more student chapters for the upcoming year and chapters are now being established at Case Western Reserve University and University of Kentucky.

- **Program Committee:** Phil Messersmith, Northwestern University (Chair). The committee has reviewed ideas submitted from the Society's Special Interest Groups and from the general membership, invited full proposals, evaluated those proposals, and has compiled the preliminary list of 64 sessions for the 2010 Annual Meeting. The quantity and quality of abstract submissions will determine how many of the proposed sessions are actually presented in Seattle.

- **Publications Committee:** Ashutosh Chilkoti, Duke University (Chair). The committee has made recommendations for revisions to the editorial processes within each journal and is working to develop strategies to reduce the backlog of articles in the pipeline. The committee has also made recommendations to the Council for the editorship of a forthcoming book series, which will be announced shortly.

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

Sincerely,

Dan Lemyre, CAE
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Special Interest Group News

The drug delivery Special Interest Group (SIG) is composed of 86 student members and 175 active, full members. The primary goal of this SIG is to address issues related to spatial and temporal control of the release of functionally active components from materials and devices. Control of drug release can be achieved by (but is not limited to) biomaterial design, mechanical mechanisms or chemical reactions in a timed or responsive mode. Controlled drug delivery has wide-ranging implications in the advancement of many biotechnology fields, including medical devices, tissue engineering scaffolds and novel pharmaceutical formulations. SIG member Michael Caplan provides an overview of mathematical modeling as a tool in controlled delivery.

Mathematical Modeling in Drug Delivery

Michael R. Caplan
Associate Professor
Arizona State University
School of Biological and Health Systems Engineering

Mathematical modeling can be useful as a tool for rational design of drug delivery technologies and delivery strategies. However, investigators new to mathematical modeling often find novel research articles based on modeling techniques to be impenetrable due to the background knowledge necessary to understand where the equations come from and how to execute the models in available software packages. This article is intended to provide a starting point for investigators interested in applying mathematical modeling to drug delivery applications.

Pharmacokinetics (PK) is a familiar term describing a branch of pharmacology which studies the dynamic behavior of drugs in the body. Mathematical modeling is often used in conjunction with PK studies to understand the action of various mechanisms to clear, store, breakdown, etc the drug. In their simplest form, these models are based on simple chemical kinetics, although a great deal of complexity can be added. Many PK models use compartmentalization to study distribution of drug to different organs, blood, etc;[1] however, the simple example provided here only uses one compartment for concentration of drug in the blood.

Chemical kinetics describes the rate of change in concentration of a chemical species. Mechanistic chemical reactions can add or remove the chemical. Take for example an enzymatic reaction S + E → P + E. If S is the chemical of interest (drug is being degraded by an enzyme), one could write an equation using Michaelis-Menten kinetics to describe breakdown of S:

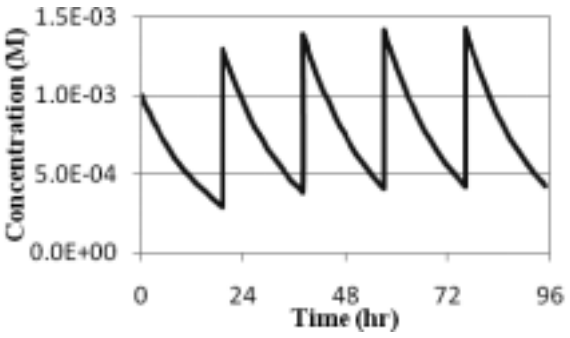
$$\frac{\partial C_S}{\partial t} = -\frac{V_{\max} C_S}{K_M + C_S}$$

where C^S is the concentration of S, V_{max} is the maximum rate of the reaction, K_M is the substrate concentration at which the rate is half-maximal, and t is time.[2] Notice that the rate is negative because drug is being degraded. Additional terms can be added to represent other forms of drug elimination such as filtration in the kidney:

$$\frac{\partial C_S}{\partial t} = -\frac{V_{\max} C_S}{K_M + C_S} - K_e C_S$$

In this case, we choose to model filtration as first-order with a rate constant k_e.Typically numerical solvers are used to solve this ordinary differential equation to find concentration of the drug. Matlab (Mathworks) is a common choice. Help files within Matlab for the various numerical solvers *ode23*, *ode45*, *ode15s*, etc. provide a guide to how to encode the above equation. The result is a matrix with two columns: time and concentration of drug. Notice that time and concentration units are defined by the parameters used.

Even this very simple model can be a useful tool in designing a dosing scheme, for example designing a daily injection regime to avoid the drug concentration becoming too high or too low.



This model was creating using only the equation described above, setting the initial condition equal to the dose of a drug (1 mM - set here as a concentration but could divide dose in mass units by blood volume), running the simulation for 24 hours, adding 1 mM to the final concentration computed, running again, and so forth. As can be seen, the dosing eventually (after 4 days) reaches a repeating cycle increasing to approximately 1.43 mM and decreasing to approximately 0.43 mM. In addition to changing the dose or timing, parameters likely to vary patient-by-patient (such as the enzyme parameter, V_{max}, and kidney filtration rate, k_e) can be studied to predict the robustness of various delivery schemes despite patient variability.

The field of biomaterials is particularly interested in controlled release devices which add complexity in that the release rate is continuous but not constant. The above model could be adjusted by addition of a source term (positive term to right of

equals) matching measured or estimated release kinetics (e.g., burst followed by linear release). Modeling the particle itself requires tracking drug concentration as it varies within the particle; thus, spatial variables are required as described below.

Introduction of spatial variables creates a partial differential equation with concentration varying in both space and time as in the general equation for mass transport:

$$\frac{\partial C_i}{\partial t} = \nabla \cdot (D_{ij} \nabla C_i) - v \cdot VC_i + R_i$$

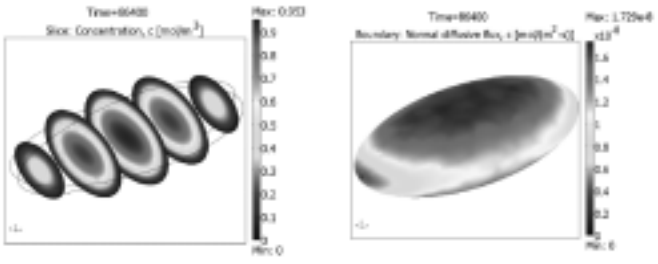
where D_{ij} is the diffusion coefficient of the solute i in the solvent j, $\boldsymbol{v}$ is the bulk fluid velocity, and R_i includes any reactions consuming or creating i as described above. Flow in a porous medium requires adding coefficients for porosity and filtration.[3]

The Matlab solver *pdepe* can be used to solve relatively simple, linear equations when only one spatial variable is required (such as radial diffusion/convection). *pdepe* requires defining c, f, s, and m as defined by:

$$c \frac{\partial u}{\partial t} = x^{-m} \frac{\partial}{\partial x} (x^m f) + s$$

To recapitulate the mass transport equation, f is defined as "DuDx" ($\partial u/\partial x$), c as $1/D_{ij}$, and s is defined to incorporate any convection or reaction terms. The power m defines the coordinate system: 0 - Cartesian or axial cylindrical, 1 - radial cylindrical, 2 - radial spherical. Boundary conditions (known concentration or flux) must also be defined at two values of the spatial variable.

Models requiring more dimensions (2-D or 3-D spatial resolution) or anisotropy require using finite difference or finite element methods. COMSOL Multiphysics is a relatively user-friendly finite element solver. The basic package can solve diffusion problems such as release of a drug from a controlled release capsule.



This simulation uses the 3D Diffusion module to simulate an ellipse (3 x 1.5 x 1 cm), with initial drug concentration of 1 mM, diffusion coefficient of 1×10^{-10} m^2/s, and boundary of the ellipse set to zero concentration. Using a transient, time-dependent solver provides solutions at times from 0 to 86400 s (1 day). Although concentration data (above, left) can be useful for understanding, flux at the surface (above, right) provides quantifiable predictions of the release rate of drug from the capsule.

This introduction to application of mathematical modeling to drug delivery only touches on the simplest of models. Models have been created to describe release from degrading polymers, diffusion in anisotropic tissues such as brain, and convection-enhanced delivery into tissue as well.[4-6] Binding terms can be incorporated to describe growth factor binding to scaffolds or other extracellular matrix, and similar terms can describe targeting via cell surface receptors.[7] Although there are practical limits to the phenomena which can be modeled, these techniques are very powerful and can at least approximate the function of most systems of interest.

As biomaterials scientists increasingly bring quantitative tools to bear on drug delivery, the ability to perform rational design will become more predictive and less trial-and-error. Such advances in biomaterials science can potentially improve patient outcomes, decrease cost of developing new delivery devices, and decrease the time before which these devices reach the market. Recently, at the ASAIO meeting (Dallas, May 2009), the FDA participated in a session on the use of computational fluid dynamics to speed up approval of cardiac assist devices.[8] There may be potential for mass transport modeling to be used in a similar way for speeding up approval of drug delivery devices.

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By Guigen Zhang,
University & Research Institution News Contributing Editor

NIH Receives 20,000 Applications for RC1 Challenge Grants

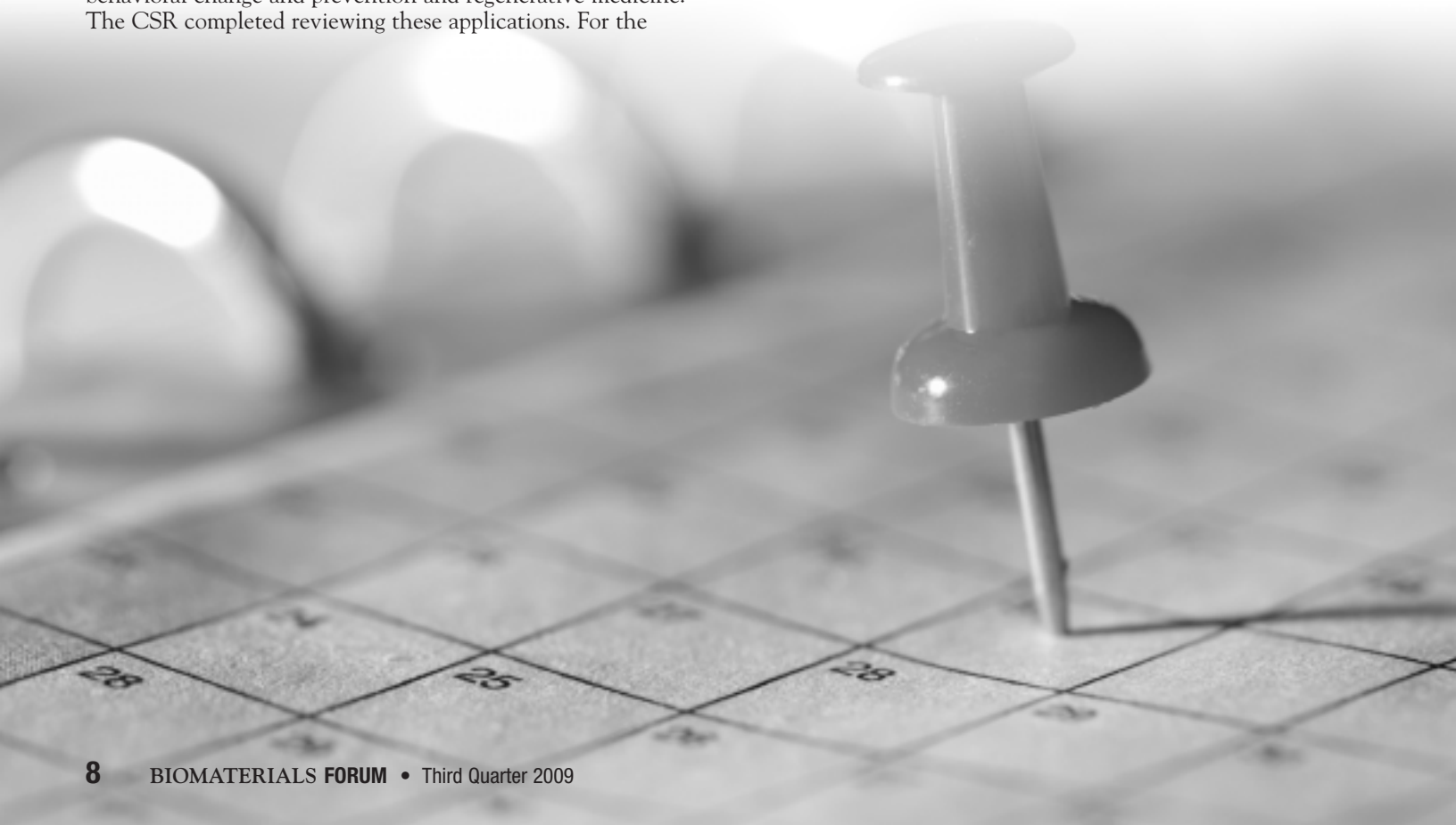
If you did not submit a Challenge Grants proposal, it is too late to do anything about it now. The number of RC1 applications submitted to the National Institutes of Health is in—it is a high number, but it is not as bad as some of us might imagine. The NIH received approximately 20,000 applications for the RC1 Challenge Grants. This number of applications is just slightly higher than the total number of applications NIH usually receives in one of the agency's three major review rounds each year. The NIH's Center for Scientific Review (CSR) typically reviews 16,000 applications in each of the three main yearly review rounds. However, if you estimate that only some 200 applications may be funded, it is a roughly one percent funding rate, much lower than that in a regular funding cycle.

The Challenge Grants program is designed to spur new areas of research and trigger an influx of research dollars into communities across the nation. NIH requested applications on topics in 15 broad scientific areas the agency believes will benefit from a jumpstart or where scientific challenges need to be overcome. They include bioethics, translational science, genomics, health disparities, enhancing clinical trials, behavioral change and prevention and regenerative medicine. The CSR completed reviewing these applications. For the RC1 Challenge Grants applications, the CSR used a two-stage review process. Stage one was mail review and Stage two was the usual in-person study section review meeting. According to the NIH, Stage one was completed by late June, and Stage two completed by late July.

All Challenge Grant applications received a summary statement containing critiques with criterion scores from three assigned reviewers. Scores and summary statements were made available in August 2009. Challenge Grant awards were issued by September 30, 2009.

NIH expected to devote at least $200 million in the American Recovery and Reinvestment Act (ARRA) funding to Challenge Grants. In addition to the approximately 200 Challenge Grants that were funded by the NIH Office of the Director, it is likely more than 200 ARRA-related grants were funded by NIH Institutes or Centers.

Hope you got a piece of the pie if you did submit a Challenge proposal.



Members in the News

Congratulations to:

Dr. Cato T. Laurencin, Vice President for Health Affairs at the University of Connecticut Health Center and Dean of the University of Connecticut School of Medicine, who was awarded a prestigious Presidential Award for Excellence by President Obama. The Presidential Award for Excellence in Science, Mathematics and Engineering Mentoring, awarded each year to individuals or organizations, recognizes the crucial role that mentoring plays in the academic and personal development of students studying science or engineering.

Dr. Laurencin has achieved national and international prominence as an orthopaedic surgeon and chemical engineering expert. He holds the Health Center's Van Dusen Endowed Chair in Academic Medicine and is a professor in the Department of Orthopaedic Surgery. He also holds an appointment in the School of Engineering as a Professor of Chemical, Materials and Biomolecular Engineering. Dr. Laurencin is a Fellow of the American Surgical Association and the American Academy of Orthopaedic Surgeons and has been named to America's Top Doctors. Dr. Laurencin is an elected member of the Institute of Medicine of the National Academy of Sciences.

Congratulations also to Dr. Laurencin for his recent election to the Connecticut Academy of Science and Engineering. Election to the Academy is on the basis of scientific and engineering distinction achieved through significant contributions in theory or applications, as demonstrated by original published books and papers, patents, the pioneering of new and developing fields and innovative products, outstanding leadership of nationally recognized technical teams, and external professional awards in recognition of scientific and engineering excellence. By statute, the Academy's membership is limited to 250 individuals.

Dr. Kristi S. Anseth, Distinguished Professor and Howard Hughes Medical Institute Investigator, Department of Chemical and Biological Engineering, University of Colorado at Boulder, who is the winner of the 2009 Professional Progress AIChE award. This prestigious AIChE award recognizes outstanding progress in the field of chemical engineering. The recipient must be less than 45 years of age at the end of the calendar year in which the award is presented and must have made a significant contribution to the science of chemical engineering.

Congratulations also to Dr. Anseth for her recent election to the Institute of Medicine (IOM). The IOM is an honorific membership organization and a policy research organization. The Institute's members, elected on the basis of their professional achievement and commitment to service, serve without compensation in the conduct of studies and other activities on matters of significance to health. Election to active membership is both an honor and a commitment to serve in Institute affairs. Dr. Anseth was cited for "seminal contributions to the rational design of biomaterials for tissue engineering, drug delivery, biosensing applications and for leadership in the biomaterials community."

BioInk

Steve T. Lin, Industrial News Contributing Editor
From Press Releases

Visiogen Inc. (Irvine, Calif.) has raised $40 million from new and current investors to support the global rollout of the company's lens that can correct for both near- and far-sightedness. The product, called Synchrony, is known as a dual optic accommodating intraocular lens. The lens has been implanted in more than 1000 patients. Visiogen's target markets are the 1.3 billion presbyopes (far-sightedness patients) and 14 million cataract procedures performed annually. The new funding was led by Novartis Venture Fund and Technology Partners.

Peak Surgical (Palo Alto, Calif.) has released positive results from a preclinical study demonstrating the use of its Peak PlasmaBlade is associated with improved fascia incision healing in an *in vivo* model compared to the use of traditional electrosurgery. Histological evaluation of the rat fascia incisions demonstrated the PlasmaBlade produced a 75 percent reduction in acute thermal injury depth with significant reductions in healed fascial scar width at one, two and six weeks compared to the traditional electrosurgery tip. Overall, the PlasmaBlade demonstrated reductions in acute thermal injury depth, healed fascial scar width and inflammatory response with greater healed wound strength.

Boston Scientific Corp. (Natick, Mass.) and **Angiotech Pharmaceuticals Inc.** (Canada) said the Food and Drug Administration approved marketing of a longer version of their Taxus Liberte drug-coated stent. The companies said the Taxus Liberte Long Paclitaxel-Eluting Coronary Stent System is the longest available drug-coated stent. It is designed to treat artery lesions up to 38 mm in length. Boston Scientific and Angiotech estimated that 8-10 percent of stent patients have long lesions, and the same clinical trials show the long stent is a better option for those patients.

Other News:

- Seven early-stage life sciences companies, working in areas ranging from cancer drugs to treatments for spinal cord injuries to tests for genetic disorders, were awarded a total of $3.4 million in loans under the Massachusetts $1 billion life sciences initiative. The so-called Accelerator loans were approved by the Massachusetts Life Sciences Center, a quasi-public agency charged with implementing the state's life sciences program. The center received 88 applications for the loans. A major goal of the loan program is to boost companies in the critical stage between when they license medical technology and the time they can attract venture capital or other financing. Another goal is to help companies expand in Massachusetts. Since the 10-year, $1 billion life sciences initiative was signed into law by Governor Deval Patrick last July, the center has invested $42.5 million.

- A computer worm that has alarmed security experts around the world crawled into hundreds of medical devices at dozens of hospitals in the United States and other countries, according to technologists monitoring the threat. The worm, known as "Conficker," has not harmed any patients, but it poses a potential threat to hospital operations. Around March 24, researchers monitoring the worm noticed that an imaging machine used to review high-resolution images was reaching out over the Internet to get instructions—presumably from the programmers who created Conficker. Normally, the solution would be to simply install a patch, which Microsoft released last October. But the device manufacturer said rules from the U.S. Food and Drug Administration required a 90-day notice be given before the machines could be patched.

- The Food and Drug Administration said it will re-examine its decision to approve a knee-surgery device last December over the objections of several scientists and managers at the agency. The device, called Menaflex, is made by ReGen Biologics Inc. of Hackensack, N.J. It is designed to help patients who have severely torn meniscus tissue in their knee joint recover long-term mobility and avoid degenerative arthritis. The House Energy and Commerce Committee in a separate action asked the FDA to re-examine the ReGen decision. In a 16-page letter to the FDA, committee leaders said that agency documents "raise concerns" about an advisory panel of orthopedic-surgery experts convened by the agency last November. The House committee's letter cited issues such as the exclusion of FDA experts who had raised concerns previously about the device, the propriety of ReGen's input into the selection of advisory committee members and the failure to hold a formal vote on whether the device should be approved.

- Sen. Chuck Grassley (R., Iowa) is investigating the matter of a former Army surgeon who allegedly used questionable data in a study of a bone-growth protein in soldiers with serious leg injuries. Sen. Grassley, who has in recent years focused on the ties of doctors to drug and medical-device companies, is looking into the circumstances surrounding a study by Timothy R. Kuklo of the bone-growth product, called Infuse, made by Medtronic Inc. Dr. Kuklo, who now is on staff at Washington University School of Medicine in St. Louis, formerly was a surgeon at Walter Reed Army Medical Center in Washington, D.C. Walter Reed officials said that Dr. Kuklo forged the signatures of purported co-authors on the study. The Walter Reed officials also said that data in the study were based on "falsified information," and the numbers in the study didn't comport with its own numbers about soldiers' wartime injuries. *The Journal of Bone & Joint Surgery* published the study last year, and then, earlier this year, retracted it.

NIST Reference Material Scaffolds for Tissue Engineering

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The National Institute of Standards and Technology (NIST) has deployed Reference Material (RM) scaffolds for tissue engineering: a series of well-characterized 3D tissue scaffolds with differing porosities (RM 8395, RM 8396 and RM 8397) (Fig. 1). Customers will use these RMs as calibration standards during characterization of tissue engineering scaffold devices to enable inter-lab comparison of measurements. The reference scaffolds were made by a freeform fabrication approach (precision extrusion deposition) since this technique affords precise control of scaffold structure. Polycaprolactone was used to fabricate the scaffolds because it is stable during storage and has been cleared for use in tissue engineering implants. The scaffold structural parameters of strut diameter, strut spacing and porosity and have been characterized. The targeted strut diameter was 200 microns for all three RMs. However, the targeted strut spacing was varied as 200 microns for 8395, 300 microns for 8396 and 450 microns for 8397, resulting in porosities of 47 percent, 60 percent and 69 percent, respectively. These parameters were selected because they span the common range of pore sizes typically required for tissue engineering applications. The reference scaffolds have been a part of ASTM's committee "F04.42 Biomaterials and Biomolecules for Tissue Engineered Medical Products" under "Working Group WK6507 Reference Scaffolds for Tissue Engineering."

Fig. 1. (a) Picture of NIST Reference Material scaffolds in packaging. (b-d) X-ray microcomputed tomographs of NIST reference scaffolds. All three have a strut diameter of 200 microns, while 8395 has a strut spacing of 200 microns (b), 8396 has a strut spacing of 300 microns and 8397 has a strut spacing of 450 microns.

For more information, please visit the NIST SRM Web site:
http://ts.nist.gov/measurementservices/referencematerials/index.cfm

Community Calendar

Stem Cells World Congress
San Francisco, CA
January 20–21, 2010
www.selectbiosciences.com/conferences/SCWC2010

SBE's Second International Conference on Stem Cell Engineering
Boston, MA
January 20–21, 2010
www.aiche.org

AIMBE's 19th Annual Event
Washington, D.C.
February 21–23, 2010
www.aimbe.org/annualevent

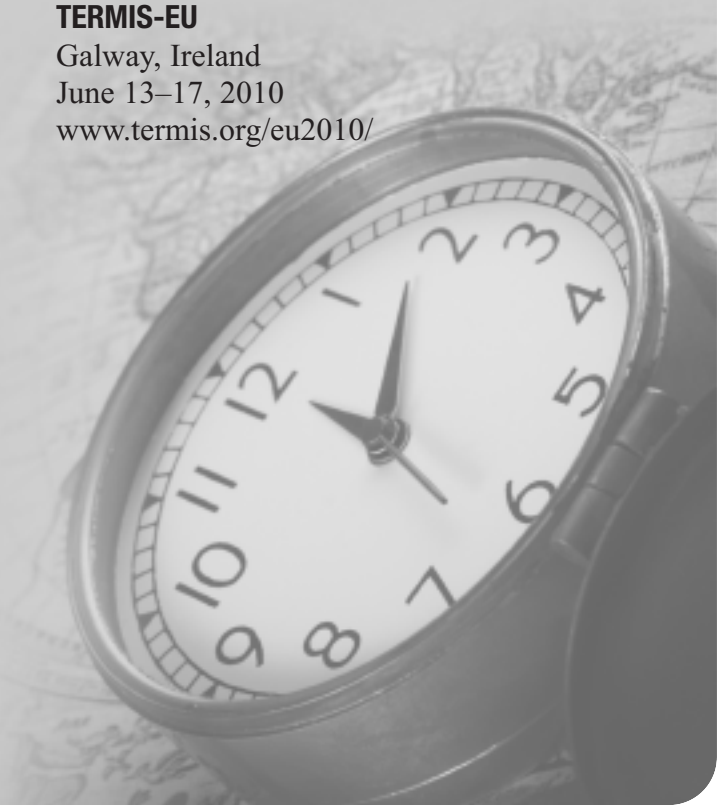
Orthopaedic Research Society 56th Annual Meeting
New Orleans, LA
March 6–9, 2010
www.ors.org/web/index.asp

14th Annual Hilton Head Workshop
Regenerative Medicine: Advancing to Next Generation Therapies
Hilton Head, SC
March 7–10, 2010
www.hiltonhead.gatech.edu/

American Chemical Society Spring 2010 National Meeting & Exposition
San Francisco, CA
March 21–25, 2010
www.acs.org

2010 AIChE Spring Meeting
San Antonio, TX
March 21-25, 2010
www.aiche.org

TERMIS-EU
Galway, Ireland
June 13–17, 2010
www.termis.org/eu2010/



IUPUI

SCHOOL OF ENGINEERING AND TECHNOLOGY

A PURDUE UNIVERSITY SCHOOL
Indianapolis

BIOMEDICAL ENGINEERING FACULTY POSITION

The Department of Biomedical Engineering in the Purdue School of Engineering and Technology at Indiana University Purdue University Indianapolis (IUPUI) is seeking qualified individuals for one or two tenure-track positions at the Assistant/Associate Professor level.

Applicants must have a Ph.D. in biomedical engineering, chemical engineering, or a related discipline, plus research expertise primarily in applied biomaterials, with emphasis on drug delivery or molecular transports. Applicants with research expertise in other related BME fields are encouraged to apply for a second position. Successful candidates will be expected to teach undergraduate and graduate courses in biomedical engineering and establish a state-of-the-art research program in collaboration with the Indiana University School of Medicine on the IUPUI campus. Qualified candidates may be offered joint appointments in both engineering and medicine.

Review of applications begins on December 1, 2009, with the final deadline for accepting applications on February 15, 2010. The desired start date is August 1, 2010. Apply online at: https://www.et.iupui.edu/apply/index.asp?pos=00028663 by submitting curriculum vitae along with a brief research and teaching plan and a list of at least five references.

Questions concerning the position can be addressed to Dr. Hiroki Yokota, Chair of the Search Committee at hyokota@iupui.edu.

IUPUI is an Equal Opportunity/Affirmative Action educator and employer and affords reasonable accommodations to persons with disabilities.

Society For Biomaterials

2010 ANNUAL MEETING & EXPOSITION

Where Materials Meet Biology

Society For Biomaterials

Giving life to a world of materials

Washington State Convention Center

Seattle, Washington

April 21-24, 2010