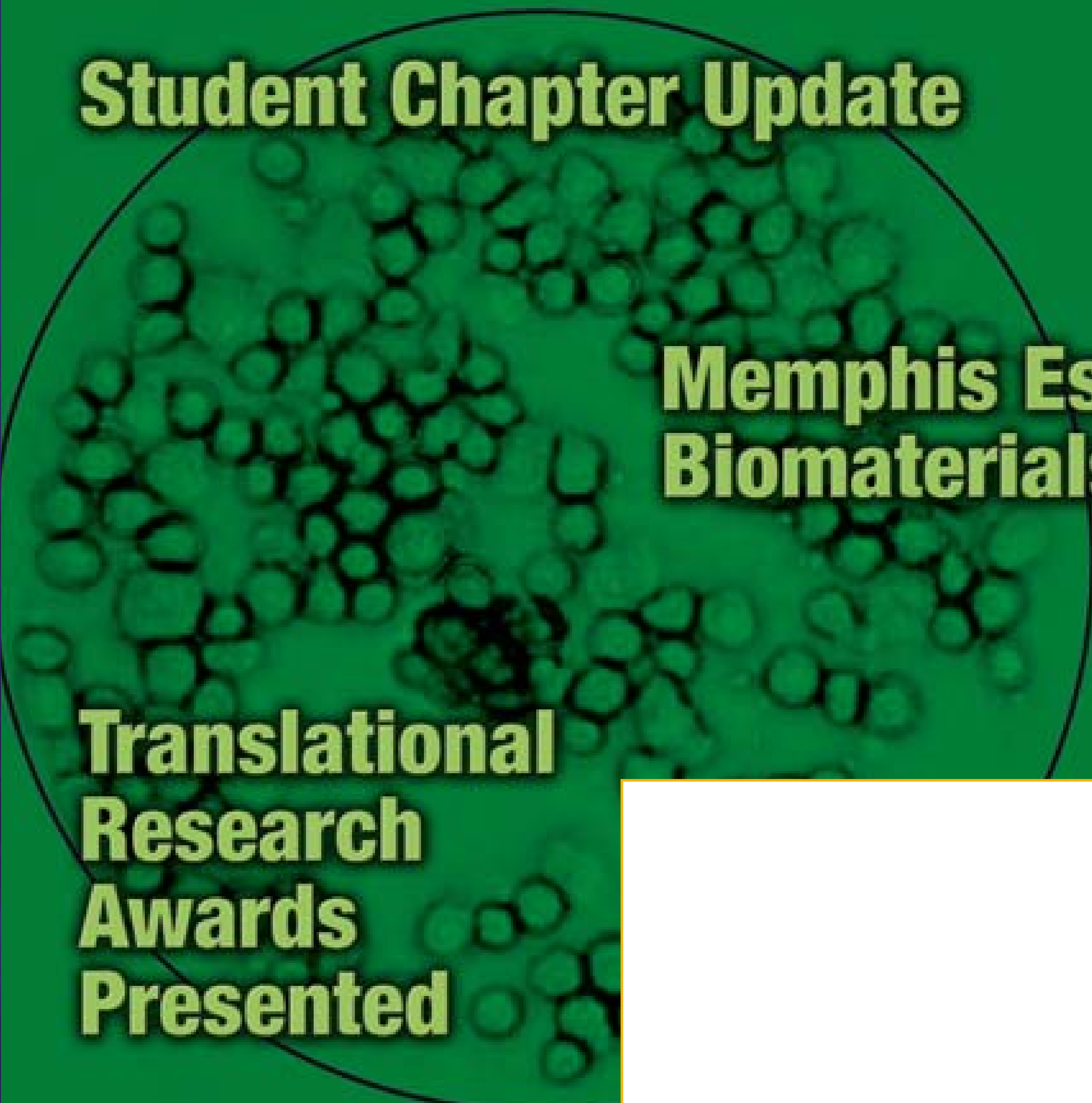
BIOMATERIALS FORUM

SOCIETY FOR BIOMATERIALS

Third Quarter 2005 • Volume 27, Issue 3



Student Chapter Update

Memphis Establishes Biomaterials Day

Translational Research Awards Presented

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BIOMATERIALS

FORUM

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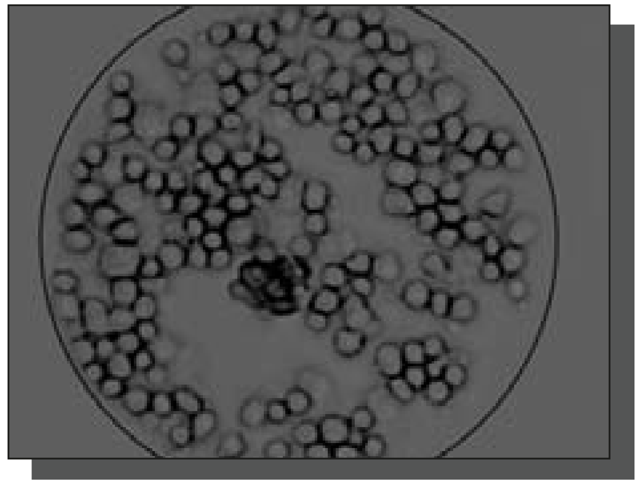

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By Martine LaBerge, Executive Editor

From the Editor

Translational Biomaterials Research: A New Academic Paradigm

The academic world either in medicine, engineering, or science is driven by the intrinsic desire of its faculty members to succeed. Success is normally recognized by publications, national awards, and funding, without neglecting teaching effectiveness! More recently, in biomedical engineering, academic success has also encompassed the translation of research findings and products made in fundamental laboratories into testable hypotheses for clinical trials. The intent of translational research is to translate knowledge derived from laboratory work or basic research into clinical applications where diagnostic or therapeutic interventions can be applied to the treatment or prevention of diseases. It is research that brings discovery directly from the bench to practical applications in patients.

Current translational research is built on the foundations of fundamental basic research leading to ideas, insights, and discoveries. As such, one would argue that translational research in biomaterials science and engineering has been conducted since the inception of this field. However, even though biomaterials researchers have been translational researchers for many years, the road to success has not been without hurdles.

NIH has been applauded for openly recognizing translational research in its road map and funding numerous Bioengineering Research Partnerships (BRPs) focusing on translational multidisciplinary research as an example. In 2004, the Wallace H. Coulter Foundation established two main programs to financially support translational research in biomedical engineering: Translational Research Partnerships in Biomedical Engineering, and Early Career Translational Research Awards in Biomedical Engineering, which clearly emphasize the role of biomedical engineers in translational research. This issue of *Biomaterials Forum* recognizes the Wallace H. Coulter Foundation for its positive impact on the field of biomaterials innovation for patient care by featuring the first Early Career Translational Research Awardees who are members of the Society For Biomaterials. According to NIH, "translational research has proven to be a powerful process that drives the clinical research engine."

The above programs catalyze the needed research infrastructure to strengthen and accelerate outcomes, and clearly establish translational research in bioengineering as a new academic paradigm.

Letter from the President

The Torch

By Michael V. Sefton

SIGs 'R Us

In Memphis, I attended my first all-SIGs meeting. I came away impressed with the enthusiasm of the many volunteers who make Special Interest Groups (SIGs) one of our core assets. There are many other scientific groups who would be jealous of the dedication of these individuals who represent the base of our Society. Perhaps that's why there are so many other organizations ranging from TMS to the Tissue Engineering Society who want to work with SFB.

I have also learned that there are concerns about the quality of our meetings. There is no doubt that we are presenting the best there is in materials used in medicine and dentistry. We had, in Memphis, a huge turnout of abstracts in a nanotechnology symposium, for example. On the other hand, the bio part might have been a little sketchy in places and many of the leaders in biomaterials chose not to come to Memphis. I also heard that some industrial non-biomaterial potential participants don't see SFB as the place to go to learn about the frontiers of biomaterial applications.

So is our strength also our weakness? We have terrific member involvement through the SIGs (or on their own initiative) in planning the program. As I am writing this in early June, John Kao (chair of the 2006 meeting) is collecting lots of terrific suggestions for symposia and workshops. This is as it is supposed to be and will enable John and his committee to build a great meeting from the ground up. But some of the suggestions, while good, are not great and certainly will not, without tweaking, meet the strategic objectives of the Society. But if we improve on these suggestions, do we run the risk of offending some of our volunteers, either symposia organizers or suggested invited speakers? A 'ground up' system is great, but then how does SFB exert quality control? How does SFB protect its brand? (I will write about branding in a future article.)

You have probably figured out that there is a deeper question. It isn't organizing the program for the Pittsburgh meeting that raises the issue—everyone understands that the symposium proposals are just that and all symposium proponents will be delighted to receive suggestions for a better symposium—but rather the variable nature and mandate of the SIGs. Some SIGs are exquisitely healthy and strong while others are not. Some are aligned well with the goals of the Society and some are not. So the overall question is, how do we make better use of the SIGs? How do we make them and fund them better? What do we really expect them to do and how do we give them the tools to get it done?

These questions and others are being addressed by Andres Garcia, the SIG representative on Council, and Elaine Duncan, the past SIG representative, who I have asked to think through these questions and suggest a number of ways in which we can move forward with the SIGs. If you have any suggestions, please contact either of them.

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We are grateful for their time and commitment to the Society For Biomaterials!

Staff Updates from Headquarters

The Torch

By Dan Lemyre, Assistant Executive Director

Things have been very busy at SFB headquarters. In addition to planning for the Annual Meeting—which was a huge success—we have been finalizing the first SFB audit of the financial statements, orienting the new Executive Director, Victoria Elliott, and training the temporary membership coordinator, Rebecca Riedesel, to move into a permanent position! This quarter, we bring you highlights from the 30th Annual Meeting and Exposition, and committee updates. The SFB staff also welcomes Dr. Michael Sefton, the Society's President for 2005-06. We look forward to a productive and fulfilling year.

Awards Ceremonies and Nominations Committee

The 2005-06 committee will be chaired by Nicholas Peppas, SFB 2nd Past President. Committee members include Julia Babensee, Joel Bumgardner, Karen Burg, and Jack Parr.

Bylaws Committee

Attendees of the Annual Business Meeting held during the 30th Annual Meeting in Memphis approved the proposed bylaws amendment to require that SFB journal editors be elected by the Council of the Society as representatives of the Society. The updated bylaws may be viewed on the SFB Web site.

Education & Professional Development Committee

In addition to ongoing requests for meeting endorsements from other societies, the Education and Professional Development Committee is also on the road toward offering a surgical video library on the Society's Web site! In the year ahead the committee also plans to take a more active role in advancing the objectives of SFB's Student Chapters.

Finance Committee

The SFB Council approved the newly proposed investment policy, and with just a couple adjustments, the long-term policy will also be approved. The Finance Committee is now embarking on a review of proposals for an investment planner so we can find one with the right skills to assist SFB in making the most of its investments.

Long Range Planning Committee

Included in the 2005 budget is a strategic planning initiative that will help ensure the Society's continued success while advancing the Society's mission to provide the leading forum to disseminate knowledge of biomaterials among researchers, educators, and developers of materials and biomedical device technology.

Meeting Committee

Congratulations to Dr. Joel Bumgardner and the entire 30th Annual Program Committee on a successful meeting! Over 1,300 professionals attended the meeting, which included over 50 exhibitors and offered four full days of excellent programming. Welcome, too, to John Kao, chair of the 31st Annual Meeting scheduled for April 26-29, 2006, in Pittsburgh, Pa.

Membership Committee

A new membership application is now available on the SFB Web site, www.biomaterials.org. The 2005-06 Membership Committee will be chaired by Margaret Kayo. Committee members elected at the Annual Business Meeting include Barbara Blum, Lynne Jones, Liisa Kuhn, and William Reichert. This new committee is already hard at work reviewing applications and exploring opportunities for new SFB membership benefits!

Publications Committee

The Publications Committee has been accepting proposals for new editors of the *Biomaterials Forum* and the SFB Web site.

SFB Staff

New Executive Director hired! Victoria Elliott was formally introduced to the membership in Memphis. Elliott, a registered pharmacist, joined Association Headquarters as the SFB Executive Director on April 25, 2005. She comes to SFB with more than eight years of association management experience, all of it spent with the Pennsylvania Society of Health-System Pharmacists. In her short time with SFB Elliott has worked with President Sefton and SFB staff to develop an action plan covering a number of organizational priorities. Stay tuned for updates in the coming issues of the *Forum*.

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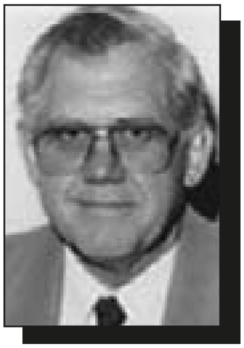
Lemons Given 2005 William T. Cavanaugh Memorial Award

The Torch



Jack E. Lemons, professor at the University of Alabama in Birmingham and Past-President of the Society For Biomaterials, has been named the 2005 recipient of the ASTM International W. T. Cavanaugh Memorial Award. He was also made an honorary member of the organization for his "outstanding and distinguished leadership in promoting national and international standards for medical/surgical implants and materials." Dr. Lemons is a long-time leader of Committee F04 on Medical and Surgical Materials and Devices.

The W. T. Cavanaugh Memorial Award was established in 1987 in memory of the late William T. Cavanaugh, ASTM chief executive officer from 1970 until his death in 1985. The award is given to a person or persons of widely recognized eminence in the voluntary standards system.

Agrawal Appointed Interim Dean of Engineering at University of Texas at San Antonio

The Torch

Society For Biomaterials President-Elect Mauli Agrawal has been appointed Interim Dean of Engineering at the University of Texas at San Antonio. He assumed his new role August 1, 2005.

Mauli has served as the Director of the Institute for Bioengineering and Translational Research and the Peter Flawn Professor of Biomedical Engineering at the University of Texas at San Antonio. He also served as the Associate Dean for Graduate Studies and Research. In 1997 he co-founded Xilas Medical, which is a medical device company now selling FDA-approved products.

An active member of the Society For Biomaterials since 1991, Mauli has been an ardent volunteer and has served the Society in various capacities, including: Secretary/Treasurer and Secretary/Treasurer Elect (2001-2005); Program Chair, Annual Meeting at St. Paul/Minneapolis (2001); Program Committee (1999-2003); Member-at-Large on Board of Directors (1999-2000); Assistant Program Chair, Annual Meeting at Providence (1999); Chair, Orthopaedic Biomaterials SIG (1988-1999); Chair, Membership Committee (1997-1999); Member, Council (1997-1999); Member, Long Range Planning Committee (1997-1998); Member, Committee for Education and Professional Development (1996-1997); Member, Sub-committee on Member Status Development (1993-1995).

He also served as a Contributing Editor for the *Biomaterials Forum* from 1993 to 2000 and currently serves on the Editorial Boards of both the *Journal of Biomedical Materials Research* and the *Journal of Biomedical Materials Research (Applied Biomaterials)*. During his term as Secretary/Treasurer, he oversaw the financial aspects of the transition between management companies handling Society business. Earlier, he was instrumental in the establishment of a Young Investigator Award (effective 1999) for the Society. As Member-at-Large, he was responsible for developing a policy for handling grievances registered by the membership and for establishing the concept of a Biomaterials Day.

Webster Named Editor-in-Chief of the International Journal of Nanomedicine

Dove Medical Press has named Thomas J. Webster, member of the Society For Biomaterials, Editor-in-Chief of their new *International Journal of Nanomedicine*. The *International Journal of Nanomedicine* is an international, peer-reviewed journal focusing on the application of nanotechnology in diagnostics, therapeutics, and drug delivery systems throughout the biomedical field. Reflecting the growing activity in this emerging specialty, the aim of this journal is to highlight research and development in the nanosciences, leading to potential clinical applications in the prevention and treatment of disease. A number of additional members of the Society For Biomaterials have joined Tom in serving on the editorial board. More details on the journal can be found at www.dovepress.com/IJN.htm.

Tom is an Associate Professor of the Weldon School of Biomedical Engineering at Purdue University. His research is in the design, synthesis, and application of nanophase materials in various medical applications. Nanophase materials are those materials with at least one dimension less than 100 nm. He hopes the journal will educate learners on the many benefits nanotechnology can make to medicine. He has been active in the Proteins and Cells at Interfaces, and Biomaterials Education, Special Interest Groups.

Memphis Establishes Biomaterials Day

In recognition of the significant role the biomaterials industry plays in and around the Memphis area, Shelby County officials declared a special Biomaterials Day in April to coincide with the Society For Biomaterials recent 30th Annual Meeting, which was held in Memphis April 27-30, 2005.

The Mayor of Shelby County, AC Wharton, Jr., presented the Society with a proclamation naming April 27, 2005, as Biomaterials Day. The proclamation urged citizens in the area to express their appreciation for the people and technologies in the field of biosciences and their impact on the entire community. According to Shelby officials, Memphis has a rich history and tradition of achievement within the biosciences, led by its academic, medical, and business communities. The Memphis area is the second largest producer of orthopedic medical devices in the United States.

Student Chapter News

By Dina Basalyga

Greetings from the SFB National Student Chapter! This article is appearing in Biomaterials Forum to highlight our student chapters and student members' accomplishments throughout the year. In addition, information pertaining to the upcoming SFB Annual Meeting in Pittsburgh will be posted in the future, as well as fun tidbits for graduate students. At our Memphis meeting the following chapters were recognized by the National Chapter for their outstanding work.

Outstanding Community Outreach

University of Washington

University of Washington chapter students were able to visit local K-12 schools and introduce students to biomaterials and tissue engineering. Graduate students volunteered their time to give presentations combined with hands-on design projects to students and teachers interested in biomaterials, bioengineering, and general science. Two projects that the kids were involved in were designing a prosthetic finger and designing a surface that can recognize a simulated cell surface. From May 2004 to April 2005 the chapter members visited 26 schools and over 1,900 students!

Outstanding Fundraising and Industry Connections

University of Florida

The University of Florida chapter participated in a number of activities with biotech companies. They hosted speakers from Ethicon Inc., Medtronic Xomed Inc., and Vistakon. In addition, members traveled to Georgia to participate in an industry tour of Kimberley-Clark's healthcare division and while in Memphis toured Medtronic Sofamor-Danek.

This chapter also did an amazing job fundraising. Through their Partners in Excellence fundraising efforts, departmental contributions, and funding secured through the Benton Engineering Council, the University of Florida chapter raised over $8,400 this year.

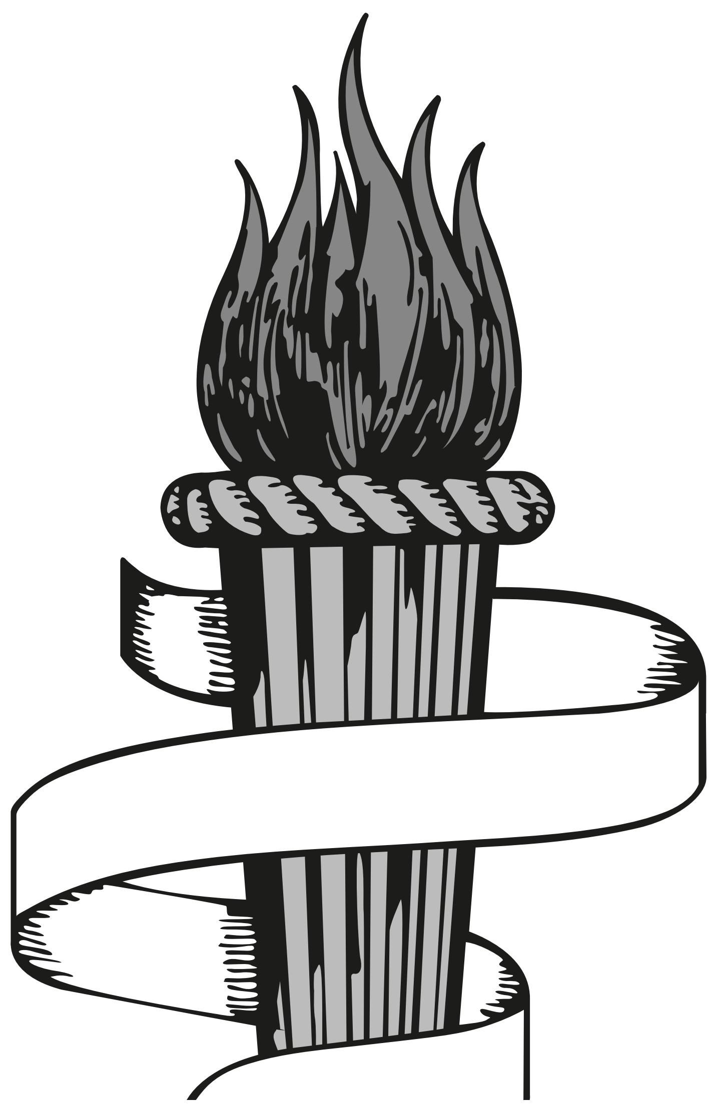
Outstanding New Chapter

Michigan Tech

Michigan Tech was recently recognized as a student chapter and they are off to a great start. Students began their year with a trip to Northwestern University to give undergraduate students a firsthand perspective of graduate life in biomaterials. The main outreach event for the chapter was called "Biomaterials Slime Time." Members went into the local elementary classrooms (6th-8th grade) to educate the students about biomedical engineering, and more specifically about biomaterials. Participants got to make slime using solutions of borax, glue, and food coloring, which was used to demonstrate viscoelastic properties and how this relates to the body. Other activities included making Christmas cookies to be delivered to the elderly and organizing a "blue-screen" photo booth for the Michigan Tech's annual Winter Carnival All-Nighter as a fundraiser and to attract new members.

Annual Travel Award

1st place: Clemson University - Clemson brought 42 students to Memphis and traveled a total of 24,150 miles.
2nd place: University of Washington
3rd place: University of Florida



Tissue and Organ Regeneration in Adults

Book Review

By Liisa Kuhn

By Ioannis V. Yannas. Springer-Verlag, New York. 2001.

While it is well known that adults, whether animal or human, do not spontaneously regenerate any of their organs that have been lost to accidental trauma or surgery, the field of tissue engineering offers a means to reverse this long-held belief. The synthesis of tissues and organs in adults through the use, or combined use, of extracellular matrix analogs, cytokines, and cells is now a clinically available reality. How do they work? Are there trans-organ rules that apply to all tissues and organs? Dr. Yannas has put the subject of tissue regeneration in the context of general wound healing in a clear and understandable manner. From this, he concludes that yes, there are generic methodologies for all tissue regeneration. The main aspects of wound healing that must be overcome, in order to get regeneration, are contraction and scar formation. Dr. Yannas demonstrates through extensive literature review that this has been done through the use of non-diffusible extracellular matrix analogs that act as regulators to arrest contraction, and to contain and maintain a vital population of regenerative cells and cytokines.

The volume is divided into four major sections. Loss of organ function, the basic medical problem treated in this volume, is defined in Chapter 1. The basic methodology of organ synthesis *in vivo* is described in Chapters 2 through 4. Application to adult skin and peripheral nerves is treated in detail in Chapters 5 through 7. Finally, detailed mechanistic hypotheses of induced tissue and organ regeneration are presented in Chapters 8 through 10, leading to generic methodology for organ regeneration. This book is still one of the only, if not the only, single-author textbooks on organ synthesis, and as such provides a much-needed, integrated, unifying treatise on the subject.

A nice feature of the book is the author's approach of providing a thorough summary of the empirical results of regenerative activities observed in both skin and nerve experiments, and then following this with a discussion of proposed common mechanisms. For example, there is a table summarizing the relative regenerative activity of growth factors, cells and scaffolds that have been used in the regeneration of skin (Table 5.3). It is separated into growth factors, pharmacological reactants, keratinocyte sheets, cell-free regeneration templates, and cell-seeded regeneration templates. For each of these categories, the animal model and the final configuration of the repaired tissue, whether contraction, scar, or regeneration is presented. Hence, at a glance, one can readily see which configurations led to skin regeneration and which particular growth factors or cytokines led to enhancement of scarring, even in fetal models. There also is a table summarizing several tubulated configurations for the regeneration of a peripheral nerve (Table 6.1), again leading to ready assessment of which configurations were most regenerative. This volume also includes an excellent discussion of critical size-defect animal models, which are required to truly assess regeneration. It was also interesting to read developmental biology tidbits about which animals can regenerate which limbs at which stage of development. I had also not realized that our own livers do not regenerate when a portion is surgically removed or damaged; the remaining segments just get larger to retain function (compensatory growth).

In summary, this textbook summarizes an extensive set of data on induced regeneration in skin and nerve, concluding with suggestions for generic methodologies for synthesis of other organs. It is well written, with high-quality diagrams and micrographs. It is appropriate for biologists, experimental surgeons, and biomedical engineers at the graduate level and above. As a professor who teaches tissue engineering, I now have an excellent summary of skin and nerve regeneration modalities, and their shortcomings and strengths to present to the students. While the emphasis of the book is on skin and nerve regeneration, I found that even a hard-tissue biomaterials scientist like myself could take away several useful biological and trans-organ regeneration concepts: mainly the important role of the extracellular matrix analog (or non-diffusible regulator) within the framework of wound healing.

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Direct Writing of Biomaterials: A Paradigm Shift in Tissue Engineering

Feature

By D.B. Chrisey, A. Doraiswamy and R.J. Narayan

Introduction

Tissue engineering[1] has always been a multidisciplinary field that encompasses biology, medicine, materials science and engineering.[2] The goal is to improve human health by maintaining, restoring, or improving tissue and organ function. While tissue engineering includes biomaterials, cells, biomolecules, informatics, and engineering, the fundamental building block of tissue engineering is the living cell. Cells are generally implanted or seeded into a scaffold material to enhance structural properties, deliver biochemical factors including vital cell nutrients, and to exert mechanical and biological influences. There are shortcomings to this approach, including random cell attachment, meaning all evolved tissue structure is lost and vascularization is needed if the construct is greater than 1 mm in thickness. Rarely though has tissue engineering been considered from a more strict engineering perspective.

We foresee the possibility to expand upon traditional tissue engineering. That is, instead of addressing medical problems by using living cells to engineer new biomaterials, use engineering principles to manipulate biomaterials (including cells) in a well-controlled manner.

Recently, researchers used a conventional ink jet printer to write patterns of biomaterials.[3] Termed "organ printing," their approach to write layered two-dimensional CAD/CAM (computer-aided design/computer aided manufacturing) patterns of biomaterials is one of several approaches to directly write biological systems.[4] Mironov et al. note that their work is a combination of engineering with developmental biology. This is a paradigm shift for tissue engineering as we are no longer growing tissues in a homogeneous and random fashion, but instead we are building tissues in some cases on the cell-by-cell level.

While the future impact of direct writing on the complex fabrication of vascularized three-dimensional tissue constructs for the long-term goal of organ construction is uncertain, it is clear that direct-write approaches offer a unique approach to study an array of novel biological systems.

Direct Writing by MAPLE DW

At the Naval Research Laboratory, we have developed a novel laser forward-transfer process to direct write biological materials.[5] Termed MAPLE DW for matrix assisted pulsed laser evaporation direct write, this approach is shown schematically in Figure 1. In this process, a low fluence laser beam (typically an excimer laser) is focused on the backside of UV transparent quartz disk that is known as a ribbon. The novelty of the MAPLE DW transfer process is in the laser-material interaction at the interface where the absorbed laser energy gently propels cells toward a precise computer-designated location on the substrate. Each laser pulse transfers a voxel of cells and biopolymer (see Figure 2) and the motion of the computer-controlled stage holding the receiving substrate is synchronized to the firing of the laser. The ribbon in MAPLE is composed of a thick layer (about 10 microns) of extracellular matrix[6] seeded with trypsinized cells. The receiving substrate has a similar thick layer of extracellular matrix and is used to reduce the deceleration of the desorbed cells.

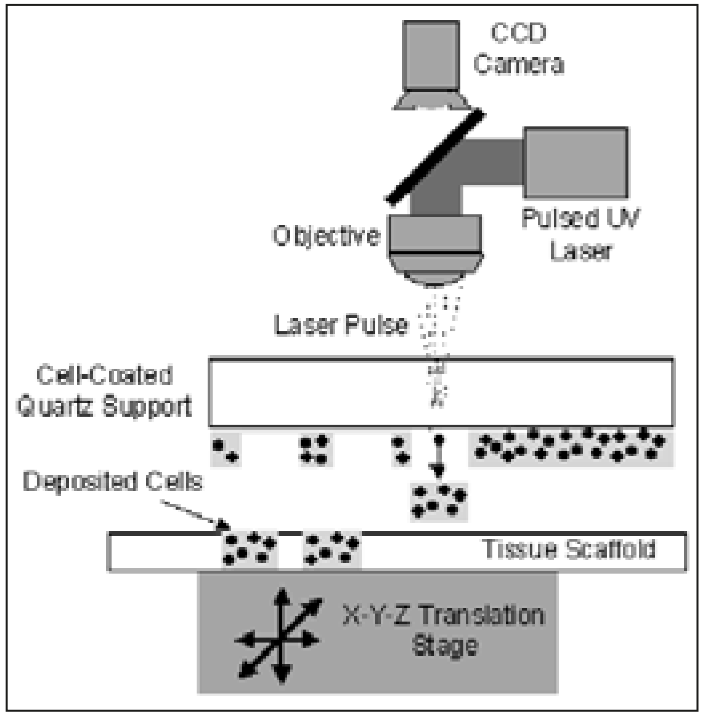

Figure 1. *A schematic diagram of a MAPLE DW set up.*

To achieve CAM tissue construction using a CAD design at the cell-by-cell level, MAPLE DW must have several attributes. The technique must: be rapid and demonstrate computer-controlled placement of different materials at the 10 to 100 micron level; be able to deposit multiple cell types; be able to deposit molecules like growth factors, recruitment factors, and differentiation chemicals; be amenable to novel scaffolding materials as well as to vascularization. The MAPLE DW process has potential advantages over other patterning processes in providing a versatile technique to transfer a wide range of materials, with great accuracy, resolution, speed and efficiency. One issue that concerns all direct-write techniques is the need for accelerated tissue maturation. Rapidly applying adherent cells in a temporarily non-adherent (trypsinized) state will require a scaffold material be co-deposited to allow for immediate structural integrity and three-dimensional construct growth.

Results

MAPLE DW has been used to form patterns and structures of living cells by optically selecting a group of cells from the ribbon and using the pulsed laser to transfer the cells to the receiving substrate.[7] Figure 2 shows an example of the transfer of MG-63 human osteoblasts transfer. This figure clearly shows that the laser effectively punches out a group of cells from the

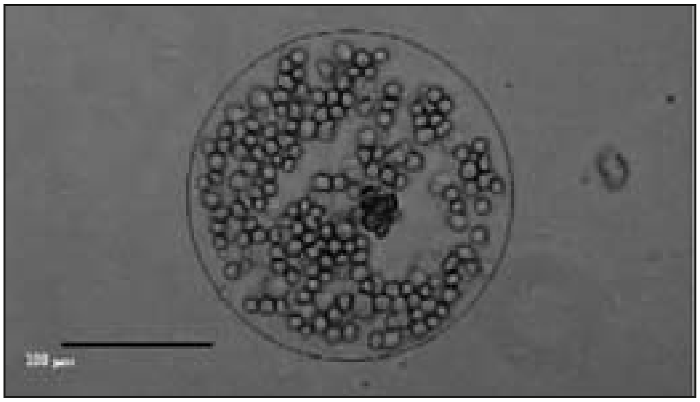

Figure 2. MAPLE DW transfer of MG-63 human osteoblast cells.

ribbon and transfers them intact. Both eukaryotic and prokaryotic cell patterns have been formed by MAPLE DW and under optimized conditions, near 100 percent viability has been achieved as determined by standard live/dead assays and green fluorescent protein marking. We have demonstrated successful transfer of a broad range of cell types including E. coli, Chinese hamster ovaries, human osteoblasts, mouse pluripotent cells and myoblasts, and rat neuroblasts. Using MAPLE DW we have also demonstrated the deposition of arrays of different cells in two-dimensional patterns, organic/inorganic scaffold and cell composites, and several cell layers have successfully been deposited on top of one another. Using ribbons with lower areal densities of trypsinized cells compared to that in Figure 2, and with a smaller laser spot size, it is possible to use MAPLE DW to deposit and carefully position single cells. In Figure 3 we show the deposition of a C2C12 mouse myoblast within 20 microns of a previously deposited B35 rat neuroblast. This is an important demonstration for the cell-by-cell construction of tissue constructs. In addition, the proximity of these different cells and the precision of their placement would allow the study of intercellular protein signaling pathways as well as the developmental cell biology of well-controlled systems.

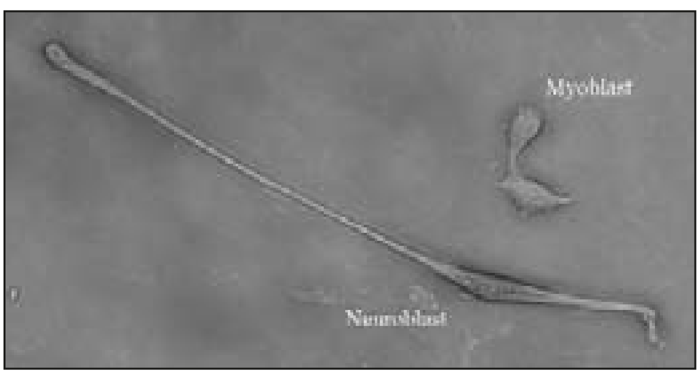

Figure 3. Demonstration of MAPLE DW unique ability to place individual cells is shown. The cells are deposited from different ribbons and the myoblast is a mouse C2C12 myoblast and the neuroblast is a B35 rat neuroblast.

The equipment shown in Figure 1 can also be used to fabricate differentially adherent substrate surfaces. We used MAPLE DW to laser micromachine a channel on the surface of an agarose gel. The channel was filled with extracellular matrix and trypsinized neuroblasts were added. Within a short time the neuroblasts migrated to the extracellular matrix and attached, grew and proliferated. After 72 hours, the increased cell density led to delamination of the entire channel and cell structure (see Figure 4). The original channel dimensions were preserved and the neuroblast bundle was obtained as a self-

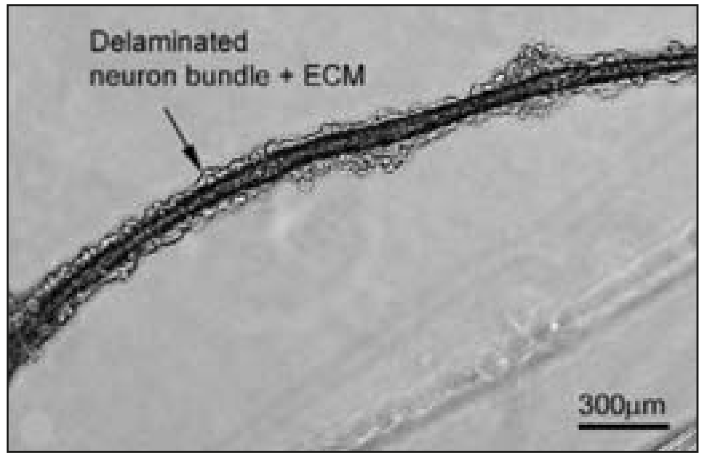

Figure 4. Optical micrograph showing a delaminated self-sustained B-35 rat neuroblast bundle.

sustained network. Though this experiment took 72 hours, it does indicate material processing pathways for the fabrication of three-dimensional tissue constructs.

Conclusions

MAPLE DW was demonstrated to be a versatile technique to develop novel, multilayer, heterogeneous biomaterial patterns for engineering tissue constructs. There are many potential applications for this approach, including three-dimensional tissue constructs, tissue-based sensing of warfare agents and environmental toxins, novel cell-signaling platforms with protein identification capabilities, living microfluidic devices and hybrid biological motors, and ultimately the repair of damaged tissue via a computer-aided surgeon.

Acknowledgements

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Early Career Translational Research Awards Given to Society Members by the Wallace H. Coulter Foundation

Feature

By Martine La Berge

The Early Career Translational Research Awards in Biomedical Engineering, supported by the Wallace H. Coulter Foundation, are designed to support biomedical engineering research that is translational in nature, and to encourage and assist eligible biomedical engineering investigators as they establish themselves in academic research careers with two years of funding. The Wallace H. Coulter Foundation is a private, nonprofit foundation dedicated to improving human healthcare by supporting translational research in biomedical engineering—research directed at the transfer of promising technologies within the university research laboratory that are progressing towards commercial development and clinical practice.

The 23 recipients of the first Early Career Translational Research Awards are full-time, tenure-track faculty members with a primary appointment in biomedical engineering. They have received their doctoral degree no more than six years prior to their application, and they held a rank no higher than assistant professor at the time of application. Biomaterials research has been highly recognized by the Wallace H. Coulter Foundation as being translational, and numerous awards were made for innovative biomaterials research (see chart).

Wallace H. Coulter was an engineer, inventor, and entrepreneur who applied engineering principles to a biomedical problem. He founded Coulter Corp., which developed and marketed the first automated blood cell counters and flow cytometers, instruments that revolutionized healthcare diagnostics and therapeutics. Coulter Corp. became the global industry leader; its mission of "Science Serving Humanity" was based on Wallace's belief that laboratory discoveries must be developed into commercially viable products to truly benefit humanity. Believing that the contributions of engineers to solving biomedical problems were generally under-recognized, Wallace mentored and encouraged young engineers to dream, take risks, and be innovative.

The Society For Biomaterials congratulates all recipients of 2005 Early Career Translational Research Awards.

Awardee	Institution	Project Title
Guillermo Ameer	Northwestern University	Biocompatibility Enhancement of ePTFE Vascular Grafts: A Tissue Engineering Approach
Xinyan Cui	University of Pittsburgh	Conducting Polymer/Hydrogel Skin Surface Electrode for High Resolution Multichannel EEG
Karen Haberstroh	Purdue University	*In vivo* Efficacy of Nano-structured Bladder Tissue Replacement Constructs
Tao Lowe	Pennsylvania State University	Subconjunctivally Implantable Hydrogels for Sustained Drug Delivery to Treat Diabetic Retinopathy
Helen Lu	Columbia University	Novel Tissue Engineered Triphasic Scaffold for the Biological Fixation of Tendon Grafts to Bone
Shelly Sakiyama-Elbert	Washington University, St. Louis	Rationally Designed Delivery Systems for Nerve Injury
Thomas Webster	Purdue University	Bionanotechnology for the Improvement of Orthopedic Implants
Xuejun Wen	Clemson University	A Tissue-engineered Multifilament Entubulation Bridging Device for the Treatment of Spinal Cord Injury

BioInk

Industry News

By Stephen Lin

Aastrom Biosciences Inc., Ann Arbor, Mich., announced the results from its feasibility clinical trial conducted with the Institut de Terapia Regenerativa Tisular (ITRT) in Barcelona, Spain, to evaluate the use of Aastrom's Tissue Repair Cells (TRCs) for the treatment of severe long bone non-union fractures. The patients treated with Aastrom's TRCs, an autologous bone marrow-derived cell product, exhibited clinical and functional healing, with five of six treatments showing bone regeneration at the fracture site as determined by radiographic imaging by six months. The results were notable in that each patient had failed prior treatment with standard of care methodologies and had a poor prognosis for healing. This feasibility trial suggests that Aastrom's autologous TRCs may offer a new way to achieve local bone regeneration for bone grafting and other clinical indications for bone repair.

Archimedes, Oakland, Calif., a Kaiser Permanente innovation, is part of an exciting launch of a ground-breaking preventative-health tool—one that will allow individuals to predict their risk of getting diabetes or its complications. Launched in close partnership with the American Diabetes Association, Diabetes PHD (Personal Health Decisions) is driven by the Archimedes Model. This online, interactive tool provides instant, highly accurate health profiles for people with, or at risk of, developing diabetes. It can be accessed at no cost by the general public through the ADA's Web site at www.diabetes.org/diabetesphd, and by Kaiser Permanente members at http://kaiserpermanente.org/diabetes.

Archus Orthopedics Inc., Redmond, Wash., announced successful completion of the first clinical implants of its Total Facet Arthroplasty System™ ("TFAS"). The TFAS, which is a novel, patented spinal implant designed to treat spinal stenosis, replaces the degenerative facet joints with a prosthetic joint implant intended to restore stability and normal motion to the spine, eliminating the need for fusion. On March 28, 2005, the U.S. Food and Drug Administration conditionally approved an Investigational Device Exemption for the TFAS, allowing the company to initiate a pivotal clinical trial of the device in the United States.

Biosensors International Group Ltd., Singapore, a manufacturer of innovative medical devices used in interventional cardiology and critical care procedures, announced the results of a 12-month safety clinical trial that found its BioMatrix™ Drug-Eluting Stent ("DES") to be safe and effective with the new device reducing the occurrence of restenosis in over 97 percent of patients studied. More than 93 percent of patients who received the BioMatrix DES experienced freedom from the adverse events of death, heart attack, and target lesion revascularization ("TLR") during the 12-month study. The clinical trial results were reported at the EuroPCR '05 held in Paris May 24-27, 2005.

First, nanotechnology researchers at **Cornell University** built a device so sensitive it could detect the mass of a single bacterium—about 665 femtograms. Then they built one that could sense the presence of a single virus—about 1.5 femtograms. Now, with a refined technique, they have detected a single DNA molecule, weighing in at 995,000 Daltons—a shade more than 1 attogram—and can even count the number of DNA molecules attached to a single receptor by noting the difference in mass. The devices, which fall in the class of nanoelectromechanical systems (NEMS), could be made even more sensitive through increased miniaturization, the researchers say. The technology, they suggest, can be combined with microfluidics to

Continued on page 15

BioInk

(Continued from page 13)

perform genetic analysis of very small samples of DNA, even the amount present in a single cell. Current techniques for genetic analysis require small samples of DNA to be replicated many times through a process called PCR amplification. DNA analysis can be used, among other things, to detect genetic markers for cancer susceptibility.

Jivan Biologics Inc., Berkeley, Calif., a privately held company, launched the first commercial genome-wide microarrays for alternate splicing. Manufactured by **Agilent Technologies** and available as a catalogue product, Jivan's TransExpress™ Whole Spliceome enables researchers to detect changes in RNA splicing across the entire human genome for a broad range of clinical and research applications. By differentiating among the splice isoforms of a gene, TransExpress Whole Spliceome multiplies the number of potential clinical biomarkers and molecular diagnostics by a factor of four or more compared with conventional gene arrays.

Scientists at the **Kenya Agricultural Research Institute** (KARI) have for the first time in the country's history of agricultural research planted biotechnology-derived maize in a field trial. The trial of the maize variety, which is resistant to stem borer, is undertaken by the Insect Resistant Maize for Africa (IRMA) project, a joint research project of KARI and the **International Maize and Wheat Improvement Centre** (CIMMYT) supported by the Syngenta Foundation for Sustainable Agriculture and the Rockfeller Foundation. The success of the undertaking would reduce maize loss resulting from destruction by the stem borer, which accounts for 40,000 tons of maize annually, about 13 percent of the annual cereal loss, or some 5.6 billion Kenya shillings.

Targepeutics Inc., Hershey, Pa., announced the issuance of U.S. Patent No. 6,884,603 for its genetically modified, mutated interleukin 13 (IL-13) technology platform for the treatment of malignant glioma, a brain tumor that impacts 17,500 people annually and has a $200 million annual market. These mutated IL-13 compounds were designed to provide greater specificity towards the IL-13 receptor that is over-expressed in brain tumors while sparing normal tissues. The more specific targeting should allow broader and safer application of recombinant cytotoxins than the first generation, wild-type IL-13-based compound, hIL13-PE38QQR.

New research from **University of North Carolina at Chapel Hill** shows how a protein called "eed" is needed for an essential chemical modification of many genes. Embryos cannot survive without the modification. The research offers an important contribution to a new wave of thinking in genetics: that not all human disease states are due to alterations in DNA sequence. Epigenetic inheritance is heritable information passed down through generations of cells that is not encoded by the DNA sequence. This information is in the form of chemical modifications on any of four core histone proteins that group together to provide a molecular scaffold supporting the roughly 35,000 genes in the nucleus of every human cell. Histone modifications affect gene activity and include methylation, in which a methyl component is attached to the histone protein. eed is the first protein shown to be required for the addition of a single methyl group to histone H3. Knowing which proteins are responsible for the various histone modifications is the first step toward understanding how epigenetics influences such occurrences as cancer and birth defects.

Community Calendar

American Society for Bone and Mineral Research 27th Annual Meeting
September 23-27, 2005
Gaylord Opryland Resort and Convention Center
Nashville, TN
(202) 367-1161
asbmr@smithbucklin.com
www.asbmr.org

American Society for Metals, International Materials & Processes for Medical Devices Conference
September 25-28, 2005
David L. Lawrence Convention Center
Pittsburgh, PA
(440) 338-5151
www.asminternational.org

Biomedical Engineering Society
September 28-October 1, 2005
Hyatt Regency
Baltimore, MD
www.bme.jhu.edu/BMES2005

Surfaces in Biomaterials Foundation BioInterface 2005
October 24-26, 2005
Marquette Hotel
Minneapolis, MN
(651) 290-6267
www.surfaces.org

Osteoarthritis Research Society International 2005 World Congress
December 8-11, 2005
Marriott Copley Place
Boston, MA
(856) 439-1385
oarsi@oarsi.org
www.oarsi.org

Orthopaedic Research Society 52nd Annual Meeting
March 5-8, 2006
Ernest N. Morial Convention Center
New Orleans, LA
(847) 698-1625
ors@aaos.org
www.ors.org

Wound Healing Society 16th Annual Meeting & Exhibition
May 14-17, 2006
Double Tree Paradise Valley
Scottsdale, AZ
(763) 765-2377
meetings@woundheal.org
www.woundheal.org