SurFACTS in Biomaterials

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Key Considerations to Successful and Rapid Development of Drug-Eluting Devices

By Andrew Luk, Ph.D., Luk Consulting

Controlled release (CR) dosage forms for pharmaceutical delivery have provided high-valued products to patients and doctors over the past 20 years. Sustained release parenteral formulations, often known as depot systems, are a class of CR dosage form that offers a prolonged drug pharmacokinetic profile, for weeks or even months, in patients. The active substance is released from either a fully bioresorbable polymeric-based system (such as PLGA microspheres[1]) or a surgically removable system (such as titanium micropumps[2]). In contrast to conventional injections or pills, such implantable systems deliver drugs efficiently by reducing side effects related to intermittent high exposure for drugs that have a narrow therapeutic index (difference between toxic level and therapeutic level). In addition, patients undergoing chronic treatment enjoy an improved quality of life with the reduction of dose administration frequency and complications related to non-adherence.

With the advances of coating technologies[3], solution containing drug substances can be efficiently applied to the surface of medical device, yielding a coating that offers sustained drug delivery at the target tissue site. Like drug-eluting stents, the primary modes of action for most of these first-generation drug-eluting devices are mechanical in nature, and such combination products follow a shorter device regulatory approval path[4]. Regardless of the regulatory pathway, it is crucial for sponsoring companies to demonstrate that their drug-device combination product meets

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From the Editor

Dear Readers:

First of all, my thanks to Klaus Wormuth for stepping in as guest editor of SurFacts during my absence from the last issue. It was a great vacation and thanks for asking.

This issue's editorial will address two topics. The first is a brief discussion on memberships in scientific societies and organizations, while the second is an update on SBIR legislation.

I recently read an editorial in The Scientist by Steven Wiley, entitled "To Join or Not to Join." In his editorial, Wiley considered the costs and benefits of joining scientific societies. His timing was appropriate since I had just done this "calculation" prior to renewing with a statewide trade organization (BioForward – Supporting the biotechnology and medical device industry of Wisconsin), and The University of Wisconsin Advanced Materials Industrial Consortium. Of course, I also maintain my membership in the Surfaces in Biomaterials Foundation. (While this could be an entreaty on the renewing Surfaces memberships, that is not my intent.) Wiley primarily discussed

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What's Inside

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By Steven L. Goodman, Ph.D., 10H Technology Corporation

memberships from the perspective of an academic scientist, wherein he posited that a major historical reason for membership is to be able to publish in scientific society journals and present at meetings. This is not a major issue for our members. For us, memberships provide a forum to create alignments and partnerships to benefit ourselves and our group. My joining BioForward, for example, provides continuous education on issues that affect my business at the local, state, national and international levels. One issue on the national level is the Small Business Innovation Research (SBIR) federal grants program. This will be discussed below since this also affects SurFacts readers. My cost-benefit analysis also showed that membership in BioForward's group purchasing contracts can directly reduce my business costs and thus membership may even pay for itself. Finally, like many local trade organizations, BioForward also provides connections to individuals and potential business partners that can provide me with expertise and services that I would not otherwise have. This too is similar to the Surfaces in Biomaterials Foundation. This brings up the second membership organization, The University of Wisconsin Advanced Materials Industrial Consortium. My firm is a member in this consortium since this provides substantial value to my Medical Device clients, such as many Surfaces in Biomaterials members. This consortium enhances my access to cutting-edge research in advanced materials and materials analysis, and enhances my access to microscopes and other analytical instruments, including the expertise and ongoing education to utilize these tools most effectively. This provides my firm with the use of dozens of million dollar analytical tools that I can utilize to answer my medical device clients' surface and structural analysis questions. Thus, a cost-benefit calculation could show that I joined this Consortium with the expectation that this membership will help to grow my analytical services business, and thus pay for itself.

Some of you may recall past editorials where I made requests for readers to contact their congressional representatives to support the reauthorization of the SBIR/STTR program. My most recent editorial on this topic appeared in the July-August 2009 SurFACTS. As a reminder, the SBIR/STTR program is a grants program that supports small business Research and Development in US high technology companies. (SBIR provides grants to small business while STTR is a subset program that provides grants to small businesses that are usually spinning out academic technology.) The SBIR/STTR program is funded by setting aside a small percentage (currently 2.8%) of government research grants for support of small business R&D from agencies that otherwise generally only support academic research. The major US grant funding agencies of relevance to the Medical Device Industry are the National Institutes of Health, the National Science Foundation, and the Department of Defense. The SBIR program has been ongoing since 1982, has been historically supported by both political parties, and most importantly has been extremely valuable to national high technology industry including Medical Devices. In the May-June 2009 SurFacts, I tracked that this program has provided over $16 million in R&D support to Surfaces member companies. Many Surfaces members use materials,

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SurFACTS in Biomaterials is the official publication of the foundation and is dedicated to serving industrial engineers, research scientists, and academicians working in the field of biomaterials, biomedical devices, or diagnostic research.

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the safety and efficacy requirements expected for a pharmaceutical product, namely identity, strength, quality and purity characteristics. When comparing between sustained release drug products and the drug-eluting devices, there are some key technical differences as summarized in Table I. This article highlights some of the unique technical challenges and mitigation approaches in the development of a drug-eluting device.

Compressed timeline for drug product-related activities

At the project level, the time line for drug-eluting device commercialization is much shorter as compared to that of a pharmaceutical product. It is therefore crucial to incorporate fabrics of pharmaceutical product development principles in the feasibility stage, so as to ensure early identification of formulation instability issues as well as reduction of downstream changes requiring bridging data.

After a drug has been selected to exert a complementary pharmacological effect to the device, certain tasks can be initiated early on, such as:

- development of a qualified drug content assay, at a minimum, to detect drug degradation
- understand the major degradation mechanisms of the drug substance and, if necessary, engineer drug stabilization approaches in prototype formulations and manufacturing processes
- procure and use API and excipient(s) from reputable and qualified vendors
- screen for signs of physical and/or chemical incompatibility between drug, excipient, and the device material
- effect of sterilization modes on formulation and coating stability.

Vague or aggressive drug-related target product profiles

It is important that a target product profile including safety and clinical endpoints (or in general, user requirement) is defined early on in development. Vague targets will yield the design of a wrong product configuration. In the design phase, the use of both a minimal and a desired target profile for each attribute offers flexibility for the product developers. When the safety and efficacy success criteria come from the ultimate pivotal clinical study endpoints, a set of preclinical attributes should be set for decision making purposes in early stage design reviews. Attributes impacting drug coating design include but are not limited to product shelf-life, storage tempera-

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Table 1: Key differences between sustained release drug products and drug-eluting devices

	Sustained release dosage form	Surgically Implanted Drug-Eluting Devices
Drug delivery site	Mostly systemic	Local
Product configuration	Injectable or implantable systems via subcutaneous and intramuscular administration	Devices implanted through surgery or through minimally invasive route like catheters
Primary mode of action for disease treatment	Drug	Mechanical feature offered by the device itself
Drug levels	Blood (measurable in clinical trials)	Tissue (locally not easily measurable in clinical trials) + Blood (systemic exposure)
Usage	Mostly chronic in nature, with repeated dosing expected	Mostly acute or episodic in nature, with possible use of multiple units in a single procedure
Drug dose	High	Low
Polymer selection – duration	User defined (frequency of dosage administration), biodegradable carrier preferred	Safety and Efficacy (preclinical/clinical), biodegradable carrier preferable
Polymer selection – integrity/ durability	Minimal mechanical concerns	Must demonstrate integrity and durability of the coating and not affect the mechanical performance of the device itself
Sterilization	Mostly aseptic manufacturing	Terminally sterilized

Medtronic Named Among World's Most Innovative Companies

From MIT Technology Review

Medtronic, Inc. was selected as one of *Massachusetts Institute of Technology (MIT) Technology Review*'s 50 most innovative companies. Known as TR50, the first annual list includes companies that *Technology Review* believes have demonstrated superiority in inventing technology and in using it both to grow their own business and transform how we live.

Medtronic was recognized for its leadership in the development and introduction of Deep Brain Stimulation (DBS) Therapy, which helps treat neurological conditions by delivering controlled electrical pulses to a specific part of the brain. For more than 15 years, Medtronic has collaborated with leading physicians and invested in and developed this therapy. DBS therapy was first commercialized outside the United States in 1995, and approved by the U.S. Food and Drug Administration in 1997 for the suppression of tremor in the upper extremities.

Medtronic has continued to improve the technology and broaden its applications. Medtronic DBS therapy is now approved to manage some of the symptoms of Parkinson's disease and in the treatment of chronic, intractable dystonia, as well as severe, treatment-resistant obsessive-compulsive disorder (OCD). The company also received FDA approval in 2009 for Activa® PC (primary cell) and Activa RC (rechargeable), the most advanced neurostimulation systems available, including the first rechargeable device used in DBS therapy.

"We are honored to be recognized for our work in advancing DBS therapy," said Don Deyo, vice president of Product Development and Technology in Medtronic's Neuromodulation business. "In collaboration with leading physicians, we pioneered DBS therapy and we have remained focused on advancing the technology for the benefit of patients worldwide. We are thrilled that the employees and partners who participated in these technology innovations are being acknowledged for their efforts."

The TR50 list spans a range of industries including energy, computing, the Web, biomedicine and materials. Each company in the 2010 TR50 was evaluated on three criteria: business model, strategies for deploying and scaling up technologies and likelihood of success. For a complete list of winners, visit http://www.technologyreview.com/companywatch/tr50/.

In announcing the selections, David Rotman, editor of *Technology Review*, said, "In choosing the TR50, we picked companies with this year's most important inventions and breakthroughs as well as companies that are successfully growing businesses and markets around innovative new products."

FDA Issues Surgical Mesh Warning

From United Press International, Inc.

The U.S. Food and Drug Administration is warning healthcare providers and consumers about counterfeit surgical mesh carrying the Bard/Davol brand name.

Surgical mesh products are used to reinforce soft tissue where weakness exists.

"The warning is of particular significance to healthcare professionals and their patients with surgical mesh implants, as well as hospitals and surgical centers, operating room medical professionals and staff, and purchasing and risk managers," the FDA said, noting investigations showed several sizes and lots of counterfeit flat sheet polypropylene surgical mesh are not manufactured by Bard.

To date, four product sizes have been identified as counterfeit by the FDA and the company: Bard Flat Mesh 2"x 4" Lots 48HVS036 and 43APD007; Bard Flat Mesh 10"x 14" Lots HUSD0629 and HURL0336; Bard Flat Mesh 3"x 6" Lots 43HPD027, 43HPD032; HUSG0540, Lot 43HDP027, HUSE0532, 43LPD507, HUSF0763, 43IOD011 and 43IPD038; and Bard Flat Mesh 6" x 6" Lot 43FQD327.

Consumers and healthcare professionals with questions can contact Bard at 800-556-6275. The FDA said patients should contact their surgeon if they experience problems that they think might be related to surgical mesh.

Cardiovascular and Orthopedic Device Manufacturers Enlist DSM PTG for Contract R&D Projects

DSM PTG, part of DSM Biomedical, a global leader in biomedical materials science, has formed eight new partnerships with medical device companies in the last year alone. These contracts underline an upward trend among medical device developers in enrolling material specialists like DSM PTG to develop and license new polymer technologies essential to increasing the value, performance, and quality of their products.

DSM PTG has demonstrated a successful track record of working with medical device companies to develop new products, focusing on creating novel technologies that will lead to downstream manufacturing opportunities and value share for DSM PTG. In fact, the company signed nine new license agreements in 2009 for its well known Bionate®, BioSpan®, CarboSil®, Elasthane™ and PurSil® brands of thermoplastic biomaterials.

This model has proved to be very successful for DSM PTG as evidenced by the expansion of the number of licensees of the company's well-respected line of polyurethane and silicone-polyurethane copolymers. The company was the first to report the enhanced in vivo stability of silicone polyurethane copolymers, providing medical device companies with these and other high-strength biomedical polymers with an impressive combination of mechanical properties, biostability, and bio-compatibility. Many medical devices and technologies have already benefited from this combination of properties (including prosthetic spinal implants, other orthopedic implants, including arthroplasty for hips and knees and cartilage repair) in addition to cardiovascular and neurostimulation devices.

"Because of today's economic conditions, medical device manufacturers of all sizes are seeking opportunities to form partnerships from which they will receive the greatest return with the least amount of risk," said Bob Ward, President and CEO, DSM PTG. "Companies looking to expedite the commercialization of new products trust DSM PTG because of our 20 years' experience developing solutions for the pharmaceutical, life sciences and medical device industries."

The company's scientists work with both start-ups and large medical device manufacturers in the United States and Europe, in various fields including cardiovascular, orthopedic, ophthalmic, wound care and disease prevention and treatment. DSM PTG's research and development team will work closely with its medical device partners throughout the various phases of development, prototyping, manufacturing and processing of product commercialization as we collectively create specialty polymers for use in the cardiovascular and orthopedic markets. DSM PTG's quality system is certified to the ISO 9001 and ISO 13845 standards, providing its partners with an expertise in quality and regulatory compliance.

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instruments, and technology every day that likely would not currently exist if it were not for the SBIR funding of companies such as SurModics (then known as BSI Corporation), The Polymer Technology Group (now part of DSM Biomedical), and Hysitron. This is but a tiny fraction of the overall SBIR program impact including the support of some $21 billion worth of research in more than 15,000 firms, leading to more than 45,000 patents, and employing more than 400,000 scientists and engineers.

So, what is the current status of the SBIR/STTR program? In the July-August 2009 editorial I wrote, "Well, little has changed since I drafted the May-June editorial." This is still pretty much the case. Continuing resolutions have kept the program going, but the SBIR program has yet to be re-authorized and is now tied into the "Jobs Bill." The House passed the Jobs Bill (HR.2847) in March 2010, but the SBIR Reauthorization does not appear to have been included in this version. The Jobs Bill is now on its way back to the Senate where it should be addressed very soon. Thus, we now have at most a few weeks to get the attention of our legislators to support the SBIR authorization by including the key aspect of Senate bill that supports and improves the SBIR/STTR program (S.1233). Please let your representatives know how important this program is to the development of life-saving and cost-lowering technologies, and to small business jobs creation in your state.

CorMatrix Announces Publication of Pre-Clinical Data in *Journal of American College of Cardiology (JACC)* Demonstrating the Role of CorMatrix ECM™ Technology in Remodeling Cardiac Tissue

CorMatrix Cardiovascular, Inc., a medical device company dedicated to developing and delivering unique extracellular matrix (ECM) biomaterial devices that harness the body's innate ability to repair damaged cardiovascular tissue, announced that investigators from the Mercer University School of Medicine, Emory University and CorMatrix Cardiovascular, Inc. demonstrated that an injectable emulsion of the company's ECM Technology enhances angiogenesis (new blood vessel growth), improves cardiac function, and increases the recruitment of bone-marrow derived (c-kit positive) stem cells, myofibroblasts, and macrophages in a rat model of myocardial infarction (heart attack). The research, published in the March 23 print version of the *Journal of the American College of Cardiology*, was posted on the Journal's website (http://content.onlinejacc.org).

"What is significant about our approach, compared to other attempts at developing stem-cell therapies for treating damaged heart tissue, is that we're able to avoid the pitfalls associated with trying to manipulate the individual cell types involved by allowing the ECM to naturally support the individual phases of tissue remodeling," said Robert G. Matheny, MD, Chief Scientific Officer of CorMatrix, and a co-author on the study. "Results from this study and previous work that we've done show that the adjacent healthy tissue is capable of supplying the correct cells and other factors needed for all phases of tissue reconstruction and regeneration. To do their work, the tissue cells simply need a physiologically correct, biologically supportive microenvironment, which our unique ECM Technology provides."

In the study, the heart muscle damage was caused by delivery of 45 minutes of reversible coronary occlusion. CorMatrix ECM emulsion or saline control was then injected into the affected ischemic myocardium. After three, seven, 21 and 42 days of reperfusion, the affected areas were analyzed for histological and molecular markers of cardiac remodeling, cellular recruitment and cardiac function.

Key Study Findings and Conclusions

- Expression of stem cell factor (SCF) was significantly increased in damaged heart tissue injected with ECM emulsion, and remained elevated throughout the study compared to the control. SCF has been previously reported to enhance endogenous cardiac repair by recruiting bone marrow-derived stem cells and other differentiated precursor cells, modulating stem cell differentiation, and stimulating expression of vascular endothelial growth factor (VEGF), a key regulator of angiogenesis.(1-2)
- Consistent with the time course of SCF expression was an observed increase in the number of c-kit positive cells found in the region injected with the ECM emulsion. c-kit is a well-known molecular marker for bone marrow-derived stem cells.
- New blood vessel formation in the ECM emulsion treated area was significantly enhanced relative to the control, as evidenced by increased density of alpha-smooth muscle actin (SMA) positive blood vessels.
- Consistent with enhanced angiogenesis, the ECM emulsion promoted infiltration and sustained accumulation of alpha-SMA expressing myofibroblasts and macrophages, whereas the accumulation of myofibroblasts declined after day seven in the control animals. Increased levels of VEGF protein expression and immunoreactivity were also observed.
- The wall thickness of the infarcted middle-anterior septum in the area of ECM emulsion injection was significantly increased relative to the control. Echocardiography showed significant improvements in fractional shortening, ejection fraction and stroke volume in the ECM emulsion group.
- The authors conclude that the data provide direct evidence that adverse cardiac remodeling can be modified by supplying CorMatrix ECM emulsion to the affected myocardium following myocardial infarction.

"The results of this study are exciting and suggest that our ECM Technology, when delivered as an injectable form directly into damaged cardiac muscle, delivers results consistent to those observed from implantation of

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Abbott Announces Positive Data from ABSORB Trial on its Bioresorbable Vascular Scaffold Technology

Abbott announced positive 30-day results from the first 101 patients enrolled in the second phase of the ABSORB trial. Patients treated with Abbott's bioresorbable vascular scaffold (BVS), under clinical investigation in Europe, demonstrated no cases of blood clots (thrombosis), no need for repeat procedures (ischemia-driven target lesion revascularization) and a very low rate of major adverse cardiac events (MACE1 rate of 2.0 percent) at 30 days. These results build on the long-term success Abbott has seen with the BVS technology in the first phase of the ABSORB trial, which has generated positive data on 30 patients out to three years. Data from the second phase of the trial were presented at the American College of Cardiology's 59th annual scientific session in Atlanta.

"The positive 30-day results reaffirm my belief that a device that bioresorbs, or disappears, into the body after restoring blood flow is the next logical step in the treatment of cardiovascular disease," said Patrick W. Serruys, M.D., Ph.D., professor of interventional cardiology at the Thoraxcentre, Erasmus University Hospital, Rotterdam, the Netherlands, and principal investigator for the ABSORB trial. "The continuing positive results of the ABSORB trial and the clinical benefits demonstrated to date by Abbott's bioresorbable technology show promise that a bioresorbable scaffold is on its way to becoming a clinical reality and will be the next revolution in interventional cardiology."

This second phase of the ABSORB clinical trial (Cohort B) enrolled 101 patients from 12 centers in Europe, Australia and New Zealand, and incorporates device enhancements designed to improve deliverability and vessel support. Abbott is the only company with long-term, three-year clinical data on a complete patient set evaluating the safety and performance of a fully bioresorbable drug eluting scaffold.

"The encouraging 30-day results show that Abbott's BVS is able to restore blood flow with no cases of blood clots or repeat procedure, suggesting that there could be important clinical benefits for patients," said Charles A. Simonton, M.D., FACC, FSCAI, divisional vice president, Medical Affairs, and chief medical officer, Abbott Vascular. "If Abbott's bioresorbable technology continues to perform well in clinical trials, it has the potential to become the new standard of care for patients with coronary artery disease."

Abbott's investigational BVS is made of polylactide, a proven biocompatible material that is commonly used in medical implants such as dissolving sutures. The bioresorbable technology is designed to restore blood flow by opening a clogged vessel and providing support until it is healed. Once the vessel can remain open without the extra support, the bioresorbable scaffold is designed to be slowly metabolized by the body, and is completely dissolved over time. Since a permanent implant is not left behind, a vessel treated with BVS has the ability to ultimately move, flex and pulsate similar to an untreated vessel. The potential to restore these naturally occurring vessel functions, or vascular restoration therapy, is what makes Abbott's BVS unique in the field of cardiology.

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the sheet form of the product that is currently in commercial use for surgical repairs of the human heart," said Beecher Lewis, President and COO of CorMatrix. "While these are very early pre-clinical results, the ability to use our injectable ECM emulsion to potentially fix or reverse the underlying damage from a heart attack could have significant potential clinical benefits and further study is warranted."

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ture, packaging configuration, safety attributes in terms of histopathology endpoints in preclinical studies, and in vivo drug release profile and drug tissue levels in animal pharmacokinetic studies.

Lack of efficacy model to drive drug dose determination

It is common that preclinical study may be adequate to screen for device safety but not to ascertain device efficacy. Preclinical safety model and related histopathology endpoints must be established early to support their use as major decision making criteria. It may also be beneficial to include a competitor device, when available, as a control to capture device-related variability. To mitigate the possibility of selecting a dose close to the maximum tolerated dose for the device, an early dose ranging study should be conducted to examine any dose-dependent response for dose optimization in the final device later on in development.

In vitro drug elution assay does not always predict in vivo drug release performance

Release rate optimization in a drug-eluting device is a challenging task. For quality control purposes, the in vitro release assay (often with a different release mechanism than in vivo release) is much shorter in duration than the actual release duration in vivo. Relative changes with in vitro release profiles therefore may not reflect in vivo performance at all. An insensitive assay should not be used for quality control purposes. On the contrary, use of a highly sensitive assay will raise unnecessary concerns that have insignificant in vivo relevance. Decision making on the sole basis from in vitro elution profiles should be avoided unless the elution assay has been proven to have a high predictive power.

To gauge the sensitivity of the in vitro release assay, the assay should be challenged early on with units manufactured with planned product and process perturbations. It is also important to include drug elution testing as an output for systems generated from product and process characterization studies. Before the elution assay is optimized for decision making, it is crucial to ascertain that the in vivo release characteristic is not drastically altered with major changes adopted in product configurations during development. Components of an in vivo pharmacokinetic study, such as tissue trimming from explants, tissue analysis, and bioassay, should also be optimized to reduce systemic variability early on.

Since preclinical study may be inadequate to ascertain device efficacy, product developers may consider bringing forward a range of slow to fast release devices into the first preclinical or even clinical study to select the optimal device[5]. If the target profile is to match the performance of a competitor's device, it is then important to include that device as a control.

In summary, engineers and pharmaceutical scientists must embrace and openly communicate the diversity of opinions between drug and device development approaches. They must jointly anticipate the complexity of drug-eluting device development as both mechanical and drug-related attributes are optimized concurrently in a short time. Unknown issues stemming from the interactions between drug product and device will arise as both product configuration and manufacturing process continuously evolve in development. Flawless executions and proactive mitigation planning will avoid unnecessary product redesign and costly project re-loops late in development.

References:
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Andrew Luk is the Founder of Luk Consulting, www.luk-consulting.com

ETEX Corporation Announces FDA Clearance and Launch of CarriGen® Porous Bone Substitute Material

The FDA has granted ETEX Corporation, an advanced biomaterials company, 510(k) clearance of CarriGen® Porous Bone Substitute Material. CarriGen is available for immediate sale through ETEX's independent sales force. CarriGen builds upon the clinically proven benefit of ETEX nanocrystalline calcium phosphate technology by adding the advantage of increased porosity and pore size. CarriGen is the first highly porous bone graft substitute that sets hard upon implantation for a complete defect fill.

CarriGen indicated as a bone void filler of the pelvis, extremities and spine, including posterolateral spine fusion.
Cleared to be hydrated with saline or blood, CarriGen viscous putty may be injected or molded to pack into a defect. Upon implantation, CarriGen sets hard to provide compressive strength comparable to cancellous bone. The resulting osteoconductive scaffold provides interconnected porosity that facilitates cell mediated remodeling at the same rate as the surrounding bone. The proprietary nanocrystalline calcium phosphate technology, which serves as the foundation of the osteoconductive scaffold, has proven to be safe and effective in more than 10,000 implantations and a landmark Level 1 clinical trial.

ETEX launched CarriGen at the American Academy of Orthopaedic Surgeons (AAOS) meeting in New Orleans, March 10-12, 2010. Attendees at the ETEX booth saw demonstrations of this new biomaterial as well as clinical presentations on the use of ETEX technology in trauma and spine surgery.

Brian Ennis, President and CEO of ETEX Corporation, comments: "We are extremely pleased to announce the market release of CarriGen. While a number of respective bone growth factors continue to populate the market landscape, none of them possess any intrinsic biomechanical characteristics nor do they possess a biologically compatible scaffold that optimizes user handling and placement. ETEX has devoted more than a decade of research efforts to formulate carrier technology for bone growth factors utilizing our clinically proven conductive scaffold in formats that combine easy mixing with extraordinary handling capabilities. CarriGen represents just the first step in our concerted ongoing efforts to establish ETEX as the market leader in carrier technology."

Meeting/Conference/Trade Show Calendar

Meeting/Conference/Trade Show	Dates	Place	Web Address
International Symposium on Surface Science Aspects of Pharmaceutical Science, Pharmacology, Cosmetics and Bio-Technology	Apr 19-21	Danbury, CT	mstconf.com/SurfSciPharm.htm
BioInterface 2010	Oct 18-20	Atlanta, GA	surfaces.org/cde.cfm?event=292411

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To be leaders in the surface science community

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- Help shape workshops and symposia that further the world-wide education of surface science
- Promote understanding of interfacial issues common to researchers, bio-medical engineers and material scientists.

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- Your logo and a link to your Web site in the member directory on the official Web site of the Foundation, www.surfaces.org.
- Complimentary full page ad in surFACTS, the Foundation's newsletter and discounts on all advertising.

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