"Let me tell you the secret that has led me to my goal. My strength lies solely in my tenacity."

-Louis Pasteur-

Brainy Quotes!!!!!

KILLER PAPER FOR NEXT-G

Sharen(738)

Scientists are reporting development and successful lab tests of "killer paper," a material intended for use as a new food packaging material that helps preserve foods by fighting the bacteria that cause spoilage. The paper, described in ACS' journal, *Langmuir*, contains a coating of silver nanoparticles, which are powerful anti-bacterial agents. Silver already finds wide use as a bacteria fighter in certain medicinal ointments, kitchen and bathroom surfaces, and even odor-resistant socks. Recently, scientists have been exploring the use of silver nanoparticles -- each 1/50,000 the width of a human hair -- as germ-fighting coatings for plastics, fabrics, and metals. Nanoparticles, which have a longer-lasting effect than larger silver particles, could help overcome the growing problem of antibiotic resistance, in which bacteria develop the ability to shrug-off existing antibiotics. Paper coated with silver nanoparticles could provide an alternative to common food preservation methods such as radiation, heat treatment, and low temperature storage, they note. However, producing "killer paper" suitable for commercial use has proven difficult. The scientists describe development of an effective, long-lasting method for depositing silver nanoparticles on the surface of paper that involves ultrasound, or the use of high frequency sound waves. The coated paper showed potent antibacterial activity against*E. coli* and *S. aureus*, two causes of bacterial food poisoning, killing all of the bacteria in just three hours. This suggests its potential application as a food packaging material for promoting longer shelf life, they note.

β-TCP

-Shalooja (736)

Researchers at Aalto University have developed a method of selection of new surface treatment processes for orthopaedic and dental implants to reduce the risk of infection.

Implants are commonly made from metals such as titanium alloys. These materials are being made porous during processing used to prepare them for medical use.

A thin coating of a biomaterial called Hydroxyapatite (HAP) or bioactive glass (BAG) is typically applied to orthopaedic and other implants to alter the surface properties. Such coatings improve the body's ability to recognize a foreign object in a more friendly way and promote implant integration into surrounding tissues. During the heat treatment process, excessive stresses can cause premature cracking and removal of the coating layer.

Picture Courtesy: Advantage

By adding a certain amount of another compound called beta-tricalcium phosphate (ß-TCP) such stresses are reduced and therefore preserves the biomaterial coating better. Thus minimizing the risk of coating destruction and bacterial adhesion, and improving cell proliferation, allows the implant surface to achieve its function in an optimal way. This research is significant in the battle against the spread of drug resistant bacteria.

BIOMATERIALS IN NEUROREGENERATION

-Saranya (734)

The research done by Professor Jose Miguel Soria, a member of the Institute of Biomedical Sciences , along with Professor Manuel Monleon of the Universitat Politecnica de Valencia has confirmed the high biocompatibility of polymeric materials, with brain tissue and its effectiveness in neuroregeneration. The study has shown that these types of implants, made of a biocompatible synthetic material, are colonized within two months by neural progenitor cells and are irrigated by new blood vessels . This allows the generation of new neurons and glia, within these structures. It is capable of repairing injured brain tissue caused by trauma, stroke or neuro-Neurodegenerative diseases. The synthetic structures used in this study are made with acrylate copolymer which is a porous and biocompatible polymeric material. Structures have been studied in vitro by implanting them into neural tissue and in vivo, when implanted in two areas of the adult rat brain: the cerebral cortex and the sub ventricular zone.

It is capable of repairing injured brain tissue caused by trauma, stroke or neurodegener ative diseases

BioGen

EMERGING TRENDS IN BIOMATERIAL SCIENCE & ENGINEERING

In This Issue....

EDITORIAL

Materials influence our daily lives in a myriad of ways. As the eminent metallurgist, **William. D. Callister, Jr.** (2003) has aptly pointed out, "Materials are probably more deep- seated in our culture than most of us actually realize". The field of ***materials science*** involves the investigation of relationships between structures and properties of materials. Whereas, ***material engineering*** refers to the design or engineering of the structure of a material, so as to produce a predetermined set of properties. Biomaterials are a novel class of materials which find increased applications in the bio-medical field. Rapid advances in the fields of analytical chemistry, instrumentation engineering, Biomimetics research and materials processing have resulted in the development of several newer biomaterials belonging to the classes of metals, ceramics, polymers and composites, each with increased biocompatibility, sterilizability, functionability and manufacturability. The present newsletter envisages at collating the major advancements in the field of Biomaterials Science and Engineering, which shall enable us in having a closer and seamless outlook of materials in medicine.

Biju Jacob
Asst. Professor
BT & BCE
SCTCE

Would you like some SILK in your vertebrae?!

-Sumitha (742)

A Silky idea promises to provide a smooth way out for lower-back pain. A student of IIT Delhi has come up with a novel idea of using silk fibres, developed through a silk-winding machine, to regenerate the Inter Vertebral Disc (IVD) in the spinal column, thus bringing huge relief to the rapidly growing tribe of patients suffering from back pain.

What differentiates fibres produced through this machine from existing treatment modalities is that these fibres restore the normal biological and mechanical properties of the human spine, says Maumita Bhattacharjee, a Ph.D from IIT Delhi along with Sannidhi Jhala, a management student at ISB Mohali, the duo who came up with the idea. The machine facilitated alignment of silk fibre at an angle of approximately 30 degree in one layer and oriented in opposite direction in successive layers that represent orientation of fibres in the IVD layer. They submitted the idea at a Young Innovator competition organised by DuPont recently.

The silk-fibre based bio-materials produced by the machine simulates the precise anatomical orientation of fibres in outer IVD layer and match its stiffness. The biomaterials developed by this machine mimic the natural body mechanism with regard to flexibility and is a better solution compared to the current treatment modalities and cheaper than the present alternatives where ceramic and metallic prosthetic discs are used in the surgery. The metal disc costs about Rs. 4 lakh while silk disc will cost around Rs. 30,000. Maumita designed the winding machine using stepper motors and decks from old broken tape recorder - Talk about innovation!

The young researcher points out that the results in lab conditions have been highly successful and the effort is on to test it on the animals. They say they need at least two years for the idea to become operational and sound quite confident of changing the lives of people suffering with lower back pain.

Today in History

1901- Rene Jules Dubos was born. Dubos was a French-American microbiologist who's antibacterial research produced many antibiotics. He also studied the social and environmental factors that affect people and was one of the earliest environmentalists. He was known for being the originator the maxim "Think Globally, Act Locally"

SCTIMST : Leaping a colossal step in Biomaterial Engineering

The Biomedical Technology Wing of Sree Chitra Thirunal Institute for Medical Sciences and Technology , Trivandrum, has played a pioneering role in the establishment of a medical device industry base in India by successfully developing and transferring technologies for diverse medical products such as disposable blood bag system, Mechanical heart valve prosthesis, blood oxygenators, ophthalmic sponge, concentric needle electrode, hydroxyapatite based bioceramic porous granules with many more in the pipeline with industrial collaboration.

CAN BRAIN TUMORS BE MADE IMPOTENT???

-Sinu *(741)*

Biomaterial-delivered chemotherapy could provide final blow to brain tumors

Researchers at The University of Nottingham have discovered that, a polymer originally designed to help mend broken bones could be successful in delivering chemotherapy drugs directly to the brains of patients suffering from brain tumors

The targeted nature of the therapy could also reduce the toxic effects of chemotherapy drugs on healthy parts of the body, potentially reducing the debilitating side-effects that many patients experience after cancer treatment.

Dr Ruman Rahman, of the University's CBTRC, who led the study, said: "Ultimately, this method of drug delivery, in combination with existing therapies, may result in more effective treatment of brain tumors, prolonged patient survival and reduced morbidity." ---->

The Nottingham polymer formulation is made from two types of micro-particles called PLGA and PEG. A powder at room temperature, it can be mixed to a toothpaste-like consistency with the addition of water. The unique properties of the polymer lie in its ability to set into a rigid structure only when it reaches body temperature (37 degrees), a feature perfectly tailored for use in medical therapies. They also spotted the potential for the polymer to deliver chemotherapy drugs directly to patients' brain tumors. The cavity left by the removal of a tumor would be lined with the polymer while in paste form, which would start to solidify and gradually release the chemotherapy drugs after the incision has been closed.

This would directly target any residual cells not initially removed during surgery. The team also dealt with concerns that the material could disintegrate and release its chemotherapy contents too quickly during the subsequent radiotherapy which many cancer patients undergo following surgery.

Type 1 diabetes, a cure???

-Veena R *(744)*

Researchers have made newly engineered biomaterials for cell transplantation that could help lead to a possible cure for Type 1 diabetes.

Successful islet transplantation would remove the need for patients to administer insulin and control glucose levels but diabetic symptoms have returned in most patients and they have had to revert to using some insulin , Normally, injecting islets directly into the blood vessels in the liver causes almost half of the cells to die due to blood clotting. Also, the islets (require significant blood flow) have problems hooking up to blood vessels once inside the body and die off over time. Georgia Tech and Emory researchers engineered a hydrogel, a material compatible with biological tissues that is a promising therapeutic delivery vehicle. This water-swollen, cross-linked polymer surrounds the insulin-producing cells and protects them during injection. The hydrogel containing the islets was delivered to a new injection site on the outside of the small intestine, thus avoiding direct injection into the blood stream. The hydrogel gradually degrades to release a growth factor protein that promotes blood vessel formation and connection of the transplanted islets to these new vessels. In the study, this was successfully done.

*Picture Courtesy: **Science Llama***

Four weeks after the transplantation, diabetic mice treated with the hydrogel, had normal glucose levels, and the delivered islets were alive and vascularized to the same extent as islets in a healthy mouse pancreas and also required fewer islets than previous transplantation attempts.

New approach to regenerate spinal discs

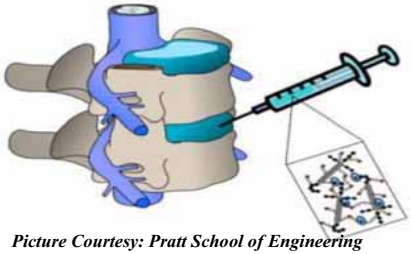
-Vishakha *(743)*

Soon we may be able to stop or reverse the pain and disability of degenerative disc through cell therapies

The researchers at Duke's Pratt School of Engineering, have designed a new biomaterial designed to deliver a booster shot of reparative cells to the nucleus pulposus, or NP, the jelly-like cushion naturally found between spinal discs. The NP tissue distributes pressure and provides spine mobility, helping to relieve back pain.

The soft compressible discs (natural shock absorbers) of the spine slowly wear down with time and cause severe pain. Previous lab research has shown that re-implanting NP cells, or even stem cells, can delay disc degeneration.

The Duke team's delivery strategy keeps the cells in place and provides cues that mimic laminin, a protein in native nucleus pulposus tissue.



Picture Courtesy: Pratt School of Engineering

The researchers developed a gel mix designed to reintroduce NP cells to the intervertebral disc (IVD) site which mixes together three components: the protein laminin-111 that has been chemically modified and two polyethylene glycol (PEG) hydrogels which is used for attachment for modified laminin. Separately, these substances are in a liquid state. The gel is what holds the cells in place upon injection.

The NP cells were then tagged with the bioluminescent marker luciferase their location was tracked. They then injected the gel into rats' tails. The solution began to solidify after five minutes and was completely set at 20 minutes. The markers showed that more than 14 days after injection, significantly more number of cells remained in place when delivered along with biomaterial carrier compared to cells delivered in a liquid suspension.

How they saved a little girl called Kaiba

-Alvin *(703)*

Glenn Green and his colleagues of University of Michigan created and implant a tracheal splint for Kaiba, a 20 months old baby, suffering from tracheobronchomalacia, made from a biopolymer called polycaprolactone.

On February 9, 2012, the specially-designed splint was placed in Kaiba. The splint was sewn around Kaiba's airway to expand the bronchus and give it a skelton to aid proper growth.

A baby's life was saved with this groundbreaking 3-D printed device that restored his breathing.

Picture courtesy: University of Michigan Health System

Over about three years, the splint will be reabsorbed by the body.

Green and team were able to make the custom-designed, custom-fabricated device using high-resolution imaging and computer-aided design. The device was created directly from a CT scan of Kaiba's trachea / bronchus , integrating an Image - based computer model with laser-based 3D printing to produce the splint.

Kaiba was off ventilator support 21 days after the procedure, and has not had breathing trouble since then. The image-based design and 3D biomaterial printing process can be adapted to build and reconstruct a number of tissue structures.

REPAIR OF HEARTS !!!

-Deepa *(721)*

Clemson University biological sciences student Meghan Stelly and Alabama cardiovascular surgeon Terry Stelly, investigated a biomedical application following a coronary artery bypass surgery and found that the application allowed the human body to regenerate its own tissue. The biomaterial extracellular matrix (ECM) is a naturally occurring substance that helps regulate cells and can be harvested and processed in such a way that removes all cells, leaving only the structural matrix, which is made of collagen.

ECM can be molded into a "bioscaffold" for medical applications to enable a patient's cells to repopulate and repair damaged tissue. The researchers examined a bioscaffold that was implanted five years earlier to close the pericardium, a double-walled sac containing the human heart, following a coronary artery bypass surgery. Pathology results revealed that the bioscaffold had remodeled into viable, fully cellularized tissue similar to the native pericardium. Essentially, the human body regrew its own tissue. The research demonstrates the long-term effectiveness of this technology as an implant for pericardial closure and cardiac tissue repair.

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