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Scientific Tracks & Abstracts

Day I

Elisabeth Engel et al, J Biotechnol Biomater 2017, 7:2 (Suppl)
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Tailoring microenvironments for *in situ* regeneration

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At present, tissue engineering for bone regeneration seeks to obtain scaffolds that mimic the cell microenvironment to recruit stem and progenitor cells to recapitulate the development of target tissues. Herein, we have explored the use of citric acid related to bone nanostructure and mechanical performance, to develop scaffolds resembling the extracellular matrix of developing bone. Elastin-like recombinamers (ELRs) hydrogels were achieved through a one-step chemical crosslinking reaction with citric acid, a molecule currently considered to be essential for the proper performance of bone tissue. We were able to control the architecture and stiffness of citric acid-crosslinked hydrogels while preserving the integrity of adhesion sequences in ELRs. Interestingly, the use of citric acid conferred so-produced hydrogels the ability to nucleate calcium phosphate. *In vivo* implantation of both mechanically-tailored and non-tailored citric acid-crosslinked hydrogels demonstrated to be able to mineralize the new formed tissue and to integrate into bone in critical size defects in mouse calvaria. Both types of hydrogels showed bone tissue formation by intramembranous ossification. The non-mechanically tailored scaffold showed higher cellular activity (in terms of osteoblasts and osteoclasts presence) related to a lower density of the matrices that allowed higher cell penetration.

Biography

Elisabeth Engel is an Associate Professor at Technical University of Catalonia since 2010. She received her PhD in 2003 in Bone Metabolism Diseases from a Medical School. She was appointed as PI at the Group of Biomaterials for Regenerative Therapies since September, 2012 at the Institute for Bioengineering of Catalonia. Her research interests include the preparation and design of materials and scaffolds for *in vitro* and *in vivo* fundamental studies, and a further focus is the provision of useful tools to assess mechanisms that govern cell behaviour in regenerative medicine.

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Avelina Sotres Vega et al, J Biotechnol Biomater 2017, 7:2 (Suppl)
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Biomaterials as a tool for teaching and learning training programs on surgery

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Statement of the Problem: Developing surgical skills is essential in the training of all surgical specialties. However ethical, legal and economic issues have limited surgical training. As surgical educators, we are always trying to identify new ways to provide skills training. We have developed training programs to teach surgical skills to junior surgeons from human and veterinary medicine based on laboratory animals using preserved tissues and organs as surgical training biomaterials. The goal is to help the trainees acquire the abilities and dexterity necessary to perform surgery on patients.

Methodology: We created a small bank of cryopreserved tracheas and stomachs harvested from Wistar rats as well as cryopreserved tracheas and lyophilized esophagus that were harvested from dogs. All animals were previously used in research studies. Stomachs, tracheas and esophagus were cleansed with saline solution, after this, tracheas and esophagus were mounted on polypropylene tubes. In the stomachs, the pyloric antrum was tied with silk 1-0, stomachs were filled with hyaluronic acid solution and the distal esophagus was tied too. Tracheas and esophagus were trimmed in segments of 5 cm. Cryopreservation of tracheas and stomachs was made with a controlled-rate freezer (-1ºC/min) and stored at -30ºC for 30 to 60 days. All the esophagus were lyophilized at -55ºC and 10 mBar of vacuum pressure during 24 hours and sterilized with low temperature hydrogen peroxide gas plasma process. On the day of the surgical skills practice, the cryopreserved organs were thawed at room temperature and all the esophagus were rehydrated with saline solution at 4ºC. Each preserved organ was used to perform end-to-end anastomosis with 4-0 running polypropilene or single stitches. Preserved organs are inexpensive, practical, portable bench models and have high-fidelity that improve the tactile perception and facilitate surgical skills learning by improving how trainees handle tissue and surgical instruments.

Biography

Avelina Sotres Vega has her expertise in teaching and learning programs on surgery using preserved biomaterials either by cryopreservation or lyophilization as well as cryopreserved tracheal grafts in experimental models of long segment replacement mainly.

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M A Mateos-Timoneda et al, J Biotechnol Biomater 2017, 7:2 (Suppl)
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Design of a composite bioink for bioprinting applications

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3D bioprinting is an expanding field that allows the fabrication of customized tissue engineered scaffolds with encapsulated cells. Designing a biomaterial fit for 3D printing and cell encapsulation (bioink) is a complex task due to the high number of requirements that need to be accomplished. Bioinks are usually based on combinations of different hydrogels due to their encapsulation capacities, but other kinds of materials can be added in order to improve certain characteristics of the final scaffold. A novel composite bioink that includes alginate as a printable hydrogel and calcium-releasing particles as a vascularization promoter is optimized and studied. Rheometry studies show that the addition of calcium-releasing particles to alginate increases its viscosity, but does not alter its shear thinning properties; therefore maintaining the printability of the material. Solid scaffolds with theoretically high nutrient diffusion rates (filament diameter ≈ 200 μm) are printed using this novel bioink and a novel cross-linking method. A bioprinting procedure that includes encapsulation of cells is optimized and tried out successfully with different bioinks, obtaining good survival rates. The addition of calcium releasing-particles improves cell survival after the bioprinting process as well as during the first culture days. Moreover, the interaction between calcium-releasing particles and alginate is proven to be adequate for bioprinting and could be an interesting line of research for bone regeneration and tissue vascularization applications.

Biography

M A Mateos-Timoneda is an expert in the field of Biomaterials and Scaffolds for Tissue Engineering. He holds a PhD in Supramolecular Chemistry from the University of Twente (Enschede, The Netherlands). Since 2007, he is a Senior Researcher at CIBER en Bioingeniería, Biomateriales y Nanomedicina (CIBER-BBN) and in the Biomaterials for Regenerative Therapies Group at the Institute for Bioengineering of Catalonia (IBEC) in Barcelona (Spain). His main interests are the study of cell delivery using biodegradable microcarriers and 3D printing and bioprinting.

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Sybille Facca et al, J Biotechnol Biomater 2017, 7:2 (Suppl)
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Development of nanostructured biomaterials for bone and osteo-articular regeneration

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During the last ten years, tissue engineering has merged with regenerative nanomedicine by combination, not only of new biomaterials but also of stem cell technology and growth factors. The goal of this work was to use bone and cartilage engineering as a model, in order to improve and to develop active and living nanostructured implants. We were interested in the development of biomaterials (natural or synthetic), tridimensional (3D), transplantable for bone and cartilage diseases treatments, that are able to induce more cellular differentiation and improved tissue regeneration. We have developed 3 types of nanostructured implants, (i) titanium implants coated with hydroxyapatite and carbon nanotubes in order to improve osteoformation and osteoinduction around arthroplasty implants; (ii) active capsules functionalized by growth factors and stems cells for bone induction (*in vitro*/*in vivo*) after a bone defect; (iii) electrospun nanofibrous membranes functionalized by growth factors and (Osteoblasts/Chondrocytes) for bone and cartilage regeneration, *in vitro* and *in vivo*.

Biography

Sybille Facca, MD, PhD, has her expertise in Orthopedic, Hand and Nerve Surgery as an Orthopedic Surgeon at Strasbourg Hospital University since 2007. She was the first person focusing her research on bone and cartilage regeneration and drug delivery systems of bone cements or nanofibers membranes and osteointegration of orthopaedic implants. Now, she is also focusing her research on tubes for nerve regeneration, microsurgery simulation or microanastomosis mechanical properties and new design of wrist arthroplasty, in a biomechanical laboratory of Strasbourg University.

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Patricia Gálvez-Martín et al, J Biotechnol Biomater 2017, 7:2 (Suppl)
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Design and characterization of bioinks with hyaluronic acid for tissue and bone-3D bioprinting

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Statement of the Problem: The 3D bioprinting of tissues and organs represents a major breakthrough in regenerative medicine and tissue engineering. Cartilage and bone regeneration provides an alternative in the treatment of diseases such as degenerative osteoarthritis, injuries of articular cartilage, osteonecrosis and bone fractures, among others. The purpose of this study is to describe the design, development and preparation of a bioink with hyaluronic acid (HA) to manufacture cartilage and bone by 3D bioprinting.

Methodology & Theoretical Orientation: For the formulation of bioinks, two hyaluronic acids were studied: high molecular weight sodium hyaluronate (bioinkA) and low molecular weight sodium hyaluronate (bioinkB), both of intra-articular grade. The HA was combined with alginate and human chondrocytes. The biopaper studied was the polylactic acid (PLA). Cell viability was studied for each bioink.

Findings: The results obtained showed that the HA concentration before and after the bioprinting process did not affect chondrocyte viability. Additionally, cells remained in proliferation after 5 weeks. The rheological properties of each bioink showed mild differences between bioinkA and bioinkB.

Conclusion & Significance: Considering the mild differences in rheological properties between the two experimental bioinks, it may be concluded that both formulations can be used for cartilage and bone bioprinting.

Biography

Patricia Galvez-Martin completed her PhD in 2014, MSc in Drug Development (2008) and MSc in Clinical Trials (2012). She has participated in several clinical trials, with great experience in the pharmaceutical industry, as a qualified person and Quality Control Manager. She is expert in the design and development of new medicines with cells, genes and tissues to treat different pathologies. She is currently working in the biotech company, Bioibérica as the Director of Advanced Therapies Unit.

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Deniz Yucel et al, J Biotechnol Biomater 2017, 7:2 (Suppl)
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The effect of scaffold topography on behavior of dental pulp stem cells

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Statement of the Problem: Tissue engineering aims to restore the damaged tissues or organs that are incapable of functioning properly. It involves scaffolds seeded with preferably the patient's own cells like mesenchymal stem cells (MSCs). For guided tissues, like nerve and bone, incorporation of guidance platforms into scaffold designs are known to enhance the regeneration environment. The aligned topography creates a permissive milieu for cell attachment, growth, cytoskeletal organization, guidance and even differentiation. The purpose of this study was to investigate the effect of scaffold topography on behavior of dental pulp stem cells, such as their attachment, proliferation and orientation.

Methodology: Random and aligned fibrous mats of polymer blend were fabricated by electrospinning. Human MSCs were isolated from dental pulp tissue. MSCs were seeded and cultured on biodegradable fibrous mats. Proliferation of cells on electrospun mats was studied using MTS. The cytoskeletal and nuclear orientation of the cells on scaffolds were investigated by confocal microscopy after FITC-Phallodin and DAPI staining for cytoskeleton and nucleus.

Findings: Random and aligned electrospun fibers without beads were obtained under optimized conditions. MTS results revealed that MSCs were able to grow and increase in number on both random and aligned fibers. Confocal microscopy results demonstrated that MSCs responded to the topography of scaffolds. MSCs on aligned electrospun mats were well oriented along the axis of the fiber while the cells on the randomly organized fibers appeared to spread randomly in every direction.

Conclusion & Significance: In the present study, guided tissue engineering approach with MSCs aligned on the highly oriented mats showed that it could serve as a guiding substrate for structural and functional regeneration for oriented tissue injuries.

Biography

Deniz Yucel has expertise in the field of Biomaterials and Tissue Engineering, 2D and 3D polymeric material design, stem cells (mesenchymal stem cells from various sources and neural stem cells), construction of biosensors, and enzyme/protein immobilization on polymeric materials. She received Best PhD Thesis Award in 2010 from Middle East Technical University for her PhD thesis titled, "Stem cell based nerve tissue engineering on guided constructs". During her PhD, she worked on mesenchymal stem cells and microfluidic systems for one year at Massachusetts General Hospital (MGH) - Harvard Medical School and at Tufts University. She is currently working on stem cells, studying their behavior on different scaffolds, and mainly on tissue engineering applications for various tissues like nerve, bone, tendon, and blood vessel.

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Cristina Plamadeala et al, J Biotechnol Biomater 2017, 7:2 (Suppl)
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Bio-inspired microstructures for directional liquid transport

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The interdisciplinary field of biomimetics has been very successful in solving engineering problems by searching for solutions in nature. Through the process of evolution, many living organisms developed different structural and chemical material properties that assured the continuation of a certain species. Technological challenges dealing with wetting and liquid collection and transportation also found solutions in nature. Our main focus is on the directional transport of liquids and as a role-model for this application, we used the flat bugs (*Dysodius lunatus*). Here, we present arrays of microstructures produced by two-photon polymerization technique that mimic the micro-ornamentation from the bugs' cuticle. A good directionality of liquid transport was achieved, directly controlled by the direction of the pointed microstructures at the surface. These results could therefore be interesting for applications in friction and wear reduction.

Biography

Cristina Plamadeala has a Bachelor's and Master's degrees in Biophysics and Medical Physics from the Alexandru Ioan Cuza University, Iasi, Romania. Currently, she is enrolled in the PhD program of Johannes Kepler University Linz, Linz, Austria, under the supervision of a Dr. Johannes Heitz and Dr. Werner Baumgartner. Her scientific work is done in the framework of the European FET-OPEN project 665337 titled, "Laser-induced nanostructures as biomimetic model of fluid transport in the integument of animals (LiNaBioFluid)". The main focus of her work is to create laser-induced microstructures for potential bio-medical applications in the fields of fluid transportation and tissue engineering.

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Mónica L Fanarraga et al, J Biotechnol Biomater 2017, 7:2 (Suppl)
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Bio-degradable carbon nanotubes display intrinsic anti-tumoral effects

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The complex biosynthetic relationships of nanomaterials with the cellular components, resulting in their chemical nature, surface properties or morphology are often unpredictable. Our research group has demonstrated that Multi-Walled Carbon Nanotubes (MWCNTs) can penetrate inside cells and bind microtubules interfering with the cellular biomechanics. This biomimetic interaction leads to the formation of biosynthetic tubulin polymers displaying an enhanced stability that triggers anti-proliferative, anti-migratory and cytotoxic effects in different types of cancer cells. This antitumor activity is intrinsic to the nature of MWCNTs, complementary and synergetic to that of traditional microtubule-stabilizing anticancer drugs such as Taxol®. A key issue to take into account for the development of new alternatives to traditional drugs based on nanodevices or nanomedicines is the possible long-term effects of these nanomaterials, the tissue accumulation and the elimination rates, just as for traditional cytotoxic chemotherapies, CNTs can also interfere with the function of healthy cells and produce many unwanted side-effects. Consequently, unless most concerns about the toxicity of these materials disappear, the development of new treatments based on CNTs offer a poor risk-to-benefit ratio in oncology. Our group investigates different surface treatments on MWCNTs to make these nanomaterials more biocompatible and biodegradable. Improving *in vivo* biodegradability of MWCNTs - some of the most resistant materials discovered - is not trivial. Here we show how to preserve the anticancer properties of these nanomaterials, these treatments should maintain the general morphology of the tubes to retain the biomimetics of these filaments with the microtubules. Furthermore, we show how single dosages of o-MWCNTs produce significant anti-tumoral effects *in vivo*, in solid malignant melanomas produced by allograft transplantation in murine recipients. We believe these findings have critical implications for the development of new CNT-based nanotherapies to overcome drug resistance in cancer among other applications.

Biography

Monica L Fanarraga obtained Bachelor's in Vet. Med. from the University of Zaragoza (Spain), PhD by the University of Glasgow (UK) and Dr. Med. by the University of Cantabria (Spain). Currently, she directs the group of Nanomedicine at the IDIVAL Institute in Santander, Spain. The IDIVAL Nanomedicine group studies the biological response to different nanomaterials focusing in the study of nanomaterials as treatments for cancer, nanotoxicity and nanodelivery.

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Modulation of cell behaviour on artificial materials by functional nano-topographies for applications in regenerative medicine

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Cells can react to synthetic surfaces with a wide way of responses which depend upon many factors, including chemical composition of the surface and the physical properties of the bulk substrate material, including substrate stiffness, topography feature size and geometry. It is now widely accepted that mechanical stimulus exerted onto cells by topographic cues can set off specific physiological processes that ultimately dictate the cell behaviour and fate. Identifying the specific topographical cues that lead to a specific cell behaviour, that is still an endeavour in biomaterial research for application areas impacting regenerative medicine or tissue engineering. In this sense, there have been numerous approaches to develop materials with fine control of the topographical features using micro and nanofabrication techniques. In our laboratory, we use polymer nanoimprinting to produce with nanoscale precision and high reproducibility, cellular instructive micro and nano topographical environments. We specifically investigate the response of progenitor neural stem cells to dense high aspect ratio polymer pillars on the micro and nano scale studies on cell viability, morphology, cell spreading and migration indicating that high aspect ratio topographies impact dramatically the cytoskeleton remodelling and distribution of the cellular tractions which in turn, gave rise to very distinctive cell behaviour. Nanosurface features inspired on the moth eye topography have also been investigated as bactericidal biocompatible surfaces for bionic implants. This surface has been demonstrated to be an effective bactericidal topography against Gram positive and Gram negative bacteria. At the same time, the surface supported cell growth and did not influence the biological cellular responses.

Biography

Isabel Rodriguez is a Research Professor at IMDEA-Nanoscience. Her research interest is on areas related to the application of micro and nano fabrication technologies on polymeric materials to construct functional surfaces. She currently works on the development of antibacterial surfaces and cell culture platforms for cell biomechanical studies. She is also working on the development of multifunctional surfaces, particularly on those with super-hydrophobic, anti-reflective and self-cleaning properties.

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Anna Cifuentes-Rius et al, J Biotechnol Biomater 2017, 7:2 (Suppl)
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Two stage, dual action cancer therapy with targeted porous silicon nanoparticles

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Despite the advances in developing efficient chemotherapy drugs, their efficacy may be diminished by the predisposition of some tumors to drug resistance and non-specific toxicity. Nanomedicine offers the possibility of tackling these key clinical challenges, by designing target delivery platforms for a combination of cancer therapies. To overcome drug resistance, we explore the synergy of hyperthermia with conventional chemotherapy. Due to the higher susceptibility of cancer cells to elevated temperatures compared to healthy cells, hyperthermia stimulates the uptake of anticancer drugs in tumor cells. Thus, nanoparticle (NP)-based delivery systems combining hyperthermia with traditional chemotherapeutics may afford the efficient treatment of highly drug-resistant tumors. Additionally, NP vectorization of therapeutics by actively targeting membrane receptors overexpressed in cancer cells has been recently suggested as a way to ensure selective delivery and improve therapeutic outcomes. Porous silicon (pSi) NPs are (i) biodegradable, (ii) suitable for conjugation with moieties for targeting of a specific cell population, and (iii) exhibit efficient loading of chemotherapy drugs. Here, we utilized these unique characteristics of pSiNPs and loaded them with multiple therapeutics while also immobilizing cell-specific antibodies to achieve active targeting. We have developed antibody functionalized pSi NP loaded with a combination of chemotherapy drug and gold nanoclusters (AuNCs). By selective targeting, these nanocarriers were observed to actively deliver both the chemotherapy drug and AuNCs to human B cells. The accumulation of AuNCs to target cells rendered them more susceptible to the co-delivered chemotherapy drug when an external electromagnetic field in the microwave region was applied. This approach represents a targeted two-stage delivery nanovector that takes advantage of dual therapeutic action in order to enhance cytotoxicity.

Biography

Anna Cifuentes-Rius is an NHMRC Early Career Fellow at the Future Industries Institute and the ARC Centre of Excellence in Convergent Bio-Nano Science and Technology. She is working in the design of three-dimensional nanoarchitectures of bioresponsive nanoparticles, containing drugs and bioactives for a range of therapeutic targets including cancer. Her interdisciplinary research is largely focused on the understanding of the biointerface of advanced bio and nano-materials for the application in the emerging field of theranostics.

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Michaela Fousova et al, J Biotechnol Biomater 2017, 7:2 (Suppl)
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Metallic 3D-printing for orthopedic surgery: Question of surface and cell compatibility

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University of Chemistry and Technology, Czech Republic

Metallic 3D printing is gaining more and more attention in these days and is gradually becoming a part of industrial production. A lot of metals and alloys can be processed already and there are more than five methods being intensely studied and improved. Application fields of this technology are very wide as almost any shape and design can be achieved. One of the most important fields is biomedicine. With 3D-printed biocompatible metals of desired shape and structure, bone defects can be successfully treated. Although bone structure with gradient porosity can be mimicked, mechanical properties can be adjusted to meet natural properties of the treated bone and osseointegration can be promoted. There are still some drawbacks needing to be solved. Especially in the case of porous structures, there is a problem of unmelted powder particles (being the material input) adhering to the final surface. These particles are harmful for several reasons. Not only they have a negative impact on mechanical performance (particularly fatigue life) and tribological properties, but they might also loosen into the body and set off an inflammatory reaction. Therefore, for biomaterials, surface quality and properties are of a particular importance. Our work focused on titanium alloy Ti6Al4V and its surface morphology and cell compatibility when prepared by 3D printing technology. Although biocompatibility of this broadly used alloy is well known, the interaction with biological environment may be affected by the 3D printing process. For this purpose, samples prepared by two most frequent metallic 3D printing methods – Selective Laser Melting (SLM) and Electron Beam Melting (EBM) were characterized in the as-printed state. Comparison of surface morphology and chemistry has been made. To assess cell compatibility contact *in vitro* tests were performed.

Biography

Michaela Fousova is a PhD student of Materials Science study program at the University of Chemistry and Technology in Prague, Czech Republic. She focuses on metallic biomaterials research and development. The main subject of her professional interest is 3D printing technology applied in the medical sector. She cooperates with industrial companies producing medical implants and also other research centers dealing with metallic additive manufacturing. She already published several papers on the topic of titanium alloy or stainless steel prepared by selective laser melting technology. Recently, she has also got into touch with electron beam melting technology.

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Peng-Sheng Wei, J Biotechnol Biomater 2017, 7:2 (Suppl)
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Stages for pore formation during fabrication of porous materials

Peng-Sheng Wei
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The pore shape in solid as a result of entrapment of a bubble by a solidification front is predicted in this work. Pore formation in solid influence microstructure of materials and contemporary issues of biology, engineering and climate change, etc. This work extends previous models by accounting for realistic mass and momentum transport across a self-consistent shape of the bubble cap. It is found that there exist three stages of solute concentration at the cap or solute gas pressure in the pore during solidification for initial contact angle greater than 90 degrees. Significant drops occur in the early stage and end of a middle stage at which solute concentration at the cap is about that in liquid far from the solidification front and contact angle is near 90 degrees. On the other hand, solute concentration at the cap exhibits two stages in most cases. The predicted pore shape agrees with experimental data. Increases in mass transfer coefficient and solidification rate decrease the pore radius. The predicted pore shape agrees with experimental data.

Biography

Peng-Sheng Wei has received his PhD from Mechanical Engineering Department at University of California, Davis, in 1984. He has been a Professor in the Department of Mechanical and Electro-Mechanical Engineering of National Sun Yat-Sen University, Kaohsiung, Taiwan, since 1989. He has contributed to advancing the understanding of and to the applications of electron and laser beam, plasma and resistance welding through theoretical analyses coupled with verification experiments. He has published more than 80 journal papers, given keynote or invited speeches in international conferences more than 90 times. He is a Fellow of AWS (2007) and a Fellow of ASME (2000). He has also received the Outstanding Research Achievement Awards from both the National Science Council (2004) and NSYSU (1991, 2001 and 2004), the Outstanding Scholar Research Project Winner Award from National Science Council (2008), the Adams Memorial Membership Award from AWS (2008), the Warren F. Savage Memorial Award from AWS (2012) and the William Irrgang Memorial Award from AWS (2014). He has been the Xi-Wan Chair Professor of NSYSU since 2009 and invited Distinguished Professor in the Beijing University of Technology, China, since 2015.

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Day 2

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Polyelectrolyte nano-complexes-safe and efficient tools for the delivery of drugs or vaccine

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The complexation of polyelectrolytes is very attractive to process polysaccharides into biomaterials, because it is energy efficient, requires no toxic chemical, has a low environmental impact and can be applied to biocompatible polymers such as polysaccharides. We used chitosan, a copolymer of N-acetyl glucosamine and glucosamine obtained from the partial deacetylation of chitin as polycation and a variety of polyanions such as dextran sulphate, hyaluronan, heparin, and chondroitin sulphate. These polysaccharides are generally regarded as safe and some of them can be found in the extracellular matrix of mammals. In this contribution we will present our latest achievement in the control of the elaboration, structure and performances of polyelectrolyte nanocomplexes as drug and vaccine carriers of high potential. In particular, we will address the issues of colloidal stability in physiological media, a major limiting factor in the development of this technology; the nanocomplex loading with drugs or vaccine; the targeting of these nanodelivery systems. The formation of polyelectrolyte complexes is spontaneous at room temperature, i.e. under kinetics control. We will present an alternative approach close to the thermodynamic equilibrium and discuss the potentiality of this particularly innovative synthesis route. Finally, we will present our latest results on the delivery of anti-retroviral drug and the inhibition of the infection by the HIV-1 virus of hPBMCs *in vitro*.

Biography

Thierry Delair received his PhD in Organic Chemistry in 1986 and Post-doctorate at the Stanford Research Institute (California). He has been Professor at University Lyon 1, since November 2008. Previously, he spent 20 years in R&D Department at BioMérieux, a medical diagnostics company. He developed polymeric materials for *in vitro* diagnostic applications and for vaccine delivery. He has published 135 articles in international peer-reviewed journals (h-index 33), filed 18 patents, and has given 60 oral presentations. His research results encouraged him to establish three companies: Ademtech (magnetic particles), CYTOSIAL BIOmedic (cosmetics SME) and Anabior (vaccines adjuvants).

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Notes:

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Biodegradable polyesters for biomedical applications: Alternatives to polylactides and polylactones

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Today's medicine requires bio-absorbable polymeric biomaterials that present thermoplastic elastomer (TPE) behavior, for their application as medical devices or scaffolds for soft tissue engineering. Among the most investigated polymers used as biomaterials, poly (glycolic acid) (PGA) and poly (lactic acid) (PLA) can be mentioned. These polyesters are however glassy at body temperature and mechanically brittle, so copolymerization with other monomers is a strategy to obtain TPEs with tuned biodegradation rate and mechanical properties. In a search of new polymeric biomaterials with TPE behavior, various lactones and macro lactones, most of them were employed previously by the chemical industry and cosmetics, which draw our attention. Among the cyclic esters, the following ones can be mentioned: β-propiolactone (β-PL), γ-butyrolactone (γ-BL), γ-valerolactone (γ-VL), δ-valerolactone (δ-VL), δ-methyl-ε-caprolactone, decalactones such as γ-decalactone (γ-DL), δ-decalactone (δ-DL) or ε-decalactone (ε-DL) (with rings of 5, 6 or 7 members respectively), ω-pentadecalactone (PDL), hexadecalactone or ethylene brassylate. Moreover, p-dioxanone or trimethylene carbonate may also be of interest. The mentioned substances are monomers that can be synthesized by ring opening polymerization on their own or on the dimmer (lactide and glycolide). In this work TPE copolymers of either high glass transition temperature (Tg) (>20ºC) or low Tg (between -65 and 0ºC) are synthesized and characterized in terms of molecular parameters, physical, chemical and mechanical properties and biodegradation. In the former case, copolymers of lactide with other co-monomers are proposed in order to reduce the melt temperature and crystallization capability of polylactide. In the latter, alternative copolymers will be introduced for poly (ε-caprolactone). This is because polymers of high Tg present low ductility, brittleness and too high stiffness for soft tissue applications. Those of low Tg, however, though excellent in the combination of mechanical properties for soft tissue engineering and devices, present often too low biodegradation rates.

Biography

Jose R Sarasua is Professor of Materials Science at the Department of Mining-Metallurgy Engineering and Materials Science, Faculty of Engineering of Bilbao, the University of the Basque Country (UPV/EHU). He is the Principal Investigator of the ZIBIO group on Science and Engineering of Polymeric Biomaterials and Member of POLYMAT, the Basque Center for Macromolecular Design and Engineering. His research interests are focused on the synthesis, structure and properties of polymeric biomaterials for medical applications.

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A novel design of low cost mastitis level measurement based on electrical resistivity

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Mastitis is the major primeval disease of dairy cattle and it leads to inflammation of mammary gland and udder tissue. It is also considered as one of the costliest diseases of dairy animals. Pathogen invades the mammary glands usually caused by bacterial infection of udder tissues. It causes significant harm to the cattleman thereby decreasing the milk production and its quality, which is usually determined by the measurement of somatic cell counts per milliliter of milk. According to the Punjab Dairy Development Board (PDDB), Punjab, India, the average daily milk production in the state is 26.5 million liters a day. Sub clinical mastitis level usually varies from 10% to 50% in cows and 5% to 20% in buffaloes in Punjab region. To minimize the huge economic loss and to provide the cost effective solution for early/preliminary detection of mastitis, the presented work shows an exhaustive survey on cows and buffaloes of Bathlana, Badmajra and Mansa region of Punjab for early detection of mastitis along with a novel design of low cost mastitis detector based on electrical resistivity measurement technique. The presented results show that Buffalo immune system is stronger as compared to cow, due to anatomical structure of mammary glands.

Biography

Dr. Ruchi Singla is working as Professor and Head of Department in Chandigarh Engineering college, Mohali , India. She has 15 years of work experience and has done PhD in Wireless Communication from Thapar University, Patiala in 2013. She has to her credit around 30 research papers in journals of good repute and filed three patents. Her areas of interest are Antennas and Biosensors.

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An analysis of dental implant materials with an exclusive focus on zirconia vs. titanium

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The key aim of this study is to present a comprehensive review of literatures on dental implant materials. The study focuses on titanium implants in a conventional manner and the newly introduced and highly popular zirconia implants. Some of the major areas covered under this study are clinical considerations and material science which includes implant materials as well as the impacts of its physical properties on outcomes of the treatment. Titanium is the gold standard for oral implants fabrication in spite of the sensitivity and despite having unclear clinical relevance. The zirconia implants are highly promising but further clinical studies are required. Also, there is a need of further technical experience and considerations for zirconia implants to lower the mechanical failure incidence.

Biography

Saurabh Gupta holds Master's Degree in Oral & Maxillofacial Surgery and has been in surgical practice since 2014. He is also trained in multiple allied surgical disciplines including Implantology and Laser Dentistry. He is involved in cosmetic dentistry including Smile Design (Certified in ClearPath, Botox & fillers). He has published his papers in various national and international journal publications and magazines like *"Dentistry Today (US)", "Access (US)"*, etc. He is an editorial board member for many national and international journals (OMICS, Openventio Publishers, Scientia Ricerca, MedCrave, Symbiosis Online Publishing, Bio-Accent, Mathews Open Access Journals, *SciFed Dental & Oral Research Journal*, etc.). He is also working as a Medical Academic Writer & Research Scientist since 2010 at one of the renowned freelancing sites www.freelancer.com. His research interests are: Dental Implants, Laser Dentistry, Oral and Maxillofacial Surgery, and Dental Pain.

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The use of silica nano-particles and microwave irradiation in dental PMMA repairs: Experimental investigation into the mechanical properties and dimensional stability of the repaired PMMA after aging

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Statement of the Problem: Despite ceaseless evolutions in the dental practice, PMMA resin has managed to keep a prime position in the panoply of dental materials. Yet, this material is far from being perfect. Concerns are constantly reiterated throughout literature about its lack of mechanical resistance which results in frequent fracture and fatigue failures of dentures. This fracture creates inconvenience to both the patient and the dentist thus it could be considered as a failure of the executed treatment, in addition to further frequently unnoticed consequences regarding the incurred costs to the community of the dentures' repair. Despite the wide range of solutions suggested to repair the damaged denture and to avoid its further fracture, a consensus seems not to be established yet. Recently, the use of microwave irradiation and nanofillers including silica nanoparticles with PMMA denture-resin has attracted researchers' attention thus it showed encouraging results in different studies but their efficiency for repairs need to be further investigated.

Methodology & Theoretical Orientation: An *in vitro* study was carried out to investigate the flexural strength, fracture toughness and dimensional stability of 120 repaired PMMA samples after aging in artificial saliva. Autopolymerizing resin was used to repair them following four methods. For the first group, autopolymerizing resin was used alone. In the second, samples were post-treated with microwave irradiations. In the third, the autopolymerizing resin was filled with 2% nanosilica. For the fourth group, the second and the third approaches were combined.

Findings: The investigated mechanical properties showed higher mean-values when silica nanoparticles and/or microwave irradiation were used compared to the repair with autopolymerizing resin alone. The dimensional variation rates were under 0.03% for all the groups.

Conclusion & Significance: The combination of autopolymerizing resin filled with 2% silica nanoparticles and post polymerization treatment with microwave irradiation showed the highest mechanical properties without affecting the dimensional stability of the repaired samples.

Biography

Nour El Houda Kharbech is Young Researcher at the Faculty of Dental Medicine of Monastir in Tunisia. She is a Member of the Tunisian Association of Dental Researches and the Tunisian Red Crescent. She received a Doctoral degree in Dental Medicine from Dental Medicine Faculty in Monastir, Tunisia, recently. Her current field placement is with the Department of Biomaterial in Dental Medicine Faculty at the University of Monastir. She is interested in introduction of nanofillers in the dental field, behavior of PMMA resin under oral conditions, *in vitro* simulation of oral conditions and removable dental restorations' problems caused by the material of fabrication.

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