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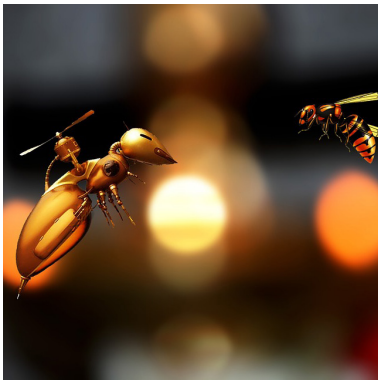
Poster Presentation

Robotics & Biomaterials 2018




International Conference on

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October 22-23, 2018 | Frankfurt, Germany

Martin Heller, Robotics & Biomaterials 2018, Volume 29
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The impact of intercellular communication in complex pre-vascularized tissue equivalents

Martin Heller
Johannes Gutenberg University Mainz, Germany

A promising approach in reconstructive surgery for the wound coverage after surgical interventions is the use of artificially generated pre-vascularized tissue equivalents. In our group we developed a pre-vascularized buccal mucosa equivalent in a tri-culture of primary buccal epithelial cells, fibroblasts and microvascular endothelial cells successfully, based on the collagen matrix Bio-Gide® from Geistlich. A successful pre-vascularization at superficial areas of the matrix was demonstrated. However, so far the generation of pre-vascularized structures within the tissue equivalent was restricted to only superficial areas of the matrix. Besides the great advances, it is not completely understood yet, why the used endothelial cells did not migrate in depth of the tissue equivalent in order to form vascular structures. To understand the cell biological background for the reduced migration willingness of endothelial cells, we investigated the intercellular communication in monocultures and co-cultures of primary microvascular endothelial cells and buccal fibroblasts based on the collagen matrix Bio-Gide®. To achieve this objective we analyzed the secretion patterns of relevant angiogenic factors such as VEGF, Ang 1, Ang 2, bFGF and eNOS and evaluated their effect on cellular parameters such as viability, proliferation, migration and tube formation. The results showed complex interactions of the investigated growth factors. A distinct influence of the co-cultivation, the spatial separation and the used collagen matrices on the expression patterns of the primary cells could be demonstrated. The co-cultivation of endothelial cells and fibroblasts led to increased levels of VEGF, bFGF, eNOS and Ang-2 compared to the monocultures. Interestingly, a spatial separation of the two cell types as well as the cultivation on the used collagen matrices enhanced this effect additionally. The gained results help us to understand the cellular interaction in complex multi-cultures and may lead to optimized cultivation approaches for tissue engineering of complex tissues.

Speaker Biography

Martin Heller has completed his PhD in Biology at the Max Planck Institute of Polymer Research Mainz in 2013. Afterwards he worked as Postdoc at the University Medical Center of Mainz and started to study Medicine in April 2014. His focus of research is the modification of biomaterials in the context of artificially generated tissue equivalents in complex multi-cultures of primary human cells.

e: martin.heller@uni-mainz.de

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Functional fe-base biodegradable materials for medical applications

Cimpoesu N
Technical University Gheorghe Asachi of Iasi, Romania

Iron represent the main source of metal applications worldwide based on consumption of steel and cast iron. After the success of stainless steels used in medical field the world is expected to use new materials with special properties in order to treat specific medical problems. With a certain chemical composition Fe-based alloys can fulfill two main functions in the same time: shape memory effect and biodegradability that can be used in medical applications. Shape memory alloys (SMAs) have been analyzed intensively over the last years by different point of view (shape memory effect, superelasticity or damping capacity) by several research teams. Biodegradable metal alloys (Mg, Fe and Zn based) have recently reached an important scientific and medical interest for applications as implant materials in cardiovascular and in orthopedic surgery. Biodegradable materials used in implantology must meet, in addition to the general requirements for an implantable material, two main functions for applications: the first is to provide the mechanical stability of the recovered element during the first part of the healing period and the second of the gradual degradation in a certain period of time. The first function can be provided by coating the biodegradable element with one or more biocompatible thin layers to ensure the integrity of the material for a precise-established period of time. The second function can be accomplished by introducing micro-alloying elements in Fe-based alloy as small quantities in the form of micro- or nano- particles to stimulate and generalize degradation of the material in contact with an electrolyte solution. We choose for thin coatings, materials based on ceramics (HA, HA+ZrO_2 and HA+Ag) and Mg, Ca or Zn as micro-alloying elements. Part of this research was funded by a research grant of TUIASI, project number 1420/2018: Design and characterization of a multifunctional element with memory effect for medical applications, code TUIASI-GI-2018 - PN-III-P1-1.1- TE-2016-1420.

Speaker Biography

Cimpoesu N has completed his PhD at the age of 30 years from Gh. Asachi Technical University of Iasi, Romania, in the field of damping capacity of shape memory alloys. He is the coordinator of Microscopy Laboratory (optical microscopy, scanning electron microscopy and atomic force microscopy), assoc. prof. at Gh. Asachi Technical University, Romania. He has over 85 ISI publications that have been cited over 450 times, and his publication H-index is 12.

e: nicanorcimpoesu@gmail.com

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Comparative assessment of various scaffolds for the construction of artificial tissues

Martin Heller
Johannes Gutenburg-Universiy of Mainz, Germany

In reconstructive surgery artificially generated soft tissue equivalents are a powerful alternative to commonly used autologous tissue transplants in order to cover bigger defects after tumor resection or after trauma. However, the generation of such tissue equivalents is complex and requires adequate cell compatible scaffolds for successful cell cultivation. In order to investigate the influence of various cell compatible matrices on cell viability and differences in cellular morphology in a complex co-culture of fibroblasts and epithelial cells, four naturally derived different collagen matrices were analyzed in a comparative study. From human buccal mucosa specimens, fibroblasts and epithelial cells were cultured separately. In a first step, primary fibroblasts were seeded on the four different collagen matrices BioGuide® (BG), BioGuidePro (BGP) and TissuFoil (TF) and small intestinal mucosa (SIS). The cellular morphology on seeded matrices was analyzed by confocal laser scan microscopy. The viability of the cells was quantified by MTT assay. For co-culture, the primary buccal epithelial cells were seeded on the opposite site of the fibroblasts covered matrices. After 18 days of cultivation microsections were analyzed using Masson-Goldner and immunohistochemical staining (Cytokeratin 13, Tenascin, Collagen IV). In a co-culture of fibroblasts and epithelial cells, BGP turned out to be the most suitable matrix. Fibroblasts growing on BGP revealed the greatest viability. Regarding mechanical characteristics such as shrinkage, degradability and handling, BGP proved to be the superior to the remaining matrices tested. Co-culture with epithelial cells resulted in epidermal stratification, a developing basement membrane. BPG matrix is a promising biomaterial for developing a full-thickness engineered buccal mucosa including cell differentiation and maturation similar to the native tissue when seeking new methods of urethral reconstruction.

Speaker Biography

Martin Heller has completed his PhD in Biology at the Max Planck Institute of Polymer Research Mainz in 2013. Afterwards he worked as Postdoc at the University Medical Center of Mainz and started to study Medicine in April 2014. His focus of research is the modification of biomaterials in the context of artificially generated tissue equivalents in complex multi-cultures of primary human cells.

e: martin.heller@uni-mainz.de

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Video Presentation

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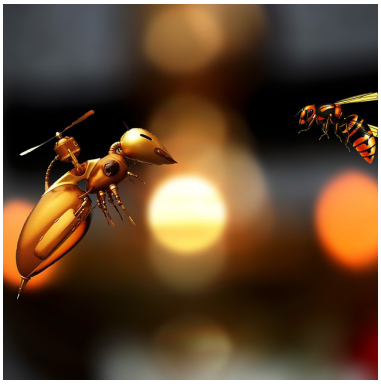


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Motion mapping from human arm to an anthropomorphic robot for tele-operation

Daoxiong GONG, Guoyu ZUO and **Jianjun YU**
Beijing University of Technology, China

Homogeneous master-slave robots have a wide application for tele-operation in dangerous environments, especially when the environment is so complicate that manual operation is needed. In this report, we present a tele-manipulation robot system with human arms as the master and an anthropomorphic dual-arm robot as the slave. The robot arm has 3 DOFs in shoulder, 2 DOFs in elbow, 2 DOFs in wrist, 2 joints in the thumb, and 3 joints in the other fingers. We adopt a wearable motion capture system to obtain the operator's action command, and employ a motion-mapping algorithm based on unit dual quaternions (UDQs) to perform the joint-to-joint motion-mapping task. We compute the expected/actual joints' angle of the slave robot via the orientation data of the adjoining limbs of the master/slave arm, and successively execute the motion of every joint from the trunk to the distal joint of the robot arms. As a result, we can keep the slave arms possessing the similar configuration of the master arms in the whole course of tele-manipulation. We validate our approach via experiment videos.

Speaker Biography

Daoxiong GONG received the PhD degree in control theory and control engineering from Beijing University of Technology in 2004. He was an academic visiting scholar with the laboratory for robotics and automation, the department of Electrical and Computer Engineering, Michigan State University, US, from 2012 to 2013. He is an associate professor with the Faculty of Information Technology, Beijing University of Technology. His research is supported by the NSFC. His research interests include tele-manipulation robot, evolutionary computation, and intelligent control.

e: d.x.gong@gmail.com

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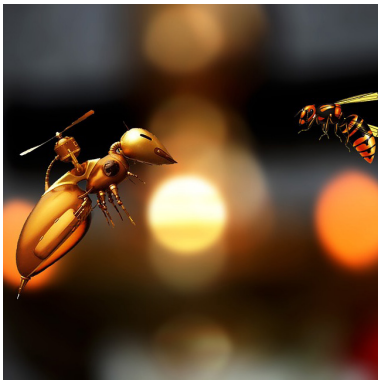
Robotics & Biomaterials 2018

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Synthesis and characterization of polylactic acid electrospun membranes for controlled drug release

Jose A Gomez-Tejedor
Technical University of Valencia, Spain

In the present work, Polylactic Acid (PLLA) electrospun membranes loaded with a drug have been developed and designed with the purpose of being used for the regeneration and healing of the skin. Tetracycline hydrochloride, a water-soluble antibiotic, was introduced into the membrane. Due to the hydrophobicity of PLLA, an emulsion was made between the polymer solution and an aqueous phase to introduce the drug into the membrane structure. Hyaluronic acid was also included in the aqueous phase to study the stability of the emulsion and its possible effects on fiber morphology. Studies were carried out to choose the operating conditions in the electrospinning process, to optimize the amount of hyaluronic acid in the aqueous phase and to observe the influence of the ratio of aqueous phase to total emulsion. The results gave the electrospinning optimum parameters of 7% of PLLA in the solution in chloroform/acetone mixtures, 14 cm traveling distance of the jet, feeding rate of 1 mL/h and an applied voltage of 18 kV. Electrospun fibrils are porous being the porosity dependent on the hyaluronic acid content of the aqueous phase. In addition, an increase of the pore area has been found by increasing the proportion of aqueous phase. Thereafter, a study of drug release by means of spectrophotometry showed low release yields (around 6%) up to five-day delivery. On the other hand, a characterization of the mechanical properties by tensile test gives the membrane with 0.2% of hyaluronic acid as an optimum.

Speaker Biography

Jose A Gomez-Tejedor (Researcher ID: H-4614-2012, Orcid ID: 0000-0001-6854-0829, Scopus ID: 55915419300) received his PhD in in theoretical physics in 1995 from the Technical University of Valencia, Spain. In 1996 he joined the Technical University of Valencia, where he is currently assistant professor of applied physics. His research has focused in the synthesis, design and characterization of biomaterials for Tissue Engineering. He has been working on the physical characterization of biomaterials using different experimental techniques: Differential Scanning Calorimetry (DSC), Thermomechanical Analysis (TMA), Dynamic Mechanical Analysis (DMA), Atomic Force Microscopy (AFM), Scanning Electron Microscopy (SEM) AFM nano-indentation, etc. He has published more than 50 papers in scientific journals and books that have been cited more than 550 times (h-index = 12) and has made more than 50 contributions to international conferences.

e: jogomez@fis.upv.es

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Accepted Abstracts

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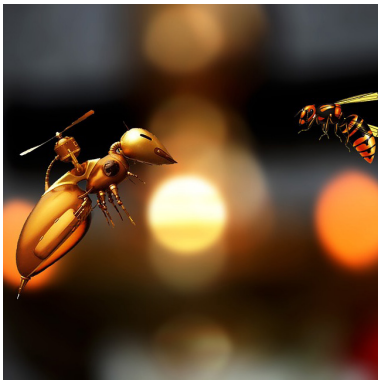


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Solutions on assistive robotics at cester-larm

Giuseppe Carbone
University of cassino and south latium, Italy

Agewell project approaches an open problem in healthcare for the aging population of Europe, committing to provide a viable solution of the (sub)acute therapy for stroke patients. The implementation team aims to deliver a solution that can be extended towards robotic assisted rehabilitation in different phases of the post-stroke therapy/rehabilitation as well as an exercise/training devices for healthy aging of the elderly population. Some proposed solutions shall be outlined as referring to LAWEX, ASPIRE, and PaRReX patent pending designs. The structure of LAWEX is a non-conventional cable-driven open architecture, which allows accessibility of patients under treatment. Using wristbands, cables are connected to the end-effector which covers the limb to be trained. ASPIRE is a spherical parallel architecture intended for shoulder assistance as it can perform multiple feasible shoulder motion ranges. PaRRex can be seen as a wearable exoskeleton with modular structure, consisting of two parallel modules, one for the forearm mobilization (elbow flexion) and the pronation/supination, the second parallel module is designed to mobilize the wrist (flexion/extension and abduction/adduction).

e: giuseppe.carbone@unicas.it

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Increasing user acceptance by augmented robot intelligence: The lesson we got from the semantics of human communication

Eleni Efthimiou and **Stavroula-Evita Fotinea**
Institute of language and speech processing, Greece

Research on assistive robots has received special focus within the domain of robotics and is continuously gaining ground, also boosted by demographic data and related AAL supportive policies worldwide. Having in mind devices which need to address real user needs and be capable of interacting with users in some sort of "human" like manner, it has become mandatory to find robust ways for augmenting robot intelligence in order to enable devices overcome basic interaction shortages which are easily spotted during validation by end user populations. One predominant parameter for user acceptance is proven to be satisfaction of the human need for communication with an "intelligent" companion or assistant, if a device has to gain user trust and be systematically used within a specific mid- to long-term time frame. In this context, we exploit the paradigm of exposure of assistive devices in real use conditions, to discuss the degree of user acceptance and the need to augment robot intelligence in the context of multimodal HRI. Focus is placed on those NLP tools and resources which may increase the span of human-robot communication by engaging standard NLP approaches in combination with signals of human embodied expression which can lead to enhanced performance of robotic devices when they interact with humans.

e: Eleni_e@ilsp.gr

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Technology and ethics for robots supporting older people living alone at home

Jim Torreson
University of Oslo, Norway

The proportion of elderly people worldwide increases which seems to result in a future shortage of health care resources. To handle this challenge, it becomes important that people live as long as possible in their own homes which is also what most older people want themselves. Thus, a rising issue is how to incorporate technology to find efficient solutions for health monitoring and care for older people staying at home. Our multimodal elderly care systems (MECS) project aims to create and evaluate a multimodal mobile human supportive robot that can sense, learn and predict future abnormal events of a person. In this keynote, three important aspects of the project will be presented including the control architecture of the robotic system, the sensing process and devices, and finally design and privacy issues, respectively. The designed control system handles the navigation of the robot in an indoor environment in the presence of static and dynamic known and unknown obstacles. The sensing part of the project deals with utilizing various types of sensing devices for health monitoring and care purposes. Finally, the design part of the project focuses on the design issues of the robotic companion as well as privacy-related matters concerning having a mobile robot moving in a residential environment with a set of sensing and recording devices.

e: Jimtoer@ifi.uio.no

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Agent-embedded robots with machine intelligence

Jong-Hwan Kim
KAIST, South Korea

To develop agent-embedded robots with machine intelligence (MI), the design of intelligence operating architecture (iOA) is required for sensing, thinking and action. One of the key modules in iOA is the memory module for storing temporal event sequences of tasks, the mechanism of thought for reasoning, and motion planning for execution, among others. This talk introduces how to develop agent-embedded robots with MI based on iOA, focusing on long-term memory for active knowledge acquisition and adaptive knowledge application. The long-term memory is developed as an integrated multi-memory neural model, in which episodic memory is designed using a Deep DRN (Developmental Resonance Network) neural model and semantic memory is built using the DRN-tree. Procedural memory is also designed using the context-based RNN (recurrent neural network) to store the trajectories of the manipulators along with context information and then retrieve them according to the context without conscious thinking. Robots are taught either by human demonstration or symbolic description. A behavior appropriate to the current situation is selected by the mechanism of thought learned through machine intelligence learning, while a proper task is retrieved from the Deep DRN model. The behaviors are executed safely and quickly with the motion planning algorithm. The effectiveness of the agent-embedded robot development is verified through experiments with a humanoid robot, Mybot, developed in the Robot Intelligence Technology Lab. at KAIST. Agent-embedded Mybot is introduced mainly for natural interactions including VQA (Visual Question Answering) with humans. In the last part, AI World Cup shall be introduced, which has three categories, AI Soccer, AI Commentator, and AI Reporter.

e: jhkim@kaist.ac.kr

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Using robotics programming in primary education

Hiroko KANOH
National University Corporation Yamagata University, Japan

Robots for educational purposes also come with a smaller size and in a low-cost market, such as the Wonder Workshop Dash Robot, Ozobot, SPHERO, BB-8, Wow Wee COJI The Coding Robot Toy, mBot, Transformable DIY Programmable Robot Kit, Clementoni my First Robot, LEGO, Bocco, Plen, Chip, Damian, Hicolor, Kamigami Robots Spot the Ladybug, DOBBY, Robi, Robohon, Roboactor, OHaNAS, Zoomer, Mip, KINGBOT, DIY Iron Bot Robot, Premaid, light sensor programing car, the exhilarated robot programming set, the Puchi little robot, block robot taste and Tama robot, etc. Why are there so many robots invented for programming education? They stimulate students through body sensation. In prior to the breakthrough learning point at 9 years old, touching various objects and observing in real objects are vitally important.So, our focus is on the planning of the implementation of robot programming as primary students in Japan, in where programming education is still in a very initial stage, students should also be more interested in programming through real and visible robotic movements than in computerized ones. Kanoh upholds the instruction proposal of nurturing "ways to learn and think about the information" defined by Kanoh and her group and the implementation of the programming education proposal in the concrete controlling period of Piaget, J's development theory is also suggested. The project 'Challenge Robots Programming' was carried out on Wednesday, October 18, 2017 at Yamagata Municipal Elementary School 5. 18 children participated. When checking the Pearson correlation coefficient on both sides, a highly positive correlation coefficient ($r=.78$, $p<.01$) was found about the degree of understanding to the programming itself. The linear approximation curve is $y = 0.48x + 3.02$, which proves that children are highly motivated to learn about and have a high degree of understanding towards programming. In addition, some children explored questions they found.

e: kanoh@pbd.kj.yamagata-u.ac.jp

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Welfare robotics in elderly care homes

Norbert Krüger
University of Southern Denmark, Denmark

The pressure caused by the demographic development in Western European countries allows for easily creating very good business models for the application of so called "welfare robots" in care institutions for the elderly. In my talk, I will give an overview of current developments in welfare robotics in the elderly care sector, the technical problems that still need to be addressed and the applications to be expected within the next decade. In particular, I will talk about the SMOOTH project (smooth-robot.dk) which stands for "Seamless human-robot interaction for the support of elderly people". In the SMOOTH project, we focus on repetitive tasks that do not involved manipulation such as transport of laundry, offering beverages and guidance. To make such applications technically feasible, it was important that the design of the robot simplifies a lot of the technical problems involved. I will in particular talk about the process that led to the design of SMOOTH robot that is currently built by a Danish start-up company.

e: Norbert.schartel@sciops.esa.int

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Different tracking technologies for intelligent and intuitive hri

Pradipta Biswas
Indian Institute of Science, India

Tracking plays an important role for any robotic development. Traditionally, tracking technologies are investigated for object tracking in large scale geographic area. In this talk, we shall explore tracking human body parts from a perspective of proposing new types of human robot interaction. The talk will present different types of sensors for tracking eye gaze, head, finger, hand and other body part movements and utilizing them in designing new types of interactive technologies. Case studies will be discussed from a variety of domains like military aviation. automotive and assistive technology and their applications in human robot interaction design.

e: Pradipta@iisc.ac.in

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MATE robots simplifying my work: The benefits and socioethical implications

Valeria Villani, Lorenzo Sabattini and **Cesare Fantuzzi**
University of Modena and Reggio Emilia, Italy

With the increasing complexity of modern industrial automatic and robotic systems, an increasing burden is put on the operators, who are requested to supervise and interact with such complex systems, typically under challenging and stressful conditions. To overcome this issue, it is necessary to adopt a responsible approach based on the anthropocentric design methodology, such that machines adapt to the humans capabilities. To this end, we have developed an integrated methodological design approach, which we call MATE, consisting in devising complex automatic or robotic solutions that measure current operator's status, adapt the interaction accordingly, and provide her/him proper training to improve the interaction and learn lacking skills and expertise. Accordingly, a MATE system is intended to be easily usable for all users, thus meeting the principle of inclusive design. Using such a MATE system gives rise to several ethical and social implications, which are discussed in this talk.

e: valeria.villani@unimore.it

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Computation mechanisms for realization of context-driven robots

Tomislav Stipancic
University of Zagreb, Croatia

Humans are using memories, twisted or guessed facts and other implicit information asserted or collected to reason about the most appropriate solutions in a given environmental conditions. They are adaptive instead of being reactive and this adaptation is happening through a constant interaction. Unlike humans, robots do not understand context by default and therefore they are mostly reactive. Deterministic chaos is a characteristic of the real world where the existence of living beings depends mostly on their capability to adapt to changes instead of controlling them. Compared to conventional approaches where robots are preprogramed to react on a finite number of environmental occurrences, the contextual awareness can enable modeling of human like adaptation skills. Computational models, as a focus of this talk, could be understood as context to data interpreters that transform (high-level or implicit) information into (low- level or explicit) data, allowing machines to make context-drivendecisions. The basic model contains three main parts. The first part is used to track and collect significant environmental information following the principles of ubiquitous computing. The second part represents formal knowledge about the domain of interest. The model contains also a probabilistic component realized through Bayesian Network ensuring a single solution in a given context. The overall methodology will be presented through three separate examples illustrating the reasoning based on: (i) phenomenon of social capital, (ii) human bodily awareness and (iii) human emotions. The design philosophy is focused here on the effects of the real human reasoning without defining the phenomenon itself.

e: c.tapiacortez@unsw.edu.au

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Artificial 3D culture systems for T-cell expansion

Eduardo Perez del Río
CIBER-BBN, Spain

Adoptive cell therapy, which consists of the extraction, manipulation, and administration of ex vivo generated autologous T cells to patients, is an emerging alternative to regular procedures in cancer treatment. Nevertheless, these personalized treatments require laborious and expensive laboratory procedures that should be alleviated to enable their incorporation into the clinics. With the objective to improve the ex vivo expansion of large amounts of specific T cells, we used three-dimensional (3D) structures during their activation with artificial antigen presenting cells, thus resembling the natural environment of the secondary lymphoid organs. Thus, the activation, proliferation, and differentiation of T cells were analyzed when cultured in the presence of two 3D systems, Matrigel and a 3D polystyrene scaffold, showing an increase in cell proliferation compared to standard suspension systems. Moreover, new synthetic biomaterials are being investigated with the same purpose.

e: eperez2@icmab.es

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Utilization of seafood waste for potential biomedical applications

Jayashree Chakravarty
University of Massachusetts, USA

Lobster shell waste was used as the source of raw material to produce chitin using biological treatment, which included the use of co-cultures with a protease-producing bacterium, either Bacillus megaterium NH21 or Serratia marcescens db11, and an organic acid-producing bacterium Lactobacillus plantarum. The optimal culture conditions, including co-cultivation strategies and glucose concentrations, were identified to improve the efficiency of deproteinization and demineralization of lobster shells. The lobster shells were also treated chemically for chitin extraction as comparison to the bio-based treatments. Overall, the successive treatment with a combination of S. marcescens db11 and L. plantarum yielded the best co-removal of $CaCO_3$ and proteins from lobster shell biomass, with total deproteinization of 87.19% and total demineralization of 89.59%. Chitin membranes were successfully prepared by dissolution of this microbially-extracted chitin in ionic liquid 1-ethyl-3-methylimidazolium acetate. The resulting materials were thoroughly characterized, revealing that freeze-drying produced chitin membranes that were highly porous. The drying methods and the concentration of chitin used defined many of the membrane properties, such as mechanical strength, porosity, and water absorbency. A mathematical model was developed to correlate and predict different polymer properties like tensile strength, which would lead to the ability to tune the properties of the biomaterial. Rayleigh's method is often used to develop an expression in the form of an exponential equation to show the functional relationship for a variable that depends on other independent variables. These chitin membranes could potentially be used for biomedical applications such as wound-dressing materials and scaffolds in tissue engineering. The results from the proof-of-concept study described here suggest that microbial treatment may be an environmentally friendly alternative to the chemical method of chitin extraction. This study provides a starting point for the design and fabrication of a family of polysaccharide-based sustainable materials with potentially broad applicability.

e: jayachakravarty91@gmail.com

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New fiber reinforced composite material for custom-made craniofacial implants

Lazar MA
University of Medicine and Pharmacy, Romania

The aim of the present research was the elaboration and the characterization of new fiber-reinforced composites (FRCs) that will serve cranial bone reconstruction, particularly in thecases of large bicortical calvarial defects. Four new formulations of FRC were obtained using polymeric matrices (combinations of monomers bisphenol A glycidylmethacrylate (bis-GMA), urethane dimethacrylate (UDMA), triethylene glycol dimethacrylate (TEGDMA), hydroxyethyl methacrylate (HEMA)) and E-glass fibers (300g/mp). Every FRC contained 65% E-glass and 35% polymeric matrix. The new materials were extensively characterized and tested for their chemical, phisical and biological properties, using well estabished methods (high performance liquid chromatography, scanning electron microscopy, atomic force microscopy, X ray diffraction, flexural and compression strength tests, citotoxicity and implantation tests) and the best formulation was selected. The selected material was used to produce personalized implants for the reconstruction of critical size defects of rabbit calvaria. Local and general impact upon animal health, quality of reconstruction, bone and dura reaction to the material were investigated by means of clinical, imaging and histological analysis. The results of our research pointed out that the FRCs based on UDMA resin reinforced with E-glass fibers could be an optimized alternative to the similar nowadays available materials used for the reconstruction of bone defects in the cranio-maxillofacial area.

e: madilazar@yahoo.com

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The immobilization anti-tuberculosis drugs loaded -car-MA-INH/nano hydroxyapatite nanocomposites for osteoarticular tuberculosis treatment

Marippan Rajan
Madurai Kamaraj University, India

Tuberculosis synovitis as often as possible introduces as a monoarthritis of weight-bearing joints, for example, the hip, knee, or lower leg. Early detection with a synovial biopsy permits incite anti-tuberculosis (anti-TB) treatment and considerably enhance the possibility of safeguarding of joint structure and capacity. Beginning treatment ordinarily incorporates mix treatment with four anti-TB drugs such as isoniazid, rifampin, pyrazinamide, and ethambutol. In addition, biocompatible polymers and bio-ceramic materials have been realized to be vital to fabricate drug delivery and bone regenerations that offer high drug loading and sustained release with remarkable in vivo bioavailability. In the present work, multi-drug delivery system was developed with the combination Rifampicin and Isoniazid anti-TB drugs. Initially, Isoniazid drug was tagged with -carrageenan grafted maleic anhydride (-Car-MA-INH) and then it was cross linked with nano hydroxyapatite (NHAP) via electrostatic interaction. Rifampicin drug was loaded on -Car-MA-INH/NHAP/RF through ionic gelation technique. The chemical modification and interaction of drug to the nanocomposites was characterised by Fourier transform infrared spectroscopy (FT-IR). The size and surface charge of the nanocomposites was measured by a zetasizer analysis. The crystalline nature and surface morphology was identified using X-ray diffraction patterns (XRD), scanning electron microscopy (SEM), and transmission electron microscopy (TEM). In-vitro cell viability and cell adhesion experiments showed that composites lower the cytotoxicity effect against fibroblast cells (L929) and higher cell adhesion against osteoblast likes cell (MG63). Since, the bio-ceramic nano drug delivery systems could be potential scaffold materials for application for osteoarticular tuberculosis treatment.

e: rajanm153@gmail.com

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Advantages of chitosan – Curcumin nano system for multiple remedies

Michael Rajan
DOTE Campus Tamil Nadu State Council for Science and Technology, India

Chitosan a natural biopolymer possess interesting properties towards drug delivery carrier system applications and theranostics application. Chitosan based polyelectrolyte complexes could be used as a promising drug delivery, antibacterial and theranostics applications now a days. Curcumin a natural therapeutic drug obtained from turmeric is a promising anticancer, antibacterial application in future. Natural Cancer Drug Curcumin is a well-known dietary polyphenol derived from the rhizomes of turmeric (Curcuma Longa), an Indian spice, which is usually used in preparation of mustard and curry. Three curcuminoids, namely curcumin, demethoxy curcumin, and bisdemethoxy curcumin, are present in the natural extracts of Curcuma Longa with curcumin as the principal constituent. This yellow color spice has been used for thousands of years as a traditional remedy. In Asian medicines, curcumin has been used for the treatment of acne, psoriasis, dermatitis, and diaper rash. It is a golden-yellow solid, with a molecular weight of 368 g mol-1 and a melting point of 183 °C. It is often used as a dye owing to its vibrant colour. The aromatic rings are functionalized with methoxy and hydroxy groups in an ortho position with respect to one another. The aromatic rings are connected to one another via a seven-carbon spacer that contains two α, β-unsaturated carbonyl groups. As a result of this structure, a beta-diketone and equilibrating keto-enol tautomeric forms of curcumin are possible. While curcumin gained immense attention as a medicinal drug in modern medical applications only a few decades ago, it has been used for hundreds of years in some regions of the world. In Asia, especially in India and China, turmeric has been used as a drug for more than two thousand years. Ayurveda, an ancient medicinal system practiced in India, incorporated the use of natural herbs to treat various illnesses. Amongst the commonly used herbs, turmeric was used most abundantly due to the medicinal effects of curcumin. In the traditional Ayurvedic approach, turmeric was crushed into a paste for the treatment of eye infections, burns, bug bites, and any skin related diseases. Furthermore, new mothers in India are given a drink containing turmeric paste, honey, ginger, and milk to drink daily following child birth. Turmeric is also used in different forms to cure cough and respiratory complications, along with dental diseases, flatulence, and indigestion. Curcumin was also used as a medicine in ancient Polynesian culture. It has been noted in historical documents that the Polynesian people carried turmeric with them during long voyages to Hawaii. Today, Hawaiians utilize curcumin for various medicinal purposes. It is known to them as Olena.

e: anjellojothi@gmail.com

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Engineering at the nanoscale: A strategy for developing high performance functional polymer nanocomposites

Sabu Thomas
Mahatma Gandhi University, India

The talk will concentrate on various approaches being used to engineer materials at the nanoscale for various applications in future technologies. In particular, the case of clay, carbon nanostructures (e.g. nanotubes, graphene), metal oxides, bionanomaterials (cellulose, starch and chitin) will be used to highlight the challenges and progress. Several biodegrdable polymer systems will be considered such as rubbers, thermoplastics, thermoSetts and their blends for the fabrication of functional polymer nanocomposites. The interfacial activity of nanomaterials in compatibilising binary polymer blends will also be discussed. Various self assembled architectures of hybrid nanostructures can be made using relatively simple processes. Some of these structures offer excellent opportunity to probe novel nanoscale behavior and can impart unusual macroscopic end properties. I will talk about various applications of these materials, taking into account their multifunctional properties. Some of the promising applications of clay, metal oxides, nano cellulose, chitin, carbon nanomaterials and their hybrids will be reviewed.

e: sabuthomas@mgu.ac.in

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Hollow porous nanocapsules: Sustained delivery of immunomodulatory drugs and adjuvant properties for the effective management of various infectious or tumor diseases

Pradip Paik
Indian Institute of Technology, India

Significant efforts have been made over recent years to design suitable delivery materials for efficient loading as well as the controlled/sustained release of drugs. Out of various materials which have been exported, polymeric colloidal particles/nanocapsul es are of particular interest in which drug can be encapsulated through absorption/conjugation onto the surfaces or in the void space of the same. Their biocompatibility and degradability, nontoxic and the ability to facilitate sustained release of drugs, have attracted significant rese arch interest as potential drug carriers over metal or inorganic, non-biodegradable nanoparticles as drug delivery systems. Different types of polymers; both synthetic and natural have been utilized in the preparation of nanocapsules Polymeric hollow nanocapsules have attracted significant research interest as novel drug carriers and their preparation is of particular concern for their feasibility to encapsulate a broad range of drug molecules. This work presents for the first time the synthesis and development of a novel poly-N-acryloyl L-phenylalanine methylester hollow core nanocapsules (NAPA-HPN's) of Avg. size ca. 100-150 nm prepared by mini-emulsion technique. NAPA-HPN's are biocompatible and capable of encapsulating sodium nitro prusside (SNP) at a rate of ~1.3 µM per mg of capsules. These NAPA-HPN's + SNP nano-formulations while maintaining homeostasis of macrophages which carries and facilitate the action of various drug molecules used against the various diseases. These NAPA-HPN's also facilitated the prolonged release of the low level of Nitric oxide(NO) and enhanced metabolic activities of pro-inflammatory macrophages which are important for the action of various drugs in body fluids. NAPA-HPN's mediated skewing of native macrophages toward M1 phenotype potentially demonstrated its adjuvant action on the innate immune system. These results potentially suggested that NAPA-HPN'scan serve both as a carrier of the drugs as well as an adjuvant for the immune system. Thus, these nanocapsules could be used for the effective management of various infectious or tumor diseases where immune-stimulation is paramount for treatment.

e: paik.bme@ iitbhu.ac.in

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Ti-Si alloys – Materials for implants applications

Sulikova M
P J Safarik University in Kosice, Slovak Republic

With an increasingly aging population and improvement of living standards, there is a rising demand for new biomaterials to replace or repair structural (load-bearing) components of the human body. Nowadays, Ti and its alloys are commonly used for implant devices that replace patient's hard tissues. However, these implants are composed from harmful elements like Al, Mn, Cr, V, Co, Ni etc. From our point of view is therefore necessary to develop a low-density alloy with a high hardness that will be biocompatible and cost-effective. We focuse on preparation and characterization of a Ti-Si alloys. Both Ti and Si are biocompatible elements and additionaly Si supports bone calcification. We prepared five types Ti-Si alloys. Only one alloy from five is composed of one sole phase Ti5Si3 alloy. Microstructure was examined by synchrotron X-ray diffraction and high resolution transmission electron microscopy. This alloy is almost 300% harder compared the implants used today. Mass density of the alloy is 4.27 g/cm^3, while modulus of elasticity is 187 GPa. All prepared Ti-Si alloys are biocompatible measured in respect to MC3T3E1 mouse preosteoblastic cells. In the talk I will present preparation, phase composition, microstructure morphology, biocompatibility and basics mechanical properties of five different Ti-Si alloys.

e: michaela.sulikova1@student.pjs.sk

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Nanomedicinal constituents in herbal plants and species impact as antioxidant

Mohamed Sikkander A
Velammal Engineering College, India

Nanomedicine is a young science. How nanotechnology can be of use to medicine, medical technology and pharmacology has only been researched since the 1990s. Nanotechnology itself has only existed for a few decades. After the invention of high resolution microscopy it evolved simultaneously in biology, physics and chemistry in the course of the 20th century and spawned new disciplines such as microelectronics, biochemistry and molecular biology. For nanomedicine, nanobiotechnology knowledge which investigates the structure and function of cells as well as intra and intercellular processes and cell communication is of prime importance. This research only became possible at the beginning of the 20th century when the door to the nanocosmos was burst open with the invention of innovative microscopes. Herbal medicines have been widely used around the world since ancient times. The advancement of photochemical and phytopharmacological sciences has enabled elucidation of the composition and biological activities of several medicinal plant products. The effectiveness of many species of medicinal plants depends on the supply of active compounds. Most of the biologically active constituents of extracts, such as flavonoids, tannins, and terpenoids, are highly soluble in water, but have low absorption, because they are unable to cross the lipid membranes of the cells, have excessively high molecular size, or are poorly absorbed, resulting in loss of bioavailability and efficacy. Some extracts are not used clinically because of these obstacles. It has been widely proposed to combine herbal medicine with nanotechnology, because nanostructured systems might be able to potentiate the action of plant extracts, reducing the required dose and side effects, and improving activity. Nanosystems can deliver the active constituent at a sufficient concentration during the entire treatment period, directing it to the desired site of action. Conventional treatments do not meet these requirements. The purpose of this study is to review nanotechnology-based drug delivery systems and herbal medicines. Natural products have been used in medicine for many years. Many top-selling pharmaceuticals are natural compounds or their derivatives. These plant or microorganism-derived compounds have shown potential as therapeutic agents against cancer, microbial infection, inflammation, and other disease conditions. However, their success in clinical trials has been less impressive, partly due to the compounds' low bioavailability. The incorporation of nanoparticles into a delivery system for natural products would be a major advance in the efforts to increase their therapeutic effects. Recently, advances have been made showing that nanoparticles can significantly increase the bioavailability of natural products both in vitro and in vivo. Nanotechnology has demonstrated its capability to manipulate particles in order to target specific areas of the body and control the release of drugs. Although there are many benefits to applying nanotechnology for better delivery of natural products, it is not without issues.

e: fengppj@ku.ac.th

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