GENERAL ASSEMBLY OF THE MARIE CURIE ALUMNI ASSOCIATION

4 TO 5 MARCH 2016, VENICE, ITALY

BOOK OF ABSTRACTS

WWW.MARIECURIEALUMNI.EU

BOOK OF ABSTRACTS

Foreword

Dear Members,

This publication makes public abstracts presented at the General Assembly of the Marie Curie Alumni Association (4 to 5 March 2016, Venice, Italy).

Browsing through the different abstracts underlines the huge diversity in our Members' areas of study (Life sciences, Engineering, Chemistry, Physics, Environmental Sciences, Economics, Social Sciences, Humanities and Arts). If you would like to know more about one of these research topics, feel free to contact the author directly.

Happy reading!

Yours,

The MCAA team

BOOK OF ABSTRACTS

Table of Contents

1. Life sciences

Possible age related changes in eye topography

Id4 regulates neurogenesis in the adult subventricular zone

Contactless Conductivity Detection of E. coli Growth

Production of a heterologous protein vaccine candidate through an autotransporter based platform

Assembly of DNA origami using long oligonucleotides

Electrooptical monitoring of polarizability in Lactobacillus plantarum Batch, Fed-Batch and Continuous Fermentations

INFECTION WITH HENNEGUYA PSOROSPERMICA (PHYLUM: MYXOZOA) IN STIZOSTEIDON LUCIOPERCA AND ESOX LUCIUS

Protein-bound anionic uremic toxins efficiently cleared by a bioengineered renal tubule

Preclinical safety evaluation of immortalized renal epithelial cell lines for bioartificial kidney

Risk-Based Privacy-Aware Access Control System for SAP ETD (Enterprise Threat Detection)

Early markers of microglial activation and neural distress

Monitoring survival of implanted islets in animal models

Adaptation of the bacterial chemotaxis system to the archaeal motility machinery

Hepatogenic differentiation of adult stem cells in an in vitro 3D model

Development of small molecular weight mimetics of glial cell line-derived neurotrophic factor for the treatment of Parkinson's d

2. Engineering

BIOMECHANICAL DESIGN OF A DYNAMIC SPINAL IMPLANT FOR THE TREATMENT OF EARLY ONSET SCOLIOSIS

CDyn - NEW DYNAMIC CERVICAL DISC REPLACEMENT DEVICE

Experimental investigation of the bond behaviour of GFRP bars and concrete

Conceptual Multidisciplinary Aircraft Design using Aero-Structural Adjoint-based method

Efficient Safety and Security in Crowded Environments

Parametric Finite Element Model of the human lumbar spine

BOOK OF ABSTRACTS

Table of Contents

Using Selective Area growth for CWDM in the COBRA Generic Photonic Integration Platform

High Current Printed Transistor: Roll-to-Roll Manufacture and Thermal Behavior

Novel Biomarkers for Identifying the Progression from Diabetic to Diabetic Retinopathy Eye

About Theory, Measurements and Simulations of Short Fiber Reinforced Concrete

Advanced Methods for Building Diagnostics and Maintenance

High speed electroabsorption modulator in the generic photonic integration platform

Improving Motorcycle Rider Safety – A Multidisciplinary approach to assessing and improving rider skill

Introduction To Personal Protective Equipments (PPEs) For Motorcyclists

A Design Framework for Introducing Collaborating Robots in Manufacturing

Mathematical modelling for self-healing robotic cell

Bidirectional Matching of Job Descriptions and Vacancies using Machine Learning

A HIGHLY STRETCHABLE ARTIFICIAL SENSITIVE SKIN FOR TOUCH INFORMATION USING ELECTRICAL IMPEDANCE TOMOGRAPHY

Buried Heterostructure laser as a new building block in the COBRA generic process for photonic integrated circuit

3. Chemistry

Structuring of edible oils into complex colloids using food-grade materials

Two-Photon Optimized 'Caged' Compounds for Molecular Biology, Physiology and Neurosciences

One-shot weather-stable low-gloss powder coatings

High-toughness supramolecular hydrogel based on hydrophobic interactions

L-proline derivative monomer acting as novel pH switcher unit in dual-stimuli responsive nanogels

Isolation and structure elucidation of sponge-derived bioactives

4. Physics

Engineered two-dimensional hetero-architectures for nanoelectronics

Shear-wave-induced acoustophoresis in polymer-based microchannels

BOOK OF ABSTRACTS

Table of Contents

ITN WALL: Controlling domain wall dynamics for functional devices

A bi-enzymatic electrochemical detection system for pesticides based on a bi-layer Au/ gas-phase nanostructured ZrO2 electrode

Rapid prototyping of integrated microfluidic pesticide biosensors based on supersonic cluster beam deposited nanostructures.

5. Environmental Sciences
ITER Project: Improving Thermal Efficiency of hoRizontal ground heat exchangers

Marine litter as a dispersal vector for invasive species

Incorporating the social dimension into hydrogeochemical investigations: the Bir Al-Nas approach for socio-hydrogeology

Disentangling the effects of CO_2 fertilization, nutrient limitation and water availability on forest ecosystem processes

6. Economics
Water Buyback in Spain: what can we expect?

7. Social Sciences, Humanities and Arts
Non-Destructive Rapid Crime Scene Investigation

The Aulos from Selinus. The Virtual Reconstruction of an Ancient Musical Instrument

Visualising Engineered Landscapes: an archaeological approach to unlock environmental resilience and sustainability in antiquity

Urbes Extinctae. Investigating abandoned Roman towns in Central Adriatic Italy

Role Models for WOmen MObile Scientists

Water as hazard and water as heritage in architecture for and by women

INTREPID FORENSICS Project 7: legal highs and their route to market

Creativity through closeness and perspective taking

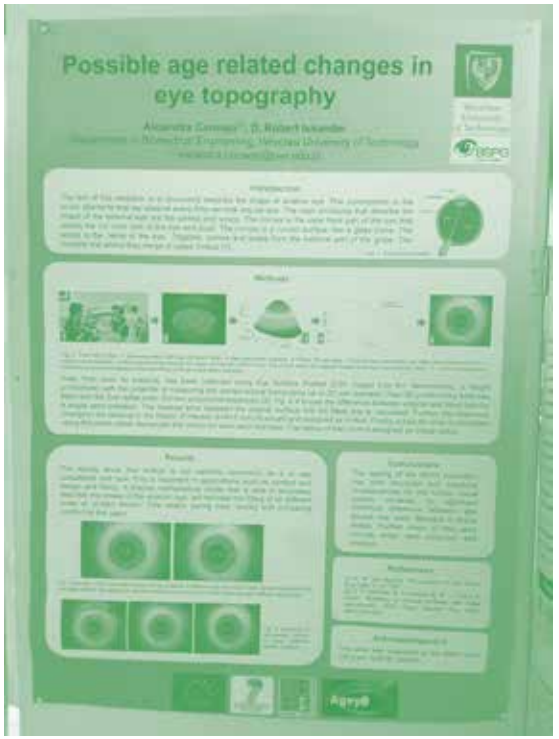
1. Life sciences

Possible age related changes in eye topography

"The aim of this research is to accurately describe the shape of anterior eye. This corresponds to the ocular elements that we observe every time we look into an eye. The main structures that describe the shape of the external eye are the cornea and sclera. The cornea is the clear front part of the eye that covers the iris -color part of the eye- and pupil. The cornea is a curved surface, like a glass dome. The sclera is the ´white of the eye´. Together, cornea and sclera form the external part of the globe. The invisible line where they merge is called 'limbus'.

Data has been collected using Eye Surface Profiler (ESP, Eaglet Eye BV, Netherlands), a height profilometer with the potential of measuring the corneo-scleral topography up to 20 mm diameter. Raw data is processed using a custom made algorithm to reproduce external eye topography and demarcate limbal region.

Over 30 subjects of different ages have been already analysed. The ageing of the World population has both structural and functional consequences for the human visual system. However, no significant statistical difference between age groups has been detected in limbal shape. Further steps of this work include wider data collection and analysis. The results show the limbus is not perfectly symmetric as it is was considered until now. This is important in applications such as contact lens design and fitting. A precise mathematical model that is able to accurately describe the shape of the anterior eye, will facilitate the fitting of all different kinds of contact lenses. This means saving time, money and increasing comfort for the users."



Author(s): Alejandra Consejo, D Robert Iskander
Organisation: Wroclaw Univesity of Technology

Id4 regulates neurogenesis in the adult subventricular zone

"The subventricular zone (SVZ) is one of the largest neurogenic niches in the adult brain of mammals. The SVZ harbours self-renewing neural stem cells (NSCs), which give rise to neural progenitor cells. These progenitor cells generate neuroblasts that migrate tangentially in chains to the olfactory bulb, where they differentiate into olfactory interneurons. Neurogenesis in the SVZ is tightly regulated by several intrinsic and extrinsic factors. Among extrinsic factors, the bone morphogenic protein (BMP) signalling pathway has been shown to positively regulate neurogenesis while inhibiting oligodendrocyte differentiation. However, the downstream transcriptional factors mediating the effects of BMPs on adult neurogenesis are not well characterized. Inhibitor of DNA binding 4 (Id4) is a helix-loop-helix (HLH) transcriptional regulator activated by BMP signalling. Id proteins participate in numerous cellular processes such as differentiation, proliferation and apoptosis, by dimerizing with bHLH transcription factors, preventing them from binding DNA. Id4 is strongly expressed in the developing central nervous system and regulates neural progenitor proliferation and differentiation. However, Id4 function in adult neurogenesis is unknown.

In the present work, we sought to understand the function of Id4 in adult neurogenesis. We first determined the expression of Id4 protein in the adult SVZ by immunohistochemistry. We found that Id4 was expressed in stem cell astrocytes, neural progenitor cells and neuroblasts. To investigate Id4 role in the adult NSC niche, we analysed the cellular organization in the SVZ of Id4-/- mice. We found decreased numbers of proliferating cells and neuroblasts in the absence of Id4. As a result, there was a decrease in the proportion of newborn neurons in the olfactory bulb. Taken together, our results indicate that Id4 regulates neurogenesis from adult neural stem cells."

Author(s): Brenda Rocamonde-Esteve, Sophie Lepannetier, Vicente Herranz-Pérez, José Manuel Garcia-Verdugo and Emmanuelle Huillard
Organisation: Institut du Cerveau et de la Moelle Epinière

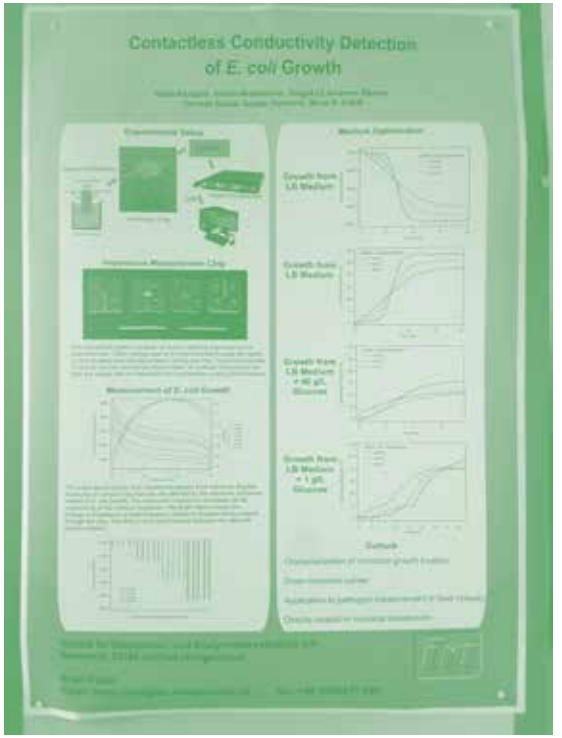
Contactless Conductivity Detection of E. coli Growth

"When bacteria grow, non-polar molecules are metabolized to ions and the medium conductivity increases. Sensing the medium conductivity allows the bacterial growth to be measured. This work describes how the contactless conductivity measurement of droplets can facilitate the high-throughput detection of microbial growth using impedance spectroscopy. This enables a low-cost high-throughput microfluidic device for applications in biotechnology.

E. Coli K12 was chosen for these experiments because of its rapid doubling time. During preliminary culture the E. Coli was grown overnight to its maximum growth. This cultured bacterium is separated from the medium using centrifugation and washed twice using LB medium and suspended in the culture medium of interest. A segmented flow of culture medium and perfluorinated oil, Novec 7500, was generated. The droplets had a length of circa 3 mm in 0.5 mm Teflon tubing. A polycarbonate chip with 0.5 mm channel diameter incorporating two metal electrodes allowed impedimetric sensing of droplets. The electrodes and chip were coated with a thin hydrophobic layer to prevent wetting problems. Impedance spectra were acquired using a high-speed USB oscilloscope and amplifier in the frequency range from 10 kHz to 10 MHz in less than 20 ms per spectrum.

By pumping droplets through the chip at half hour intervals the dependence of the metabolic processes on medium composition, temperature and initial bacterial concentration could be followed. The bacterial growth kinetics followed a sigmoid curve: (i) initially a lag phase is observed, (ii) rapid bacterial growth is observed (exponential phase) and (iii) the stationary phase is reached and the signal change reduces considerably.

The sensor enables the analysis of bacterial kinetics in droplet-based bioreactors. Reduced droplet volumes lead to more rapid bacterial culture of droplets that initially contain a single or a few bacteria. This sensor opens up electrical sensing for high-throughput toxicity testing."



© Fot. Matt, Foto-modeloses

Author(s): Brian P. Cahill*, Karippai Nobu, Stefan Wiedemeier, Yingjia Li, Andreas Barthel, Thomas Nacke, Gunter Gastrock
Organisation: Institut für Bioprozess - und Analysenmesstechnik

Production of a heterologous protein vaccine candidate through an autotransporter based platform

"Recently, we developed a method for the selective extracellular accumulation of recombinant proteins using an autotransporter secretion pathway. This technology involves engineering of the Pet autotransporter protein to allow secretion of a protein of interest into the culture medium. In this work we report how the platform can be exploited for the production of an ETEC protein vaccine candidate. This production system offers a valid alternative to other traditional methods for production of "difficult" proteins with comparable results in terms of purity and protein conformational stability thus having a simplified and cost effective downstream process. The antigen production using the Pet autotransporter system has been scaled for the first time up to a fermentation level, obtaining up to 29 mg of antigen produced per litre of culture supernatant. Taken together these findings suggest the suitability of the system for further industrial applications.

Irene Beriotto (a,b), Yanina Sevastsyanovich (a), Giacomo Romagnoli (c), Silvana Savino (c), Christiane Gerke (b), Allan J. Saul (b), Francesca Micoli (b), Adam F. Cunningham (a), Calman A. MacLennan (d), Ian R. Henderson (a)

a Institute of Microbiology and Infection, University of Birmingham, Birmingham, United Kingdom

b GSK Vaccines Institute for Global Health S. r. l., Siena, Italy

c GSK Vaccines S. r. l, Siena, Italy

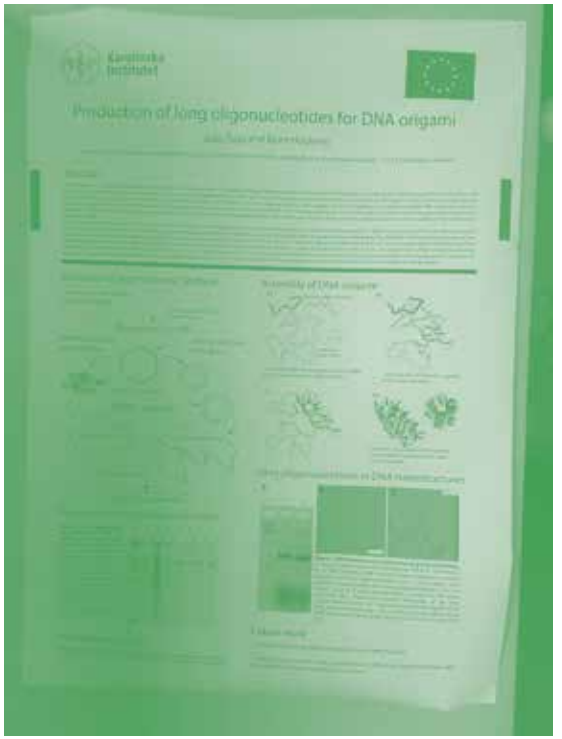
d The Jenner Institute, Nuffield Department of Medicine, University of Oxford, Oxford, United Kingdom"

Author(s): Irene Beriotto
Organisation: University of Bimingham (UK), GSK Vaccines Institute for Global Health S.r.l.

Assembly of DNA origami using long oligonucleotides

"Nucleic acids are incredibly versatile molecules. They are fundamental in the understanding of Biology as they are responsible for encoding, transmitting and expressing genetic information in all living things. However, their material properties such as structural predictability and self-assembly are also becoming relevant in other branches of scientific research. DNA nanotechnology explores these properties to design nanostructures with predictable geometry and function. The most popular method, DNA origami, consists of adding a long single-stranded DNA molecule, acting as scaffold, to hundreds of synthetic oligonucleotides programmed to act like staples holding the scaffold in the predesigned structure. The rapid expansion of DNA nanotechnology demonstrated the potential of DNA nanostructures as tools in biological contexts but it also led to the awareness of their limitations: the price of the synthetic oligonucleotides and the stability of the structures in biological media.

Here, we present an approach to DNA origami that consists on the biological production of the staple oligonucleotides and its incorporation in DNA nanostructures. We used the Monoclonal Stoichiometric (MOSIC) method to enzymatically produce oligonucleotides. This method consists of the amplification of clonal templates followed by the digestion of the produced sequences that result in pools of monoclonal oligonucleotides. The use of enzymatic methods leads to the decrease of the costs of oligonucleotides and allows the use of longer oligonucleotides that have prohibitive costs when produced by chemical synthesis. More importantly, the MOSIC method can produce longer oligonucleotides which, in turn, can reduce the number of oligonucleotides required to create an equivalent DNA nanostructure, resulting in a more stable and cohesive nanostructure. We have successfully produced long oligonucleotides with enough quality and purity to be used in the assembly of DNA origami and incorporated long staples in structures and are now working on producing nanostructures consisting only of scaffold and long staples."



© Fot. Matt. Foto-modelos.es

Author(s): João Rosa, Björn Högberg
Organisation: Karolinska Institutet

Electrooptical monitoring of polarizability in Lactobacillus plantarum Batch, Fed-Batch and Continuous Fermentations

"The degree of polarizability of cells depends particularly on the cells' composition and structure and is related to their viability: cells with high metabolic activity have a larger polarizability. The anisotropy of polarizability (AP) can be monitored at line applying electrooptical methods coupled to automated sample preparation. In previous reports, we showed that the monitoring of the AP of rod-shaped bacteria in batch cultures allowed a better insight into the cells' physiologic stages during the process. The application of the methodology to E. coli continuous cultivations offered the possibility to identify phases of optimal substrate supply among various dilution rates.

The objective of our research consists in investigating the benefits of monitoring anaerobic L. plantarum ATCC 8014 batch, fed-batch and continuous cultivations. The aim of the study is to observe whether conditions at different feed rates (and thus different substrate uptake rates), influence the AP, aiming to identify suitable cultivation conditions. The effects of substrate pulses, temperature variation, pH shifts and presence of oxygen have also been investigated concerning influences on the AP signals. In all cases, the growth phase could be divided in several stages, based on AP spectra, created out of electrooptical measurements dependent of four frequencies (200, 400 and 900 kHz and 2.1 MHz). Regression analyses with growth and synthesis rates were performed in order to predict these values, based on the AP spectra.

Futhermore, since the AP seems to be related strongly to the overall metabolic activity of the cell, disturbances during cultivation can be detected very early. Hence, measurements of this parameter enable a deeper insight into the actual physiological state of cells. Finally, the automated measurement approach allows its application as a process analytical tool.

Acknowledgments

The authors gratefully acknowledge the financial support from the EU-Horizon 2020 Marie Sklodowska-Curie ITN project BIORAPID (no. 643056)."

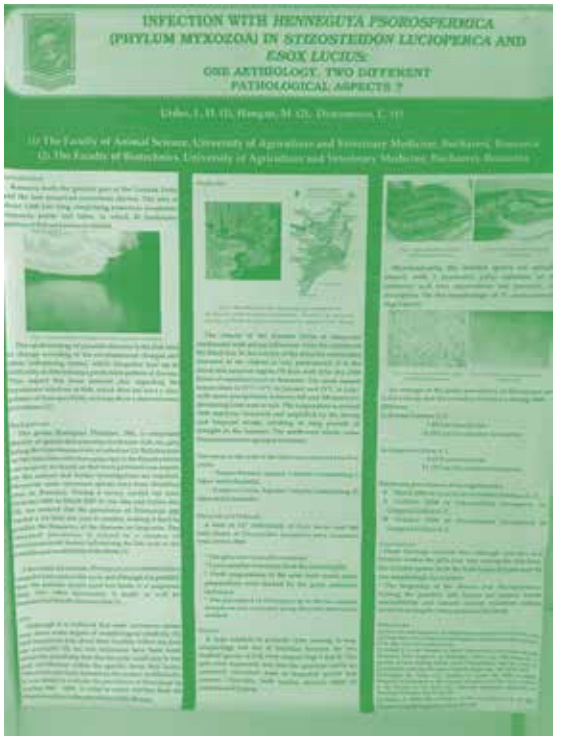
Author(s): Klaus Pellicer, Robert Spann, Alexander Angersbach, Anna Eliasson, Gürkan Sin, Krist Gernaey, Peter Neubauer, Stefan Junne
Organisation: Technische Universität Berlin (TU Berlin)

INFECTION WITH HENNEGUYA PSOROSPERMICA (PHYLUM: MYXOZOA) IN STIZOSTEIDON LUCIOPERCA AND ESOX LUCIUS

"Myxozoans are metazoans pathogenic for vertebrate and invertebrate aquatic animals. Many species cause severe outbreaks in farmed and wild finfish, in both freshwater and marine systems. The actinospore stage of Henneguya sporospermica, which is pathogenic for finfish, has been reported mostly in Nadidae and Tubicidae. However, there are not currently available clear scientific data about the parasite's intermediate and definitive host specificity, nor about the parasite's pathogenity on vertebrate hosts.

The aim of this study was to investigate the aethiology of a gill infection observed in perch (Stizosteidon lucioperca) and pike (Exos lucius) during a series of case studies performed within the Danube Delta area, Romania.

During the parasitological investigations, noticeable differences between the two finfish species, in terms of cysts position on the gill and morphology of the lesions were observed. However, H. psorospermica was found in the cysts, in all the studied cases."


INFECTION WITH *HENNEGUYA PSOROSPERMICA* (PHYLUM MYXOZOA) IN *STIZOSTEIDON LUCIOPERCA* AND *ESOX LUCIUS*: ONE AETIOLOGY, TWO DIFFERENT PATHOLOGICAL ASPECTS ?

Author(s): Laura D. Urdes, Hangan Marius, Cristiana Diaconescu
Organisation: Faculty of Animal Sciences of Bucharest, Romania

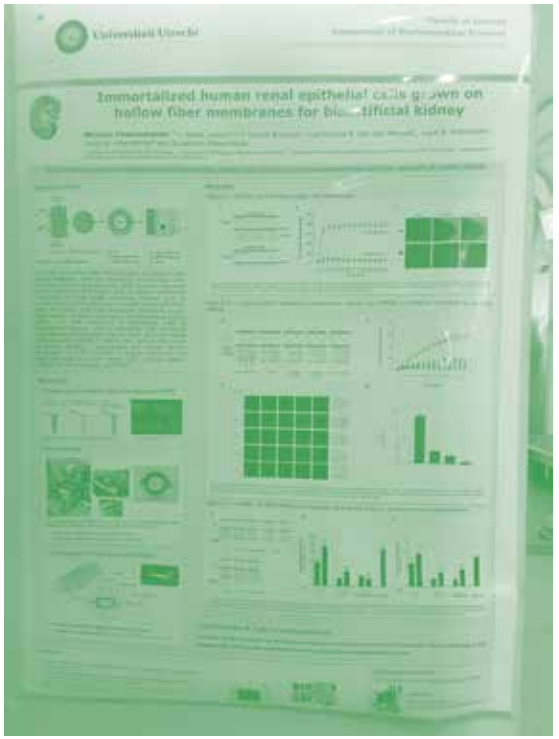
Protein-bound anionic uremic toxins efficiently cleared by a bioengineered renal tubule

"INTRODUCTION: The development of a biotechnological platform for the removal of protein-bound waste products (e.g. uremic toxins (UT)) is a prerequisite to improve current treatment modalities for patients suffering from end stage renal disease.

METHODS: Conditional immortalized proximal tubule epithelial cells overexpressing the OAT-1 transporter (ciPTEC-OAT1) were seeded on the outside of double coated hollow fiber membrane (HFM). To investigate the barrier function, unseeded or seeded double coated HFM were perfused with FITC-inulin and diffusion was measured in real-time. To measure the activity of the main transporters involved in anionic uremic toxins handling (organic anionic transporter 1 (OAT1), breast cancer resistance protein (BCRP) and multidrug resistance-associated proteins 4 (MRP4)), the fibers were perfused with their specific substrate, 1 µM fluorescein, in the presence or absence of specific transporter inhibitors, indoxyl sulfate (IS) and kynurenic acid (KA). Finally transepithelial transport of free and bound (using human serum albumin (HSA)) fraction of IS and KA was measured.

RESULTS: Within 1 min of perfusion, unseeded-HFM showed a sustained leakage compared to the seeded HFM (no cells: 89 ± 4 % vs. cells: 10 ± 3 %; p<0.001). Fluorescein uptake, in the presence of EP inhibitors, was inhibited by 100 µM IS (45 ± 13%; p<0.001) and 30 µM KA (83 ± 3%; p<0.001). The transport tests revealed a clearance of 44 ± 6 µl.min-1.cm-2 and 72 ± 20 µl.min-1.cm-2 for IS and KA, respectively. In presence of 66 µg/ml HSA the clearance of IS and KA were 74 ± 10 µl.min-1.cm-2 (p<0.01) and 101 ± 23 µl.min-1.cm-2, respectively.

DISCUSSION & CONCLUSIONS: Altogether, a successful bioartificial renal tubule was established which presented a clear barrier function and facilitated transepithelial transport of protein-bound IS and KA. This provides an innovative basis for regenerative nephrology through advanced function replacement."



© Fot. Matt. Foto-modelos.es

Author(s): M Fedecostante, J Jansen, MJ Wilmer, LP van den Heuvel, JG Hoenderop and R Masereeuw
Organisation: Utrecht Institute for Pharmaceutical Sciences

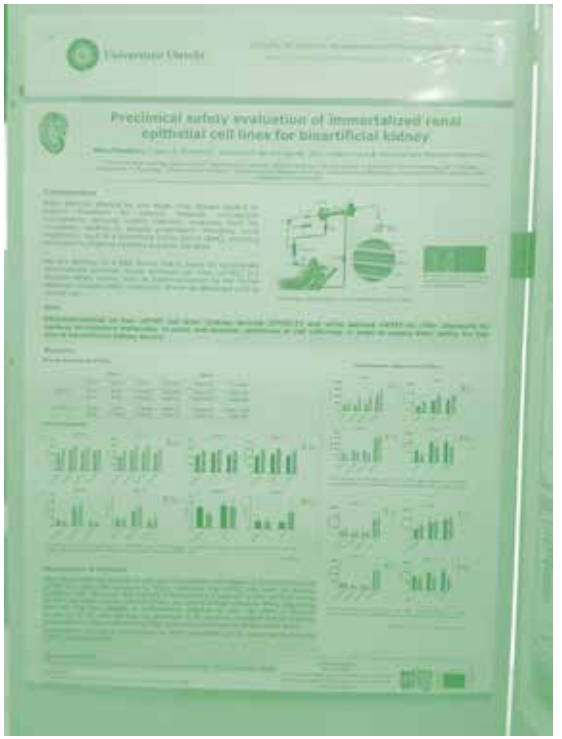
Preclinical safety evaluation of immortalized renal epithelial cell lines for bioartificial kidney

"Aim: Many patients affected by end stage renal disease (ESRD) depend on dialysis treatment for survival. However, hemodialysis incompletely removes uremic retention molecules from the circulation. Therefore, novel treatments, such as a bioartificial kidney device, are needed. We are working on a bioartificial kidney device that is based on conditionally immortalized human proximal tubule epithelial cell lines (ciPTEC). Several safety issues, such as alloimmunization by the human leukocyte antigen (HLA) molecules, should be addressed prior to clinical use.

Methods: To assess the safety for their safe use in a kidney device, two ciPTEC lines (ciPTEC-U, ciPTEC-T1) were characterized in terms of HLA-I expression and pro-inflammatory cytokine (IL-6, TNF-x) production. HLA-I expression was measured by flow cytometry and cytokine production by ELISA after exposure to various stimulatory conditions, in static and dynamic conditions of cell culturing.

Results: Exposing cells to IFN-x (300 ng/ml; 48h) resulted in an increase of HLA-I expression by 37±12% (ciPTEC-T1) and 20±8% (ciPTEC-U). LPS (10 µg/ml; 48h) increased HLA-I expression by 29±9% in ciPTEC-T1 and 15±8% in ciPTEC-U. The uremic retention solute indoxyl sulfate (1mM; 48h) did not induce a significant increment of HLA-I expression. Furthermore, the cytokine production was induced in ciPTEC-U by LPS (IL-6: 3.5±0.1 fold; TNF-x: 2.4±0.1 fold) and by indoxyl sulfate (IL-6: 1.9±0.2 fold). Remarkably, IFN-x reduced TNF-x production (0.29±0.07 fold) and did not affect IL-6 production. An increasing trend of HLA-I and cytokine expression in dynamic with respect to static conditions was observed.

Conclusion: ciPTEC can have an accessory role in (allo)immune responses. However, further studies are needed to complete the characterization and to elucidate the possible effects in the context of the bioartificial kidney. In particular, co-culture experiments with peripheral blood mononuclear cells (PBMC) will help evaluating the immunogenicity of ciPTEC in vitro."



Author(s): Milos Mihajlovic, Joost Hoenderop, Lambertus van den Heuvel, Wil Allebes, Luuk Hilbrands and Rosalinde Masereeuw
Organisation: Utrecht University

Risk-Based Privacy-Aware Access Control System for SAP ETD (Enterprise Threat Detection)

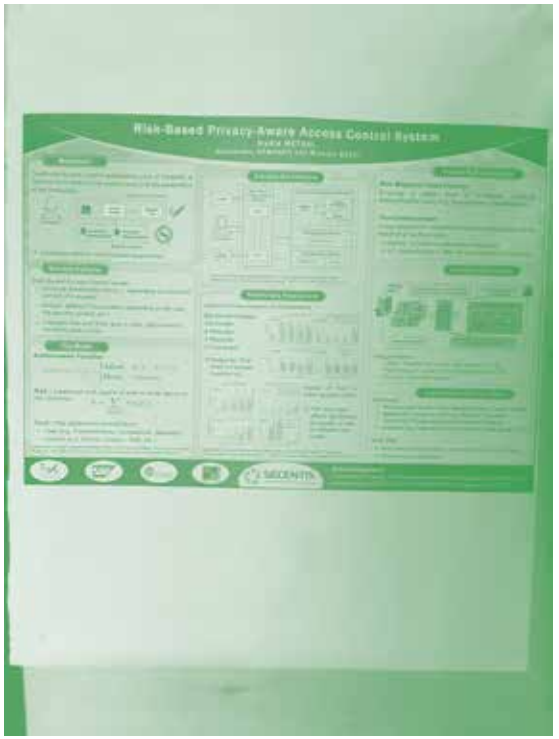
"The increasing availability of large and diverse datasets (big-data) calls for increased flexibility in access control to improve the exploitation of the data. Risk-aware systems offer an interesting approach to this problem.

The aim of my industrial PhD thesis (part of the SECENTIS Doctoral Program) is to develop a novel Risk-Based framework that combines trust with risk to support access control in dynamic contexts through trust enhancement mechanisms and risk mitigation strategies.

To assess several aspects of this approach (e.g., performance, scalability) I developed a first prototype of a Risk-Based Privacy-Aware Access Control System. Currently I am adapting this model to an industrial case study: SAP Enterprise Threat Detection a new SAP security product. ETD performs real time detection of cyber-attacks by analyzing a large amount of log files. It also facilitates exploring the log data to investigate security alerts and guides towards an intelligent response decision.

The log data used by ETD contains privacy-sensitive information (e.g., user-id, IP addresses) and information on user behaviors. In order to be processed in a compliant way, privacy-preserving techniques (e.g., anonymization) should be applied to the log data. However, privacy protection comes with a certain cost: the deterioration of the quality or utility of the data. At the same time the increasing complexity and diversity of attacks increases the difficulty of detection and asks for more access to complex combination of sensitive information.

Thus one of the biggest challenges to face is to find an efficient way to evaluate and mitigate privacy risk, while ensuring high utility of data. The trust of the request can be used to counterbalance risk (user role, access purpose) and enhanced (by performing certain actions, considering a need-to-know principle, etc.) which increases the flexibility of access while preserving the utility of data."



© Fot. Matt, Foto-modelos.es

Author(s): Nadia METOUI, Michele BEZZI, Alessandro ARMANDO
Organisation: Fondazione Bruno Kessler and University of Trento

Early markers of microglial activation and neural distress

Inflammation and demyelination are the primary pathologies in multiple sclerosis lesions and in the EAE (experimental allergic encephalomyelitis), a widely used experimental animal model for this human disease. Despite the prevailing efforts made in the field of biomarkers to determine prognostic factors and predict the clinical disease course, a correlation between tissue neuroinflammation, demyelination, neurodegeneration and potential biomarkers in biological fluids remain to be defined. In this study, we perform a time-course investigation based on a discovery strategy of myelination and inflammation biomarkers in cerebrospinal fluid (CSF) and spinal cord (SC), using high-throughput technologies in order to highlight the potential of novel early biomarkers for MS. Dark-Agouti rats were immunized and were daily weighed and examined for clinical score. At 1, 5, 8, 11 and 18 day post-immunization (DPI), rats were sacrificed, CSF was collected and total SC was dissected. We performed multiparametric quantification of inflammatory mediators in the CSF through xMAP technology and Luminex platform. We used the SC for investigating inflammation and myelination markers by real-time PCR array and immunohistochemistry. Several proteins significantly changed in the CSF of EAE animals compared with control. In particular, the pro-inflammatory cytokines IL1b, TNFa and the anti-inflammatory such as IL5, IL10 are upregulated starting from 8 DPI. Myelination genes were highly down-regulated starting from 8 DPI, especially MAL, MBP while an opposite expression profile was observed for inflammation related genes. SC inflammatory infiltrates were identified in EAE animals and double staining with antibodies markers of microglia and myeloid (CD11b) M1 (CD86), M2 (CD163) phenotypes, T cells (CD44), astrcytes (GFAP) oligodendrocyte precursor cells at different maturation stages (NG2, CNPase, MBP) was performed in order to identify the producing cell type. This early biomarkers regulation reflects the immunological response and the demyelination process taking part as soon as 8 DPI, before the clinical onset.

© Fot. Matt, Foto-modelos.es

Author(s): Nozha Borjini, Mercedes Fernandez, Laura Calza
Organisation: Chiesi Farmaceutici spa c/o University of Bologna

Monitoring survival of implanted islets in animal models

Monitoring implanted islets non-invasively by MRI after labeling with iron oxide based contrast agents is established in pre-clinical and clinical research. However, those agents have the disadvantage of being not designed for cell labeling applications, provide no quantitative information, result in often unspecific contrast and do not provide information on cell viability. We developed and evaluated new labeling approaches (using new iron based contrast agents – Magnetolipossomes (MLs) to provide a read-out that overcomes above mentioned limitations. We are working on the development and validation of different types of MLs, functionalized with fluorescent probes and biological molecules (small molecules targeting the GLP1 receptor) for targeted beta cell imaging (MRI) and potentially drug delivery. For these applications, we used rodent models with normal beta-cell mass for islet isolation. Implantation was performed under the kidney capsule and the portal vein (liver) for longitudinal follow up by Magnetic Ressonance Image (MRI). MR of rat islets transplanted in healthy rats demonstrated a strong signal with MLs which persisted up to 45 days. An excellent correlation was observed between radiologic images and histology. MLs allow a high spatial resolution, able to detect transplanted islets under the kidney capsule or in the liver, giving an islet-specific signal that can be easily and accurately quantified, and, correlated to islet functionality. Future prespectives focus on the application of this method to chronic diabetic animals for non-invasive follow up of beta cell mass. The research leading to these results has received funding from the People Programme (Marie Curie Actions) of the European Union's Seventh Framework Programme FP7/2007-2013/ under REA grant agreement n° 289932.

Author(s): Rita Garcia Ribeiro; Joao Paulo Carvalho; Willy Gsel; Conny Gysemans; Chantal Mathieu; Uwe Himmelreich
Organisation: KU Leuven

Adaptation of the bacterial chemotaxis system to the archaeal motility machinery

Background

The ability to sense and respond to external stimuli is a key feature of all living organisms. Motility is essential to achieve this goal. Archaea are able to swim using a rotating surface structure, the archaellum. It functions analogous to the bacterial flagellum, but its components are unrelated. Instead the archaellum subunits are homologous to components of type IV pili. In bacteria, transfer of external stimuli to the flagellum is mediated by the chemotaxis system. The response regulator CheY plays herein a central role. Euryarchaea display photoaxis, aerotaxis and chemotaxis. Euryarchaea have acquired chemotaxis components from bacteria via horizontal gene transfer. This raises the question how the bacterial chemotaxis machinery has been evolutionary adapted in order to interact with subunits of the archaeal motility structure.

Objectives

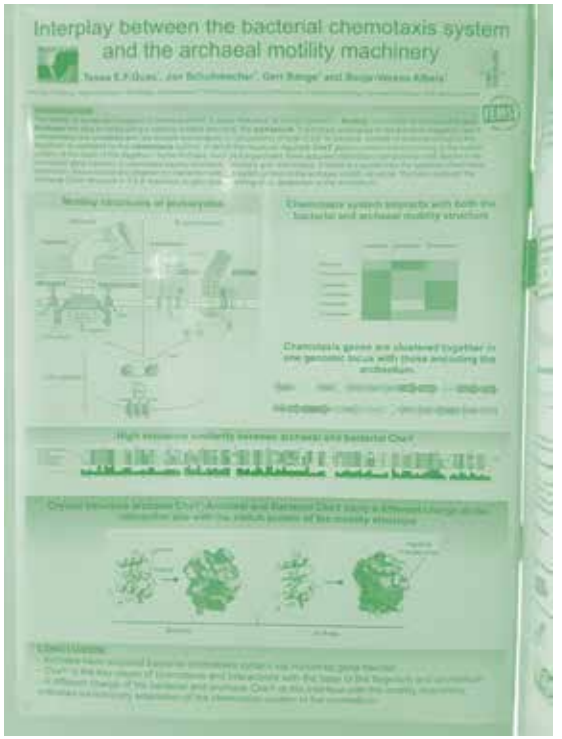
We aim to elucidate the functional and structural details interaction of the archaeal CheY with the archaellum motor complex to alter the direction of swimming.

Methods

We have applied crystallography to reveal the structure of the euryarchaeal CheY in 1.6 Å resolution. In addition we have determined its phosphorylation state as well as that of CheA. CheA is an upstream chemotaxis signaling component, which in bacteria is responsible for phosphorylation of CheY.

Conclusions

The crystal structure of the archaeal CheY shows high similarity to the bacterial CheY. However, the interface of flagellum interaction is very basic in the bacterial CheY, while this same site shows a negative charge in the archaeal CheY. This suggests that the archaeal CheY is structurally adapted for interaction with the archaellum.

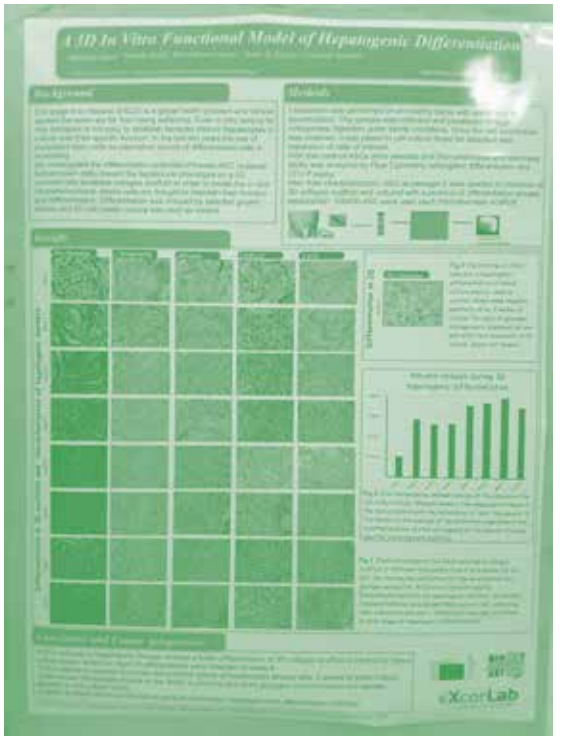


Author(s): Tessa E.F.Quax, Jan Schuhmacher, Gert Bange and Sonja-Verena Albers
Organisation: University of Freiburg

Hepatogenic differentiation of adult stem cells in an in vitro 3D model

"End-stage liver disease (ESLD) is a global health problem. Current therapy is far from being satisfying and mortality remains high. In vitro testing for novel therapies is difficult to establish because mature hepatocytes in culture lose their specific functions. Recently, pluripotent stem cells have been promoted as an alternative source for differentiated cells. We investigated the differentiation potential of human adipose-derived stem cells (ASCs) toward hepatocyte phenotype on a commercially available 3D collagen scaffold in order to model the in vivo microenvironment, in which cells may better maintain their functional and differentiation properties .ASCs were isolated from adipose tissue and differentiated in 3D collagen scaffolds thanks to specified growth factors. The differentiation potential of ASCs, as mesenchymal stem cells (MSC), was verified by using their ability to turn into adipogenic (evaluated by OilRedO staining) and osteogenic (by alkaline phosphatase staining) phenotypes and to form clones in 2D culture. Hepatogenic differentiaton was assessed by PAS staining and by immunohistochemistry of albumin, Thy-1, cKit and Ftl3. Albumin in the media was evaluated. ASCs confirmed their mesenchymal phenotype by differentiating into adipocytes and osteocytes, by forming clones and by retaining mesenchymal cell markers on their surface. PAS staining after 16 days of 3D culture in hepatogenic differentiation media showed high glycogen accumulation, which did not change during two months of static culture.

In contrast, in the 2D control at 16 days, cells were all negative to the glycogen. Thy-1, cKit and Ftl3 were expressed on the cell surface, while albumin was located intracellular. Compared with the 2D cultures, albumin concentration was higher in 3D, indicating an improved hepatogenic phenotype of the cells.Our results demonstrated an improved differentiation of ASCS to hepatocytes in 3D versus 2D cultures. 3D culture and extracellular matrix proteins provided cells with the right differentiation's environment."



© Fot. Matt, Foto-modelos.es

Author(s): *V. Strusi1, M. Rueth1, H.- D. Lemke1, D. H. Krieter2, C. Sauvant1 1eXcorLab GmbH, Obernburg, Germany 2University Hospital Würzb
Organisation: eXcorLab GmbH

Development of small molecular weight mimetics of glial cell line-derived neurotrophic factor for the treatment of Parkinson's d

"Our project is focused on the development of orally available disease-modifying treatment against Parkinson's disease (PD) caused by degeneration and progressive loss of dopaminergic (DA) neurons in the brains of affected individuals. Existing therapeutic strategies alleviate PD symptoms, but do not prevent or slow down degeneration of DA neurons.

Glial cell line-derived neurotrophic factor (GDNF) is one of the few molecules able to protect and repair DA neurons in vitro and in vivo in animal models of PD. However, its poor pharmacological properties (inability to penetrate tissues barriers, low biodistribution and bioavailability) hamper it clinical development.

Using a combination of rational drug design methods and biological assays, we are developing small molecules acting similarly to GDNF family ligands (GDNF mimetics) but with better pharmacological characteristics. We have already identified several molecules that selectively activate GDNF receptors and respective intracellular signalling in immortalized cells. Some of them are also able to support survival of cultured dopaminergic neurons in 10 nM-10 uM concentrations. One of these molecules was able to stimulate dopamine release when injected to mouse brain and alleviate PD-like symptoms in animal model of PD with similar efficacy to GDNF protein. Currently, we analyse the number of DA neurons and the density of their fibers in the brains of animals treated with GDNF mimetic, vehicle and GDNF to confirm the neuroprotective properties of small molecule GDNF mimetic. Since pharmacokinetics studies demonstrated that this compound readily penetrates blood brain barrier, we plan to assess neurorestorative properties of this molecule in 6-OHDA model of PD. In addition, we will test other GDNF mimetics in vivo and subsequently optimize active molecules using medicinal chemistry approaches to improve their efficacy and safety. Supported by FP7-PEOPLE-2013-IAPP GA N 612275, Parkinson's UK Innovation grant K-1408, Sigrid Juselius Foundation grant."

© Fot. Matt, Foto-modelos.es

Author(s): Y. Sidorova, M.Bespalov, J.-M. Renko, A.K.Mahato, I.Suleymanova, J.Kopra, M.Voutilainen, R.K. Tuominen, M. Karelson, M.Saarma
Organisation: Institute of Biotechnology, University of Helsinki

2. Engineering

Biomechanical Design Of A Dynamic Spinal Implant For The Treatment Of Early Onset Scoliosis

"Early-onset scoliosis (abnormal twisting and curvature of the spine) is defined as a severe form of the disorder diagnosed at the age of five years. After diagnosis, patients are treated to prevent progression of the deformity producing chest cavity anomalies and consequently abnormal lung formation, evolving into pulmonary failure. As alveolar development continues until puberty, the challenge is to preserve the growth potential of the spine and lungs by delaying the undertaking of fusion treatment, the gold standard to correct scoliosis. The fusion treatment effectively turns the spine into a rigid straight construction, inhibiting any mobility between vertebrae and, in consequence, preventing any spinal growth. The development of new implants offers an alternative for young patients, the most widespread treatments being distraction-based techniques. However, the frequency with which complications arise from the use of these implants is very high, as are the costs involved. Current research conducted within the Biomedical Engineering Research Centre at the University of Birmingham in collaboration with S14 Implants (France) has developed the GSDyn implant (Growing Spine-Dynamic), an innovative extendable device that mechanically corrects three-dimensional spinal deformities whilst improving lung growth in paediatric patients.

The GSDyn implant is composed of a rack-rod and pinion system that allows repetitive distraction under local anaesthesia with a surgical incision of less than one centimetre. It can be anchored simultaneously to the ribs and/ or using a combination of hooking points and pedicle screws, allowing for different anchoring configurations depending on the patient's needs. The design has been finalised under the guidance of spinal surgeons from the Orthopedic Rizzoli Institute in Bologna, Italy, and two working prototypes have been successfully manufactured.

With a full understanding of the biomechanics of scoliosis a high performance growing rod implant has been created and first implantation is planned for the beginning of 2017"

© Fot. Matt, Foto-modelos.es

Author(s): Alba Gonzalez, Duncan E.T. Shepherd, Karl Dearn
Organisation: University of Birmingham

CDYN – NEW DYNAMIC CERVICAL DISC REPLACEMENT DEVICE

"Intervertebral disc degeneration is an important social and economic problem. A herniated disc occurs when the outer portion of a spinal disc breaks down and the inner portion leaks out. The inner portion of the disc that extrudes can then irritate or compress nearby nerves, causing radiating pain and disability.

Anterior cervical discectomy and fusion (ACDF) has been a standard surgical procedure indicated for painful degenerative disc disorders. Successful fusion provides satisfactory pain relief, but results in loss of joint motion. Furthermore, some biomechanical studies suggested that, fusion alters adjacent-level kinematics, which may lead to accelerated degeneration at adjacent segments. Therefore, an alternative approach to spinal fusion has been sought, in the form of disc replacement.

Cervical disc replacement aims to preserve range of motion and to prevent overload of the adjacent discs and subsequent degeneration. The first generation of artificial cervical discs was based on the concept of ball-and-socket, providing a certain degree of motion. However, the intervertebral disc joint, is a complex structure and so far its complex kinematics has been difficult to reproduce.

Acknowledging that it is important, to develop the device that will be able to mimic the properties of an intact intervertebral disc, we are in the process of developing a new concept. The CDyn device is a result of collaboration between the University of Birmingham and the company S14 Implants (Pessac, France). It is a unique design, because apart from sustaining the range of motion, it contains an elastomeric core which mimics viscoelastic properties of the natural, healthy disc allowing for axial compression. Additionally, it is made of polymer, which excludes the possibility of emission of harmful metal ions into the organism and makes it translucent on MRI. CDyn device may in a near future provide a new quality in cervical disc replacement procedure."

© Fot. Matt, Foto-modelos.es

Author(s): Alicja Kubiak, D.E.T. Shepherd, K.D. Dearn
Organisation: The University of Birmingham

Experimental investigation of the bond behaviour of GFRP bars and concrete

"This experimental investigation intends to study the influence of the concrete cover and other parameters on the static and the fatigue behaviour of the bond between GFRP rebars and concrete. This is an important aspect in FRP reinforced concrete structures and of relevant importance in thin reinforced concrete panels extensively adopted as façade or pavements. In the literature, the influence of the concrete cover on the static and fatigue bond performance of FRP bar and concrete is not deeply investigated.

The pull-out set-up with eccentrically positioned GFRP bar is adopted to measure the effect of three parameters: (1) thickness of the concrete cover, (2) diameter and surface of the bar and (3) concrete mechanical properties. For cycling tests, 4th parameter, the ratio R of the maximum load in the cycle and the static strength is introduced to estimate the fatigue resistance under different load levels. The tension-tension cyclic loading of the bar is performed until bond failure or until reaching one million cycles. In case of fatigue life longer than this threshold, bar is pulled out statically to estimate residual bond strength.

Static experimental results showed similar shear strength of GFRP and steel bars of diameter 8 mm and an increasing shear strength with increasing of the concrete cover. Failure mode was changed depending on thickness of the concrete cover. The preliminary results of the cyclic tests show a fatigue life exceeding one million cycles for a ratio R of 0.6 and for both concrete covers."

© Fot. Matt. Foto-modelos.es

Author(s): Ana Veljkovic, Marcin Michal Haffke, prof. Valter Carvelli, prof. Matthias Pahn
Organisation: Politecnico di Milano

Conceptual Multidisciplinary Aircraft Design using Aero-Structural Adjoint-based method

"New aircraft concept is very challenging but appears as the only way to achieve drastic fuel consumption and operating cost reduction. However, the industry constraints to keep under control the risk and investment doesn't help to perform the jump towards very new concepts.

This study comes from the need of allowing a wide exploration of the design space during the very first design phases, having reliable result will lead all the downstream detailed process.

For aircraft design in particular, any kind of decision taken in preliminary design has a strong impact downstream, and any modification of them during the later more detailed phase is extremely expensive.

Actually, a Forward-Swept Wing (FSW) concept has been adopted and, starting from scratch the wing geometry, wing structure and wing-body configuration have been generated. Rigid and aero-elastic analyses have been compared, showing the importance of taking into account the aero-structural coupling in a more multidisciplinary environment. Pure aerodynamic optimizations on the isolated wing showed a great efficacy in reducing transonic shock phenomena using airfoil camber at several spanwise control sections as design variable. This optimization is important because the FSW-fuselage configuration may suffer from a strong shock at the wing-fuselage intersection. Then, a more complete aero-elastic optimization has been set-up and applied to the FSW configuration and yielded better result in terms of L/D ratio.

Beside the aero-elastic and structural optimizations using light CFD-CSM models, the Overall Aircraft Design (OAD) optimization has been adopted in order to take into account Direct Operative Cost (DOC) reduction. Top level variables that strongly couple aerodynamics and structure have been optimized in the above level, reducing the amount of information the previous disciplines have to exchange. In fact, the study introduces a new approach different from the even more common aero-structural fully coupled system and optimization."

© Fot. Matt, Foto-modelos.es

Author(s): Andrea Viti
Organisation: ONERA, The French Aerospace Lab

Efficient Safety and Security in Crowded Environments

"One challenging problem in commercial security system deployments is that system intelligence lags far behind hardware capability. In a surveillance system of hundreds of interconnected video cameras there are operators who need to check each camera view regularly in order to monitor the surveilled area effectively. Currently there is a trade-off between maintaining security in the facility and its operating costs in terms of manpower.

The CENTAUR project addresses one important aspect of system intelligence by researching automated understanding of crowded environments. As crowds are often highly dynamic in nature e.g. changing in size, density, velocity and direction, this is a challenging task and remains an active research topic. To tackle this we have formed a consortium which brings together top European computer vision academic labs and industrial research labs. To date cutting edge tracking and re-identification algorithms have been integrated successfully; the resulting software facilitates automated tracking of subjects of interest across the entire area and can cope with set-ups where cameras do not have overlapping fields of view. Another notable achievement is that technology developed under the CENTAUR project is able to detect the outbreak of violence in a crowd. A commercial software tool which incorporated these algorithms would greatly assist the work of the security operator by enhancing their situational awareness in real-time monitoring and by reducing time spent on forensic search in offline tasks. This would help to achieve the objective of maintaining a safe and secure environment at lower operating cost.

Deploying a surveillance system with such automated data analytics means that it is vital to consider privacy protection. In this regard the 'privacy by design' approach is taken in the CENTAUR project. During development each technique is reviewed in order to gauge its potential impact and measures to guarantee privacy are recommended."

© Fot. Matt, Foto-modelos.es

Author(s): Dr. Andrew Spence on behalf of the CENTAUR consortium
Organisation: CENTAUR consortium (EPFL, Honeywell, INRIA, QMUL, NeoVision)

Parametric Finite Element Model of the human lumbar spine

"The World Health Organisation and the Global Burden of Disease recognises low back pain as one of the major causes of disability worldwide. Much focus is on the development of new devices to preserve the range of motion of the spine and to restore quality of life. However, evaluating the performance of these devices, once implanted in the human body, is still challenging. A method largely used in the field of biomechanics is to evaluate the biomechanical behaviour of the spine using Finite Element Models. The aim of this study was to develop a parametric model of the lumbar spine, enabling evaluation of spinal implants and their effect on the biomechanics of the spine.

The parametric model was based on a model supplied by an industrial collaborator (S14 Implants, Pessac, France), and it allows models to be reconstructed for patients with different heights and ages. As a first approximation, only certain geometrical parameters were taken in account. Nevertheless, it allows five parameters to be modified for each vertebrae and one parameter for the intervertebral disc (correlated to the patient's age) in the lumbar region, making a total of thirty parameters for each subject. Moreover, as the model's dimensions are user controlled, it is possible to define different regions of vertebrae in order to apply the correct regional material properties to the Finite Element Models. The developed parametric model enables sensitivity analysis on geometric parameters, so as to understand the influences of morphological parameters on the biomechanics of the spine. Furthermore, this model will be used to evaluate the influence of spinal implants on the biomechanics of the lumbar spine and it would be possible for the company and surgeons to analyse the anatomical and pathological conditions and work out the best solution according to the results previously obtained."

© Fot. Matt, Foto-modelos.es

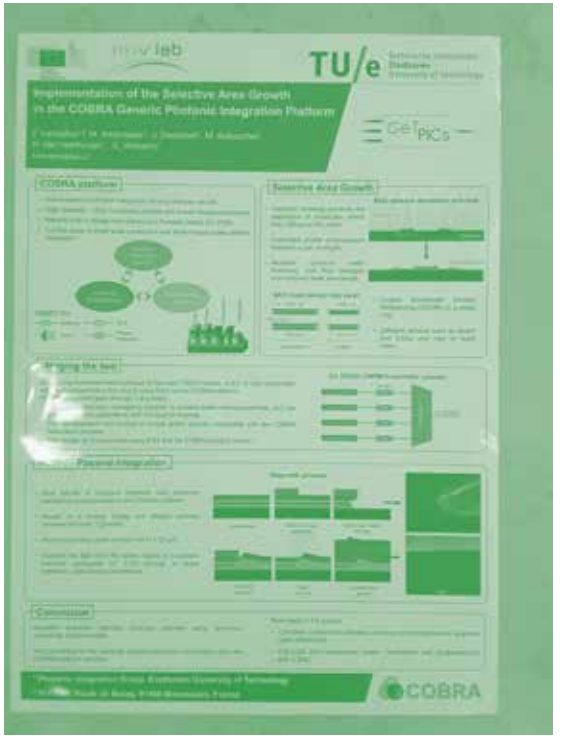
Author(s): Carolina E.Lavecchia, Daniel M.Espino, Duncan E.T.Shepherd
Organisation: University of Birmingham

Using Selective Area growth for CWDM in the COBRA Generic Photonic Integration Platform

"The COBRA generic photonic integration platform provides a library of photonic devices used as building blocks combined to form photonic integrated circuits. It relies on a well-developed process flow compatible with every building block, in order to design photonic integrated circuits with high reliability at small costs.

In the scope of its permanent development, the GeTPICs Marie-Curie project aims at diversifying the capabilities of this Generic Photonic Integration Platform.

This work consists in using a material deposition technique developed by the III-V Lab, called Selective Area Growth (SAG), which allows to locally modify the band gap of active devices, and thus tune their wavelength of emission over a range larger than 100 nm (centered around a wavelength of around 1550 nm). This will allow to make transmitters for Coarse Wavelength Division Multiplexing, but also to make other photonic devices, and to optimize some already available in the platform."



© Fot. Matt. Foto-modelos.es

Author(s): F. Lemaitre
Organisation: Eindhoven University of Technology

High Current Printed Transistor: Roll-to-Roll Manufacture and Thermal Behavior

The footprint of organic electronic technologies is important when united in complex circuitry. We present flexible organic power transistors prepared by fast (20 m min−1) roll-to-roll flexographic printing of the drain and source electrode structures, with an interspace below 50 um, directly on polyester foil[1]. The devices have top gate architecture and were completed by slot-die coating of the organic semiconductor poly-3-hexylthiophene and the dielectric material polyvinylphenol before the gate was applied by screen printing. We explore the footprint and the practically accessible geometry of such devices with a special view toward being able to drive large currents while handling the thermal aspects in operation together with other organic printed electronics technologies such as large area organic photovoltaics (OPV) and large area electrochromic displays (EC). We find especially that an elevated operational temperature is beneficial with respect to both transconductance and on/off ratio. We achieve high currents of up to 45 mA at a temperature of 80 °C with an on/off ratio of 100 which is sufficient to drive large area organic electronics such as an EC device powered by OPV devices that we also demonstrate. Finally, we observe a significant temperature dependence of the performance which can be explored further in sensing applications.

© Fot. Matt, Foto-modelos.es

Author(s): Francesco Pastorelli, Thomas M. Schmidt, Markus Hösel, Roar R. Søndergaard, Mikkel Jørgensen and Frederik C. Krebs
Organisation: DTU

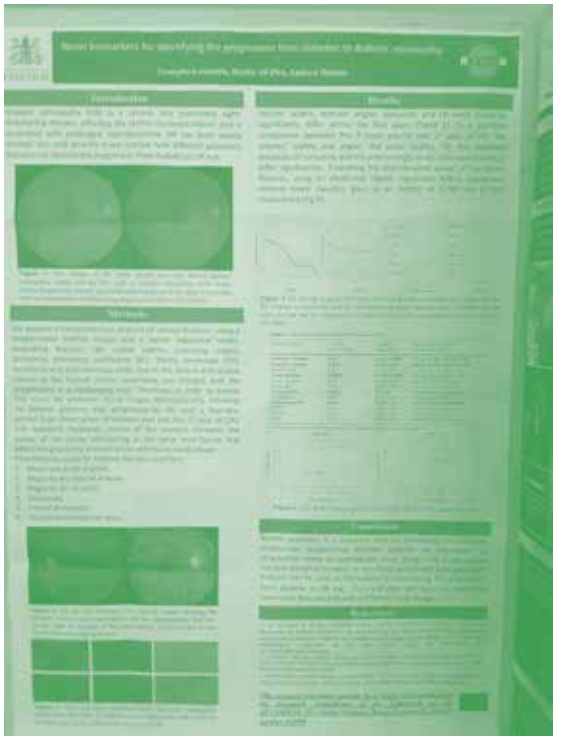
Novel Biomarkers for Identifying the Progression from Diabetic to Diabetic Retinopathy Eye

"**Introduction:** Diabetic retinopathy (DR) is a chronic and potentially sight-threatening disease, affecting the retinal microvasculature, and is associated with prolonged hyperglycaemia. DR has been widely studied, but until recently it was unclear how different geometric features can identify the progression from diabetic to DR eye.

Methods: We present a comprehensive analysis of various features, using a mixed-model ANOVA design and a logistic regression model, evaluating features like vessel widths, branching angles, tortuosity, branching coefficient (BC), fractal dimension (FD), lacunarity and arteriovenous ratio. Due to the diverse and unique nature of the human retina, associating any changes with the progression is a challenging task. Therefore, in order to bypass this issue, we analysed retinal images retrospectively, following up diabetic patients that progressed to DR, over a four-year period (Last three years of diabetic eye and the 1st year of DR). The repeated measures nature of the analysis increases the power of the study, eliminating at the same time factors that affect the geometry and cannot be otherwise standardised.

Results: Vessel widths and FD were found to be significantly different across the four years. In a pairwise comparison between the 3 years pre-DR and 1st year of DR, the arteries' widths and angles, the veins' widths, FD, the standard deviation of tortuosity and the arterial angle-to-BC ratio were found to differ significantly. Evaluating the discriminative power of the above features, using an elastic-net logistic regression and a regularised random forest classifier, gave us an AUROC of 0.785 and 0.7925 respectively.

Conclusion: Retinal geometry is a powerful tool for identifying the progression. Establishing different features as biomarkers of progression needs an appropriate study design and a robust and suitable statistical analysis. In this study we showed how geometric features can be used as biomarkers for monitoring the progression from diabetic to DR eye."



© Fot. Matt, Foto-modelos.es

Auhtor(s): Georgios Leontidis; Andrew Hunter; Bashir Al-Diri
Organisation: University of Lincoln

About Theory, Measurements and Simulations of Short Fiber Reinforced Concrete

"Concrete reinforced with short fibers is a construction material that is becoming increasingly popular for different reasons. By itself, concrete is a brittle material that is strong under compression but cannot take tension forces well. Therefore, reinforcement is added to cope with tension forces, this can be done either by use of traditional steel re-bars or by mixing in short fibers. Depending on the application, these can be steel, propylene or glass fibers. The addition of short fibers increases the complexity of the material, as properties depend on the fiber orientation (e.g. heat conductivity and elasticity). This also means that the fiber orientation needs to be taken into account when calculating the load bearing capacity of structural elements and that the fiber orientations need to be predicted for the production process (flow simulations).

This poster presents some aspects of the investigation of steel fiber concrete, like casting simulations, fiber orientation analysis from x-ray tomography scans and elasticity theory."

Author(s): Heiko Herrmann
Organisation: Institute of Cybernetics at Tallinn University of Technology

Advanced Methods for Building Diagnostics and Maintenance

"Buildings consume more than 40 % of the energy in Europe. Efficient building automation systems can considerably reduce their energy consumption. In order to sustainably achieve this goal a continuous monitoring and maintenance of building automation systems is needed.

Advanced Methods for Building Diagnostics and Maintenance (AMBI) is a research project that aims at application of advanced diagnostics and prognostics for optimized maintenance of building automation systems. The goal is to enhance facility management with efficient decision making about maintenance actions.

In AMBI, the building maintenance is addressed in a systematic way, combining the extraordinary achievements of the four involved project partners. Theory of stochastic hybrid systems is adopted to formulate and optimize a variety of diagnostics algorithms and maintenance actions. Virtual sensors, which are automatically set up based on available building information formalized as ontology, provide additional data points necessary for efficient reasoning.

Optimized maintenance is achieved by continuously performing three steps: 1) Available building data is logged and analyzed, and the states and degradations of plants and equipment are reflected by mathematical models of the building. 2) By applying Bayesian methodology on these models, the evolution of the system over time is predicted, and degradations and faults can be forecasted. 3) Dynamic decision making algorithms finally combine these predictions with complex cost models in order to compute the optimal maintenance strategy. An optimal maintenance strategy ensures optimized costs for operating a building. It does so by scheduling the right maintenance actions at the right time, thus proactively avoiding faults, saving maintenance costs and reducing the energy consumption by ensuring a high energy efficiency."

Author(s): Henrik Dibowski
Organisation: Advanced Methods for Building Diagnostics and Maintenance

High speed electroabsorption modulator in the generic photonic integration platform

"Photonic integrated circuits have a key position in the advancement of high speed communication devices, offering high capacity links on a small footprint. In order to make the most out of the integration process we focus on optimizing different components in the COBRA generic integration platform. The scope of this research is to develop a high speed electroabsorption modulator (EAM), which will allow for more complex integrated circuits, with higher modulation bandwidth.

In this work we present the development and the first measurements of an EAM in the COBRA platform. Two slightly different cross sections of the device have been tested for optical performance. Together with the characterization of the metal tracks on top of the device, which guide a microwave field for modulation, the modulator has fully been characterized. High static extinction ratio, fairly low bias voltage, high Q-factor and clear eye opening at 20 Gb/s have been achieved."

Author(s): M. Trajkovic
Organisation: Eindhoven University of Technology

Improving Motorcycle Rider Safety - A Multidisciplinary approach to assessing and improving rider skill

Research shows that one of the biggest threats to powered two wheeler (PTW) riders is collision with another vehicle at or near an intersection. Our goal is to devise a method for training riders to perform better at emergency evasive maneuvers. This method must address the integration of perception and action inherent in any coordinated response to an emergency event. Similarly, an effective approach must address the three-sided reality of motorcycle riding: interaction with a constantly changing environment, dynamics of a two-wheeled vehicle, and capability of the rider. To achieve our aims, we will employ a uniquely integrated approach to PTW rider safety that combines theory, methodology and expertise from the multiple disciplines of traffic accident research, motorcycle engineering and dynamics, biomechanics, human movement science and skill acquisition. We will utilize combined data collected from instrumented vehicles and body worn sensors to record environmental events, kinematics of the PTW, and rider perceptual-motor skill responses to emergency situations. From these measurements we will be able to analyze the relationship between vehicle kinematics and rider control strategy in the performance of emergency evasive maneuvers such as braking. The results will enable us to 1) identify when and how accurately highly skilled riders identify potential collisions in comparison to less skilled riders, 2) quantify rider performance for identification of characteristic patterns of integrated rider-bike response to a potential collision with respect to the rider's skill, 3) identify trainable perceptual-motor skills to develop best practice evidence-based training programs, 4) develop and evaluate technology-based training aids. The outcomes will support future studies by providing insights for design of HMIs and active and passive safety systems for PTWs, as well as providing methodological guidelines and data comparisons for training studies using motorcycle simulators.

© Fot. Matt, Foto-modelos.es

Author(s): Marilee Nugent, Pedro Huertas-Leyva, Simon Rosalie
Organisation: Università Degli Studi di Firenze

Introduction To Personal Protective Equipments (PPEs) For Motorcyclists

The need of PPEs for motorcyclists has brought the researchers to study in-depth the crash dynamics and the features need to be adjusted in the PPEs. Studies found that effective injury prevention is most likely to come from protection systems worn by the rider rather than attached to the motorcycle. No PPE is currently into existence which can claim to be protective hundred percent, though a significant proportion of motorcycle injuries may be minimized or protected by the use of standard PPEs. The importance of PPE has been underlined as reducing the frequency and extent of fatality, fracture of the bones, abrasions and lacerations of the skin and soft tissues during motorcycle crashes. Though the urge of developing a PPE is based on the injury biomechanics, the designing of a PPE not only depends on the protection from the injuries but also wearer's comfort and style.

Author(s): Mohammad Nasim
Organisation: Dainese S.p.A.

A Design Framework for Introducing Collaborating Robots in Manufacturing

"Robots are still primarily kept and operated in safety cages. The working sphere of an industrial robot and human has a very clear and firm boundary that does not intersect with each other. Introducing the concept of Collaborative Robots or robots as co-workers is promising for the Manufacturing sector but it also comes with a lot of challenges.

This research investigates the design challenges of Collaborative Robots in Industries. Simulation, Analytical and Experimental analysis were done to understand the problem taking a psychological and engineering perspective. This poster presents the methodology implemented, 3 important conclusions of the analysis and its implication in terms of design guidelines for developing Human-Robot Industrial System."

Author(s): Roy Someshwar
Organisation: Osaka University, Japan

Mathematical modelling for self-healing robotic cell

A key to creating highly adaptable, autonomous and flexible maintenance systems is the embedding of cognitive and cybernetic capabilities for machines inside the factory. A factory will then reason using knowledge and models that are continuously updated through on-line observation, it will autonomously plan its own actions, learn new models, new actions and new skills. This project has developed a novel mathematical model of imperfect repair for complex systems with multiple components, and we will integrate this model within a maintenance and spare parts decision-making tool with an autonomous capability. In this way, the project will take a significant step towards the development of a system that will plan and execute its own maintenance, in a manner that gives the appearance of "self-healing". We have Modelled Reliability based on dependencies between sub-systems and components. We will develop a maintenance system with an autonomous capability. The maintenance system will be based on a cognitive framework and through machine learning techniques we will provide a predictive model for faults and failures and thus move closer towards condition based maintenance.

© Fot. Matt. Foto-modelos.es

Author(s): Roy Assaf
Organisation: University of Salford

Bidirectional Matching of Job Descriptions and Vacancies using Machine Learning

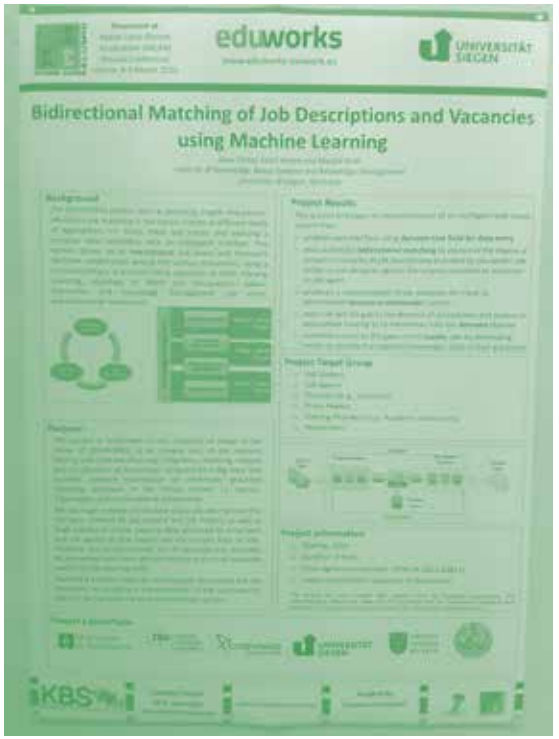
"Purpose: We propose a framework of an automatic bidirectional matching system that measures the degree of semantic similarity of job descriptions provided by job-seeker, job-holder or job-designer against the vacancy provided by employer or job-agent.

Background: There is a huge online data about job descriptions that has been entered by job seekers and job holders. Employers also produce large volume of vacancy data online which can be exploited to portray the current demand of the job market. However, due to this volume, not all vacancies are reachable by job-seekers who have relevant skill set and not all vacancies specify all the required skills.

Method: After carefully reviewing literature on problems associated with mismatch between job descriptions and job vacancies, we propose the application of bidirectional matching of job descriptions and job vacancies with the objective of improving either of them by the other. That is, when preparing job vacancies by getting information from job descriptions taking into account the information contained in job vacancies, and vice versa, the likelihood of getting the bidirectional match of a job description and a vacancy will be improved. To improve the quality of job descriptions and job vacancies, the proposed system suggestions to improve both job descriptions and vacancies using a combination of machine learning methods.

Conclusion: To meet the objective, we employ algorithms for i) preprocessing and representing the documents, ii) similarity analysis, iii) performing the matching between job descriptions and vacancies, and iv) evaluating the effectiveness of the results.

Application: The system in its application not only provides accurate and up-to-date information for job designers to develop reference job descriptions such as the ones present in standard occupation databases but also supports employers or job-agents to identify crucial and cross-cutting skill sets to be stated in the requirements for a vacancy advertisements."



© Fot. Matt, Foto-modelos.es

Author(s): Sisay Chala, Fazel Ansari, Madjid Fathi
Organisation: University of Siegen

A HIGHLY STRETCHABLE ARTIFICIAL SENSITIVE SKIN FOR TOUCH INFORMATION USING ELECTRICAL IMPEDANCE TOMOGRAPHY

"The sense of touch is one of the most important sensory systems in humans. Our skin is soft and deformable, and yet it presents a huge density of sensors that give us basic touch information like contact location, force magnitude, and structured information as the identification of the contact object texture.

Current sensing technologies are very challenging to implement over 3D surfaces, expensive and difficult to replace, while a soft and low-cost solution able to reproduce some of the properties of our skin is needed, especially on high-deformable areas as the robotic-joints.

This work describes an initial step towards the realisation of a stretchable and deformation-responsive "sensitive skin" for reproducing the human sensing capabilities on a robotic hand. We are developing a new pressure sensitive sensor which responds to external stimuli by changing its electrical conductivity.

We introduce a method called Electrical Impedance Tomography (EIT) which is a method of imaging the internal conductivity distribution of a domain through boundary measurement. In this technique, multiple electrodes are placed around a conductive body and a small current is applied across two of the electrodes, while the resulting voltage is measured between the remaining electrode pairs, thus eliminating wires from the most of the sensing area. In this way, since it does not present internal wires, the sensor is extremely soft and stretchable. The injection and the measurement is repeated until every electrode has received a current injection; the voltage data measured are then sent to a software for reconstructing the image of the internal conductivity distribution through an inverse solution of Maxwell's equations.

Future work will focus on developing reconstruction algorithms to improve the time and spatial resolution of the sensor and to achieve touch interpretation for robotic manipulation."

© Fot. Matt, Foto-modelos.es

Author(s): Stefania Russo, Alessandro Tognetti, Nicola Carbonaro, Samia Nefti-Meziani
Organisation: University of Salford

Buried Heterostructure laser as a new building block in the COBRA generic process for photonic integrated circuit

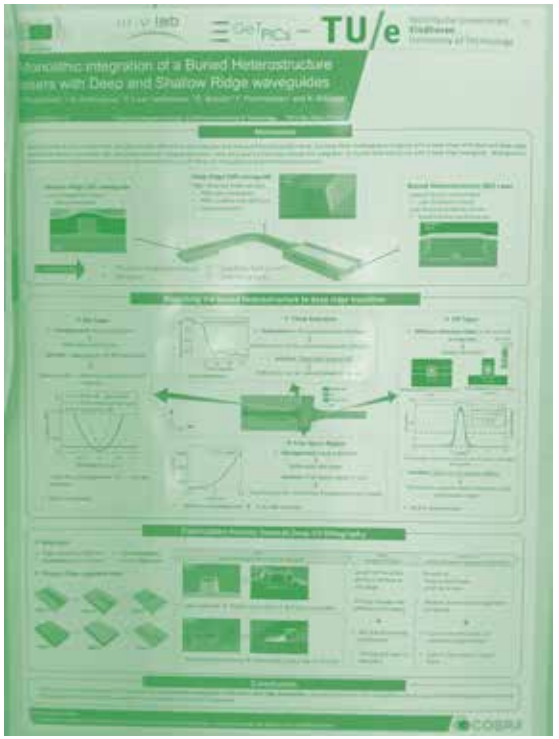
"The COBRA research institute has pioneered a generic process for the design of InP photonic circuits and different building blocks are available to design complex devices and circuits.

Currently the gain sections, used in lasers and amplifiers, are based on Shallow Ridge technology restricting the performance of the device. Buried Heterostucture (BH) Lasers and amplifiers show better thermal performances and lower optical losses, with respect to the shallow ridge devices.

Here we show the first steps towards inclusion of the BH-gain section in the generic photonic integration process of COBRA as a new building block, exploiting the combined advantages of these devices and the shallow and deep ridge building blocks that are already present in the COBRA library, which allows for compact passive circuits.

The modelling and the simulation of taper jointed region at the interface between the buried and deep ridge area are demonstrated. The proposed structure assures a high transmission but a precise alignment of 200 nm is required.

This can be obtained by the use of deep UV lithography, which is a powerful lithographic technique allowing high resolution and high throughput but it requires the wafer to have a flat surface during the exposition.In this work, the fabrication of ultra-flat active buried stripes, guaranteeing a full exploitation of the deep UV lithography, is also presented."



© Fot. Matt, Foto-modelos.es

Author(s): Valeria Rustichelli
Organisation: Eindhoven University of Technology

3. Chemistry

Structuring of edible oils into complex colloids using food-grade materials

"The functional application of liquid oils in food product development is mostly accomplished by structuring them into soft, plastic-like materials. This structuring of oil is traditionally based on the fat crystal network formed by high melting triacylglycerol (TAG) molecules that are rich in trans and/or saturated fatty acids. Currently, due to the factors such as the requirement for trans- and saturated fat-free food products, sustainable manufacturing and ethical trade practices, the research in the area of identifying alternative routes to oil structuring (in the absence of trans and saturated fats) has been regarded as a 'hot topic' in the bio-scientific community.

The SAT-FAT-FREE project funded by Marie Curie Career Integration Grant aims at exploring innovative approaches to create complex colloids from liquid edible oils. This poster gives an overview of a range of complex colloids (such as oleogels, multiple emulsions, oil foams and surfactant-free emulsions) developed so far under the framework of MC-CIG project. Fabrication, characterization and potential edible applications of these complex colloids will be discussed with the help of some specific examples."

Author(s): Ashok R. Patel
Organisation: Ghent University

Two-Photon Optimized 'Caged' Compounds for Molecular Biology, Physiology and Neurosciences

"'Caged compounds' are light sensitive prodrugs allowing the release of a biologically active ligand in a spatially and temporally controlled manner by using a pulse of light [1]. Since the first report on 'caged' ATP in 1978, this technique became highly popular in molecular biology, physiology and neurosciences for the dynamic study of complex biological processes [2]. Probes can be activated by flash-lamp and also by fs pulsed laser light under two-photon irradiation conditions. Although two-photon activation offers several advantages over more conventional UV activation, such as better spatial control, decreased phototoxicity and increased tissue penetration, it is inherently less efficient, necessitating the development and use of optimized probes. Besides improved two-photon absorption, caging groups should maintain fast response rates, high water solubility, hydrolytic stability and biological inertness.

The difficulty in the rational design of two-photon probes is the lack of reliable rules enabling the prediction of the chemical fate of the two-photon excitation: the optimization of 'caged' compounds relies on trial and error methods.

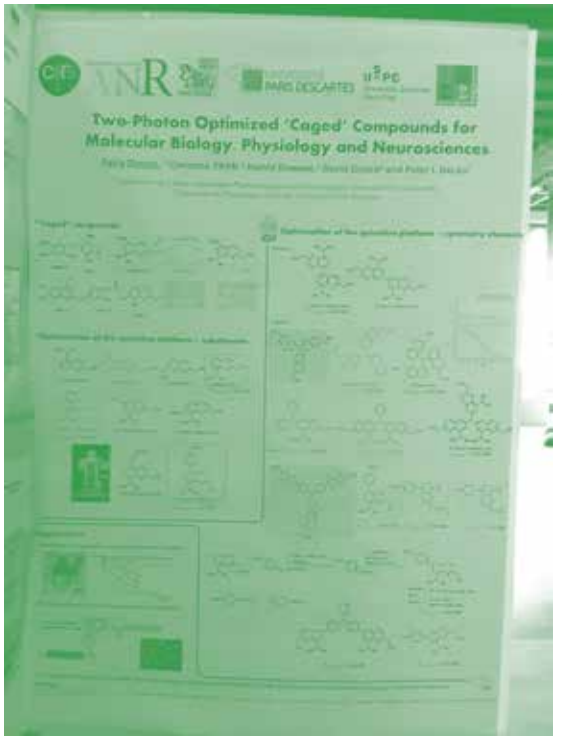
The quinoline platform selected for further optimisations was described by Dore et al. in the 2000's. By modifying the substitution pattern, the photophysical properties and photofragmentation has been significantly improved [3]. In the course of our project, incorporation of different symmetry-elements is studied. Synthesis and photofragmentation of monomeric (dipolar), dimeric (quadrupolar) and trimeric (octupolar) 2-hydroxymethylene-dimethylaminoquinoline (DMAQ) derived caged compounds will be discussed.

PD acknowledges the research fellowship from FP7 Marie Curie Actions (FP7-PEOPLE-2013-IEF: 629675).

References:

[1] Angew. Chem. Int. Ed. 2013, 52, 4526-4537; Angew. Chem. Int. Ed. 2009, 48, 3244-3266; Nat. Methods 2007, 4, 619-628;

[2] Biochemistry 1978, 17, 1929-1935; **[3]** Org. Lett. 2012, 14, 6366-6369; Org. Biomol. Chem. 2014, 12, 9899-9908; Org. Lett. 2015, 17, 402-405"



© Fot. Matt, Foto-modelos.es

Author(s): Petra Dunkel, Christine Tran, Hamid Dhimane, David Ogden, Peter I. Dalko
Organisation: Université Paris Descartes

One-shot weather-stable low-gloss powder coatings

The shift towards stricter regulations concerning emissions of volatile organic compounds (VOCs) (e.g. 2010/79/EU Directive), waste disposal and workers' safety is placing a continuous pressure for conceptual changes in the coatings industry which is thus focusing on the replacement of conventional paint products containing VOCs with alternative technologies such as powder coating systems. Weather-stable powder coatings forming (semi-)matt films with consistent quality are an important but also highly challenging application field in European and U.S. markets. Such low-gloss coatings are a requirement for decorative and architectural applications where there is a need to minimise undesired light reflectance or make surface defects in the substrate less visible. The addition of additives and the dry blending of powders are common methods for low-gloss powder coatings. However, those techniques are time-consuming and fail to give reproducible gloss levels. An attractive alternative can be the attempt to produce (semi-)matt powder coatings by a simpler "one-shot" process. In such process, all components of the formulation are subjected to a joint extrusion process. This "chemically induced incompatibility" process is based on the principle of the "double curing" mechanism and involves the premixing of selected resins with bifunctional curing agents in a way to initiate a difference in reaction rates resulting in a low-gloss film. We wish to report herein the use of glycidyl-functional acrylic resins suitable for one-shot low-gloss weather-stable powder coatings. In particular, a range of glycidyl-functional acrylic resins were synthesized and successfully used for one-shot extrusion processes leading to reproducible low-gloss exterior-durable powder coatings. It was demonstrated that monofunctional glycidyl acrylic resins added at 60-70% can reproducibly produce low-gloss coatings (gloss values ranging from 20-40 @ 60) with superior weathering resistance. The research is now focused on bifunctional acrylic resins and preliminary results are encouraging in terms of reproducible gloss reduction.

© Fot. Matt, Foto-modelos.es

Author(s): Dr. Nicolas Das Neves, MSc. Poppy Krassa, Dr. Charalambos Varelas
Organisation: Megara Resins

High-toughness supramolecular hydrogel based on hydrophobic interactions

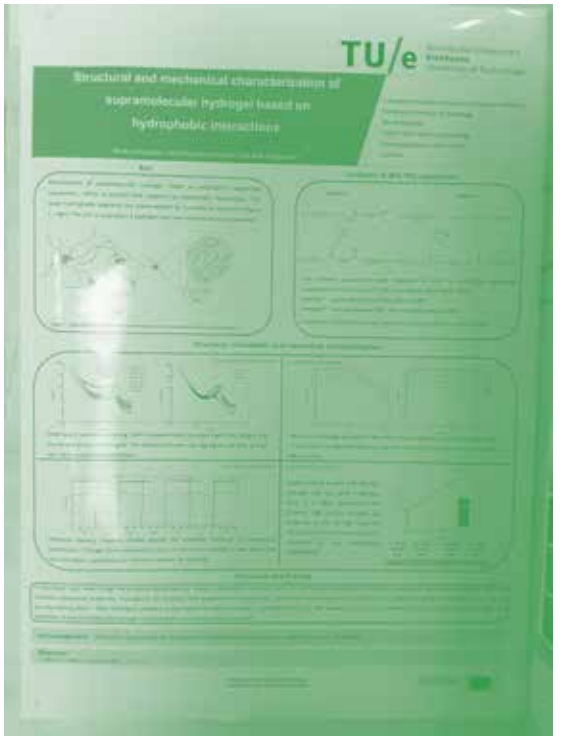
AIM: Hydrogels are scientifically interesting soft materials with only partly fulfilled potential for biomedical applications. They have proven to be essential for developing novel methodologies of therapy in the biomedical field, such as tissue engineering. A novel development in the field is the preparation of hydrogels with improved mechanical properties, which can be easily and specifically functionalized by means of non-covalent interactions. The aim of this project is to prepare a supramolecular hydrogel, based only on hydrophobic interactions. For this purpose dimer fatty acid (DFA) and polyethylene glycol (PEG) were chosen as building blocks.

METHODS: Segmented copolymer based on DFA and PEG was synthesized via polyesterification reaction and the resulting hydrogel was thoroughly characterized by swelling and stability studies. Structure of the gel was studied by means of small-angle neutron scattering (SANS), while mechanical properties were determined with oscillatory rheology and tensile testing.

RESULTS: Swelling studies showed that the equilibrium water content in this hydrogel was 75%. Once reached the swelling equilibrium, hydrogel showed exceptional stability, being able to maintain constant weight for over 60 days. Furthermore, SANS data analysis proved that the crosslinks in the network are spherical domains, formed by supramolecular assembly of DFA segments (micelle size 30-60A). Oscillatory shear experiments provided insight into mechanical properties of this hydrogel, demonstrating network's transient character, predominantly elastic behaviour and high modulus (100 kPa). Finally, tensile testing showed that DFA-PEG hydrogel had very good toughness, with maximum strength of more than 200 kPa and maximum extension at strains over 300%.

CONCLUSIONS: Supramolecular hydrogel crosslinked via hydrophobic interactions can be considered as a potential system for further improvement, due to its stability and excellent toughness. In particular, double-network hydrogels will be prepared, in order to obtain even better mechanical properties and self-healing.

ACKNOWLEDGEMENTS: This work is supported by ITN-SASSYPOL project (No. 607602)."



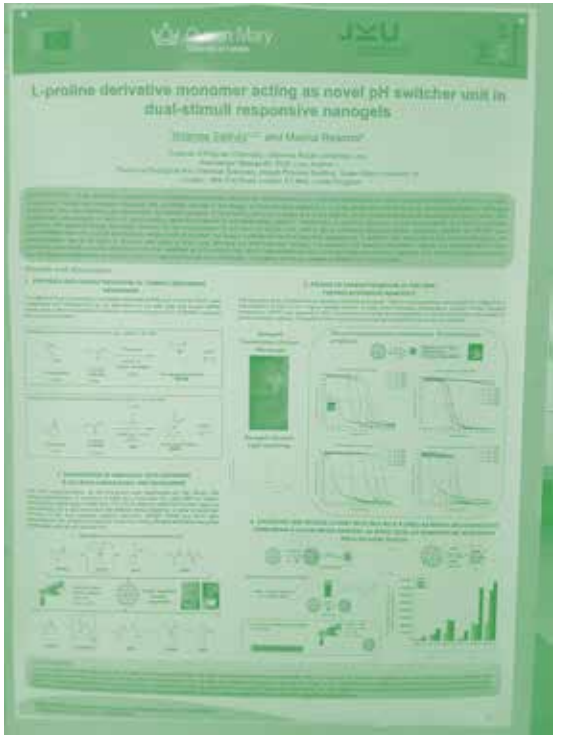
© Fot. Matt, Foto-modelos.es

Author(s): Marko Mihajlovic, Wim Pyckhout-Hintzen and Rint P. Sijbesma
Organisation: Eindhoven University of Technology

L-proline derivative monomer acting as novel pH switcher unit in dual-stimuli responsive nanogels

"In the last years, polymers have attracted considerable attention as potential platforms in delivery applications as stimuli responsive systems, and among them, of particular interest are nanogels. However, the challenge still lies in the design of dual sensitive systems to provide advanced control for several applications. Nanogels present two key characteristics for applications as delivery systems: i) the swelling behavior in water and ii) the stability of the crosslinked three-dimensional structure, which offer considerable advantages, in terms of cargo loading capacity compared to self-assembled systems. Therefore, a novel dual stimuli-responsive nanogel is proposed here, consisting of acrylamide thermoresponsive monomer N-n-propylacrylamide (NPAM) and L-proline derivative monomer acting as a novel pH-switcher unit. The effect of the cross-linker/comonomer ratio was studied in aqueous solutions and the results demonstrated the link between chemical structure, hydrophobicity/hydrophilicity ratio and physico-chemical characteristics. A tailoring of the thermo-responsiveness "on-demand" was achieved succesfully by the selection of different amounts of cross-linker N,N×-methylenebis(acrylamide) (MBA) in combination with three different thermoresponsive monomers: N-isopropylacrylamide (NIPAM), NPAM and N-acryloylpyrrolidine (NAPr). The effect of the L-proline derivative monomer incorporation on the thermoresponsiveness of NPAM-based nanogels was studied, which resulted in a maximum incorporation of 10 % mol/mol composition without losing thermosensitiviness. The dual stimuli-responsiveness of the nanogel was checked by fluorescence, through the uploading of the cationic Nile Blue A, considering the ionic interaction dye-carboxylic groups. The electrostatic interaction was demonstrated to be disrupted at acidic pH, between 6.5-5.2 (acid pH related with cancer cells), and much higher release was observed due to the dual effect temperature-pH. This new dual responsive nanogel based on L-proline represents a promising candidate for future dual 'off-on' drug delivery applications.

ACKNOWLEDGMENTS: This work was supported by the European Commission via the ITN NANODRUG and Marie Curie Actions (GA n. 289454, YS)."

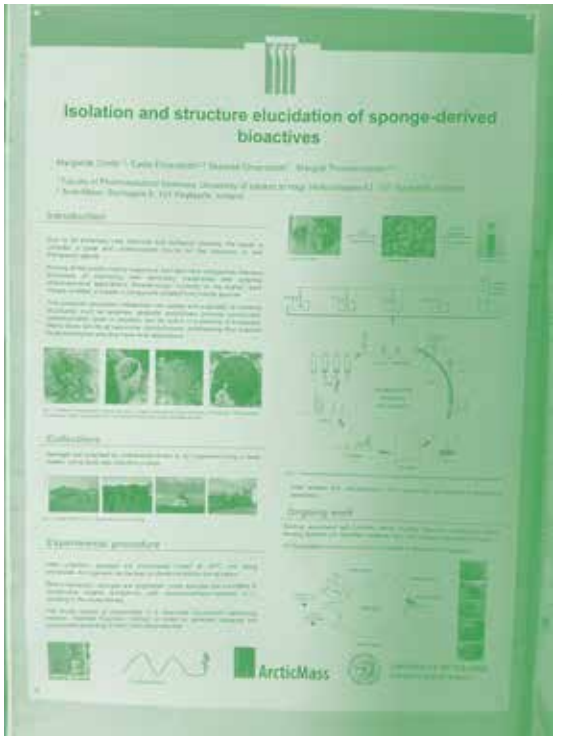


Author(s): Dr. Yolanda Salinas and Prof. Dr. Marina Resmini
Organisation: School of Biological and Chemical Sciences, Queen Mary University of London, United Kingdom

Isolation and structure elucidation of sponge-derived bioactives

"There has been a growing interest on the ocean as a source of bioactive natural compounds for drug discovery. The marine organisms are there continuously suffering a high selective pressure due to the underwater conditions, and for this reason, they develop the production of secondary metabolites as a mechanism of defense. The produced compounds, many of them completely isolated and characterized, can appear with a plurality of chemical structures and different bioactivities. Among all the prolific marine organisms, sponges have emerged as intensive producers of interesting new secondary metabolites with potential pharmaceutical applications. These organisms often contain a diverse and abundant microorganisms community, including bacteria, archaea, microalgae, and fungi, and together, they exponentially increase the production of secondary metabolites. However, the real importance of the sponges, and sponge-associated microbes, as bioactives producers is yet underexplored.

This work has as main goal the chemical study of sponges, collected in the Icelandic waters, in order to isolate bioactive chemical entities with new structures. Several sponge specimens were submitted to organic extractions in order to obtain the produced secondary metabolites. Currently, separation techniques have been applied in order to obtain pure compounds and their structure is being elucidated. Further studies will allow us to infer if, in the future, the isolated natural compounds can have an achievable role in the pharmacological and biotechnological fields."



Author(s): Margarida Costa, Eydís Einarsdóttir, Sesselja Ómarsdóttir, Margrét Thorsteinsdóttir
Organisation: Faculty of Pharmaceutical Sciences - University of Iceland

4. Physics

Engineered two-dimensional hetero-architectures for nanoelectronics

Graphene – a single layer of carbon atoms – exhibits a unique combination of superior properties, which makes it a credible starting point for new disruptive technologies in a wide range of fields. However, the absence of an energy gap in its electronic band structure prevents at present its integration in digital logic devices. Here I tackle the challenge by combining graphene with insulating or semiconducting two-dimensional materials like boron nitride or boron carbon nitride. For the last two years, growth and characterization of the electronic properties of such hetero-structures have been a very hot topic in the two-dimensional material community. In this context, my goal is to achieve control over the synthesis in terms of size, shape and stoichiometry of the hetero-structures, which will be then used for fabricating field-effect transistors in order to investigate the electron transport properties.

© Fot. Matt. Foto-modelos.es

Author(s): Luca Camilli
Organisation: Technical University of Denmark

Shear-wave-induced acoustophoresis in polymer-based microchannels

We present a numerical study of shear-wave-induced microparticle acoustophoresis in a polymer-based microchannels. In contrast to the usual longitudinal (half-wave) MHz resonances supported by the liquid-filled microchannels inside acoustically hard chip, this approach is based on shear-wave resonances supported by an acoustically soft polymer-based chip surrounding the microchannel, depending on the material properties it can be observed at kHz frequency range. The in-channel acoustic energy densities as well as the geometrical dimensions of the microchannels are close to the conventional acoustofluidic devices. Our results open up for using cheap and easily processable polymers in acoustofluidics, beyond the hietherto only successful configuration of sandwiching polymer structures between acoustically hard co-planar reflectors.

Author(s): Rayisa P. Moiseyenko and Henrik Bruus
Organisation: DTU

ITN WALL: Controlling domain wall dynamics for functional devices

"Domain walls (DWs) are the interfaces separating magnetic domains in ferromagnetic materials. Their high speed manipulation in nanostructures could lead to the next generation of new and low power functional devices for sensing, computation and data storage [1-5]. Such applications have led to increased interest within the scientific community to better understand the motion of these boundaries under the application of fields and currents.

This poster presents some of the results from the EU project Marie Currie ITN WALL, aimed at studying the manipulation of magnetic domain walls, from both theoretical and experimental perspectives. We present both experimental and computational evidence that longitudinal in-plane magnetic fields could be used to control current-driven DW motion in perpendicularly magnetized heterostructures. We also highlight how image processing techniques could be used to better quantify results from experiments on DW creep, shedding light on the dynamics of expanding magnetic bubbles.

References:

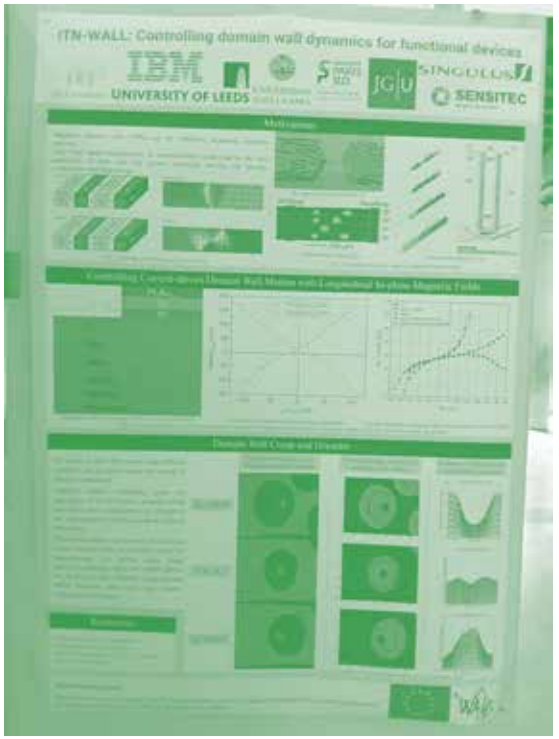
[1] Scientific Reports, 5: 9166 (2015).

[2] Nature Nanotechnology, 10, pp. 195–198 (2015).

[3] J. Phys. D: Appl. Phys. 47: 193001 (2014).

[4] J. Phys. D: Appl. Phys. 47: 333001 (2014).

[5] Science, 349: 6245, pp. 283–286 (2015)."



© Fot. Matt, Foto-modelos.es

Author(s): S. A. Nasseri1, G. Durin1,2
1 ISI Foundation
2 Istituto Nazionale di Ricerca Metrologica,
Organisation: ISI Foundation

A bi-enzymatic electrochemical detection system for pesticides based on a bi-layer Au/ gas-phase nanostructured ZrO2 electrode

"Nowadays, the use of pesticides has raised a serious public concern in the terms of health, environment and food safety due to their high neurotoxicity. One of the most commonly used groups of pesticides is organophosphate (OPs) that can inhibit irreversibly enzymes, such as acetylcholinesterase (AChE). The development of biosensors, as fast, sensitive, more compact and low-cost instruments has been approached by several research groups. Among several types of transducers, electrochemical ones have been widely used in biosensors for pesticides detection due to their high sensitivity. Nanostructured zirconia nanoparticles and films have recently been considered as a potential solid support for the immobilization of bioactive molecules in biosensor applications [1].

In this work, we propose a transducer based on gas-phase deposited zirconia nanostructures produced by mean of Supersonic Cluster Beam Deposition (SCBD) technique, functionalized with AChE, in order to be implemented in a portable detection system for OPs. As it has been previously proven by our group, the nanoscale surface morphology and the nanopores have an important role in promoting the formation of protein aggregates, because the they provide the conditions for protein nucleation inside the pores. [1,2]. Therefore, we expect that the nanostructrured zirconia produced with SCBD would be particularly suitable as a transducer component for the OPs detection system and that it would favor the electron transfer rate between the enzyme and the working electrode.

References

[1] A V Singh, M Ferri, M Tamplenizza, F Borghi, G Divitini, C Ducati, C Lenardi, C Piazzoni, M Merlini, A Podesta and P Milani, Bottom-up engineering of the surface roughness of nanostructured cubic zirconia to control cell adhesion, 2012,Nanotechnology 23. 475101

[2] Scopelliti PE, Borgonovo A, Indrieri M, Giorgetti L, Bongiorno G, et al. (2010) The Effect of Surface Nanometre-Scale Morphology on Protein Adsorption. PLoS ONE 5(7): e11862. doi:10.1371/journal.pone.0011862"

Author(s): Alexandra Raileanu, Claudio Piazzoni, Paolo Milani
Organisation: University of Milano

Rapid prototyping of integrated microfluidic pesticide biosensors based on supersonic cluster beam deposited nanostructures.

"We investigated the designing and manufacturing scale up of high-throughput and high sensitivity minifluidic electrochemical biosensors for on-chip pesticides detection using a novel rapid prototyping method. To produce the devices, an integrated approach that merges 3D printing technologies and nanostructures fabrication by mean of supersonic cluster beam deposition (SCBD) of metal nanoparticles is considered. Recently, 3D printing has been utilized to manufacture fluidic reactionwares1 and biosensors that are robust, rugged and with reusable electrodes2, therefore assessing the feasibility of the technique for the production of this family of systems. On the other hand, SCBD is a suitable technology for the fabrication of thin nanostructured films firmly anchored to plastic substrates3,4, due to the metal clusters penetration into the polymers. In the presented work, consumer grade fused deposition modeling (FDM) was used to print fluidic thermoplastic components with channels having different dimensions, fluidic ports and electrical interconnections, employing acrylonitrile butadiene styrene (ABS) as the base material. Preliminary investigation of SCBD Au nanoparticles adhesion onto ABS substrates for electrodes integration in the microfluidic biosensing platform was also carried out.

References:

[1] P. J. Kiston,; M. H. Rosnes,; V. Sans,; V. Dragone,; L. Cronin, Lab Chip 2012, 12, 3267-3271

[2] J. L. Erkal, A. Selimovic, B. C. Gross, S. Y. Lockwood, E. L. Walton, S. McNamara, R. S. Martin and D. M. Spence, Lab Chip, 2014, 14, 2023–2032

[3] C. Ghisleri, F. Borghi, L. Ravagnan, A. Podestà, C. Melis, L. Colombo, P. Milani, J. Phy. D: Applied Physics, 2014, 47, 1, 015301

[4] G. Corbelli, C. Ghisleri, M. Marelli , Prof. P. Milani, Adv. Mater. 2011, 23, 4504–4508"

© Fot. Matt. Foto-modelos.es

Author(s): Wondimu Alemu Gebreyes, Tommaso Santaniello1, Paolo Milani
Organisation: University of Milan

5. Environmental Sciences

ITER Project: Improving Thermal Efficiency of hoRizontal ground heat exchangers

"Since shallow geothermal energy resource is becoming increasingly important as renewable energy resource, due to its huge potential in providing thermal energy for residential and tertiary buildings and in contributing to reduce greenhouse gas emission, the number of installed geothermal systems is expected to continue to rise in the near future.

Moreover; in this timeframe the population living in urban areas is expected to increase. This worldwide trend will lead to a high concentrations of infrastructures in confined areas, whose impact on land use and shallow subsurface must be well evaluated.

Aim of ITER Project (Improving Thermal Efficiency of hoRizontal ground heat exchangers, No. 661396), is to improve the heat transfer efficiency and ensure the sustainability of very shallow geothermal collectors and special forms (e.g. heat baskets), interesting the first 2 m of depth from ground level.

Key challenges are

i. to enhance the heat transfer of the ground surrounding the pipes creating thermally enhanced backfilling material (TEBM) suitable for horizontal systems;

ii. to assess the performance and the environmental impacts of new promising technological solutions as heat baskets with and without TEBM;

iii. to monitor the results over time through direct measurements and numerical simulation, in order to understand the heat pollution effect in the surrounding environment.

Thermal laboratory measurements and in situ monitoring of existing and duly installed horizontal systems are provided by close cooperation between host institutions and non-academic partners.

A test site was realized in Eltersdorf, near Erlangen (Germany): 5 Helix probes (3m length) were installed at a depth of 0.6 m below the ground level and the trenches were filled in with 5 different materials, ranging from natural material as fine sand (0-1 mm) till commercial products. Here are showed the preliminary results obtained during the first months of research activity."

© Fot. Matt, Foto-modeloses

Author(s): Eloisa Di Sipio, David Bertermann
Organisation: Friedrich-Alexander-Universität, GeoZentrum Nordbayern, Lehrstuhl für Geologie

Marine litter as a dispersal vector for invasive species

Marine anthropogenic debris is a ubiquitous problem, posing a variety of threats to natural environments. A major concern, which has scarcely been investigated until now, is the ability of floating litter items or fragments to transport attached biota over large distances, thereby acting as a possible vector for the spreading of invasive species. Several authors have described this phenomenon but only localized studies are available from some parts of the world. Currently, there is no comprehensive understanding of the exact processes of colonization of and transport mediated by floating debris items on a large geographic scale. The current state of knowledge about floating marine litter as a vector for the transport of invasive species and its pathways is presented in this work. The role of fisheries and aquaculture in the release of marine debris and their implications for marine and estuarine regions is also explained, including the influence of the different litter characteristics and their impacts on ecosystems. Finally, knowledge gaps are identified and the risks posed to different environments and areas are estimated. We recommend here concrete goals for future research and also management priorities.

Author(s): Rech, Sabine; Borrell Pichs, Yaisel Juan; García Vazquez, Eva
Organisation: University of Oviedo

Incorporating the social dimension into hydrogeochemical investigations: the Bir Al-Nas approach for socio-hydrogeology

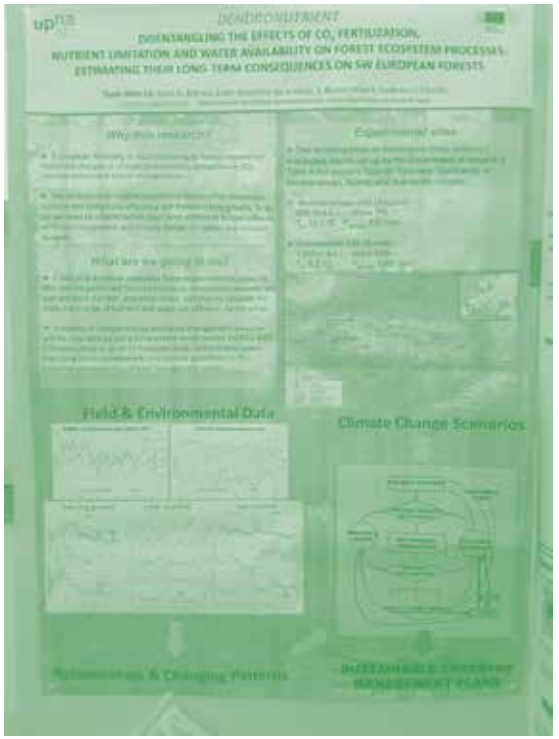
A replicable multidisciplinary approach is presented for science-based groundwater management practices: Bir Al-Nas (Bottom-up IntegRated Approach for sustainabLe grouNdwater mAnagement in rural areaS). This approach provides a practical example of the concept of "socio-hydrogeology", a way of incorporating the social dimension into hydrogeological investigations, as reinforced by the translation of the Arabic bir al-nas: "the people's well". To achieve this, hydrogeologists act as "social hydrologists" during their monitoring activities, which often bring them into contact with local communities and end users (and polluters) of water. Not only can they retrieve reliable information about traditional know-how and local issues, but they can also change the public perception of science/scientists to create the basis for mutual collaboration and understanding in view of implementing improved integrated groundwater management. Although the importance of using such methods in groundwater analysis and management is widely recognized, hydrogeological investigations are currently dominated by sectoral approaches that are easier to implement but less sustainable. The pressure of population growth, the shift towards more water-dependent economies, climate change and its impact on water availability will require scientists to use a more integrated approach, such as Bir Al-Nas, when dealing with increasing water pollution and water-scarcity issues.

© Fot. Matt, Foto-modelos.es

Author(s): Re Viviana
Organisation: Ca' Foscari University of Venice (Italy) - National Engineering School of Sfax (Tunisia)

Disentangling the effects of CO_2 fertilization, nutrient limitation and water availability on forest ecosystem processes

European forestry is fast evolving as forests could experience important changes in climate (precipitation, temperature, CO_2 concentrations) and also in management, which is moving from timber production to values such as bioenergy, carbon sequestration, biodiversity and others. These factors could change the idoneity of traditional forestry in Scots pine forests. To explore the importance of these factors, this project ×s objectives are: 1) To characterize past and estimate future effects of forest management and climate change on carbon and nutrient budgets in Pinus sylvestris stands in SW Europe, to support sustainable forestry that maximizes nutrient and carbon use efficiency and therefore tree growth; 2) To develop, evaluate and apply reliable ecologically-based mathematical models that can be applied in forest management, to study interactions among elevated atmospheric CO_2, tree growth and limiting nutrients and moisture. To achieve these objectives the project will be implemented in three stages: 1) Field and archival samples form experimental plots will be used to analyze connections between soil, leaf and stem nutrient status in the last 16 years. The magnitude of ecosystem biomass and nutrient pools will be estimated to calculate the historical change of nutrient use efficiency by the pines. Stem water and nutrient status will be estimated by wood scanning combined with techniques discriminating isotopes of carbon and nitrogen. 2) The ecosystem model FORECAST-Climate will be calibrated, validated, and used as a virtual lab to test the relative importance of nutrient, water, and CO_2 availability on tree growth. 3) A battery of climate change and forest management scenarios will be simulated to assess their long-term consequences and provide guidelines on the potential consequences of each management option. Preliminary results are showing the importance of accounting for indirect effects of climate change on nutrient cycling when simulating future forest productivity in SW European forests.



© Fot. Matt. Foto-modelos.es

Author(s): Yueh-Hsin Lo, Juan A. Blanco, Ester González de Andrés, J. Bosco Imbert, Federico J Castillo
Organisation: Dep. Ciencias del Medio Natural, Universidad Publica de Navarra

6. Economics

Water Buyback in Spain: what can we expect?

Water buyback is an increasingly popular policy to restore environmental flows threatened by overallocation. Purchase tenders offer a compensation to irrigators who decide to surrender (part of) their right to withdraw water, provided effective use exists. A major concern in water buyback involves the extent of the compensation and rent-seeking behavior: targeted environmental goals often constraint government agencies to trade in specific catchments and flow conditions, and this results in narrow markets with a limited number of bidders. The efficiency of water buyback is therefore conditioned to the capacity of this policy to shift bids as close as possible to the shadow price of the would-be seller and thus limit rent extraction. This demands an in-depth knowledge of sellers behavior. This paper uses a revealed preference method to estimate the objective function of irrigators in SE Spain. Agents are then confronted with decreasing water allocations to reveal the shadow price of irrigation water. The capitalized value of the shadow price provides a benchmark to inform and assess water purchase tenders.

Author(s): Pérez-Blanco C. D. and Gutiérrez-Martín C.
Organisation: Fondazione Eni Enrico Mattei

7. Social Sciences, Humanities and Arts

Non-Destructive Rapid Crime Scene Investigation

"Imaging is one of the easiest, non-destructive methods for detecting forensic evidence at crime scenes. Different evidence types have either characteristic absorption or fluorescent properties when illuminated under certain light wavelengths. Rapidly detecting and imaging evidence, particularly fingerprints, as well as blood and semen, at the crime scene could be a major advancement in forensic evidence retrieval and preservation.

In this research fingerprints and blood were deposited on a variety of substrates, typical of those found at crime scenes. Seven wavelengths of light were selected to irradiate the samples. Two multi-spectral imaging cameras were used to image the samples under selected illumination wavelengths, one camera which is commercially available and one which was built in-house.

The results were graded with regard to the amount of enhancement needed to easily detect the evidence being imaged. We confirmed direct detection of fingerprints being possible on a variety of substrates under ultraviolet illumination with the use of these modern multi-spectral imaging cameras. In many cases, no enhancement at all was needed. In some cases, the fingerprint definition was so good that the images could be immediately used without any need for the evidence type to be physically or chemically treated, making this not only a non-invasive method for speculatively detecting evidence, but also, in the case of fingerprints, a non-invasive confirmatory method too. It was also shown that the in-house built multi-spectral imaging camera performed better than the commercially available one."

Author(s): Smyth A., Sims M., Holt J.
Organisation: University of Leicester

The Aulos from Selinus. The Virtual Reconstruction of an Ancient Musical Instrument

In the summer of 2012, the IFA–NYU Selinunte Mission began to explore the interior of the cella of Temple R. This excavation showed that the Classical and Archaic layers had been sealed by a deep fill of the Hellenistic period and left untouched by earlier archaeological research at the site. Among the discoveries was a series of votive depositions against the walls, dating back to the sixth century BCE. One of the most striking finds among the votive depositions was the discovery of two parts of a bone aulos, which can be dated to 570 BCE. The virtual reconstruction of the aulos found in Temple R at Selinus aims to study the acoustic and morphological attributes of the ancient musical instrument, but also to increase and improve the scientific investigation by overcoming the limitations caused by the instrument's fragility. Digital technology allowed us to produce a 3D model of the aulos. This digital model has been translated into a three-dimensional artificial copy, using polymer as a material. Our goal is to reconstruct the aulos after analysing its organological characteristic and, if possible, discover its scale. We hope that this new study of the aulos will increase our knowledge of Ancient Greek music.

© Fot. Matt. Foto-modelos.es

Author(s): Angela Bellia
Organisation: University of Bologna/ New York University

Visualising Engineered Landscapes: an archaeological approach to unlock environmental resilience and sustainability in antiquity

"This project aims to illuminate the process of landscape engineering undertaken in antiquity by the Roman surveyors and contribute to the discipline of landscape engineering by injecting a new body of evidence into the debate about past land division and design in order to inform models of sustainable practice for contemporary landscape management. To achieve its research agenda, this study will develop new methods based on Artificial Intelligence for automatically identifying field system elements on remote sensing imagery, even where they are no longer readily identifiable.

Land surveying and division were the first forms of widespread landscape engineering performed by pre-industrial societies. Among those, the most complex was unquestionably the Roman Centuriation, which still characterises and shapes the rural landscapes of many European countries. Notwithstanding its impact on modern European land organisation, the principles underlying the design approach used by Roman land commissioners are still largely ambiguous, yet studying the long term persistence of centuriation and how its features survived has a key impact on our understanding of current European landscapes. Thus the VEiL project integrates archaeological, historical, geospatial and pattern recognition information to investigate the forms, impact and endurance of complex engineering on the landscape of Aquileia (Italy), a major city of the Roman Empire. Imprinted with the Roman 'spatial signature', the Aquileian countryside provides an unparalleled opportunity to expand our current understanding and perception of the origins and advances of landscape engineering and its efforts to build sustainable responses to long-term environmental and socio-economic pressures."

Author(s): Arianna Traviglia, Andrea Torsello
Organisation: University Ca' Foscari of Venice

Urbes Extinctae. Investigating abandoned Roman towns in Central Adriatic Italy

"In Italy, almost 1/3 of the Roman urban settlements were abandoned between the fourth and the eighth century but, more generally, it is the concept of city itself which changed, from Late Antiquity onwards.

Thanks to research progress on urban archaeology, attention has in recent years focused on the material aspects of the settlement transformations and, even if the number of abandoned towns and the level of decay of urban centres are different from region to region, there is now more agreement about the most common patterns in which this phenomenon occurred.

The research has tackled the challenging integration of new archaeological methods of urban survey and in depth regional-historical research, focusing on Marche region, in Adriatic Italy. This area suits perfectly for such a kind of analysis, regarding the period which is traditionally assimilated with the disruption moment of Classical cities. The region covers the two different Italiae, recognized by the Diocletian reform, and then represents both the area of the Byzantine Exarchate and the part ruled by the Lombards, following the conquest of AD 580.

In order to offer a key to understanding the phenomenon of urbes extinctae, different factors influencing change in settlement dynamics have been emphasized, on the basis of selected case studies where interdisciplinary and holistic approaches have been recently applied.

By better combining the traditional topographical approach with large-scale non-invasive intra-site survey (remote sensing applications, geomorphological research, intensive artifact pickups, GIS mapping, etc.) it has been possible to achieve a deeper understanding of the chronology, character and scale of discontinuity between the Roman urban models and the new settlement patterns of the early medieval period. "

Author(s): Francesca Carboni
Organisation: Ghent University

Role Models for WOmen MObile Scientists

"Researchers mainly choose mobility as a path to acquiring new and different skills with respect to those available in their country of origin, but the aim of each individual who chooses mobility depends mainly on their previous occupation and age. The benefits gained from the mobility experience and the ease of reintegration afterwards also depend largely on the career stage and country of origin. For researchers facing such issues the availability of role models who have triumphed over similar situations can be inspiring. Challenges specific to mobility can arise due to family situations; often it can be difficult to fulfil the needs of dual careers. Practical arrangements for the everyday life in a new country, inside and outside Europe, are also a critical issue. All of the women researchers of MCAA, whose stories are included herein, agree that mobility is an enriching experience from both the point of view of their personal lives and their careers.

However, there is still a gap between female graduates and the pool of female job applicants – even though the proportion of female graduate students and postdocs in most scientific fields is higher today than it is ever been. Therefore we suggest that focus should be placed on examining the real challenges which women need to overcome, particularly when ""mobility"" comes into play. Role models who have overcome these challenges will continue to play an important part achieving true gender equity in science.

We implemented MCAA GEMS WG ebook with the contribution of 13 women mobile researchers of MCAA.

The ebook on Role Models for Mobile Women Scientists is available to be used by programs that support the development of systematic approaches to increasing the representation and advancement of women in science, engineering and technology, since mobility plays a key role in these programs."

© Fot. Matt. Foto-modelos.es

Author(s): Gianna Avellis and Riia Chmielowski
Organisation: "MCAA GEMS WG InnovaPuglia"

Water as hazard and water as heritage in architecture for and by women

"The paper regards the issues connected to architecture at water for and by women. It is about two pillars: water as a hazard and the way gender issues are considered in climate change adaptation and post-disaster reconstruction and water as heritage: the design of leisure architecture next to water or architecture objects such as thermal bathes. The needs of women have to be included in the architecture programmes which react to the presence of water, as well as in research programme dealing with this (ex. Horizon 2020). Architects' and researchers' mobility contribute to the fact that little cultural differences can be observed between the countries. We will concentrate on Romania and Italy. From the historical evolution conclusions can be drawn regarding architecture design today.

This research is funded by a Vasile Parvan fellowship."

© Fot. Matt. Foto-modelos.es

Author(s): Maria BOSTENARU DAN
Organisation: Accademia di Romania a Roma

INTREPID FORENSICS Project 7: legal highs and their route to market

The rise in popularity of New Psychoactive Substances (NPS) more commonly known as legal highs has coincided with a rise the number of retailers supplying them. With the impending UK blanket ban on NPS fast approaching it is important to get a clear idea of how these businesses operate prior to the ban in order to better understand how the ban will impact the market. A mixed methods approach is being used to gain a comprehensive understanding of various aspects of the legal high market. These methods include the distribution of an anonymous online survey targeting the manufacturers/distributors of these substances, in depth interviews with law enforcement and well as suppliers and content analysis of online vendors. Preliminary results indicate that while a number of retailers have been in operation for more than a decade the vast majority of retailers have appeared on the market over the past five years. These vendors appear to be taking clear measures to circumvent government regulations aimed at preventing the sale and distribution of their products. Further data collection and analysis is needed to fully understand how the NPS market has operated in recent years and how it will continue to operate following the implementation of the blanket ban.

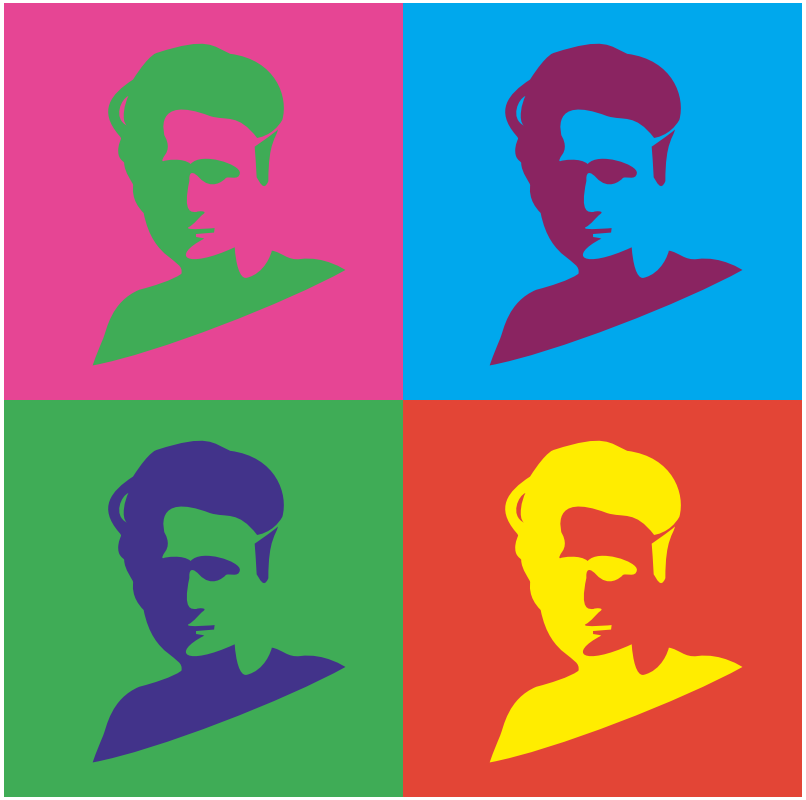
Author(s): Maurits Beltgens
Organisation: University of Leicester

Creativity through closeness and perspective taking

"Most of creativity research has so far focused on individual creativity with little emphasis on group creativity and the role of group processes in creativity (Paulus & Nijstad, 2003). Perspective taking, as a facilitator of social interactions and cooperative behaviour, was found to be a moderator of group creativity only if the groups were diverse (Hoever et al, 2012). Another important variable for groups is interpersonal closeness, which so far was only theoretically connected to group creativity (Elsbach & Kramer, 2003).

The current study investigated the role of perspective taking and closeness using a collaborative story writing task with 61 triads. Closeness and perspective taking were manipulated in experimental groups. Stories formed by the groups are judged by experts and group that received only closeness instructions displayed the highest creativity ratings, followed by group that received the perspective taking instructions. Group that received both instructions together displayed lower means of creativity compared two groups received only one of the instructions; however that difference was not statistically significant. Results indicate the significance of interpersonal closeness and perspective taking for group creativity. Findings will be discussed in light of the literature on the cohesion-creativity conflict (Staw, 2009)."

Author(s): Pinar Oztop & Michaela Gummerum (Plymouth University,CogNovo) & Konstantinos Katsikopoulos (Max Planck Ins. for H. Development)
Organisation: CogNovo, Plymouth University



Marie Curie Alumni Association Website

www.mariecuriealumni.eu

ISBN: 978-2-9601724-1-6