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BOOK OF ABSTRACTS: POSTER SESSIONS

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FOREWORD

Dear Members,

This Book of Abstracts collects the posters presented at the Annual Conference of the Marie Curie Alumni Association which took place online on 5-7 March 2021.

For each poster, a page includes an abstract, an image of the poster, and information about the author(s) and their organisation(s). Posters are categorised under nine areas:

- Chemistry
- Economics
- Engineering
- Environmental Sciences
- Life Sciences
- Mathematics
- Physics
- Social Sciences, Humanities & Arts
- MCAA Chapters

The MCAA wishes to thank everyone who showcased their posters at the first-ever online Annual Conference event. All members and non-members are encouraged to submit posters for future Annual Conferences and General Assemblies.

The abstract authors may be contacted via the MCAA web portal.

Sincerely,
The MCAA 2021 Conference Committee

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SOCIAL SCIENCES, HUMANITIES AND ARTS

CHAPTERS

CHEMISTRY

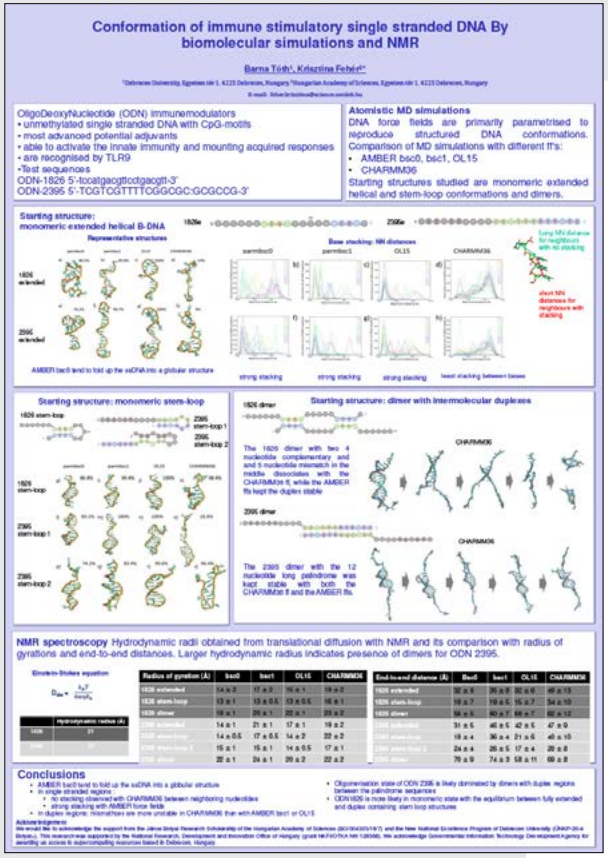
Conformation of immune stimulatory single stranded DNA by biomolecular simulations and NMR

Author(s):
Krisztina Fehér
Organisation:
Hungarian Academy of Sciences - Eötvös Lóránt Research Network
Place of residence:
Hungary

Cancer immunotherapy requires a novel type of delivery system with specifically tailored adjuvants to activate immune responses. Among immune stimulators of microbial origin, oligodeoxynucleotides (ODNs) represent the most advanced potential adjuvants. ODNs are unmethylated single-stranded DNA (ssDNA) sequences with CpG-motifs, which are able to activate the innate immune system by binding to TLR9 receptors. Adjuvant effects are optimised by maintaining ODNs and vaccine antigens in close proximity, which can be achieved by loading the immune stimulator and the antigen cargo to an appropriate carrier such as inorganic nanoparticles.

The immobilisation of ODN immune stimulators onto the surface of nanoparticles while maintaining multivalent presentation to TLR9 receptors requires knowledge of their conformational properties. De novo modelling of ssDNA conformation, opposed to that of double-stranded DNA, is challenging due to multiple reasons. ssDNA lacks stable structures and can only be described as an ensemble of interconverting conformations, thus methods for adequate sampling of the conformational space need to be applied. Force fields for the simulation of DNAs were, however, developed by testing them on structured DNA and their ability to reproduce conformations of ssDNA is unclear. In this regard, modelling of ssDNA likely faces similar challenges as modelling of Intrinsically Disordered Proteins.

We set out to test the accuracy of existing DNA force fields using atomistic molecular dynamics (MD) simulations and NMR spectroscopy. Translational diffusion coefficients were obtained from diffusion experiments and compared to translational diffusion coefficients, the radius of gyration and end-to-end distances calculated from MD simulations. Furthermore, we analysed secondary structure formation and descriptors of dynamic behaviour. The outcome of comparisons for different DNA force fields are discussed.



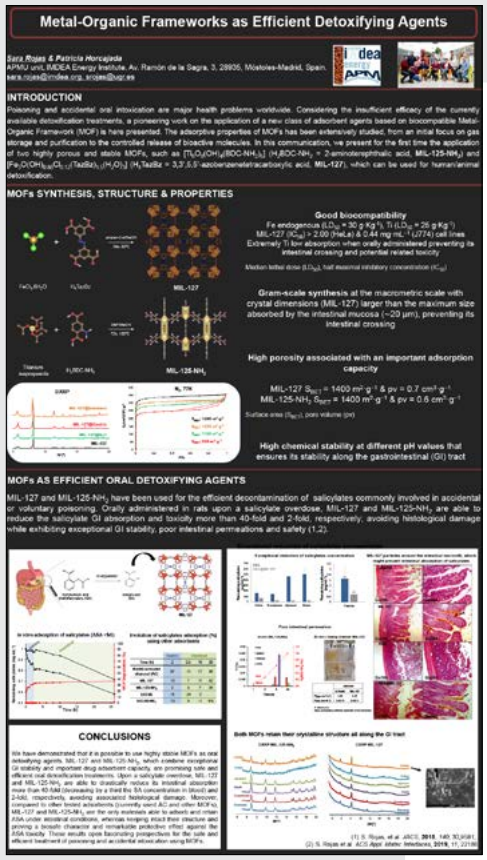
CHEMISTRY

Metal-Organic Frameworks as efficient Detoxifying Agent

Author(s):
Sara Rojas
Organisation:
IMDEA Energy
Place of residence:
Granada

In human health risk assessment, ingestion of food and water is considered a major route of exposure to many contaminants. Moreover, therapeutic misadventures, illicit drug ingestion or attempted suicide by using harmful substances is a major worldwide public health problem that causes both a significant cost and severe health problems, even death. Unfortunately, for the vast majority of these poisoning, there are no specific antidotes and currently available detoxification methods are weak and poorly prescribed. However, they are accused of being ineffective and even of causing unnecessary complications, inducing severe adverse effects, which limit their use. Therefore, a fast and effective detoxification treatment remains a challenge. In general, it is desirable to use adsorbents in the form of powders or fine particles exhibiting a larger surface area, because substances present a smaller diffusion velocity in the liquid phase than in the gaseous phase, and the adsorption velocity is consequently dependent on the absorbent's surface area. These materials should act like "chemical sponges" and selectively adsorb the toxins in the gastrointestinal tract, thus preventing the uptake in the blood and subsequent distribution to target organs. In this context, a new class of crystalline porous materials known as Metal-Organic Frameworks (MOFs) has attracted increasing attention from academic and industrial domains. Compared to classical adsorbent materials such as organic or inorganic solids, MOFs present several advantages (versatile composition, large structural variability, important porosity, etc.). making them excellent candidates for the selective and important adsorption toxins.

Materials and Methods: In this study, we target the oral detoxification of aspirin (used as a toxin drug) with two biocompatible MOFs (MIL-127 and MIL-125-NH2). Aside from their biocompatibility, these materials exhibit a high porosity associated with an important adsorption capacity and are stable at different pH values, even under gastrointestinal conditions.



CHEMISTRY

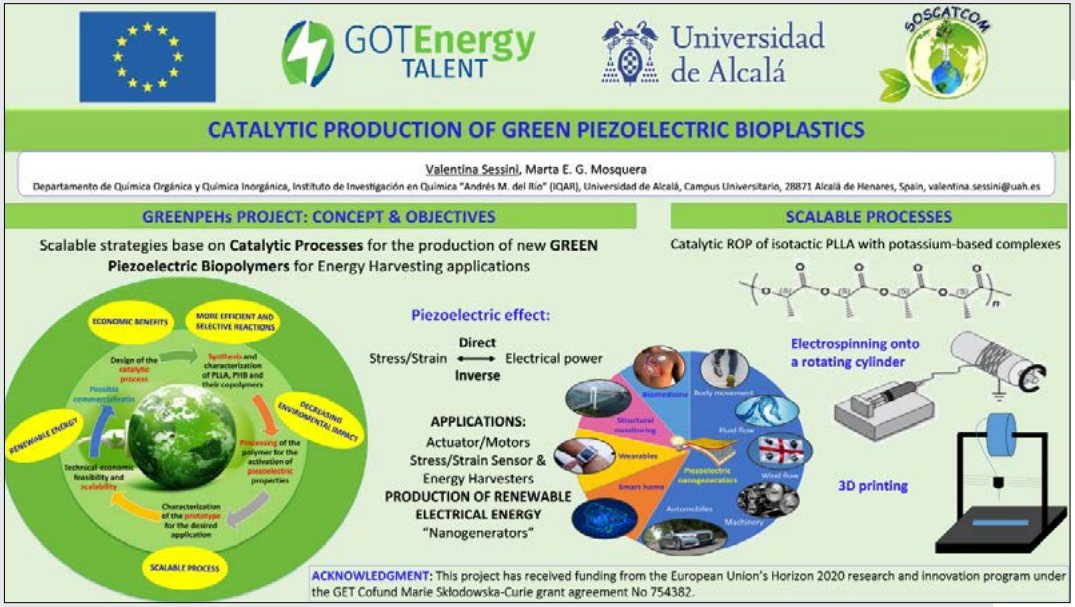
Catalytic production of green piezoelectric bioplastics

Author(s):
Valentina Sessini
Organisation:
Universidad de Alcalá
Place of residence:
Spain

Mechanical Energy Harvesters (MEH) are miniature power generation devices based on the use of innovative piezoelectric materials which can convert a mechanical stimulus to electrical energy. Piezoelectric energy harvesters (PEHs) are regarded as promising independent renewable power sources for low-power electronic devices such as wireless sensors, portable devices, stretchable electronics and medical implants (biosensors). Green piezoelectric biopolymers optically active, such as poly(L-lactic acid) (PLLA) and Poly-B-hydroxybutyrate (PHB) and their copolymers, could represent an interesting alternative that has benefits regarding carbon footprint, decreasing the environmental impact of PEHs devices. Moreover, compared to other piezoelectric materials, optically active biopolymers do not need to be polarised by an electrical field as they reach the polarisation by direct mechanical stretching. However, the practical application of biopolymers is limited because of their low piezoelectric constant, although it can be engineered and improved since the magnitude of the piezoelectric constant is proportional to the degree of chain orientation and crystallinity of the polymer.

On the other hand, an attractive synthetic pathway for the production of aliphatic polyesters is the ring-opening polymerisation (ROP) of cyclic esters catalysed by metallic complexes. This process has the advantage of allowing effective control over the properties of the produced polymers. In fact, ROP continues to be the most versatile method of synthesis of major groups of bioplastics, particularly when big amounts are required.

This poster presentation will focus on the main objective of the GREENPEHs project, which aims to design and synthesise, by catalysed ROP, new bioplastics with piezoelectric properties for possible energy harvesting applications, in order to offer innovative industrial solutions in the field of smart energy. It will contribute to the smart energy area creating innovative green strategies and producing, by an energy, cost-efficient and scalable process, new advanced piezoelectric bioplastics capable to generate renewable energy.

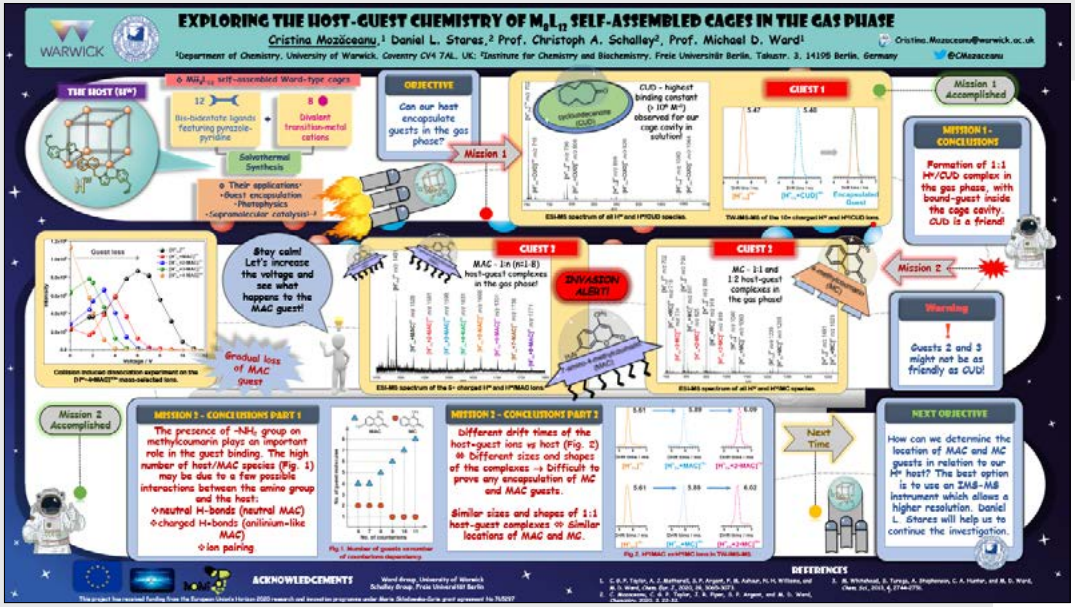


CHEMISTRY

Exploring the host-guest chemistry of M8L12 self-assembled cages in the gas phase

Author(s):
Cristina Mozaceanu
Organisation:
University of Warwick
Place of residence:
Coventry, UK

The application of mass spectrometric techniques using M8L12 supramolecular cages as hosts is an area of host-guest chemistry that is yet to be explored in the Ward group. By utilising ESI-MS and TW-IMS-MS techniques, different guest binding behaviours were identified within a series of complexes featuring cycloundecanone, 4-methylcoumarin, and 7-amino-4-methylcoumarin as high-binding guests. Results showed that cycloundecanone binds inside the cage cavity, forming a 1:1 host-guest assembly, and the presence or absence of the amino-functional group on 4-methylcoumarin plays an important role in the formation of host-guest complexes using these containers.



CHEMISTRY

Inkjet printing for biosensor application. Progress report

Author(s):
Semen Vasilev
Organisation:
University of Limerick
Place of residence:
Limerick, Ireland

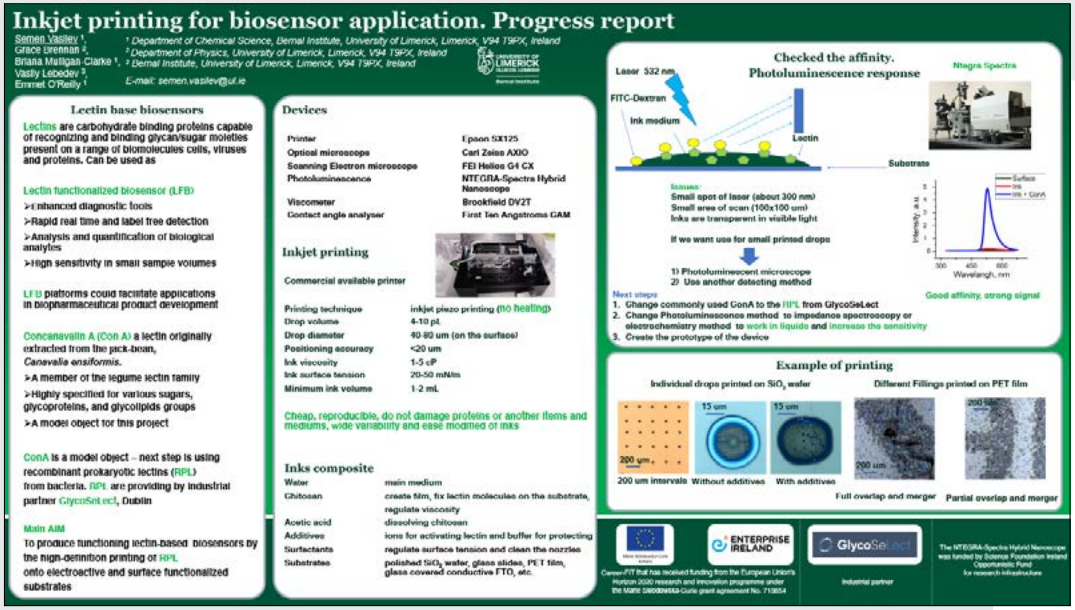
Lectins are carbohydrate-binding proteins capable of recognising and binding glycan/sugar moieties present on a range of biomolecules including cells, viruses and proteins.

Lectins functionalised biosensor (LFB) platforms present exciting opportunities as enhanced diagnostic tools enabling simple, rapid, real-time, label-free detection, analysis and quantification of biological analytes with high sensitivity using small sample volumes. The use of high throughput LFB platforms could facilitate applications in biopharmaceutical product development or act as Process Analytical Technology tools to enhance the fidelity and efficiency of production processes. While the technology of immobilising lectins on silica particles for chromatography applications has been well established by the industrial partner the ability to immobilise biological molecules such as lectins in predefined, highly concentrated and structurally organised orientations in an array format presents many challenges. Such challenges must be overcome if the benefits of LFB technology are to be fully exploited.

We plan to produce biosensors by ink-jet printing of specific LFBs in a highly structured form to enable their use as a point of care diagnostic devices and screening arrays for biopharmaceutical production.

This work is a progress report and demonstration of inkjet printing possibilities.

We have shown by the photoluminescence method that lectin Concanavalin A affinity to carbohydrate remains intact after printing. 2) We have found the method of fixing lectin on the substrate. 3) We have demonstrated the possibility of printing high ordered arrays using commercially available printer Epson.

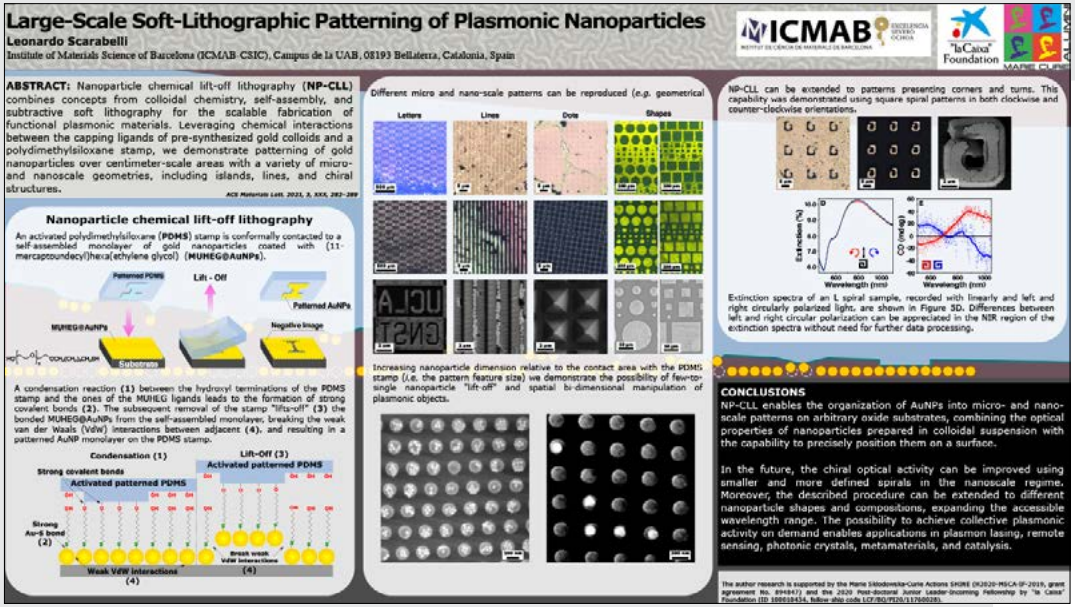


CHEMISTRY

Large-Scale Soft-Lithographic Patterning of Plasmonic Nanoparticles

Author(s):
Leonardo Scarabelli
Organisation:
Institute of Materials Science of BArcelona (ICMAB-CSIC
Place of residence:
Spain

The application of plasmonics in solid-state devices is often limited to the impossibility of patterning single plasmonic objects on arbitrary substrates using standard self-assembly methods. Herein, we demonstrate the patterning of gold metal nanoparticles through a scalable, and straightforward chemical patterning technique, termed chemical lift-off lithography (CLL), a soft lithographic technique capable of generating micro- and nanoscale patterned gold monolayers on a polydimethylsiloxane (PDMS) stamp that is conformally contacted with a mercaptoalkanol self-assembled monolayer (SAM) on a gold substrate. The procedure is modified, substituting the gold substrate with a monolayer of mercaptoalkanol-functionalised gold nanoparticles, that are lifted-off from the PDMS, generating patterned plasmonic nanostructures. The capability of CLL to access feature sizes below 100 nm opens the possibility to achieve single-particle patterning resolution, enabling the precise positioning of single plasmonic objects on arbitrary substrates over large scales (wafer-size). In conclusion, the developed approach allows the organisation of gold nanoparticles into nanoscale patterns on arbitrary oxide substrates. The procedure holds the potential to combine the unmatchable optical properties of nanoparticle colloidal suspension, with the possibility of precisely locating them on a surface.

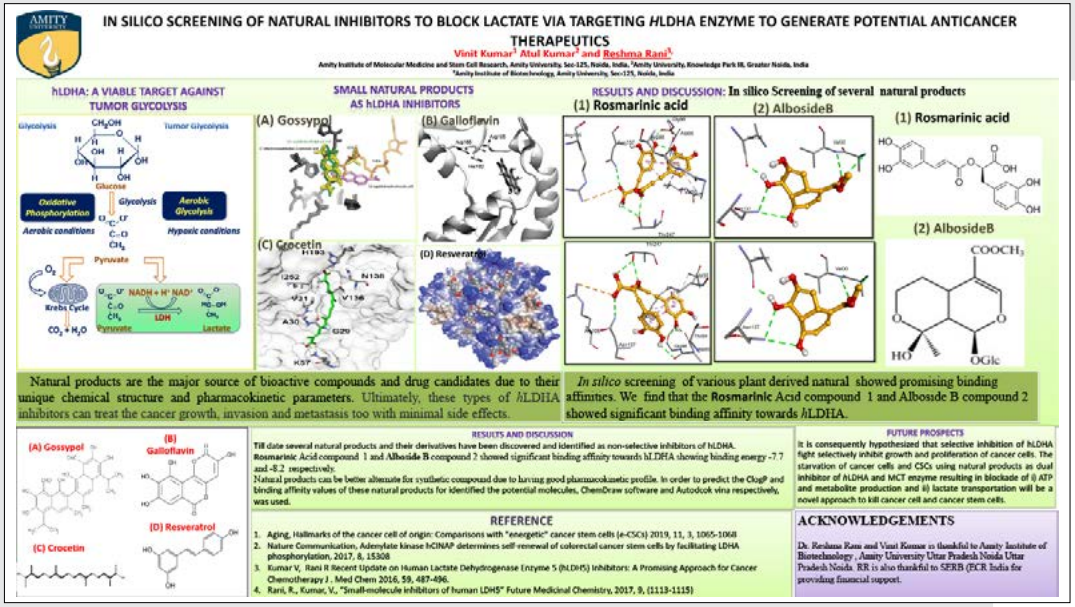


CHEMISTRY

In silico binding affinity, ADME prediction of selected biorelevant small molecules as hLDHA inhibitors

Author(s):
Reshma Rani
Organisation:
Amity University Uttar Pradesh
Place of residence:
Noida, India

Biorelevant Small molecules isolated from natural products are important bioactive compounds and drug candidates due to their chemical structure and pharmacokinetic properties. Natural products offer diverse therapeutic alternatives possessing a wide range of biological activities. The hLDHA enzyme catalyses the conversion of pyruvate to lactate coupled with the cofactor NADH. It attracts significant attention because it exists at the bifurcation point from where selective starvation of cancer cells is possible. In this work identified a potential natural product that showed significant binding affinities with hLDHA and could be a lead candidate for further drug development.



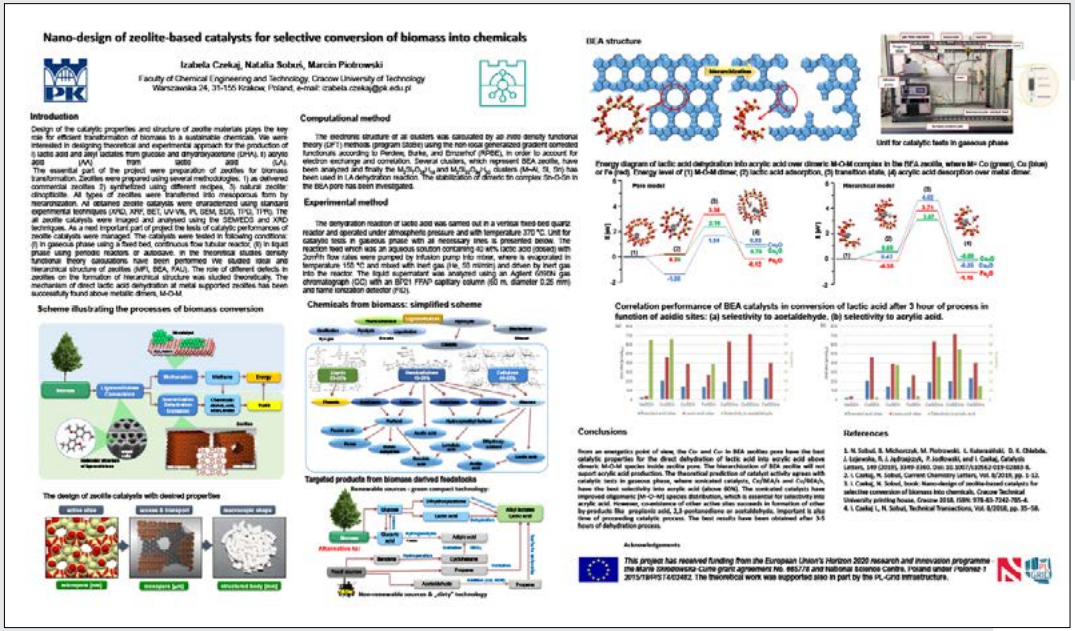
CHEMISTRY

Nano-design of zeolite-based catalysts for selective conversion of biomass into chemical

Author(s):
Izabela Czekaj
Organisation:
Cracow University of Technology
Place of residence:
Krakow, Poland

The design of the catalytic properties and structure of zeolite materials plays a key role for the efficient transformation of biomass to sustainable chemicals. We were interested in designing a theoretical and experimental approach for the production of i) lactic acid and alkyl lactates from glucose and dihydroxyacetone (DHA), ii) acrylic acid (AA) from lactic acid (LA).

The essential part of the project was the preparation of zeolites for biomass transformation. Zeolites were prepared using several methodologies: 1) as delivered commercial zeolites 2) synthetised using different recipes, 3) natural zeolite: clinoptilolite. All types of zeolites were transferred into mesoporous form by hierarchisation. All obtained zeolite catalysts were characterised using standard experimental techniques (XRD, XRF, BET, UV-Vis, IR, SEM, EDS, TPD, TPR). The all-zeolite catalysts were imaged and analysed using the SEM/EDS and XRD techniques. As a next important part of the project, the tests of catalytic performances of zeolite catalysts were managed. The catalysts were tested in the following conditions: (i) in gaseous phase using a fixed bed, continuous flow tubular reactor, (ii) in liquid phase using periodic reactors or autoclave. In the theoretical studies density functional theory calculations have been performed We studied ideal and hierarchical structure of zeolites (MFI, BEA, FAU). The role of different defects in zeolites on the formation of hierarchical structure was studied theoretically. The mechanism of direct lactic acid dehydration at metal supported zeolites has been successfully found above metallic dimers, M-O-M.

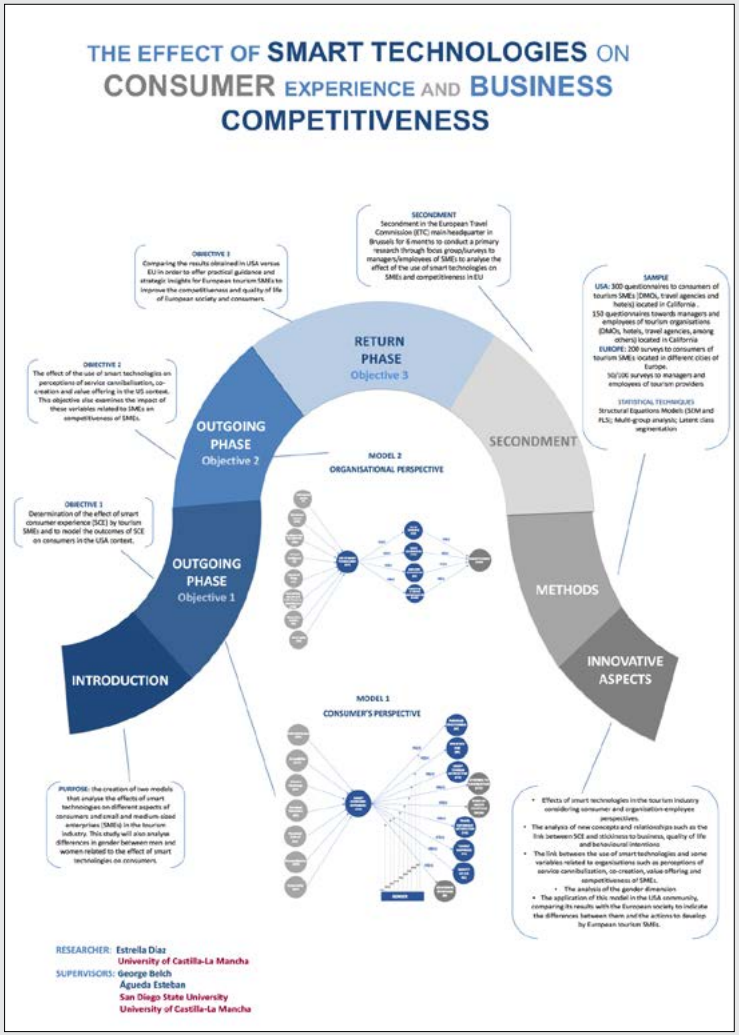


ECONOMICS

The Effect of Smart Technologies on Consumer Experience and Business Competitiveness

Author(s):
Estrella Diaz
Organisation:
University of Castilla-La Mancha
Place of residence:
Spain

This poster examines the main aspects of the SMARTOURISM project developed between the United States and Europe. Specifically, this project analyses two innovative models that reflect the effects of smart technologies on different aspects of consumers and small and medium-sized enterprises (SMEs) in the tourism industry. This study will also analyse differences in gender between men and women related to the effect of smart technologies on consumers.



ECONOMICS

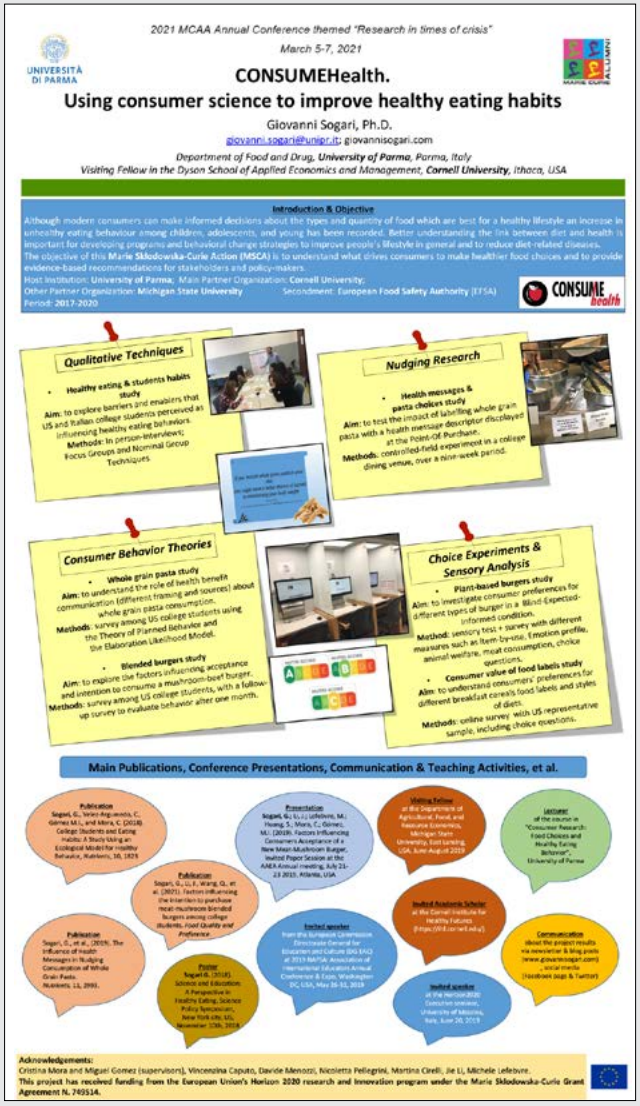
CONSUMEHealth. Using consumer science to improve healthy eating habits

Author(s):
Giovanni Sogari
Organisation:
University of Parma
Place of residence:
Parma, Italy

This poster presentation aims to present the overview of a Marie Skłodowska-Curie Action (MSCA) project titled “CONSUMEHealth” Using consumer science to improve healthy eating habits. This MSCA will deal with healthy eating habits, a key issue for the EU in contributing to safe, healthy and nutritious food for preserving life and making a positive impact on health and society.

In fact, although today’s consumers can make informed decisions about which foods, and in what quantities, are best for a healthy lifestyle, in recent years in the European Union there has been an increase of diet-related health problems caused by unhealthy and over-consumption of food (e.g., overweight, obesity, and other chronic diet-related diseases).

The objective of this MSCA was twofold: (1) understand what drives consumers to make healthier food choices and (2) provide evidence-based recommendations for stakeholders and policymakers to develop and communicate innovative win-win solutions to improve eating habits.

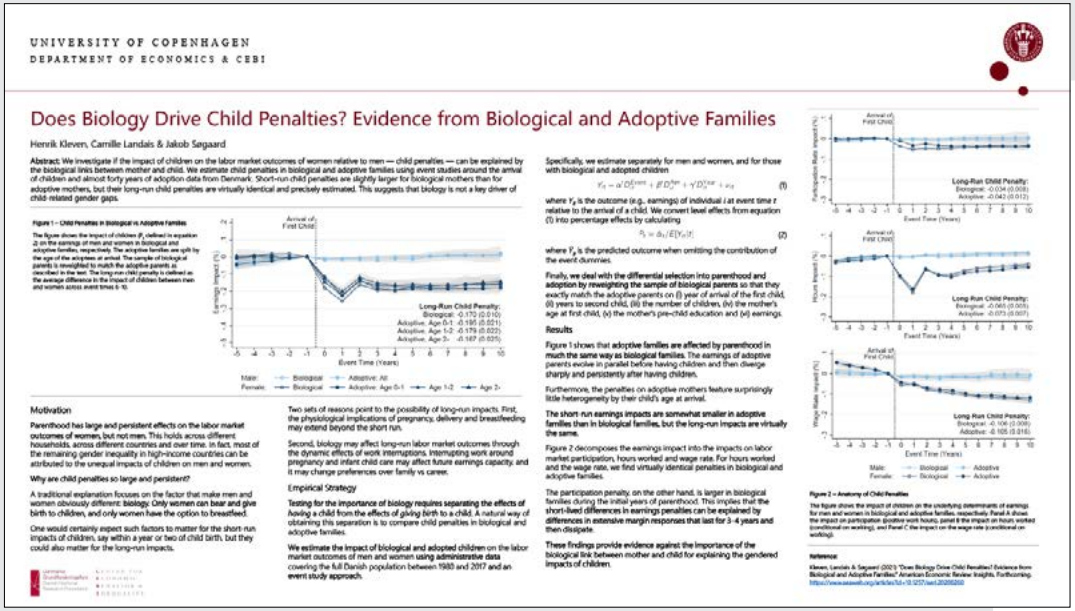


ECONOMICS

Does Biology Drive Child Penalties? Evidence from Biological and Adoptive Families

Author(s):
Jakob Søgaard
Organisation:
University of Copenhagen
Place of residence:
Copenhagen, Denmark

We investigate if the impact of children on the labour market outcomes of women relative to men – child penalties – can be explained by the biological links between mother and child. We estimate child penalties in biological and adoptive families using event studies around the arrival of children and almost forty years of adoption data from Denmark. Short-run child penalties are slightly larger for biological mothers than for adoptive mothers, but their long-run child penalties are virtually identical and precisely estimated. This suggests that biology is not a key driver of child-related gender gaps.



UNIVERSITY OF COPENHAGEN
DEPARTMENT OF ECONOMICS & CEBI

Does Biology Drive Child Penalties? Evidence from Biological and Adoptive Families

Henrik Kleven, Camille Landais & Jakob Søgaard

Abstract: We investigate if the impact of children on the labor market outcomes of women relative to men — child penalties — can be explained by the biological links between mother and child. We estimate child penalties in biological and adoptive families using event studies around the arrival of children and almost forty years of adoption data from Denmark. Short-run child penalties are slightly larger for biological mothers than for adoptive mothers, but their long-run child penalties are virtually identical and precisely estimated. This suggests that biology is not a key driver of child-related gender gaps.

Motivation

Parenthood has large and persistent effects on the labor market outcomes of women, but not men. This holds across different households, across different countries and over time. In fact, most of the remaining gender inequality in high-income countries can be attributed to the unequal impacts of children on men and women.

Why are child penalties so large and persistent?

A traditional explanation focuses on the factor that make men and women obviously different: biology. Only women can bear and give birth to children, and only women have the option to breastfeed.

One would certainly expect such factors to matter for the short-run impacts of children, say within a year or two of child birth, but they could also matter for the long-run impacts.

Two sets of reasons point to the possibility of long-run impacts. First, the physiological implications of pregnancy, delivery and breastfeeding may extend beyond the short run.

Second, biology may affect long-run labor market outcomes through the dynamic effects of work interruptions. Interrupting work around pregnancy and infant child care may affect future earnings capacity, and it may change preferences over family vs career.

Empirical Strategy

Testing for the importance of biology requires separating the effects of having a child from the effects of giving birth to a child. A natural way of obtaining this separation is to compare child penalties in biological and adoptive families.

We estimate the impact of biological and adopted children on the labor market outcomes of men and women using administrative data covering the full Danish population between 1980 and 2017 and an event study approach.

Specifically, we estimate separately for men and women, and for those with biological and adopted children

$$Y_{it} = \alpha' D_{it}^{event} + \beta' D_{it}^{age} + \gamma' D_{it}^{cal} + \nu_{it} \quad (1)$$

where Y_{it} is the outcome (e.g., earnings) of individual i at event time t relative to the arrival of a child. We convert level effects from equation (1) into percentage effects by calculating

$$\hat{P}_{it} = \hat{\alpha}_t / E[Y_{it}|t] \quad (2)$$

where $\hat{Y}_{it}$ is the predicted outcome when omitting the contribution of the event dummies.

Finally, we deal with the differential selection into parenthood and adoption by reweighting the sample of biological parents so that they exactly match the adoptive parents on (i) year of arrival of the first child, (ii) years to second child, (iii) the number of children, (iv) the mother's age at first child, (v) the mother's pre-child education and (vi) earnings.

Results

Figure 1 shows that adoptive families are affected by parenthood in much the same way as biological families. The earnings of adoptive parents evolve in parallel before having children and then diverge sharply and persistently after having children.

Furthermore, the penalties on adoptive mothers feature surprisingly little heterogeneity by their child's age at arrival.

The short-run earnings impacts are somewhat smaller in adoptive families than in biological families, but the long-run impacts are virtually the same.

Figure 2 decomposes the earnings impact into the impacts on labor market participation, hours worked and wage rate. For hours worked and the wage rate, we find virtually identical penalties in biological and adoptive families.

The participation penalty, on the other hand, is larger in biological families during the initial years of parenthood. This implies that the short-lived differences in earnings penalties can be explained by differences in extensive margin responses that last for 3-4 years and then dissipate.

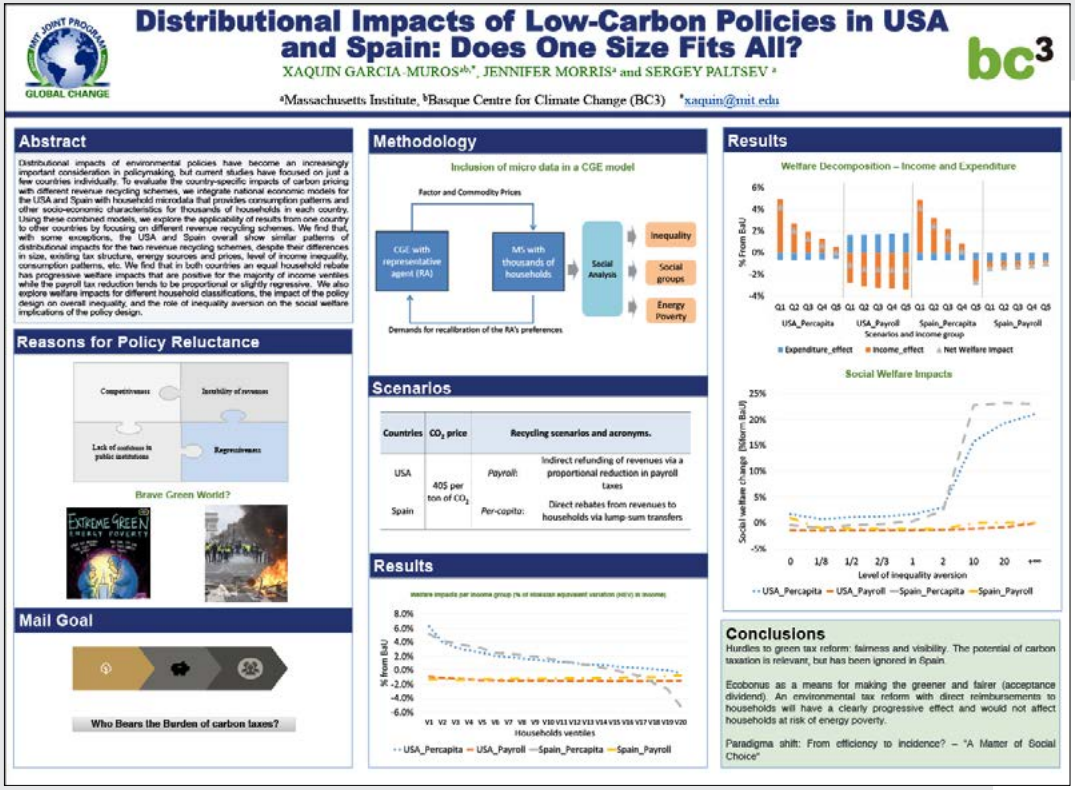
These findings provide evidence against the importance of the biological link between mother and child for explaining the gendered impacts of children.

ECONOMICS

Distributional Impacts of Low-Carbon Policies in USA and Spain: Does One Size Fit All?

Author(s):
Xaquin García-Muros
Organisation:
MIT Joint Program on the Science and Policy of Global Change and Basque Centre for Climate Change (BC3)
Place of residence:
Bilbao, Spain

Distributional impacts of environmental policies have become an increasingly important consideration in policymaking, but current studies have focused on just a few countries individually. To evaluate the country-specific impacts of carbon pricing with different revenue recycling schemes, we integrate national economic models for the USA and Spain with household microdata that provides consumption patterns and other socio-economic characteristics for thousands of households in each country. Using these combined models, we explore the applicability of results from one country to other countries by focusing on different revenue recycling schemes. We find that, with some exceptions, the USA and Spain overall show similar patterns of distributional impacts for the two revenue recycling schemes, despite their differences in size, existing tax structure, energy sources and prices, level of income inequality, consumption patterns, etc. We find that in both countries an equal household rebate has progressive welfare impacts that are positive for the majority of income ventiles while the payroll tax reduction tends to be proportional or slightly regressive. We also explore welfare impacts for different household classifications, the impact of the policy design on overall inequality, and the role of inequality aversion on the social welfare implications of the policy design.



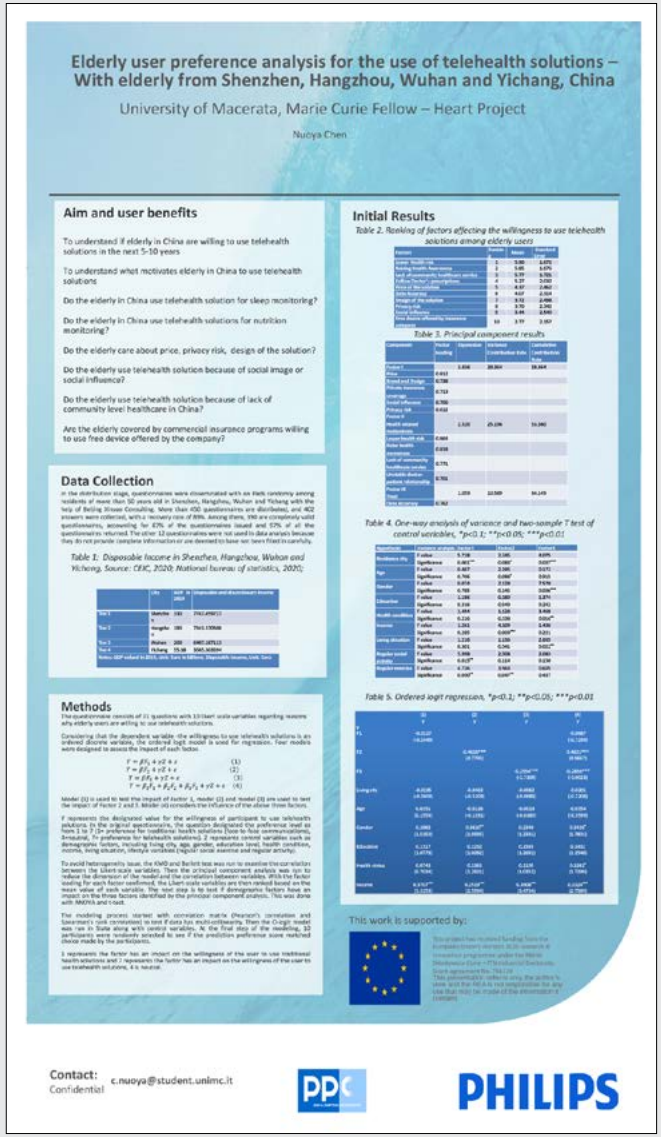
ECONOMICS

Assessing elderly user preference for telehealth solutions in Shenzhen, Hangzhou, Wuhan and Yichang, China

Author(s):
Nuoya Chen
Organisation:
Health related Activity Recognition System based on IoT Project
Place of residence:
Eindhoven, The Netherlands

COVID-19 has rendered the elderly the vulnerable group. Telehealth solution usage has been accelerated during COVID. Yet the trust of elderly users with telehealth solutions is thin with many face difficulties in reality to access and use such tools.

To assess elderly user preference for telehealth solutions, a questionnaire has been distributed in Shenzhen, Hangzhou, Wuhan and Yichang among elderly more than 50 years old in 2019. 390 valid responses were collected. A multi-nominal regression model was able to predict 80% of participants' preferences. Health-related motivations have a statistically positive relationship with user preference while trust over data accuracy of telehealth solutions have a statistically negative relationship with user preference. The top four factors inducing telehealth solution preferences are, lowering health risk, raising health awareness, accessing healthcare (lack of community health services), following doctors' prescription.

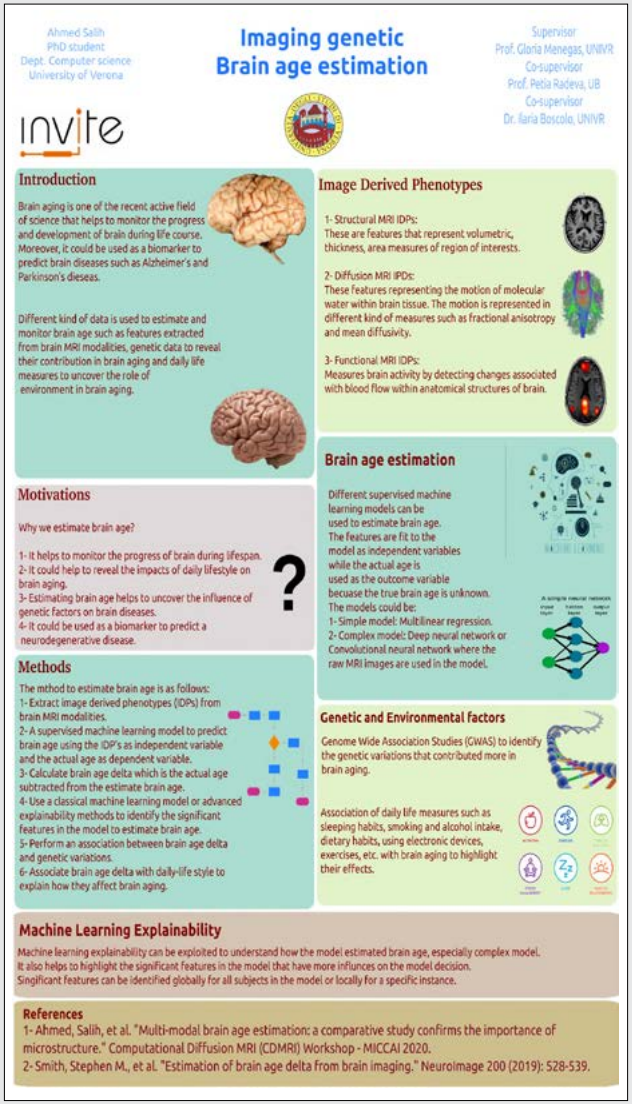


ENGINEERING

Imaging genetic: Brain age estimation

Author(s):
Ahmed Salih
Organisation:
University of Verona
Place of residence:
Barcelona, Spain

Brain age inferred from neuroimaging data could reveal important information about the evolution of structural and functional cerebral features across the life span. This has important implications for understanding healthy aging and for identifying Imaging-Derived Phenotypes (IDPs) that characterise age-related neurodegenerative illnesses, such as Alzheimer's and Parkinson's disease. The so-called brain age delta refers to the difference between image-derived brain age and chronological age. Accelerated aging (positive delta) or resilience to aging (negative delta) have been found to be useful correlates of factors such as disease and cognitive decline. Genetic and Environmental factors play critical roles in brain aging. The aim of such studies is to uncover the impacts of genetic and daily lifestyle on the process of brain development during life span in both healthy and patients populations.

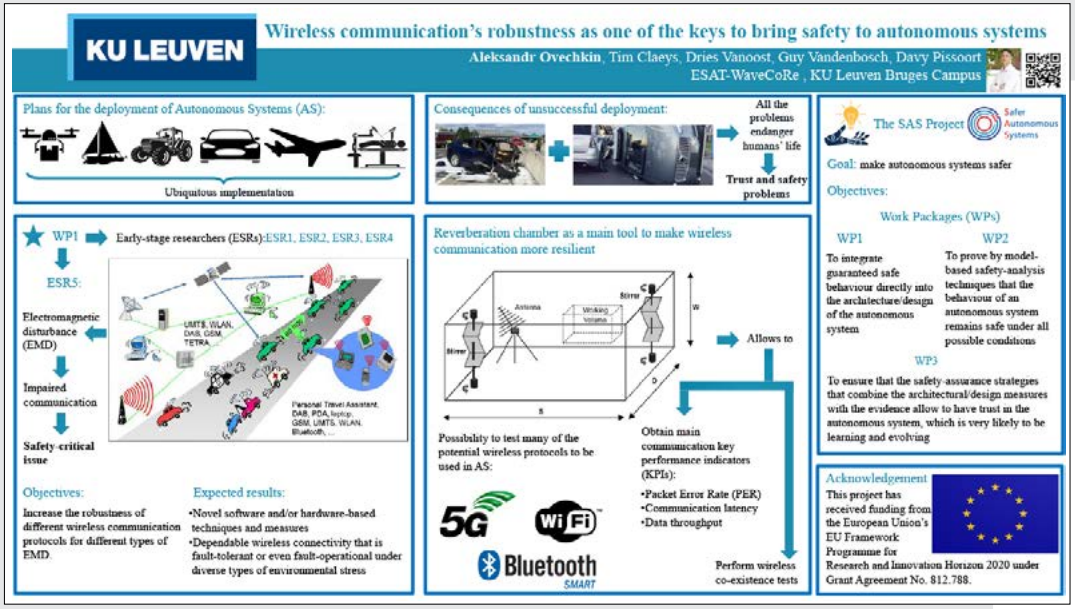


ENGINEERING

Wireless communication's robustness as one of the keys to bring safety to autonomous systems

Author(s):
Aleksandr Ovechkin
Organisation:
KU Leuven
Place of residence:
Bruges, Belgium

With the current rise of interest in autonomous systems, we have to solve a lot of problems, one of which is communication quality. Communication impairment can lead to casualties. One way of detecting wireless communication weak points is by using the reverberation chamber. Such a test facility can relatively easily identify the main key performance indicators of wireless communication protocols.



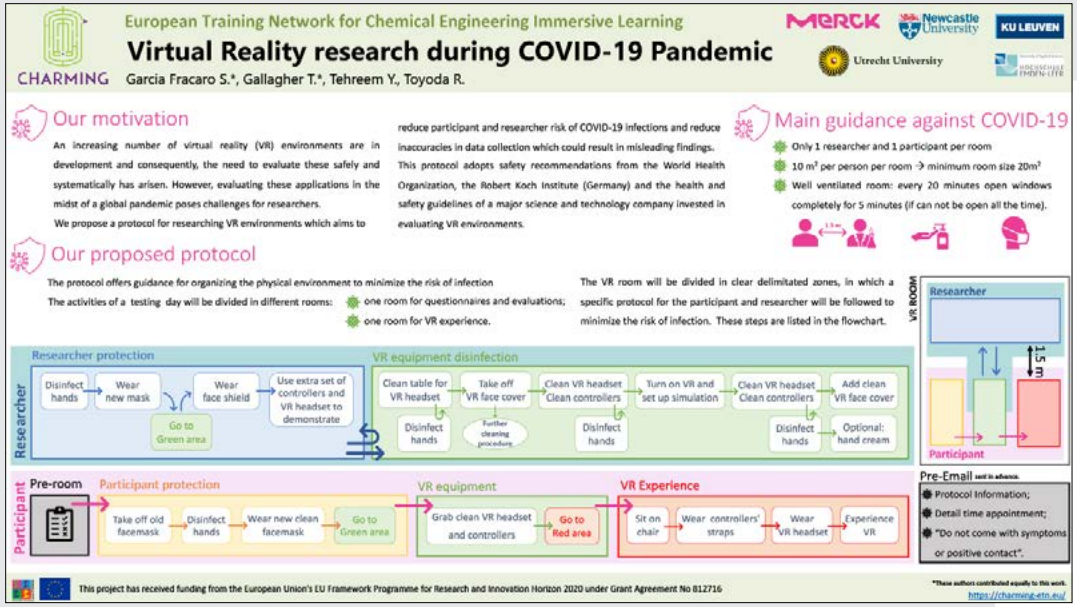
ENGINEERING

Virtual Reality research during COVID-19 Pandemic

Author(s):
Sofia Garcia Fracaro
Organisation:
Merck KGaA
Place of residence:
Mannheim, Germany

An increasing number of virtual reality (VR) environments are in development and consequently, the need to evaluate these safely and systematically has arisen. However, evaluating these applications in the midst of a global pandemic poses challenges for researchers. To our knowledge, no systematic methods for evaluating VR environments exist which address both the safety and methodological issues related to this type of research. To address this gap, we propose a protocol for researching VR environments that aims to reduce participant and researcher risk of COVID-19 infections, and reduce inaccuracies in data collection which could result in misleading findings. This protocol adopts safety recommendations from the World Health Organisation, the German Government's central scientific institution in the field of biomedicine, the Robert Koch Institute and the health and safety guidelines of a major science and technology company invested in evaluating VR environments.

The protocol offers guidance for organizing the physical environment to minimise the risk of infection. For example, only one participant and one researcher should be present in the same room at the same time and should maintain a distance of at least 1.5 meters, the room should meet the minimum size requirements suggested by local regulations, and the room should be well ventilated. Furthermore, the protocol stipulates the need to divide the research room into pre-defined areas with safety markings on the floor. This precaution aims to reduce the risk of contamination through proximity between researcher and participant. In addition to physical environment guidelines, guidance for personal safety behaviour is also included. For example, FFP2 class face masks must be always worn by both researcher and participant, they must sanitise their hands at crucial stages of the research, and the researcher must ensure that the VR head-mounted display and controllers are clean for the participant prior to use.



ENGINEERING

Electromagnetic Time Reversal to Locate Partial Discharges

Author(s):
Antonella Ragusa
Organisation:
De Montfort University
Place of residence:
Leicester, United Kingdom

Energy is crucial for the developing world and must be provided when needed to avoid a serious impact on society.

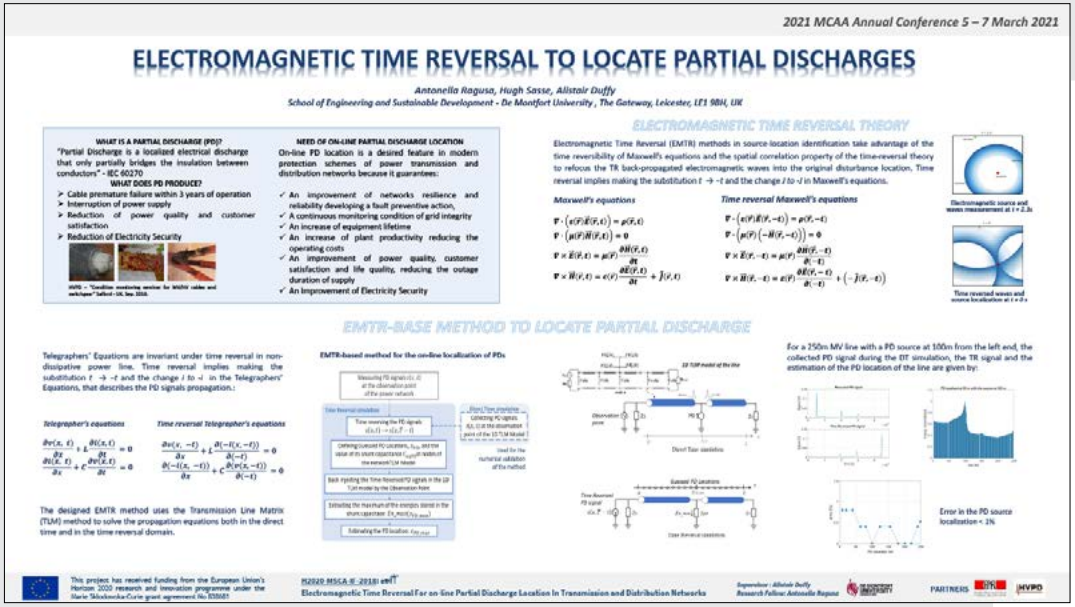
Electricity is becoming the increasingly central energy source, strongly demonstrated in the current pandemic, allowing people to remain in contact and to work from home.

Electricity security is the power system's capability to withstand disturbances/ contingencies with an acceptable service disruption and represents a crucial concern for policy decision making at all levels.

Usually, service disruption is due to cables' insulation damage, often caused by partial discharges (PDs) that are localised electrical discharges that partially bridge the insulation between conductors. Since PD is one of the best early-warning indicators of insulation damage, the on-line PD location is the most suitable method to prevent faults, enhancing network reliability.

Most location methods are traveling wave-based techniques, using the principle that PD produces electromagnetic waves which are measured at different line points. The difference in the times of their arrival allows the PD localisation. However, their implementation is difficult due to the need for synchronisation and their accuracy is influenced by the PD signals distortion and the presence of electromagnetic interference on networks.

This project proposes a new method to locate PDs using the electromagnetic time reversal (EMTR) theory. It is based on the time reversibility of the wave propagation equations and on the spatial correlation property of the EMTR theory that allows refocussing the time-reversed back-propagated PD signals into their original location. The method has been designed in simulation using the Transmission Line Matrix method and experimentally validated on real MV networks. It is able to locate PDs using only one observation point in the harsh electromagnetic environment of real networks with an accuracy of >99%.



ENGINEERING

Predicting emotional state using behavioural markers derived from passively sensed data

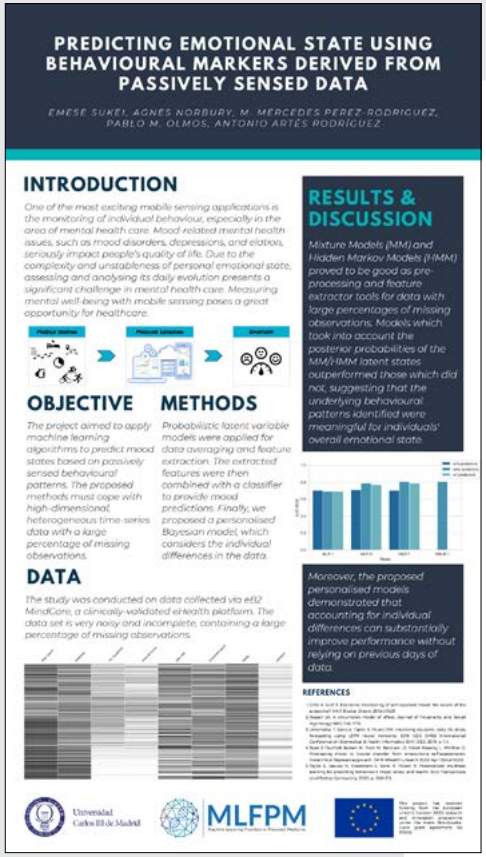
Author(s):
Emese Sukei
Organisation:
Universidad Carlos III de Madrid
Place of residence:
Madrid, Spain

Nowadays, it is common to carry a multitude of sensors in our pockets in the form of smartphones and different tools such as Fitbit, Garmin, etc. These sensors collect information about usage as well as the owner's daily activity. The availability of this type of data opens up a plethora of possibilities, one of which is the analysis of individual behaviour.

In this project, we worked on a generic machine learning-based approach for emotional state prediction using passively collected data from mobile phones and wearable devices, and self-reported emotions by patients. Emotional state prediction and forecasting could be used as early warning signs in clinical treatment. Detecting major affective episodes risk could help catch the early onset of major depressive or manic phases that can be addressed and handled in time, which could reduce the severity of symptoms and the degree of treatment.

We applied probabilistic latent variable models (Mixture Model (MM) and Hidden Markov Model (HMM)) for data averaging and feature extraction on the regularly sampled, but frequently missing and heterogeneous time series data. The extracted features were then combined with a classifier to provide emotional state predictions. Furthermore, we proposed a personalised Bayesian model to improve the performance, which considers the individual differences in the data by applying a different classifier bias term for each patient.

Probabilistic generative models proved to be good as pre-processing and feature extractor tools for data with large percentages of missing observations. Models which took into account the posterior probabilities of the MM/HMM latent states outperformed those which did not, suggesting that the underlying behavioural patterns identified were meaningful for individuals' overall emotional state. Moreover, the proposed personalised models demonstrated that accounting for individual differences through a simple hierarchical model substantially improves emotional state prediction performance without relying on previous days of data.



ENGINEERING

Professional development under MC-IAPP fellowship

Author(s):
Gordon Gilja
Organisation:
University of Zagreb Faculty of Civil Engineering
Place of residence:
Zagreb, Croatia

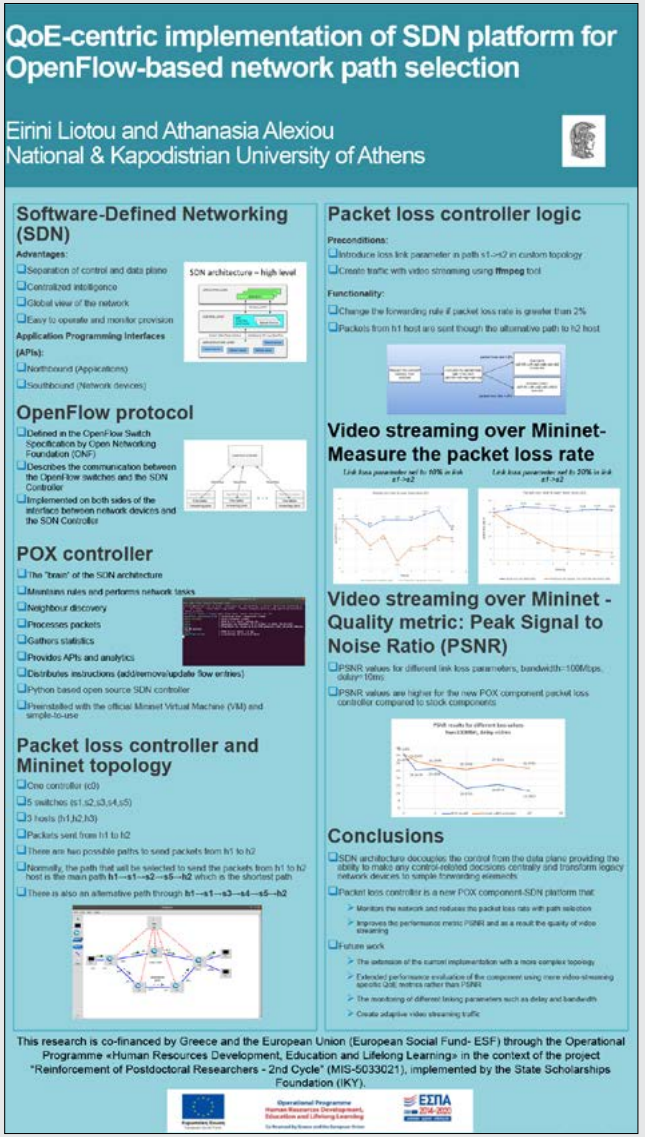
BRIDGE SMS is one of the projects funded under the Marie Curie Industry-Academia Partnerships and Pathways Scheme in the period from 2015-2018. Through participation in the BRIDGE SMS project, researchers and professional staff employed by the partner organisations had the opportunity to participate in Marie Curie mobility actions. This paper shows how knowledge sharing and inter-sector mobility activities within BRIDGE SMS project contributed to the professional development of MC fellow and resulted in successful project application to the Croatian Science Foundation under which R3PEAT (Remote Real-time Riprap Protection Erosion AssessmenT on large rivers) project is funded. Under BRIDGE SMS an open-source cloud-based intelligent decision support system for the assessment and management of the hydraulic vulnerability of bridges over water was developed. The inception of the R3PEAT project idea was based on training conducted as experienced researcher during the secondment period in a total duration of 8.5 months. Marie Curie fellowship contributed to an innovative idea of real-time monitoring system of scour development on large rivers during the flood – ScourBuoy. Under the project, three young researchers will develop their careers, each of them developing skills and conducting research ultimately leading to the PhD degree.

ENGINEERING

QoE-centric implementation of SDN platform for OpenFlow-based network path selection

Author(s):
Eirini Liotou
Organisation:
National and Kapodistrian University of Athens
Place of residence:
Athens, Greece

Software Defined Networking (SDN) provides the ability to make any control-related decisions centrally, which transforms legacy network devices to simple forwarding elements. In this new architecture, the decisions are made from an application that acts as a strategic control point in the network and manages the flow control for improved network management and application performance. This poster aims at presenting the development of a novel SDN platform that monitors the network and makes changes in the paths to achieve better performance in the network in the case of video streaming. More specifically, the developed SDN packet loss controller periodically monitors a networking parameter on the video packets transmission path and collects statistics, based on which, it performs network path selection. As a result, the Quality of Experience (QoE) for the end-users is increased, as compared to a standard SDN controller.

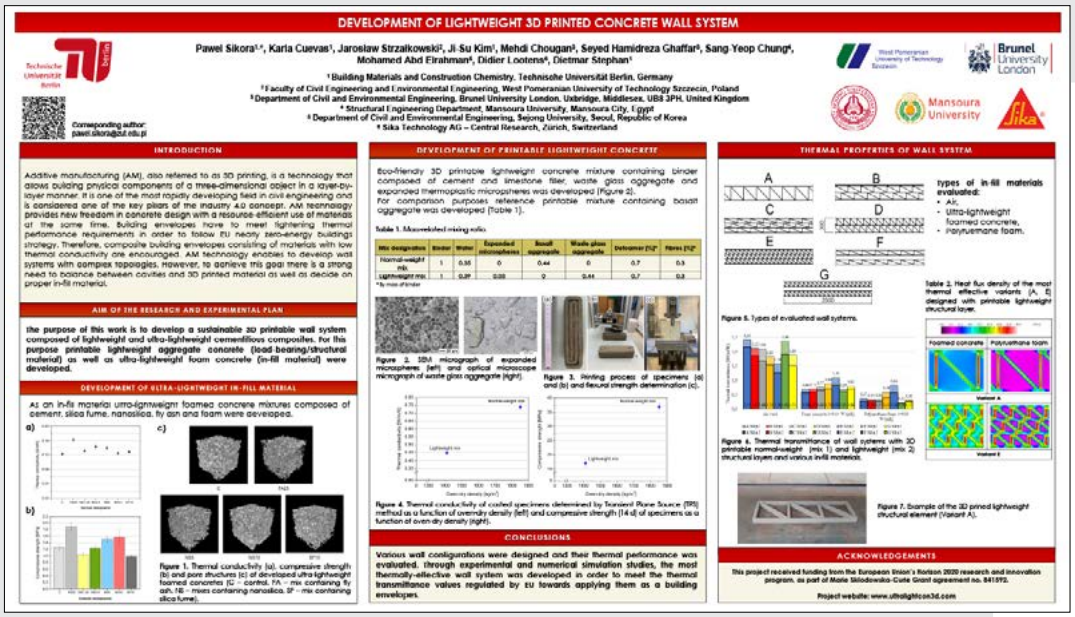


ENGINEERING

Development of lightweight 3D printed concrete wall system

Author(s):
Pawel Sikora
Organisation:
Technische Universität Berlin
Place of residence:
Germany

Additive manufacturing (AM), also referred to as 3D printing, is a technology that allows building physical components of a three-dimensional object in a layer-by-layer manner. It is one of the most rapidly developing fields in civil engineering and is considered one of the key pillars of the Industry 4.0. AM technology provides both innovative designs in concrete manufacturing and efficient use of materials. Building envelopes have to meet tightening thermal performance requirements to follow EU zero-energy buildings strategy. Therefore, composite building envelopes consisting of materials with low thermal conductivity are the focus of work. Additionally, AM technology enables the realisation of wall systems with complex architecture. However, to achieve this goal there is a strong need to balance between cavities and 3D printed material as well as an appropriate in-fill material. The purpose of this work is to develop a sustainable 3D printable wall system composed of lightweight and ultra-lightweight cementitious composites. For this purpose, printable lightweight aggregate concrete (load-bearing material) as well as ultra-lightweight foam concrete (in-fill material) were developed. Through incorporation of waste material (glass cullets) as well as lightweight filler materials with reasonable mechanical and thermal performances were developed. Comprehensive material characterisations (i.e., fresh and hardened properties) of developed concrete mixtures were carried out to determine their suitability for 3D printing application. Subsequently, various wall configurations were designed and their thermal performance was evaluated. Through experimental and numerical simulation studies, the most thermally-effective wall system was developed to meet the thermal transmittance values regulated by EU towards applying them as building envelopes.



ENGINEERING

Exploring in silico the influence of local mechanical stimuli on vertebrate joint shape

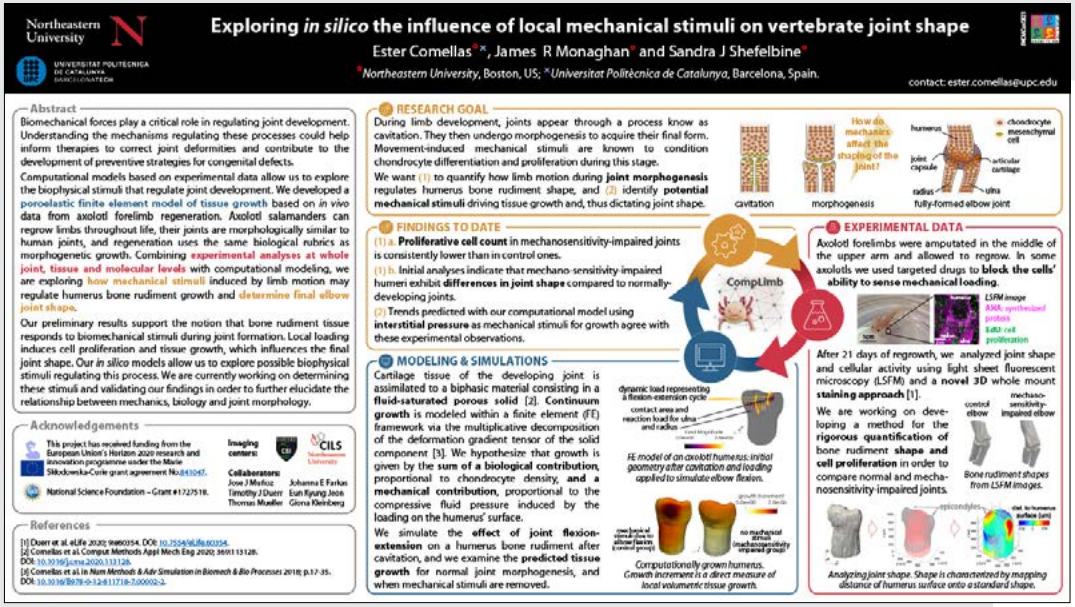
Author(s):
Ester Comellas
Organisation:
Universitat Politècnica de Catalunya / Northeastern University
Place of residence:
Barcelona, Spain

Biomechanical forces play a critical role in regulating chondrocytes during vertebrate skeletal development. Yet, how physical stimuli drive the shaping of the joints in vivo is still unclear. A better understanding of the mechanisms regulating these processes could help inform therapies to correct joint deformities in humans, as well as contribute to the development of preventive strategies for congenital defects.

Axolotl salamanders can regrow limbs throughout life, their joints are morphologically similar to human joints, and regeneration uses the same biological rubrics as morphogenetic growth. Computational models built on an experimental basis allow to test experimental hypotheses and explore “what-ifs” scenarios of normal and pathological joint development.

We developed a poroelastic finite element model of tissue growth based on in vivo data from axolotl forelimb regeneration. Combining experimental analyses at whole joint, tissue and molecular levels with computational modelling, we are exploring how mechanical stimuli induced by limb motion may regulate humerus bone rudiment growth and determine final elbow joint shape.

Our preliminary results support the notion that bone rudiment tissue responds to biomechanical stimuli during joint formation. Local loading induces increased cell proliferation and tissue growth, which results in a more pronounced final joint shape. However, our in silico experiments seem to indicate that morphogenetic factors have a fundamental role in establishing the basic geometry of joints. We are currently working on confirming these findings and further elucidating the relationship between mechanics, biology and joint morphology.



ENGINEERING

Safety monitoring of ML-based perception tasks of autonomous systems

Author(s):
Raul Ferreira
Organisation:
LAAS/CNRS
Place of residence:
Colomiers, France

Machine learning (ML) provides no guarantee of safe operation in safety-critical systems such as autonomous vehicles.

ML decisions are based on data that tends to represent a partial and imprecise knowledge of the environment.

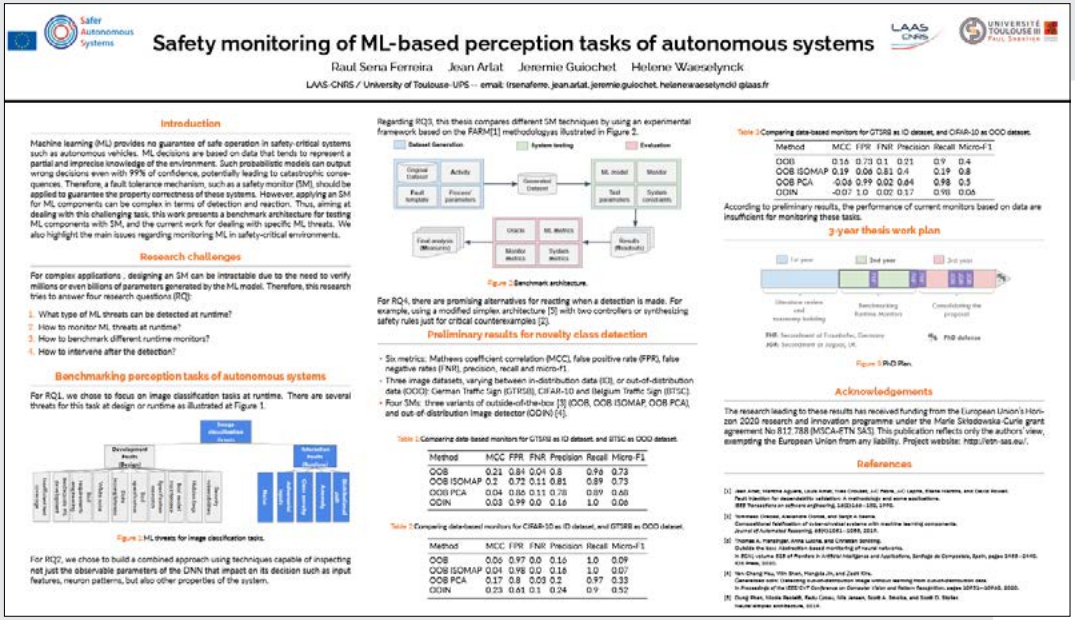
Such probabilistic models can output wrong decisions even with 99% of confidence, potentially leading to catastrophic consequences.

Therefore, a fault tolerance mechanism, such as a safety monitor (SM), should be applied to guarantee the property correctness of these systems.

However, applying an SM for ML components can be complex in terms of detection and reaction.

Thus, aiming at dealing with this challenging task, this work presents a benchmark architecture for testing ML components with SM, and the current work for dealing with specific ML threats.

We also highlight the main issues regarding monitoring ML in safety-critical environments.



ENGINEERING

New architectural devices to increase our connection to Nature from interior dwelling space: from our architectural heritage

Author(s):
Carmen García Sánchez
Organisation:
The Royal Danish Academy, School of Architectur, Design and Conservation
Place of residence:
Copenhagen, Denmark

Due to the increase in global population, there is a growing potential for losing regular “contact with Nature”; diminishing access to the documented wide range of associated human health and wellbeing benefits of daily interaction with the natural world. This leads us to a sensorily deprived built environment and to an increasing placelessness. Alienation from nature is not an inevitable consequence of modern life but rather a failure in how we have deliberately chosen to design and develop our world. In order to maximise dwellers’ connectivity to the natural environment in new and existing communities, new architectural design knowledge and useful creative strategies at all levels and scales of design, are urgently needed. Despite the increasing interest in this global concern, there exists limited knowledge and research into “how to integrate Nature with our interior dwelling space” and “how these solutions can enable their integration”.

To bridge these gaps, I develop an innovative research project that unfolds and analyses the underlying forms of knowledge behind exemplary post-war Danish and traditional Japanese buildings that offer exemplary sensory experiences of the natural world - not only by visual contact but by other complex mechanisms - to inform us of a sustainable contemporary interior design practice, through Landscape, Architectural Interior and Biophilic Design approaches. The main aim is to effectively enhance the health and wellbeing of communities through daily interaction with Nature in the urban areas of the future, an urgent challenge at EU and Global level.

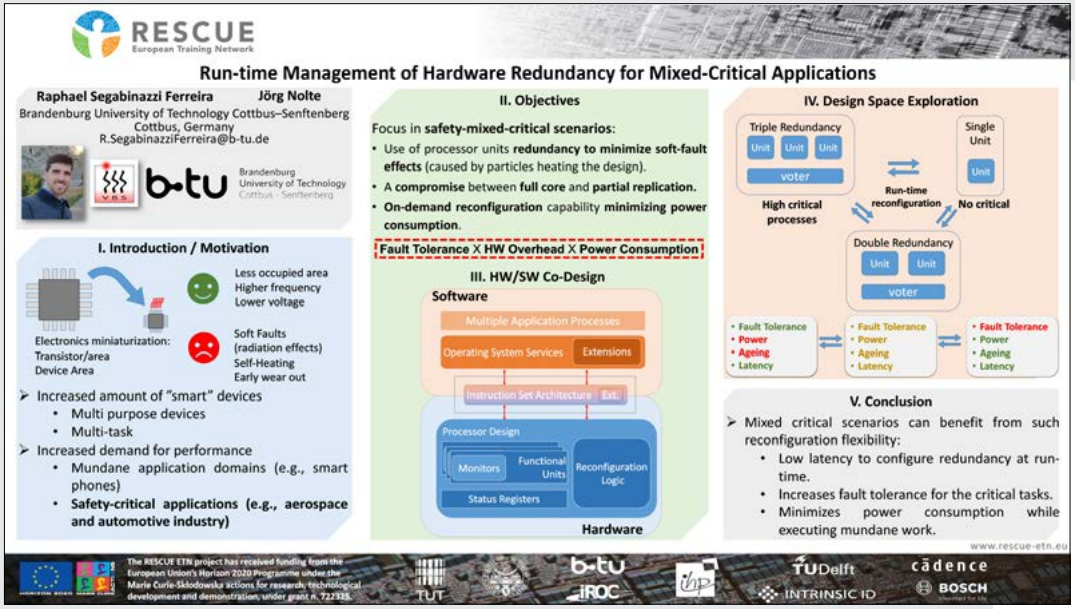
The study opens a new research branch of Architectural Design and a new phase in the Biophilic design’s implementation for built environments. Moreover, it will make an important contribution to the EU-knowledge base on nature-based solutions.

ENGINEERING

Run-time Management of Hardware Redundancy for Mixed-Critical Applications

Author(s):
Raphael Segabinazzi Ferreira
Organisation:
Brandenburg University of Technology Cottbus–Senftenberg
Place of residence:
Cottbus, Germany

Since electronics started to scale down, a growing concern about the reliability of these devices has emerged. At the same time, the increased demand for high performance in critical applications motivated a shift from the old reliable technologies to the new cutting-edge devices. In this work, we present a design that uses configurable redundancy in functional units to increase fault tolerance against soft faults. These units are managed by an operating system that can enable and disable redundancy on-demand, as the criticality of the application processes increases or decreases. As a result, we were able to perform such a redundancy configuration at run-time with only a small increase in execution time. Furthermore, besides the extra area for triplicating the functional units, little extra hardware was necessary for the control logic to enable such redundancy management.



ENGINEERING

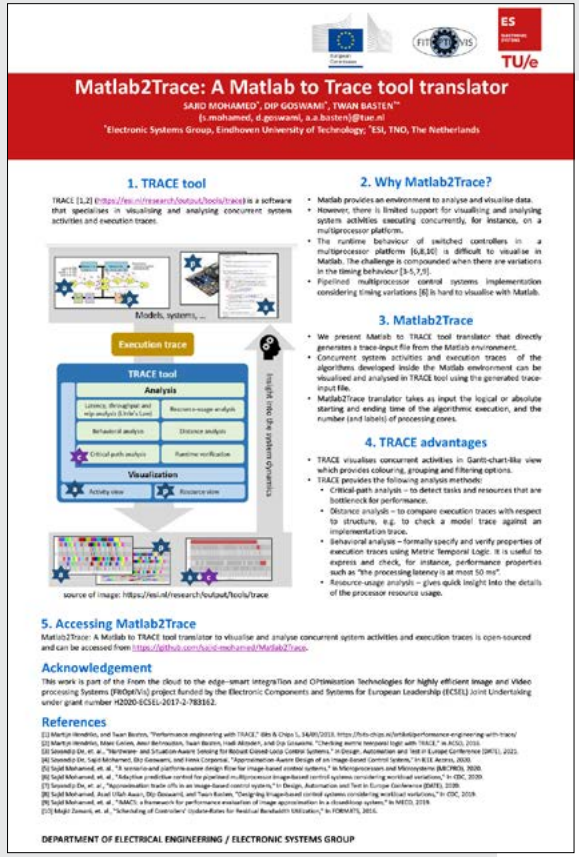
Matlab2Trace: A Matlab to Trace translator to visualise and analyse concurrent system activities and execution traces

Author(s):
Sajid Mohamed
Organisation:
Eindhoven University of Technology
Place of residence:
The Netherlands

Matlab provides an environment to analyse and visualise data and develop algorithms. However, there is limited support for visualising and analysing system activities executing concurrently, for instance, on a multiprocessor platform. Trace (www.esi.nl/solutions/trace/index.dot) is software that specialises in visualising and analysing concurrent system activities and execution traces. We present a Matlab to Trace translator that directly generates a trace-input file from the Matlab environment. Concurrent system activities and execution traces of the algorithms developed inside the Matlab environment can be visualised and analysed in Trace using the generated trace-input file. The translator takes as input the logical or absolute starting and ending time of the algorithmic execution, and the number (and labels) of processing cores.

TRACE visualises concurrent activities in a Gantt-chart-like view which provides colouring, grouping and filtering options. TRACE also provides many analysis methods, which sets it apart from the many other Gantt-chart visualisation tools: i) Critical-path analysis can be used to detect tasks and resources that are bottlenecks for performance; ii) Distance analysis can be used to compare execution traces with respect to structure, e.g., to check a model trace against an implementation trace; iii) MTL checking provides a means to formally specify and verify properties of execution traces using Metric Temporal Logic. It is useful to express and check, for instance, performance properties such as 'the processing latency is at most 50 ms'; iv) The streaming performance DSL is a domain-specific language that captures often-used performance properties for stream-processing systems (e.g., image or video processing), and which eases the use of the MTL checker; and v) The resource usage feature can quickly give insight in the details of the resource usage.

The Matlab2Trace can be downloaded from https://github.com/sajid-mohamed/Matlab2Trace.



ENGINEERING

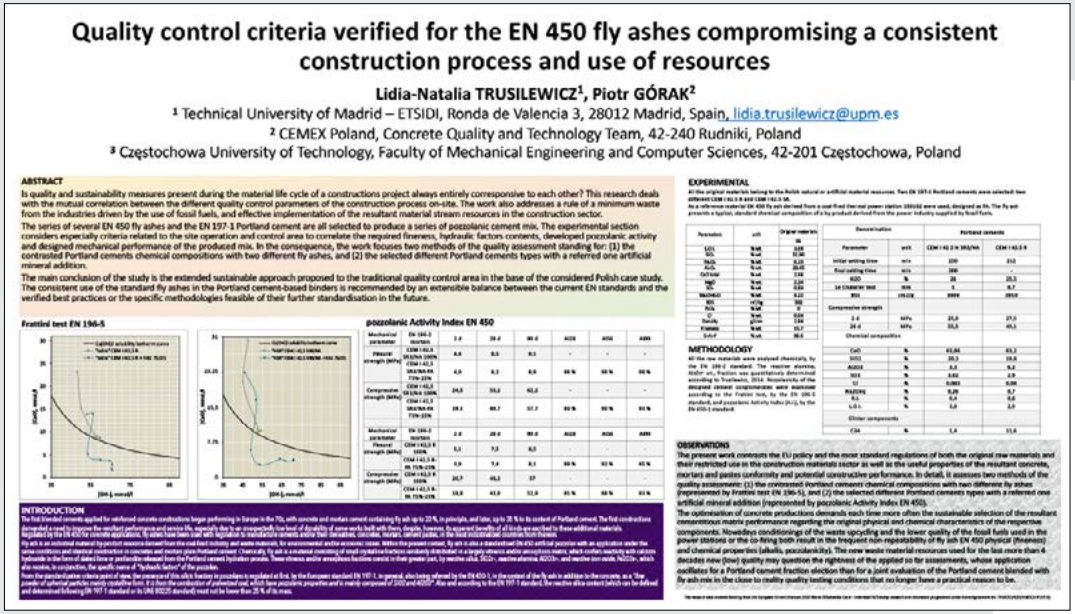
Quality control criteria verified for the EN 450 fly ashes compromising a consistent construction process and use of resources

Author(s):
Lidia Natalia Trusilewicz
Organisation:
AGH University of Science and Technology
Place of residence:
Poland

Are quality and sustainability measures present during the material life cycle of a construction project always entirely corresponsive to each other? This research deals with the mutual correlation between the different quality control parameters of the construction process on-site. The work also addresses a rule of minimum waste from the industries driven by the use of fossil fuels, and effective implementation of the resultant material stream resources in the construction sector.

The series of several EN 450 fly ashes and the EN 197-1 Portland cement are all selected to produce a series of pozzolanic cement mix. The experimental section considers especially criteria related to the site operation and control area to correlate the required fineness, hydraulic factors contents, developed pozzolanic activity and designed mechanical performance of the produced mix. In the consequence, the work focuses on two methods of the quality assessment standing for: (1) the contrasted Portland cements chemical compositions with two different fly ashes, and (2) the selected different Portland cements types with a referred one artificial mineral addition.

The main conclusion of the study is the extended sustainable approach proposed to the traditional quality control area in the base of the considered Polish case study. The consistent use of the standard fly ashes in the Portland cement-based binders is recommended by an extensible balance between the current EN standards and the verified best practices or the specific methodologies feasible of their further standardisation in the future.


Quality control criteria verified for the EN 450 fly ashes compromising a consistent construction process and use of resources

Lidia-Natalia TRUSILEWICZ[1], Piotr GÓRAK[2]

[1] Technical University of Madrid – ETSIDI, Ronda de Valencia 3, 28012 Madrid, Spain, lidia.trusilewicz@upm.es

[2] CEMEX Poland, Concrete Quality and Technology Team, 42-240 Rudniki, Poland

[3] Częstochowa University of Technology, Faculty of Mechanical Engineering and Computer Sciences, 42-201 Częstochowa, Poland

ABSTRACT

Is quality and sustainability measures present during the material life cycle of a constructions project always entirely corresponsive to each other? This research deals with the mutual correlation between the different quality control parameters of the construction process on-site. The work also addresses a rule of a minimum waste from the industries driven by the use of fossil fuels, and effective implementation of the resultant material stream resources in the construction sector.

The series of several EN 450 fly ashes and the EN 197-1 Portland cement are all selected to produce a series of pozzolanic cement mix. The experimental section considers especially criteria related to the site operation and control area to correlate the required fineness, hydraulic factors contents, developed pozzolanic activity and designed mechanical performance of the produced mix. In the consequence, the work focuses two methods of the quality assessment standing for: (1) the contrasted Portland cements chemical compositions with two different fly ashes, and (2) the selected different Portland cements types with a referred one artificial mineral addition.

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Frattini test EN 196-5

pozzolanic Activity Index EN 450

EXPERIMENTAL

METHODOLOGY

OBSERVATIONS

INTRODUCTION

ENGINEERING

Development and validation of an in-silico tool for the study of therapeutic agents in 3D cell cultures

Author(s):
Marilisa Cortesi
Organisation:
University of Bologna
Place of residence:
Cesena, Italy

3D cell cultures are a more accurate representation of in vivo biology but their use is hampered by the increased complexity and the difficulty in predicting the effect of changing the experimental conditions on measurable outcomes.

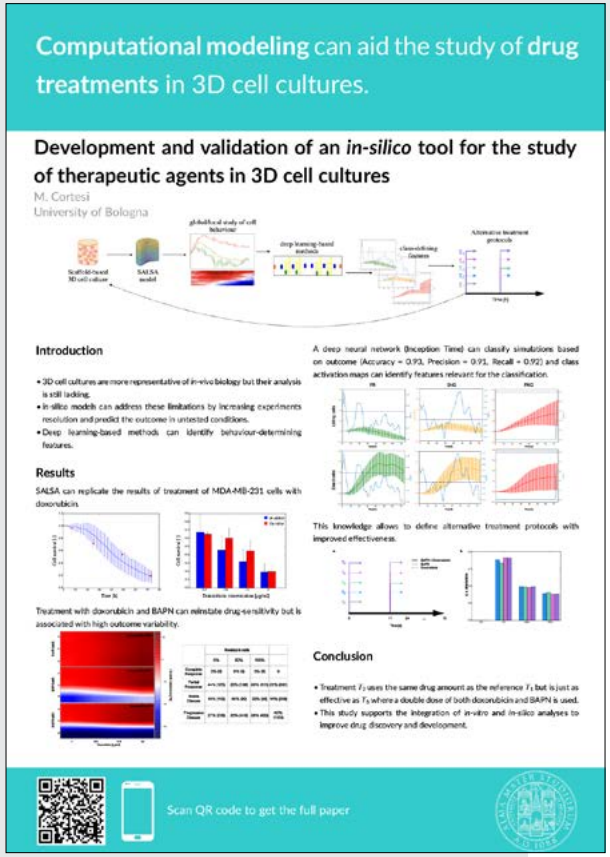
Computational simulations constitute an effective strategy for addressing these limitations being able to test hypotheses regarding the molecular mechanisms behind specific macroscopic behaviours and predict measurable outcomes in untested conditions.

Within this context, we have developed SALSA (ScAffoLd SimulAtor), a hybrid continuous/discrete cellular automaton that effectively couples the study of the dynamic evolution of the status and position of the cells, with the representation over time of local changes in resources, drug availability and scaffold's mechanical properties.

This model was programmed to replicate the behaviour of a population of breast cancer cells (MDA-MB-231) cultured in collagen scaffolds and was then shown to be able to recapitulate the response of these cells to pharmacological treatment in both drug-sensitive and -resistant populations.

Additionally, these SALSA simulations were used to train a deep neural network to classify therapeutic outcomes. The calculation of class activation maps allowed for the identification of class-defining features and the definition of alternative treatment protocols. The simulation of these machine-learning optimised protocols led to a shift in the outcome distribution toward a more extensive response to treatment with minimal or no increase in the overall amount of drug.

The integration of in-vitro and in-silico experimentation is becoming a key strategy for the effective characterisation of potential therapeutic agents or novel drug combinations. Within this context, the method here proposed holds great potential for the creation of a feedback loop between experimental and simulated results.



ENVIRONMENTAL SCIENCES

Addressing Environmental Change through Emergent Integrated Environmental Observatories: A Case Study in the Czech Republic

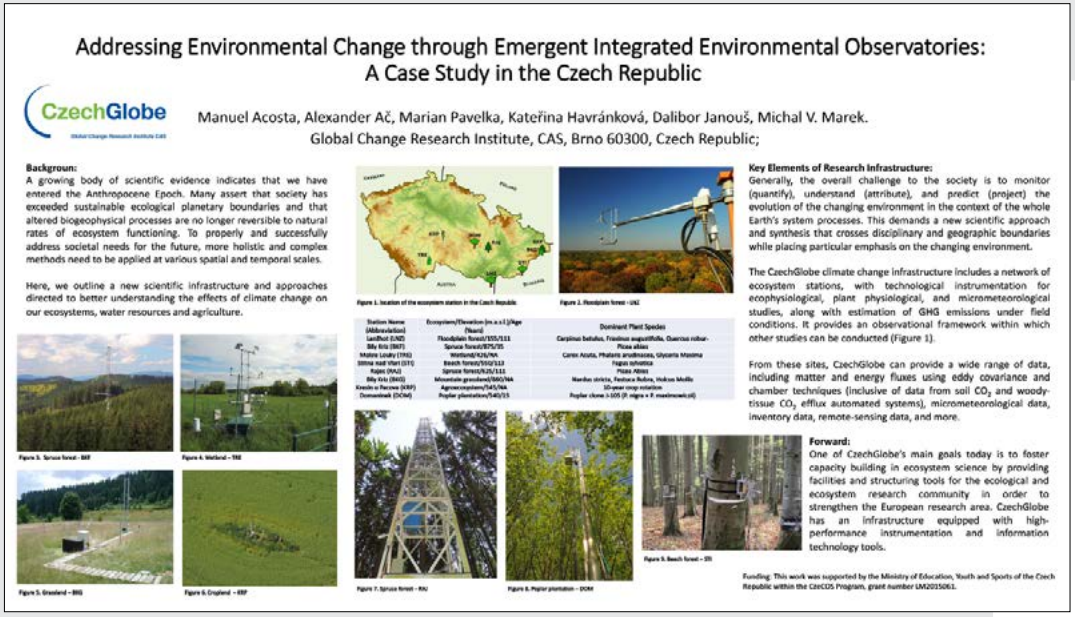
Author(s):
Manuel Acosta
Organisation:
Global Change Research Institute, CAS
Place of residence:
Czech Republic

A growing body of scientific evidence indicates that we have entered the Anthropocene Epoch. Many assert that society has exceeded sustainable ecological planetary boundaries and that altered biogeophysical processes are no longer reversible to natural rates of ecosystem functioning.

To properly and successfully address societal needs for the future, more holistic and complex methods need to be applied at various spatial and temporal scales. The increasingly interconnected nature of human and natural environments – from individuals to large megacities and entire continents and from cells through ecosystems to the biosphere as a whole (e.g., as seen in the carbon cycle)– demands new and often interdisciplinary and international approaches to address emerging global challenges.

With that perspective in mind, the Czech Republic's National Climate Program was established in 1991 with the aim to understand the impact of global environmental change on society. The National

Climate Program was updated in 2017 to formulate a new Climate Protection Policy. Here, we outline the multifaceted problems that climate change poses for the Czech Republic, as well as a new scientific infrastructure and approaches directed to better understanding the effects of climate change on our ecosystems, water resources, urban environment, agriculture, human health, and the general economy.

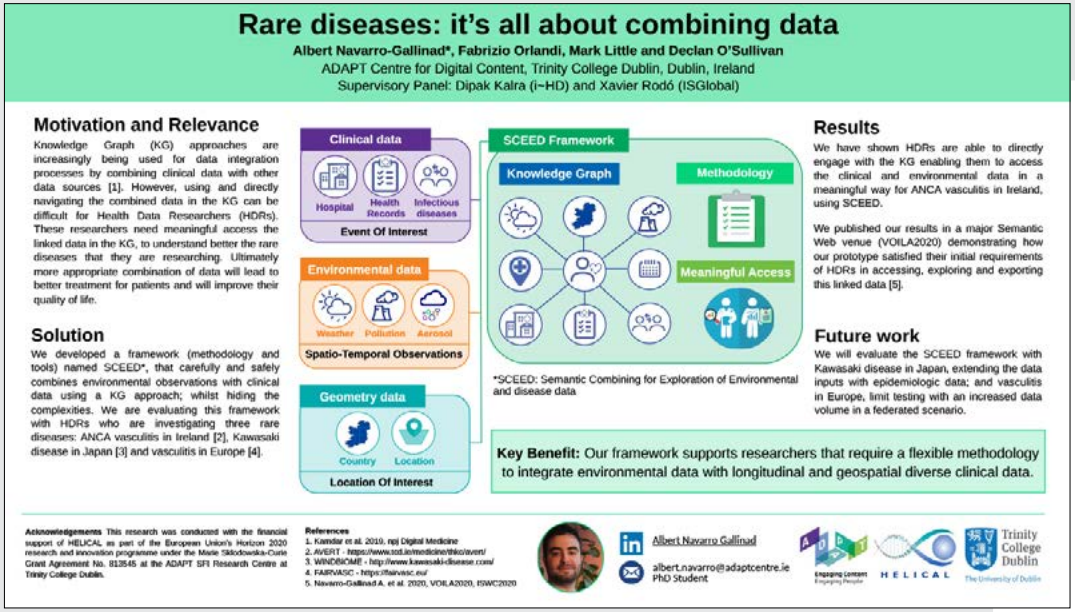


ENVIRONMENTAL SCIENCES

Rare diseases: it's all about combining data

Author(s):
Albert Navarro Gallinad
Organisation:
ADAPT Centre Dublin
Place of residence:
Ireland

Knowledge Graph (KG) approaches are increasingly being used for data integration processes by combining clinical data with other data sources. However, using and directly navigating the combined data in the KG can be difficult for Health Data Researchers (HDRs). These researchers need meaningful access to the linked data in the KG, to understand better the rare diseases that they are researching. Ultimately a more appropriate combination of data will lead to better treatment for patients and will improve their quality of life. We developed a framework (methodology and tools) named SCEED (Semantic Combining for Exploration of Environmental and disease data), that carefully and safely combines environmental observations with clinical data using a KG approach; whilst hiding the complexities. We are evaluating this framework with HDRs who are investigating three rare diseases: ANCA vasculitis in Ireland, Kawasaki disease in Japan and vasculitis in Europe. We have shown HDRs are able to directly engage with the KG enabling them to access the clinical and environmental data in a meaningful way for ANCA vasculitis in Ireland, using SCEED. We published our results in a major Semantic Web venue (VOILA2020) demonstrating how our prototype satisfied their initial requirements of HDRs in accessing, exploring and exporting this linked data. Thus, our framework supports researchers that require a flexible methodology to integrate environmental data with longitudinal and geospatial diverse clinical data. Furthermore, we will evaluate the SCEED framework with Kawasaki disease in Japan, extending the data inputs with epidemiologic data; and vasculitis in Europe, limit testing with an increased data volume in a federated scenario.

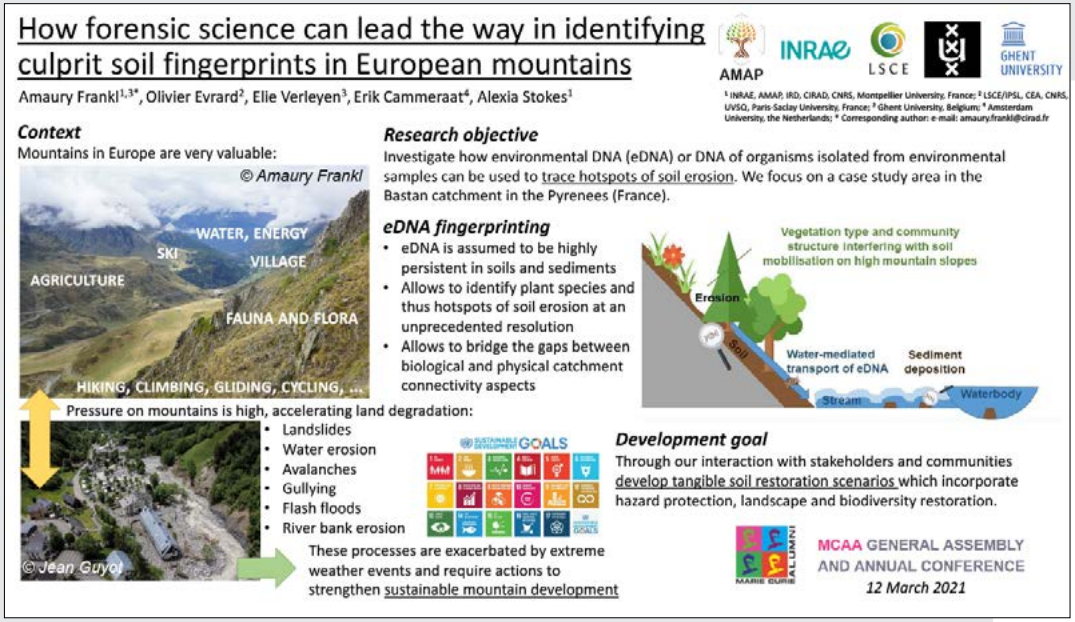


ENVIRONMENTAL SCIENCES

How forensic science can lead the way in identifying culprit soil fingerprints in European mountains

Author(s):
Amaury Frankl
Organisation:
INRAE
Place of residence:
Montpellier

Mountains in Europe are highly valued as they provide diverse living and recreational opportunities and unique landscapes, are key economic assets, and because they are treasures of unique flora and fauna. Their vulnerable environment is, however, threatened by the frequent occurrence of shallow landslides and water erosion which produce large amounts of sediment during floods. The urgency to mitigate natural hazards calls for an improved understanding of how physical and biological dimensions of soil restoration interact. We address this issue by investigating how environmental DNA (eDNA) or DNA of organisms isolated from environmental samples can be used to trace hotspots of soil erosion in the Bastan catchment in the Pyrenees (France). Based on the persistence eDNA from vascular plant litter in soils and sediments, and the possibilities offered by DNA metabarcoding to characterise whole plant communities to the species level, we argue that eDNA can be used as a high-resolution fingerprinting method for identifying and tracing sediment sources. As such, bridging the gaps between physical and biological connectivity features at the catchment scale will allow us to develop tangible soil restoration scenarios which incorporate hazard protection, landscape and biodiversity restoration.



ENVIRONMENTAL SCIENCES

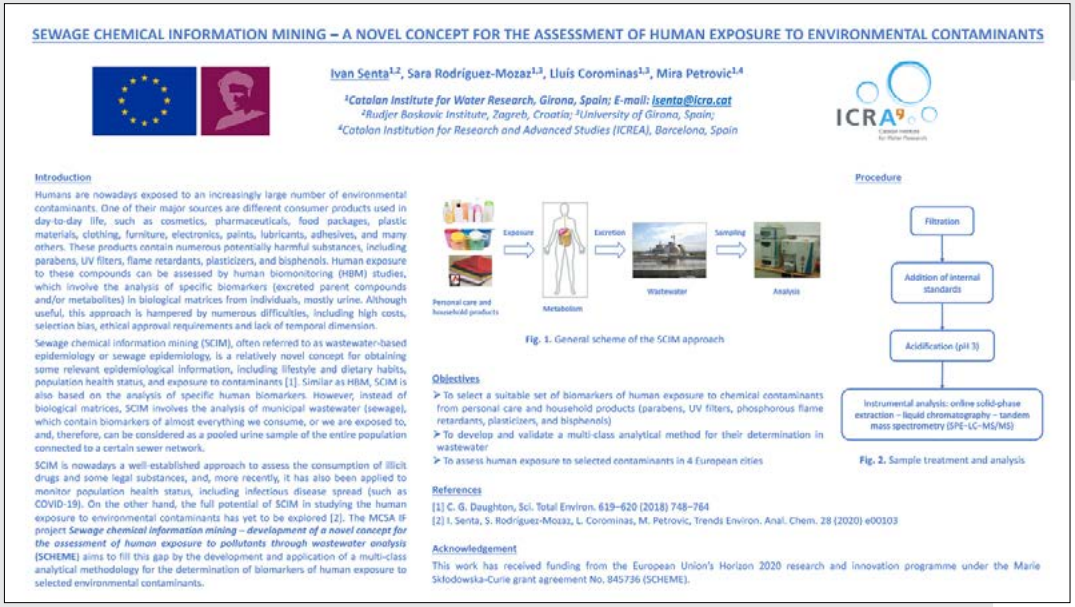
Sewage chemical information mining – a novel concept for the assessment of human exposure to environmental contaminants

Author(s):
Ivan Senta
Organisation:
Catalan Institute for Water Research
Place of residence:
Girona, Spain

Humans are nowadays exposed to an increasingly large number of environmental contaminants. One of their major sources is personal care and household products, which contain numerous potentially harmful substances. Human exposure to these compounds can be assessed by human biomonitoring (HBM) studies, which involve the analysis of specific biomarkers (excreted parent compounds and/or metabolites) in biological matrices from individuals, mostly urine. Although useful, this approach is hampered by numerous difficulties.

Sewage chemical information mining (SCIM), often referred to as wastewater-based epidemiology, is a relatively novel concept for obtaining some relevant epidemiological information, including lifestyle and dietary habits, population health status, and exposure to contaminants. Similar to HBM, SCIM is also based on the analysis of specific human biomarkers. However, instead of biological matrices, SCIM involves the analysis of municipal wastewater (sewage), which contain biomarkers of almost everything we consume, or are exposed to, and, therefore, can be considered as a pooled urine sample of the entire population connected to a certain sewer network.

So far, SCIM has been mostly applied in the field of lifestyle biomarkers, to assess the consumption of illicit drugs and some legal substances, while its full potential in studying the human exposure to environmental contaminants has yet to be explored. The MCSA IF project "Sewage chemical information mining – development of a novel concept for the assessment of human exposure to pollutants through wastewater analysis" (SCHEME), aims to fill this gap by the development of a multi-class analytical method for the SCIM-based determination of biomarkers of human exposure to parabens, UV filters, phosphorous flame retardants, plasticisers, and bisphenols. The developed methodology will be used to assess human exposure to these compounds in selected cities. Eventually, SCIM could be applied as an "early warning system", helping to identify communities with the highest exposure to environmental contaminants.



SEWAGE CHEMICAL INFORMATION MINING – A NOVEL CONCEPT FOR THE ASSESSMENT OF HUMAN EXPOSURE TO ENVIRONMENTAL CONTAMINANTS

Ivan Senta[1,2], Sara Rodriguez-Mozaz[1,3], Lluis Corominas[1,3], Mira Petrovic[1,4]

[1]Catalan Institute for Water Research, Girona, Spain; E-mail: isenta@icra.cat
[2]Rudjer Boskovic Institute, Zagreb, Croatia; [3]University of Girona, Spain;
[4]Catalan Institution for Research and Advanced Studies (ICREA), Barcelona, Spain

Introduction

Humans are nowadays exposed to an increasingly large number of environmental contaminants. One of their major sources are different consumer products used in day-to-day life, such as cosmetics, pharmaceuticals, food packages, plastic materials, clothing, furniture, electronics, paints, lubricants, adhesives, and many others. These products contain numerous potentially harmful substances, including parabens, UV filters, flame retardants, plasticizers, and bisphenols. Human exposure to these compounds can be assessed by human biomonitoring (HBM) studies, which involve the analysis of specific biomarkers (excreted parent compounds and/or metabolites) in biological matrices from individuals, mostly urine. Although useful, this approach is hampered by numerous difficulties, including high costs, selection bias, ethical approval requirements and lack of temporal dimension.

Sewage chemical information mining (SCIM), often referred to as wastewater-based epidemiology or sewage epidemiology, is a relatively novel concept for obtaining some relevant epidemiological information, including lifestyle and dietary habits, population health status, and exposure to contaminants [1]. Similar as HBM, SCIM is also based on the analysis of specific human biomarkers. However, instead of biological matrices, SCIM involves the analysis of municipal wastewater (sewage), which contain biomarkers of almost everything we consume, or we are exposed to, and, therefore, can be considered as a pooled urine sample of the entire population connected to a certain sewer network.

SCIM is nowadays a well-established approach to assess the consumption of illicit drugs and some legal substances, and, more recently, it has also been applied to monitor population health status, including infectious disease spread (such as COVID-19). On the other hand, the full potential of SCIM in studying the human exposure to environmental contaminants has yet to be explored [2]. The MCSA IF project ***Sewage chemical information mining – development of a novel concept for the assessment of human exposure to pollutants through wastewater analysis*** (**SCHEME**) aims to fill this gap by the development and application of a multi-class analytical methodology for the determination of biomarkers of human exposure to selected environmental contaminants.

Exposure
Excretion
Sampling
Personal care and household products
Metabolism
Wastewater
Analysis

Fig. 1. General scheme of the SCIM approach

Objectives

- To select a suitable set of biomarkers of human exposure to chemical contaminants from personal care and household products (parabens, UV filters, phosphorous flame retardants, plasticizers, and bisphenols)
- To develop and validate a multi-class analytical method for their determination in wastewater
- To assess human exposure to selected contaminants in 4 European cities

References

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Acknowledgement

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Procedure

Filtration
Addition of internal standards
Acidification (pH 3)
Instrumental analysis: online solid-phase extraction – liquid chromatography – tandem mass spectrometry (SPE-LC-MS/MS)

Fig. 2. Sample treatment and analysis

ENVIRONMENTAL SCIENCES

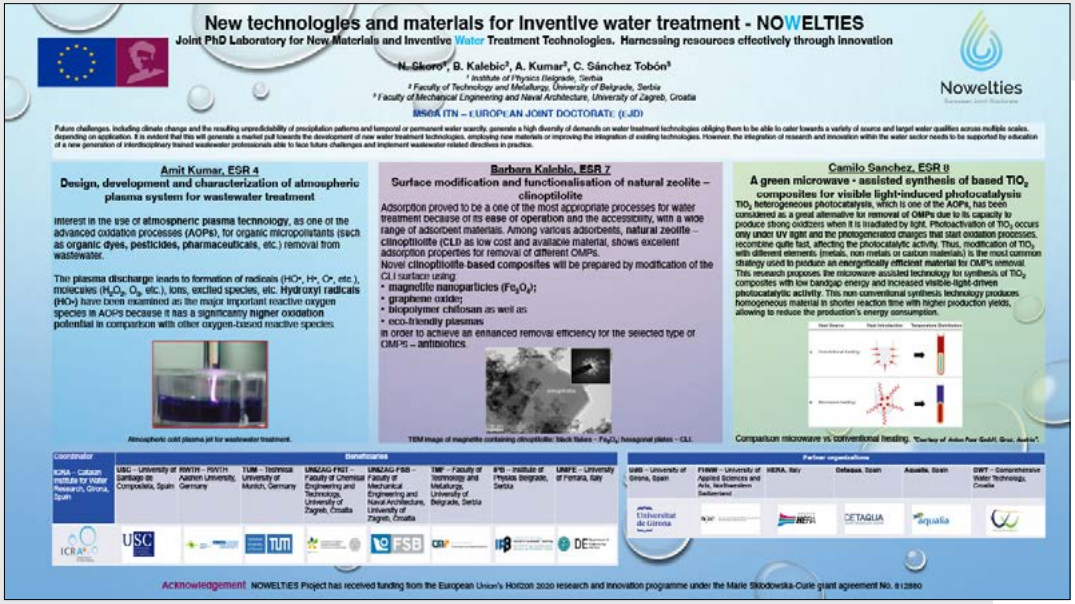
New technologies and materials for inventive water treatment – NOWELTIES

Author(s):
Amit Kumar
Organisation:
Institute of Physics Belgrade, Serbia
Place of residence:
Belgrade, Serbia

Future challenges, including climate change and the resulting unpredictability of precipitation patterns and temporal or permanent water scarcity, generate a high diversity of demands on water treatment technologies obliging them to be able to cater towards a variety of source and target water qualities across multiple scales, depending on the application. Thus, it is evident that the integration of research and innovation within the water sector needs to be supported by the education of a new generation of interdisciplinary trained wastewater professionals able to face future challenges and implement wastewater-related directives in practice.

The core activity of NOWELTIES project is the research programme composed of 14 individual research projects aimed at the development of inventive water treatment technologies: advanced biological treatments, innovative oxidation processes, hybrid systems. This will allow catering for the varied treatment demands for many interconnected streams arising from recycling loops. These technologies will be able to control contamination by organic micropollutants (OMPs) and improve recovery of water across a diversity of scales enabling a smart combination of decentralised and centralised approaches. Besides a holistic training in the field of wastewater treatment dealing with state-of-the-art technologies, experimental techniques and knowledge management methodologies, NOWELTIES will provide a unique training approach to learning complex complementary skills leading to independent and critical thinking which seeks originality and innovation.

Here we will present three NOWELTIES' ESRs that have the goal to investigate and apply different new technologies and materials for water treatment.



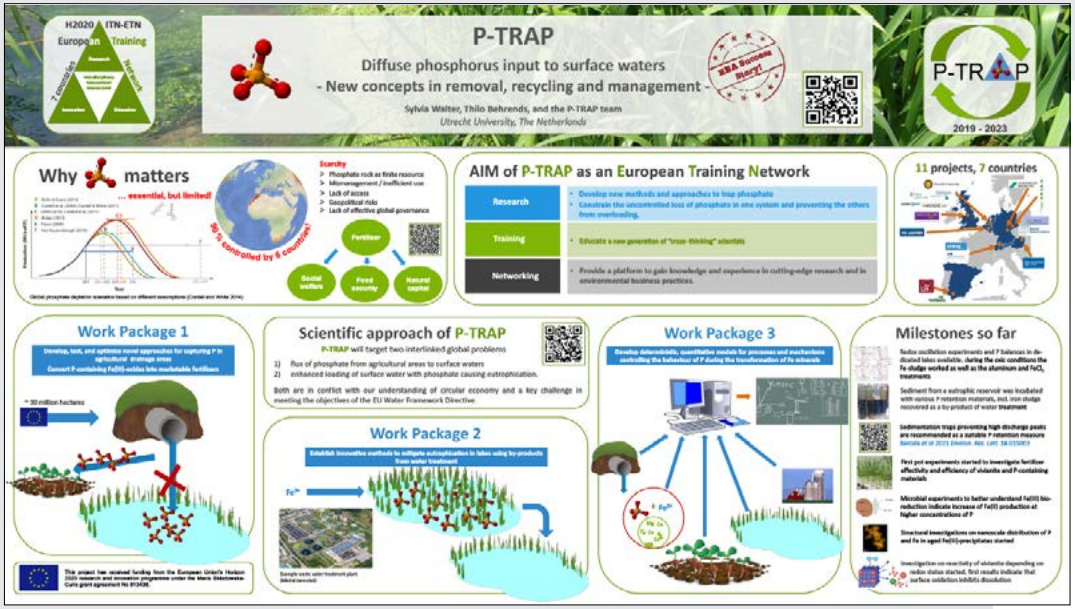
ENVIRONMENTAL SCIENCES

P-TRAP: Diffuse phosphorus input to surface waters

Author(s):
Sylvia Walter
Organisation:
Utrecht University
Place of residence:
Utrecht, The Netherlands

Phosphate, an essential resource for food production is becoming scarce. Its uncontrolled loss from agricultural areas is in conflict with the principles of a circular economy. Enhanced loading of surface waters with phosphate is the main cause for eutrophication and presents a key challenge in meeting the objectives of the EU Water Framework Directive. Understanding and controlling environmental phosphate fluxes, therefore, is key to target both problems, to develop new methods and approaches to manage environmental phosphate fluxes, and to improve surface water quality.

In March 2019, P-TRAP has been launched. P-TRAP, an MSCA-ETN, establishes a framework of partners from multiple science and engineering disciplines, integrating partner organisations from various stakeholder groups to pave the way for the direct implementation of the acquired knowledge. The project is targeting the diffuse flux of phosphate into surface waters, i.e. the problems of understanding and controlling environmental phosphate fluxes. P-TRAP aims to develop new methods and approaches to trap phosphate in drained agricultural areas and the sediments of eutrophic lakes. Trapping of phosphate involves the application of iron-containing by-products from drinking water treatment. P-TRAP espouses the ideas of a circular economy and aims at recovering the retained phosphate in agricultural systems. Novel microbial technologies will be developed to convert phosphate-loaded iron-minerals into marketable fertilisers whose suitability will be evaluated. The P-TRAP technologies have in common that they rely on the naturally strong connection between phosphate and iron, and the innovative P-TRAP strategies will be underpinned by process-orientated investigations on the behaviour of phosphate during the transformation of iron minerals. The latter are key in trapping and recycling of phosphate in agricultural systems and lakes. Here we will present the structure and the planned research of the project, including an overview of achievements of the first two years.



ENVIRONMENTAL SCIENCES

MEMO2 - MEthane goes MObile – MEasurements and Modelling

Author(s):
Sylvia Walter
Organisation:
Utrecht University
Place of residence:
Utrecht, The Netherlands

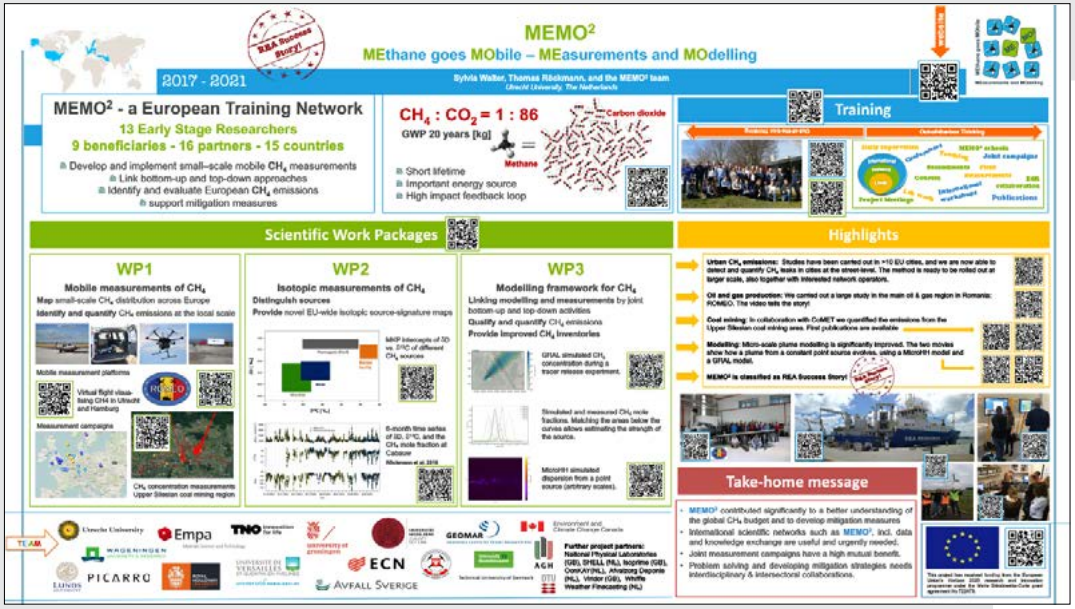
MEMO2 was a 4-years European Training Network with more than 20 collaborators from 7 countries. The project contributed significantly to the targets of the EU with a focus on methane (CH4). CH4 emissions are a major contributor to Europe's global warming impact, and the official inventories of emissions and estimates derived from direct atmospheric measurement show significant discrepancies. However, effective emission reduction can only be achieved if sources are properly quantified, and mitigation efforts are verified. MEMO2 contributed to advanced combinations of measurement and modelling which are needed to archive such quantification.

With respect to the recently released EU methane strategy and the implementation of independent verification of emissions by atmospheric measurements, we will present some examples of relevant results up to now:

Urban CH4 emissions: We can now detect and quantify CH4 leaks in cities at the street-level with mobile nigh precision analysers. Similar studies have been carried out in >10 EU cities and in collaboration with interested network operators those measurements are ready to be rolled out at a larger scale.

Oil and gas production: We carried out a large study in the oil and gas production region in Romania (ROMEO), with aircraft, drones and vehicles. The final results are close to publication and help to improve the emission verification.

Coal mining: In collaboration with CoMet, another science project, we quantified the CH4 emissions from the Upper Silesian coal mining area. The collaboration and its results contribute to the development of an independent and objective emission monitoring system



Modelling: Micro-scale plume modelling is significantly improved. Those models, e.g., help to simulate a measurement day as we had during our field campaign in Romania and improve sampling and measurement strategies.

ENVIRONMENTAL SCIENCES

BioENErgy from biomass and bio-oil Fermentation using mIcrobial Communities to produce Chemicals and Enzymes (BENEFICCE)

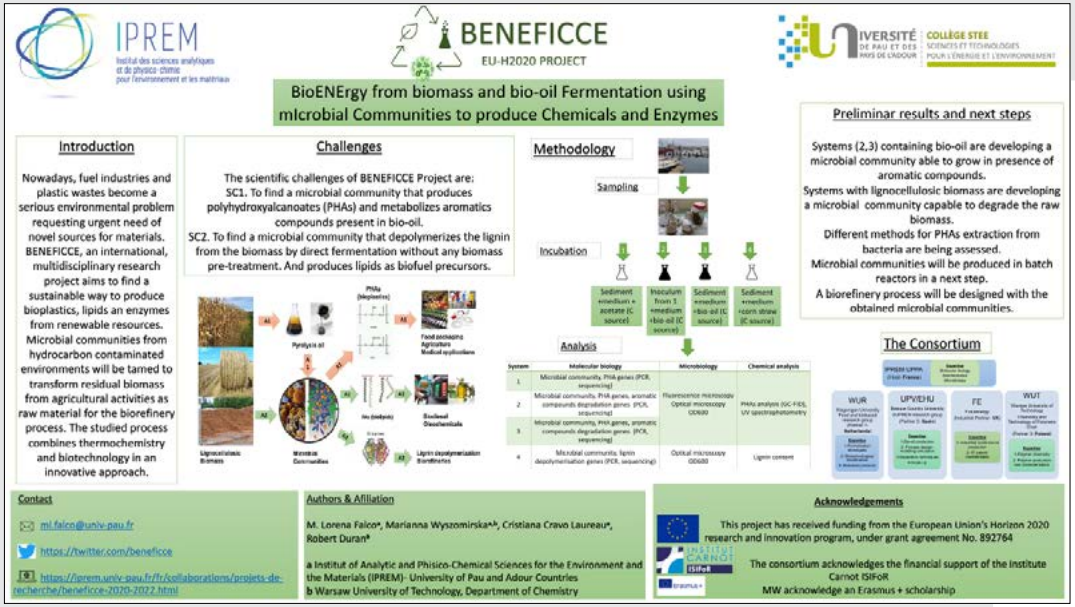
Author(s):
Maria Lorena Falco
Organisation:
Université de Pau et des Pays de l'Adour
Place of residence:
Pau, France

Although many efforts have been dedicated to the research and development of sustainable biorefineries, there are still some gaps to cover, especially to make chemical production energetically efficient and rentable. The proposed route combines biotechnological and thermochemical processes, departing from low-cost raw materials, like lignocellulosic biomass, to produce valuable chemicals via the activity of environmental microbial communities.

Bioplastics, enzymes, and lipids will be produced in a competitive biorefinery process. The project develops two approaches,

- Approach 1. Aims to study the fermentation of bio-oil, obtained from pyrolysis of waste biomass, to produce bioplastics, using microbial communities from contaminated environments. The scientific challenge is to find a microbial community able to metabolise the chemicals present in bio-oil (including the toxic compounds) with the concomitant production of bioplastics in one pot.
- Approach 2. Aims to study the fermentation of lignocellulosic biomass to produce fatty acids and enzymes that degrade the lignocellulose. The scientific challenge of this approach is to find a microbial community that can degrade the lignocellulosic material without any pre-treatment, and that can metabolise the toxic chemicals produced during biomass fermentation.

The BENEFICCE project is looking for developing a new technology for the sustainable production of bioplastics, lipids, and enzymes. Contributing to 2 of the 17 Sustainable Development Goals of the United Nations: Sustainable Production and Combat Climate Change. Moreover, the resulting biorefinery process aims to be competitive by using low-cost raw material and having fewer process steps than other existent technologies.



This project has received funding from the European Union's Horizon 2020 research and innovation program, under grant agreement No. 892764.

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Marianna Wyszomirska acknowledges the Erasmus+ scholarship.

ENVIRONMENTAL SCIENCES

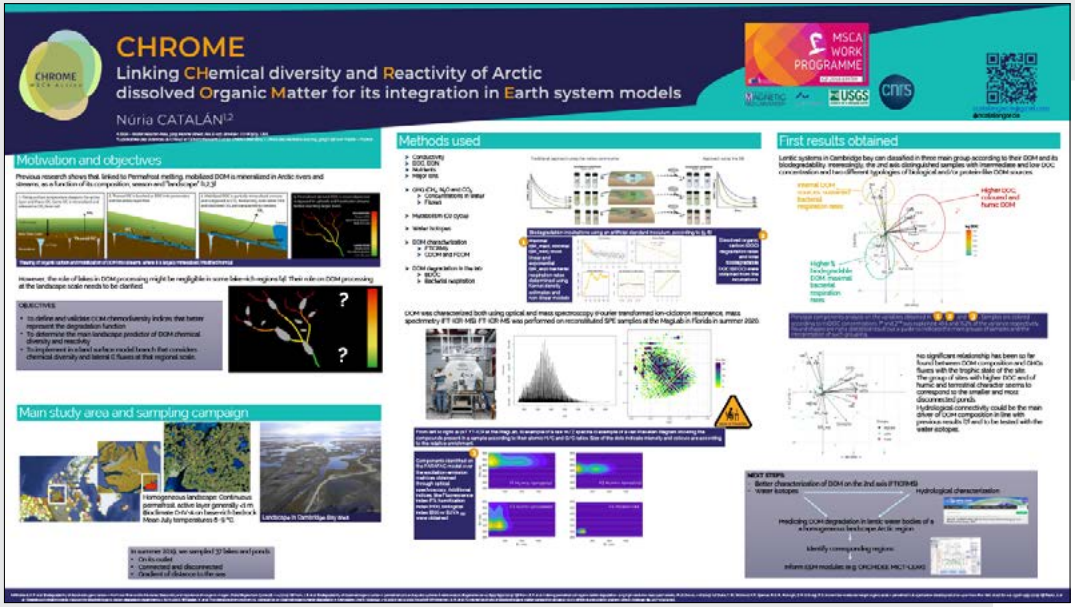
Linking chemical diversity and reactivity of arctic dissolved organic matter for its integration in earth system models (chrome)

Author(s):
Nuria Catalan
Organisation:
LSCE-CNRS
Place of residence:
Spain

Organic carbon (OC) is exported from terrestrial to freshwater ecosystems where, not only is it being degraded and eventually lost as CO_2, but such degradation occurs faster than in soils or marine systems. Across freshwaters, variations in OC degradation and reactivity have been related to compositional changes in OC. The flux from terrestrial to aquatic systems seems to be increasingly associated with anthropogenic perturbations. However, despite the relevance of these fluxes for the global C cycle, Earth System Models (ESMs) are just starting to consider them. In that sense, a particularly crucial region deserving urgent attention is the Arctic, as permafrost soils hold a massive C stock that is vulnerable to being mobilised towards freshwaters. Such transfer could turn that vulnerable C stock from a sink into a CO_2 source. Therefore, determining the reactivity of that OC flux and incorporating it in surface models is key now.

The foundation of CHROME project is the idea that the chemical diversity of OC explains its reactivity and, as such, should be considered in biogeochemical models. CHROME represents the first attempt to incorporate OC chemical diversity to ESMs and will do so by: i) developing and selecting functional chemical diversity indices as indicators of Arctic OC reactivity and ii) implementing that knowledge in a regional branch of an ESM.

In this session, we will present an overview of the project as well as the first results of our first objective, determining the chemical diversity in Arctic lakes and ponds using high-resolution mass spectrometry data. This includes both the development and assessment of the indices describing diversity as well as the spatial distribution of such diversity across these water bodies, in order to identify gradients to be applied in the second stage of the project.



LIFE SCIENCES

Next-generation biodiversity monitoring: Bats as ecosystem samplers

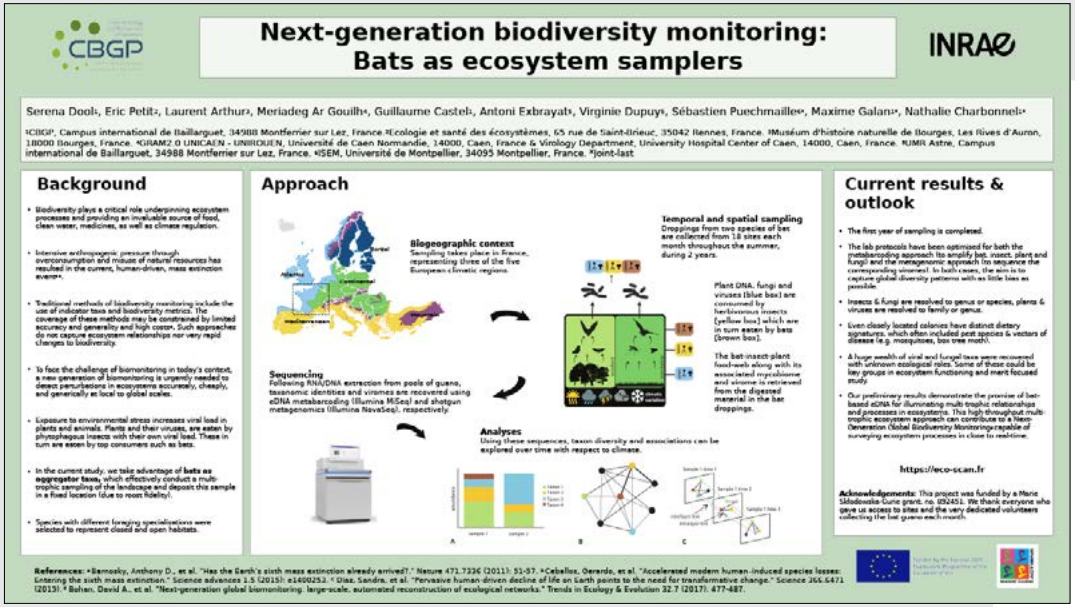
Author(s):
Serena Dool
Organisation:
INRAE
Place of residence:
Montpellier, France

Biodiversity underpins fundamental ecosystem processes and provides invaluable services. Current approaches of biodiversity monitoring may be limited to individual taxonomic groups and typically measure the end-state, but not the underlying processes. Drastic biodiversity loss and climate change have made the development of rapid, high-throughput multi-trophic ecosystem monitoring protocols a pressing need.

Plants are the primary producers responsible for oxygen production and carbohydrate synthesis and form the base of almost all global ecosystems. They are known to accumulate viral loads in response to climate-related stress. Plants, and their viruses, are eaten by phytophagous insects (with their own viral load), which are in turn eaten by a top consumer such as a bat. We will take advantage of this natural aggregation through trophic levels by collecting bat guano to retrieve the viromes of plants, fungi, insects and bats. The identity of eukaryotic taxa will be revealed by metabarcoding.

Temporal sampling across climates and habitats will ensure that complex and seasonal ecosystem processes are captured. We will explore taxon diversity and associations, and how these change over time and in response to environmental conditions.

This will increase our knowledge on biodiverse understudied groups, shed light on ecosystem processes and how they respond to climate change, and provide proof of concept results for 'aggregation' as a means to rapidly survey ecosystem health on a global scale.

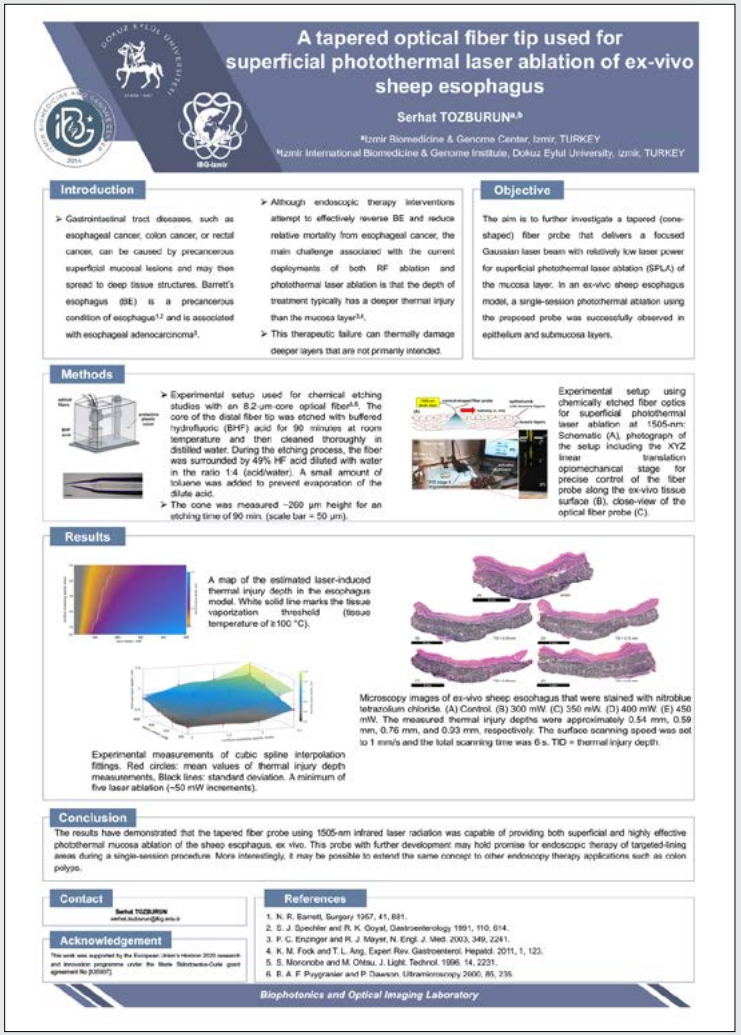


LIFE SCIENCES

A tapered optical fiber tip used for superficial photothermal laser ablation of ex-vivo sheep esophagus

Author(s):
Serhat Tozburun
Organisation:
İzmir Biomedicine and Genome Center
Place of residence:
Izmir, Turkey

Gastrointestinal tract diseases can be caused by precancerous superficial mucosal lesions and may then spread to deep tissue structures. Barrett's esophagus (BE) is a precancerous condition of the esophagus and is associated with esophageal adenocarcinoma. Although endoscopic therapy interventions attempt to effectively reverse BE and reduce relative mortality from esophageal cancer, the main challenge associated with the current deployments of both RF ablation and photo-thermal laser ablation is that the depth of treatment typically has a deeper thermal injury than the mucosa layer. This therapeutic failure can thermally damage deeper layers that are not primarily intended. The aim is to further investigate a tapered fiber probe that delivers a focused Gaussian laser beam with relatively low laser power for superficial photo-thermal laser ablation of the mucosa layer. In an ex-vivo sheep esophagus model, a single-session photo-thermal ablation at 1505-nm using the proposed probe was successfully observed in epithelium and submucosa layers. The successful SPLA of the sheep mucosa layer was demonstrated for various speed-power combinations, including 300 mW laser power at a surface scanning rate of 0.5 mm/s and 450 mW laser power at a surface scanning rate of 2.0 mm/s.



LIFE SCIENCES

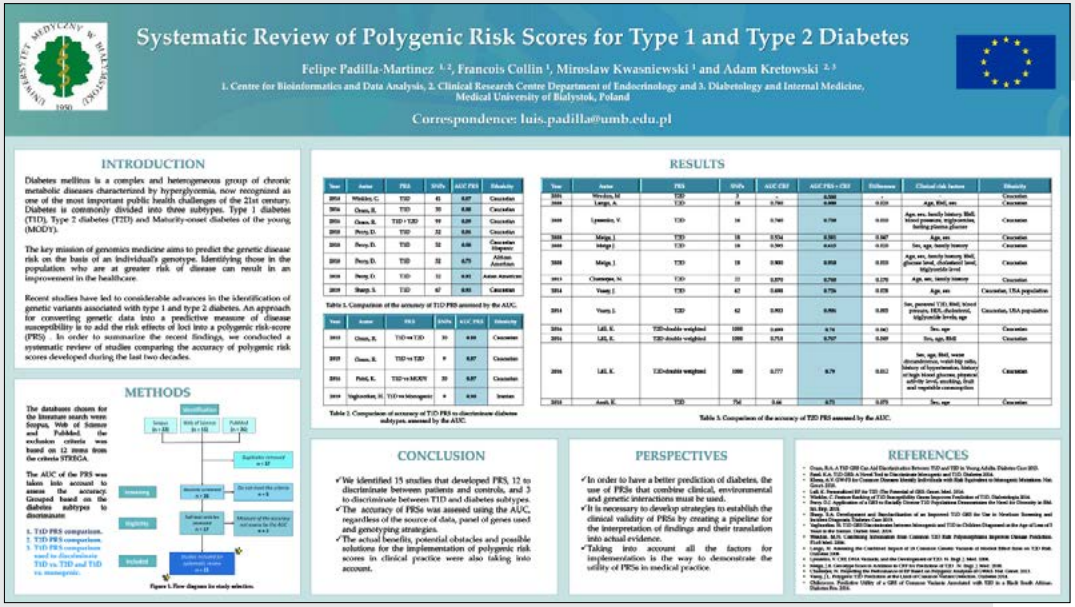
Systematic Review of Polygenic Risk Scores for Type 1 and Type 2 Diabetes

Author(s):
Felipe Padilla-Martinez
Organisation:
Medical University of Bialystok
Place of residence:
Bialystok

Recent studies have led to considerable advances in the identification of genetic variants associated with type 1 and type 2 diabetes. An approach for converting genetic data into a predictive measure of disease susceptibility is to add the risk effects of loci into a polygenic risk score. In order to summarise the recent findings, we conducted a systematic review of studies comparing the accuracy of polygenic risk scores developed during the last two decades.

We selected 15 risk scores from three databases (Scopus, Web of Science and PubMed) enrolled in a systematic review. We identified three polygenic risk scores that discriminate between type 1 diabetes patients and healthy people, one that discriminates between type 1 and type 2 diabetes, two that discriminate between type 1 and monogenic diabetes and nine polygenic risk scores that discriminate between type 2 diabetes patients and healthy people.

Prediction accuracy of polygenic risk scores was assessed by comparing the area under the curve. The actual benefits, potential obstacles and possible solutions for the implementation of polygenic risk scores in clinical practice were also taking into account. Develop strategies to establish the clinical validity of polygenic risk scores by creating a framework for the interpretation of findings and their translation into actual evidence, are the way to demonstrate their utility in medical practice.



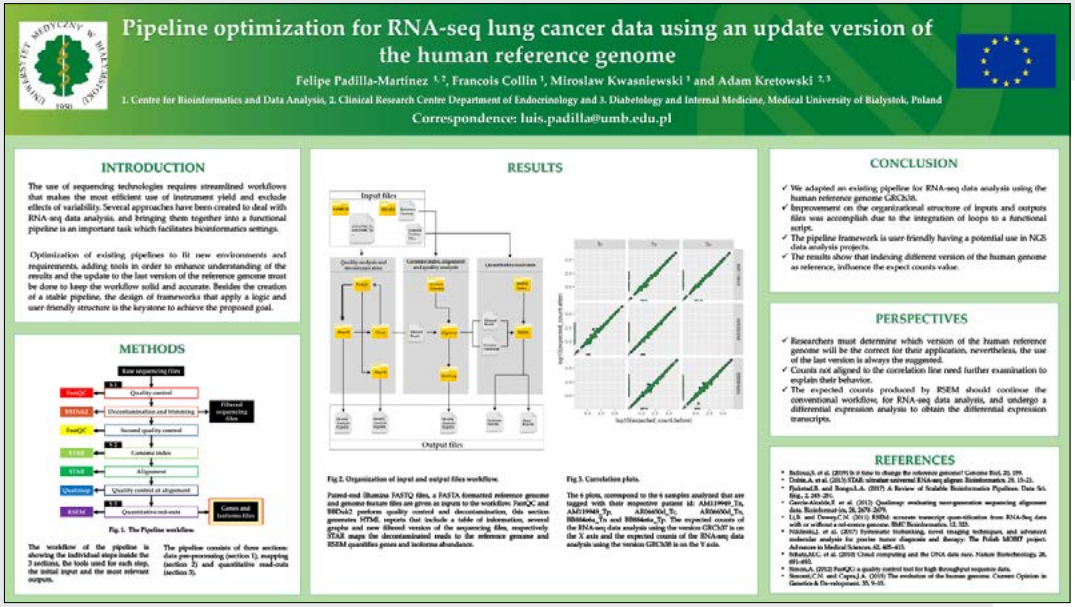
LIFE SCIENCES

Pipeline optimisation for RNA-seq lung cancer data using an update version of the human reference genome

Author(s):
Felipe Padilla-Martinez
Organisation:
Medical University of Bialystok
Place of residence:
Bialystok, Poland

The use of sequencing technologies requires streamlined workflows that make the most efficient use of instrument yield and exclude effects of variability. Several approaches have been created to deal with RNA-seq data analysis, and bringing them together into a functional pipeline is an important task that facilitates bioinformatics settings. Optimisation of existing pipelines to fit new environments and requirements, adding tools in order to enhance understanding of the results and the update to the last version of the reference genome must be done to keep the workflow solid and accurate. Besides the creation of a stable pipeline, the design of frameworks that apply a logic and user-friendly structure is the keystone to achieve the proposed goal.

To keep an existing pipeline for RNA-seq lung cancer data analysis updated, the recreation of the pipeline with its specific flags on bioinformatic tools was performed, then its optimisation was done by using the last version of the human genome (GRCh38) as a reference and an improvement of the organisational structure of inputs and outputs files, as a result of using loops in the script. The resulting framework is user-friendly, having potential use in next-generation sequencing data analysis projects. The results observed on correlation plots after the analysis, using the two pipelines on the same RNA-seq dataset, provide evidence that the use of a different version of the human reference genome can influence the estimation of gene expression levels, which subsequently impacts identification of differentially expressed genes.

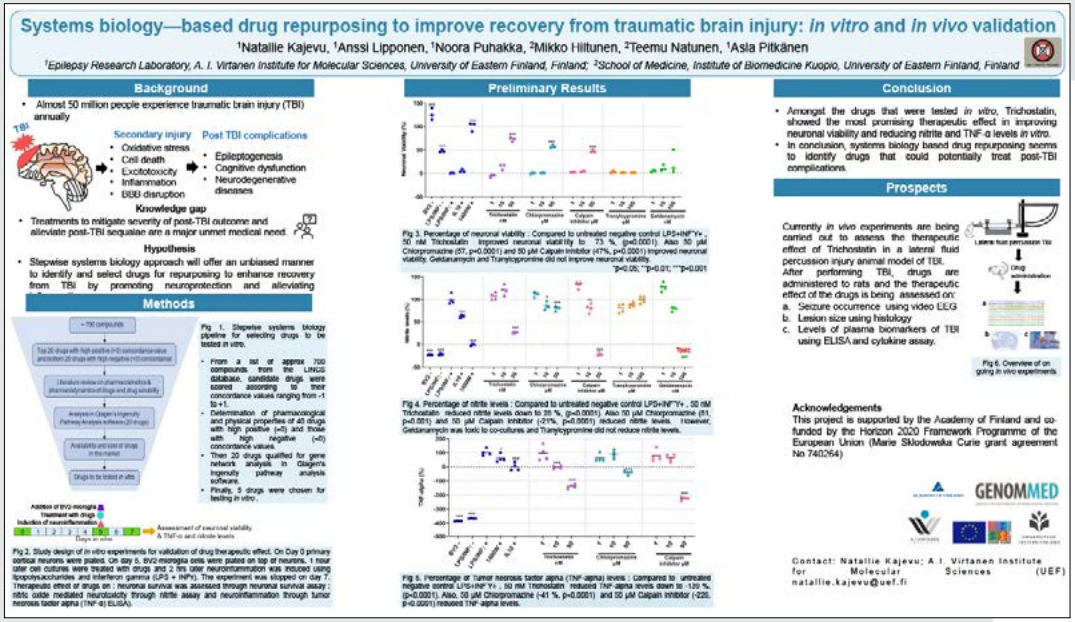


LIFE SCIENCES

Systems biology-based drug repurposing to improve recovery from traumatic brain injury: in vitro and in vivo validation

Author(s):
Natallie Kajevu
Organisation:
University if Eastern Finland (UEF)-A. I Virtanen Institute for Molecular Sciences
Place of residence:
Finland

Almost 50 million people suffer from traumatic brain injury (TBI) each year and over 40% TBI survivors develop long-term post-TBI complications such as epileptogenesis. To date, no treatment can alleviate progression of TBI sequalae, and identification of novel treatments to improve post-TBI outcome is major unmet medical need. Systems biology approach offers an unbiased approach to identify and select drugs for repurposing to enhance recovery from TBI by promoting neuroprotection and alleviating inflammation. This study aims at mitigating severity of pathological and functional post—TBI outcomes by using systems biology -identified drugs. Selected drugs were tested in cortical neuron-BV2 microglia co-cultures to assess in vitro efficacy of drugs on: (a) Neuronal survival using microtubule associated protein 2—based neuronal survival assay (b) Neuroprotective potential from nitric oxide mediated neurotoxicity using Griess reagent-nitrite assay (c) Anti-inflammatory effect using tumour necrosis factor alpha (TNF-alpha) ELISA. Our in vitro results revealed that neuronal survival was improved by 50 nM Trichostatin-A (73%, p<0.001); 50 M Chlorpromazine (57%, p<0.001) and 50 M Calpain inhibitor (47%, p<0.001). Tranylcypromine and Geldanamycin did not improve neuronal survival. Levels of nitrite were reduced by 50 nM Trichostatin-A down to (28%, p<0.001); 50 M Chlorpromazine to (81%, p<0.001) and 50 M Calpain inhibitor to (-21%, p<0.001). Tranylcypromine and Geldanamycin had no effect. Levels of TNF-alpha were reduced by 50 nM Trichostatin-A down to (-139%, p<0.001); 50 M Chlorpromazine to (-41%, p<0.001) and 50 M Calpain inhibitor to (-226%, p<0.001). Our in vitro findings suggest that the systems biology approach helps identification of drugs that have a potential to treat post-TBI complications. In vivo experiments in a clinically relevant rat model of TBI are currently ongoing to assess the therapeutic effect of drugs that showed the best efficacy in in vitro testing. If effective, these drugs could promote the recovery of TBI patients and prevent post-traumatic epileptogenesis.

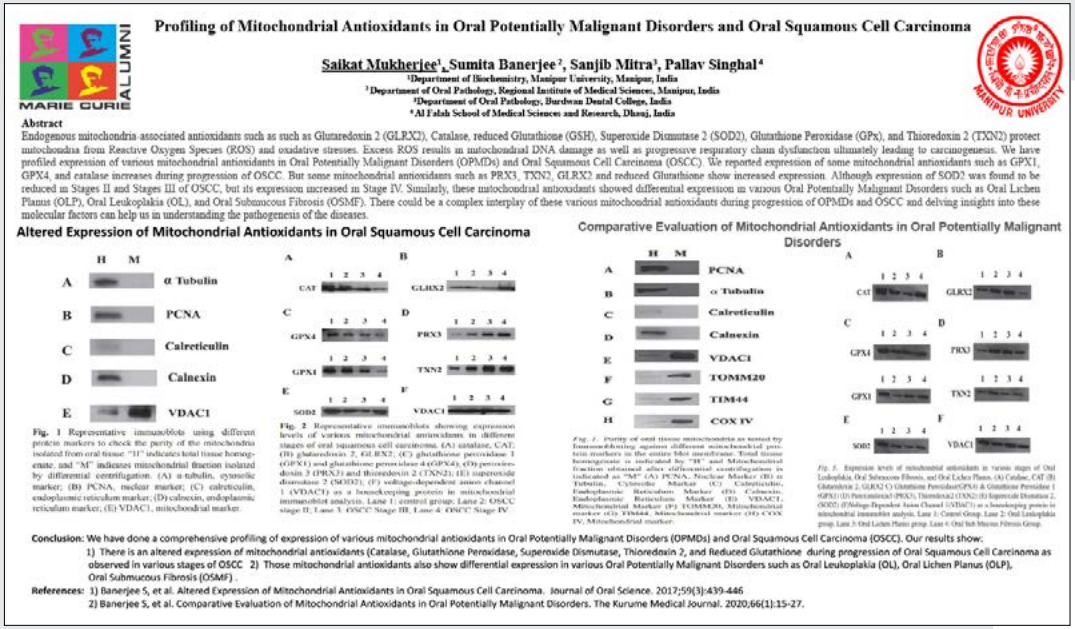


LIFE SCIENCES

Profiling of Mitochondrial Antioxidants in Oral Potentially Malignant Disorders and Oral Squamous Cell Carcinoma

Author(s):
Saikat Mukherjee
Organisation:
Manipur University
Place of residence:
Imphal, India

Endogenous mitochondria-associated antioxidants such as Glutaredoxin 2 (GLRX2), Catalase, reduced Glutathione (GSH), Superoxide Dismutase 2 (SOD2), Glutathione Peroxidase (GPx), and Thioredoxin 2 (TXN2) protect mitochondria from Reactive Oxygen Species (ROS) and oxidative stresses. Excess ROS results in mitochondrial DNA damage as well as progressive respiratory chain dysfunction ultimately leading to carcinogenesis. We have profiled the expression of various mitochondrial antioxidants in Oral Potentially Malignant Disorders (OPMDs) and Oral Squamous Cell Carcinoma (OSCC). We reported expression of some mitochondrial antioxidants such as GPX1, GPX4, and catalase increases during the progression of OSCC. But some mitochondrial antioxidants such as PRX3, TXN2, GLRX2 and reduced Glutathione show increased expression. Although expression of SOD2 was found to be reduced in Stages II and Stages III of OSCC, but its expression increased in Stage IV. Similarly, these mitochondrial antioxidants showed differential expression in various Oral Potentially Malignant Disorders such as Oral Lichen Planus (OLP), Oral Leukoplakia (OL), and Oral Submucous Fibrosis (OSMF). There could be a complex interplay of these various mitochondrial antioxidants during progression of OPMDs and OSCC and delving insights into these molecular factors can help us in understanding the pathogenesis of the diseases.

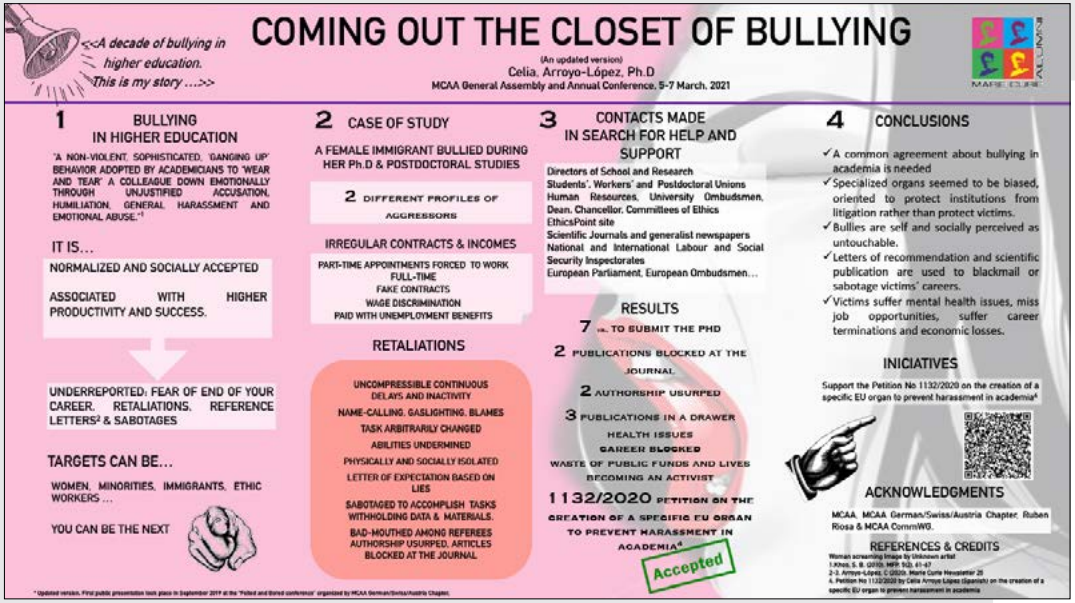


LIFE SCIENCES

Academic Bullying, Trendy against Women during their Ph.D., Abused by their Supervisors. Abuses took place in 17 Countries

Author(s):
Celia Arroyo López
Organisation:
Marie Curie Alumni Association
Place of residence:
Toledo, Spain

54 persons anonymously completed the survey about academic bullying, 75.9% identified themselves as victims of harassment. 64.8% of the respondents were women. Most of the episodes of abuse occurred during Ph.D. studies. The respondents mentioned the USA, Spain, Germany, France, UK, Italy, Denmark, Portugal, Austria, the Republic of Ireland, China, Netherlands, Latvia, Canada, Sweden, Chile, or Poland as the countries where either they witnessed or suffered abuses. 3% of the respondents noted two different countries as the place where abuses took place, the supervisor is considered the main abuser. The reasons behind the abuser were mainly the general environmental trend at the workplace, others associated the abuses with the responsibility, ethics, and hard work of the target. The reasons behind underreporting academic harassment were manly fear damaging and jeopardizing their scientific careers, receiving bad reference letters, being badmouthed and blacklisted.

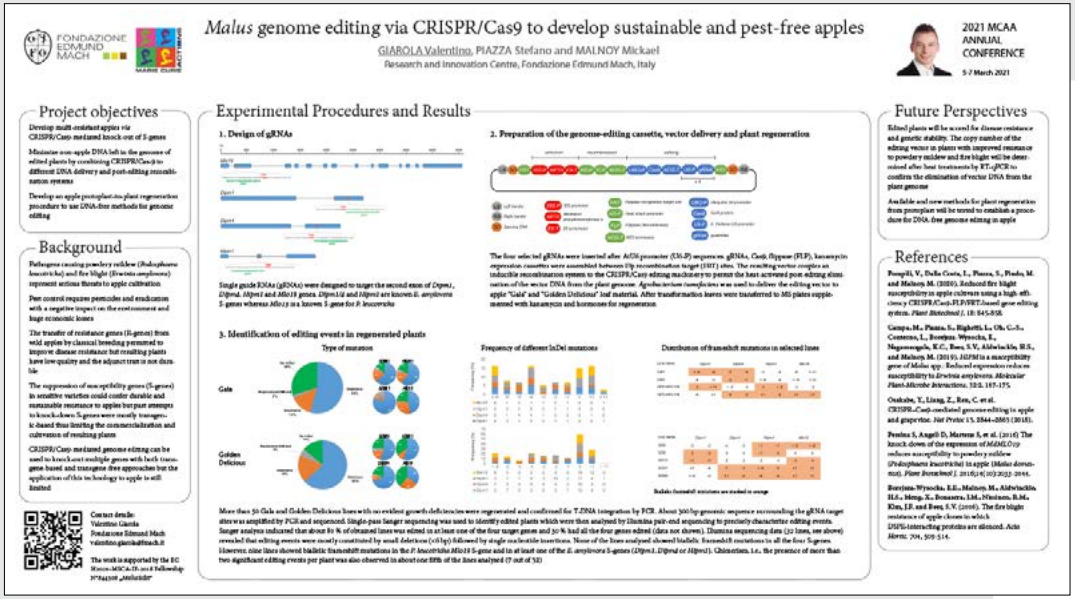


LIFE SCIENCES

Malus genome editing via CRISPR/Cas9 to develop sustainable and pest-free apples

Author(s):
Valentino Giarola
Organisation:
Fondazione Edmund Mach
Place of residence:
Italy

Most commercial apples are sensitive to pathogens causing fire blight (Erwinia amylovora) and powdery mildew (Podosphaera leucotricha). Pest control requires pesticides and eradication with a negative impact on the environment and huge economic losses. Resistant varieties were produced by classical breeding via the transfer of resistance genes (R-genes), but the resulting plants have low quality, and the resistance can be easily overcome by pathogens. The suppression of susceptibility genes (S-genes) could be used to confer durable resistance but past attempts to knock-down S-genes were mostly transgenic-based thus limiting the commercialisation of resulting plants. This project aims to use CRISPR/Cas9 to develop pest-free apples by simultaneously mutating S-genes responsible for the susceptibility to E. amylovora (Dipm1, Dipm4, Hipm1) and P. leucotricha (Mlo19). Gene mutation is obtained through the delivery of a vector containing the genome-editing machinery combined with a heat-inducible recombination system to permit the elimination of vector DNA from the genome of plants after editing. Here we present the results obtained from plants where vector delivery was achieved using Agrobacterium. More than 50 Gala and Golden Delicious lines with no evident growth deficiencies were regenerated and confirmed for T-DNA integration by PCR. Single-pass sequencing analysis indicated that about 80 % of such lines were edited in at least one of the four target genes and 30 % had all the four genes edited. The analysis of the Illumina sequencing data revealed that editing events were mostly constituted by small deletions (<6 bp). Edited plants will be scored for fire blight and powdery mildew resistance and then will be submitted to heat-treatments for the excision of the editing cassette. Alternative delivery methods and a protoplast-to-plant regeneration procedure will also be developed during the project to minimise the non-apple DNA left in the plant genome and to allow DNA-free genome editing.

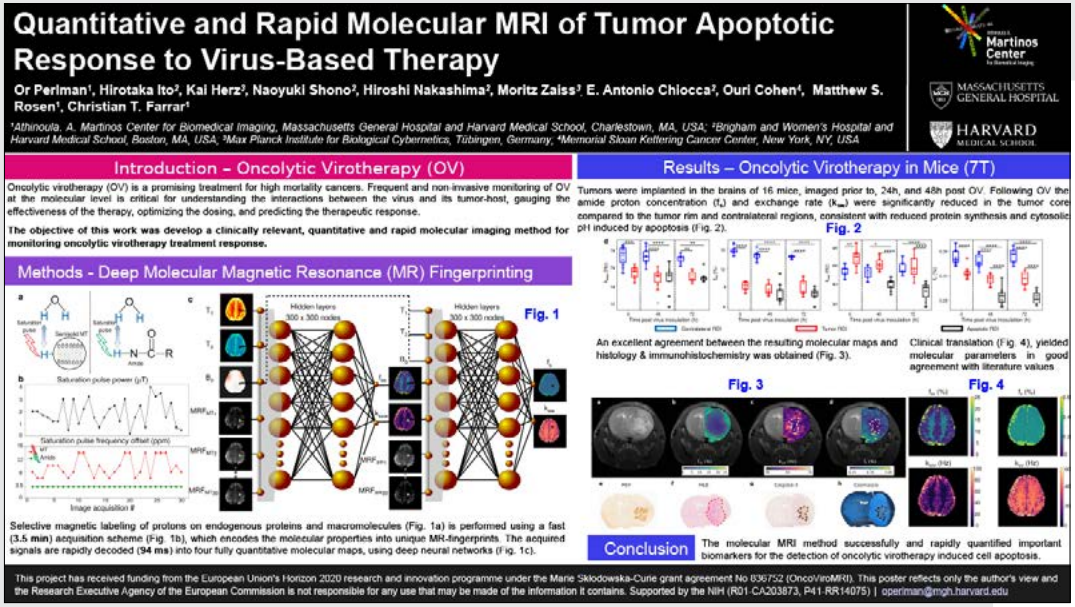


LIFE SCIENCES

Quantitative and rapid molecular MRI of tumor apoptotic response to virus-based therapy

Author(s):
Or Perlman
Organisation:
Massachusetts General Hospital and Harvard Medical School
Place of residence:
Cambridge, Massachusetts, USA

The highly invasive nature of many cancer types and the toxicity of most systemic chemotherapies represent significant challenges for cancer therapies. An especially promising approach for overcoming these challenges is the use of oncolytic viruses that selectively kill only cancer cells while sparing the surrounding normal cells. Non-invasive imaging of the underlying molecular processes is an essential tool for achieving the full potential of this biological therapeutic, enabling the assessment of viral spread, innate immunity, and therapeutic response. However, previous methods for imaging oncolytic virotherapy had poor sensitivity and specificity or required the administration of radioactive or metal-based contrast-materials. Here, we present a new non-invasive method for quantitative and rapid molecular imaging of oncolytic virotherapy treatment response. The method combines proton exchange-based MRI with deep learning, yielding quantitative biomarker maps of protein and lipid/macromolecule concentrations as well as intracellular pH. The benefit of using this method was demonstrated in a glioblastoma mouse brain tumour model, where it allowed the early detection of apoptotic response to oncolytic virotherapy, in excellent agreement with histology and immunohistochemistry findings. The method was translated to clinical scanners and produced reproducible and quantitative 3D molecular maps of the human brain across 3 different imaging sites. The acquisition of 4 biomarker volumetric maps was achieved in less than 12 min; thus, it could potentially be incorporated within routine imaging sessions. The method is directly applicable to a wide range of additional pathologies where the intracellular pH or the lipid/metabolite concentration is altered, including stroke and neurological disorders.

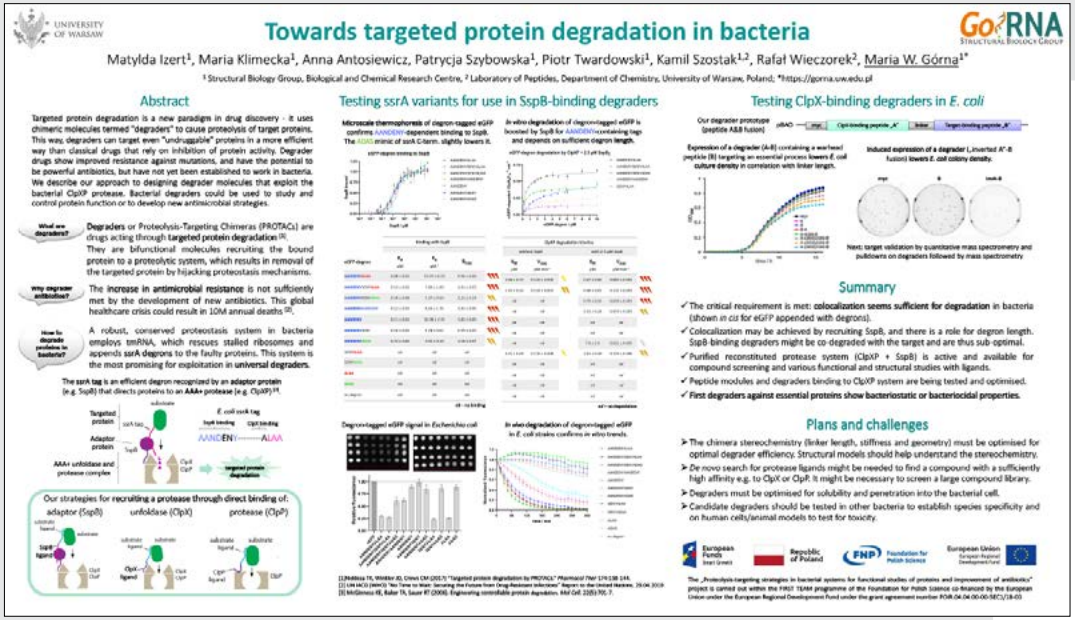


LIFE SCIENCES

Towards targeted protein degradation in bacteria

Author(s):
Maria Górna
Organisation:
University of Warsaw
Place of residence:
Poland

Targeted protein degradation is a new paradigm in drug discovery; it uses chimeric molecules termed “degraders” to cause proteolysis of target proteins. This way, degraders can target even “undruggable” proteins in a more efficient way than classical drugs that rely on inhibition of protein activity. Degrader drugs show improved resistance against mutations, and have the potential to be powerful antibiotics, but have not yet been established to work in bacteria. We describe our approach to designing degrader molecules that exploit the bacterial ClpXP protease. Bacterial degraders could be used to study and control protein function or to develop new antimicrobial strategies.

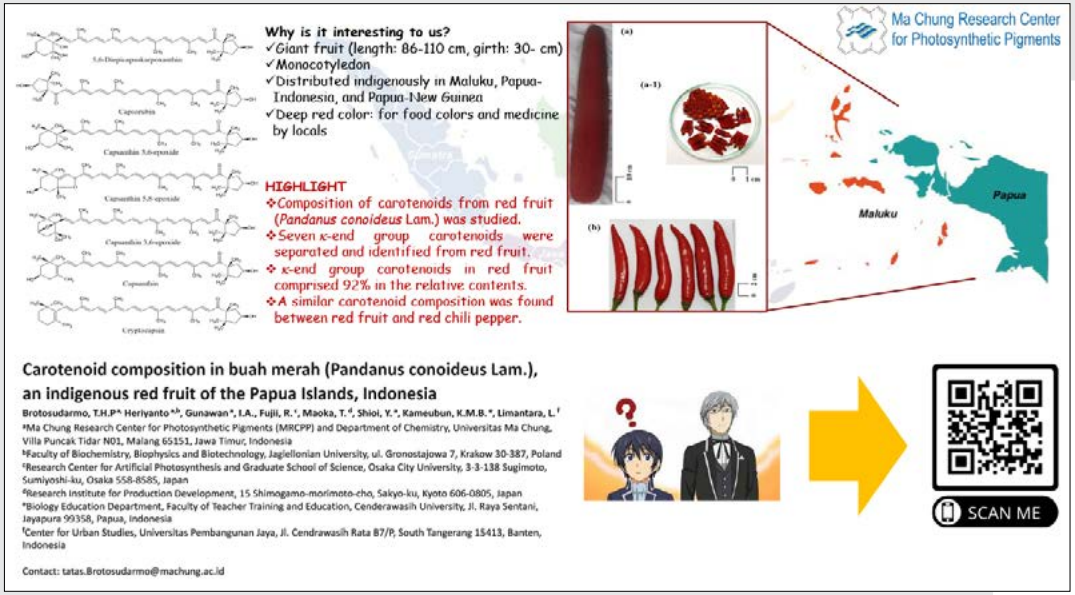


LIFE SCIENCES

Carotenoid composition in buah merah (Pandanus conoideus Lam.), an indigenous red fruit of the Papua Islands, Indonesia

Author(s):
Tatas Hardo Panintingjati Brotosudarmo
Organisation:
Ma Chung Research Center for Photosynthetic Pigments (MRCPP) and Department of Chemistry, Universitas Ma Chung
Place of residence:
Malang, Indonesia

At this conference, I would like to present research findings of my research group that have been published recently in Journal of Food Composition and Analysis (2021), 96, 103722. We studied the composition of carotenoid pigments from the fruit of the Pandanus plant, Pandanus conoideus Lam. monocot, or locally named as red fruit, indigenous to the Papua Islands, was investigated. By chromatographic and spectrometric analyses using RP-HPLC with C18 and C30 columns and gradient elution, NMR, MS/MS and FT-IR, eight κ-end group carotenoids, 5,6-diepicapsokarpoxanthin, capsorubin, capsanthin, cryptocapsin, 13-cis capsorubin, and three capsanthin epoxides were identified. Additionally, β-cryptoxanthin 5,6-epoxide, α- and β-cryptoxanthin, α- and β-carotene, and other carotenoid-type compounds were found. The κ-end group carotenoids in red fruit comprised 92 % in relative contents and was much higher than that in red chili pepper, Capsicum annuum L., at 64 %. These findings indicate that red fruit has similar carotenoids to those of red chili pepper, not only in composition but also in the content. Xanthophyll cycle carotenoids antheraxanthin and violaxanthin are the precursors of capsanthin and capsorubin, respectively. However, these precursors, as well as the precursors of zeaxanthin, were not detected in the chromatographic separation and identification in the extracts of red fruit, although they were detected in red chili pepper under the same analytical conditions used. Therefore, in red fruit, those precursors are likely not responsible for the biosynthesis of □-end group carotenoids.

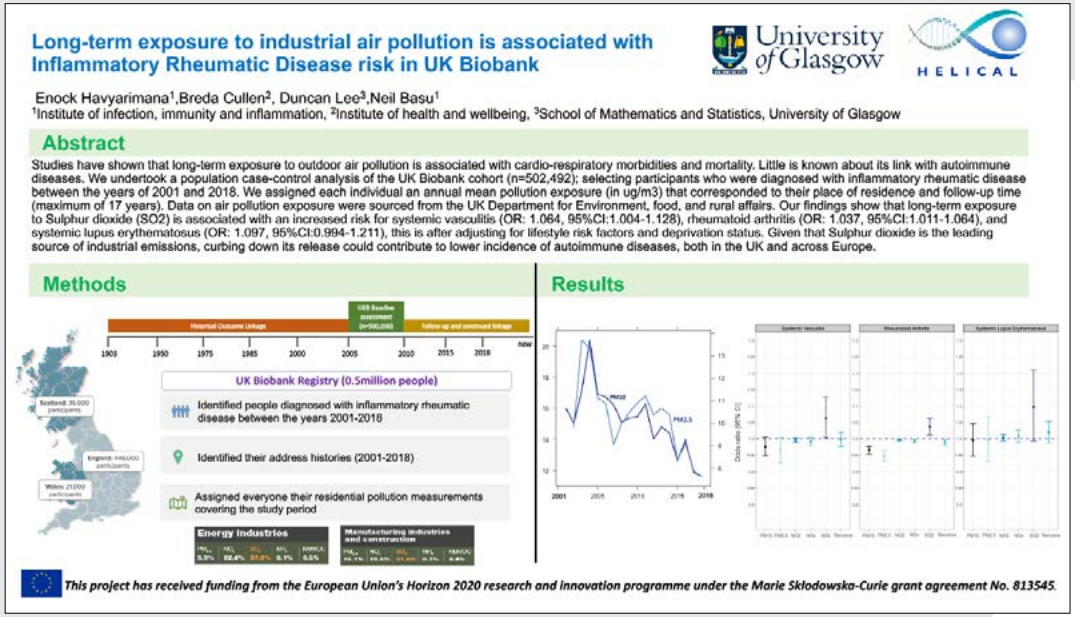


LIFE SCIENCES

Long-term exposure to industrial air pollution is associated Inflammatory Rheumatic Disease Risk in UK Biobank

Author(s):
Enock Havyarimana
Organisation:
University of Glasgow
Place of residence:
United Kingdom

Studies have shown that long-term exposure to outdoor air pollution is associated with cardio-respiratory morbidities and mortality. Little is known about its link with autoimmune diseases. We undertook a population case-control analysis of the UK Biobank cohort (n=502,492), selecting participants who were diagnosed with the inflammatory rheumatic disease between the years 2001 and 2018. We assigned each individual an annual mean pollution exposure (in ug/m3) that corresponded to their place of residence and follow-up time (maximum of 17 years). Data on air pollution exposure was sourced from the UK Department for Environment, food, and rural affairs. Our findings show long-term exposure to Sulphur dioxide (SO2) is associated with an increased risk for systemic vasculitis (OR: 1.064, 95%CI:1.004-1.128), rheumatoid arthritis (OR: 1.037, 95%CI:1.011-1.064), and systemic lupus erythematosus (OR: 1.097, 95%CI:0.994-1.211), this is after adjusting for lifestyle risk factors and deprivation status. This association was again seen with markers of inflammation and disease activity. A 1ug/m3 increase in annual SO2 was linked with 2% (95% CI: 1.9 - 2.4), 0.6% (95% CI: 0.5-0.7) and 0.7% (95% CI:0.6- 0.8) increase in C-reactive, neutrophil and monocyte levels in UK Biobank population, irrespective of disease status. Given that Sulphur dioxide is the leading source of industrial emissions, curbing down its release could contribute to lowering incidence of autoimmune diseases, both in the UK and Europe.



LIFE SCIENCES

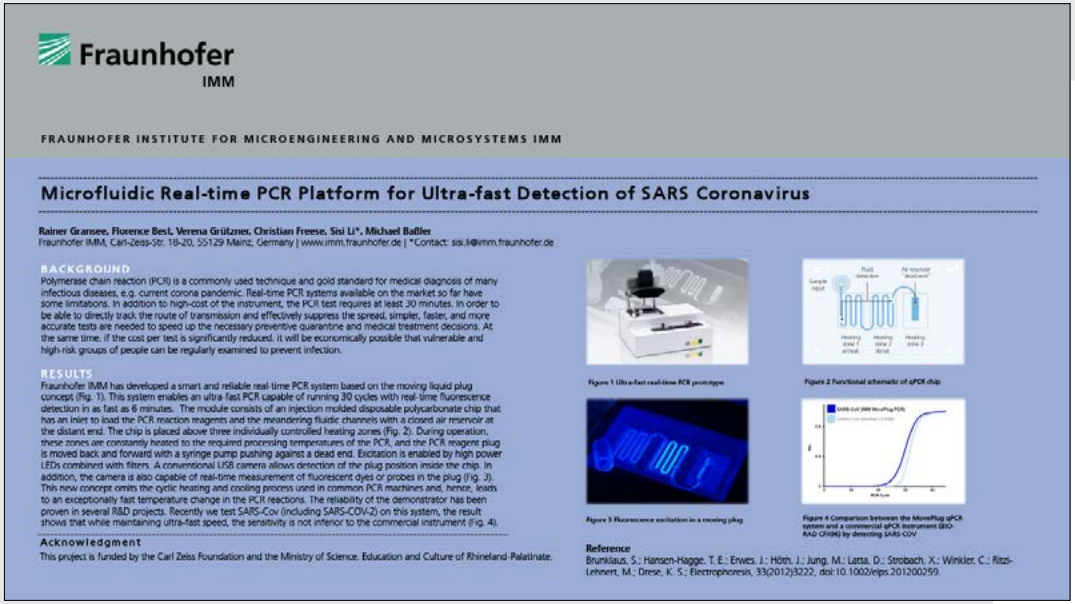
Point-of-care microfluidic PCR platform for fast detection of SARS-COV-2 and discrimination from other respiratory diseases

Author(s):
Sisi Li
Organisation:
Fraunhofer IMM
Place of residence:
Mainz, Germany

Covid-19 pandemic is a threat all over the world. PCR (polymer chain reaction) is the gold standard for SARS-COV-2 diagnostics. Today, almost all analyses require sending patient samples to core lab facilities. The related sample logistics cause diagnostic delays of at least several hours. Point-of-care testing approaches have the potential to revolutionise medicine as they offer immediate access to diagnostic parameters facilitating and accelerating treatment and isolation. The basic prerequisite for this is the speed and complete automation of pathogen detection.

In Fraunhofer IMM, we have built-up a so-called Panplex system that ensures sample-to-answer in a time as short as 30 minutes. What is unique about this system compared to the point-of-care diagnostic platforms on the market is that it allows up to 27 different detection reactions running in parallel by pre-storing 9 trays of assay reagents in the processing cartridge. To analyse the infection status, only a nasopharyngeal swab is necessary to be transferred in the sample container. After the container is placed on the microfluidic cartridge, the sample processing can be started. This step as well as the subsequent measurements are carried out completely automatically in the system developed for this purpose. The processed data are made available to the attending physician for a diagnosis.

As the SARS-COV-2 mutation is popular more and more, the typical applications of our system can be applied to multiple mutations test and discrimination in parallel. Multiplex tests, e.g., SARS-CoV-2 + Influenza + RSV are easily achievable on our platform as well. The platform also enables instant testing of entire disease panels (e.g., respiratory viruses, sexually transmitted diseases, MRSA and related resistance markers).


Fraunhofer
IMM

FRAUNHOFER INSTITUTE FOR MICROENGINEERING AND MICROSYSTEMS IMM

Microfluidic Real-time PCR Platform for Ultra-fast Detection of SARS Coronavirus

Rainer Gransee, Florence Best, Verena Grützner, Christian Freese, Sisi Li*, Michael Baßler
Fraunhofer IMM, Carl-Zeiss-Str. 18-20, 55129 Mainz, Germany | www.imm.fraunhofer.de | *Contact: sisi.li@imm.fraunhofer.de

BACKGROUND

Polymerase chain reaction (PCR) is a commonly used technique and gold standard for medical diagnosis of many infectious diseases, e.g. current corona pandemic. Real-time PCR systems available on the market so far have some limitations. In addition to high-cost of the instrument, the PCR test requires at least 30 minutes. In order to be able to directly track the route of transmission and effectively suppress the spread, simpler, faster, and more accurate tests are needed to speed up the necessary preventive quarantine and medical treatment decisions. At the same time, if the cost per test is significantly reduced, it will be economically possible that vulnerable and high-risk groups of people can be regularly examined to prevent infection.

RESULTS

Fraunhofer IMM has developed a smart and reliable real-time PCR system based on the moving liquid plug concept (Fig. 1). This system enables an ultra-fast PCR capable of running 30 cycles with real-time fluorescence detection in as fast as 6 minutes. The module consists of an injection molded disposable polycarbonate chip that has an inlet to load the PCR reaction reagents and the meandering fluidic channels with a closed air reservoir at the distant end. The chip is placed above three individually controlled heating zones (Fig. 2). During operation, these zones are constantly heated to the required processing temperatures of the PCR, and the PCR reagent plug is moved back and forward with a syringe pump pushing against a dead end. Excitation is enabled by high power LEDs combined with filters. A conventional USB camera allows detection of the plug position inside the chip. In addition, the camera is also capable of real-time measurement of fluorescent dyes or probes in the plug (Fig. 3). This new concept omits the cyclic heating and cooling process used in common PCR machines and, hence, leads to an exceptionally fast temperature change in the PCR reactions. The reliability of the demonstrator has been proven in several R&D projects. Recently we test SARS-Cov (including SARS-COV-2) on this system, the result shows that while maintaining ultra-fast speed, the sensitivity is not inferior to the commercial instrument (Fig. 4).

Acknowledgment

This project is funded by the Carl Zeiss Foundation and the Ministry of Science, Education and Culture of Rhineland-Palatinate.

Reference

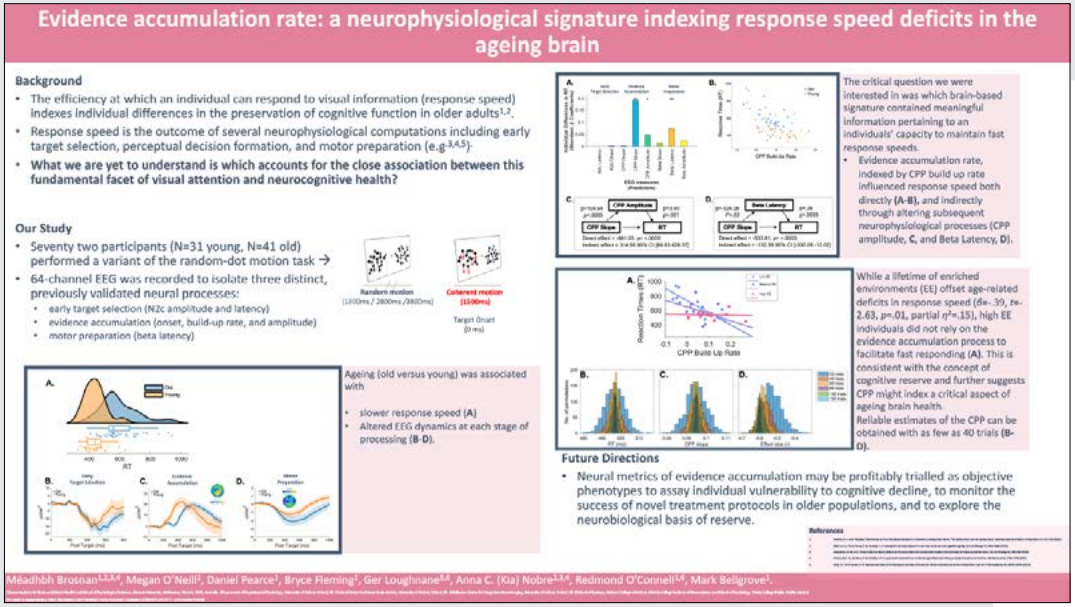
Brunklaus, S.; Hansen-Hagge, T. E.; Erwes, J.; Höth, J.; Jung, M.; Latsa, D.; Strobach, X.; Winkler, C.; Ritzi-Lehnert, M.; Drese, K. S.; Electrophoresis, 33(2012)3222, doi:10.1002/elps.201200259.

LIFE SCIENCES

Evidence accumulation rate: a neurophysiological signature indexing response speed deficits in the ageing brain

Author(s):
Méadhbh Brosnan
Organisation:
University of Oxford
Place of residence:
United Kingdom

Older adults differ vastly in their capacity to maintain healthy cognition in the face of advancing age and age-related neuropathological conditions. The concept of neurocognitive reserve refers to the phenomenon where older adults who have been exposed to enriched environments (EE) can maintain high levels of cognitive performance despite compromised markers of brain health. Individual differences in the preservation of cognitive function are indexed by the efficiency at which an individual can respond to visual information (response speed). The response speed is the outcome of several neurophysiological computations including early target selection, perceptual decision formation, and motor preparation and we are yet to understand which accounts for the close association between this fundamental facet of visual attention and neurocognitive health. Here, we isolate neurophysiological eight metrics indexing these discrete processing stages using extracranial human electroencephalography (EEG) in a cohort of 72 older and younger comparison human participants. Critically, we show that the efficiency at which an individual can formulate a perceptual decision, indexed by the build-up rate of sensory evidence accumulation influence response speed both directly, and indirectly by alerting subsequent neurophysiological processes (decision thresholds and motor preparation). Consistent with the notion that the evidence accumulation process might index a critical aspect of brain health, we found that high EE individuals did not rely on the evidence accumulation process to facilitate fast responding. We show that reliable estimates of evidence accumulation rate can be obtained in under six minutes, and we suggest that neural metrics of evidence accumulation may be profitably trialled as objective phenotypes to assay individual vulnerability to cognitive decline, to monitor the success of novel treatment protocols in older populations, and to explore the neurobiological basis of the reserve.



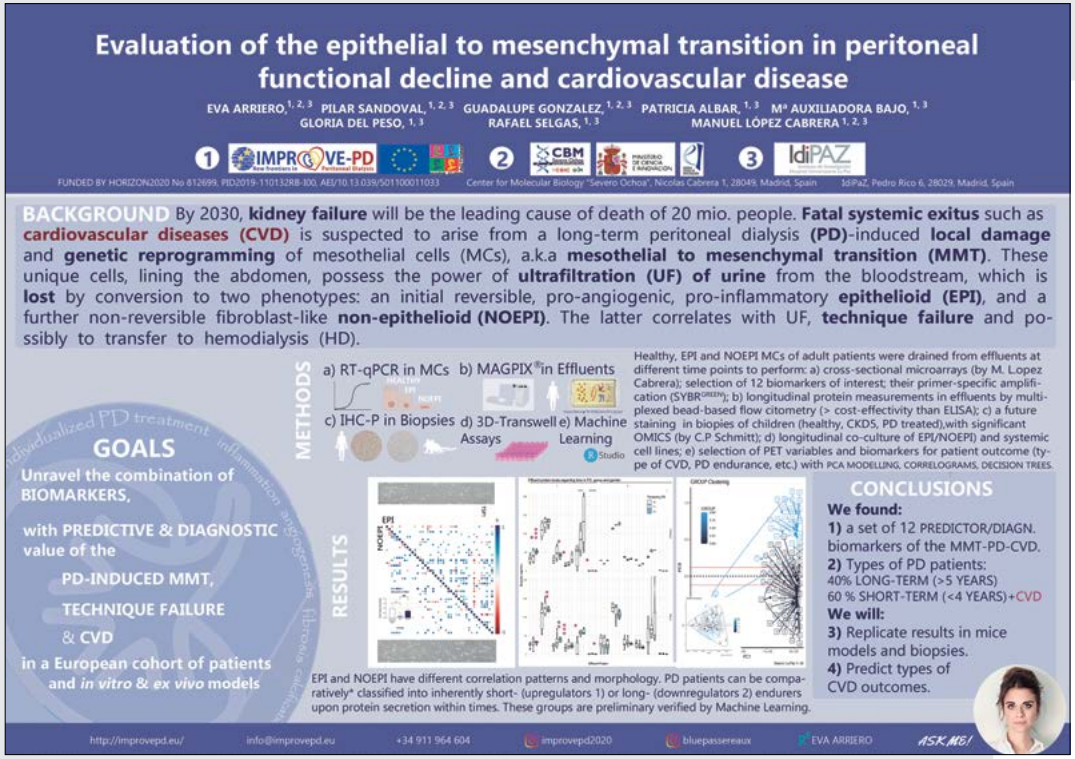
LIFE SCIENCES

Evaluation of epithelial to mesenchymal transition in peritoneal functional decline and cardiovascular disease

Author(s):
Eva María Arriero País
Organisation:
CBMSO
Place of residence:
Madrid, Spain

Prior preliminary results in peritoneal dialysis (PD) patients demonstrated that mesothelial cells are able to undergo mesothelial to mesenchymal transition (MMT) by differential genomic reprogramming, correlating with local damage of the peritoneum and a final ultrafiltration failure.

Therefore, our main goal is to find biomarkers with prediction and diagnosis value of all PD-induced MMT changes and CVD outcomes in PD effluents, biopsies or plasma from a longitudinal retrospective study of a European patient cohort of CKD, PD and HD; correlating them with cardiovascular disease (CVD), systemic inflammation, patient outcome and animal models along with IMPROVE-PD consortium.

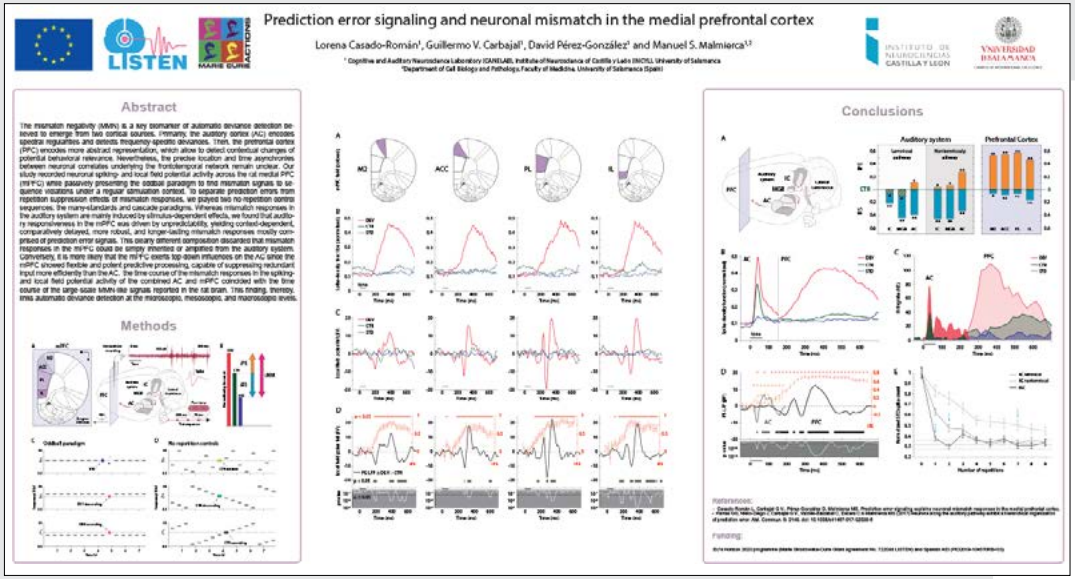


LIFE SCIENCES

Prediction error signalling and neuronal mismatch in the medial prefrontal cortex

Author(s):
Lorena Casado-Román
Organisation:
Institute of Neuroscience of Castilla y León. University of Salamanca.
Place of residence:
Salamanca, Spain

The mismatch negativity (MMN) is a key biomarker of automatic deviance detection believed to emerge from two cortical sources. Primarily, the auditory cortex (AC) encodes spectral regularities and detects frequency-specific deviances. Subsequently, the prefrontal cortex (PFC) encodes more abstract representation, which allows detecting contextual changes of potential behavioural relevance. Nevertheless, the precise location and time asynchronies between neuronal correlates underlying the frontotemporal network remain unclear. Our study recorded neuronal spiking- and local field potential activity across the rat medial PFC (mPFC) while passively presenting the oddball paradigm to find mismatch signals to sequence violations under a regular stimulation context. To separate prediction errors from repetition suppression effects of mismatch responses, we played two no-repetition control sequences: the many-standards and cascade paradigms. Whereas mismatch responses in the auditory system are mainly induced by stimulus-dependent effects, we found that auditory responsiveness in the mPFC was driven by unpredictability, yielding context-dependent, comparatively delayed, more robust, and longer-lasting mismatch responses mostly comprised of prediction error signals. This clearly different composition discarded that mismatch responses in the mPFC could be simply inherited or amplified from the auditory system. Conversely, it is more likely that the mPFC exerts top-down influences on the AC since the mPFC showed flexible and potent predictive processing, capable of suppressing redundant input more efficiently than the AC. the time course of the mismatch responses in the spiking- and local field potential activity of the combined AC and mPFC coincided with the time course of the large-scale MMN-like signals reported in the rat brain. This finding, thereby, links automatic deviance detection at the microscopic, mesoscopic, and macroscopic levels.



Reference: Casado-Román L, Carbajal G V., Pérez-González D, Malmierca MS. Prediction error signaling explains neuronal mismatch responses in the medial prefrontal cortex. Deouell L, editor. PLoS Biol. 2020;18: e3001019. doi:10.1371/journal.pbio.3001019

MATHEMATICS

Model Reduction and Numerical Simulation using Moment Models

Author(s):
Julian Koellermeier
Organisation:
KU Leuven
Place of residence:
Leuven, Belgium

Classical fluid equations are inaccurate for a wide range of scientific and engineering applications, e.g., fusion energy reactors as well as atmospheric re-entry of spacecraft and shallow flows. The technological progress of these applications requires advances in modelling and simulation. The equations pose severe simulation challenges, due to their high dimensionality and a wide range of time scales.

The high dimensionality can be addressed by an extended set of fluid quantities via moment models. To deal with the stiffness of the equations, asymptotic-preserving time discretisation methods need to be used. Since both the stiffness and the accuracy of a kinetic model depend on space and time, the design of numerical methods incorporating fully integrated space-time adaptivity is crucial to allow these methods to be efficiently used in real-world applications.

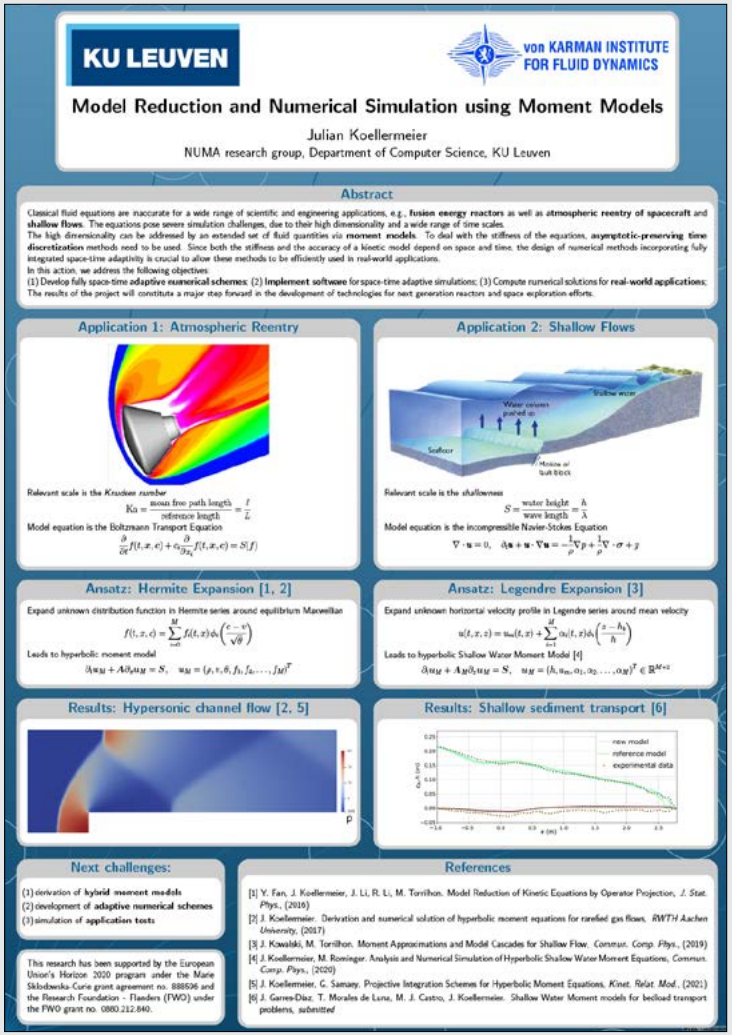
In this action, we address the following objectives:

(1) Develop fully space-time adaptive numerical schemes

(2) Implement software for space-time adaptive simulations

(3) Compute numerical solutions for real-world applications

The results of the project will constitute a major step forward in the development of technologies for next-generation reactors and space exploration efforts.

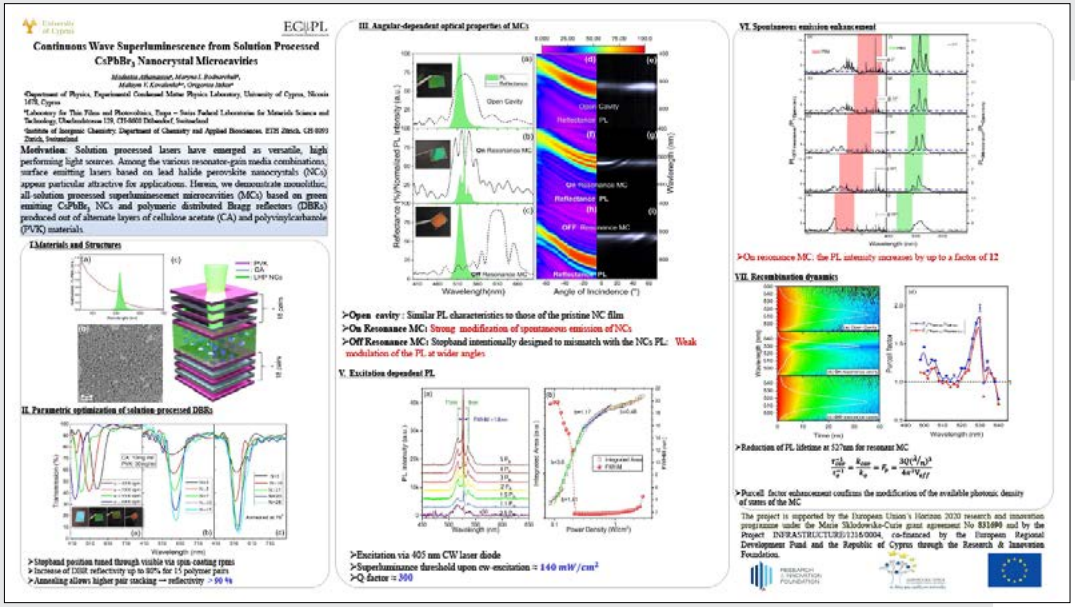


PHYSICS

Continuous Wave Superluminescence from Solution Processed CsPbBr3 Nanocrystal Microcavities

Author(s):
Modestos Athanasiou
Organisation:
University of Cyrpus
Place of residence:
Nicosia, Cyprus

Solution-processed lasers have emerged as versatile, high-performing light sources. Among the various resonator-gain media combinations, surface-emitting lasers based on lead halide perovskite nanocrystals (NCs) appear particularly attractive for applications. Herein, we demonstrate monolithic, all-solution processed superluminescenct microcavities (MCs) based on green-emitting CsPbBr3 NCs and polymeric distributed Bragg reflectors (DBRs) produced out of alternate layers of cellulose acetate (CA) and polyvinylcarbazole (PVK) materials.

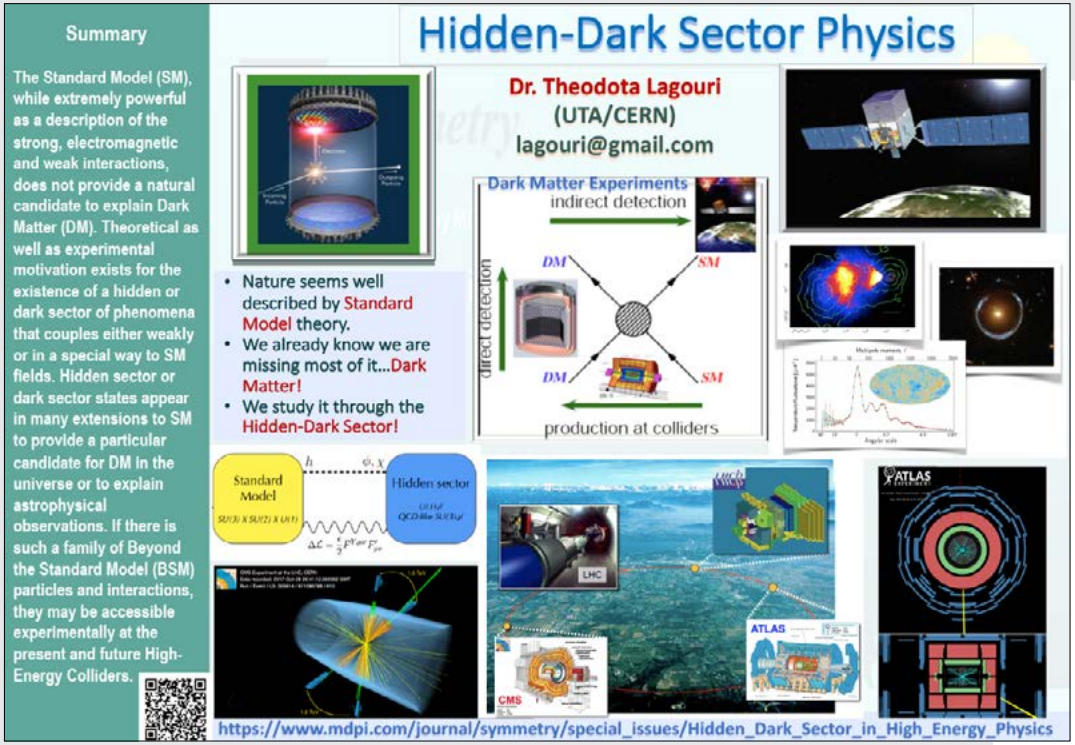


PHYSICS

Higgs Hidden-Dark Sector Physics

Author(s):
Theodota Lagouri
Organisation:
UTA/CERN
Place of residence:
Geneva, Switzerland

The Standard Model (SM), while extremely powerful as a description of the strong, electromagnetic and weak interactions, does not provide a natural candidate to explain Dark Matter (DM). Theoretical, as well as experimental, motivation exists for the existence of a hidden or dark sector of phenomena that couples either weakly or in a special way to SM fields. Hidden sector or dark sector states appear in many extensions to SM to provide a particular candidate for dark matter in the universe or to explain astrophysical observations. If there is such a family of Beyond the Standard Model (BSM) particles and interactions, they may be accessible experimentally at the present and future high-energy Colliders.

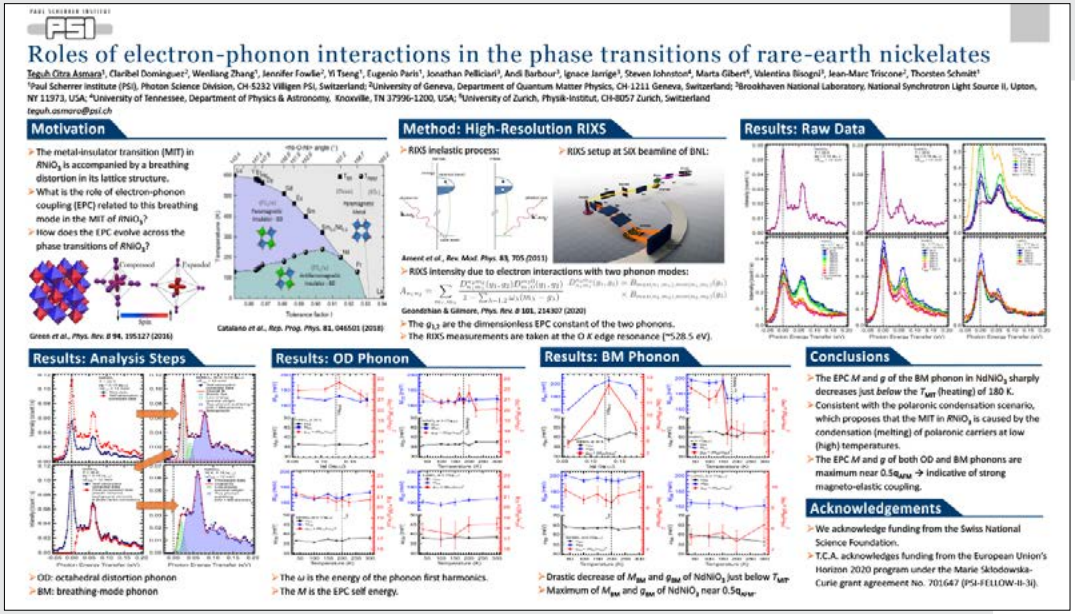


PHYSICS

Roles of electron-phonon interactions in the phase transitions of rare-earth nickelates

Author(s):
Teguh Citra Asmara
Organisation:
Paul Scherrer Institute
Place of residence:
Würenlingen, Switzerland

Rare-earth nickelates (RNiO3) are unusual among transition metal oxides due to their negative charge-transfer electronic configuration of Ni 3d8L (L = oxygen ligand hole) in their paramagnetic metallic state. Most RNiO3 undergo metal-insulating (MIT) and antiferromagnetic (AFM) transitions at low temperatures accompanied by breathing distortion in their crystal structure. This leads to bond disproportionation where expanded NiO6 octahedra (Ni 3d8, no holes on oxygen, and high spin) alternate with collapsed NiO6 octahedra (Ni 3d8L2, an average of two holes on oxygen, and low spin), resulting in an AFM ordering vector of (¼,¼,¼) pseudocubic. This close relationship between breathing distortion and electronic configurations suggests that electron-phonon couplings (EPC) lie at the heart of the MIT in RNiO3. Recent progress in both theory and instrumentation have allowed the use of high-resolution resonant inelastic x-ray scattering (RIXS) to probe this EPC. Here, we use high-resolution RIXS to track the momentum- and temperature-dependent evolution of the EPC across the phase transitions of RNiO3 films for R = La, Nd, and Sm. We find that the EPC of the phonon mode related to the breathing distortion of NdNiO3 reduces significantly by ~20% at the onset of its MIT just below 180 K. This drastic change of EPC is consistent with the polaronic condensation model, which proposes that the MIT of RNiO3 is caused by the condensation (melting) of polaronic carriers at low (high) temperatures. Furthermore, we also find that the momentum-dependent EPC of insulating NdNiO3 becomes maximum at half of the AFM ordering vector, signifying a strong magneto-elastic coupling in this material. These results reveal the intimate connection between electronic, lattice, and spin degrees of freedom in RNiO3 that can be exploited for future advanced functional devices, and demonstrate the capability of high-resolution RIXS in probing and quantifying the electron-phonon interactions in advanced materials.

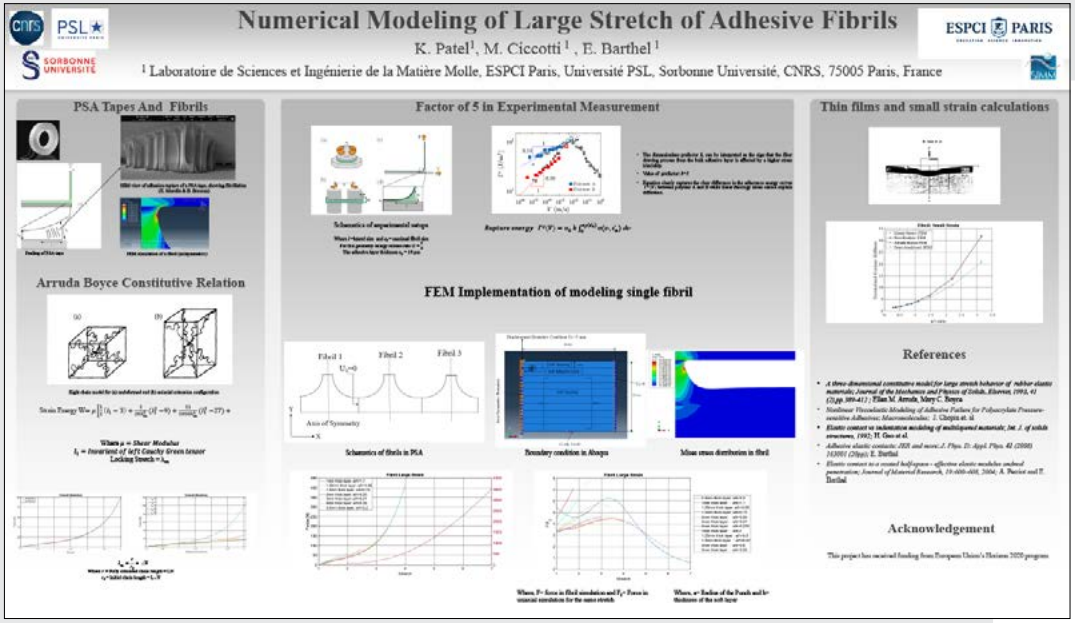


PHYSICS

Numerical modelling of the large stretch of adhesive fibrils seen in PSA tapes

Author(s):
Krupal Patel
Organisation:
ESPCI PARIS
Place of residence:
Paris, France

In a pressure-sensitive adhesive (PSA) tape, adhesion rupture is accompanied by fibrillation and cavitation of the adhesive layer. In this study, we propose a multiscale picture of adhesion rupture, involving a better understanding of fibrillation. Numerically, a single fibril is modelled using the Finite element method using axis-symmetric boundary conditions. An Arruda Boyce, hyper-elastic constitutive law is employed to tackle the large strains associated with the computer modelling of the layer of adhesive. Our final aim is to connect the macroscopic work of fracture and the dissipative properties of the PSA material through a proper description of the large strain deformation of the interface.



PHYSICS

Atmospheric pressure synthesis of metallic particles, via radiofrequency plasma, starting from various bulk metals

Author(s):
Andrada Lazea-Stoyanova
Organisation:
National Institute for Laser, Plasma and Radiation Physics (I. N. F. L. P. R.)
Place of residence:
Bucharest, Romania

To understand the importance of nano and micro metallic particle research topic, one has to be aware of the increase in the global market for nanoparticles from USD 12.35 Billion in 2017 up to USD 25.26 Billion by 2022 [1]. A similar trend is foreseen for micro metallic particles [2].

Hence, our study presents a radiofrequency (RF) plasma jet that operates in argon at atmospheric pressure, suitable for the generation of both nano- and micro-metallic particles from bulk metals (i.e. iron, copper, titanium, zinc or nickel). The main advantage of our synthesis method is its attractiveness which derives from the fact that the metal source is the RF-powered electrode itself, hence, making this physical method a more environmentally friendly and non-toxic technique. For further details see the already published results regarding the synthesis of copper particles using this method [3, 4].

Diverse analysis techniques (Scanning Electron Microscopy (SEM), Energy Dispersive X-ray Spectroscopy (EDS), etc) reveal that nano and micro-oxide metallic particles can be obtained, regardless of the used metal. During the synthesis, and depending on the metal, nanoparticles with diameters between 20 and 50 nm or microparticles with sizes of 1 to 3 m were obtained. Electrical and optical emission spectroscopy measurements show the complexity of the synthesis process and point out to the key parameter to control the synthesis process, namely the RF power.

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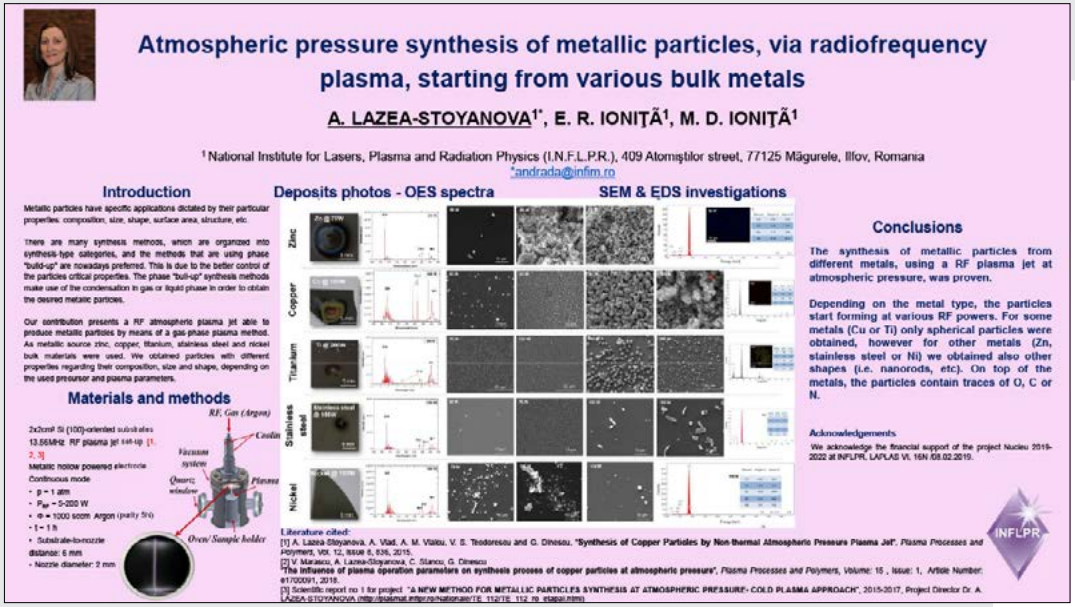
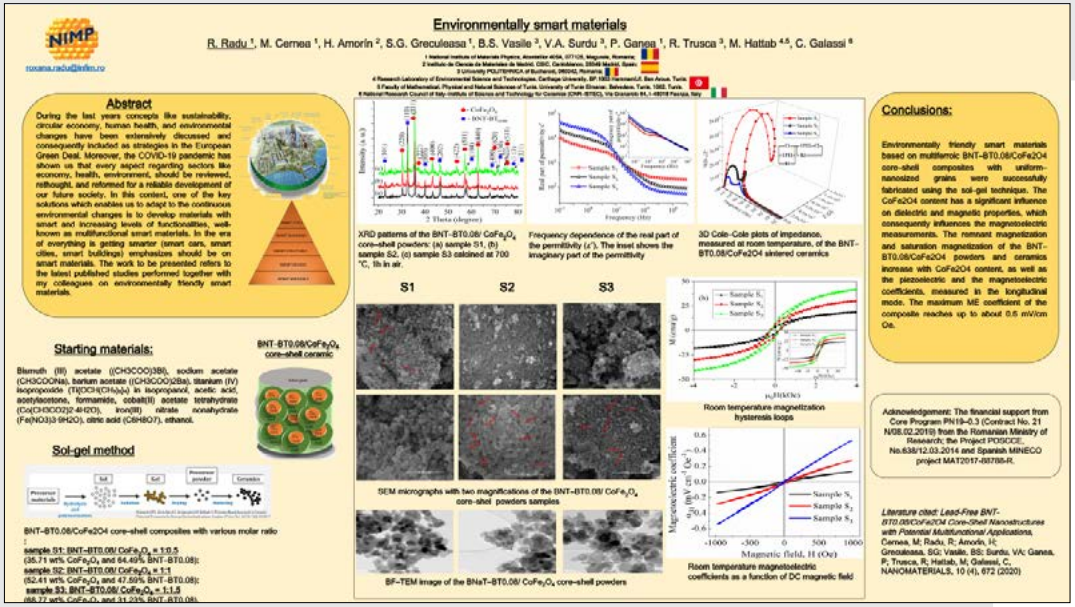


PHYSICS

Environmentally smart materials

Author(s):
Roxana Radu
Organisation:
National Institute of Material Physics
Place of residence:
Magurele, Romania

During the last years, concepts like sustainability, circular economy, human health, and environmental changes have been extensively discussed and consequently included as strategies in the European Green Deal. Moreover, the COVID-19 pandemic has shown us that every aspect regarding sectors like economy, health, environment, should be reviewed, rethought, and reformed for the reliable development of our future society. In this context, one of the key solutions which enables us to adapt to the continuous environmental changes is to develop materials with smart and increasing levels of functionalities, well-known as multifunctional smart materials. In the era of everything is getting smarter (smart cars, smart cities, smart buildings) emphasises should be on smart materials. The work to be presented refers to the latest published studies performed together with my colleagues on environmentally friendly smart materials.

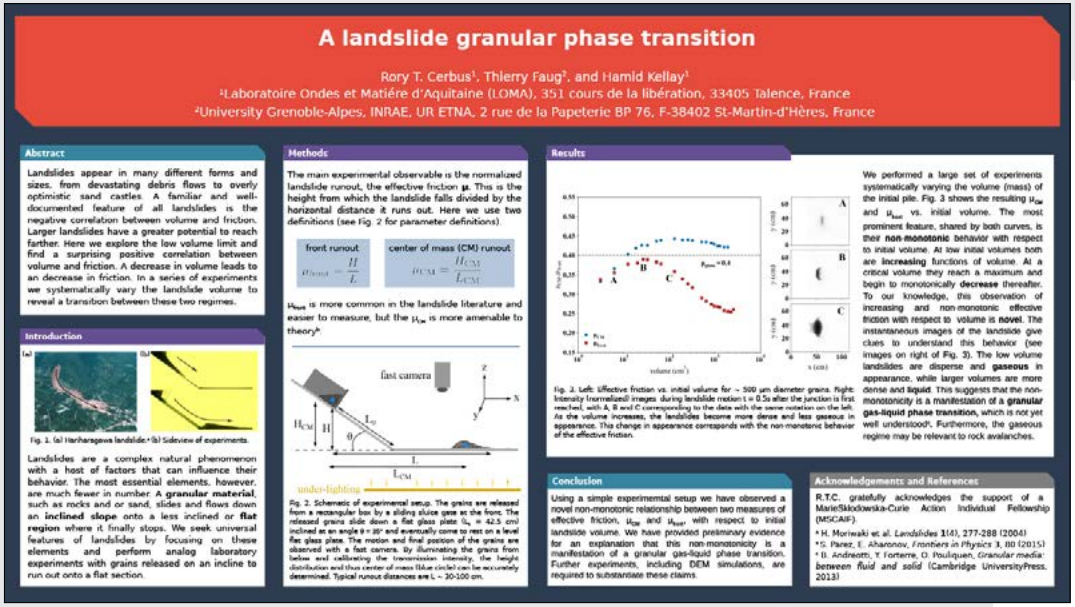


PHYSICS

A landslide granular phase transition

Author(s):
Rory Cerbus
Organisation:
University of Bordeaux
Place of residence:
France

Landslides appear in many different forms and sizes, from devastating debris flows to overly optimistic sandcastles. A familiar and well-documented feature of all landslides is the positive correlation between volume and mobility. Larger landslides have a greater potential to reach farther. Here we explore the low volume limit and find a surprising negative correlation between volume and mobility. A decrease in volume leads to an increase in mobility. In a series of experiments, we systematically vary the landslide volume to reveal a transition between these two regimes.

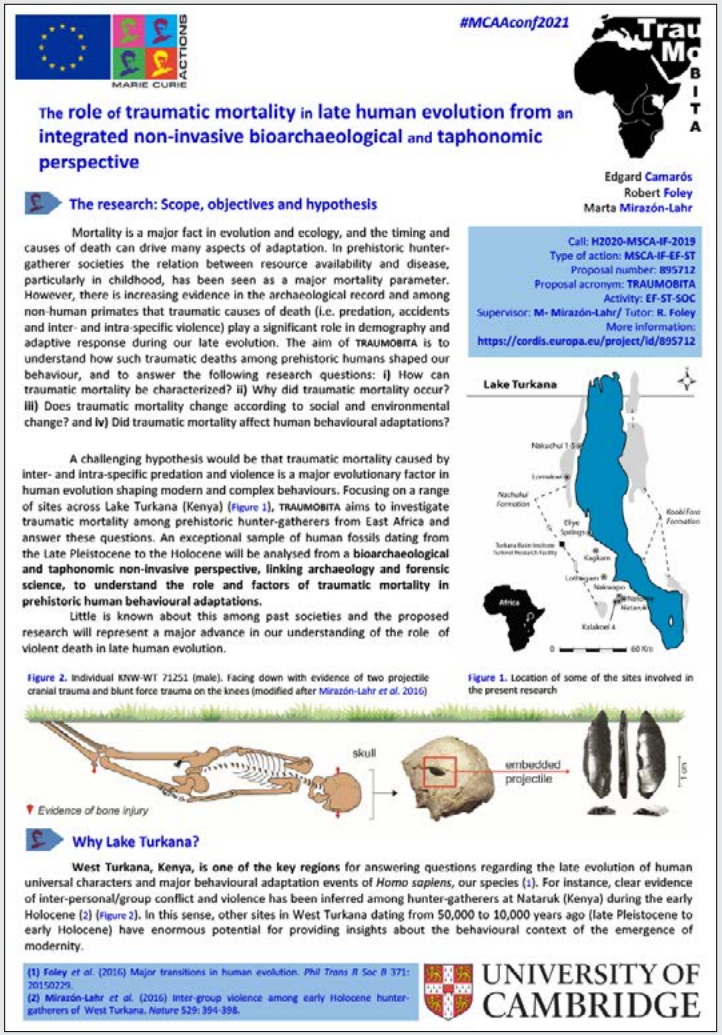


SOCIAL SCIENCES, HUMANITIES AND ARTS

Traumatic mortality in late human evolution from an integrated non-invasive bioarchaeological and taphonomic perspective

Author(s):
Edgard Camarós
Organisation:
University of Cambridge
Place of residence:
United Kingdom

Traumatic death affects our daily life, but how did traumatic mortality affect human behaviour from an evolutionary perspective? TRAUMOBITA aims to understand how traumatic mortality among prehistoric humans shaped our behaviour during the Late Pleistocene to the Middle Holocene. Confirming that how we died had an enormous influence on our ancestors and represents an enormous change in how we understand human societies. Traumatic mortality has an enormous influence among non-human primate social life and environmental adaptations, but not much effort has been dedicated to the study of how such deaths affected the behavioural development of modern humans. Identifying and understanding how humans died is essential for determining the role of violence in shaping our behaviour and, it seems, an equally important factor among our primate relatives. The goal here is to study these behavioural adaptations on the basis of two analytical sections. The first will comprise analysis of human fossils from different key sites from Lake Turkana (Africa): the region is known as the cradle of humankind and the archaeopaleontological record is an essential one for reconstructing our own evolutionary path. The second will be dedicated to the integration of forensic science into taphonomic study of human fossils, in addition to the development of new non-invasive methods based on virtual analysis and experimentation. The data obtained from this approach will facilitate the identification and the characterisation of traumatic mortality in the archaeological record, in order to integrate our results into the study of past societies to determine which behavioural changes are related to traumatic mortality. The research is an integrated analysis that guarantees the interdisciplinary and innovative nature of the project. Little is known on the role of traumatic mortality in human behavioural adaptations, and therefore the project will represent a major advance.

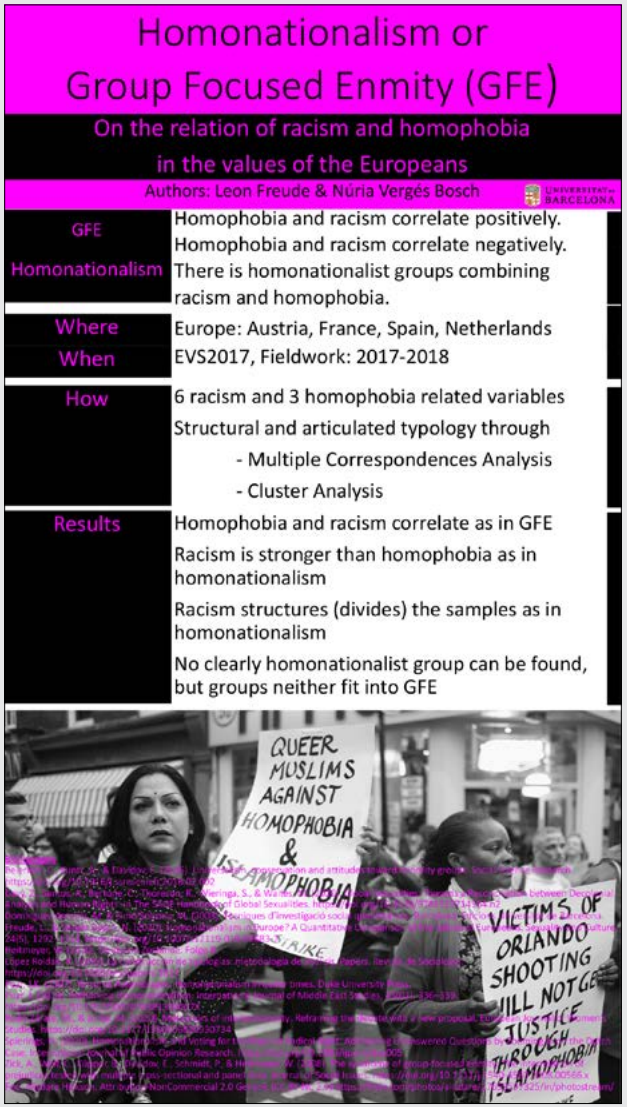


SOCIAL SCIENCES, HUMANITIES AND ARTS

Group enmity syndrome and/or Homonationalism? The articulation of racism and homophobia in the values of the Europeans

Author(s):
Leon Freude
Organisation:
Universitat de Barcelona
Place of residence:
Barcelona, Catalonia

Social science identified racism and homophobia as two of the important challenges for contemporary societies. Group-focused enmity (GFE) and homonationalism represent two key concepts that are opposed concerning their understanding of the relationship between racism and homophobia. In this presentation, we seek to analyse this relationship of racism and homophobia in the population of Austria, France, Spain and the Netherlands, based on data from the European Values Study (EVS) 2017. Methodologically we constructed a structural and articulated typology, combining correspondence and classification analysis. Our results lead us to partially confirm the adequacy of both GEF and homonationalism to explain the relationship between racism and homophobia. On the one hand, racism was higher than homophobia in all groups. On the other hand, we obtained a moderately racist and little homophobic group, another racist and homophobic, and only in a very minority group were their trends towards a genuinely inclusive society.



Mirror installations

Author(s):
Maria Bostenaru-Dan
Organisation:
"Ion Mincu" University of Architecture and Urbanis
Place of residence:
București (Sectorul 3)

At the exhibition 'Spazi Aperti at the Accademia di Romania a Roma', the author developed an installation, based on a photograph from Rome and a mirror. During the pandemic crisis, the exhibition has been redone in Bucharest using images from Maramures county, a place full of tradition in Romania.

The poster presents the installations and places them in the context of mirror installations, be them from the Italian 1960s kinetik art as present in the Novecento museum in Milan, the arte povera in the contemporary art museum next to the Accademia di Romania a Roma, or Olafur Eliasson's installations as in Baroque in Vienna, also at the time of the stay at Accademia di Romania a Roma. This way an exhibition rooted in Italian tradition has been converted to Romanian space. Both variations included seeing the author reflected in the context of the photograph. In the case of the Romanian variation this was done including the Getty challenge of redoing artworks and made use of the oval shape of the mirror and the painting in oval framing of Revolutionary Romania by C.D. Rosenthal which features folk art as the heritage of Maramures is.

SOCIAL SCIENCES, HUMANITIES AND ARTS

Imitations and inTeractions in the Eastern Mediterranean

Author(s):
Sarah Vilain
Organisation:
Université Paris Nanterre
Place of residence:
France

During the Second Millennium BC, Cypriot ceramics were traded widely throughout the Eastern Mediterranean, leading to the development of imitations as well as innovative productions inspired by Cypriot shapes and motives. Questioning the concept of imitation and its traditionally held theories, the EU-funded ITEM project investigates where, when and why these productions developed and how foreign motifs and techniques were integrated into the local traditions of geographically diverse regions. ITEM aims further to produce a comprehensive study of the social and economic mechanisms involved in the transition from trading connections to cultural exchanges. Ultimately, the project explores the link between the circulation of goods and ideas and the complex processes by which both aspects are interconnected.

ITEM

Imitations and inTeractions in the Eastern Mediterranean

Sarah Vilain[1]

Marie Skłodowska-Curie Fellow (December 2020-November 2022)
Université Paris Nanterre - UMR 7041 ArScAn - HAROC[2]

IMITATION, INSPIRATION, INFLUENCE

The project ITEM is a diachronic and multi-regional reassessment of mechanisms at work in the development of imitations and productions inspired by Cypriot pottery in the Eastern Mediterranean during the Second Millennium BCE (Fig. 1). The project questions when imitations developed, why they were elaborated, who made them, what their functions were and how foreign motifs and know-how were adopted in the local traditions. ITEM also evaluates how the imitation process is linked to the development of trading connections and assesses their progressive evolution into cultural exchanges during the Middle and Late Bronze Ages (c. 1750-1200 BCE).

Fig. 1. The distribution of imitations of Cypriot wares in the Eastern Mediterranean ©Sarah Vilain

Fig. 2. Cypriot juglet and its imitations in stone and glass (a. MMA 12.181.264, courtesy of the Metropolitan Museum of Art, New York, Rogers Fund, 1912; b. AO10721 ©Musée du Louvre / Franck Raux; c. EA1099,1229.93, courtesy of the British Museum ©Sarah Vilain; d. EA 22819 ©The Trustees of the British Museum)

A TECHNOLOGICAL STUDY

The project relies on a corpus of artefacts from both archaeological excavations and museum collections. The cautious examination of the assemblages is completed by a technological study of the pottery fabrics and the macro-traces (Fig. 3) in order to pinpoint which features are part of the Cypriot tradition and which ones belong to the local craftsmanship.

References:

Vilain, S. (2019), "Is imitation the sincerest form of flattery? New light on local productions inspired by Cypriot wares at Tell el-Dab'a", in M. Bietak & S. Prell, (éds.), *The Enigma of the Hyksos, Volume I*, CAENL 9, Harrassowitz, Wiesbaden, p. 305-315.

Vilain, S. (2018), "Imitations et productions locales influencées par la céramique chypriote *White Painted Pendent Line Style* à Tell el-Dab'a", *Egypt & the Levant* XXVIII, p. 497-505.

A HOLISTIC APPROACH

ITEM develops five complementary key research axes:

1) From concepts to theories
Notions of copy, imitation, inspiration and influence are explored through the varied scopes of archaeological, anthropological and sociological theories to offer new perspectives on the archaeological material.

2) From occasional contacts to trading connections
This axis scrutinises the development of trading connections between Cyprus and the Eastern Mediterranean and evaluates their overall evolution.

3) From decorative motifs to techniques
This part appraises how shapes, motifs and techniques were adapted in different raw materials, such as clay, stone or glass (Fig. 2), in order to clarify the complex processes at work in the transfer of know-how and to identify regional variations.

4) From the circulation of goods to the circulation of ideas
Building from 3), this section aims to define if only elements of shape and decoration were adopted from Cyprus, or also the technology, the social functions and the meanings of the objects.

5) From the circulation of ideas to the circulation of people
Relying on both archaeological and epigraphic data, this axis investigates the presence of Cypriot sailors, merchants and craftsmen in the Eastern Mediterranean and questions their role in the diffusion of various ceramic productions.

Fig. 3. a. Clay imitation of a Cypriot juglet (UC11456, courtesy of the Petrie Museum ©Sarah Vilain); b. Incised mark (16 AO 5 ©Musée du Louvre / Sarah Vilain); c. and d. Samples of Cypriot fabrics ©Sarah Vilain

LEARNING ABOUT ANCIENT SOCIETIES TO UNDERSTAND OUR MODERN WORLD

Ultimately, ITEM explores how intercultural encounters shaped human societies throughout the ages.

The main topics of this research - globalisation, mobility, cultural exchanges and diversity - are highly relevant to our modern and ultra-connected world.

Contact: svilain@parisnanterre.fr
Project supervisor: Dr Aline Tenu, CNRS
UMR 7041 - ArScAn - HAROC - aline.tenu@cnrs.fr

Follow ITEM on: facebook.com/MSCITEM
mscitem.hypotheses.org @mscitem

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SOCIAL SCIENCES, HUMANITIES AND ARTS

Resisting isolation: Research with persons with dementia in times of Covid-19

Author(s):
Giulia Frezza
Organisation:
University of Amsterdam
Place of residence:
Amsterdam, The Netherlands

The spread of Covid-19 highly impacted on my MSCA project 'Metaphorical Narratives in Dementia Discourse' (MeNDD). MeNDD research focuses on the potential that persons with dementia themselves bring to dementia discourse by challenging the common stereotypes about dementia and persons with dementia to help to change public views.

The project plan included face-to-face (ftf) activities, interviews and focus group, involving vulnerable groups of persons with dementia in three different countries highly affected by the coronavirus (United Kingdom, the Netherlands, and Italy).

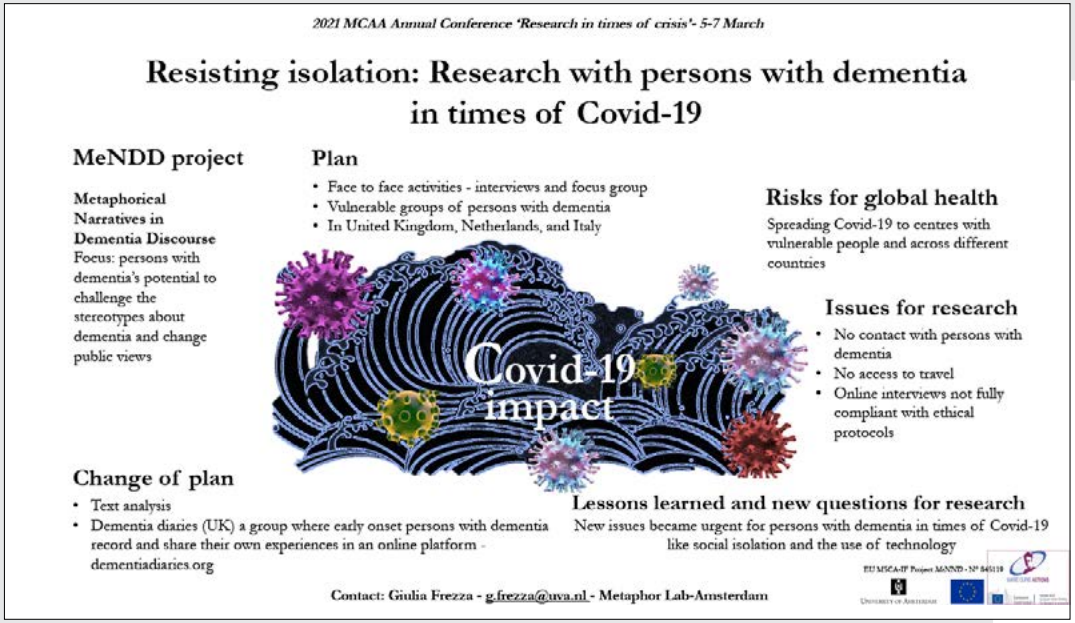
A new plan was set up considering the risks for global health, spreading Covid-19 to centres with vulnerable older people and across different countries, and the new constraints imposed by the crisis. In the new situation, ftf contact with persons with dementia was forbidden, and ad hoc solutions like online interviews were non-fully compliant with ethical protocols. Moreover, there was limited or no access to travel and different regulations in different countries.

Solution

The research methodology shifted from ftf and online interviews to text analysis. In the UK, 'Dementia Diaries' gathers a group where early-onset persons with dementia record and share their own experiences on an online platform (dementiadiaries.org). The group was contacted, and research is now carried out on their diaries.

Lessons learned and new questions for research

Persons with dementia are facing new issues brought by the Covid-19 pandemics which deserve attention and set new goals for researchers and innovators in the forthcoming future. Special consideration in MeNDD's analyses of the diaries is given to themes that became even more urgent for persons with dementia in times of crisis, like social isolation and the use of technology.



The green and digital transition of EU cities: urban innovation ecosystem and urban governance

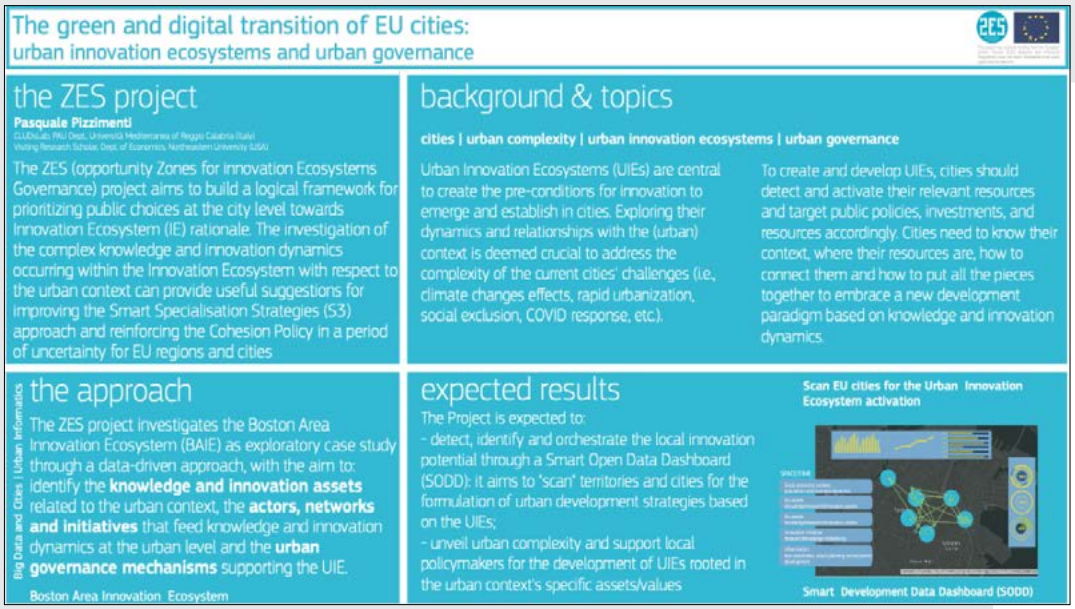
Author(s):
Pasquale Pizzimenti
Organisation:
CLUDsLab - PAU Department Università degli Studi Mediterranea Reggio Calabria, Italy
Place of residence:
Reggio Calabria, Italy

The ZES (opportunity Zones for innovation Ecosystems Governance) project aims to build a logical framework for prioritizing public choices at the city level towards Innovation Ecosystem (IE) rationale. The investigation of the complex knowledge and innovation dynamics occurring within the Innovation Ecosystem with respect to the urban context can provide useful suggestions for improving the Smart Specialisation Strategies (S3) approach and reinforcing the Cohesion Policy in a period of uncertainty for EU regions and cities.

Urban Innovation Ecosystems (UIEs) are central to create the pre-conditions for innovation to emerge and establish in cities. Exploring their dynamics and relationships with the (urban) context is deemed crucial to address the complexity of the current cities' challenges (i.e., climate change effects, rapid urbanisation, social exclusion, COVID response, etc.).

To create and develop UIEs, cities should detect and activate their relevant resources and target public policies, investments, and resources accordingly. Cities need to know their context, where their resources are, how to connect them and how to put all the pieces together to embrace a new development paradigm based on knowledge and innovation dynamics.

The ZES project investigates the Boston Area Innovation Ecosystem (BAIE) as an exploratory case study through a data-driven approach, with the aim to: identify the knowledge and innovation assets related to the urban context, the actors, networks and initiatives that feed knowledge and innovation dynamics at the urban level and the urban governance mechanisms supporting the UIE.



The Project is expected to:

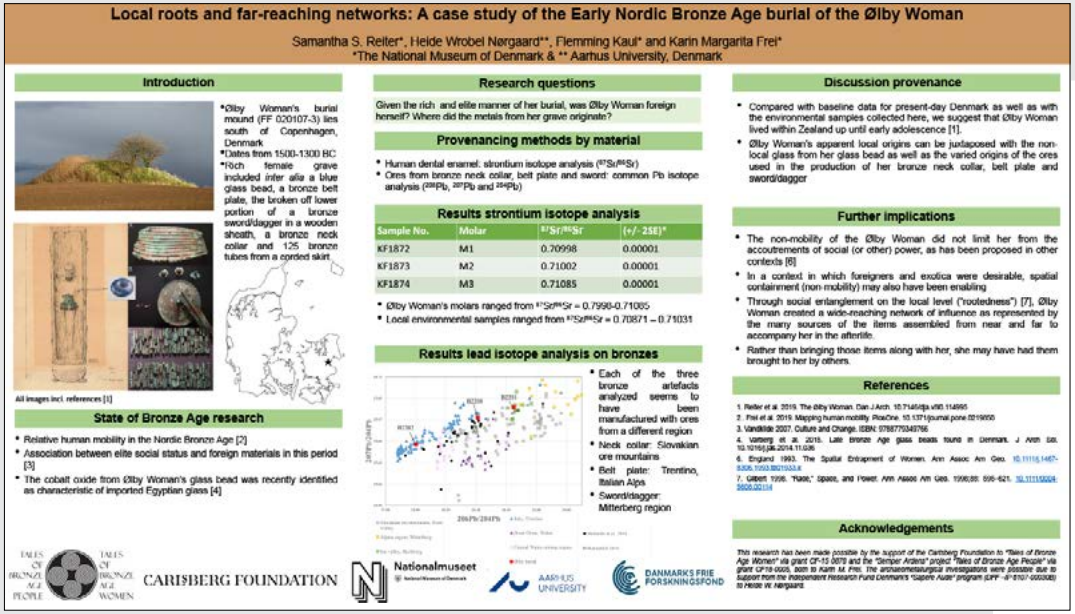
- detect, identify and orchestrate the local innovation potential through a Smart Open Data Dashboard (SODD): it aims to "scan" territories and cities for the formulation of urban development strategies based on the UIEs;
- unveil urban complexity and support local policymakers for the development of UIEs rooted in the urban context's specific assets/values.

SOCIAL SCIENCES, HUMANITIES AND ARTS

Local roots and far-reaching networks: A case study of the Early Nordic Bronze Age burial of the Ølby Woman

Author(s):
Samantha Reiter
Organisation:
The National Museum of Denmark
Place of residence:
Copenhagen, Denmark

The elite Nordic Bronze Age Period II (1500-1300 BC) oak coffin burial known as the Ølby Woman has been the subject of several scientific analyses over the past five years. These have, inter alia, examined the origins of the ores used in the production of her bronze neck collar, sword/dagger and belt plate, the glass of her blue bead and even her own origin through isotopic analyses of her dental enamel. While the results suggest that Ølby Woman may have lived locally within Denmark during her lifetime, she was nonetheless buried with objects originating from many different parts of the Bronze Age World (Northern Italy, Austria, the Carpathian Basin and Egypt). This poster examines this body of provenience data via Gilbert's concept of "rootedness" in order to suggest that Ølby Woman's local roots and high status allowed her to participate in the greater cross-cultural systems which connected the Bronze Age World and that the cultivation of a combination of long-distance and local networks may have been a specific strategy for coalescing social power.



SOCIAL SCIENCES, HUMANITIES AND ARTS

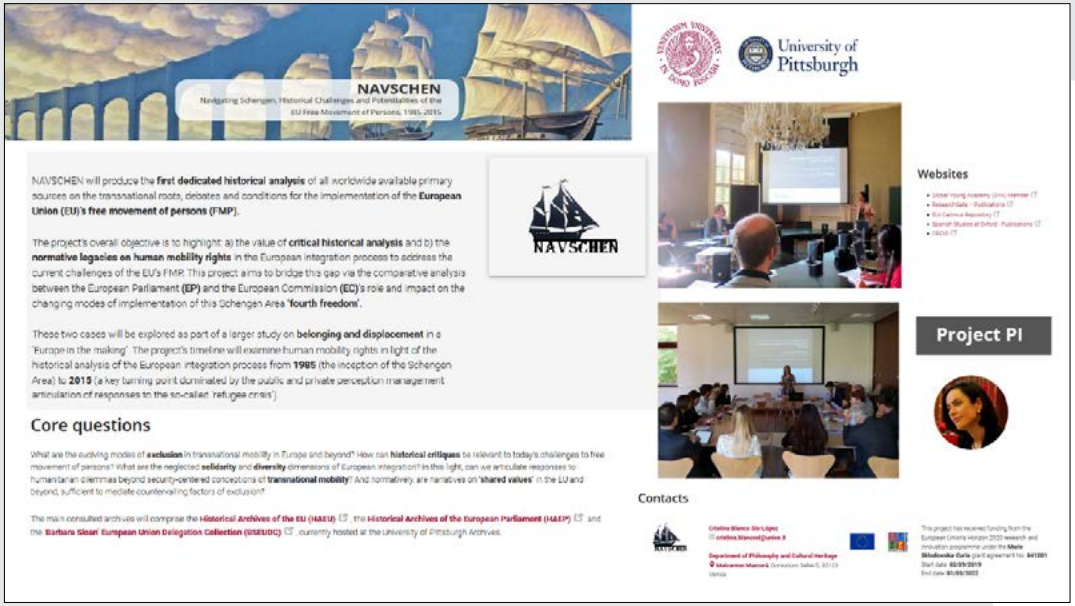
Navigating Schengen: Historical Challenges and Potentialities of the EU's Free Movement of Persons, 1985-2015 (NAVSCHEN)

Author(s):
Cristina Blanco Sío-López
Organisation:
University of Pittsburgh/Ca' Foscari University of Venice
Place of residence:
Pittsburgh (USA)/Venice (Italy)

NAVSCHEN will produce the first dedicated historical analysis of all worldwide available primary sources on the transnational roots, debates and conditions for the implementation of the European Union (EU)'s free movement of persons (henceforth, FMP). The project's overall objective is to highlight: a) the value of critical historical analysis and b) the normative legacies on human mobility rights in the European integration process to address the current challenges of the EU's FMP.

This project aims to bridge this gap via the comparative analysis between the European Parliament (EP) and the European Commission (EC)'s role and impact on the changing modes of implementation of this Schengen Area 'fourth freedom'. These two cases will be explored as part of a larger study on belonging and displacement in a 'Europe in the making'. The project's timeline will examine human mobility rights under the light of the historical analysis of the European integration process from 1985 (the inception of the Schengen Area) to 2015 (a key turning point dominated by the public and private perception management articulation of responses to the so-called 'refugee crisis').

Core questions: What are the evolving modes of exclusion in transnational mobility in Europe and beyond? How can historical critiques be relevant to today's challenges to the free movement of persons? What are the neglected solidarity and diversity dimensions of European integration? In this light, can we articulate responses to humanitarian dilemmas beyond security-centered conceptions of transnational mobility? And normatively, are narratives on 'shared values' in the EU and beyond, sufficient to mediate countervailing factors of exclusion?



In short, NAVSCHEN aims to look back into the past to find inspiring and socially inclusive ways to promote a right to free movement as a fundamental human right in our present.

Private sponsorship of refugees. Insights and lessons from Canada's experience

Author(s):
Ervis Martani
Organisation:
Institut National de la Recherche Scientifique
Place of residence:
Montréal, Canada

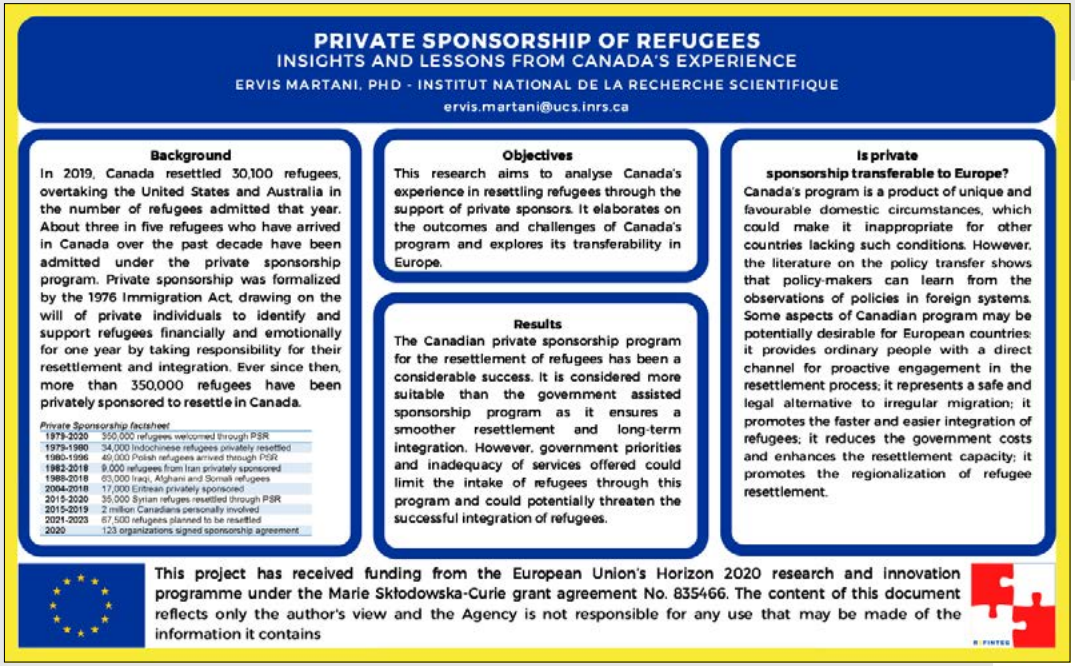
In 2019, Canada resettled 30,100 refugees, overtaking the United States and Australia in the number of refugees admitted that year. About three in five refugees who have arrived in Canada over the past decade have been admitted under the private sponsorship program.

Private sponsorship was formalised by the 1976 Immigration Act, drawing on the will of private individuals to identify and support refugees financially and emotionally for one year by taking responsibility for their resettlement and integration. Ever since then, more than 350,000 refugees have been privately sponsored to resettle in Canada.

Objectives
This research aims to analyse Canada's experience in resettling refugees through the support of private sponsors. It elaborates on the outcomes and challenges of Canada's program and explores its transferability in Europe.

Results
The Canadian program of resettlement of refugees has been a considerable success. It is considered more suitable than the government-assisted sponsorship program as it ensures a smoother and long-term integration of refugees. However, government priorities and inadequacy of services offered could limit the intake of refugees through this program and could potentially threaten the successful integration of refugees.

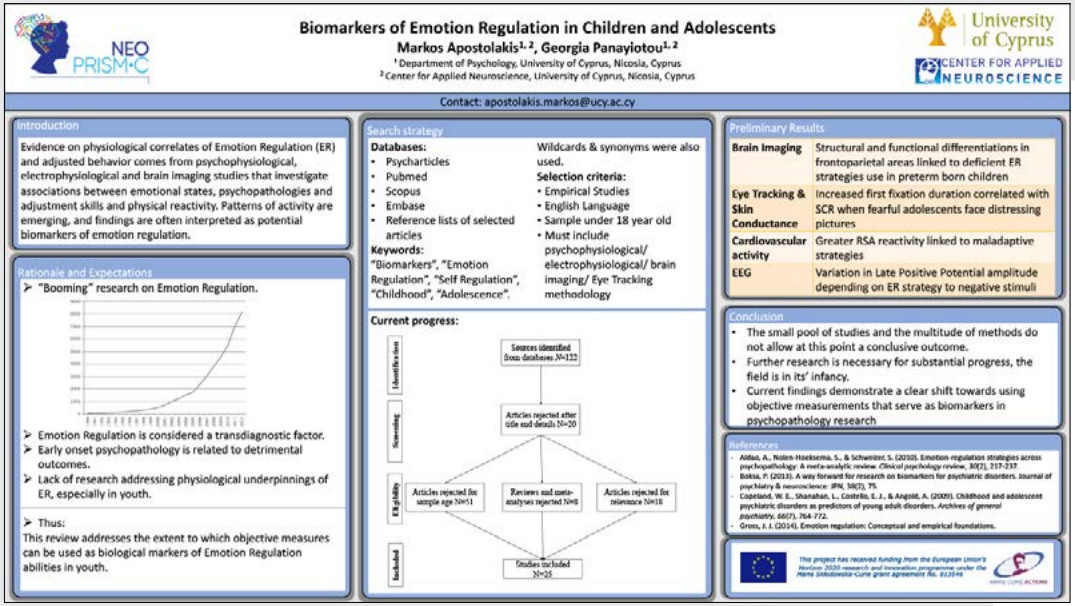
Is private sponsorship transferable to Europe? Canada's program is a product of unique and favourable domestic circumstances, which could make it inappropriate for other countries lacking such conditions. However, the literature on policy transfer shows that policy-makers can learn from the observations of policies in foreign systems. Some aspects of Canadian program may be potentially desirable for European countries: it provides ordinary people with a direct channel for proactive engagement in the resettlement process; it represents a safe and legal alternative to irregular migration; it promotes the faster and easier integration of refugees; it reduces the government costs and enhances the resettlement capacity; it promotes the regionalisation of refugee resettlement.



Biomarkers of Emotion Regulation in Children and Adolescents

Author(s):
Markos Apostolakis
Organisation:
University of Cyprus
Place of residence:
Nicosia

Emotion regulation (ER) is considered a transdiagnostic factor and, specifically, maladaptive strategies are associated more with psychopathology than adaptive strategies. In a similar vein, psychopathology is often characterised by emotion dysregulation. Despite the growth of research on the role of ER in healthy adaptation and psychopathology, evidence on the physiological underpinnings of ER abilities is in its' infancy, though patterns of activity are emerging and are often labelled as biomarkers of ER. Biomarkers are used as objective measures of risk factors for various disorders and illnesses and psychological research has started implementing candidate biomarkers in the diagnosis and treatment of psychiatric disorders. Research on ER includes usually adult samples whereas younger ages are sparsely investigated, which is inversely proportional to the role of ER in later psychopathology and mental health difficulties. Here, the literature on candidate biomarkers of ER abilities in childhood and adolescence was reviewed to identify areas of convergence that may serve as reference points for a more systematic search of ER biomarkers. The focus was on the link between generic ER skills and brain and psychophysiological reactions to emotion eliciting material. Findings are not uniform and suggest that a multimodal approach is more suitable in the search for biomarkers due to the complexity of the reaction to emotion eliciting stimuli and the individual differences in the implementation of ER strategies.



SOCIAL SCIENCES, HUMANITIES AND ARTS

Changing Legacies: A Snapshot of European Law Enforcement's Pandemic Communications

Author(s):
Sarah Young
Organisation:
Erasmus University Rotterdam
Place of residence:
The Netherlands

Emergency communications can be classified into a variety of sub-genres, falling under the larger domain of business communication. For instance, risk communication involves minimizing emergencies before they start through the dissemination of information about possible risks (Kostelnick, 2007); crisis communications involve addressing businesses-borne emergencies (Moon & Rhee, 2012), and disaster communications respond to and communicate typically natural disasters (National Institute of Disaster Management, 2014). One interesting thing about these types of communications is that they are often limited to a department or a group of individuals to provide the communication, and they are often short-term periods of communication. The COVID-19 pandemic has forced many emergency workers to operate in a state similar to what Agamben (2004) called the "state of exception" though, and this has created institution-wide, exceptional communication changes that radically alter the way people work. But how has the pandemic affected law enforcement's technological communications? And what can this say about business communications during the pandemic in general? Based on an analysis of literature and interviews of law enforcement workers across Europe, I argue that some forms of law enforcement communication have obviously suffered during the pandemic such as disaster response training, but there have been some surprising benefits to law enforcement personnel in regards to increased virtual communications.

Ultimately, this poster will illustrate some of the pandemic's challenges and benefits to the law enforcement communication practices and argue that overall, the pandemic has encouraged some police organisations with large legacy practices to challenge the status quo and adopt virtual communications.

SOCIAL SCIENCES, HUMANITIES AND ARTS

Women in Research Ireland: A Platform for Unheard Voices in Research and Academia

Author(s):
Susan Kathleen Fetics
Organisation:
Women in Research Ireland
Place of residence:
Dublin, Ireland

Women in Research Ireland (WIRI) is a registered charity founded in 2017. Based in Dublin, Ireland, WIRI's mission is to build a community that connects and unites women, minorities, non-binary and other underrepresented groups. WIRI provides a safe platform for unheard voices with solution-based conversations. The goal is to raise awareness and create cultural changes. This poster explores WIRI's origins and illustrates the diversity of topics explored at events. WIRI's grass-roots approach empowers the audience with tools and knowledge to respond against obstacles that minority groups commonly face in academia.

SOCIAL SCIENCES, HUMANITIES AND ARTS

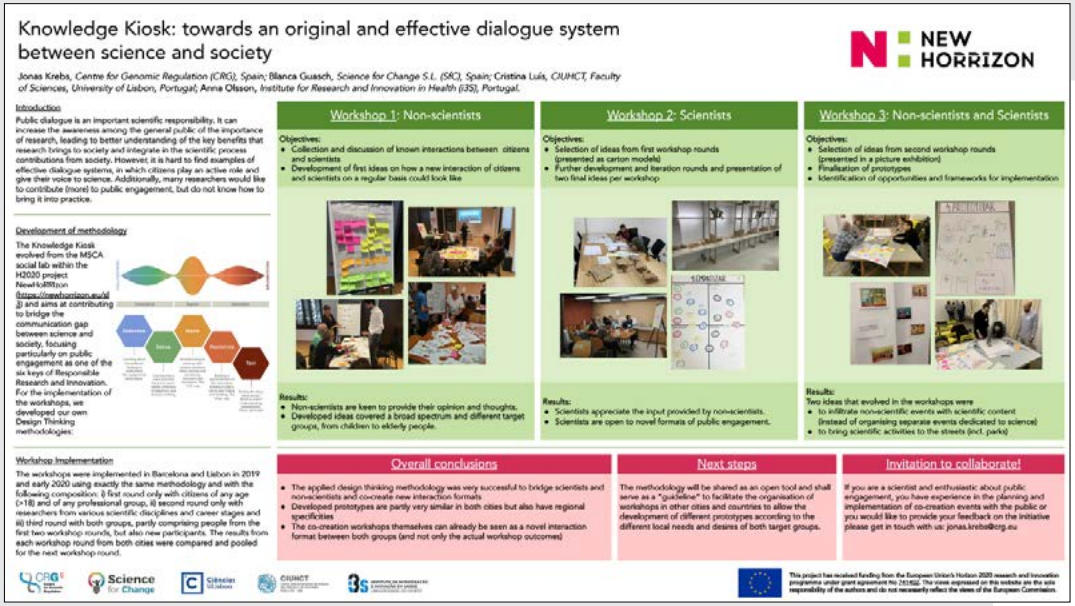
Knowledge Kiosk: towards an original and effective dialogue system between science and society

Author(s):
Jonas Krebs
Organisation:
Centre for Genomic Regulation (CRG)
Place of residence:
Barcelona, Spain

Public dialogue is an important scientific responsibility. It can increase the awareness among the general public of the importance of research, lead to a better understanding of the key benefits that research brings to society and integrate into the scientific process contributions from society. However, it is hard to find examples of effective dialogue systems, in which citizens play an active role and give their voice to science. Additionally, many researchers would like to contribute (more) to public engagement, but do not know how to bring it into practice.

The Knowledge Kiosk started as a series of co-creation workshops to design novel and original dialogue systems between citizens and researchers. For the implementation of the workshops, we developed our own Design Thinking methodologies. The workshops were implemented in Barcelona and Lisbon in 2019 and early 2020 and had the following composition and structure: i) first round with only citizens, who developed first ideas for new interaction formats of citizens and researchers; ii) second round with only researchers to select some ideas from the first workshop and further develop them; iii) third round with both groups to finalise a prototype that could be ideally implemented. The workshop results from both cities were compared and delivered insightful results.

The methodology used in the workshops was very successful and will therefore be shared as an open tool. It shall serve as a “manual” to facilitate the organisation of workshops in other cities and countries to allow the development of different prototypes according to the different local needs and desires of both target groups.



The Knowledge Kiosk evolved from the MSCA social lab within the H2020 project NewHoRRIzon (https://newhorrizon.eu/sl3/) and aims at contributing to bridge the communication gap between science and society, focusing particularly on public engagement as one of the six RRI key elements.

SOCIAL SCIENCES, HUMANITIES AND ARTS

Using Institutional Ethnography to improve policy: an example from STRESS-Mums project

Author(s):
Morena Tartari
Organisation:
University of Antwerp
Place of residence:
Antwerp, Belgium

STRESS-Mums project is a two-year Institutional Ethnography (Smith, 2005, 2006) in four European countries on the legal transition (separation/divorce) from double to single parenthood. The research study investigates how judicial institutions and legal professionals shape this phase of transition. The fieldwork involves lone mothers, legal professionals (attorneys), gender activists, and other professionals. Through discursive interviews and interviews to the double, the study investigates how mothers and professionals "read" and interpret the legal texts translating them in a language that fits the everyday experience of the lone mothers.

Institutional Ethnography (IE) is a feminist research approach. IE allows investigating how texts' interpretations, the translations of these texts done by people to other people, and institutional discourses (Manicom and Campbell 1995) socially organise the knowledge. In other words, IE allows understanding how texts shape the everyday life of people.

The methodological approach focuses on three aspects: the text, the process, the discourse (Murray 2020). In STRESS-Mums, the texts are the law on children custody and other laws and codes that organise the civil trial; the process concerns the active translation of the law by professionals ("specialised readers") and by the mothers ("non-specialised readers"); the discourse is the textually mediated discourse that circulates among institutions, professionals, and mothers. The disjunctures between texts, process, and discourse and the concrete needs of the mothers are highlighted.

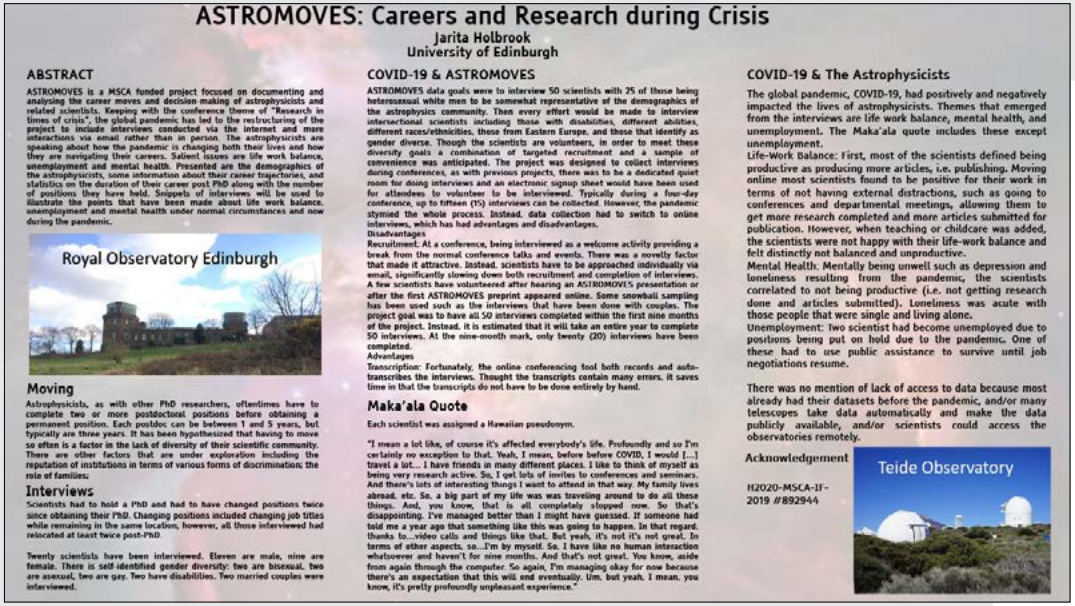
This poster illustrates how IE collects data and identifies disjunctures, and how the research project works in explaining these disjunctures to participants, policymakers, and stakeholders to improve policies and practices. Using the STRESS-Mums project as an example, the poster shows how the IE approach can be applied to other areas of research that need to detect gaps between the people's everyday experience and institutions' ruling functions by texts (e.g., law, regulations, and guidelines).

SOCIAL SCIENCES, HUMANITIES AND ARTS

ASTROMOVES: Careers and Research during Crisis

Author(s):
Jarita Holbrook
Organisation:
University of Edinburgh
Place of residence:
United Kingdom

ASTROMOVES is a MSCA funded project focused on documenting and analysing the career moves and decision-making of astrophysicists and related scientists. Keeping with the conference theme of “Research in times of crisis”, the global pandemic has led to the restructuring of the project to include interviews conducted via the internet and more interactions via email rather than in person. The astrophysicists are speaking about how the pandemic is changing both their lives and how they are navigating their careers. Salient issues are life-work balance, unemployment and mental health. Presented are the demographics of the astrophysicists, some information about their career trajectories, and statistics on the duration of their career post PhD along with the number of positions they have held. Snippets of interviews will be used to illustrate the points that have been made about life-work balance, unemployment and mental health under normal circumstances and now during the pandemic.



ASTROMOVES: Careers and Research during Crisis

Jarita Holbrook
University of Edinburgh

ABSTRACT

ASTROMOVES is a MSCA funded project focused on documenting and analysing the career moves and decision-making of astrophysicists and related scientists. Keeping with the conference theme of "Research in times of crisis", the global pandemic has led to the restructuring of the project to include interviews conducted via the internet and more interactions via email rather than in person. The astrophysicists are speaking about how the pandemic is changing both their lives and how they are navigating their careers. Salient issues are life work balance, unemployment and mental health. Presented are the demographics of the astrophysicists, some information about their career trajectories, and statistics on the duration of their career post PhD along with the number of positions they have held. Snippets of interviews will be used to illustrate the points that have been made about life work balance, unemployment and mental health under normal circumstances and now during the pandemic.

Royal Observatory Edinburgh

Moving

Astrophysicists, as with other PhD researchers, oftentimes have to complete two or more postdoctoral positions before obtaining a permanent position. Each postdoc can be between 1 and 5 years, but typically are three years. It has been hypothesized that having to move so often is a factor in the lack of diversity of their scientific community. There are other factors that are under exploration including the reputation of institutions in terms of various forms of discrimination; the role of families;

Interviews

Scientists had to hold a PhD and had to have changed positions twice since obtaining their PhD. Changing positions included changing job titles while remaining in the same location, however, all those interviewed had relocated at least twice post-PhD.

Twenty scientists have been interviewed. Eleven are male, nine are female. There is self-identified gender diversity: two are bisexual, two are asexual, two are gay. Two have disabilities. Two married couples were interviewed.

COVID-19 & ASTROMOVES

ASTROMOVES data goals were to interview 50 scientists with 25 of those being heterosexual white men to be somewhat representative of the demographics of the astrophysics community. Then every effort would be made to interview intersectional scientists including those with disabilities, different abilities, different races/ethnicities, those from Eastern Europe, and those that identify as gender diverse. Though the scientists are volunteers, in order to meet these diversity goals a combination of targeted recruitment and a sample of convenience was anticipated. The project was designed to collect interviews during conferences, as with previous projects, there was to be a dedicated quiet room for doing interviews and an electronic signup sheet would have been used for attendees to volunteer to be interviewed. Typically during a four-day conference, up to fifteen (15) interviews can be collected. However, the pandemic stymied the whole process. Instead, data collection had to switch to online interviews, which has had advantages and disadvantages.

Disadvantages

Recruitment: At a conference, being interviewed as a welcome activity providing a break from the normal conference talks and events. There was a novelty factor that made it attractive. Instead, scientists have to be approached individually via email, significantly slowing down both recruitment and completion of interviews. A few scientists have volunteered after hearing an ASTROMOVES presentation or after the first ASTROMOVES preprint appeared online. Some snowball sampling has been used such as the interviews that have been done with couples. The project goal was to have all 50 interviews completed within the first nine months of the project. Instead, it is estimated that it will take an entire year to complete 50 interviews. At the nine-month mark, only twenty (20) interviews have been completed.

Advantages

Transcription: Fortunately, the online conferencing tool both records and auto-transcribes the interviews. Thought the transcripts contain many errors, it saves time in that the transcripts do not have to be done entirely by hand.

Maka'ala Quote

Each scientist was assigned a Hawaiian pseudonym.

"I mean a lot like, of course it's affected everybody's life. Profoundly and so I'm certainly no exception to that. Yeah, I mean, before before COVID, I would [...] travel a lot... I have friends in many different places. I like to think of myself as being very research active. So, I get lots of invites to conferences and seminars. And there's lots of interesting things I want to attend in that way. My family lives abroad, etc. So, a big part of my life was was traveling around to do all these things. And, you know, that is all completely stopped now. So that's disappointing. I've managed better than I might have guessed. If someone had told me a year ago that something like this was going to happen. In that regard, thanks to...video calls and things like that. But yeah, it's not it's not great. In terms of other aspects, so...I'm by myself. So. I have like no human interaction whatsoever and haven't for nine months. And that's not great. You know, aside from again through the computer. So again, I'm managing okay for now because there's an expectation that this will end eventually. Um. but yeah. I mean, you know, it's pretty profoundly unpleasant experience."

COVID-19 & The Astrophysicists

The global pandemic, COVID-19, had positively and negatively impacted the lives of astrophysicists. Themes that emerged from the interviews are life work balance, mental health, and unemployment. The Maka'ala quote includes these except unemployment.

Life-Work Balance: First, most of the scientists defined being productive as producing more articles, i.e. publishing. Moving online most scientists found to be positive for their work in terms of not having external distractions, such as going to conferences and departmental meetings, allowing them to get more research completed and more articles submitted for publication. However, when teaching or childcare was added, the scientists were not happy with their life-work balance and felt distinctly not balanced and unproductive.

Mental Health: Mentally being unwell such as depression and loneliness resulting from the pandemic, the scientists correlated to not being productive (i.e. not getting research done and articles submitted). Loneliness was acute with those people that were single and living alone.

Unemployment: Two scientist had become unemployed due to positions being put on hold due to the pandemic. One of these had to use public assistance to survive until job negotiations resume.

There was no mention of lack of access to data because most already had their datasets before the pandemic, and/or many telescopes take data automatically and make the data publicly available, and/or scientists could access the observatories remotely.

Acknowledgement

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Teide Observatory

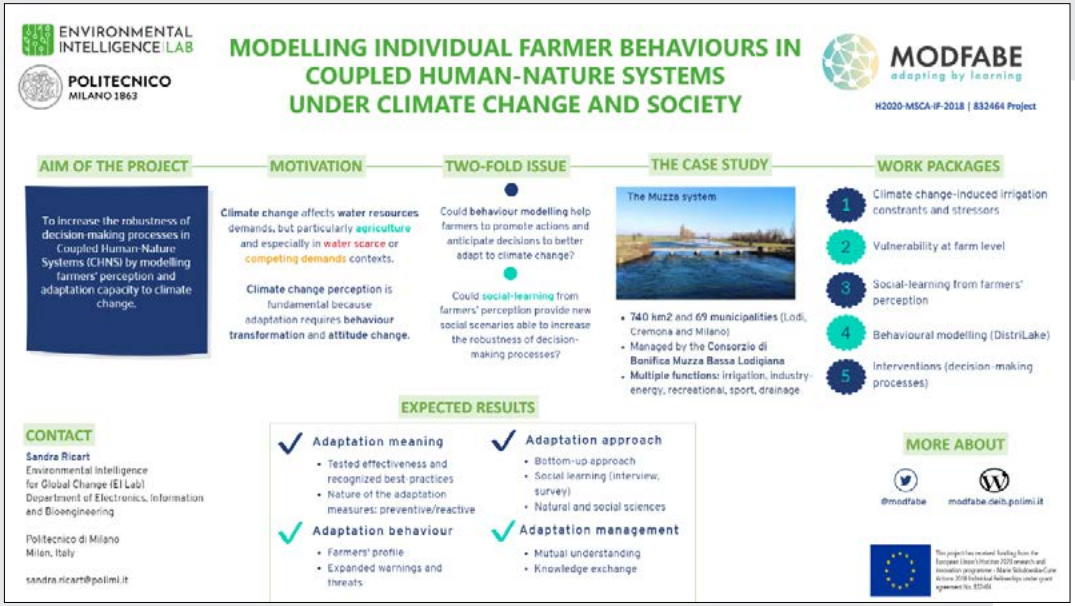
SOCIAL SCIENCES, HUMANITIES AND ARTS

Modelling individual farmers behaviours in Coupled Human Natural Systems under changing climate and society (MODFaBe)

Author(s):
Sandra Ricart
Organisation:
Politecnico di Milano
Place of residence:
Milan, Italy

Climate change and water resources governance represent two necessarily interdisciplinary topics in which the natural and social sciences must be integrated. Assuming water flows as physical, social, political, and symbolic matters, it is necessary to entwining these domains in specific configurations in which water users, managers, and decision-makers could be directly involved. Social learning is considered an important issue in achieving this goal by promoting new understanding or shared meaning to (1) increase adaptive capacity, (2) build trust and collaborative problem solving, and (3) ensure better co-working. The perception of climate change is fundamental for two important reasons: first, because it constitutes a key component of the socio-political context within which policymakers exercise their decisions in socio-ecological systems. The second reason is more direct: climate change adaptation requires behaviour transformation and attitude change from those who make individual and collective choices that have a huge impact on the planet's climate balance.

The MODFABE project aims to increase the robustness of decision-making processes in Coupled Human-Nature Systems (CHNS) by modelling farmers' perception and adaptation capacity to climate change. The MODFABE's core is to integrate observational data (farmers' perception) into an existing behavioural model (DistriLake) applied to the management of water supply and demand in Lake Como (Italy) to increase the rationality of farmers' interventions in the decision-making processes considering multiple competing purposes and a multi-objective context. The Muzza system is the case study acting as a test for understanding which driving factors are affecting farmers' perception regarding climate change impacts and how their adaptation capacity affects the management of the CHNS. Results could be extrapolated to other socio-ecological systems and used to reformulate policy recommendations from social-learning to better respond to climate change by considering the preferences shift toward a new equilibrium in decision-making processes.



Spain-Portugal Chapter Activities

Author(s):
Joaquin Capablo
Organisation:
MCAA Spain-Portugal Chapter
Place of residence:
Pamplona, Spain

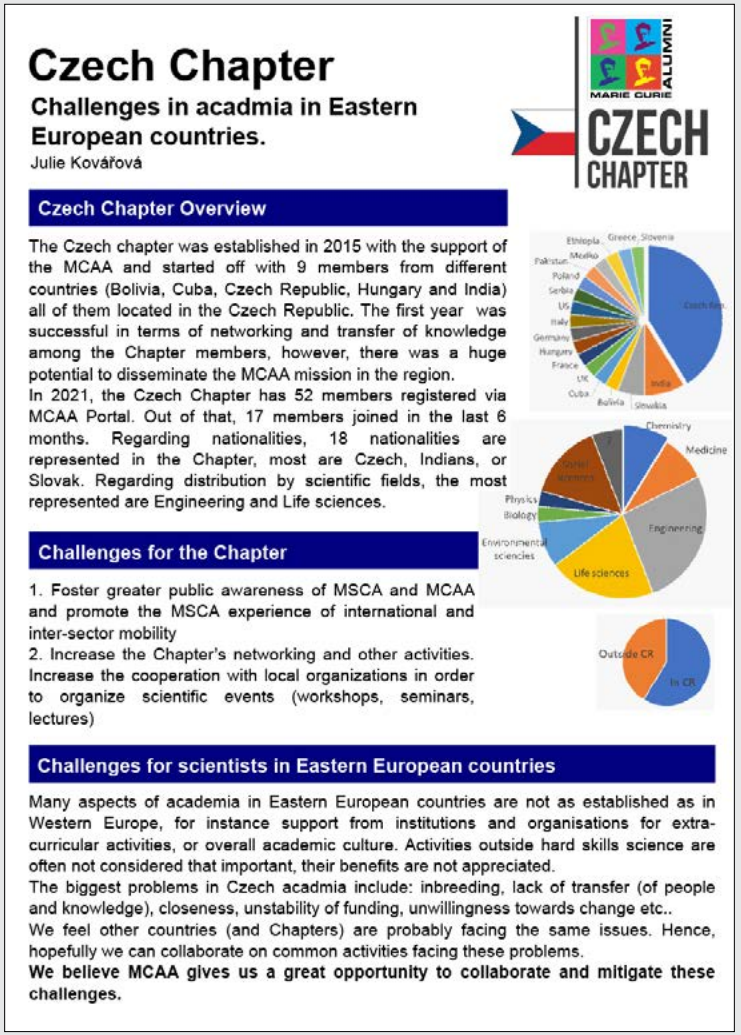
Description of the activities of the MCAA Spain-Portugal Chapter in 2021.

CHAPTERS

Czech Chapter
Challenges in academia in Eastern European countries

Author(s):
Julie Kovářová
Organisation:
MCAA Czech Chapter
Place of residence:
Czech Republic

The Czech Chapter has currently 50 members, thanks to an increase we had in recent months. One of our biggest challenges is how to reach out to potential members, and to make people interested in activities outside their research area. We are keen to hear from other Chapters about their experiences, what helped, what was appreciated by the members etc. Compared to Western European countries, academia in the Czech Republic is facing some additional challenges. The academic culture is often very old-fashioned and lacks enthusiasm for change. In general, the biggest problems of Czech academia are inbreeding, nepotism, unwillingness towards change, nationalism, and refusal of international exchange. Supposedly, other Eastern European countries face similar challenges. Hence, we hope that our MCAA Chapters can work together on mitigating them, prepare workshops on common topics, and support each other. Networking, soft skills training, or mentoring are not considered as important or natural parts of academic culture and training. Hence, often people do not understand their advantages and have sceptical attitudes. We believe MCAA gives us a great opportunity to face these challenges, provide networking activities, soft skills training, and other extra-curricular activities. Through our Chapter, we can offer such opportunities to our members. Step by step, we want to show academics in Czechia the benefits of these activities and hopefully, we can kindle their widening.



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