Catalogue of Knowledge

SCIENCE FIRST

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Overview of Scientific
Research and Art Projects
of the University of Rijeka
2019 - 2021

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Catalogue of Knowledge

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IMPRESSUM

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SCIENCE FIRST

This 'Catalogue of Knowledge' contains an overview of the scientific-research and art projects of the University of Rijeka registered in 2018, and approved for institutional funding up to 2021. It includes an overview of projects financed by external, national and international sources in the academic year 2018/2019, as well as projects funded by the University of Rijeka in the period 2019/2020 as part of the Rijeka European Capital of Culture 2020 (ECOC2020), Campus Neighbourhood. The Catalogue of Knowledge is intended for University of Rijeka employees, students, and associates, as well as representatives of other scientific and higher education institutions as part of a presentation by the University of Rijeka.

In addition to the three project groups presented in this Catalogue of Knowledge, the University of Rijeka also implements additional program funding lines in order to give a comprehensive boost to scientific-research and artistic productivity. In the moment of printing this issue of the Catalogue of Knowledge, the following tenders are underway: UNIRI-plus projects, i.e. scientific-research projects in young scientific-educational areas, and ZIP UNIRI projects adapted to development priorities and specialized strategic goals of the University of Rijeka constituents.

CATALOGUE OF KNOWLEDGE

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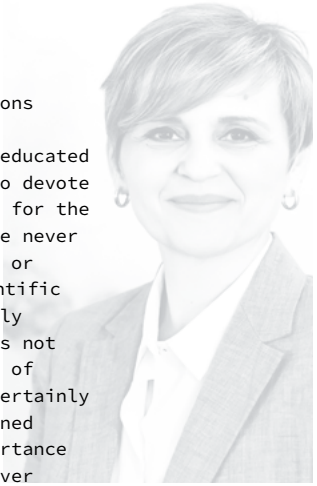
SEMPER MAGIS

A Word from Madam Rector

Prof. Snježana Prijić-Samaržija, Ph.D.,
University of Rijeka Madam Rector



Universities are not simply public institutions whose employees engage in research projects. Universities are the confluence of the most educated people in society, scientists and artists who devote their life experiments to incessant research for the everyday benefit of society. However, we have never been exposed to such movements that disprove or relativize science in favour of pseudo-scientific and dogmatic ideologies, and which are falsely represented as critical or pluralistic. It is not necessary to mystify or romanticise the role of universities and their research, but it is certainly necessary to oppose the nameless and unreasoned culture of ignorance that questions the importance of universities and the sciences. We must never lose sight of Goethe's words: 'There is nothing more frightening than ignorance in action.'

I deeply believe that there is no alternative to science and scientific research. There will be no hope for us should we falter in our belief in the value of education and science, and in the public good that only education and science can bring. If we stop believing, we will lose our greatest fortune in these times of crisis. Disagreement and diversity are an inseparable part of science, and failure is often as important as success.

All of us should consider these thoughts chosen from Marcus Aurelius' 'Meditations'. 'Let us try to be focused on what is ahead of us every minute, with the right fortitude, the will to do good and to be just. Let us not assume that something is impossible if it seems difficult. We can do anything and everything that is not humanly impossible. Should we be warned that we are wrong because we made a mistake or we have a wrong perspective, we should change our attitude. Truth cannot do any harm to anyone, but persistence in self-deception and ignorance can.'

228 PROJECTS

UNIRI projects

UNIRI PROJECTS represent a system of fundamental institutional funding of the University of Rijeka's research activities, conducted on a competitive basis, through the tendering process, and with external independent scientific evaluation. The terms of the tenders include all the relevant development policies of the University of Rijeka, in line with the Scientific Grant Agreement of the University of Rijeka and the Ministry of Science and Education of the Republic of Croatia and were formulated according to the guidelines of the relevant institutional bodies: the International Scientific Council, the Expert Council for Internationalisation, Research and Projects, the Council for Science and the University of Rijeka Senate. In addition to the scientific relevance of the hypotheses, research plans and the development of the scientific-research teams, the elements of the projects' contribution to the total institutional development, knowledge transfer, scientific visibility, inclusion and advancement of doctoral students, and compliance with the S3 Strategy of Smart Specialisation have also been evaluated in project applications, as well as creating preconditions and incentives to involve researchers in external competitive sources of science funding.

The tendering process was initiated in September 2018 and completed in March 2019, and funding for research projects was granted for a three-year period with an obligation to submit annual reports and evaluation of results, with a one-year period for art projects and subsidies. The tendering process allowed a convergence of the institutional terminology in line with the valid acts of the University and ensured the implementation of a system of scientific visibility for project managers and associates in international scientific bases. According to their field of application, the funded projects are divided into natural sciences, technical sciences, biomedical and biotechnical sciences, social sciences, humanities, and arts. There are 228 approved UNIRI projects, and the data presented in this issue was all generated from project applications approved for funding.

Biomedical and Biotechnical Sciences

▼

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074 The Improvement of the Control of Polypharmacy and Adherence to the Prescribed Therapy of Chronic Diseases by Using Information Communication Technologies
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079 Francisella - The Molecular Mechanisms of Adaptation in Amoeba Cells

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Bacterial Pathogenesis – from Research to Clinics

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ABSTRACT

The ability to form biofilm is one of the most important factors of bacterial virulence and the reason for increased resistance to antibiotics. From a clinical point of view, biofilm is responsible for numerous persistent, chronic infections, including urinary tract infections and chronic, non - healing wounds. Biofilm associated infections are difficult to cure because bacteria in biofilm are much more resistant to antibiotics than the same bacteria in planktonic phenotype. In addition, traditional microbiological methods are often insufficiently successful in diagnosing biofilm infections due to an increased number of sessile bacteria and activation of dormancy. Therefore, the aim of the project is to examine the bacterial diversity, population structure and anti - microbial resistance of clinically relevant biofilms using conventional microbiological methods, microbial culturomics and molecular techniques including new generation sequencing. In addition, the anti - microbial effect of bioactive preparations and potential synergies with antibiotics will be investigated. The project will bring together researchers from the fields of clinical and general microbiology, dermatology and infectology, biochemistry and biotechnology, who are facing the problem of bacterial biofilm. Such collaboration can stimulate the translation of expected results into urgently needed approaches in diagnostics, prevention and treatment of biofilm infections.

Morphological and Functional Research of the Iliopsoas Muscle and Deep Back Muscles in Rabbits and Patients with Lower Back Pain

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ABSTRACT

The psoas major muscle originates from the lumbar spine, and joins the iliacus muscle which originates from the iliac fossae to form the iliopsoas muscle (IPM). The IPM is joined to the lesser trochanter of the femur. The IPM is a major flexor of the hip joint, and during the maintenance of an upright stance of the human body, it maintains the lumbar lordosis and stabilises the sacroiliac joint. There are differences in the posture, the way of moving and the body size of a rabbit compared to a human being, a rat and a pig. In human IPM, there is a high percentage of slow as well as fast - twitch muscle fibres which points to both a static and a dynamic role for the muscle in stabilising the lumbar spine and moving the hip joint. Moreover, from the cranial down to the caudal, the direction function of the IPM changes towards the dynamic role. However, the IPM of rats and pigs has the opposite composition compared to humans. Thus, the composition of the IPM suggests its dynamic role with a more stabilising function in the caudal direction. The deep back muscles and the IPM of humans are important stabilisers of the vertebral column, but they also have an important dynamic role. There is a connection between degenerative changes in the spine with changes in the morphology of the listed muscles. There are not so many studies about the association of degenerative changes of the lumbar spine and listed muscles with muscle strength in patients with lower back pain. The aims of this study are to analyse the composition of the IPM of a rabbit and to compare the degenerative changes of the lumbar spine, deep back muscles, IPM and gluteus maximus muscle with the strength of the listed muscles in patients with lower back pain. Muscle fibre types in the IPM of a rabbit will be characterised using monoclonal antibodies for myosin-heavy chain identification. Degenerative changes in humans will be analysed using MRI scans. Muscle strength will be measured using an isokinetic dynamometer. For the estimation of the severity of the lower back pain, specific questionnaires and the Lasègue sign will be used.

The Predictive and Prognostic Role of Immune System Cells, PD-1, PDL-1 and Heat Shock Proteins in Patients with Triple Negative, HER-2 Positive and Neo - adjuvantly Treated Breast Cancer

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ABSTRACT

This study is conceived as a retrospective observational analytical study of three different groups. The first group will be composed of patients with a triple negative, and the second group with HER-2 positive breast cancer, treated and operated on at the Department of General and Oncological Surgery of Clinical Hospital Centre Rijeka, Rijeka and the Department of General and Abdominal Surgery of the OB Pula in the period from 2008 to 2016. The third group is composed of neo - adjuvantly treated patients with locally advanced disease, treated and operated on at the Department of Oncology and Department of General and Oncological Surgery, CHC Rijeka, in the period from 2016 to 2020. The aim of the study involving the first and second group of patients is to perform the immunohistochemical characterisation of tumour inflammatory infiltrate in triple negative and HER-2 positive breast carcinoma, as well as to determine the presence of PD-1 / PDL-1 and heat shock proteins in immune and tumour cells. The aim is to analyse the relationship between CD8, CD4, CD20, FOXP3, CD56 positive cells, tumour associated macrophages, PD-1 / PDL-1 expression and heat shock proteins according to prognostic factors, primarily pT, pN, pTNM and histological grade. The interplay of inflammatory cells and the expression of listed proteins will be analysed, respectively, to determine their potential prognostic significance. The aim of the third part of the study is to determine the possible predictive significance of clinical, histological and immunohistochemical tumour characteristics, expression of PD-1 / PDL-1 and heat shock proteins in immune and tumour cells in response to neo - adjuvant therapy. Furthermore, the aim is to investigate the interconnection of inflammatory cells with pathohistological tumour characteristics. In addition, in the group of patients where no complete response to neo - adjuvant treatment was achieved, the immunohistochemical characterisation of the immune response in the material after completion of neo - adjuvant therapy will be performed. The presence of PD-1 and PDL-1 and heat shock proteins will be determined and compared with the response to neo-adjuvant therapy.

Knowledge, Attitudes and Use of Open Science Tools in Biomedicine

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ABSTRACT

Published scientific information directly affects the health and quality of life in all areas of science, especially in biomedicine. Publication and research in science are changing and, in the context of open science, facilitate the exchange of scientific information by expanding open access and dissemination tools. Research on knowledge, use and attitudes of open science, especially in biomedicine, according to the available literature, is scarce. The aim of this research is to examine the knowledge, attitudes and tools usage in open science with a special emphasis on biomedicine. Specific objectives are to examine: (a) scientists' knowledge and attitudes of the concepts of open science; (b) the usage of open science tools in fields of biomedicine, natural and social sciences; (c) the usage of social networks for the dissemination of scientific information; (d) the practice of publishing and sharing scientific papers in biomedical, natural and social sciences. Methods: In year I: a) Qualitative methods (focus group and the Delphi panel) will be used for the construction of a measuring instrument – a questionnaire for the testing of the first three objectives of the project. A validated questionnaire will be circulated among researchers in the institutions covered by the research. b) An analysis of the practice of publishing and sharing scientific papers in the context of open science will include the dissemination of scientific publications of biomedical, natural and social scientists. In the 2nd year we will translate the questionnaire into English and send it to the corresponding authors of biomedical publications (PubMed). In the 3rd year of research, the collected results will be analysed and prepared for scientific publications. The project is interdisciplinary; within the domain of smart specialisation, it can be classified as being in the field of public health and quality of life, since it investigates and promotes a concept that enables access to scientific information by the general public.

Arf GTPases in the Regulation of Endosomal Trafficking during Cytomegalovirus Infection

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ABSTRACT

The primary mechanism by which cells sense and adapt to the changes in their environment is through modification of the cell membrane composition and surface protein expression. In short time scales, the surface expression of membrane proteins can be regulated only by endocytosis and the subsequent sorting of molecules either to the late endosomal pathway via degradation or to the endosomal recycling compartment from which molecules recycle back to the plasma membrane. Arf proteins are from the family of small GTPases that regulate intracellular trafficking of endocytosed molecules. In an active form they mobilise their effector molecules on the targeted membranes of intracellular compartments where they mediate membrane fusions and fissions and regulate interaction of endosomal compartments with actin cytoskeleton. Arf GTPases, like other small GTPases act as molecular switches. They are active when they are in the GTP - bound form and exchange of GTP with GDP causes their inactivation. This mechanism enables precise control of their function. Considering the importance of Arf GTPases in the regulation of intracellular trafficking of membrane proteins, it is our goal to investigate if cytomegaloviruses (CMV), DNA viruses from the beta herpesvirus family, manipulate Arf cascade in order to escape host immune response and create an environment that is suitable for their replication. Afr6 GTPase regulates endocytosis as well as recycling immunologically essential membrane proteins like MHC class I molecules, and that is why Arf6 will be the focus of our investigations. Considering that cytomegalovirus infection is one of the risk factors for breast carcinoma, we will determine any correlation between CMV infection, expression of Arf proteins in the cancer cells and cancer aggressiveness for different types of breast carcinoma.

Molecular Biomarkers of Cancerogenesis in Laryngeal Squamous Epithelial Lesions

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ABSTRACT

Malignant laryngeal tumours represent a significant public health problem. Therapy for such lesions seeks a multidisciplinary and multimodal approach, despite being mutilating and expensive, while the results of such therapy are still unfortunately not satisfactory, bringing a lowered quality of life to patients. Therefore, early and precise diagnostics are needed, which today can be improved by using the new knowledge in molecular biology for detecting carcinogenesis markers. The hypothesis is that molecular biomarkers can contribute to an early diagnosis of a disease and to an assessment of laryngeal squamous lesions' aggressiveness, consequently improving therapeutic protocols and creating an adequate therapeutic approach for each patient. Continuing the previous project by expanding the biomarker palette (membranous and nuclear EGFR, IMP3, wnt, TGF-& alpha; Ki-67, cyclin D1, p53, MMP1, MMP2 and MMP9, as well as applying TMA technology using immunohistochemical methods and FISH analysis), we strive to find new answers to cancerous processes of proliferation, cell growth, invasion and metastasis. The purpose is to integrate the new knowledge from molecular biology into the classical palette of pathohistological and clinical diagnostic procedures of laryngeal squamous lesions. It is expected that the results of this, and similar research, will be of importance for choosing a therapeutic modality for each patient, for improving local control of the disease resulting in better survival rates, for lowering the aggressiveness of the therapy and for maintaining the patients' quality of life. The topic is multidisciplinary and includes translation research linking pre - clinical and clinical medical sciences, therefore improving co - operation and teamwork within the University. Internationally recognised researchers have confirmed their collaboration on this project, which leads to a better exchange of ideas and knowledge, while also opening new opportunities in education and the advancement of young scientists.

The Role of Brain - resident CD4+ T Cells in Congenitally Infected Mice

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ABSTRACT

Approximately 1% of new - borns are born with the cytomegalovirus (CMV) infection. Consequences of this infection can be particularly harmful, the most common being hearing loss and vision impairment, reduced cognitive abilities and mental retardation. Only 10% of children born with CMV infection develop symptoms, but still more individuals develop long - term disabilities compared with other congenital syndromes (Down, fetal alcohol or spina bifidae). Since it is not possible to do mechanistic investigations of congenital CMV infection in humans, we are using mice as a model. In our previous work we assessed the immune response in the brains of mice infected with CMV. Our work showed that the immune response in the central nervous system (CNS) is essential for the survival of the mice. However, it also causes neurodevelopmental disorders. Furthermore, we have observed that infection of the CNS induces permanent changes in immune cell homeostasis, namely, microglia is essentially polarised for life following infection as T lymphocytes, normally not present in brain, infiltrate the brain during infection and remain for life. If the particular sensitivity of brain tissue and its inability to regenerate neurons is considered, these changes pose a serious threat since these immune cells have the ability to mediate inflammation, but also to destroy brain cells. In our recent work, we have determined that the infection of new - born mice with CMV results in the formation of tissue resident memory CD8+ T cells in the brain, which remain in the brain for life despite the resolution of acute infection. Although these cells are quiescent, they are key for controlling the latent virus, and brain inflammation. We have also shown that besides tissue - resident CD8+ T cells, tissue resident CD4+ T cells also persist in the brain; however, their role is currently unknown. The aim of this research is to characterise tissue - resident CD4+ T cells in the brains of congenitally infected mice, and to determine their role.

Development of New Analytical Methods in the Analysis of Imidacloprid Residues and their Degradation Products in the Olive Orchard Soils of Primorje - Gorski Kotar County

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ABSTRACT

Soil ecosystems are one of the most representative natural indicators of ecosystem pollution because they can contain the residues of many pesticides. Nowadays, the greatest attention is given to neonicotinoid insecticides and imidacloprid as their main representative. Since the concentrations of imidacloprid residues in the soil are very low, often on the threshold of analytical detection, it is very important to develop a highly sensitive analytical method of insecticide extraction and detection. By analysing the insecticide residues, it will be possible to evaluate the exposure of the human population to imidacloprid from the consumption of agricultural products and drinking water. Due to the above - mentioned reasons, this research tends to develop and optimise ecologically acceptable methods of micro - extraction and accelerated solid phase extraction (ASE) of imidacloprid from the soil, which will enable, not only the pre - concentration of imidacloprid, but also the removal of the interfering substances present in the soil matrix. Furthermore, the LC/MS method for detection of imidacloprid residues and its degradation products (5-hydroxy imidacloprid, olefinic metabolite, desnitroimidacloprid and 6-chloronicotinic acid) in the soil will be developed and validated, with the aim of their application, not only in research but also, in routine soil sample analysis. It is to be expected that the results of the proposed study will allow easier extraction, determination of imidacloprid at a low detection limit, simultaneous analysis of a large number of samples with a minimum number of preparation steps, and a reduction of solvent consumption as required by "green chemistry" principles. The established validated method could enable a systematic monitoring of the presence of imidacloprid and its degradation products in the soil, which can then serve as a basis for ensuring the quality of agricultural crops and for the assessment of human exposure to imidacloprid.

The Prevalence of, and Clinical significance of, Hepatitis B Surface Antigen Mutants

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ABSTRACT

The mutations in the S-gene region of HBsAg may result in a failure of HBV detection. Anti-HBc typically persists for life, regardless of the outcome of the infection. Because of increasing awareness of the emergence of the HBsAg escape mutant virus, testing for the presence of HBV DNA in plasma helps define whether patients with serological pattern isolated anti-HBc (negative for both HBsAg and anti-HBs) are harbouring "occult HBV infection" (OBI). OBI may be involved in different clinical contexts. There is a potential risk of HBV reactivation in OBI patients after intense immunosuppression. Also, OBI may be involved in the transmission of the infection by blood transfusion/organ transplantation. In addition, mutations in the HBs region may be responsible for escaping vaccine induced immunity. Considering the above, there is increased awareness of the importance of reliable diagnostics of occult HBV infections. The aim of the present study is to compare the prevalence of OBI among Primorje Gorski Kotar County (PGC) patients and characterise the molecular patterns in HBV genomes. After obtaining the ethics committees' approvals for planned research we collected sera with isolated an anti-HBc profile. Sera were previously tested at the Department of Clinical Microbiology, Clinical Hospital Centre Rijeka and the Department of Microbiology, at the Teaching Institute of Public Health PGC as part of routine HBV diagnostic testing from 2015 to 2017. The presence of HBV DNA was tested in part of the archived sera. In the present study, we plan to test the presence of HBV DNA in the rest of the samples and then perform HBV genotyping and nucleic acid sequence analysis of the S-genes. Afterwards, we will analyse genetic mutations associated with drug resistance. To the best of our knowledge this is the first study on this topic in Croatia and it will improve our knowledge of this clinically important but apparently mysterious entity.

Biological Monitoring of Volatile Aromatic Hydrocarbons Influence (BTEX) on the Health of the Population of Primorje - Gorski Kotar County

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ABSTRACT

Scientific studies have shown that the concentration of volatile aromatic hydrocarbons introduced into the human body correlates with the proximity of human habitation to major city roads and industrial plants. The level of exposure of an individual to environmental pollutants can be determined by biological monitoring. Biological monitoring is the first step in assessing the toxic effects of some pollutants in humans. Because of the above, some areas of the Primorje - Gorski Kotar County are considered to be areas of relative risk for human health because they represent areas that are burdened with the above - mentioned pollutants. The project will include measurements of volatile aromatic hydrocarbons, benzene, ethylbenzene, toluene and xylene isomers (BTEX) in the urine of respondents from developed industrial areas, which will be compared with those in control areas. The data obtained in the urine of the respondents will correlate with the data of concentrations of the same pollutants in the surrounding air. Data obtained from respondents who meet the specificity of this project according to the strict criteria, will be compared with immunological, enzymatic, epidemiological and respiratory data on the health status of respondents. To evaluate nutritional habits, the energy and nutritional value of whole - day meals and the intake of protective nutrients will be determined and results compared with recommended daily intake values. Proper nutrition, especially the Mediterranean diet, can protect the organism from harmful substances if it is rich in various foods, enabling the daily intake of antioxidants, polyunsaturated fatty acids and dietary fibre. The main instrument for collecting data on food choice and the type and quantity of food intake in the examined population is a quantitative method of frequency determination, which will give us data on energy intake, nutrients and protective substances, cholesterol and dietary fibre, and water intake.

The Role of NK Cells in the Control of Urinary Infections in Adults

PROJECT MANAGER

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ABSTRACT

Urinary tract infections (UTI) are one of the most frequent infections in the human population. Although UTI targets all age groups, paediatric and geriatric patients are most commonly affected. It is estimated that more than 180 000 annual births will encounter UTI by the age of 6 years and half of adult women will have at least one episode of UTI in their lifetime. The propensity for recurrence and chronicity of UTI that leads to renal scaring, chronic renal disease and hypertension, coupled with rising anti - microbial resistance of the bacteria that causes UTI, underscore the need for better understanding the pathogenesis of UTI. Currently, augmentation of a body´s defences against UTI are considered as new therapeutic protocols in order to improve patient care. Components of innate immune response are considered as the most important arm of the immune response in anti - bacterial definitions of the urinary tract infection, but their activity mechanisms have not yet been elucidated. Whilst the role of urinary bladder epithelial cells activity in response to uropathogens has been extensively studied in human UTI, the role of infiltrating leukocytes is still largely unknown. The anti - bacterial activity of infiltrating immune cells was mainly investigated through the murine model of UTI and this showed the role of neutrophils and infiltrating monocytes and, in one study only, NK cells in control of UTI. To date, data investigating the role of infiltrating leukocytes in control of UTI in humans is scarce, moreover there is no data on the role of NK cells in humans. We, therefore, propose to analyse the components of the immune response in the urinary tract of adult patients with UTI, with special emphasis on NK cell activity.

MRI Markers for Dementia in Parkinson's Disease

PROJECT MANAGER

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ABSTRACT

Along with the typical motoric symptoms of the disease, Parkinson's disease is characterised by the so - called "non - motoric" symptoms of the early stage, the most important of which is cognitive deficit. This stage of mild cognitive disorder is often followed by dementia. Why patients tend to convert from normal cognition to mild cognitive disorder and then to dementia is unknown. The timeline of occurrence and the dementia rate amongst patients is also unknown. The aim of our research, through using MRI, is to identify neuroimaging predictors of dementia in Parkinson's disease. In this study, we will include 70 examinees from CBC Rijeka with Parkinson's disease that we will monitor with magnetic resonance and carry out cognitive evaluation. The study will include subjects of varying degrees of cognition, on whom we will visualise the cognitive disturbance (or stability) predictors by visualising whether changes in the cortical thickness and surface area, as well as the basal ganglia volume, indicate cognitive dysfunction in patients with Parkinson's. The results of this research will improve the understanding of the cognitive deficit in Parkinson's disease and point to neuroimaging markers associated with dementia. Such findings will enable clinicians to better diagnose the cognitive deficit in Parkinson's disease as well as provide a clearer prognosis regarding the progression of the disease. The results will also enable a better development of therapeutic research aimed at targeting cognitive disorders. We chose MRI because we want to use the simple technique of brain morphology imaging available to patients in clinics, and with the help of the development of new software available to doctors, to improve the analysis of the same. We expect that neuroimaging by analysing thickness and surface area of the cortex and the volume of subcortical nuclei can correlate with dementia predictors and/or signs of cognitive stability and the morphological difference between the subtypes of cognitive deficit.

The Role of Recently Discovered Proteases in Colorectal Cancer Development and Progression

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ABSTRACT

Colorectal cancer is the third most commonly diagnosed malignant tumour and the leading cause of cancer death and therefore represents a field of scientific interest. It is supposed that it occurs as a result of histological and molecular changes in a complex interaction between genetic and (micro)environmental factors. Chronic inflammation is an important risk factor, but molecular mechanisms underlying carcinogenesis in its setting are not elucidated. Our results, as well as those from other groups, determined that the protease, dipeptidyl peptidase (DP)4 and recently discovered DP8 and 9 are involved in the development of inflammatory and metabolic diseases. It was shown that they are involved in the regulation of cell adhesion, migration, apoptosis, and angiogenesis which are key processes in carcinogenesis. The association between the tumour - associated inflammatory cells activity and the modulation of extracellular matrix has been determined, implying their role in the remodulation of the tumour microenvironment, which is a crucial feature of carcinogenesis. However, although there are numerous causal connections, the clinical and biological properties in the orchestration of the progression of chronic inflammation into a malignant process is poorly investigated and results are contradictory. Considering our previous results and experience, we hypothesised that changes in the expression and/or catalytic activity of DP4/8/9 will significantly influence colorectal cancer development and progression. To test our hypothesis, our project goals are: i) to show changes in the expression of DP4/8/9 in an in vivo model of tumour development in patients with inflammatory bowel disease ii) to detect and clarify the underlying cellular and molecular mechanisms iii) to determine cellular localisation of DP8/9 under inflammatory conditions and during carcinogenesis. The proposed investigation will broaden the research portfolio and provide new insights into understanding mechanisms underlying colorectal cancer development and progression.

Managing Cardiovascular Risk Factors in Primary Health Care - New Interventions

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ABSTRACT

One of the global public health goals that can best be realised in primary health care is the managing of risk factors for cardiovascular disease (CVD). Arterial Hypertension (AH) is the most significant variable risk factor for the illness and mortality of CVD. The prevalence of AH in Croatia is 37.5%; the prevalence in Europe is 30 - 45%. The poor regulation of AH, despite being classified as a preventable risk factor and the possibility of effective treatment, is worrying. Taking into account the unique ability of a family physician to diagnose, treat and monitor AH, it is necessary to improve the proportion of patients with controlled AH by modern, scientific - based interventions in family medicine. The possibility of more precise diagnoses of AH and the monitoring of blood pressure (BP) values in real life conditions allows us a non - invasive device for ambulatory blood pressure measurement (ABPM). ABPM is indicated as a possible factor in "white cage" hypertension, masked hypertension, and resistant hypertension. Numerous studies particularly emphasise the evaluation of AT movements during the night as elevated night - time BP values are a powerful predictor of CVD development. The benefits of using ABPM in day to day family doctor work are: early detection of patients with "specific" forms of AH, allocating appropriate therapy to people with normal or lower BP values, therapeutic intervention in unregulated hypertension, detection of high or very high CV risk in patients with initially low CV risk, and the possibility of early detection of subclinical damage to target organs. Despite research in different populations around the globe, there is a lack of data on the linkage between systematic ABPM application in family medicine and the reduction of risk factors in the general population for which a family doctor is responsible. The project also encompasses research into the effect of intervention on lifestyle changes and treatment costs.

Interaction between Drugs and Phytochemicals: The Role of the FOXO Signalling Pathway

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ABSTRACT

The interaction between drugs and phytochemicals is poorly investigated. This issue deserves greater attention due to the fact that many phytochemicals in food and dietary supplements are taken by patients together with the prescribed therapy, which can result in drug - phytochemical interaction. Simultaneous application of phytochemicals and other drugs and their interaction in metabolism may have unpredictable adverse effects. Although some phytochemicals show a protective effect in various pathological processes, including cancer, in combination with other drugs there can be an increase or decrease in their activity which changes the outcome of the therapy. In cancer treatment, phytochemicals can mitigate the toxic effects of anti - tumour drugs in the organism. However, in certain combinations they can even increase their toxic effect. Ideally, phytochemicals should show a significant anti - cancer effect and mitigate the possible organ toxicity of the drug. FOXO (forkhead box O) transcription factors are involved in the regulation of metabolism and oxidative stress. In addition, they play a key functional role as tumour suppressors. The activity of FOXO proteins regulates numerous signalling pathways, including Akt, ERK (extracellular signal regulated kinases), JNK (c-Jun N-terminal kinase) IKK (I kappa B kinase), and AMPK (5 'AMP-activated protein kinase). The role of different FOXO proteins (FOXO1, FOXO3a, FOXO4 and FOXO6) in drug - phytochemical interaction is poorly investigated, while in kidneys the degree of toxic injury is unknown. The aim of this study is to determine the role of the FOXO signalling pathway in the anti - cancer activity of the selected phytochemicals and its role in the modulation of the effect of anti - cancer drugs by phytochemicals in vitro and in vivo. The results of this study will contribute to a better understanding of the role of the FOXO signal pathway in the treatment of cancer as well as in the drug - phytochemical interaction and the modulation of organotoxicity induced by anti - cancer drugs.

Opportunistic Premise Plumbing Pathogens: A New Challenge for Water Treatment

PROJECT MANAGER

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ABSTRACT

In the last few years, much attention has been paid to a group of opportunistic micro - organisms whose source is water from the distribution systems in residential buildings and health facilities, which is why the group was named Opportunistic Premise Plumbing Pathogens (OPPP). The group encompasses various bacteria such as species from the genera *Legionella, Mycobacterium, Pseudomonas*, but also amoeba, such as *Acanthamoeba*. This group of pathogens is colonising a part of the water distribution system, which includes both hot and cold water pipes and associated devices such as heaters, showers, taps and the like. Their common features include disinfection resistance, adhesion to tube surfaces, and biofilm formation. Their frequent occurrence is due to the fact that they can survive the standard treatment of drinking water. For this reason, there is a need for new approaches to effectively eliminate them or to disable their biofilm formation. The aim of the project is to examine, through an interdisciplinary approach, conditions that lead to the survival of these bacteria in the water and the formation of biofilm in water supply systems. The antimicrobial potential of natural substances (essential oils and hydrolates), active bacterial metabolites from the *Bacillus* genus and selected synthesised photodynamic active compounds, as well as their interaction with anti - microbial drugs and anti - bacterial agents, to treat these resistant pathogens will be investigated.

Extracellular Vesicles as Clinical Markers for Neuro - regeneration after Severe Traumatic Brain Injury

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ABSTRACT

Extracellular vesicles (EVs) are membrane - enveloped and nano - sized particles secreted by cells into body fluids and involved in intercellular communication. Molecular composition of EVs includes proteins, lipids and nuclear acids and depends on the type and (patho) physiological state of the originating cells. Since EVs are available from body fluids and their changing composition can indicate on - going processes in tissues and organs, they have a great prognostic and diagnostic potential. Thanks to this potential, EV research has been one of the most intensive biomedical fields in the last 10 years. Our previous study by nanoparticle tracking analysis has shown that severe traumatic brain injury (TBI), which is the leading cause of morbidity and mortality in young people, induces secretion of enlarged EVs into intracranial cerebrospinal fluid (CSF) 4 days after injury (Kuharic et al. 2018). The intracranial CSF from TBI patients also shows changed levels of protein EV markers associated with neuroregeneration. The dynamic changes of intracranial EVs indicate a new response of the human brain to injury and open the possibility of tracking neuroregeneration processes at a molecular level. The goal of the project is to investigate the proteom of intracranial EVs induced in patients with severe TBI and to identify potential protein markers of neuroregeneration. Several new methods for clinical EV isolation and characterisation will be applied including chromatography - based isolation of total EsVs, slot - blot immunodetection, acetil - cholin esterase activity assay, EV visualisation by atomic force microscopy and scanning electron microscopy, as well as proteome analysis by mass spectrometry. This innovative approach in TBI studying will include UniRi into up - to - date nanomedical research. Moreover, discovery of neuroregeneration - associated intracranial biomarkers is expected to enable long - term goals like studies of the effects of medical intervention on neuroregeneration.

The Quality of Life in Patients with Autoimmune and Non - autoimmune Diseases of the Locomotor System

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ABSTRACT

Patients with locomotor system disorders including autoimmune and non - autoimmune etiology, such as multiple sclerosis (MS), rheumatoid arthritis, spondyloarthritis (SA), osteoarthritis (OA), osteoporosis, etc. are encountered on a daily basis with accompanying, "invisible" symptoms, like primary fatigue, pain and emotional - cognitive disorders. With disease progression, these symptoms only intensify, and in combination with basic physical symptoms, the quality of life rapidly decreases.

With detailed exploration of these "invisible" symptoms by researchers, clinicians and physiotherapists, a better insight into everyday life issues and the inflammatory processes that form the basis of these illnesses will be able to contribute to an earlier application of rehabilitation and/or medication treatment, thereby slowing disease progression and improving the quality of life. MS is an inflammatory AI disease that affects the nervous system, and due to the nature of the disease and the resulting psycho - physical limitations and the effects of fatigue and pain, physical activity is of a high importance. So far, not so many studies have explored the effect of low - intensity exercise on fatigue, pain and quality of life, or its suitability for patients with low mobility, and the ease of performing such exercises in the home. RA, OA, SA are inflammatory rheumatoid diseases that primarily affect the joints, including tiredness and other "invisible" symptoms but are not, as with MS, directly related to the neurological system. So far, little research has been done to examine the quality of life for people with rheumatic diseases including "invisible" symptoms, especially at the early stage of the disease. Vitamin D is believed to play an important role in the underlying etiology of these diseases. It possesses immunomodulatory and anti - inflammatory activity, and besides the connection to inflammation, it also connects to depression, anxiety disorders, chronic fatigue and headache, musculoskeletal pain, muscle weakness and osteoporosis. The aim of this three - year study is to investigate the quality of life of people with autoimmune and non - autoimmune diseases affecting the locomotor system. Separately, its aim is to examine how a particular exercise programme affects motivation and different aspects of everyday life in MS patients (registered at www.clinicaltrial.gov: NTC03222596). Due to possible therapeutic implications in rheumatoid diseases (RA, OA and SA), the aim is to examine the linkage of the disease's clinical severity, the associated fatigue and the emotional - cognitive disorders with vitamin D levels in the blood. However, since patients with MS have high doses of vitamin D in daily therapy, it is not possible to do this with MS patients.

The Clinical Significance of Low Level JAK2 V617F Mutation in Peripheral Blood: An Examination of the Effect on Phenotype and Prognosis

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ABSTRACT

Philadelphia's chromosome (Ph-) negative myeloproliferative neoplasms (MPN) include polycythaemia (PV), essential thrombocytosis (ET) and primary myelofibrosis (PMF). PV and ET are relatively indolent diseases that result in a slight reduction in life expectancy while PMF has a more serious clinical course with median survival of about 5 years, although many patients have survived for more than 10 years. Somatic mutation V617F in Janus kinase 2 (JAK2) is the main recognised diagnostic marker for Ph-MPN resulting in excessive proliferation of one or more myeloid cells. The JAK2 V617F mutation can be found in more than 95% of patients with PV and 50 - 60% of patients with ET or PMF. In patients with JAK2 V617F mutations and allel burden above 50%, there is a higher risk of thrombosis, both in PV and ET. On the other hand, studies show that low JAK2 V617 allele burden in PMF is associated with statistically significant shorter survival and shorter intervals without progression into acute leukaemia. As a result, the JAK2 mutation has become a diagnostic standard, and the level of allel burden is part of standard diagnostics in most molecular laboratories (percentage of JAK V617F mutations), although the World Health Organization (WHO) does not specify the reference value for setting the diagnosis of MPN. Due to the use of allele - specific real - time PCR with high sensitivity, cases with low - level JAK2 V617F mutation are increasingly being detected. Also, 0.03-1% of JAK2 V617F mutations can also be found in the healthy adult population. Therefore, the MPN & MPNr - EuroNet study suggests that the diagnosis of MPN cannot be established only on the basis of the detected low - level JAK2 mutation. In one of the studies it was found that patients with a low level of mutation (JAK2 V617F <12%) also had an increased incidence of additional mutations in exon 12 JAK2 and exon 10 MPL genes. The prognostic significance of the quantification of JAK2 mutations, as well as the correlation with the general clinical picture, has not yet been fully clarified. Therefore, the aim of this study is to compare the clinical - pathological parameters of patients with high and low levels of JAK2 mutations, to determine the incidence of additional mutations (CAL, MPL and JAK2 exon 12) in a low - level JAK2 mutation patient, and to monitor which patients with a low JAK2 mutation level (<3%) will eventually develop MPN or not. The project will also try to estimate a possible cut - off level of JAK2 mutation that would suggest the patients with a higher probability of developing MPN.

The Positive Experience of Childbirth and the Use of Non - medication Methods of Labour Pain Relief

PROJECT MANAGER

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ABSTRACT

The change in the approach to childbirth results from an acceptance of the perception of childbirth as not only a mere physical act of giving birth, but also as a psycho - social event of large proportions to the child - bearing woman and to her partner. Thus, during physiological birth, doctors and midwives are increasingly trying to apply an individual approach to each child - bearing woman, and when possible, to avoid unnecessary medical interventions. These practitioners are aware that the main precondition for not experiencing childbirth as a trauma, but as an achievement, is that women take an active part in making the decision about the position they want to give birth in, and thus become active participants, and not passive objects of the childbirth process they must undergo. Among non - medication methods of labour pain relief most frequently mentioned are: choosing the most convenient position for a woman, rocking the pelvis, sitting on a birth ball, delivery on a stool, breathing, massage, hydrotherapy, audio analgesia, TENS, acupuncture and hypnosis. The choice of position can be easily indicated by a competent obstetrician and in accordance with the current perinatology practice, and can be applied mostly in uncomplicated deliveries. A woman in labour has the main role of choosing the method of pain relief, which is in line with her individuality, preparation before childbirth, social status, and her wishes, in cases where there are no negative indications concerning her choice of pain relief. Childbirth outcomes for mothers and new - borns, regardless of the position adopted, are all positively comparable, so there is no reason not to allow mothers to use birthing positions other than the lying down position. With the introduction of a choice of positions, in addition to the lying position, the frequency of episiotomy and perineum rupture, periportal medication, that is, oxytocin stimulation, have been reduced, and in this way the experience of childbirth has improved. When we take into consideration all the above - mentioned, the freedom of making decisions about the most comfortable way of giving birth, if it is a "normal birth," allows the woman to have a more positive experience of childbirth. It is of special importance, considering the fact that many women who have only one child report the reason for not having more is their bad experience during childbirth. Related to this, we can conclude that a positive experience of childbirth with the use of non - medication methods of relieving labour pain, could support the desire to give birth and be a part of a pro - natalist policy for the Republic of Croatia.

The Neuroprotective Role of Progesterone Receptors

PROJECT MANAGER

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ABSTRACT

A growing body of evidence points to the fact that progesterone (P) exerts neuroprotective and immunomodulatory effects in addition to its "canonical" reproductive functions. However, given the large receptor pleotropism and the redundancy of P and its metabolites, as well as marked tissue specific activity, molecular and receptor mechanisms of neuroprotective progesterone effects are very poorly understood. The biological activity of P is performed mainly through two nuclear receptors, PR-A and PR-B. The hypothesis of the proposed research is that activation of PR is neuroprotective, and thereby contributes to the resistance of certain mouse strains to experimentally induced nervous tissue damages. The main goal of this research is to examine and characterise the reactivity and neuropathological features of progesterone receptor in knocking out control mice (PRKO) and mice with selective ablation of progesterone receptor A (PRAKO) or progesterone receptor B (PRBKO) isoform using different models of experimental nervous tissue damage. The models of autoimmune inflammatory demyelination (experimental autoimmune encephalomyelitis) and cuprizone - induced demyelination will be used as the common animal models of multiple sclerosis. The sciatic nerve crush injury will be used as a model of peripheral neuropathy. Furthermore, degenerative changes to the central nervous system caused by aging will also be assessed and characterised in PR deficient mice. The results could contribute to the elucidation of mechanisms of neuroprotective progesterone effects and point out the need for testing possible associations of PR gene variants with neurological diseases in humans, for which, to our knowledge, there is no data. The obtained findings could also focus further research on selective modulation of PR activity as a novel pharmacotherapeutic approach to the treatment of neurological diseases.

The Role of Anti - viral NK Cells in the Development of Diabetic Nephropathy

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ABSTRACT

Diabetic Nephropathy (DN) affects 20 - 40% of all patients with diabetes mellitus type 2 (DM2). DN causes the progressive loss of kidney function because of damage to its primary functional unit, the nephron. If left untreated DN can result in end stage renal disease. How pathology of nephrons is induced is only partially understood but it requires activation of the immune system and production of pro - inflammatory cytokines. Which cells mediate these signals is largely unclear. Importantly, it is unknown whether other pro - inflammatory events in the kidney, such as infection, are an independent risk factor for developing DN. In this project, we aim to determine how chronic infection aggravates DN, with a special focus on the role of NK cells. Cytomegalovirus (CMV) causes chronic latent infection in many organs, including the kidney. Our preliminary data shows that obese mice, which are normally resistant to the development of kidney disease, readily develop DN upon CMV infection. NK cells play an important role in the control of mCMV through the production of cytokines, not only during acute infection, but also at the latent stage. In this project, we will use a combination of genetic and antibody - based techniques to determine the role of NK cells in the induction of DN. In vitro co - cultivation of renal cells with activated NK cells will reveal whether these cells mediate tissue remodelling and, if so, through which cytokines. We will confirm their role in vivo using mice genetically deficient in NK cells or their cytokines. Finally, by blocking NK derived cytokines with antibodies, we will investigate whether the targeting of this axis has therapeutic potential for the prevention of DN. Our proposal addresses a highly relevant issue in the field of diabetes, using an interdisciplinary project that bridges immunology with nephrology. We present new in vivo approaches in a largely unexplored aspect of DN. Finally, we build on the expertise of our group to answer these questions.

Deciphering the Immunoregulatory Potential of Soluble PVR

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ABSTRACT

The poliovirus receptor (PVR) is involved in immunity surveillance where PVR, by binding the activating receptor DNAM-1 and the inhibitory receptors TIGIT and CD96, determines the outcome of the immune response: immune cell activation or inhibition. This function of PVR has been mainly studied on the most abundant transmembrane of this protein: isoform &alpha. However, in humans, PVR is also present as secreted isoforms (sPVR) that lack a transmembrane region and are denoted as PVR &beta and &gamma. Soluble isoforms of PVR have been found in different body fluids and much research has shown that their levels are increased in the sera of cancer patients. Nevertheless, the physiological and immunological role of this soluble form remains unknown. Based on the functions of other soluble ligands of immune cell receptors that serve either to enhance or to avoid immune cell recognition, it has been hypothesised that sPVR can do the same. Finally, given that PVR could serve as a potential anti - tumour therapeutic target, deciphering the immunological role of sPVR is the main goal of this project proposal. To that end, in this research, we will produce recombinant sPVR β and &gamma proteins and test i) their ability to bind receptors DNAM-1, TIGIT and CD96 on cell transfectants and primary immune cells in vitro ii) the effect of sPVR on the expression of indicated receptors and iii) the effect of sPVR on activation/inhibition of immune cells in vitro using tumour cells as targets. Besides using recombinant proteins, we will use tumour cell lines - derived sPVR in the indicated experiments. Furthermore, we will investigate the presence and kinetics of expression of sPVR in mouse tumour models. For that purpose, we will use immunodeficient mice innoculated with human tumour cell lines. Finally, to determine the role of sPVR on immune response in vivo, we will use a humanised mouse model in which we will reconstitute the immune system by using human PBMCs and assess the effect of tumour - derived sPVR on phenotype, activity and proliferation of immune cells.

High - throughput Analysis of Glycosylation of Plasma, Serum and Cell

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ABSTRACT

The very fast development of proteomic tools, namely mass spectrometry, fast chromatography and their use in diagnostics, has led to discoveries of new biomarkers for malignant diseases. However, there have been many issues present, and following the initial success, possible errors and misconceptions were analysed. The experience and the results sprouting from the successfully finished GlycoMet programme in November 2017 will be used and developed in the parallel running IRI project, "New Generation of High Throughput Glycol Methods." Complementary parts to this programme suggested for financing by the University are: i) further development of high throughput protein isolation from blood plasma and cell membranes by optimising familiar protocols, but also by implementing new techniques; ii) direct, minimally invasive sampling using new methods; iii) implementing high throughput methods for sample preparation and enzyme conversion prior to the analysis of glycopeptide and oligosaccharide parts of protein of interest by LC-MALDI ToF and LC-ESI-MS/MS; iv) introducing bioinformatic tools for data analysis. The above - mentioned high throughput methods for fast isolation of plasma proteins and cell membranes are affinity, immune - affinity chromatography and conjoint or hyphened chromatography, which use new active molecules immobilised onto monolithic stationary phases for very fast chromatography. Successful isolation of both antibodies and cell membrane proteins has proved the plausibility of this strategy. New combinations of monolithic carriers will enable fast sample preparation, liquid chromatography and enzymatic conversion. Introducing the optimised chromatographic method using immobilised Fc receptors is intended to be an important part of the programme. This will enable further optimisation of sample preparation and fractionation of antibodies and other glycoproteins of interest. Using enzymes immobilised onto monolithic carriers, primarily proteases and glycosidases, will enable speeding up of the analysis in the direction of even higher throughput and "on line" analytics with a mass spectrometer and a computer with a bio - informatics programme as the last link in the chain. The final goal of this work is high throughput isolation and characterisation of plasma glycoproteins and cell membranes of control patients and patients suffering from malignant diseases, as well as the identification of oligosaccharides characteristic for certain diseases as candidates for new biomarkers. Our scientific efforts during the last ten years, as well as published manuscripts, have confirmed that this work is practicable. A further step would be the validation of potential biomarkers and their use in diagnostics.

Identification of New Vps34 Interacting Partners in Megakaryopoiesis

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ABSTRACT

Platelets play a key role in stopping bleeding by identifying blood vessel injuries, and they also participate in angiogenesis and wound healing. Platelets are derived from bone marrow precursor cells, megakaryocytes, that undergo, through the process of endocytosis, maturation of the cytoplasm including formation of the demarcation membrane system (DMS) and the formation of granules. The production of platelets and their release into the blood stream occurs through a series of complex processes involving remodelling of the cytoskeleton, and finally the release of thousands of platelets from one megakaryocyte. In the process of platelet production, megakaryocytes extend their cytoplasm into long, branched structures called proplatelets, whose ends eventually release platelets. Irregularities in this process can result in clinically relevant disorders. The only therapy of thrombocytopenia in hemato - oncological diseases or induced by chemotherapy is platelet transfusions. Therefore, numerous attempts are underway to produce functional platelets in vitro. To this end, it is necessary to acquire a better knowledge of the molecular mechanisms governing megakaryocyte maturation. In previous studies, we have shown that the protein that binds and deforms membranes, PACSIN2, by binding it to filamin A, contributes to the emergence of DMS. Furthermore, we found that dynamic membrane exchange between late endosomes/lysosomes and plasma membrane regulated by phosphatidylinositol 3-monophosphate (PI3P) contributes to the formation of functional DMS and the emergence of proplatelets. PI3P is important for vesicular trafficking, controls membrane exchange and is produced by Vps34 kinase. Our preliminary results show a differential localisation of PI3P and Vps34 kinase at various stages of megakaryocyte development. The aim of this project is to identify new interaction partners of Vps34 and / or PI3P that will reveal new mechanisms of megakaryopoiesis.

Continuous Glucose Monitoring in Patients with Type 1 Diabetes Mellitus – The Impact on the Development of Disease Complications and Quality of Life

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ABSTRACT

Glycosylated haemoglobin A1c (HbA1c) is a global indicator of the achievement of glucoregulation but it carries little information on glucovariability, an important factor in the development of endothelial dysfunction, the mechanism responsible for vascular complications. For conventional estimation of glucoregulation, conventional markers (HbA1C) or modern methods for continuous subcutaneous glucose monitoring (CGMS) and FGM (flex glucose monitoring system) can be used. These two methods allow for the detection and reduction of the frequency and duration of the period of glucovariability, thus reducing the amount and duration of the glucose range above and below normal values, hence significantly reducing the number of severe hypoglycemics, especially during the night, which is considered today as an independent factor for increasing KV mortality. According to recent literature, the use of an insulin pump and CGMS/FGM, and in particular the education of patients with special programmes DTTP and DAFNE, have the highest level of evidence for efficacy in unregulated DM type 1. Graphs and glycemic trends that can be printed after carrying the appropriate sensors allow for a better understanding of how various factors such as physical activity, nutrition and such like actually affect glycemic control, which could be additional motivation for patients to take an even more active part in controlling their underlying disease. At the same time, the use of an insulin pump and CGMS makes a closed loop, i.e. an artificial pancreas with the application of an insulin delivery system at the time of hypoglycemia - LGS (low glucose suspend); before the occurrence of hypoglycaemia - PLGS (predictive low glucose suspend) or basal insulin dose algorithm - PLGM (predictive low glucose management).

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The Feasibility of Introducing Synthesised 2D Mammography Combined with Tomosynthesis for the National Breast Cancer Screening Programme

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ABSTRACT

Mammography is the only screening modality proved to reduce breast cancer mortality, however, the overlapping breast tissue on mammograms poses a significant problem in interpreting the examinations, especially in patients with dense breasts. Digital breast tomosynthesis (DBT) is based on acquisition of three - dimensional digital image data which subsequently can be reconstructed as conventional mammographic projections. With tomosynthesis, the border of the mass is better delineated, any adjacent architectural distortion is better visualised, and the extent of the accompanying microcalcifications is better depicted on breast tomosynthesis images than on mammograms. Introduction of tomosynthesis in breast imaging has shown a simultaneous increase in cancer detection rates and a decrease of recall rates, especially in patients with dense breasts. However, combining conventional 2D mammography together with DBT raises issues of a longer interpretation time and a radiation dose increase to the imaged breast. On the other hand, when screening mammograms demonstrate a questionable finding, the additional imaging and analysis causes anxiety to the patients and increases healthcare costs, with high rates of false positive results. With DBT this problem could be avoided by reducing or eliminating tissue overlap, thus reducing the number of additional images with a redundant decrease of patient radiation. Methods have been developed to reconstruct conventional 2D images (cranio - caudal and mediolateral oblique views) from the information acquired using DBT. If it could be demonstrated that synthetically reconstructed 2D images are of sufficient quality, double exposure could be eliminated. Two fully digital DBT systems will be used in the project; Hologic Selenia Dimension installed at the University Hospital Rijeka and GE Senographe installed at the Community Health Centre of Primorje - Gorski Kotar County. Primorje - Gorski Kotar County is the first to start the screening programme in South Eastern Europe.

Craniodentofacial Biometry – 2D and 3D Technology in Identification, Diagnostics and Treatment

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ABSTRACT

The project consists of the evaluation of the craniodentofacial biometric characteristics within the local community and a comparison of the findings with different populations; an assessment of the influence and amount of the growth, development and maturation on the skeletal, dental and soft tissue relations; the influence of the treatment options on the changes in craniodentofacial biometric characteristics; a determination of the influence of the craniodentofacial biometric characteristics on the long term stability of the treatment. The hypothesis of the research is that craniodentofacial biometric characteristics, as well as the maturation stage substantially influence the treatment options and the long - term stability of the treatment, with the treatment planning adjusted to individual biometric characteristics, and in the cases of greater defects, to the average biometric characteristics of the local community. Comparison of the sample of the local community with several different populations will determine craniodentofacial biometric characteristics, which are specific to a certain population, and the amount of the average facial asymmetry. Generated average face models over time will be useful in every field in which there is a need for facial reconstruction (identification, craniofacial deformities, facial clefts). A laboratory for craniodentofacial biometry will be established at the Faculty of Medicine, University of Rijeka. The plan is to acquire the hardware, study cast scanner and portable stereo photographic camera, which will enable acquisition of the sample for this research project, but also for other projects which involve craniodentofacial biometry. The use of the camera will be introduced as an adjuvant non - invasive tool in diagnostic, treatment planning, for prevision of the treatment outcome, for monitoring the changes caused by the treatment, growth, development and maturation, and in solving complex problems in collaboration with experts from the joint institutions.

An Evaluation of Endothelial Dysfunction in Patients with Spondyloarthritis

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ABSTRACT

Spondyloarthritis (SpA) is a heterogeneous group of auto - immune/auto - inflammatory diseases with a genetic predisposition, the pathogenesis of which is not fully understood. It is assumed that the pro - inflammatory cytokines are responsible for initiating and encouraging inflammatory bone changes in SpA patients. We have assumed that pro - inflammatory cytokines (IL-17 and TNF-&alpha) diffuse from the tissue of the joints into the circulation, depending of the intensity of inflammation, and activate peripheral blood lymphocytes, which might further support chronic inflammation and may mediate additional damage of endothelial cells creating the basis for the development of cardiovascular disease. The aim is to evaluate and compare the degree of endothelial dysfunction in SpA patients with the inflammation status, and the damage in morphology and function of the musculoskeletal system. The methods: it is planned to introduce a comprehensive approach to medical monitoring of SpA patients including the monitoring of the basic disease and early detection of endothelial dysfunction by using various modern standard clinical and laboratory methods. The ELISA method will determine the soluble inflammatory factors in serum interleukin (IL)-17, TNF-α (Tumour necrosis factor alpha), MCP-1 (monocyte chemo attractant protein 1), granulysin, matrix metalloproteinase and MRP 8/14 (myeloid- related protein 8/14). We plan to introduce flow mediated dilatation of the brachial artery in routine clinical monitoring of the patients with SpA in order to evaluate subclinical endothelial dysfunction. We expect to find a laboratory parameter that will correlate well with the SpA activity and endothelial dysfunction. We believe that a holistic approach to SpA patients will lead to a better understanding of the pathogenesis of the disease and to a more holistic approach to the treatment.

The Inflammatory Potential of Diet in Obesity and Associated Metabolic Complications

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ABSTRACT

Obesity is one of the leading scientific and public health challenges of the 21st century. Changes in visceral adipose tissue and immune response disregulation play a key role in initiating and maintaining chronic low - grade systemic inflammation as a fundamental determinant not only of obesity but of the entire spectrum of associated chronic non - communicable diseases such as type 2 diabetes, non - alcoholic fatty liver disease and cardiovascular diseases which are the leading cause of morbidity and mortality nowadays. It is well known that nutrition has a significant effect on overall health. Furthermore, there is a growing body of evidence that an anti - inflammatory diet can contribute to the reduction of chronic low - grade inflammation and related chronic non - communicable diseases. Dietary Inflammatory Index (DII) is a scoring algorithm linking 45 food parameters with inflammatory biomarkers designed as a tool for assessing diet quality based on its inflammatory potential. The aim of this study is to evaluate the applicability and effectiveness of an anti - inflammatory diet in the treatment of obesity and associated metabolic complications and to determine changes in immune response, inflammatory and metabolic status and in the body composition of obese persons following nutritional intervention based on an anti - inflammatory diet. The importance of the proposed translational research is reflected in interdisciplinarity, interconnection between basic and clinical research with possible public health implications, especially in the development of the dietary guidelines based on anti - inflammatory diet, which could have an impact on the wider community, through the co - operation with the public sector. The ultimate goal is to contribute to the reduction in the incidence of leading chronic non - communicable diseases associated with chronic low - grade inflammation and improvement in the quality of life, which is in accordance with the Smart specialisation strategy of the University of Rijeka.

Apoptotic Cell Death in Vascular Disease

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ABSTRACT

Atherosclerosis is a chronic inflammatory disease which causes a large number of cardiovascular diseases that are a major cause of morbidity and mortality nationwide. Atherosclerotic plaques are made of lipid core and fibrous cap. Apoptotic cell death in the lipid core leads to its enlargement: the fibrous cap gets thinner which causes erosion and instability of the plaque. This leads to further complications like thrombosis and embolisation. In abdominal aortic aneurysm there is a progressive dilatation of the aortic wall which leads to weakening of the aortic wall that causes further progressive dilatation and rupture. Rupture of the abdominal aortic aneurysm is a state with high mortality (50 - 80%). In abdominal aortic aneurysm, histologically we see apoptosis of the smooth muscle cells. This research will investigate the stage of apoptotic cell death in carotid arteries and the aortic wall. It will also investigate different biomarkers in the serum with the goal of discovering in which way apoptotic cell death contributes to the development of atherosclerosis and the abdominal aortic aneurysm and also to the development of their complications. By interfering in the mechanisms of the apoptosis, these complications could be prevented. This research will also clarify whether the apoptotic cell death levels in atherosclerotic plaques and the aortic wall depend on demographic, clinical and laboratory variables, pre - operative medicament therapy and other comorbidities.

Isolation and Characterisation of Secondary Metabolites from Marine Organisms of the Adriatic Sea and Evaluation of their Biological Potential In Vitro

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ABSTRACT

Natural compounds from the sea are an important starting point for the development of new products in many areas of the biomedical sciences as well as in biotechnological applications. It has been shown that these compounds have a wide variety of significant biological effects, such as anti - viral or anti - tumour properties, which are often associated with completely new and previously unknown activities. Therefore, this study will be carried out on selected organisms from the Adriatic Sea, the cnidarian *Eunicella cavollini* and the *Caulerpa racemosa*, *Cystosira barbata* and *Padina pavonica* algae with the aim of isolating extracts and bioactive compounds from these marine organisms, characterising bioactive compounds (primarily secondary metabolites) and organisms' proteomes by mass spectrometry - based methods and proteomics methods, evaluating the biological potential in silico and biological effects on tumour cell lines and fibroblasts in vitro. For selected extracts and compounds, anti - tumour effect mechanisms will be analysed as well. As marine resources and secondary metabolites are in the focus of the modern pharmaceutical industry and the sector of the production of medical devices and dietary supplements, it is expected that this research holds a realistic potential for acquiring industrial partners.

Mouse Cytomegalovirus Evasion of NCR1 Mediated Immune Control

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ABSTRACT

Human cytomegalovirus (HCMV) is widely spread amongst the human population. Although in immunocompetent individuals HCMV infection is usually asymptomatic, it establishes a lifelong latency. In immunocompromised individuals HCMV can cause severe and even lethal diseases. HCMV infection is the most common viral congenital infection and may result in lifelong neurological sequelae. No effective HCMV vaccine is currently available. Since cytomegaloviruses (CMVs) are species specific, animal CMVs are used to study immunobiology and pathogenesis of HCMV and mouse CMV (MCMV) is the most widely used model. While NK cells play a key role in limiting CMV infection at an early stage, long - term virus control is maintained predominantly by T cells. HCMV - specific antibodies are protective during congenital infection by the passive transfer of maternal antibodies to the fetus. NK cells also possess immunoregulatory functions that can lead to the induction or suppression of other immune cells depending on the nature of the infection. Their activity is determined by a balance of signals from the inhibitory and activating receptors expressed on their cell surface. NCR1 is one of the activating NK cell receptors which has been shown to be important in the control of various viral and bacterial infections. It has also a role in NK cell mediated modulation of the adaptive immune response. Recently, we showed the role of NCR1 in the formation of humoral responses to MCMV. CMVs possess numerous mechanisms to evade immune surveillance by NK and CD8 T cells. Since the NCR1 receptor is important in virus control, we hypothesise that MCMV has evolved a mechanism to avoid control mediated by this receptor. We plan to identify the viral gene (protein) with this function, the mechanism of its action, its importance during infection and the possible impact on other components of an immune response. The results of this study will contribute to a better understanding of the immunobiology of CMV infection and will help in designing new vaccines.

The Activation of Macrophages in Patients with Osteoarthritis

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ABSTRACT

Osteoarthritis (OA) is a chronic disease of the joints, resulting mostly from mechanical (load of joint) or metabolic reasons (for example hypercholesterolemia). We have assumed that Heat Shock Proteins (HSPs), released from the cells after mechanical damage and oxidised cholesterol derivatives in hypercholesterolemia represent Damage Associated Molecular Patterns (DAMPs) in extracellular space. After internalisation by Pattern Recognition Receptors (PRRs) expressed on synovial macrophages, they might be inductors of M1 pro - inflammatory events. The leaking of locally generated pro-inflammatory substances in the blood could create a mild systemic pro - inflammatory response and increase the cytotoxicity of lymphocytes. Activated lymphocytes could damage the endothelium, and joint tissues after being recruited at the site of local inflammation. The aim of this study is to analyse the expression of HSP70, oxisterols and PRRs in synovial tissue of OA patients at the time of total knee endoprosthesis implantation, with a special focus on macrophages. Their M1/M2 orientation will be analysed by phenotype, transcriptional factors, cytokines and chemokines, endocytosis and chemotactic ability or the presence of apoptosis, after the evidences of hsps and oxisterol interactions with PRRRs. We will investigate the expression, tissue distribution and intracellular setting of granulysin and/or cytokine production (IFN-γ IL-4, IL-15 and IL-17) in the synovial membrane, synovial fluid and peripheral blood of OA patients. We will analyse whether pain intensity affects the walking distance of the patients with initial knee OA and whether it correlates with the expression of granulysin in peripheral blood lymphocytes. In addition to the routine laboratory methods for analysis of protein, RNA, DNA, phagocytosis and metabolic activity, we plan to introduce in our laboratory the method of separating macrophages from the synovial membrane and to establish an in vitro macrophage differentiation model from peripheral blood monocytes to study M1/M2 orientation after stimulation with HSP70 or oxisterols. By researching the OA of the knee, we will try to illuminate at least some pathogenic events that can possibly be avoided by preventing mechanical loads due to obesity and persistent treatment of hypercholesterolemia.

The Role of PrPC in the Immune System upon Exposure to Viruses

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ABSTRACT

PrPC (cellular prion protein) is a ubiquitous membrane glycoprotein whose main physiological role remains unknown. In line with that, no real consensus has emerged on the PrPC contribution to the immune response. One of the possible reasons might be due to the large number of PrPC interaction partners that can mediate downstream signalling. An additional explanation might be the anonymity of the immune cell receptors recognising PrPC. However, several studies have confirmed the role of PrPC in the host defines against pathogens and inflammation in general. The role of PrPC in human cytomegalovirus (HCMV) infection has not yet been established. HCMV is a ubiquitous & beta - herpesvirus that still represents an unsolved threat for the immunocompromised or immunologically immature patients. It is the most frequently transmitted virus in utero and a significant cause of damage to the developing brain. The strict species specificity of HCMV limits the study of its pathogenesis and immunobiology in experimental animals. Mouse CMV (MCMV) is the most widely used model to study HCMV infection. Both CMVs have devoted a significant part of their coding potential to subvert almost every aspect of the immune system, resulting in their lifelong persistence even in immunocompetent hosts. Our preliminary results indicate that MCMV modulates the expression of PrPC. Our goal is to determine the immune function of PrPC using a model of MCMV infection. This project aims to specifically determine: 1) the role of PrPC in cytokine - mediated activation of the host response to infection and 2) the presence of an HCMV effect on the human PrPC molecule.

Transcriptomic Analysis of Microglia Following Cytomegalovirus Infection

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ABSTRACT

Human Cytomegalovirus (HCMV) is an important pathogen that can cause permanent neurological damage such as cerebral palsy, mental retardation or deafness in infants or fetuses. Since HCMV can only infect humans, we have developed an experimental system for studying the pathogenesis of congenital CMV infection, in which new - born mice (NEM) are infected with mouse cytomegalovirus (MCMV). Due to a high similarity of these viruses, infection of NEM with MCMV completely recapitulates all the hallmarks of congenital HCMV infection in humans. Previously, we have found that MCMV penetrates the brain of NEM very early after infection, while active viral replication, along with the infiltration of numerous cells of the innate and adaptive immune system, causes strong and highly dangerous inflammation, which is believed to be the underlying cause of neurological injury to the brain. In addition, MCMV infection results in prolonged polarisation of microglia towards the proinflammatory phenotype, while the microglia - secreted inflammatory cytokines can have a significant effect on the recruitment of other immune system cells from the bloodstream into the brain as well. To gain insights into the molecular mechanisms underlying the long - lasting microglia polarisation, which may be a crucial factor in the development of brain pathology following CMV infection, we propose a transcriptional analysis of microglia from perinatally infected mice at early and late time - points following infection. Such an analysis will provide insights into alterations in gene expression patterns and the activity of molecular pathways in proinflammatory microglia and could result in the identification of new: a) reliable biomarkers for polarised microglia; and b) targets for smart biopharmaceuticals, such as antibodies, which would enable highly specific and safe depletion of the permanently activated microglia, and thus prevent the neurological sequelae of brain infection by CMV.

Cytomegalovirus Assembly Compartment

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ABSTRACT

Cytomegalovirus (CMV) infection induces extensive reorganisation of the membranous system of the cell which leads to the development of the cytoplasmic virion assembly compartment (cVAC). The reorganisation starts early in the infection with the reorganisation of early endosomes, recycling endosomes, and the Golgi which form the core of cVAC. In the late phase, the cVAC core is upgraded by the expansion of a membranous organelle around the tegument aggregate that collect viral glycoproteins. The assembly of new virions occur as a multistep transition through the cVAC and ends up in the vacuolar virus - glycoprotein loaded compartment which releases infectious virions. Both, the biogenesis of the final assembly site and mechanisms of virion release are insufficiently characterised. This project is aimed to characterise a phenotype of the virus - glycoprotein loaded compartment and to demonstrate final virus envelopment at this site. Recruitment of Rab and Arf proteins that shape membranous organelles, their regulators (GEFs and GAPs) and their effectors will be analysed by immunofluorescence. The phosphoinositide (PI) composition will be analysed using the transient expression of fluorescently tagged PI-binding domains and lipid domains using fluorescent recombinant aegerolysins. A new method for visualisation of virions will be developed using the Clic-iT technology in order to visualise virion assembly and virion release. The cVAC characterisation, virion assembly and release will be analysed using confocal, 3D cell explorer and electron microscopy. These analyses, together with an analysis of cellular transcriptome and interactome of major regulatory proteins will enable identification of cellular regulatory components affected by CMV. This step represents a basis for further identification of major viral gene functions that reorganise cells in order to develop cVAC and for further development of anti - viral drug - targeting strategies.

The Role of Rab10 in the Biogenesis of the Endosomal Recycling Compartment

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ABSTRACT

The endoplasmic recycling compartment (ERC) is a complex cellular organelle where membrane traffic is targeted from the early endosome (EE). It also represents an endocytic sorting hub and is necessary for the maintenance of cell homeostasis. Although it has been intensively investigated, biogenesis and organisation of ERC are still poorly clarified. The lack of a suitable model for testing in physiological conditions is undoubtedly one of the reasons. This project will investigate the role of the Rab10 protein during the process of ERC biogenesis, and the model of murine cytomegalovirus (MCMV) infected cells will be applied. Namely, the Rab10-positive compartment will expand during the early phase of the infection. Current knowledge about the Rab10 function is mostly achieved in polarised cells, does not consider ERC biogenesis, and was performed in nonphysiological conditions (e.g., after transfection). The MCMV induced expanding of Rab10-positive compartments indicates that Rab10-subcompartmenst could play a significant role during the ERC biogenesis. Therefore, the investigation of Rab10 is now possible to perform under the physiological concentrations of regulatory molecules. Our present knowledge indicates three possible routes of Rab10 cascade activation: following Rab5, Rab35, and Rab11. Our investigations will be focused on the Rab5 activation pathway on the expanded Rab10 compartment during the early phase of infection. The goal is a mapping of the Rab10 regulatory network by establishing the expression of their regulators (GAPs and GEFs) and effectors. Possible interactions should be confirmed by pull - down experiments. Furthermore, an analysis of phosphoinositides (PI(3)P, and PI(4,5) P2) expression and the silencing of key regulators will help us to determine if Rab10 acts downstream of Rab5 – then Rab10 would be essential during the ERC biogenesis. The final picture will be reconstructed by using bioinformatic methods, and the results will be verified on non - infected cells. The reconstructed network of Rab10 regulators and effectors will be tested in endometrial carcinoma. Therefore, we will contribute to the understanding the physiology of recycling, and possibly to carcinoma diagnostics.

The Implementation of Protocols in the University of Rijeka for Nanotechnological Methods: Atomic - force and Scanning Electron Microscopy for the Visualisation and Characterisation of Exosomes

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ABSTRACT

The virtual research platform of scientists gathered around exosomal research was established in 2015 (NanoBioLab). This project will enable the formation of a platform specialised in the visualisation and characterisation of exosomes by applying nanotechnological equipment present at the University of Rijeka (SuRI). The aim of this support is to transfer knowledge adopted during research on two international projects, Nanoscience foundries & fine analysis (NFFA, 2017 - 2019) in order to establish nanotechnological methods and protocols for exosome research at SuRI. Exosome research is a "cutting - edge" field in the world, requiring an interdisciplinary approach and specialisation of work on sophisticated equipment. This project will enable the transfer of know - how for nanotechnological methods in exosome research. The visualisation method will be optimized by applying the Ion Scanning Probe Microscope (SPM) in the liquid medium to preserve the biological properties of exosomes. The Scanning Electron Microscope (SEM) will be applied in visualisation using 2 methods: scanning and transmission. The scanning method will give an insight into the morphology of exosomes, however, because of the vacuum that is applied artifacts may appear. The transmission methodology will determine the presence of membrane protein markers on exosomes by immunodetection with appropriate primary antibodies and secondary labelling with gold particles. Additionally, an energy dispersive X - ray spectrometer (EDS) detector on SEM will be applied for investigation of element profile. Exosomes are biological nanoparticles, and due to their presence in physiological fluids present a great diagnostic potential. They are being studied by groups at the Department of Biotechnology and the Faculty of Medicine, and this project will set up a platform that will enable visualisation and characterisation of exosomes on the SuRI, which has not been possible up to now.

NK cells, Tumour Infiltrating Lymphocytes and Cell Cytotoxicity in Renal Cell Cancer

PROJECT MANAGER

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ABSTRACT

Renal cell cancer (RCC) is one of the most important urogenital tumours because of its high mortality and increasing incidence. RCC, which accounts for about 3% of all malignant tumours in adults, is the most lethal urogenital cancer. The high mortality rate stimulates investigator groups to study RCC pathogenesis including the immunological aspect. It is interesting that immunotherapy was firstly started in patients with metastatic RCC using IL-2 and interferon gamma. The first results were promising but the exact mechanism of acting was not found. In the RCC, as in the other tumours, immune cells (T lymphocytes, NK and NKT cells) are responsible for the main anti - tumour effect. Their effect is caused by cytotoxic activity on the tumour cells. In the investigation we will determine patterns of aggregation of tumour infiltrating immune cells in the blood, in healthy kidney and carcinomatous tissue. However, the presence of these cells does not mean that these cells are active. Their activity will be determined by the proofing against cytotoxicity of different subgroups of immune cells. In that way we will present different patterns of aggregation of tumour infiltrating immune cells and their cytotoxicity which will direct us to the cells that are active with an anti - tumour effect. The correlation of collected data with classical prognostic factors in patients with RCC as tumour staging, tumour grading (Fuhrman) and histological subtypes will help us to determine some immunological factors as possible new prognostic factors. In conclusion, the results of our study will allow for a better understanding of RCC pathogenesis, especially their immunological role and become a foundation for future investigations.

Personalised Therapy of Oncology Patients Using Digitization of Pathological Laboratory Diagnostic Processing

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ABSTRACT

Digital pathology and the adoption of image analysis have grown rapidly in the last few years. This is largely due to the implementation of whole slide scanning, advances in software and computer processing capacity and the increasing importance of cell and tissue - based research for biomarker discovery and stratified medicine. This project sets out the key application areas for digital pathology and image analysis, with a particular focus on research and biomarker discovery and delivery of personalised cancer therapy treatments. A variety of image analysis applications are available including nuclear morphometry and tissue architecture analysis, but with an emphasis on immunohistochemistry and fluorescence analysis of tissue biomarkers and digitalisation and standardisation of laboratory procedures. Digital pathology and image analysis have important roles across the drug/companion diagnostic development pipeline including biobanking, molecular pathology, tissue micro - array analysis, molecular profiling of tissues, and are necessary for the right choice of adequate therapy in oncology patents. Underpinning all of these important developments is the need for high quality tissue samples and the impact of pre - analytical variables on tissue research and clinical practice quality assurance. This requirement is combined with practical advice on setting up and running a digital pathology laboratory. Finally, we aim to integrate digital image analysis data with epidemiological, clinical and genomic data in order to fully understand the relationship between genotype and phenotype and to drive the discovery and the delivery of personalised medicine. This project proposal will be the pioneer endeavour in our community with the implementation of the first standardised digitalised pathology laboratory.

The Prognostic Value of Magnetic Resonance in the Therapy of Patients with Locally Advanced Rectal Cancer and Patients with Crohn's Disease

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ABSTRACT

This individual project submission comprises of two studies and includes three doctorate candidates who will participate in all the scientific activities. Firstly, the prospective study will include patients with newfound locally advanced rectal cancer and planned neoadjuvant chemoradiation therapy (CRT). We plan to perform two additional interval magnetic resonance (MR) examinations of the pelvis within and after CRT endeavouring to define criteria for recognition resistance to therapy in the early phase of treatment. For the first time, we will demonstrate real dynamic tumour changes on MR during the pre - surgical CRT and contribute to early selection of patients without potential for positive response to CRT. That could enable cessation of inefficient therapy and unnecessary exposure to its side - effects and adjustment of the therapeutic approach to every individual patient. We also aim to obtain potential predictors of complete pathologic response and candidates for conservative treatment of a selected group of patients. We will perform all MR exams, analyses and measurements during the first two years of the research. In the third year results will be statistically processed and disseminated. The second study will be retrospective research of MR imaging biomarkers as predictors of the course of Crohn's disease, of a biologic therapy response and of the probability of surgery. It will be carried out in patients with at least 3 MR entero - colonography examinations performed by a strictly defined protocol within the last 8 years. We will also encompass a control group of healthy volunteers who were examined with the same protocol. We plan to explore the diagnostic quality of bowel distension on MR enterocolonography in both groups. Image and clinical data analysis as well as statistical processing will be performed during the first 18 months, and dissemination of results will be accomplished within the next 18 months. Two blinded readers will analyse all sets of images.

The Role of Iron Metabolism Genes in the Etiopathogenesis of Non - alcoholic Fatty Liver Disease

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ABSTRACT

Metabolic syndrome (MetS) and its liver manifestations of non - alcoholic fatty liver disease (NAFLD) are common in the general population as well as in the population of transplanted liver patients. NAFLD is a unique disease, but represents a series of liver disorders common to the excessive accumulation of fat in liver parenchyma. The simplest form is the fatty liver followed by non - alcoholic steatohepatitis that can lead to cirrhosis of the liver and hepatocellular carcinoma. MetS after liver transplantation is associated with NAFLD development. NAFLD has a pathophysiological association with hyperinsulinemia, proatherogenic status and iron metabolism changes, as evidenced by hyperferhythmcs (HPF) and, which may be more relevant in these patients since iron accumulation causes the formation of free radicals and damage to cellular function. Ferritin is an intracellular protein present in all cells involved in iron metabolism. Hyperferhythmics in NAFLD, as it may have more meaning and correct interpretation, is necessary to direct appropriate clinical procedures for a patient with this type of liver disease. The most common gene mutations in iron metabolism are associated with the iron metabolism disorders: C282Y, H63D and S65C, and others are: HAMP gene polymorphism, transferrin receptor gene and ferroprotein gene. The aim of the project is a molecular genetic analysis of gene variants in iron metabolism that potentially affects the different clinical responses in patients with NAFLD. The study will include about 200 patients. Timely detection and treatment of the disorder prevents irreversible damage as in NAFLD and transplanted livers.

Identification of Key Molecules Controlling Heat Shock Proteins - Mediated Neuroprotection and Neuroregeneration after In Vitro Opossum Spinal Cord Injury

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ABSTRACT

The proposed project is based on the continuation and linking of the previous research projects of the PI, some of which have led to quite unexpected and very interesting results that open up new directions in the research, described here. Thus, we have previously shown that Activation Transcription Factor 3 plays an important role in the activation of endogenous mammalian stem cells after spinal cord injury and various members of this protein family have been found in Monodelphis Domestica spinal cord tissue, which has the ability of fully functional neuroregeneration. Furthermore, we have proved that pharmacological induction of heat shock proteins increases survival of the motoneurons after experimental spinal cord injury in rats and that the homologue of the human Hsp70B 'gene, which does not exist in rodents, exists in the proteome of the opossum. We will, therefore, identify the molecules involved in the cellular response to stress after experimental injury of the opossum spinal cord in vitro. This response will be pharmacologically-induced by arimoclomol, a drug that has been shown to be successful in the treatment of amyotrophic lateral sclerosis. The effect of arimoclomol on neuroprotection (survival of spinal motoneurons) and the activation of endogenous spinal cord stem cells, that play a key role in neuroregeneration, will be measured. Likewise, by mass spectrometry, we will detect molecules whose expression is induced by arymoclomol, and special attention will be given to the ATF family of transcription factors. The presence of heat shock proteins will be detected in exosomes secreted into a medium in which opossum spinal cord will be maintained *in vitro* after treatment with arimoclomol. Genetic manipulations and proteomic tissue analysis will identify molecular pathways essential for the cellular response to stress the effect of neuroprotection and neuroregeneration and these results will possibly present the foundations for new therapeutic approaches to treat spinal cord injuries.

Cross - talk between Innate Immune Cells and the Enzymes Matrix Metalloproteinases 2 and 9 in Professional Sport, Tissue Remodelling Wand Angiogenesis

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ABSTRACT

Physical activity and exercise training improve the quality of life, reduce oxidative damage and have a protective role against the sequels of several disorders, including diabetes, obesity and cardiovascular disease, including hypertension and coronary heart disease. These effects on the health of an individual depend on exercise type, intensity, frequency and duration. Signalling pathways underly the anti - inflammatory actions of exercise. Regular exercise down - regulates innate immunity, but there is still insufficient knowledge about the changes that occur during professional sport activities. Irregular endurance exercise may result in disturbance to the angiogenesis of heart muscles and blood supply. Furthermore, exercise modulates key players in the inflammatory process such as NF-κB, ICAM-1, MAPK, and COX-2. The matrix metalloproteinases (MMPs) are zinc dependent endopeptidases that play very important roles in the regulation of the extracellular matrix and heart angiogenesis. The angiogenic activity of MMP-2 may lead to its collagenolytic activity, accompanied with an increase in endothelial cells in order to invade the basement membrane of the vascular endothelium. MMPs encourage the liberation of biologically active proteins, such as cytokines, growth factors and chemokines from the cell membrane. MMP-9 plays a key role in cancer cell invasion, tumour metastasis and in atherosclerosis. The aim of this research is to investigate the interactions between the innate immune cells and the enzymes MMP 2 and 9 in three different models: in professional athletes, during early tissue recovery after orthopaedic surgery and in patients suffering cancer (colorectal and breast cancer). The early assessment of the weakening of the innate and acquired immune response will be able to find faster and better treatment and selection of the appropriate exercise training or operating approach in compliance with the rules of personalised medicine.

The Molecular Mechanisms of Ischemic Brain Damage and Neuroprotection

PROJECT MANAGER

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ABSTRACT

Strokes are the second most common cause of mortality and the most common cause of disability worldwide. Although significant advances have been made in understanding the mechanisms of ischemic brain injury and neuroprotection, effective therapy is still lacking. Furthermore, most drugs that were successfully tested under experimental conditions have not showed effectiveness in clinical trials. In recent years, a significant shift in the pharmacotherapeutic approach to the study of potential neuroprotection following ischemic brain injury has been made, based on the so - called multifunctional drugs. They act on multiple stages of complex pathophysiological cascades with a dominant effect on the inhibition of oxidative stress and neuronal damage parameters such as the stimulation of endogenous neuroprotective activation mechanisms following cerebral ischemic damage. Therefore, the proposed research aims to examine: a) the cellular and molecular mechanisms involved in ischemic brain damage processes following the experimental focal cerebral ischemia; b) the level of activation and regulation of the so - called endogenous neuroprotective activation mechanisms in the brain, induced in response to ischemic stress; c) mechanisms of neuroprotective action of multifunctional drugs from the human erythropoietin group. As expected, the results of research related to mechanisms responsible for ischemic damage of various cerebral structures and the induction of endogenous neuroprotection such as potential neuroprotective action of the investigated drugs, could contribute to efforts in finding new therapeutic possibilities in the treatment of ischemic brain injury. This can be extremely important both from a pharmacotherapeutic and from a pharmacoeconomic point of view.

Orofacial Disorders in Patients with Autoimmune and Chronic Inflammatory Diseases

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ABSTRACT

The number of patients with multiple sclerosis and chronic inflammatory bowel diseases is constantly rising, becoming an important public health issue. Patients with these diseases can also develop problems in the head and neck region, so - called orofacial disorders that can additionally negatively affect their quality of life. The aim of this study is to investigate the influence of autoimmune and chronic diseases (multiple sclerosis, Crohn's disease, and ulcerative colitis) on orofacial structures and their function, their influence on the quality of life, as well as the influence of orofacial disorders itself on the quality of life. The study is planned to be a prospective study and a case and control study. It will be conducted in collaboration with doctors of dental medicine, neurologists and gastroenterologists who will constitute the basis for the interdisciplinary approach. In the study trough, a series of questionnaires will be filled out, clinical examination and additional laboratory examination will be conducted, a correlation between diseases/biological features, psychological and sociodemographic determinants with orofacial disorders will be determined along with their roll in predicting the onset of orofacial disorders. The connection of the severity of the diseases with orofacial disorders will be also investigated. The influence of diseases and orofacial disorders on the quality of life will be investigated through questionnaires. We hope that we will be able to identify the risk factors for the onset of orofacial disorders in patients with multiple sclerosis and chronic inflammatory bowel diseases, in order to focus on the treatment, elimination and prevention of the conditions. The results of this project should improve the existing health care and multidisciplinary approach, and provide new guidelines for the health care and prevention of orofacial disorders and dysfunctions in these populations. In addition, as a result of the study we expect new multicentric and international collaborations in this field and to strengthen the individual and institutional capacity of the medical faculty and the UNRI.

The Generation and Molecular Characterisation of In Vitro and In Vivo Models of Amyotrophic Lateral Sclerosis

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ABSTRACT

More than 25 years after the discovery of the first mutation leading to amyotrophic lateral sclerosis (ALS), its pathogenesis is still unclear and no cure is available. Given that mutations in more than 20 genes of different functions lead to ALS, it is puzzling how they converge onto the same phenotype of devastating motor neuron degeneration. Moreover, as the majority of ALS patients are considered sporadic with no defined genetic background, environmental factors are considered to contribute to the development and rapid disease progression. One of the hypotheses is that, similar to cancer, neurodegeneration is an aftermath of multiple hits i.e. that multiple cumulative insults lead to a breakdown of neuronal and/or surrounding cell homeostasis. Here we will generate and characterise multiple - hits in vitro and in vivo ALS model systems in which we will sequentially apply potential neurodegeneration triggers. The foundation for additional manipulation will be mouse models that carry mutations similar to ALS patients: optineurin insufficiency model (Optn470T) and mutation in TDP-43 (TDP-43A315T). TDP-43 accumulates in damaged neurons and glial cells in > 95% ALS patients, and optineurin is a multifunctional adapter that regulates several key cellular processes such as inflammation, cell death and autophagy. Since our preliminary results suggest accumulation of TDP-43 in the Optn470T model, we plan to investigate the causes of TDP-43 proteinopathy, first in neuronal and microglial cell lines by removing optineurin by CRISPR-Cas9 technology, and then in primary brain cultures or the Optn470T and TDP-43A315T models. To this end we will analyse the accumulation of proteins, secretion of exosomes and cell death upon manipulation of autophagy and inflammation. The latter will be triggered by LPS, and MCMV and F. novicida infections. To validate the relevance of these findings in vivo, we will make a complex genetic model of ALS by crossing Optn470T and TDP-43A315T mice.

The Role of Polymorphism in Thrombophilic Genes (Factor V G1961A (actor V Leiden), Prothrombin G20210A, MTHFR C677T and PAI-1 4G / 5G) in Adverse Pregnancy Outcomes and the Influence on Morphology of Pathohistological Changes in Placenta and Child Development

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ABSTRACT

This research is designed as predominately prospective, the smaller part being a retrospective analytical study of three different groups. The first group will be those whose pregnancies have ended with intrauterine deaths, the second group with intrauterine growth failure (IUGR), and the third group of premature birth recipients, all hospitalised at the Clinic of Gynaecology and Obstetrics at the Clinical Hospital Centre in Rijeka in the period 2018 - 2020. The material collected at the Clinic for Gynaecology and Obstetrics at Clinical Hospital Centre Rijeka, Rijeka will be analysed, including the blood and placental tissue of women in treatment due to adverse outcomes in previous pregnancies. The diagnostic procedures will be performed at the Clinical Institute of Pathology at the Department of Molecular Pathology of Clinical Hospital Centre Rijeka, Rijeka and the research procedures at the Department of Pathology of the Faculty of Medicine of Rijeka. The aim of the study will be to perform a molecular analysis of all groups to determine the polymorphism of thrombophilic genes (factor V G1961A (factor V Leiden), prothrombin G20210A, MTHFR C677T and PAI-1 4G / 5G), and to achieve a characterisation of morphological changes in placenta and the immunohistochemical analysis of inflammatory factors and indicators of hypoxia and their interdependence, in order to determine their potential significance in pregnancy outcomes.

Genetic and Biochemical Markers of the Membrane Phospholipid and Fatty Acid Metabolism as Predictors of Treatment Response to Anti - psychotic Therapy in Patients with Psychotic Episodes

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ABSTRACT

Anti - psychotic medications are the basis of the modern treatment of schizophrenia. Numerous recent findings indicate that these medications modulate the membrane phospholipid and polyunsaturated fatty acid (PUFA) metabolism and that such modulation might be implicated in the therapeutic response to anti - psychotic therapy. According to the phospholipid membrane hypothesis, a disturbed composition of membrane phospholipids and PUFA deficit, which have been continuously observed in neuronal and peripheral red blood cell membranes in patients with schizophrenia, might imply neurodevelopmental abnormalities, as well as other cell function disturbances, among which abnormal signal transduction might be of significant importance. In addition to the disruption of central neurotransmitter systems, disturbances in cell signalling might also be reflected in peripheral cells; diminished vasodilatation of the forearm skin following the application of niacin (a solution of vitamin B) is likely to underlie such disturbances. Furthermore, abnormal signal transduction, due to a deficit and/or imbalance of specific PUFA molecules, might also contribute to the increased state of the inflammatory response, as well as to the abnormal lipid and glucose metabolism, which is particularly prominent after anti - psychotic treatment. Within the framework of this grant, we will investigate whether polymorphisms in genes involved in the membrane phospholipid and the PUFA metabolism, which were shown to influence a number of clinical features of schizophrenia in our previous work, may influence the response to anti - psychotic treatment. Furthermore, we will examine whether the investigated polymorphic variants might contribute to the modulation of plasma lipid and glucose concentration following anti - psychotic treatment, and whether such modulation (alone and in interaction with gene polymorphisms) influences treatment response. Finally, we will investigate whether the modulation of red blood cell membrane fatty acid composition and skin response to niacin by anti - psychotic treatment, as well as initial red blood cell membrane fatty acid content and initial skin response to niacin, could serve as predictors of treatment response to anti - psychotics in anti - psychotic - naive patients.

Genetic and Epigenetic Factors in the Etiology of Recurrent Spontaneous Abortion and Spontaneous Pre-term Birth

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ABSTRACT

Recurrent spontaneous abortion (RSA), two or more miscarriages before the 22nd week of gestation, and spontaneous preterm birth (SPTB), birth before the 37th week of gestation, are among the most common complications at the beginning and end of pregnancy. According to epidemiologic studies, (epi)genetic factors contribute to the etiology of both disorders. Although chromosome aberrations are present in up to 70% of miscarried embryos in RSA couples, karyotyping is not part of routine clinical evaluation due to the numerous shortcomings of chromosome banding techniques. Conversely, cytogenomic analysis, including QF-PCR (quantitative fluorescent polymerase chain reaction) followed by aCGH (array comparative genomic hybridisation) for negative and uninformed results, does not require cell culture and has a high resolution. Therefore, the aim of this project is to investigate, for the first time, the frequency and type of chromosome aberrations in miscarried embryos in couples with at least one previous miscarriage, using QF-PCR and aCGH. Although causes of SPTB are unknown, in >50% of cases, epigenetic studies associate them with abnormal DNA methylation. The aim of this project is to investigate the association between epigenome-wide DNA methylation in maternal blood and SPTB of unknown etiology using aCGH, as well as the association between DNA methylation and MTHFR gene polymorphisms (methylenetetrahydrofolate reductase), which encode an enzyme essential for methylation, using PCR-RFLP (restriction fragment length polymorphism). Such studies have not been conducted in the European population. The proposed original research is an extension of our previous projects and is conducted on human genomic DNA, which is of great importance due to the potential discovery of causes and biomarkers, and the application of results to clinical practice. The project is multidisciplinary, multicentric and international, contributing to the recognition of the Faculty of Medicine and the University of Rijeka.

Reparation and Immune Response of Bone Tissue after Applying New Biomaterial and the Immune Response of Soft Tissue on Jason® Membrane in Rats

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ABSTRACT

Cerabone® (Botiss biometerials, Zossen, Germany) is one of today's most widely used biomaterials in dental implantology. After the implantation of Cerabon, in vivo, the maximum bone volume (%) was determined and the best vascularisation was on the 60th day and the expression of MNGC cells was present on the 10th day and was maintained in large numbers even up to the 60th day after implantation. In ideal conditions, biomaterials should be resorbed gradually to allow the bone defect to be fully filled with newly formed bone tissue. In this context, it has been shown that rapidly resorbable biomaterials may disappear even before osteoconduction of osteogenic cells elicits and causes bone formation. On the other hand, non - resorbable biomaterials prevent primary osteogenesis as well as maturation of bone tissue. Jason® membrane (Botiss biometerials, Zossen, Germany) is a collagen barrier membrane positioned over a bone defect filled with bone graft. The immune response of soft tissue to the collagen membrane is still not fully known and further in vivo research is needed. Since new biomaterial contains easily resorbable magnesium, we expect that, after graft implantation, in the late stages of bone repair, new biomaterial (Cerabon with magnesium) will be more resorbated and more bone tissue in parietal bone cavity is expected, compared to Cerabon. The aim is to quantify the percentage of newly formed bone tissue, degraded bone tissue and remaining bone tissue of the bone graft, after implantation of new biomaterial into the bone defect in the parietal bone of a rat. Furthermore, the aim is to clarify the type of immune response of the parietal bone tissue of a rat to new biomaterial (Cerabon with magnesium) as well as the response of the soft tissue on the Jason® membrane, which is of utmost importance for the understanding of the biological properties of the graft and collagen membranes and their biocompatibility with the recipient.

Physical Activity and Risk Factors in Secondary and Tertiary Prevention of Cardiovascular Diseases

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ABSTRACT

The rate of cardiovascular disease and mortality (CVD) in the Republic of Croatia (HR) is disproportionate to the standards of low risk countries of the EU and it represents a major public health problem. The precondition for conducting effective and timely prevention measures in patients with a previously diagnosed CVD is to know the connection between risk factors and physical inactivity with CVD progression and consequently, lower life quality. The aim of the project is to raise the level of knowledge and implementation of secondary and tertiary prevention measures and subsequently, to decrease the mortality of cardiovascular diseases in Primorje - Gorski Kotar County and Croatia. Also, the aim of the project is to reduce the main CVD risk factors at the population level, stimulate necessary lifestyle changes and thereby promote secondary prevention of CVD. The research will use the connection between physical activity and functional cardio - respiratory status, both before and immediately after cardiologic rehabilitation (CR), as well as at certain time intervals after its completion (after 6 months, 1 year). The correlation between physical activity and functional cardio - respiratory status with anthropometric characteristics, lifestyle habits, arterial pressure, echocardiogram, biochemical indicators (GUK, lipidogram, hepatogram, urate, hsCRP, BNP, DPP-4-I, vitamin D) will also be researched, in terms of psychosocial and nutritional status and quality of life at defined time intervals. Data will be collected on standard patient survey patterns for determining the degree of physical activity, nutrition status and psychological profile. Among the anthropometric measurements we will include: determination of body weight, height and waist size and body mass index. Fat content will be determined by the bioelectric impedance method. Specific methods will include those we use to evaluate the risk of CR patients: functional tests (ergospirometry, ergometry, 6 - minute test run), echocardiography. Blood analysis will be done according to the dynamics of previously defined time intervals. Based on all input parameters, an aerobic exercise programme will be created with the aim of achieving more than 1,000 METS weekly physical activities. The data obtained will be statistically processed according to the previously defined time dynamics (0 day, 21 days, 6 months, 1 year). The acquired knowledge will identify the cause of increased morbidity and mortality, and thus innovative ways and solutions for their reduction. One of these innovative ways is a unified web portal that will implement and strengthen secondary and tertiary prevention through educational programmes and enable the monitoring and implementation of personalised CR programmes with educational content related to the preparation and implementation of permanent prevention of CVD.

The Influence of General Health on Oral Health

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ABSTRACT

Oral health must be considered as an integral part of general health. One of the most interesting issues facing the dental community over the last century is a possible connection between chronic oral inflammatory conditions and systemic health, as well as adverse habits. One of the scopes of this project is to determine the association of socio - economic and health - related variables with a prevalence of apical periodontitis. Apical periodontitis is an inflammatory disorder of periradicular tissues usually caused by microbial infection of the root canal system of the affected tooth. The disease affects many adults, and frequency increases with the increased age of the examinee. The association of eating disorder severity with oral cavity pathological processes will be investigated through a multivariate approach to determine the effect of systemic factors on conditions of oral mucous. The prevalence of infective and non - infective oral diseases will be determined in representative samples of patients having eating disorders. As an integral part of this project, any differences in the healing rates of periapical lesions between smokers and non - smokers will be investigated. The assessment of these variables will define the factors significantly associated with pathological changes of oral mucous and periapical tissues. The acquired results will ensure the establishment of preventive and therapeutic guidelines.

Molecular Mechanisms of Neurodegeneration in Traumatic Brain Injury: The Role of TAR DNA - binding Protein 43

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ABSTRACT

Traumatic brain injury (TBI) is one of the risk factors for the development of neurodegenerative diseases such as Alzheimer's and Parkinson's disease, and amyotrophic lateral sclerosis (ALS) and frontotemporal lobar degeneration (FTLD). In ALS and FTLD, the major component of cytoplasmic inclusions in degenerated neurons is TAR DNA-binding protein 43 (TDP-43). Physiologically, TDP-43 is mainly located in the nucleus, but studies have shown that its pathological function is associated with its permanent shift into the cytosol. Causes of TDP-43 proteinopathy development are still unclear, but it is well known that intracellular TDP-43 translocation may be induced by axotomy, cellular stress as well as gene mutation or overexpression of this protein. TDP-43 proteinopathy was also observed in people with TBI, which was confirmed in studies using different TBI animal models. Still, the exact mechanism that links TDP-43 proteinopathy and neurodegeneration after TBI is unclear. A possible explanation of the effects of TDP-43 proteinopathy on neurons is related to the activation of inflammation, one of the most important secondary injury processes after TBI, but this has not been investigated so far. The main hypotheses are: 1. single moderate TBI in mice causes TDP-43 proteinopathy that can be detected in different brain regions and types of central nervous system cells, and 2. TBI in TDP-43 transgenic mice causes significantly stronger neuroinflammation compared to wild - type mice, which is due to the activation of some inflammation signalling pathways. In this study, a lateral fluid percussion brain injury model in the mouse will be used and the brain expression of TDP-43 will be analysed at different post - injury time points. Inflammation markers and the activation of specific signalling pathways will also be investigated. The results of this project should contribute to new knowledge about the role of TDP-43 in the development of neurodegeneration after TBI.

The Role of Innate Immune Cells in the Development of Non - alcoholic Steato - hepatitis (NASH) and Liver Fibrosis

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ABSTRACT

Non - alcoholic fatty liver disease (NAFLD) is a clinical term for a spectrum of changes in the liver starting from steatosis through to steatohepatitis (NASH) to cirrhosis and hepatocellular carcinoma. The disease is closely linked to obesity and type 2 diabetes mellitus. The proportion of the human population affected by the disease, means that it is now a leading cause of liver failure and transplantation. Although a significant proportion of the overweight population develop steatosis, about one third of this group develops NASH, a sign of the progression of the disease which can end up in liver cirrhosis and/or the development of hepatocellular carcinoma. Therefore, to determine how the immune system is activated in steatotic liver leading to NASH is an important medical question. Answering this question would raise the possibility of efficient preventive and therapeutic treatment for patients. We have established a mouse model for NAFLD induced with modified high - fat diet (SSD) that contains saturated fatty acids (40%), cholesterol (2%) and fructose (22%). This model mimics well all phases of NAFLD in humans within 16 weeks of introducing SSD. Using this model in our preliminary research, we noticed an increase in the number of innate immune cells like gamma/delta and CD4-CD8- (DN) alpha/beta T cells very early upon SSD (after 2 weeks). We also determined that these cells are expressing proinflammatory cytokine IL17A. Based on our hypothesis that the above-mentioned T cells play essential role in induction and development of NASH, the major goal of this project is to investigate the immune signals of activation of these cells as well as their functional role in development of NASH and fibrosis. In the planned research, we will use appropriate genetically modified mice (TCR delta k.o., TCR alfa k.o., IL17ARfl/fl, CD4Cre, Ncr1Cre, LysCre Klrk1 k.o., Klrk1fl/fl i dr.) and standard methods in immunology, molecular and cell biology.

The Application of Balanced Crystalloid Solutions in the Early Phase of Treatment of Acute Pancreatitis

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ABSTRACT

Intensive fluid resuscitation is the basic principle of treatment in the early phase of acute pancreatitis. According to current guidelines, crystalloid solutions are recommended, particularly Ringer's lactate, due to certain characteristics of its composition compared to regular saline. Lower chlorine levels and the presence of bicarbonates improve its buffer aspects, while lactate supposedly exerts anti - inflammatory effects. Therefore, there is a justifiable assumption that balanced crystalloid solutions have additional benefits due to their even lower chlorine content and additional anti - inflammatory components such as gluconate and acetate. This research is designed as a prospective, randomised, double - blind clinical trial which aims to investigate the beneficial and harmful effects of balanced crystalloid solutions compared to Ringer's lactate as standard treatment in the early phase of acute pancreatitis. Patients diagnosed with acute pancreatitis, regardless of etiology, severity of disease, and prior attacks will be randomised in two groups. The intervention group will receive a balanced crystalloid at a rate of 10 ml/kg during the first 60 minutes and then continue at 3 ml/kg/h for the next 72 hours. The control group will receive Ringer's lactate at the same rate. The rate of volume resuscitation will be regulated according to clinical and biochemical inflammatory and hydration parameters. Systemic inflammatory response syndrome will be assessed as the primary outcome. Secondary outcomes include mortality, organ failure, local complications, systemic complications, infected pancreatic necrosis, a need for percutaneous, endoscopic and surgical interventions, and the length of hospitalisation.

The Long - term Outcome of Children Prenatally Exposed to Methyl - mercury: Genetic and Environmental Influences

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ABSTRACT

Methyl mercury has negative effects of intrauterine growth and development of the fetus. The central nervous system is the most sensitive to it, because the methyl - mercury passes through the placenta and accumulates in the fetal brain. Previous research has shown neuronal migration disorder (mostly in small brains, brain stems and cerebral cores) and abnormalities in brain development. The animal and human models described above delayed methyl - mercury toxicity. This implies the ability of a single factor to achieve neurotoxicity for years after termination of the exposure itself. This is explained by the fact that the development of a particular brain function is delayed and/or that there is a certain neuronal plasticity of the central nervous system that compensates, for a certain period of time, manifestation of pathological brain changes. Delayed methyl - mercury neurotoxicity may affect new - borns and children's neurodevelopment, and is associated with intrauterine fetal exposure due to nutritional habits during pregnancy. In addition, certain gene polymorphisms may also affect increased susceptibility to prenatal exposure in individuals. On animal models, in which exposure is controlled by experimental conditions, intrauterine exposure has been shown to develop sensory and motor failure. Certain potential mechanisms for responding to the above - mentioned consequences are identified, but mostly it is when a high level of exposure is present. Until now, it has been found that dopamine and GABA-ergic neurotransmitter systems, as well as the cortical region, are particularly sensitive to low levels of methyl mercury. Our results suggest a cerebellar length reduction in total methyl - mercury concentrations above 1 μg/g in mothers' hair and suggest further investigations, especially the correlation with long - term neuropsychological outcomes.

The Role of Cytotoxicity Mediated by Granulysin and Perforin-2 in the Development of Psoriasis and Lichen Planus

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ABSTRACT

Psoriasis and lichen planus are inflammatory, immunologically mediated skin diseases, which share a similar immunological pattern of occurrence. While psoriasis, besides skin changes, is also characterised by the appearance of psoriatic arthritis, as well as numerous comorbidities such as metabolic syndrome, cardiovascular disease, diabetes mellitus and depression, and represents a significant public health problem, lichen planus is in most cases a skin and/or mucous disease of good prognosis, except for resistant erosive - ulcerative forms that can result in malignant transformation. Previous research in the field of immunopathogenesis has demonstrated the involvement of lymphocytes T and their cytokines in the development of both diseases, and these cytokines have become the target molecules for new biological drugs. Furthermore, through our four previous projects, and demonstrated by other authors as well, the involvement of cell cytotoxicity mechanisms in the pathogenesis of both diseases has been confirmed. The perforin and granzyme B as well as Fas / FasL and TRAIL / TRAILR are enhanced in the lesions of psoriasis and lichen planus in comparison to unchanged and healthy skin, and the perforin expression is also evidenced in the peripheral blood of patients particularly in severe forms of psoriasis. The main objectives of this study are to determine the role of granulysin and perforin-2 by the method of flow cytometry in lymphocyte T subpopulations, NK and NKT peripheral blood cells, and by the method of immunohistochemistry in the tissue sections of the changed and unchanged skin of psoriasis and lichen planus, and the skin of healthy subjects. This research is expected to clarify the role of granulysin and perforin-2 mediated cytotoxicity in the pathogenesis of psoriasis and lichen planus, which will help to better understand and possibly better treat these diseases as these molecules can in the future become the target molecule for new biological drugs.

Extracellular Vesicles in Human Follicular Fluid: The Content and Role in Oocyte Maturation and Embryo Quality

PROJECT MANAGER

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ABSTRACT

Human reproduction is becoming a major public health problem for developed countries. In the last 25 years the number of infertile couples has tripled. On the other hand, there seems to be no room for improvement in assisted reproduction techniques. Today's morphological methods of selecting high - quality oocyte and embryos remain quite subjective. Pursuing a search for a reliable quality marker is, however, possible with the development of new technologies. This research will include patients from the Human Reproduction Department of Clinical Hospital Centre Rijeka, Rijeka and KBC Sestre Milosrdnice, who are treated for male infertility factors using the ICSI method. The quality of the oocyte and embryo will be evaluated, and the associated follicular fluid (FF) will be further investigated through extraction of its extracellular vesicles (EV). EV will be subjected to advanced microscopy and molecular methods, including Western blotting for the EV markers: CD9, flotilin-1, flotilin-2, Alix, and proteins of the Rab family. Subsequently, the content of the isolated EVs, namely the miRNA and the proteins, will be determined and compared between morphologically differently classified oocytes and embryos. MicroRNA will then be isolated from FF, followed by reverse transcription, pre-amplification, and ultimately profiling. The miRNA expression analysis and the differently expressed miRNAs in total FF will be compared to miRNAs isolated from EV. We will also seek to identify specific miRNAs whose expression differs between oocytes assessed to be of differing morphological quality in FF as well as in the medium in which the embryos are grown. The protein composition of EV isolated from FF will be investigated by mass spectrometry, in order to determine differences in the amount and type of protein between oocytes of differing morphological quality. The aim of the study is to identify markers, such as protein and miRNA profiles, which are characteristic of high quality oocytes or embryos.

The Expression Pattern of Metallothionein and Megalin in Premalignant and Malignant Epithelial Lesions

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ABSTRACT

In line with current knowledge, our previous data have shown that the disturbance of morphostasis and tissue damage of various etiologies induce a synthesis of cysteine - rich proteins - metallothioneins (MTs) and that they, through metalloregulation and anti - oxidative and immunoregulatory activities, provide cytoprotection in numerous physiological (liver regeneration, fetal growth) and pathological conditions (demyelination induced by autoimmune and toxic mechanisms, acute and chronic stress, inflammatory diseases, ageing). Besides this, we confirmed that the neuroprotective effects of MT-I/II might be mediated not only by their intracellular activities, but also by signalling pathways activated after binding of extracellular MT to their receptor megalin/LRP2 (low density lipoprotein receptor protein 2), since it might stimulate endocytosis of MT and induce the transcription of numerous factors that modulate cell cycle, differentiation and apoptosis. The final outcome is usually cytoprotection and better survival of cells, but occasionally MTs might stimulate also the processes of carcinogenesis. The goals of this investigation are therefore the following: 1) to explore the expression profile of MT-I/II and megalin during the progression phases of cervical intraepithelial neoplasias (CIN) and the development of uterine carcinomas in situ, as well as in epidermal neoplasias (keratoacanthomas and baseocellular carcinomas), 2) to analyse the transduction pathways induced after the binding of MT to megalin, 3) to explore the relationship between megalin and steroid receptors and 4) to investigate the incidence of HPV infection in the school population in the Primorje - Gorski Kotar County by an epidemiologic study. In this context, our preliminary data implies that enhanced expression of MTs and megalin might be a good diagnostic indicator of CIN progression and the malignant transformation of squamous epithelial cells in the uterine cervix.

The Improvement of the Control of Polypharmacy and Adherence to the Prescribed Therapy of Chronic Diseases by Using Information Communication Technologies

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ABSTRACT

According to WHO, 50% of patients with chronic diseases in the developed world do not take prescribed medicines. This problem is particularly pronounced in adults older than 65 where adherence is a serious challenge due to the great burden of symptoms and illnesses resulting from the use of multiple drugs with an increased likelihood of non - adherence. Non - adherence in the elderly with chronic diseases varies from 40 to 75%. Non - adherence may be caused by a number of factors. Failure to follow therapeutic guidance has the effect of increasing complications, reducing the quality of life, increasing the need for hospitalisation, premature death, disability, and increased health care costs. Changes in the style and way of life, at the age of the appearance of chronic illnesses, are decreasing. Multimorbidity or presence of 2 or more chronic diseases is a significant challenge for the health system. The decrease in the age of occurrence of these diseases, means these challenges are even more pronounced. The literature contains information on the magnitude of these problems, but there is little systematic data from the Republic of Croatia. Adherence to therapy means the degree of adherence to the prescribed treatment. Literature data on non - adherence in chronic elderly patients vary between 40 and 75%, while for younger groups data is scarce. This research will include populations older than 50 years from urban and rural environments. Population will include those who meet the project criteria. Data on prevalence and adherence will be collected from the archives of family physician practices, databases of the Croatian Institute of Public Health and the Croatian Health Insurance Fund and from the pharmacies. The prevalence of multimorbidity, polypharmacy and adherence in the target population, differences between urban and rural areas, and gender differences will be investigated. In order to control and improve adherence, the previously developed smartphone application which was developed within the international Urban Health Centre Europe 2.0 (UHCE 2.0) project and its effectiveness will be investigated in the examined population.

Molecular Features Associated with BRAFV600E-mutated Versus Wild Type BRAF Colorectal Cancer

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ABSTRACT

The current research proposal is an upgrade to the CSF project No. 3900 "Dissecting the mechanisms of therapy resistance in BRAF-mutant colon cancer using an integrated –omics approach" led by M. Sedić, which is currently under negotiation with CSF for the project financial and work plans. The CSF project will illuminate processes underlying the development of resistance to BRAF inhibition by vemurafenib in BRAFV600E mutant colorectal cancer (CRC) cells via integration of results of proteome, glycoproteome, secretome and sphingolipidome analysis. The CSF project will identify novel biomarkers and targets associated with the development of resistance to vemurafenib in BRAF mutant CRC cells and will investigate the role of bioactive sphingolipid metabolism in acquired resistance to vemurafenib. However, identification of molecular and cellular mechanisms specifically modulated by oncogenic BRAF mutation represents an important piece of information that adds to better understanding of the role of BRAFV600E mutant protein in the regulation of growth, survival and response of CRC cells to chemotherapy. This project has several goals: 1. exploring differences in the molecular profiles (global proteome, sphingoid bases) between BRAF mutant vs. wild-type BRAF CRC cells to identify molecular factors associated with the aggressive phenotype of BRAF mutant CRC; 2. determining a correlation between BRAF status and the expression of the key proteins regulating metabolism and the functions of bioactive sphingolipids; 3. identifying proteins at the level of global proteome and the key enzymes in sphingolipid metabolism and signalling whose expression is directly controlled by BRAF mutant protein. Results obtained in this study are expected to reveal new molecular features of the aggressive phenotype of BRAFV600E mutant CRC, whose validation in tissues from CRC patients will deliver novel histopathologic biomarkers as a foundation for the development of new diagnostic and prognostic tools.

The Characteristics of Endothelial Disfunction and the Role of IL-18 in Ischaemic - Reperfusion Injury after Coronary Artery By - pass Grafting

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ABSTRACT

Coronary artery by - pass grafting (CABG) represents the gold standard in the treatment of multi - vessel coronary heart disease when medications and percutaneous intervention are not effective. There are two available techniques: CABG with the use of an extra - corporal circulation device, and this is called the on - pump technique. Another surgical technique is performed on the pumping heart and this is called the off – pump technique. The choice of the CABG technique depends on the condition of the patient and the choice of the surgeon. Regardless of which CABG technique, the operation is followed by the development of ischemic - reperfusion injury and endothelial dysfunction, which can lead to myocardial infarction, acute renal injury, and acute respiratory insufficiency in the early post - operative period. As well as the surgical procedure, the development of post - operative endothelial dysfunction can also be caused by the anaesthesia technique and the use of intravenous fluids. Ischemic - reperfusion injury is characterised by a strong inflammatory response with pro - inflammatory cytokine secretion, including interleukin (IL)-18. IL-18 presents a potent pro - inflammatory cytokine, which is secreted from cardiomyocytes and is found in systemic circulation of patients during and after surgical revascularisation. Triggering the cytotoxic mediators (perforin, granulizine), IL-18 leads to the activation of cytotoxic lymphocytes that can cause further damage to the endothelium. In this way, the endothelium becomes the major source of pro - inflammatory cytokines, chemokines and adhesion which leads the lymphocytes into the subintimal layer of coronary blood vessels, forming the plaque which leads to development of myocardial infarction. Using this study, the biomarker potential of IL-18 in developing the ischemic - reperfusion injury can be analysed for the effect of CABG on the creation and secretion of IL-18.

The Pharmacogenetics of Multiple Sclerosis: The Response to Disease - modifying Therapy

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ABSTRACT

Multiple sclerosis (MS) is a complex autoimmune neurodegenerative disease of the central nervous system (CNS) which is caused by environmental factors acting on genetically predisposed individuals. MS occurs in early adulthood, is more common in women and is characterised by inflammatory destruction of myelin, axon damage and by the loss of oligodendrocytes.
In spite of recent progress in the development of new therapies, there are no therapeutics which are fully effective in all patients. Interferon-beta (IFN-β) and glatiramer - acetate (GA) are the first choice in immunomodulatory therapy (IMT) but, the favourable therapeutic response was not observed in 30 - 50% of patients. It has been suggested that response to IMT is polygenic but pharmacogenomic studies are still scarce. Recent pharmacogenomic genome wide association studies (GWAS) and the candidate gene driven approach have not defined the key genetic variants responsible for an unfavourable response to therapy. These findings suggest that gene interactions and epistasis should be analysed, as was previously done in the research of MS susceptibility. MS incidence, age at onset and disease progression are different among males and females, so the therapeutic response with regard to gender should be investigated, as well. This project aims to investigate genetic variants with proposed significant influence for different response to IMT, in 500 MS patients on IMT. The selection of genetic variants will be based on the results of the most relevant GWAS and on the suggested functional capacity of genetic variants. Regarding the complex polygenic basis of MS and pleiotropy of IFN-β and GA, the additive and epistatic effects will be investigated toward diversification of patients for treatment with particular IMT. The difference in response to therapy driven by interaction of gender and genetic variants will be another major focus of the project.

The Prevalence of Lower Back Pain and its Impact on the Quality of Life of Women after Childbirth

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ABSTRACT

Lower back pain (LBP) appears in approximately 40% of women six months post - partum, and 20% of them complain of persistent pain even three years after delivery. The incidence of LBP is higher after caesarean section compared to vaginal delivery whereby 45 - 54% of women had LBP after delivery. LBP affects the daily activities of women and reduces their quality of life, and in about one third of women, LBP represents a serious health problem that leads to functional disability. During pregnancy, women experience significant changes such as increased body weight, increased lumbar lordosis, abdominal deformity, and diastasis recti abdominis muscle. These changes lead to muscle dysfunction, postural changes and joint and ligament loads, which cause inflammatory processes and lead to degenerative changes in ligaments and joints. In addition, a caesarean section leads to localised muscle and aponeurosis lesions, scar tissue formation and adherence on the anterior abdominal wall. Due to the prolonged period of rest after caesarean section, atrophy of the abdominal wall muscles and pelvis muscles occurs. Not many well - documented studies have been conducted regarding the influence of the caesarean section on abdominal muscle weakness. Although, the incidence of LBP in women who have had vaginal delivery has been extensively studied the information regarding the increased incidence of LBP in women who have had a caesarean section, several years after delivery are rather limited. Therefore, the main objective of this project is to investigate the incidence of pain in the lumbosacral part of the back in women after vaginal and caesarean section delivery and determine if there is a correlation between the degree of diastasis recti abdominis and the incidence of LBP. The project proposal can be of importance in understanding mechanisms of LBP and may contribute to the development of new therapeutic approaches to women during pregnancy and after delivery.

Francisella - The Molecular Mechanisms of Adaptation in Amoeba Cells

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ABSTRACT

Tularemia is an emerging zoonosis caused by gram - negative bacterium *Francisella tularensis*, which is able to infect a broad range of animal species and humans. *F. tularensis* subsp. *tularensis* (Type A) and *holarctica* (Type B) cause most human illnesses. *F. tularensis* subsp. *holarctica, F. philomiragia* and *F. novicida* have a strong association with freshwater environments, free - living amoeba, and biofilms. Several factors that facilitate intracellular survival of *Francisella* have been identified, including *Francisella* pathogenicity island (FPI), which encodes a type VI secretion system (T6SS). Interestingly, the FPI is duplicated in all species of *Francisella*, but is present in a single copy in *F. philomiragia* and *novicida*. Recently a gene cluster in *F. novicida* (FNI) has been discovered and it shows a homology to FPI in the type A and B strains, especially for the proteins IglA, IglB, PdpB. We assume that these proteins are necessary for survival in amoeba cells, and that *Francisella* uses two T6SS in amoeba. Our studies have shown intravacuolar replication of *F. novicida* within amoeba *Hartmanella vermiformis*, which is a major difference from the cytosolic proliferation of this bacterium within mammalian cells. In the proposed project we will try to elucidate the role of proteins within FPI/FNI in the intracellular lifecycles of *F.* subsp. *holarctica, F. novicda* and *philomiragia* within amoeba. Our special focus will be on the mechanisms of cell death as well as the role of vacuole in their life cycle. It is possible that the long - term evolution of *F. tularensis* within amoeba has facilitated its intravacuolar adaptation in the aquatic environment for long - term survival and transmission to arthropod and mammalian hosts. The incidence of tularemia associated with water sources is increasing in Europe. The project will contribute to understanding the mechanism of survival of *Francisella* in aquatic environments, providing opportunities for the development of preventive strategies.

The Determinants of the Effectiveness of Treatment of Altered Orofacial Functions and Appearance

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ABSTRACT

The efficacy and effectiveness of treatment are not only conditional on biological characteristics and the modality of treatment but also on a series of the patient's psychological characteristics, the daily functioning of the patient and their social interactions. This project is focused on the disorders and conditions affecting facial bones, temporomandibular joints, masticatory muscles and teeth, including musculoskeletal pain, mandibular dynamics, orofacial functions, craniofacial anomalies and malocclusions with altered facial and smile appearance. Their etiology is multifactorial, with trauma and anatomical, pathophysiologic, genetic, psycho - social factors, oral parafunctions and occlusal factors considered to be the key factors contributing to the emergence. Their conditions are sometimes related as well as their treatment. The aim of this study is to evaluate the outcomes of impaired orofacial functions and dentofacial aesthetics and explore the determinants of treatment effectiveness and efficacy. The efficacy of the treatment will be assessed by randomised trials under controlled clinical conditions. Effectiveness will be evaluated by analysing the results in the 'real' world of treatment in outpatient clinics by therapists that are not university teachers. Apart from clinical outcomes, the self - reported quality of life (symptoms, functions, psychological and social aspects) will be measured. In the concept of personalised medicine, biomarkers are certainly important determinants of the effectiveness of therapy. However, several psychological factors can modify the perception of health conditions and pain and affect the success of the treatment. The environment (the media and society) can also influence the perception of health condition and appearance. In this study, the determinants of the success of a particular analysed treatment will be amplified perception and attention, cognitive distortion, body image, self - esteem, self - confidence, perfectionism, anxiety, depression and health competence, i.e. the degree to which a person feels able to cope with their own health outcomes.

The Influence of Topically Applied Bone Morphogenetic Protein 7 (BMP-7) on Renal Parenchyma Regeneration

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ABSTRACT

Kidneys have the natural ability to repair parenchyma after a chronic injury such as chronic kidney disease or after acute injury such as obstruction of the urinary tract. The bone morphogenetic protein -7 (BMP-7) produced by kidney cells has an important role in these processes. This protein prevents epithelial - mesenchymal transformation and thus acts protectively on epithelial parenchymal structures. The aim of this project is to examine whether the recombinant BMP-7 can induce regeneration processes after a traumatic injury, whereby a fibrous scar or nonfunctional tissue is normally formed at the site of the defect. The experimental model (rat) will be used in the research, where one and three months after, the type and quality of the site changes will be monitored. Expression of BMP-7, TGF-ß, SMAD 1/5/8, SMAD 2,3 and 4, E-cadherin, N-cadherin, PCNA, &alpha, SMA and desmin will be analysed. Immunohistochemistry, Western Blot and the polymerase chain reaction (PCR) will be used to detect and monitor the changes in kidney parenchyma.

The Prognostic Significance of Survivin and Crypto-1 in the Micro - environment of Prostate Cancer

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ABSTRACT

Our goal is to investigate the cancer cell micro - environment in prostate cancer (PCa) to target molecular markers, Survivin and Crypto-1, which might be potentially significant in PC progression. Survivin is a member of the protein family of apoptosis inhibitors and it has been shown that Survivin gene polymorphism may induce predisposition to PCs. Crypto-1 is among the embryonic genes that regulate the function of stem cells and is found to be over - expressed in human tumours. Immunosuppressive tumours associated with macrophage (TAMs) are associated with poor clinical outcomes and can potentially be induced by their change through dietary intervention. Since some authors have assumed that a dietary protein restriction could modify the function of macrophage against anti - tumour phenotypes and the immune response in prostate microcirculation. It is necessary to further investigate the state of macrophage polarisation in prostate microcirculation and its colocalisation within the angiogenic properties of tumour neovascularisation. We assume that crosscutting multiple path activation could be responsible for progression, for PC architecture change in the broader sense and for Gleason score progression. We will use a tumour model on the entire tissue cut for immunohistochemical analysis and tissue microarrays; and molecular analysis of tumour tissue obtained by radical prostatectomy. In conclusion, the signalling pathways Crypto-1 and Survivin can be attractive targets for cancer treatment. Blocking Crypto-1 and Survivin can potentially be used to eliminate not only differentiated cancer cells but also to target the poorly differentiated and undifferentiated sub cellular lines of cells that have properties similar to embryonic and stem cell lines.

The Correlation between the Development and Degree of Liver and Pancreas Damage in Patients Suffering from Alcohol Addiction

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ABSTRACT

Liver and pancreas damage are the most common types of alcohol - induced organ damage. It is known by experience that lesions in these two organs rarely occur simultaneously, meaning that clinically manifest liver damage is most often not followed by significant pancreatic damage and vice versa. The importance of determining this potential linkage relates to the need to include diagnostic testing of liver or pancreatic function in patients with known liver or pancreatic damage in the routine diagnostic algorithm. The lack of evident correlation suggests the importance of the influence of other factors, like environmental or genetic factors, on the development of alcohol - induced organ damage. This prospective observational study is designed to determine the relationship between liver and pancreas damage. We plan to include 200 patients who suffer from alcohol addiction by recruiting them from primary healthcare by using a specialised questionnaire. The target population will be assessed for liver damage by biochemical analysis, abdominal ultrasound, and transient elastography. Patients will then be divided into two groups based on the presence of liver damage and will be assessed for possible pancreatic disease by faecal elastase and endoscopic ultrasound. The aim of this study is to determine the simultaneity of liver and pancreatic damage caused by alcohol consumption. Additionally, we will try to determine the correlation between the degree of organ damage and the amount and duration of alcohol consumption, as well as investigate other risk factors possibly influencing the development and severity of alcohol - induced organ damage.

The Role of Biomarkers in Early Prediction of Preeclampsia

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ABSTRACT

Preeclampsia (PE) is a multisystemic disorder characterised by hypertension, proteinuria, and possibly edema, which occurs after the 20th week of pregnancy. With a prevalence of 3 - 8%, PE causes about 18% mortality of women and up to 40% of perinatal mortality. Despite numerous studies, the etiology of PE is still unclear. The basic pathophysiological change is the absence of physiological blood vessel replacement, which causes reduced perfusion and the emergence of elevated resistance to placenta blood vessels. Important factors in the mechanism of PE development are: intolerance of the immune system on the antigen side, abnormal placental, cardiovascular and inflammatory changes, and genetic, environmental and nutritional factors. Numerous biomarkers that appear in early pregnancy prior to the onset of clinical symptoms are being investigated, which could predict the onset of PE during pregnancy progression (especially in the second and third trimesters).This prospective study would include all pregnant women of the Primorje - Gorski Kotar County who have been referred to a screening test for first - trimester chromosomal abnormalities (so - called combined test probes) that will identify risk factors and store a blood sample. In a pregnant woman who is diagnosed with PE during pregnancy, one of the following biomarkers is stored from the blood sample: Placental Growth Factor (PlGF), soluble fms - like tyrosine kinase 1 receptor- (Placental Protein 13), Vitamin D, Urinary Acid, Medium Platelet Volume (MPV), Endothelin-A (Peptide Protein) 1 (ET-1), human horonic gonadotropin and free subunit (free ß-HCG). The importance of early PE prediction with the help of biomarkers, is the ability to prevent preeclampsia in the 2nd and 3rd trimester through intensive monitoring of pregnant women with PE predisposition.

The Role of Lung and Respiratory Tract Ultrasound with Special Reference to the Detection of the B Line ("Comet - tail Ultrasound Artefact ") in the Assessment of Adequate Ventilation and Hemodynamic Status in Mechanically Ventilated, Critically - ill Patients

PROJECT MANAGER

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ABSTRACT

Mechanical ventilation is the most fundamental and relevant procedure in the treatment of critically ill patients. Although this procedure is of vital importance for the patient, mechanical ventilation can lead to various local (pulmonal) and systematic consequences since non - physiologic breathing under positive pressure is involved. Different local lung and respiratory tract injuries bare the shared name, ventilator - induced lung injury, which is the result of volutrauma, atelectrauma, barotrauma and biotrauma while the systemic effects of mechanical ventilation are basically a result of hemodynamic instability of the patient. Lung ultrasound (LUS) has existed in intensive care for almost twenty years and is considered to be a relatively new diagnostic method with great (research) potential. To simplify, lung and respiratory tract ultrasound can be divided between a direct view of the anatomic (pleura, upper respiratory tract) or pathological structures (parenchyma, pleural effusion, etc.) and the display and interpretation of the various artefacts, the most significant one being the display of B lines (in shape of the so - called tail comets). By definition, the B lines are an artefact created as a consequence of the reflection and reverberation of the ultrasonic wave at the point of contact of two regions of different acoustic impedance, lung parenchyma filled with air and liquid - filled alveolus, and are thus presented as hyperehogenic lines similar to laser beams with a narrow base at the pleural level lines, reaching to the edge of the ultrasound window and moving synchronously with the breathing. Given that the B lines indicate the presence of extravascular lung water (EVLW), they stand as an excellent parameter in the assessment of the regional (for example lung congestion, noncardiac pulmonary edema), but also the systemic hemodynamic status of the patient (volume overload, cardiac pulmonary edema). Also, given that the B-line movement is synchronous with the lung ventilation, their presence informs us about the ventilation of the lung and their presence or absence is an important element in the diagnostics of pneumothorax.

The objectives of the study are to evaluate the relevance of daily ultrasound examination of the lungs and respiratory tract of patients treated in intensive care units when assessing:

- the potential impact of the examination on the change of the patient's treatment,
- the quality and suitability of mechanical ventilation,
- patient's hemodynamic status and
- novel changes, primarily conditioned by mechanical ventilation, but also by progression of the underlying disease.

In addition, we will try to determine the influence of the preconceived knowledge of ultrasound diagnostics in B line detection, i.e. the difference when estimating the number of lines between the observers (inter - observer difference) of different levels of knowledge (and experience), then the difference between repeated examinations within the same observer (intra - observational difference) and, finally, the degree to which the role of software algorithms are relevant in the case of the precise counting of B lines.

Population Exposure to Traditional and Emerging Contaminants Due to the Consumption of Seafood and the Characterisation of the Related Health Risks

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ABSTRACT

Due to anthropogenic emissions, the marine environment is the ultimate sink for many toxic and persistent pollutants. Many of these compounds bioaccumulate in the food chain and can reach high concentrations in fish species used for human consumption, thus presenting a significant threat to public health. Therefore, it is of the uttermost importance to characterise the health risk involved and offer evidence - based nutritional guidelines for seafood consumption. So far only the health risks related to the exposure to certain heavy metals in seafood have been assessed in Croatia. Exposure to other contaminants, such as polychlorinated biphenyls (PCBs), polychlorinated naphtalenes (PCNs), as well as polybrominated diphenyl ethers (PBD) have not been properly studied so far. In addition, the exposure and risks characterisation which have been performed for selected heavy metals in fish were based on a relatively small number of samples, and the results obtained thus far have to be validated using larger datasets. Based on the above, the scope of the proposed project is to obtain data on the exposure of the population of the Primorje - Gorski Kotar County to several traditional and emerging contaminants through seafood consumption and determine the health risks involved. Exposure data will be gathered through questionnaires and analysis of pollutant concentrations in seafood. These methods will be coupled with rigorous statistical algorithms in order to gather representative data sets. Based on the assessment of health risks the existing nutritional guidelines related to seafood consumption will be re - evaluated. Due to the fact that exposure data for emerging contaminants is lacking on a global scale, the results obtained through the proposed research will be of both regional and international significance.

The Direct Impact of Hypoglycaemia on Heart Rhythm in Patients with Diabetes Mellitus Type 2

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ABSTRACT

Hypoglycemia is one of the most frequent and most important complications of diabetes mellitus type 2 (DM2). Using clinical definitions, hypoglycaemia can be classified as mild if it is self - treated or severe if it the patient needs help from other people. The biochemical definition of hypoglycaemia, according to ADA and EMA, is a plasma glucose level of less than 3.9 mmol/L. (1) & (2). Based on the influential HAT study, it has been estimated that patients with DM2 have more than 20 episodes of hypoglycaemia per year (3). In addition, up to two thirds of these hypoglycemic events occur during the night (4). New technologies that allow continuous glucose monitoring (CGMS) have revealed that up to 47% of patients with DM2 have hypoglycemic events that go completely unnoticed and, therefore, remain untreated. This observation is particularly worrying, because hypoglycemic events are an independent risk factor for cardiovascular disease (CVD). Furthermore, it is presumed, but insufficiently investigated, that hypoglycaemias occurring during the day potentiate atrial and ventricular ectopic rhythms due to the dominance of simpatoadrenal activity during the day while nightime hypoglycaemias, due to parasymphatetical dominance, increase the risk of ventricular arrhythmias and cardiac arrest (5). In this project we will recruit 25 patients with DM2 who have a high - risk profile for the development of hypoglycemic events as well as heart arrhythmias. We will observe these patients simultaneously through CGSM and by continuous heart rhythm monitoring (Holter ECG) and try to answer the question as to whether hypoglycemic events have arrythmogenic potential in this group of patients. To our knowledge, no similar research has been done before.

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The Role of Angiogenesis and Other Factors of the Microenvironment in the Progression and Prognosis of Plasma Cell Dyscrasia

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ABSTRACT

Multiple myeloma (MM) is a very common and incurable hematological malignancy. MM is almost always preceded with monoclonal gammopathy of undetermined significance (MGUS) that represents a plasma cell dyscrasia (PCD) which may or may not progress into MM. The reasons behind the progression into a malignant PCD are still unknown but could include an "angiogenic switch" where pro - angiogenic cytokines prevail against anti - angiogenic cytokines which in turn promotes the occurrence of small blood vessels in the bone marrow as well as disease progression. Other possible promoters of progression related to plasma cells and the microenvironment are being investigated as well, such as activation of the NFkB signal pathway, activity of cyclin D1, tumour macrophages infiltration (TM) and the expression of certain metalloproteinases (MMP-2 and MMP-9). The proposed research is retrospective. An assessment of bone/bone marrow biopsies of 50 patients with MGUS, 50 patients with newly discovered MM and 50 patients with relapsed/refractory MM, immunohistochemical staining will quantify angiogenesis parameters such as small vessel density (SVD), expression of pro - angiogenic cytokines VEGF, OPN and other parameters such as NFkB protein and cyclin D1 expression as well as TM infiltration, MMP-2 and MMP-9 expression in the bone marrow microenvironment. Furthermore, we will determine relevant clinical/prognostic parameters as well as survival rates for all patients. Statistical analysis will aim to determine the interconnectivity of the above parameters and compare their expression in different forms of PCD. We will ascertain the relationship of the above parameters with established prognostic factors and survival rates in order to determine prognostic potential. With this research we will further clarify the pathogenesis of different forms of PCD, that is, factors that may influence progression from one form to another as well as their prognostic value in different forms of PCD. A PhD student will actively work on this research.

The Molecular Characterisation of the Pathological Phenotype of RPL24-heterozygous Mice

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ABSTRACT

Ribosomes are composed of 4 rRNAs and 80 ribosomal proteins (RP) and they are involved in protein synthesis. Recent evidence has demonstrated that mutations of a number of RP genes in humans can lead to a variety of disorders, collectively termed ribosomopathies. However, mechanisms underlying ribosomopathies remain largely unknown. We have previously shown that p53 has a pro-survival role in RPL24+/- mice at birth. We have demonstrated that p53 inhibits mTORC1, a positive regulator of protein synthesis and a negative regulator of autophagy, a cellular protein degradation mechanism, during the neonatal period in these mice. From these observations, we hypothesise that RPL24-heterozygosity alters protein synthesis and that p53 enables RPL24+/- mice to resist dysregulated protein homeostasis, thus promoting their survival. Given the potential complexity of these mechanisms, we will first investigate them in mouse embryonic fibroblasts (MEF) of specific genotypes, and then validate the obtained results in new-born mice.

WE PROPOSE THE FOLLOWING AIMS:

1. Generate wt, RPL24+/-, p53-/- i RPL24+/-: p53-/- MEFs
2. Assess protein homeostasis in wt, RPL24+/-, p53-/- and RPL24+/-: p53-/- MEFs
3. Uncover the role of p53 in protein homeostasis in u RPL24+/- MEFs
4. Validate the results obtained in MEFs in new-born RPL24+/- and RPL24+/-: p53-/- mice

This study will elucidate the mechanisms by which RPL24-heterozygosity causes pathological phenotypes and uncover the p53-mediated adaptive mechanisms under these conditions, providing guidance for studying other ribosomophaties. An outstanding set of international collaborators will assist us in this innovative project, which will positively impact education and science at the University of Rijeka. The project is fully compliant with the strategy for Smart Specialisation (S3) and the S3 priority thematic areas defined by the University of Rijeka, including public health, quality of life and open society.

Epigenetic and Genetic Factors in the Etiology of Congenital Heart Defects in Downs Syndrome Subjects

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ABSTRACT

Congenital heart defects (CHD) are one of the most common abnormalities occurring in 40% - 60% of Down Syndrome (DS) cases. Most commonly, these are septal defects, including atrial septal defects, ventricular septal defects and complete atrioventricular canal. Studies have shown that phenotypic variability in individuals with DS may contribute to various genetic and epigenetic factors such as gene expression variability, transcriptional factor activity, variable repeat sequences, regulatory RNA molecule, and DNA methylation. DNA hypomethylation is associated with the development of PSG, particularly septal defects. Endogenous factors such as the polymorphisms of genes involved in folate metabolism, in which methyl groups are synthesised, as well as the polymorphisms of the methyltransferase gene, the enzymes responsible for establishing and maintaining the methylation pattern, may contribute to modified DNA methylation patterns. The aim of the study is to investigate the association of LINE 1 DNA methylation in DS individuals and the presence of CHD, with particular reference to endogenous factors affecting global methylation. Therefore polymorphisms of various genes will be analysed; 5-methyltetrahydrofolate homocysteine methyltransferase reductase - MTRR, 5, 10-methylenetetrahydrofolate reductase MTHFR and DNA methyltransferase (DNA methyltransferase - DNMT). The effect of individual polymorphisms, as well as their combinations on LINE 1 DNA methylation as well as CHD development, will be investigated. Molecular genetic analysis will be performed on samples of genomic DNA molecules isolated from peripheral blood lymphocytes. The bisulphite conversion of DNA will precede the quantification of methylation LINE-1 using the MethyLight method. PCR (polymerase chain reaction), RT-PCR (real time polymerase chain reaction), RFLP (restriction fragment length polymorphism), and electrophoresis on agarose gel will be used for genotyping. Data processing will be performed using the HaploView and Statistica for Windows software (StatSoft, Inc. Tulsa, OK, USA).

Adjustment to the New EU Directive on Bathing Water Quality

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ABSTRACT

Bathing water quality is one of the main elements influencing the choice of tourist destinations. According to survey results, Croatia is located in the "top five countries" within the EU. In order to maintain good results, monitoring of the seawater quality on beaches needs to be continuously developed and supplemented. The main EU directive objective is public health protection, and for its achievement, it is of great importance to periodically review the quality indicators and methodology used for water quality assessment. Therefore, the EC has committed itself to revising the existing directive by 2020. Previous research suggests the need to include faster molecular methods of quantitative polymerase chain reaction (qPCR) for proofing of E. coli and enterococci in bathing water, as these methods significantly shorten the time until the results are issued. The methods used for bathing water analysis are traditionally based on cultivation techniques, and the time required for conducting an analytical procedure is up to 50 hours, while the duration of the qPCR method is 4 to 6 hours. Therefore, a swimming ban is not enforced on the beaches at the time of contamination, and disclosure of data often comes only when the pollution is over. The time lag, from the occurrence of pollution to the issuing of results and implementation of further prescribed measures, represents a potential health risk for beach users. The European directive states the need for the development of predictive models that enable forecasting of water quality, allowing the beach user access to notification of contamination before it appears. The aim of this study is to examine the suitability of molecular qPCR methods for assessing bathing water quality. The goal is to develop a predictive model of beach water bathing quality that records chronic contamination as well as more widely used applications.

The Genetic Epidemiology of Parkinson's Disease in Croatia

PROJECT MANAGER

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ABSTRACT

Parkinson's disease (PD) is a progressive neurodegenerative disorder most frequently developed after the age of 60. Prevalence is 0.3% of the general population and 3% in those older than 65. It is characterised by degeneration of dopaminergic neurons, cytoplasmic inclusions and a clinical picture which includes rest tremors, bradykinesia, rigidity and postural instability. PD is a genetically heterogeneous disease with monogenic familial form (5 - 10%) and a sporadic form of disease. Today, we know 23 genes and loci connected with the familial form of PD and more than 12 genetic risk factors determining sporadic PD. Some genes are associated with early onset at age 20 - 40 years, some with rapid progression or onset of dystonia etc. Current therapy is based on the enhancement of dopamine using precursor levodopa or dopamine agonists. To date, there has been no genetic - epidemiological study of PD patients conducted in Croatia and the percentage of sporadic and familial forms, and a possible spectrum of known and maybe new genetic risk factors, is unknown in our area. The aim of the suggested project is to determine the representation of familial and sporadic forms of PD in Croatia and to identify genetic variants in patients with the familial form by analysis of exome's sequencing. With this study, we are expecting to obtain the first genetic - epidemiological data of PD in Croatia and to identify risk genetic variants influencing susceptibility and expression of PD in Croatian patients which will contribute to the clarification of etiopathogenesis of PD. At the same time, we will make a brain bank and register of patients which will help our further research work by planning the intervention with patients, family members and society. This investigation in different parts of Croatia is very important for society, to popularise science and to potentially influence public health and quality of life. We hope it will open the way for further investigations in this area, to new collaborations, to the education of young researchers and to the dissemination of our organisations' research.

The Role of Insulin in NK Cell Function

PROJECT MANAGER

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ABSTRACT

Insulin is an endocrine hormone, best known for its role in the control of blood glucose levels. In addition, insulin gives an anabolic stimulus to insulin - sensitive cells increasing glucose utilisation for growth, protein synthesis and cell division. Following infection, activated immune cells switch from catabolic to anabolic metabolism to allow for the proliferation of cells and the acquisition of an anti - microbial phenotype. We recently discovered that anti - viral immune cells express the insulin receptor. Importantly, we could demonstrate that during viral infection, systemic insulin levels are increased, which promotes anti - viral CD8 T cell responses. NK cells play a crucial role in containing viral spread upon infection and these cells also express the insulin receptor. Our preliminary data indicates that in response to insulin stimulation, NK cells produce higher levels of the cytokine IFN&gamma. In this project we will investigate the role of insulin signalling in NK cell mediated immune responses. Mice with NK-cell specific deficiency for the insulin receptor (InsRNK-KO) will be generated. Bone marrow and peripheral organs of these animals will be analysed to determine the role of insulin in the development and function of NK cells under homeostatic conditions. Next, InsRNK-KO mice will be challenged by viral infection or injection of B16 melanoma cells to determine the importance of insulin signalling in NK cell function. Finally, the therapeutic potential of insulin as an anti - viral or anti - tumour agent will be explored. The project described here builds on the know - how of the team members in relation to NK cell biology and in vivo models. The project itself is in line with topic 1 of the smart specialisation strategy of UniRi. The team contains experienced researchers, which allows optimal knowledge transfer to the younger researchers. Finally, the broad international network of the project leader ensures a successful outcome to this project.

The Regulation of PD-1/PD-L1 Pathway in Malignant Melanoma

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ABSTRACT

BACKROUND: Malignant melanoma is one of the genetically most complex tumours. Inhibitory molecules on the surface of malignant cells block the cytotoxic effect of T lymphocytes. Lymphocytes in tumour inflammatory cell infiltrate show PD-1 (programmed cell death 1) protein expression. Known ligands for PD-1 are PD-L1 and PD-L2, which are glycoprotein - linked cell membrane components. Binding PD-1 with ligand can inhibit T cell proliferation.
AIM: This research is based on the role of several types of regulation of signal path control PD-1 / PD-L1 proteins. We divided the types into three groups: changes in the genetic material and signal pathways of melanoma cells, regulation by the immune system and by tumour - microenvironment enzymes.
METHODS: Retrospectively, material from the Department of Pathology, Faculty of Medicine in Rijeka will be used in this research. Preparation and immunohistochemical staining will follow. With the determination of PD-1 and PD-L1 immunohistochemical positivity, the presence of CD8+ lymphocytes, CD4+ lymphocytes, Foxp3 lymphocytes, CD20+ lymphocytes, CD163 M2 macrophages and DC-LAMP mature dendritic cells will be investigated. Immunohistochemical methods will be used to investigate the relationship between the expression of matrix metalloproteinase and PD-L1 expression on melanoma cells. In this prospective study, the same immune cells will be determined by the flow cytometry of a patient's blood. Molecular genetic methods will be used to investigate somatic mutations and amplification/deletion of CD274, JAK2 and PTEN genes and MITF gene. The prospective monitoring of patients with metastatic melanoma in therapy with PD-1/PD-L1 inhibitors, as well as patients with high-risk primary melanoma is planned.
SCIENTIFIC CONTRIBUTION: The results will improve pathohistological diagnosis and the classification of melanoma. The definition of proteins responsible for immune inhibition will contribute to better use of immunotherapy as the first line of treatment for metastatic melanoma.

The Early Detection of Chemotherapy - related Cardiotoxicity

PROJECT MANAGER

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ABSTRACT

The incidence of malignant diseases is steadily increasing, but thanks to the development of more effective therapeutic procedures, mortality is decreasing. Precisely because of better survival rates amongst patients with cancer, cardiotoxicity is becoming increasingly important as a serious complication of chemotherapy. It may cause severe heart failure (HF) and have high mortality, so its prevention and early detection are becoming crucial. In terms of cardiotoxicity, chemotherapy is divided into two groups: the anthracyclines give irreversible damage to the heart muscle, whereas the monoclonal antibodies (trastuzumab - like therapy) result in reversible damage. Today it is well known that endothelial dysfunction (ED) often proceeds manifest forms of HF. The predictive value of ED in the development of HF caused by chemotherapy is unknown to our knowledge. Determination of left ventricle (LV) ejection fraction (EF) is a routine method for diagnosing cardiotoxicity induced by chemotherapy. However, as the EF reduction is a relatively late change, in recent years LV global longitudinal strain (GLS) has been used for this purpose. It detects subclinical changes in LV function and enables the diagnosis of early myocardial damage. Changes in myocardial deformation precede a reduction in EF and the determination of the maximum systolic GLS of the left ventricle is more appropriate in the diagnosis of the cardiotoxic effect of chemotherapy. Previous studies have mainly focused on the detection of chemotherapy - caused LV damage, the right ventricle (RV) was less explored, while the diagnostic value of deformational echocardiographic changes in RV has not been investigated at all. Due to the morphological and functional features of the right side of the heart, we believe that sensitive diagnostic imaging of the RV can allow the early detection of chemotherapy - induced cardiotoxicity. In this parallel group - study we will analyse the early morphological and functional changes of RV and LV using advanced deformational echocardiographic techniques, magnetic resonance imaging and humoral markers in patients after non - metastatic breast cancer surgery treated with anthracycline or trastuzumab chemotherapy. We will also investigate changes in ED after chemotherapy and analyse its relationship to changes in ventricular morphology and function. ED will be investigated using plasma markers (vWF, PAI-1) and high - resolution ultrasound of the brachial artery (flow mediated dilatation-FMD). We believe our research will provide useful information in prediction and early detection of chemotherapeutic cardiotoxicity.

The Expression of the Pro - inflammatory and Fibrotic Cytokines during Osteoarthritis and Carpal Tunnel Syndrome

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ABSTRACT

Carpal Tunnel Syndrome (CTS) is a compressive neuropathy of the median nerve, associated with the non - inflammatory fibrosis and thickening of the subsynovial tissue in the flexor retinaculum. Numerous studies have shown statistically significant association of degenerative osteoarthritis (OA) and idiopathic CTS, and therefore the comorbidity of these two entities exists. Still, the pathological mechanism of this comorbidity is not known. The role of chronic systemic inflammation in the process of tissue damage away from the site of the primary inflammation is increasingly emphasised. The products of inflammation enter circulation so that elevated concentrations of pro - inflammatory cytokines such as TNF-α IL-1, IL-6 can be found in serum. These factors can act on other tissues and organs and cause inflammatory and fibrotic changes. It is apparent that certain humoral factors are candidates for explanation of the CTS and OA comorbidity since the synovial membrane of the joints and the subsynovial tissue of the carpal tunnel secrete various inflammatory and fibrotic cytokines. Therefore, with this study we are planning to investigate the tissue expression and serum level of pro - inflammatory (IL-1, TNFa), fibrotic (TGFb) and antifibrotic factors (BMP-7) in the synovial tissue of OA joints and the subsynovial tissue of CTS. For this purpose, we will conduct research on four different groups of patients undergoing surgical treatment in the Clinical orthopedic hospital Lovran. The groups of patients will be formed according to the diagnosis of isolated CTS or the comorbidity of OA and CTS. The aim of this study is to determine the association between inflammatory, fibrotic and antifibrotic factors in CTS and OA comorbidity. We believe that an understanding of the systemic regulation of comorbidity between these two different clinical entities is very important for the understanding of pathogenesis, and for the monitoring of progression, prevention and treatment of idiopathic CTS.

Pathophysiology and Neuroprotective Therapy in the Model of Traumatic Brain Injury in Rats

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ABSTRACT

Traumatic brain injury (TBI) is a major worldwide public healthcare problem and the leading cause of death and disability in persons younger than 40 years of age. Despite the fact that TBI has been the objective of numerous clinical studies over the past twenty years, not all the mechanisms included in the cascade of pathophysiological processes characteristic for the brain trauma are known. Also, in clinical medicine there is no one effective neuroprotective drug. Various different mechanisms and processes of brain damage in TBI are parallel which additionally makes its pathophysiology as well as its therapy extremely complicated and provocative. In addition, because TBI, according to injury severity, can be clinically mild, moderate or severe as well as focal, diffuse and combined regarding its extent, it is clear that different pathophysiological mechanisms could result from various, individually specific therapeutic approaches. In this project, the focus of interest will be the appearance and the extent of the processes of damage and repair, the neurodegeneration and programmed cell death pathways in different brain regions that have not been previously sufficiently investigated, at various time points following TBI in the rat. Also, the effects of different multifunctional drugs on various brain damage and repair parameters will be examined. The lateral fluid percussion injury model of brain trauma will be used, and different parameters of interest will be determined by biochemical methods, Western blotting with densitometric quantification, immunohistochemistry/immunofluorescence, TUNEL and Fluoro Jade B histofluorescence or by combinations of the former. We expect that the results of this project will lead to a better understanding of the pathophysiological events included in TBI and to novel pharmacotherapeutic approaches.

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Metacognitive Processes in Learning and Reasoning

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ABSTRACT

Metacognition includes knowledge of one's own cognitive processes, as well as the monitoring and control of those processes. Although metacognitive processes have been studied extensively in the domain of memory, it has been recognised recently that the research on metacognition should be expanded to other domains of cognition, in particular to the processes of thinking, including reasoning, judgment, decision - making and problem solving, as well as to the processes of category learning and categorisation. According to the recent theoretical and methodological framework of meta - reasoning, the outcomes of the processes of thinking (for example, during solving complex problems, drawing conclusions, or acquiring complex category structures) depend to a large extent on the metacognitive monitoring of these processes and on the regulatory activities people employ when they attempt to solve a problem. The main aim of the project is to study the metacognitive processes of monitoring and control in reasoning and category learning. In particular, we will examine metacognitive processes during conflict detection, metacognitive monitoring during category learning, and we will test the predictions of the self - consistency model applied to the domain of thinking. Several psychological experiments on reasoning and category learning will be conducted, in which the features of the task and solution procedures will be manipulated, and the effects of those manipulations on normative accuracy, response times, and metacognitive judgments will be examined. The obtained results will be used in order to test the hypotheses that are based on the theory of meta - reasoning, as well as on other theories in the domain of metacognition, including the self - consistency model.

Industry 4.0 and the Export Competitiveness of the European Union

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ABSTRACT

The EU, China and the USA are the world's largest exporters. If the exports of EU countries are observed individually then Germany is the third largest world exporter behind China and the US. The Netherlands, France, Italy and Great Britain, from within the EU, are among the top ten exporters and have a significant impact on worldwide exports. The particularity of exporting EU goods is that they are mostly sold to other EU member states. Only about 30% of total EU exports go to countries outside of Europe.

Most developed countries, including leading exporters, are making significant steps towards re - industrialisation of their economies and are striving to keep up with their global competitors. Exports and export competitiveness are extremely important because international trade accounts for about 20% of world GDP. Re - industrialisation is based on the implementation of digitisation - Industry 4.0. This is the concept of connectivity and communication between machines, people, products and business systems through Internet technology. Past results show that those companies that started digitising their production through Industry 4.0 are on an equal footing in the world market with their foreign competitors and they indicate the direction in which EU industry should develop in all its member states. Industry 4.0 contributes to the growth of the gross value added to production but at the same time it requires considerable financial resources for its implementation.

This research is expected to answer the following questions: To what extent is the digital industry influencing the growth and development of the economy and its competitiveness? Can the application of Industry 4.0 to the EU economy have a positive impact on export competitiveness? How will Industry 4.0 affect employment, the development of the education system and production resources? How will the EU finance the implementation of Industry 4.0 in the member states? Will Industry 4.0 reduce the differences in the level of development of member states or will it only deepen these differences?

The Digital Transformation of Society: Legal Aspects

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ABSTRACT

Digitalisation transforms and accelerates not only the ways of doing business, but also the ways of thinking. Unprecedented interconnectedness and access in cyberspace, where everything is available at the touch of a finger, gives rise to many issues concerning the transfer and impact of new technologies from the digital world onto social relations in the 'real' world. There is a dichotomy between the accelerated development of the digital world and the limited capacities of institutions, communities and individuals to absorb these seemingly unlimited possibilities in the real world. The purpose of law is to create legal certainty. Digitalisation erases the traditional space - time divide on which the law depends and without which its purpose is at risk. Current legal knowledge has only begun to grasp the rapid development and digital transformation of society. Further research is needed to provide the basis for the elaboration of a well - planned regulatory policy and legal framework in the Croatian and European context. This project gathers scholars from the areas of EU, constitutional, labour, social, family and criminal law, as well as linguistics, with the aim of identifying specific legal challenges and suggesting possible solutions. The plan is to enable synergic flow and to link research results in various selected areas in which law and technology meet. Digitalisation benefits the economy: the digital market knows no boundaries and changes economic paradigms. A competitive economy transforms into a sharing economy. The legal framework is not adapted to an economy based on sharing. The risks of digital transformation primarily affect the labour market, since many jobs become automated. Work relations are the binding force of any society. Changes in the world of work will dictate the destiny and future development of social systems and family relations, as well as the application of constitutional principles and traditional procedural guarantees to the digital transformation of society.

Value Orientations and Social Actions of Students of Rijeka

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ABSTRACT

This project examines the political, religious and economic value orientations of the students from the University of Rijeka and their impacts on students' social actions. The theoretical framework of the project is based upon a contextualized theory of modernisation. The project points out that, unlike the late - modern societies which are characterised by processes of retraditionalization and individualisation (Beck, Giddens), modernization of Croatian society, which has been affected by war and political and economic transition, is characterised by a loss of value consensus and contradictory changes in social and political structures. These structural contradictions have caused the change in predominant social values within political and social discourses and are the basis of the value legitimation of institutional and everyday actions of social actors. Existing sociological research reveals that the essential feature of this change in Croatian society is the retraditionalization of social values. How does this contradiction affect the students, who belong to the "world of youth"? What happens with the transmission of values in a society where there is no basic value consensus? What are the political, religious and economic values of students' orientation and how do they affect their social activity? Is there an intergenerational (dis)continuity and conflict of values in the transfer of social values and, if so, to what extent? In an effort to answer these questions, a combination of quantitative and qualitative methods will be used. Surveys will be conducted on a representative sample of students from the University of Rijeka (N = 700). The results will be elaborated at the level of univariate, bivariate and multivariate statistical analysis. As a control group, half - structured interviews with the students engaged in student, political, religious and volunteer organizations and associations will be conducted (N = 50). The data collected from the interviews will be transcribed, coded and categorised.

Psychological Well - Being: Determinants, Models and Cross - Cultural Aspects of Happiness

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ABSTRACT

Defining the concept of the term happiness is one of the most controversial issues in the research of psychological well - being. People define happiness differently, because it is subjective and refers to an abstract concept that is difficult to verbally express. In the conceptualisation of happiness, there are also significant cultural differences that need to be further explored. The cultural context shapes values and thus the way an individual wants to achieve psychological well - being. Different theories try to explain both the construct and the determinants of psychological well - being. Happiness is explored within two theoretical perspectives. Whereas Hedonism is focused on enjoyment, Eudaimonism highlights the importance of meaning in life and self - actualization. The aim of the project is to explore the conceptualisation and contextualisation of happiness, meaning in life and life goals in different cultures, as well as the determinants of psychological well - being. People engage in certain activity for various reasons - because it is interesting and enables self - actualisation or because they enjoy it. The effects of these activities on well - being depend on the type of motive. It will be explored how Eudaimonsm and hedonism, which are operationalised as motions for activities in free time, contribute to subjective well - being. Furthermore, daily mood fluctuation will be investigated to construct a model that will include respondents' characteristics and daily variations. The research will apply a mixed - method approach, which includes both quantitative and qualitative investigation. In addition, the experience sampling method will be used in the experimental study. Students and adults from 30 to 60 years of age from Croatia and some 20 countries from around the world will participate in the research.

A Knowledge - Based System to Support the Learning of Students with Dyslexia

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ABSTRACT

The aim of this project is to develop a computer knowledge - based system (KBS) for students with dyslexia, to ensure a more efficient learning experience based on individual needs. Due to the differences in brain function of these students, the use of ICT in learning and teaching ensures an individual and multi - modal approach, based on a student's strongest learning characteristics.
The use of ICT enables adaptation of teaching materials through the variation of written texts (shorter texts for reading, shorter sentences with more simple structures and dictionary use), visual support in the form of pictures and the use of a glossary. The computer system will include immediate feedback, positive support, additional multi - modal applications and prompted questioning, which lead to increased motivation, focus and self - regulatory ability. The system will use neural networks to individualise and automatically lead the teaching process; natural language processing (NLP) to implement semantically correct interaction and learning support; and will also use interrelated multimedia learning content. Let us suppose that within the educational content there exists a sentence: "Autumn is the season that brings yellow leaves and rain." The system can automatically ask a student: Which season brings yellow leaves? What does autumn bring? A student will learn from the text by answering these questions. Textual knowledge will be interconnected with multi - media knowledge: image, sound, video. A student can ask the system questions as well, and receive answers from it. The system will track individual student progress and, based on neural networks, adapt the learning process. The proposed research is a unique contribution in the development of computer knowledge - based systems that integrate the neural network method to achieve individualised and guided teaching, natural language processing to identify poorly - adopted learning content and multimedia for appropriate representation of educational content.

The Legal Aspects of Companies Restructuring and Transition Towards New Corporate Governance Culture

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ABSTRACT

Domestic companies are regularly involved in cross - border and domestic corporate acquisitions and restructurings with the participation of foreign financial intermediaries in the post - accession period. The objects of these acquisitions are mostly listed companies, but also include state - and privately - owned companies which have difficulties and are parts of business groups. A similar process is visible in closed companies (family companies) whose majority shareholders are simultaneously managers or employees of the company. The entry of foreign competitors has changed the paradigm of corporate governance and introduced new forms of low - cost work and employment. This process has created more complex relations and processes between stakeholders. New proactive shareholders transform the company on all levels with the aim of maximizing its profit. This opens up the question of socially responsible investment in target companies. In groups of companies, the issues of relations between members of these groups and the liabilities of their managements needs to be addressed, as well as questions of the insurance of their respective liability. The most important social influence of these changes is the transformation of the employment of the active working population in conditions of depopulation. New flexible forms of employment change relations between employee and employer. Employment is no longer a relatively permanent legal relationship and safe harbour of social security. The aim of this project is to investigate the above - mentioned problems and to propose legal solutions for closed companies and state - and privately - owned companies, whether successful or suffering business difficulties. The project idea is that adequate solutions for a new corporate culture may be introduced through companies' self - regulating acts or through corporate soft law.

Advancing Marketing Approaches in Business through Value Co - Creation

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ABSTRACT

Nowadays, consumers are not passive in accepting a company's product, but they actively collaborate in the value co - creation process. Therefore, the focus of market exchange has moved away from the traditional delivering of value to customers through products/services towards a perception of value-in-exchange that is co - created through interaction between different parties in the exchange process. That is, a value co - creation process occurs. By acknowledging a marketing approach through focusing on consumers in the business - to - business and business - to - customer markets, a company recognises consumers as active partners in value creation. As a consequence, value co - creation between customers and a company based on the marketing approach improves consumer relationships and enhances business. The project's goal is to draw attention to the importance of value co - creation elements and to stress the importance of building relationships between consumers and companies as this positively contributes to this process. The value co-creation process alters market conditions, and applying the marketing approach helps a company to appreciate new market interactions and changes in the market. This contributes to consumer understanding and helps to improve company business. The project's goals will be accomplished through desk and field research in three countries. Proposed hypotheses will be tested by applying multi - variate statistical methods as well as by implementing structural equation modelling. Contributions in the scientific field are related to emphasising the importance of the value co - creation process, which is based on the marketing approach, and to the understanding of consumer behaviour and this also enhances company business. Research will contribute to a deeper understanding of the theory of service - dominant logic and the value co - creation phenomenon. The managerial contribution is seen as stressing the importance of the value co - creation process for improving company business.

Neurodynamic Modelling of Visual Perception and Attention

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ABSTRACT

The aim of the proposed project is to develop and test new neuro - computational models to explain the empirically observed effects of attention and expectation on conscious visual perception. Theoretical models of neural networks provide a unique perspective in addressing a major challenge for modern psychology and neuroscience: How do complex brain interactions generate intelligent behaviour? They enable a rigorous quantitative analysis of how neurons and their synaptic connections give rise to cognitive functions such as visual perception and attention. In the project, we will examine two challenging questions: 1) does the existence of feedback projections in the visual cortex necessarily imply that expectations and prior knowledge can alter the content of conscious visual perception; and 2) what are the neural mechanisms that enable visual attention to flexibly select space, objects or features depending on the task demands. Newly proposed models will be inspired by the previously published models and by recent psychological and neuroscientific data that does not fit within existing models. To address the first question, we will focus on three specific domains that attract great interest in the scientific community today: the effect of prior knowledge on colour perception, the effect of emotions on brightness perception and the effect of action preparation on the perception of speed. We will develop a real - time implementation of the adaptive resonance theory to explain how expectations and knowledge influence colour, brightness and motion perception. To address the second question, we will develop a new model of lateral inhibition, which simultaneously selects multiple locations that correspond to objects or features in a 2-D spatial map representing visual space. In addition, we will show that the newly proposed network supports the implementation of mental contour tracing when it is embedded in a larger multi - scale neural architecture for boundary detection.

Smart Cities in the Function of the Development of the National Economy

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ABSTRACT

The basic goal of the project is to provide theoretical and empirical foundations for raising the efficiency of society by implementing a smart city concept, as one of the key contemporary development models. Within the framework of the new system, each tier of the public financing system is going through disruptive transformation. The smart city concept is about the integrated connection of physical, societal and informational infrastructure, which embodies a level of collective intelligence of state, region or city. The goal of development of such a platform is to increase the efficiency of both public and private sectors, to enable the matching of growing societal needs. In a practical sense, the task of the project is to envisage mechanisms by which modern states can use available information - communication technologies (Internet of Things), and within a framework of redefinition of the public financing system, territorial - administrative organisation, new relations between tiers of government, and better and newer public services, raise the overall productivity of society. At the regional level, it is important to analyse technological development overspill effects on inter - regional and intra - regional dynamics and on new mechanisms of stimulating development. The concepts of "big data", "smart infrastructure" and "smart buildings" integrated through the concept of the "Internet of Things" is crucial for the implementation of the smart city concept. We will research these concepts through theoretical and empirical studies but also by empirical and simulation analysis. The key method of data collection is through sensors integrated within "smart infrastructure" and "smart buildings" which communicate through the "Internet of Things" platform. Finally, we will research the "big data" concept in order to determine mechanisms of collection, storage and analysis of large quantities of data with the goal of providing systemic solutions for the management and optimisation of the urban community in real time.

The Importance of Creating a Brand for Products Based on Natural and Traditional Resources

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ABSTRACT

The aim of this research is to gather new insights to help small producers of natural and traditional products strengthen their position on the local and international market through establishing a brand and connecting the brand's story to the identity of Croatia as a country of tradition and rich cultural heritage. This will contribute to the preservation of natural and traditional resources and the strengthening of a sustainable economy. Three research questions are to be answered. The first: What are the success factors for branded natural and traditional products? To answer the question an in - depth case study analysis will be conducted among 5 businesses. The second: How do natural and traditional branded products strengthen the desired identity of Croatia as a tourist destination? The answer will be found by conducting a questionnaire among tourists. The third: Which kind of brand identity and which product characteristics (hand - made /organic /Croatian /natural /traditional) are the most important for customers of natural and traditional products? To answer this question, surveys will be conducted among local people and tourists. The research team includes experienced researchers, doctoral students and a practitioner. Each experienced researcher is specialized in one aspect of the proposal, and comes from a different institution within or outside of UNIRI. This diversity is perceived as a precondition for meeting planned research results, mobility and knowledge transfer to young researchers, colleagues at the University and beyond, and from scientific institutions to businesses. The results of this project will be published at five international conferences and in 5a1 journals. The results will also be disseminated to producers of traditional and natural products and relevant institutions during a scientific - professional conference to be organised. Finally, one outcome will also be a life - long learning programme for the relevant practitioners. This project is fully aligned with the fifth smart specialization priority of the University.

The Factors Affecting International Competitiveness of EU Enterprises

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ABSTRACT

EU companies continually face rapid changes in the European Union's internal market, but also in international markets. Therefore, companies are forced to implement a variety of effective mechanisms and business strategies to maintain (or increase) a level of international competitiveness that is satisfactory. Depending on their characteristics (e.g. size, revenue, costs, tangible and intangible assets, human resources, innovativeness, etc.), companies react differently to internal and external factors of international competitiveness. External factors (e.g. legislative, political, cultural, environmental) often require customisation of the company to become more successful in the international market. Internal factors of the enterprise often involve factors that each company can manage, whether it is labour, capital or technology.
To become more competitive in the international market, companies have to strive for an efficient allocation of their resources. Optimal use of resources (i.e. internal factors), encourages productivity growth. Productivity growth increases the company's competitiveness, which, in turn, is manifested through market share growth, cost reduction, and profit maximisation. This research project will demonstrate that an efficient policy of exploiting the internal and external aspects of international competitiveness factors can create a platform for effective productivity growth and for the growth of the international competitiveness of EU enterprises. By creating a suitable environment and with investment in, and effective management of, technology, labour and capital, positive effects on the international competitiveness of EU companies can be achieved.

Digital Games in the Context of Learning, Teaching, and Promoting of Inclusive Education

PROJECT MANAGER

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ABSTRACT

Game - Based Learning (GBL) is an approach that involves the use of serious, didactic games whose purpose is to achieve certain learning outcomes. Today, it is increasingly used to motivate students, increase their engagement, and improve their learning outcomes. The purpose of the project is to explore the possibilities of using digital games to improve the quality of teaching, learning and the promotion of inclusive education, as well as the development and promotion of contemporary pedagogical - technological frameworks for the use of GBL in schools. The project will cover activities that correspond to specific research objectives, which are 1) the selection and development of digital tools, games and modern teaching models for building GBL frameworks, and 2) the designing of learning scenarios based on developed frameworks applicable in practice for the teaching and learning of subjects in primary schools. Design Based Research (DBR) will include the improvement of existing e - learning models by introducing GBL and gamification through learning resources such as digital games, puzzles, logical tasks and similar elements for encouraging learning (technological aspect) and contemporary teaching and learning strategies that place students at the centre of the educational process (pedagogical aspect). Several studies based on the principles of GBL will be begun in the context of the project. Encouraging the integration of computational thinking into the daily teaching of different subjects in the lower grades of primary school using GBL will be investigated, with the aim of stimulating creativity, logical thinking and problem - solving skills among students. GBL will also be applied to encourage motivation for learning programming and in the domain of computational thinking and programming in teaching Informatics in primary schools. It will explore how GBL can be used to promote the inclusion of students with intellectual disabilities through the assistance in acquiring new data, developing new skills and gaining everyday life skills.

Transport, International Trade and Economic Growth: Analysis of Trade Facilitation in the Case of the Republic of Croatia and Primorje - Gorski Kotar County

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ABSTRACT

Trade facilitation plays a crucial role in a country's engagement in international trade. As tariffs come down, it remains to be seen how other factors such as transport and the logistics infrastructure affect trade. This project has two parts: first, it investigates the effects of the transport and logistics infrastructure on Croatia's engagement in international trade flows. Considering the importance of trade for the national economy and the significant amount of funds directed into trade facilitation in Croatia, the purpose of this research is to evaluate whether these funds are justified and to quantify the impact of the infrastructure on international trade between Croatia and its main trading partners and consequently the impact on economic growth. In order to fully understand the effects of trade facilitation on international trade, it is important to estimate the effects on both, the macro (aggregate) and the micro level. Thus, the second part of the research is dedicated to the analysis of the effects of transport and the logistics infrastructure on a regional level where we analyse the effects of trade facilitation on the business performance of companies located in the Primorje - Gorski Kotar County. The aim of the research is to investigate how trade facilitation, partly through trade liberalisation, and partly through domestic transport and logistics infrastructure (hard and soft) has contributed to the economic growth of Croatia, both at a country and a regional level. In the first part of the research, focused on the aggregate level, we use macroeconomic data (value of imports and exports, gross domestic capital formation, logistics performance index, economic growth etc.) from the period 2001 – 2018, while in the second part of the research, focused on the regional level, we use microeconomic data (share of income from exports to operating profit enterprises, enterprise income, enterprise expense, total assets of the company) on a company level from the period 2008 - 2017.

Man Machine Communication

PROJECT MANAGER

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ABSTRACT

The development of intelligent devices and sensors and their increasingly frequent use in everyday life creates the need to develop new interfaces that will facilitate communication in a way that is natural, safe and more efficient. In the proposed project, procedures required for the construction of computer systems based on modular and autonomous computer structures that can simulate the human process of perception, recognition and understanding of speech and image signals will be evaluated. Simulation of the ability to understand speech and image information enables modelling of dialogue and communication between man and machine. The procedures used in intelligent communication systems between man and machine are applied in computer speech and image analysis and research.

Automatic Recognition of Sports Technique in Young Athletes and Amateurs for the Purpose of Adoption of Motor Skills and Style Enhancement

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ABSTRACT

In the recent period, sport and recreation have become increasingly important and a part of everyday life for an increasing number of people. In order to successfully engage with some sports that use the widest range of movement, it is necessary to master the techniques of that sport in order to prevent injuries. In mastering technique and style enhancement, top athletes use complex and expensive systems accompanied by expert analysis, but for amateurs, such systems are not available. The idea behind this project is to create a system that will use cameras to help amateurs when attempting to master techniques, giving them feedback on their style and performance. The aim of the project is to use methods of artificial intelligence and deep learning to develop models that will enable the automatic recognition of techniques in video materials of young athletes and amateurs to improve the development of their motor skills and style enhancement. Video materials will be recorded at sports schools, in training and competition after obtaining a recording licence. It will begin with swimming and handball. For swimming it will develop models for recognising swimming techniques (freestyle, backstroke, butterfly, breaststroke) and techniques such as turning and diving. Techniques for recognising individual handball actions such as the throwing, catching, shooting and jumping with a ball will also be modelled. The project will enable the continuation of existing research in the area of automatic action detection in sports and the gathering of a research team that will work on the development of new models for detecting athletes in multi-media material, tracking them and recognising their actions. The database and developed models will form the basis for further exploration in the recognition of techniques in different applications. By introducing the project to users from the sports domain, the prototype of the model will be promoted and help gain an insight into additional user requirements and possible improvements as well as the promotion of the role of science in the sports community.

Dynamic Capabilities and Strategic Management

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ABSTRACT

The project incorporates two different streams of research for the dynamic capabilities of a strategic manager; cognitive managerial capabilities from the field of strategic management and micro - foundations of managerial capabilities from the field of quality management. Both research streams have the same aim: to understand the sources of, and the creation and sustainability of, the competitive advantage of Croatian managers. Croatia held the 74th position in the ranking of WEF global competitiveness in 2016 with a noted tendency for stagnation. The classic analysis of competitiveness pointed to the problem of competitiveness on the company level, more precisely the problem of the lack of resources needed for the creation and sustainability of competitive advantage. The proposed project suggests a deeper level of analysis, micro - foundations of dynamic capability, which can explain and point to the qualities of competitiveness of the Croatian economy that exist at the cellular level. Quality management is predominantly researched from a technical perspective or perspective of improving business processes. Up to now, the research has arrived at conclusions on general trends, but not on the dynamic managerial capabilities that should be the foundation of quality. Additionally, the innovation of this project lies in the fact that research in strategic management has never focused on the principles of cognition in strategy. By using this suggested contemporary approach in strategic management, it will be possible to comprehend the micro - foundations of managerial capabilities, namely their cognitive foundations, which have not been researched before. The priority of this project is to offer support for PhD students in the early stages of their career when they create and implement scientific research. The project will assure domestic and international mentor capacities for giving support and direction to PhD students. Additionally, this project will support PhD students with professional and scientific training within the framework of this project.

The Effects of Personality, Emotions and Social Processes in Interpersonal Contexts

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ABSTRACT

Previous studies have shown that our understanding of the effects of personality traits, emotions and social processes on various outcomes in the context of dyadic relationships may be improved if we analyse not only the perspective of an individual, but also the perspective of his/her partner. Other persons, and especially those with whom we are in relevant social interactions, are an important part of the social context that partly determines our behaviour. In dyadic, interpersonal interactions, different outcomes may be influenced by our own characteristics, the characteristics of our partners, and the (dis)similarities between those characteristics. Therefore, the aim of this project is to explore the effects of personality, emotions and social processes on various outcomes in the context of various interpersonal relationships. Along with the effects of the characteristics of an individual, we will examine the effects of his/her partner's characteristics, the effects of the degree and type of (dis)similarity in these characteristics, as well as the effects of various moderating variables. These effects will be examined by using different data sources (self - reports, partner - reports, non - verbal behaviours) and in the context of different types of dyadic relationships such as romantic, family, friendly and professional relationships as well as random interactions. Data will be collected partly in field studies from different samples of participants in dyadic relationships, and partly in laboratory experimental settings. The results of this project will allow for a better understanding of the effects of interpersonal relationships in different types of relevant dyadic interactions as well as the consequences of these interactions on the quality of life and some aspects of health.

Personal and Co - Textual Determinants of Learning and Teaching at Different Educational Levels

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ABSTRACT

The main goal of the project is to examine the effects of personal and contextual determinants on the processes and outcomes of primary and secondary school students and university students in different domains (e.g. STEM, psychology). At the personal level, (meta)cognitive, affective, and motivational determinants of self - regulated learning will be examined given their importance for lifelong learning and general well - being. At the contextual level, we will focus on teaching and using digital technology in learning and teaching, as well as on parental influence. Within the project, data obtained using questionnaires and performance tasks from a larger number of studies, one of which will be intercultural (comparison of Croatian and Finnish students), will be analysed. The effects of motivational components on self - regulated learning are expected to be to a greater extent dependent on personal motivational profiles than on single components. It is also assumed that different motivational beliefs and academic emotions are linked to specific strategies for the self - regulation of motivation, which supports cognitive self - regulation and conceptual change. Concerning the effect of contextual conditions on self - regulation processes and outcomes of learning, it is expected that parental beliefs will determine both the motivational beliefs of students and their academic emotions. On the other hand, teachers focused on student - centred teaching will probably foster student motivation for self - regulation and will be more inclined to use technology. It is assumed that the use of technology, as well as collaborative learning, will contribute to more effective self - regulation of learning and conceptual change in students. The findings that will be obtained within this project will contribute to the understanding of the relationship between personal and contextual aspects of self - regulated learning in different age groups and to providing guidelines for planning educational interventions.

The Characteristics and Predictors of Instructional School Leadership

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ABSTRACT

The proposed research is focused on the construction and practice of Instructional School Leadership (ISL). The results of previous studies have already confirmed the strong correlation between ISL and the better students' or schools' achievements. Instructional School Leadership refers to comprehensive school leadership processes that can be observed by encouraging the development of the social and academic capacities of students, and the professional and intellectual capital of teachers, which enables students' development, teachers' learning, and greater teaching efficiency. The research goal is to describe and analyse the experiences, approaches and efficiency of school principals in Croatia when practising and implementing ISL. Furthermore, the research will identify the behaviour of school principals, that contributes to the improvement of the learning and teaching process in schools. It will also identify which circumstances within and outside of schools stimulate or inhibit the practice of ISL. Data will be collected through semi - structured interviews that will be conducted on a sample of primary and secondary school principals in Croatia. The research results will contribute to the understanding and development of adequate strategies for encouraging the features of "instructionally - efficient schools", such as those schools that purposefully ensure better student achievement. The practical contribution of the project will be realised through the implementation of the acquired knowledge in a programme of postgraduate specialist study for heads of educational institutions.

Increasing the Efficiency of Learning Analytics in E - learning Systems Based on Interactive Visualisation of Data

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ABSTRACT

Learning analytics encompasses measurement, data collection, analysis and reporting (visualisation) of data about learners and the learning process. E - learning systems maintain data about the learning process that can be used for data analytics. One of the key phases of data analytics is analysis and presentation of learning data. Increasing the quality of data presentation and the level of visualisation interactivity has a direct influence on the quality and success of data analytics. Distance Learning System Based on Dialogue – DITUS – is an adaptive tutoring system for e - learning that features a hierarchical organisation of domain learning concepts. It caters for individual learning styles using a knowledge matrix (of competences). The existing web system for DITUS has been integrated with tools for data mining and offers visualisations of e - learning data based on statistical analysis and/or data mining. By improving the quality of graphical presentation of e - learning data obtained through statistical methods or data mining methods, using interactive visualisation, the analytics of the learning process will consequently improve. For the purposes of English language learning, a system named LLS (Language Learning System) has been developed. Its main goal is to help learners improve their linguistic competences and reading skills. Updating the LLS system with a module for graphical data presentation using interactive visualisation of data will improve the quality of learning analytics for the overall system. The results of research on improving the DITUS and LLS systems will be applied in the development of a new System for Interactive Data Visualizations (SIDV) which will enable the import of data from e - learning systems, the definition of criteria for data analysis, and interactive data visualisation.

Sustainable Cities as Carriers of Economic Development

PROJECT MANAGER

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ABSTRACT

Urban areas in Croatia encounter complex challenges including economic, demographic, social and ecological changes. Urban development can no longer be treated as an issue only to be conducted at a national level. It is necessary to co - ordinate regional and local policies in order to reduce economic and social differences that exist among Croatian towns. More harmonious urban development implies stimulating the development of medium and small - sized towns and development centres as the main thrust of a regional urban system. The aim of this project is to investigate demographic, economic and ecological trends in Croatian towns in order to analyse the current situation and to answer the main research question: Is tourism the only economic activity that gives Croatian townspeople the prospect of a better life? The purpose of the project, through the use of scientific instruments, is to examine the ability of smaller towns to maintain their urban vitality. The purpose of the research is to determine whether small towns as tourist destinations are attractive places to live in, and to identify within which sectors their development guidelines lie? For the implementation of the empirical part of the research, data from urban statistics will be used and will be processed via panel analysis. An additional feature of this research will be the qualitative and quantitative research that will cover two target research groups, the first being the inhabitants of smaller urban areas and the second the relevant decision makers. The project's evident contribution will be in developing a model of local economic development that will not have the same criteria for every destination. However, the researchers suggest using the Triple Helix concept as a social innovation that includes universities, the state and the business sector in finding the solutions. The local community should also be included in development planning in order to raise awareness of the creation of transitional sustainable towns that can be economically and energetically independent and, at the same time, attractive not only to tourists but also to the town's residents.

Efficient Regulation of the Digital Market Fostering Innovation in the ICT Sector

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ABSTRACT

The inefficiency of the ICT sector stands in sharp contrast to the high - profile of human resources in Croatia. This Croatian reality comes about as a result of several factors, among which the project team recognises the inadequacy of the regulatory framework which leads to insufficient stimulation of economic development, especially of SMEs which make up 99% of the economy. Examples of this inadequacy can be taken from intellectual property law, competition law, e - commerce, commercial practices and consumer protection, data protection and business information which, despite EU legislation, suffer from legal uncertainty, lacunas and out - dated rules and are inadequate for new technologies and business models. The aim of this research is to implement a new approach to understanding this issue, particularly by using empirical evidence as a basis for legal research. This will be done through intensive contact with the real economy, which the project team will reach using its network, as well as including in the project team an equal number of members from outside scientific institutions, who represent the judiciary, attorneys, multi - national companies and SMEs in the ICT sector. The results of this scientific, theoretical and empirical research will result in precise guidelines and criteria for making new regulations, adjusted to modern changes in the digital market. The project results will determine key elements in decision - making for legislators and competent authorities and will contribute to linking science with the law profession, and in particular the business community. The aim is also to increase the visibility of the project team, and thus also of the University, both in the academic community and the ICT sector. To achieve this, the project team will use various dissemination channels, from conference presentations and lectures at foreign universities, to publishing with distinguished publishers and the use of social networks. In parallel, the project team will organise lifelong learning activities, such as seminars for businesses in the ICT sector to raise awareness and share project results.

Andragogues and Education for Sustainable Development

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ABSTRACT

Today's society is faced with a series of challenges that need addressing, from the increased complexity and uncertainty of living conditions, the degradation of the eco - system upon which we depend, the expansion of economic and cultural uniformity, to individualisation and increasing social diversity, and a growing vulnerability and exposure to natural and technological hazards. These challenges demand adaptable, creative and self - organised activity, while people need to learn how to understand the complex world they live in as well as how to co - operate, engage and progress forward towards positive change (UNESCO, 2015; 2017). Education for Sustainable Development (ESD) refers to educational programmes and experiences designed to enable the acquisition of knowledge, skills and values necessary to shape a sustainable future as well as to successfully respond to the above - mentioned challenges (UNESCO, 2015). Teachers are recognised as the most important agents of change in terms of promoting ESD, among which, andragogues are especially interesting due to their important role in promoting ESD in adult education, taking into account that adult education is given substantial significance in terms of economic, cultural, individual and social development. In order to be prepared to integrate and facilitate ESD while working with adults, andragogues need to develop key sustainability competencies, including knowledge, skills, attitudes, values, motivation and commitment. In recent scientific literature, people who have developed these key competencies are called “citizens of sustainability”. Accordingly, the main aim of this research is to examine the indicators of sustainability citizenship which refer to the attitudes, values and behaviour of andragogues. Additionally, the aim is to examine their preparedness for ESD implementation in their classes as well as to examine the inter - relationship of the indicators of sustainability citizenship present among andragogues and their subjective estimates of their preparedness to implement ESD.

The Junior Researchers' Professional Socialization into Teaching

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ABSTRACT

The aim of this project is to examine the characteristics of junior researchers' professional socialisation which contributes to developing positive attitudes towards teaching. The results of research conducted thus far indicate that professional socialisation is rather challenging for junior researchers. An unfavourable professional (institutional) environment and insufficient (mentor and collegial) support are seen as being particularly challenging in terms of preparing junior researchers for teaching. However, it has also been established that junior researchers regard teaching in a positive manner. This project is based on the latter research and placed in the context of recent demands to generate additional research interest in teaching in higher education (e.g. Yerevan Communiqué, 2015; Paris Communiqué, 2018). Therefore, the focus of this research is the positive university teaching practices which have been hitherto insufficiently examined. The aim of this research is to identify, describe and understand the characteristics of junior researchers' professional socialisation which are beneficial for developing positive attitudes towards teaching in the Croatian system of higher education. The research will employ a qualitative approach, through case studies, which will ensure a multiple perspective on the phenomenon, thus obtaining a better and deeper understanding of the junior researchers' professional socialisation and the development of positive attitudes towards teaching. These research results will serve as a significant starting point for discussion and co - operation with the key stakeholders with the aim of proposing new guidelines for improving teaching in the system of higher education in Croatia. Additionally, the results will be presented at scientific conferences and in papers published in relevant journals.

Teacher Beliefs as Determinants of Self - Regulation and Creativity of Students in the BSTEM Field of Education

PROJECT MANAGER

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ABSTRACT

The development of the education system needs to follow the needs of modern society and be based on innovation, creativity, collaboration and life - long learning. For such a step, an inter - disciplinary approach to all aspects and processes of competency development from the perspectives of learners and students in a wider, inclusive educational context is necessary. There are a limited number of studies in the educational sciences that simultaneously consider the perspectives of the educational programme students, teachers and pupils, with the aim of testing the effects of teachers' beliefs on changes in approaches to teaching and to the students' creativity, motivation and self - regulated learning skills. The motivational outcomes of teaching and self - regulation differ in different groups of teaching courses. Given the strategic priorities, the emphasis has been placed on the STEM area of education and the inclusive education of pupils with special needs, which in this research specifically refers to gifted students with specific learning disabilities. This research will broaden the previous segmented research findings through the integration of the research conducted on educational programme students, teachers and pupils, in the context of the natural sciences teaching subjects. From the wider structure of teacher competencies, teachers' beliefs are defined as a key determinant of teachers' readiness to adopt new approaches to teaching. Given that similar learning approaches are needed for the development of creativity and self - regulation, these two constructs are the main focus. The research will cover the unexplored perspective of twice exceptional children (e.g. dyslexia), considering indications that these children have above - average abilities and unrecognised creative potential. The results obtained will point to necessary changes in the initial education and professional development of teachers.

Principles, Methods, and Applications of Pharmacoeconomics: Positive and Normative Methodological Approaches

PROJECT MANAGER

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ABSTRACT

The Republic of Croatia allocates more than 20 percent of its state budget (i.e. more than 10 percent of GDP) to health care and medical and pharmacological treatment, which is praiseworthy from a social point of view but problematic from the point of view of public spending, the sustainability of the insurance system, and public funds management. With the aging of the population, the nation's health needs are increasing, and the health budget is at the upper limit of sustainability. Therefore, the need for pharmacoeconomics, i.e. the economic allocation of public and state consumption of medicines, pharmacological therapy and accompanying health services is obvious. In its positive part, the project will rely on the methods and principles of pharmacoeconomic analyses relating to different perspectives: society as a whole, public health management organisations (Croatian Health Insurance Fund), health care providers, the pharmaceutical industry, and especially the patients. The most frequent pharmacoeconomic analyses include cost minimisation, cost - benefit, cost - efficacy/effectiveness, cost - benefit, and the budget impact analysis. Budget Impact Analysis (BIA) is the basic economic criterion for inclusion on the primary and secondary CHIF lists. The following criteria are used to place drugs on the basic or supplementary list of CHIF drugs: the importance of the drug from the point of view of public health, the therapeutic importance of the drug, the relative therapeutic value of the drug compared to other drugs on the market, relative to the market price and overall budget limitations. The normative part of the project relies on ethical aspects that are necessarily contextually related to efficiency, relative effectiveness, morbidity, budget constraint and other indicators, factors and determinants. The project will investigate the relationship between the aforementioned factors in the allocation of drugs and pharmacological therapies, and will specifically investigate the evaluation of risks.

Keyword Extraction and Summarisation Based on Language Networks - LangNet

PROJECT MANAGER

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ABSTRACT

We live in a time of exponential growth of data – in this big data era the unstructured texts which represent a significant proportion of data sources require advanced computing techniques for processing, fast - indexing, retrieval, classification, and even fast reading enabled by text summarisation. Design and development of new techniques for keyword extraction and document summarisation are at the very core of the natural language processing of large quantities of texts. Recently, complex networks, deep learning methods and multi - layered neural networks have become more attractive to the research community, leading to success in various applications of artificial intelligence. In the proposed research, we are planning to investigate various representations of texts based on new and innovative combinations of complex networks and deep neural networks for solving the problems of keyword extraction and document summarisation. As well as English, the reference language in the field, research will also be conducted for the Croatian language. The goal of this research is to develop new methods for keyword extraction and extractive summarisation enabled by the formalisms of complex networks and neural networks. The comparative analysis of the performance of the proposed methods in terms of their effectiveness and correctness will be performed on both English and Croatian texts.

Data Stream Mining for Smart Cold Chain Management (SmaCC)

PROJECT MANAGER

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ABSTRACT

With limited land resources and a growing population, the perishable food cold chain is faced with the challenge of increasing handling efficiency and minimising post - harvest food losses. This project proposes the SmaCC system which is based on the application of data stream mining methods for the analysis of sensor stream data. The data is generated by state - of - the - art sensor technology with the task of monitoring the logistical conditions within the food cold chain and has the aim of improving food shelf life. Huge data volumes produced in the form of fast streams on different cold chains are affected by non - stationary phenomena. Due to the resulting lack of stationarity in the distribution of the produced data, the need exists for efficient and scalable algorithms for online analysis which are capable of adapting to such changes (concept drift). Concept drift often represents an anomaly detected as an unstable state of a food cold chain. The prediction task of the SmaCC system is to detect these rare events. Since these events are rarely observed, the prediction task suffers from a lack of balanced data. Therefore, in order to classify data streams, the SmaCC system will rely on cost sensitive learning which is computationally more efficient than data sampling techniques in the context of data streams. The SmaCC system will be based on state - of - the - art data stream mining methods such as the Incremental Support Vector Machine, Evolving Spiking Neural Networks, and Genetic Algorithms. The requests and hypotheses posed by the domain experts will be collected in the form of a code book. In order to efficiently share expert knowledge, expert domain ontologies will be formed (pomology and aquaculture domains). The data stream mining results, namely predictive and descriptive cold chain models, will, additionally, be evaluated by experts from the application domain in co - ordination with Chinese experts from the domains of sensor technology development and cold chain logistics.

Approaches for Measuring Semantic Similarity of Texts (SemTex)

PROJECT MANAGER

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ABSTRACT

The measuring of the semantic similarity of texts has an important role in various tasks from the field of natural language processing such as information retrieval, document classification, word sense disambiguation, plagiarism detection, machine translation, text summarisation, etc. Likewise, a somewhat more general task, the measuring of the similarity of concepts is of significant importance for other fields in which similarity is defined differently, although the same methods are used. For example, the proposed methods can be used in the field of biotechnology for the determination of the similarity of the ontology of genes or the comparison of proteins based on their functions. Traditional methods developed so far have either been insufficiently fast for the processing of large amounts of data, or insufficiently precise. In the latest research, it has been shown that some models of deep learning have the potential for the efficient identification of semantic relationships. On the back of this several models (word2vec, doc2vec, GloVe) were developed. However, the additional possibilities of combining these models with external knowledge sources have still not been researched sufficiently. The goal of the proposed project is to fill this gap and to research the possibilities of combining the models of deep learning with other approaches, particularly knowledge-based approaches. Within the proposed research framework, a new method will be proposed and the Automatic Measuring of the Semantic Similarity of Texts (AMSSTEX) system will be implemented. Specific corpora in the English and Croatian languages, suitable for the evaluation of the proposed procedures, are also planned to be developed. In addition, the possibility of the application of the proposed approaches for the detection of paraphrasing plagiarism, will be analysed. It is expected that the research will advance the approaches to measuring semantic similarity, and will result in a new method and system for measuring semantic similarity.

The Efficiency and Regulation of Financial Institutions in the Function of the Development of Croatian Economy

PROJECT MANAGER

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ABSTRACT

A well developed, regulated and efficient financial system is essential for each national economy due to the need to overcome market imperfections and minimise systemic risks. A properly designed, regulatory framework ensures the stability and liquidity of the financial system and promotes competitiveness and market efficiency. The past decade has been marked by a re - examination of the functioning of financial systems and regulatory frameworks in the light of globalisation processes, the deregulation of financial markets and the recent global financial crisis. Therefore, it seemed necessary to investigate the existing EU regulations and supervision system for deposit insurance systems that act as the cornerstone of financial stability. This project will examine the efficiency of deposit and non - deposit financial institutions in EU member states, but also less developed financial systems in the countries of South East Europe. The measurement of efficiency in the context of the financial industry by Data Envelopment Analysis (DEA) is increasingly used in numerous scientific studies instead of analysing the traditional measures of financial institutions' performance. The project will explore the structure and performance of deposit (banks) and non - deposit financial institutions (investment funds, pension funds and insurance companies), as well as their legislative and institutional framework in the domestic financial system. The project idea is based on the assumption that an institutional framework and the development of financial institutions should be incentives for further development and improvement of the financial system. The main goal of the project is to address financial stability, in particular the features of the deposit insurance system and the regulatory framework in the EU, and to assess the characteristics and efficiency of the financial institutions in the Republic of Croatia in order to improve the socio - economic performance and development of the domestic economy.

Development of the NOK Platform for the Transformation of Natural Language Sentences into a Relational Database

PROJECT MANAGER

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ABSTRACT

The representation of natural language sentences using various methods is an attempt to solve the problem of organising verbalised knowledge in a computer system (information system - IS). In this research, a method for modelling knowledge, Nodes of Knowledge (NOK), will be developed with the aim of creating a knowledge model contained within the text, i.e. to organise a network of verbalised knowledge. The NOK method will present a graphical representation of knowledge in the form of a diagram (DNOK), but also a textual language equivalent, TNOK (Text Nodes of Knowledge) in the form of customised sentences (scrambled, rearranged, enriched with questions) and will be used to define the structure of the knowledge network. Based on this model, the relational form of the FNOK method will be developed to represent the NOK version with a one - way link suitable for implementation in programming languages. The NOK method suggests and verifies the process of the enrichment of human language sentences with semantics of the relationship between words, along with a record of such enriched sentences in the database. It is possible to extract knowledge from the computer knowledge network in the form of enriched sentences and translate them into a formal natural language. To solve this problem, different versions of the NOK method will be suggested and checked. NOK should enable the design and construction of systems to keep texts, in the form of related knowledge, in a form different from existing languages, speech, written language, or thoughts of the human mind. The method is based on research and analysis of natural human language, which is important for approaching human intelligence. The sentences, the words and their meaning, and the process of connecting words into more complex thoughts are analysed. The method, which will enable the transfer of language knowledge into computers, will be useful for an unlimited number of applications and will have a significant impact on society.

Impacts and Strategic Outcomes of Large Sport Tourism Events - the Perspective of Local Residents

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ABSTRACT

Sports tourism events create significant positive as well as negative economic, socio - cultural and environmental impacts for organisers, the local community and the country as a whole. Previous research has focused on the sustainability of major sports events in larger and developed countries, while such events in smaller countries, due to infrastructure and organisational constraints, and lower frequencies of hosting events, are under researched. Among the many actors involved in the organisation and consumption of sustainable sports events, the local community is confirmed as a key stakeholder, since no form of tourism should be at the expense of the local residents. Building on the *Triple Bottom Line* approach and *Social Exchange Theory*, the aim of this empirical study is to develop and test a theoretical model for understanding local residents support for hosting large sport tourism events based on economic opportunities and social incentives. This study will analyse the perception of local residents and further attempt to understand the economic and social impacts of one of the largest sport tourism events in Croatia, *the Tour of Croatia* cycling race. It will further analyse whether these impacts are predictors of local resident support for hosting large events in the future and for sport tourism as a method of sustainable tourism development. In that sense, residents of selected major places along the race track will be surveyed during the two race editions. The number of perceived event impacts will be reduced by factor analysis to a smaller number of factors, while the influence of perceived impacts on local resident support will be tested by a regression model and by structural modelling. In addition to theoretical implications, research results can help the organisers of sports tourism events better understand the attitude of the wider community regarding the events they organise and to gain local resident support that can be crucial to the overall success of future editions.

Establishing a System for Monitoring Physical Activities with Contemporary Technology in Institutions of Early Ages Education

PROJECT MANAGER

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ABSTRACT

The level of children's physical activity declines every year. They spend most of their time in early institutions where they have a great opportunity to develop motor literacy and habits that involve movement. We want to point to the importance of physical activity in early institutions, and at the centre of our research set movement as a human biotic need and a precondition for achieving optimal growth and development of a child. The primary objective of this project is to establish a system for monitoring and evaluating the movement of children in early institutions using contemporary technology. It seeks to determine the quality of life of children based on the estimated level of physical activity and develop models of professional development for the educators. The results can influence a change in the study programme and strengthen the competences of future educators in the creation of curricula for kindergartens that is in harmony with the need to raise the quality of life and learning of children in an institutional context. Contemporary technology, based on artificial intelligence, can be one of the best solutions for monitoring and evaluating the physical activity of children. We will use motion tracking sensors as specialised devices that record and store a series of measurements during a child's physical activity. By applying the method of statistical processing of such a time series, a framework will be established for assessing the quality of movement of individuals and groups of individuals. The project involves scientists from the field of physical activity and educational system from six universities: Bratislava, Brno, Ljubljana, Zagreb, Pula and Rijeka. The University of Rijeka will become the first to use such a system of monitoring and evaluation of children's movement. A permanent database will be established as a basis for scientific work and the possibility of implementing various community educational programmes.

Automation for Development of Sports Action Recognition Datasets

PROJECT MANAGER

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ABSTRACT

Contemporary machine learning methods used in the field of computer vision depend on exceptionally large datasets for particular domains. For example, datasets for learning models of object detection and recognition in images include hundreds of thousands of images with millions of manually annotated objects. Dataset building for the domain of action recognition in videos is even more demanding because it combines temporal and spatial image components, so the timing and duration of each action can be accurately marked, as well as the person who performs the action in every part of the video. Due to the need for manual annotation of recordings, the development of such datasets is a lengthy and expensive process that involves the participation of a large number of people. We propose to research and develop methods that will partially automate labelling of actions in videos in the sports domain, thus facilitating and expediting the creation of datasets suitable for machine learning. The development of automatic detection and tracking of currently active players is planned, which will automate the most time - consuming job of annotating the active player at any moment in the video during the dataset building. This research relies on previously developed procedures for detecting people in images and for tracking the detected objects in video based on background subtraction or on spatial - temporal features. The second goal is the application of refined methods for the development of a video dataset for learning sports action recognition models, which will enable the research team at the Department of Informatics to improve the level of research in the field of video analysis. The results of this project will be the foundation for further development of methods for automatic action detection and recognition in video from a selected domain, which, besides the scientific component, will also have the potential to be applied in commercial video analysis tools.

Risk and Protective Factors in the Development of Excessive Weight and Obesity in Adolescence

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ABSTRACT

Although obesity causes serious health and psychological problems, the underlying mechanisms are still not clear. One possible mechanism for developing and maintaining obesity is a lack of emotional regulation, which could include identification, understanding and acceptance of emotional experiences, control of impulsive behaviour, and flexibility in emotional response. Difficulties in emotional regulation may lead to emotional eating, which can lead to obesity. Frequent experience of negative emotions can result in lower motivation for exercise in adolescents, which contributes to sedentary behaviour. The general aim of this study is to examine the impact of a lack of emotional regulation on the development of eating habits and the reduction of physical activity, which can lead to elevated body weight in young girls and boys (from early to middle adolescence). The hypothesis is that eating habits and physical activity will be associated with the nourishment status of adolescent girls and boys. We assume that obese adolescents and those with healthy body weight use different strategies for emotional regulation, and that obese individuals will have more difficulty regulating emotions, such as regulating anger or impulsiveness. Less frequent physical activity can also contribute to the development of body dissatisfaction and unhealthy eating habits (e.g. overeating). Inappropriate eating habits, with reduced energy consumption, will very likely result in elevated body weight. The participants in this study will include around 1,500 first grade high school students in the Primorje - Gorski Kotar County. Participation in the research will be anonymous. Gender differences will be compared, as well as the differences between adolescents from urban and rural areas. The results obtained in this study will contribute to a better understanding of some of the risks and protective factors in the development of obesity in adolescents. The results can be used for the development of preventive programmes.

The Development of a New Generation of the Data Warehouse System Catalogue

PROJECT MANAGER

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ABSTRACT

The Data Warehouse (DW) nowadays has a remarkably dynamic business environment consisting of a number of (heterogeneous) data sources that are subjected to frequent changes in data and structure, and a number of changes in the information requirements placed by business users. Research into the evolution of DW is focused on storing both the scope and the schema of data and metadata, over a longer period of time. This needs to be done in order for the DW to respond more efficiently to user requirements for business analysis. The aim of this project is to develop a model and a prototype of a new temporal system catalogue that maintains all the historized DW metadata (from data sources, through an integrated/central DW and up to multi - dimensional data marts) and is supported by a realistic set of business case scenarios, all for the purpose of a more effective tracking of changes in data and its schema. The scope of our research covers both structured data sources (e.g. relational databases) and unstructured data sources (e.g. NoSQL databases/web data sources/big data). The developed model of the new and temporalized system catalogue will be validated formally and empirically through: a) formalisation of the model using sets theory principles, a formal validation of evolution operations and a formal definition of the schema translation and schema integration rules; and b) development of a new system catalogue prototype and its validation through implementation of benchmark tests. Research results will serve to define new methods and approaches in this research field, as well as to further develop the new generation of DW. The research topic is extremely 'actual' and includes some very popular areas of integration - data warehousing, business intelligence, big data and unstructured data sources. Here is where we see the contribution of this research to the scientific profiling of both the University of Rijeka and the Department of Informatics.

A Curriculum Based on Preferences - Student Preferences as a Framework for the Modular Curriculum of General Technology Education and Sustainable Development

PROJECT MANAGER

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ABSTRACT

The fulfilment of student curricula preferences, such as preferences and interests conditioned by successful individual development in a particular teaching subject, can greatly determine a student's successful career development. Given that the aim of each education is related to the success of students, pupils' preferences should be an indispensable factor in the development and dynamic adaptation of the curriculum of general and compulsory education. Nevertheless, there is no systematic study of student preferences in the Croatian education system or any developed mechanism of dynamics of curriculum alignment with such preferences. This is particularly important in teaching subjects that are characterised by a high degree of dynamic changes, such as technology and informatics. Since the curriculum is extremely important for the choice of future occupation and excellence in the field of technology and engineering, and indirectly for the sustainable development of the country, the importance of student preferences for such development is also evident. According to the abovementioned starting points, this research will systematically examine students' preferences according to the Technical Culture teaching programme, taking into account the main characteristics of the group and the specific context of Croatian society and economy. By exploring preferences with regard to the main characteristics of the group and the context of the pupils' life, such as age and gender, but also the material, economic and cultural environment in which the pupil, his family and community live, we want to establish a clear structure of preferences towards technology education and regularities which appear in such a structure. Based on the established structure, and by comparison with the preliminary results of the research, the preferred framework of the curriculum of technology education will be established. From the established structure the modular curriculum of the Technical Culture will be elaborated and a mechanism for the dynamic adaptation to students' preferences.

Sexual Abuse of Children in the Republic of Croatia: Phenomenological and Etiological Perspectives

PROJECT MANAGER

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ABSTRACT

Issues concerning sexual offences against children have recently emerged in the Croatian public space. While the media often reports about the sexual abuse of children, NGOs and individuals openly criticise current criminal legal provisions aimed at supressing this highly negative social phenomenon. The legislator is facing concrete demands to implement legal reform allowing harsher penalties for sexual offenders and their long - time incapacitation. Apart from public criticism, a call to reassess criminal offences of sexual abuse and sexual exploitation of children is the subject of the European Union Directive 2011/93/EU. Although there has been a strong need for legal scrutiny, academic writing on criminal legal protection of children from sexual abuse is scarce. Prior research has also shown that previous amendments to the Criminal Code provisions on sexual crimes against children were accepted rashly without in - depth scientific analysis that would support the legislative reform. With the purpose of contributing to the discussion on possible legislative interventions with scientifically founded arguments, the criminal offences form, 'Title XVII of the Criminal Code' will be analysed in detail. The assessment will be made whether these provisions are in accordance with either European and/or conventional standards. In order to examine the implementation of norms governing sexual delicts against children in practice, research will be conducted at municipal and county courts in Rijeka, Split, Zagreb and Osijek on a sample of all final court judgments against offenders who committed the heaviest offences of sexual abuse of children during the last ten years. The phenomenological and etiological characteristics of these crimes will be evaluated together with primary and secondary child victimisation. Based on conducted theoretical and practical analysis, the solutions *de lege ferenda* will be offered to strengthen children's right to protection from sexual abuse through criminal legislation.

The Academic Community from within: The Challenges of Changes in the Academic Profession

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ABSTRACT

The research project “Academic Profession in the Knowledge Society" (APIKS) is an international comparative study involving more than 30 countries. The aforementioned study is the third wave of data collection on changes in the academic profession. The first survey was carried out in 1992 under the title “Carnegie Studies”, and Croatia joined in 2009, during the second wave of research called “Changing Academy Profession”, (CAP). Therefore, the aim of the continued study, now called "Academic Profession in the Knowledge Society", is to further monitor, describe and explain the state and potential changes in the previous period, through an international comparative perspective, in order to answer the question of what the role is of the academic profession in the knowledge society. The added value of the project is the fact that the results of the research from 2018 will be compared with the data from a national sample from 2009, in order to be able to describe and analyse the state of, and the changes in, the Croatian academic community. It is expected that the analysis and interpretation of the problems, obstacles and potential changes in the academic profession in a specific semi - peripheral Croatian context, in comparison to global trends, will result in guidelines for the development of future higher education policies.

The Development of Management in the Entrepreneurial Economy and Society

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ABSTRACT

Research efforts in this scientific project have been integrated on the basis of the following main hypothesis: the implementation of a co - operative management approach towards various stakeholders, in terms of designing integrative solutions, contributes to the positive effects on the development of an entrepreneurial economy and society. The modern entrepreneurial economy and society both rest on the inclusion of various stakeholders on the basis of co - operation, or simultaneous competition and co - operation, in various aspects of their mutual relationships. This approach is based on the process of understanding and integrating stakeholders' perspectives, overcoming asymmetries of information, reaching consensus regarding causes and implications of a problem and in so doing moving towards the design of integrative solutions. It can be concluded that all the stakeholders of modern society behave entrepreneurially. The concept of an entrepreneurial eco - system represents an insightful theoretical framework for analysing the set of interdependent actors and factors that enable entrepreneurial development. Co - operative management in this research project is considered and analysed from the standpoint of the following aspects: strategic alliances and logistical value added chains, supply chain management, implications of implementing business and especially management information systems, entrepreneurial eco - systems, entrepreneurial orientation and intra - entrepreneurship, learning organisations, organisational learning and knowledge management, relationship management (with an emphasis on conflict management), social responsibility and assessment of the Triple Bottom Line leading to the development of sustainable added value. These aspects represent the derived goals of the research project.

The Budgeting Process from a Gender Equality Perspective

PROJECT MANAGER

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ABSTRACT

In spite of the perception of many individuals, gender inequality in European society continues to be persistent and best - reflected by the position of women in the labour market. Women make up a larger proportion of the highly educated population, but activity rates, employment rates and the gross earnings of women are lower than those of men. This indicates that although women represent a huge workforce potential, their contribution to economic activity, growth and prosperity is disproportionate to their potential. The reason for unequal participation of men and women in the labour market can be linked to their gender. Society expects women to do the majority of socially unpaid work and this expectation often prevents equal opportunities in the labour market. Exclusion from the labour market makes women financially dependent on men, which limits their control over their own lives and creates a hierarchical relationship of subordination between equally valuable social groups.
Since economic power is unsustainable without a more intensive participation of women in the labour market, the problem of gender inequality is often a central focus of macro - economic policies among which, due to their allocation and redistribution function, fiscal policy and budgeting are seen as a good tool for the elimination of this disparity. Government spending of public funds should, with continuous support for economic development, equally meet the public needs of all citizens and redistribute wealth to ensure greater equality and minimum living conditions of all, including men and women. The aim of this project is to point out that it is necessary to take into account the different socially and biologically created roles of women and men, and thus to consider additional criteria for determining public expenditure and revenue in a way that, apart from the stabilisation goals, will also contribute to better redistribution of income and equal fulfilment of public needs of all members of society, including women and men.

The Role of Audio Management in Tourist Destination Development

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ABSTRACT

This interdisciplinary study (fields of social science, economics, humanities, and art history) focuses on the theme of sound and music as vital elements of both the tourism product and tourism promotion which are aimed at destination development and branding. Theoretical research is based on the critical exploration of the research topic and builds on recent literature. Applied research is conducted through a survey of the attitudes of destination stakeholders and managers, a study of the acoustic quality of musical events, and the proposals of the authors based on the scientific literature, for the purpose of analysing the current state, and actively creating the future of the audio offer, promoting the destination, and designing an audio management model. This incorporates the valorisation of sound and music within a soundscape approach, and business operations within the framework of a tourism product club as a new form of collaboration in value chain innovation. The purpose of the new business model is to set up a well - designed, development - oriented process of dynamic interactions among all stakeholders in order to transform resources (sound and music) into innovative products.

Research involves the following areas:

- Defining audio management as a specific management process, tool and method of planning, producing, leading and controlling of the effectiveness of music and sound
- Proposing and reasoning the modes of sound management in space and noise pollution prevention
- Setting up a management model and process in the field of sound and music, within the framework of ecology, sustainability and creative industries in tourism (offering and promotion development)
- Defining a collaboration model based on the synergistic integration of all stakeholders.
- Innovating a dynamic model for incorporating the audio offering into an integrated destination product and distinctive brand.

The contribution of the study is seen in the dissemination of new scientific knowledge concerning the potential of audio management in creating an innovative product and a distinctive destination brand for Krk Island, as well as in the design of a model for future research.

The Significance of Academic Injustice

PROJECT MANAGER

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ABSTRACT

Organisational justice is an employee's perception of the degree to which he is treated fairly. Fair treatment can lead to positive work outcomes, while unfair treatment can damage employees' work performance and health. Unfair treatment, aside from physical disturbances, affects the development of mental disorders. Research confirms that unfairness is related to an increase in mental distress and can lead to psychiatric disorders and co - occurring absenteeism. Although research confirms the effects of unfairness on mental health, it is still not clear why this occurs. The allostatic load model provides a potential explanation of mechanisms affecting health, in which injustice is interpreted as a stressor that creates difficulties in dealing with work obligations and leads to a decrease in productivity and deterioration in mental health. Rumination about negative events prolongs physiological activation and increases negative effects, whereas individual personal predispositions and situational determinants change the effects of injustice. In the academic environment, justice is based on the distribution of grades, procedure of defining grading criteria, and the relationship between students and teachers. Only a few studies have examined the effects of classroom justice. Fair treatment positively predicts academic achievement, well - being and lessening of distress. This research will use a correlational design and a diary method to carry out a longitudinal study of mechanisms underlying the effects of unfairness on students' well - being and achievement. Specifically, the aim is to determine the effects of unfair treatment on mental health, motivation and productivity, as well as to examine mechanisms (i.e. situational factors, dispositions, cognitive and affective processes) underlying such relationships. Research results will be of great practical importance for interventions aimed at facilitating justice restoration in the academic context.

The Impact of Intangible Capital on the Croatian Economy

PROJECT MANAGER

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ABSTRACT

Traditional economic doctrine, in researching the source of value creation shaped the concepts of material (tangible) and financial capital. In contemporary economic conditions intangible capital - intellectual capital, knowledge, intangible assets, 'hidden' capital, innovations, information, etc., is gaining importance for the well - being and development of national economies. It has been shown that this very capital has surpassed the potential of a mere combination of the traditional factors of production, and has enabled unprecedented growth in new value creation. Intangible capital is becoming a dominant factor in the profit performance of companies as well as for the global competitiveness of national economies. Therefore, it is justified to devote research effort in defining criteria and developing methodology for the identification and evaluation of the constituent elements of intangible capital, and to measuring its impact at all levels of economic activity - from the enterprise level to the national and global levels. This is particularly justified and necessary in national economies that want to accelerate the pace of achieving more desirable development levels, such as Croatia. This project aims to open the area of research and measurement of the impact of intangible capital on the Croatian economy - in the private and public sector, including micro - economic and macro - economic aspects of analysis as well as accounting issues of recognition and measurement of intangible assets. Previous research has demonstrated the importance of intangible capital. The methodology of measurement developed so far will be applied and improved, and this is the main objective of the proposed project. The project aims to prove the existence of links between intangible capital and national economy growth rates, national competitiveness and the performance of business entities. The research team, with its current scientific profile, can cover all the proposed research areas, and the project should also enable the development of a young associate – a Ph.D. student.

Construction of a Questionnaire for the Assessment of Emotional Competence in Children

PROJECT MANAGER

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ABSTRACT

The aim of the Project is to adapt the Emotional Competence Questionnaire (ECQ-45) to a design suitable for testing children at an early age. The questionnaire was constructed originally in the framework of a model that Jack Mayer and Peter Salovey proposed, and it is still the best way of operationalising the emotional intelligence construct. The content of the items in the questionnaire will be adjusted to the needs of the population of young children. The Emotional Competence Questionnaire (ECQ-45) was constructed in the year 2002, and it has been used in various settings and samples. It has been translated and adapted into more than 30 languages and countries, and its content will be adapted for use in our young children sample. The initiative has come from experts in various fields (school, social work, scientific and work organisations) that have used ECQ-45, claiming that the content of some items is too complex for young children. Taking into account all the feedback about which items need additional explanation, a simpler version will be constructed and applied to the sample of 4 to 7 - grade pupils. In several iterations, according to final outcomes of statistical analyses of psychometric properties (reliability, content and construct validity), the dimensionality of the questionnaire will be examined (three - factor structure is expected), together with the internal consistency of each of the subscales. The final outcome will be a version of the questionnaire which contains items that satisfy all the psychometric criteria. The validity of the new version of the questionnaire will be examined according to psychometric theory criterion and its ability to predict various real existing criteria (empathy, life satisfaction, academic achievement, aggression, depression) will be tested.

Children's Well - Being in Transition Periods: An Empirical Validation of the Ecological - Dynamic Model

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ABSTRACT

Transition is defined as an intense process of change and movement from one identity to another, determined by the various factors described in the Contemporary Ecological - Dynamic Transition Model (Rimm - Kaufman & Pianta, 2000). Within transition, the various contexts in which, and through which, a child passes, and the inter - relations between identities over time, are crucial. The purpose of this project is to empirically test this model and to analyse significant correlates of transition from family to kindergarten, as well as of transition from kindergarten to primary school. This research will provide clear guidelines for ensuring the highest levels of children's well - being during transition for the children and their parents, teachers and associates. The following variables will be explored in the representative samples of early aged children (transition from family to kindergarten) and preschool children (transition from kindergarten to primary school): intra - personal factors of children (temperament, socio - emotional well - being, strength and difficulties, resilience), parents/caregivers (personality, sensitivity, subjective well - being, resilience) and teachers (personality, subjective well - being, resilience); and the inter - personal factors of child - parents - teachers - environment (attachment, adaptation, relationship with parents/ teachers, teaching strategies, relationship between family - kindergarten - school - local community - environment, social values). A quantitative methodology will be applied with reliable measurements that will objectively present the perspective of children, parents, teachers and associates. This analysis will contribute to the realisation of short - term goals by validating the theoretical model and postulating the practical guidelines for achieving optimal transition in the early and pre - school periods, as well as to a realisation of long - term goals by preventing mental health problems among children with the aim of enhancing their lifelong psychological well - being.

Cognitive - Affective and Behavioural Determinants of Irritable Bowel Syndrome

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ABSTRACT

Irritable bowel syndrome (IBS) is one of the most common functional bowel disorders, and IBS patients have significant quality of life impairments (Wong & Drossman, 2010). The current approach to this disorder is based on the biopsychosocial perspective, specifically on the cognitive - behavioural model which integrates biological and psychosocial aspects of IBS (Deary et al., 2007; Lackner et al., 2010). The model emphasises the importance of investigating dispositional, and precipitating and perpetuating factors which contribute to the development and maintenance of the illness (Deary et al., 2007). Building upon the model, the goal of this study is to investigate different cognitive - affective (mood, anxiety, illness perception, attention and executive functions) and behavioural (coping, control and avoidance) determinants of health outcomes (quality of life and symptom severity) in IBS patients. The participants in the study will be patients diagnosed with IBS (around 100 participants), who are being treated in several clinical hospital centres. There will be three phases of research. The first and third phase will involve the completion of questionnaires and participation in computerised cognitive tasks. Between those phases, for a period of 14 days, participants will keep a diary of their symptoms, mood and daily stress levels. We hypothesise that there will be an intra - individual correlation of mood, stress and symptom severity and that different aspects of anxiety (trait anxiety, anxiety sensitivity, anxious thoughts, and visceral anxiety) and mood (depression, negative and positive mood) will significantly predict quality of life and illness behaviours. Also, they will be related to higher levels of interception, altered attentional patterns and a poorer performance on cognitive tasks. Additionally, a poor understanding of one's illness accompanied by a subjective sense of lack of control and attribution of the cause of the illness to psychological factors will be related to higher levels of suffering and to a lower quality of life. We expect that the results obtained will enable a better understanding of IBS and lead to the creation of an individualised treatment plan with the aim of increasing patients' quality of life.

Expertise of Teachers in Croatia in the Educational Inclusion of Pupils with Behavioural Difficulties

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ABSTRACT

Pupils with behavioural difficulties in the primary schools of the Republic of Croatia are sub - groups of students with special needs who, by implementing their right to an appropriate form of education and educational inclusion, receive protection from unfavourable psycho - social development in behavioural disorders and mental health disorders. According to current knowledge, we do not know enough about teachers' expertise in applying appropriate methods, procedures and inclusion strategies. Therefore, the aim is to ascertain the expertise of elementary school teachers in the Republic of Croatia for the educational inclusion of students with behavioural difficulties. Characteristics of students with behavioural difficulties will be observed through student aggressiveness, antisocial behaviour, emotional problems, attention focus, impulsivity and hyperactivity. Teachers' expertise will be observed through some elements of educational inclusion components: beliefs about the well - being of inclusion, effectiveness in work, the frequency of inclusive instruction in the classroom and the use of positive reinforcement methods. The application purpose of the obtained results is to improve the teacher's competence by changing their training programme(s) as well as proposing lifelong learning programmes to enhance their competences in areas that empirically demonstrate a skills deficit. In this regard, we will cooperate with the National Education Agency as well as with interested primary schools. A quantitative methodology will be adopted in this transversal multivariate correlation study using a questionnaire with previously validated scales for focus variables and with prior assurance of ethical and administrative consent. A doctoral student on the project will develop his own research in the direction of expanding research questions by selecting only one county sample. Collaboration is planned with three universities in Croatia, as well as the preparation of approximately ten diploma papers from the project.

The Energy Sector and Sustainable Economic Growth in Terms of Low - Carbon Economy

PROJECT MANAGER

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ABSTRACT

Since sustainable economic growth is strongly correlated and determined by stable energy supply, the role of the energy sector is crucial, not just for the security of supply, but also for the impact on energy prices and the prices and competitiveness of all goods and services. In order to have available a price competitive energy supply, the energy sector has to improve its technological development and competitiveness and to adapt according to a demanding economic climate and to environmental regulation. The energy sector is going through big changes – economic, regulatory and technological ones. Market circumstances are changing due to liberalisation, regulatory reforms and institutional arrangements which define stricter environmental and climatic standards. The most important factor is technological development which changes the business paradigm, lowers costs and prices of renewable energy exploitation and enables the transition towards low - carbon economy. In November 2016, the European Commission presented the 'Winter Package' that will lead to huge changes in the Croatian energy sector and hopefully result in sustainable economic growth. New shifts in the energy production mix can be expected - a decrease in the share of fossil fuels and an increase in the share of renewables with a growing focus on energy efficiency. In such circumstances, energy cannot be cheap and it will influence the cost structure and competitiveness of the national economy. Therefore, the crucial question is whether it is possible to implement, and at what cost? What consequences for economic growth and energy development will result from an 80% decrease in GHG emissions by 2050. The research within this project is based on the hypothesis that the transition towards a low - carbon economy will result in structural changes in the energy and other sectors, while newly emerging industries and services can surpass transition economic costs and thus accelerate economic growth that will be both environmentally and socially sustainable.

Family Empowerment for Positive Relationships and Family Togetherness Development

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ABSTRACT

A family, as a specific social group and a unique factor in an individual's development, as well as family pluralism, family development, family relationships, children's upbringing, a family's future and other important issues have been subject to many multidisciplinary approaches and studies. A family is a deeply powerful social group and one of the strongest social and upbringing environments, even when relations amongst members are not satisfying. There are many reasons why family life is not always emotionally warm and leads to family members being confused and unhappy. Relationships between family members, a positive family environment and a supportive social environment can encourage, but also repress, successful personal development. The existing scientific knowledge (Beavers and Hampson, 2000; Olson and Garall, 2003; Ljubetić, 2011; Walsh, 2012; Berc, 2012; Zloković, 2012 etc.) and international EU initiatives have made a contribution to positive endeavours to strengthen the family and to make life within the family more humane. The conceptual framework used includes the Circumplex Model of Marital and Family Systems (Olson, Garrall, 2003) which operates through three fundamental dimensions: cohesion, flexibility and communication. The fundamental cognitive aim is a longitudinal study of family cohesion, flexibility, communication, educational procedures and competencies based on an independent probabilistic sample of parents, children and older family members. The research will address challenges in family relations both in their pedagogical and social aspects. A support programme for family empowerment will be designed based on results which assume a higher level of life quality as important strategic goals of the Council of Europe. The proposed project represents an innovation in the scientific approach to understanding families and a contribution to basic developmental and practical outcomes of family pedagogy and the pedagogy of early and pre - school education.

A Critical Discussion of the Didactic Models and Competences of Adult Education Teachers

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ABSTRACT

The emergence of globalisation has led to a rapid transformation of the methods and forms of learning and education and to the emergence of a "knowledge society" (Kušić, Vrcelj, Klapan, 2015). In such circumstances, adult education gains special significance because the labour market requires continuous improvement of knowledge and skills in order to keep a particular country competitive (Wagner, Kozma, 2005). In the last few decades, adult education has become the central focus of economic development; therefore, it is not surprising that various efforts on a global and national level are being made, that are aimed at raising the quality of, and re - conceptualising, adult education (Marzano, Lubka, Usca, Pigozne, 2015). Nevertheless, there are still open questions whose resolution would contribute to the improvement of this particularly important and dynamic segment of education. One of those questions is that of didactic models in adult education. Although there are different didactic concepts, and from them have derived models and teaching strategies in adult education, the concepts, models and teaching strategies that are being used are more appropriate for working with children and young people then with adult learners, which indicates non - compliance with the psychological traits and educational needs of adult learners. A different approach is required, that should re - conceptualise the existing didactic models because the class organisation in these circumstances represents one of the barriers to successful adult education (Marzano, Lubka, Usca, Pigozne, 2015). Through qualitative and quantitative research methods, this project will explore the didactic models that are being used by teachers who are working in the adult education system, examine their competence and develop guidelines for enhancing didactic models in adult education, which is also the main goal of the project. This will certainly improve the practice of adult education, particularly in the field of the application of various contemporary didactic models, as well as the andragogic - didactic competences of adult education teachers.

The New Energy Paradigm: How to Reconciliate Sustainability and Feasibility

PROJECT MANAGER

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ABSTRACT

Although reforms in the energy sector started in the 1990s, they have not yet been fully implemented, with even the most developed EU members not having fully implemented EU directives related to the single electricity and natural gas market. The problem of the competitiveness of renewable energy sources in the open electricity market is one of the main problems in formulating national energy policy as well as the supra - national policies of the EU itself. Through our research, the competitiveness of various types of power plants will be analysed with regard to capital costs, operating and fuel costs as well as wholesale electricity prices and incentives for renewable energy in selected EU countries. Given the great changes expected in energy and all other sectors due to energy transition towards the low - carbon and sustainable economy, the area of research also relates to current energy efficiency issues in EU countries. Furthermore, we will analyse the changes in the portfolio of primary and secondary energy sources in the "new" EU countries, given the growing importance of natural gas and its derivatives. The key area of the analysis relates to the opportunities created by the development of technologies that enable gas transport with the use of a logistics infrastructure other than the conventional gas pipeline. Since the construction of a new gas infrastructure is a time consuming and expensive process, the development of LNG (Liquefied Natural Gas) and CNG (Compressed Natural Gas) technologies to circumvent geographic and geo-political obstacles represents an outstanding opportunity to improve the energy security of CEE countries. Securing an alternative strategy for natural gas supply consequently leads to stronger negotiating positions for CEE countries in relation to the major gas suppliers, such as Norway and Russia. We will analyse how the individual European countries have approached this issue and what can be expected in the future.

The Determinants of Emotional Adjustment across Normative Life Transitions

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ABSTRACT

Life transitions are stressful periods that might result in emotional difficulties. The main goal of the project is to determine the specific protective and risk factors in the explanation of emotional adjustment, primarily depressive and anxiety symptoms, during normative life transitions (entering high school, college and work). Starting from the cognitive model of emotional disorders, the role of cognitive vulnerability and perception of adequate social support in explaining anxiety and depression will be tested. The relationship between the level of identity commitment and emotional adjustment, in relation to achieved criteria of adulthood, will also be assessed. As social networks have a significant role in young people's lives today, we will check their contribution to the level of anxiety and depressive symptoms. Several correlational researches are planned, with the use of transversal and prospective design. One study will include both freshmen and students in the final year who will be assessed again after one and two years respectively, using a set of self - report questionnaires in printed form and on - line. This prospective research will provide inter - individual, but also intra - individual changes in symptoms and their determinants. Another study will include a one - time assessment of elementary and high school students and their parents in order to determine the role of parents' emotional functioning, cognitive style and parental behaviour in explaining the emotional adjustment of children and youth. The results of the project are expected to provide additional insight into understanding the contributors to anxiety and depressive symptoms during educational transitions. They might also be useful in the development of preventive and interventionist programmes in order to improve the emotional adjustment of children and youth.

Humanities

Democracy: Human Rights and Intellectual Virtues

PROJECT MANAGER

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ABSTRACT

The role of professional experts in making political decisions poses a pressing challenge. On the one hand, in certain areas we witness a weakened role for experts, such as in vaccination policies. On the other hand, in some areas, this role is unwarrantedly strong, as in cases of involuntary confinement in psychiatry. To respond to this challenge, we use theoretical resources from the philosophy of politics and social epistemology. Within the philosophy of politics, we develop an innovative democratic model, which rests on a division of labour between citizens and experts. The model affirms the role of experts or epistemic authorities and the proper justification of decisions, as opposed to mere majority acceptance. We differentiate three kinds of beliefs: (i) beliefs supported by an expert consensus which alone guarantee a legitimacy to public decisions; (ii) beliefs refuted by an expert consensus, like those based on fake news, which have no role in public justification, despite possible majority support; (iii) beliefs in the realm of justified pluralism for which voting is a legitimate procedure. We supplement this democratic model with a social epistemological theory which emphasises precisely the issue of making epistemically sound decisions by individual or collective entities in sub - ideal conditions when citizens are neither adequately informed or educated (epistemic conditions), nor are they prepared to reassess or revise their beliefs in situations of disagreement (ethical/political conditions). We argue that the epistemic quality of decisions made by individuals depends on the intellectual virtues of conscientiousness and the responsibility of individuals, which enables correct assessment of the competence of the subject as compared with those of epistemic authorities. Only a correct allocation of the epistemic labour, that includes institutions that develop procedures for epistemically and politically optimal mechanisms of decision - making, can address the democratic deficit.

From Grammar to Pragmatics

PROJECT MANAGER

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ABSTRACT

The results of the previous studies of grammatical and pragmatic themes conceived by the members of the project team are the starting point of this new scientific research. Two main cores of the project have to be followed: the first is a traditional philological one (study of the Croatian grammatical tradition); the second refers to recent (functional) linguistic descriptions which are related to the knowledge of other fields of science. The main feature of the functional language approaches is their orientation towards the language in use. That is the feature which differentiates such approaches from the formal, structural ones. Consequently, the upper limit of linguistic descriptions has to be transferred from the sentence (as an abstract linguistic unit) to the supra - syntactic unit, text and/or discourse as a communicative event. Modified and/or changed theoretical and methodological concepts will be applied to specific (Croatian) language descriptions.

PRESENT STATE OF SCIENTIFIC KNOWLEDGE. The research has been equally based on both existing grammars of the Croatian language (older and newer), recent linguistic theories (pragma - linguistics, systematic functional theory and grammar, linguistic/text theory, etc.) and theoretical works from the field of language philosophy. Research conceived by the members of the project team will also be followed.

HYPOTHESIS. Integration of the pragmatic aspect into linguistic research, as well as the knowledge of other humanities and social science disciplines, could be the solution to deficient structural approaches to language. This could also help us to improve the grammatical descriptions of (Croatian) language. It is expected that new (functional) approaches integrated into university classes of (Croatian) language would help students to understand the mechanisms on which language functions.

THE AIM OF THE RESEARCH. The aim of the research is to deepen the knowledge of the mechanisms on which the grammatical structure of (Croatian) language and linguistic communication are based.

Meta - metaphysics

PROJECT MANAGER

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ABSTRACT

In this project, we will work on the basic problems of meta - metaphysics – the part of philosophy that examines the foundations of metaphysics. The central question is whether the problems of metaphysics are substantive and real or just verbal and trivial.

- Berčić: Since presentists and eternalists agree about all the facts from history, what sense does it make to discuss whether or not the past exists? Is the discussion about the reality of the past just a pseudo - discussion?
- Balaguer: Does the discussion about the existence of abstract objects make sense? Does our metaphysical view about the existence of the number 4 make any difference to the practice of mathematicians or in everyday counting?
- Borstner: Since there is no matter of fact that could decide the discussion between realists and antirealists, the question is posed whether the discussion is legitimate.
- Jandrić: Since no fact can determine whether objects, during their existence, have or do not have temporal parts, the question is whether the discussion between endurantists and perdurantists is legitimate?
- Vidmar: Since Ana Karenina never existed, how can statements about her be true or false? Are fictionalism and trivialism theories that are strong enough to offer a satisfactory answer to this and similar questions?
- Hanžek: Is the discussion about material constitution legitimate? If there exist parts assembled in a certain way, what sense does it make to ask whether a corresponding whole exists?
- Čeč: Is the discussion about free will an empirical matter? Can any fact decide whether libertarians, compatibilists or determinists are right?
- Biondić: Can events that happen after one's death be good or bad for that person? Is this a legitimate question that brings about deep and important insights about the nature of values and human existence, or can it only lead to a trivial answer?
- Dožudić: What is the difference between verbalism and trivialism?

The Cultural Landscape of the Northern Adriatic – Filling in the Lacunae

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ABSTRACT

Art - historical research focuses geographically and thematically on the urbanistic, architectural and architectural - decorative heritage of the Northern Adriatic, more precisely, the Kvarner islands, Istria, Rijeka, Vinodol and Senj. Selective, generally less known or unknown examples of the artistic heritage of the region are found within the broader picture, which is characterised by diverse influences, both Adriatic (Venice, Zadar and other Dalmatian cultural centres) and continental (Kranjska, Modruš). Examples are also being interpreted within the key of regional cultural centres of certain periods, such as the town of Rab, Rijeka, Senj, Trieste, Pazin County and the centres of Venetian Istria. The chronological focus is put on the late Middle Ages, the early New Age, and in some elements also on the early 19th century, which is important due to the abundance of archival database on the former appearance of the Northern Adriatic, such as the Cadastre of Francis I. Thematically, art - historical research is based on urbanism, architecture, decorative architectural plastics and the protection of cultural goods, but also covers the history of the protection of cultural goods. Within the traditional art - historical approach to research and the disclosure of its results, attention is also paid to the history of the recognition of research subjects within the system of cultural heritage protection and of the various conservation services which operated in this area. The chapters of the work that will be published will be routinely devoted to the proposals of conservation valorisation, from the recognition of the cultural asset to its overall valuation. The aim is not, and cannot be, the creation of a comprehensive corpus, but the filling in of lacunae in the image of the cultural landscape of the Northern Adriatic and turning attention to examples of degraded, less known or totally unknown values as the beginning of the path of their transformation into an officially recognised and protected cultural heritage.

Sentence Processing in Italian

PROJECT MANAGER

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ABSTRACT

This project deals with sentence processing in Italian by native speakers and highly proficient non - native speakers whose native language is English or Croatian. The focus is on sentences with null and overt subject pronouns. In Italian, subject pronouns can be expressed, i.e. overtly (e.g. Lei scrive) or omitted, i.e. null (e.g. Ø Scrive). According to Carminati (2002), the two types of subject pronouns prefer different sentence elements as referents: the null pronoun tends to refer to the sentence subject, while the overt pronoun tends to refer to a non - subject referent. By means of eye tracking during reading we have already established that Italian native speakers obey this principle during sentence processing. On the other hand, non - native speakers of Italian whose native language is English violate this principle, trying to associate both pronoun types with the same sentence element, either the subject or the object, depending on the context. We explain this as resulting from their native language, in which subject pronouns must always be expressed (e.g. She writes) and are used to refer to all sentence elements. In the continuation of the study, we wish to test the hypothesis that the processing of subject pronouns in Italian as a second language is under the influence of the learners' native language by testing non - native speakers with two different native languages, English and Croatian, by means of self - paced reading. Croatian is the same as Italian when it comes to subject pronouns: the null pronoun (e.g. Ø Piše) tends to refer to the sentence subject, while the overt pronoun (e.g. Ona piše) commonly refers to a different sentence element. If the hypothesis is on the right track, Croatian native speakers will process Italian subject pronouns in the same way as Italian native speakers, while English native speakers will differ from them.

Baroque Rijeka

PROJECT MANAGER

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ABSTRACT

The city of Rijeka was the subject of a feud between the Habsburgs from 1466 to 1719 when Charles VI gave the city the status of a free port. This resulted in economic development, which had already been in the making during the previous century. What proves Rijeka's importance and economic fortitude at this time, is the fact that the Habsburg Empire used the port of Rijeka to as a central part of their European trading strategy. By doing so, the Empire established a favourable economic climate that attracted various merchants, manufacturers, craftsmen and artists from all around Europe, which aided the creation of a multicultural and a multi - confessional community on the northwest Adriatic coast. Consequently, the artistic heritage of Baroque Rijeka greatly surpasses national and regional horizons and is impossible to research and validate without contextualizing it within the framework of the European, and more importantly, Central European artistic traditions – a task which has yet to be comprehensively and thoroughly completed. This project's research team, consisting of experienced scientists and postgraduate students in different stages of their studies, will be researching the architecture and urbanism, sculpture and altars, paintings and prints, applied arts and relics as well as archival documents dating from 1600 to 1825, which are kept by public institutions and private collectors or have a local provenance. The team's investigations will span from artistic identities and workshops in the area of Rijeka to the luxurious imported artistic heritage. The research will consist of field work in Rijeka and its surroundings, and in northern Italy and Austria; research in specialized libraries in Austria, Italy, Germany and the UK; and expanded archival research in Vienna, Budapest, Ljubljana, Rijeka, Venice and Zagreb. The results of the project will be presented in international scholarly publications, congress papers and in the concluding monograph.

The Rijeka Croatian Cultural Circle of the Nineteenth Century

PROJECT MANAGER

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ABSTRACT

The problems of the Rijeka Croatian Cultural Circle of the nineteenth century belong to those historical issues that have been insufficiently researched. The complex and dramatic political destiny of Rijeka in this period has provoked numerous disagreements, controversies and erroneous interpretations that extend to this day. The aim of the project is to illuminate the objective historical truth about the Rijeka Croatian Cultural Circle and its peculiar intellectual tradition, which has so far been unfairly neglected not only in Rijeka but also by Croatian social science in general, thus stimulating the need for new research and systematic work on the topic which concerns overwhelming issues of national and cultural identity. Within the research, special attention will be given to several major thematic units: the first Croatian Cultural Circle of Rijeka in general; the activity of the Croatian gymnasium in Rijeka as the fundamental educational and national institution of Rijeka Croats, where many famous Croatian intellectuals, writers, scholars, politicians and cultural workers were active in teaching or acting as professors; the work of the Rijeka Public Library. A special thematic aspect of the research will refer to the Rijeka Philological School. The research will also include the history of local printing and periodicals in the Croatian language. The project will attempt to gather domestic researchers and scholars, philologists and historians from the Rijeka Faculty of Humanities and Social Sciences, and other scientific institutions to systematically study this topic, to publish articles and studies relating to it and to organise exhibitions. This research will be particularly beneficial for young researchers. Material that will be collected through this research could eventually be disclosed in monographs.

Orthoepic Diversity in the Croatian Standard Language (OrthoUNIRI)

PROJECT MANAGER

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ABSTRACT

Research of standard Croatian orthoepy is important for gaining a complete description of the Croatian Standard language. Attempts to come up with such a description based on a normative perspective were, for the most part, abandoned towards the end of 20th and the beginning of the 21st century, because they failed to outline the actual situation with respect to orthoepy that marks neutral communication in contemporary Croatian society. In other words, there is a sharp discrepancy in the orthoepic view of language presupposed by given norms, and language usage in the contemporary Croatian linguistic community. Therefore, it can be said that with respect to usage, contemporary Croatian is marked by diversity. Consequently, we need a new methodological approach to describe the norm. The one that has proved successful, in recent years, was the one based on the sociolinguistic theory of varieties. This approach makes it possible to explain orthoepic diversity by treating the breach of the norm, under certain circumstances, not as a language mistake but as a language innovation. Research within this project is focused on empirical data regarding the contemporary Croatian Standard language, and on the research of the attitudes towards both the 'high' and 'low' varieties of Standard Croatian. This presupposes a construction of appropriate and representative patterns of spoken language, taking into consideration competent speakers who participate in public discourse. The project research sets out to determine spoken features of the contemporary Croatian Standard language and to evaluate the hypothesis according to which the choice of these properties is determined by perceptive salience. The results of the research will be disseminated to the scholarly public at international conferences, through edited books, an authorial book and via relevant journals. In addition to individual papers, there will be two themed issues of journals dedicated to the topic of orthoepic diversity.

New Trends in Bioethics of Middle and South - Eastern Europe: Researching and Networking the Resources

PROJECT MANAGER

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ABSTRACT

"Bioethics," as interpreted by the Georgetown Kennedy Institute, has spread throughout the world since 1971 and, been fostered by politics, powerful publishing apparatuses, conferences and courses, and transformed into a global mainstream discourse. With its exaggerated pragmatism, narrow focus on medical ethics and four principles anchored in mostly Anglo - American culture, this "bioethics" has been severely criticised in recent decades. After the discovery of Fritz Jahr's work, the re - interpretation of V. R. Potter's ideas, and some other original initiatives at the beginning of the 20th century, mainstream bioethics confronted an alternative in the so - called "European" bioethics based on broader foundations of (not - only - European) philosophical tradition, with a shift from anthropocentric perspective towards the ethics of life and environment. By investigating the new trends in bioethics, the possibility opens up of the conception and discovery of a more universal bioethics, more capable of responding to contemporary global and societal challenges than the content and methodology limited mainstream. After several years of experience in studying the development of bioethics in the USA, Germany, Spain, Italy, and Croatia, it is the intention of the research group proposing this project to explore new ideas emanating from Middle and South - Eastern Europe, which up to now have been completely neglected when it comes to bioethical mapping. Many existing contacts will facilitate the research, and networking will strengthen not only the exchange of ideas and practices, but also the potential applications of joint projects. The basic method of the realisation of the project will be comparative analysis of bioethical publications and activities in the target area, detection of individuals, groups, and institutions developing ideas in accordance with "European" bioethics, and the establishment of contacts and networks for the purpose of a concrete collaboration.

Rijeka Memoryscapes

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ABSTRACT

This project follows on the success of the HRZZ project "Framing the Nation and Collective Identity in Croatia" (FRAMNAT), and seeks to apply the same methodology, digital humanity tools, and fieldwork experience to the local case study of Rijeka, the European Capital of Culture in 2020. The goal of Rijeka Memoryscapes is to analyse the city's multiple layers of historical memory, from physical objects in the landscape (monuments, architecture) to cultural representations (commemorations, visual art, political discourse). While one aspect of the analysis is to critically evaluate how this memoryscape is used politically within the context of contemporary Croatia, the other aspect is to see how this cultural heritage can be used for tourism and local valorisation. The project is based on three tasks: mapping the memoryscape, observing commemorative practices, and continuing to develop the digital tools and platform created in FRAMNAT. The first task is to map significant sites of memory related to the 20th century in Rijeka and its surroundings, focusing on its monumental heritage. By analysing the chronological and geographical erection of WW2 and Homeland War memorials, it will be possible to trace how cultural memory changes over time and is affected by the socio - political context. The second task is to observe local commemorative practices, drawing upon the experience and methodologies developed for the national level in the FRAMNAT project. Commemorative speeches, protocols, and media reporting will be collected for the commemorations identified to be most relevant for Rijeka. Finally, realising the need to strengthen the role of digital tools in humanities research, the third task is to continue to develop the platform created in FRAMNAT so it can be applied and patented for future research projects beyond Croatia. The results of this research project will contribute to existing initiatives, such as ECOC2020 and Rijeka in Flux, and will include FFRI students.

Linguistic expression of Emotion: Computational resources, methods of identification and ontological modelling of the psychological states (EmoCNet)

PROJECT MANAGER

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ABSTRACT

The aim of the project 'Linguistic Expression of Emotions: computer resources, identification methods and ontological modelling of psychological states (EmoCNet)' is to describe the linguistic expression of emotions and affective states with the aim of creating models for machine learning and identifying affective states in texts. The significance of this project is in the interdisciplinary approach that combines the insights from the cognitive sciences, affective sciences, corpus and computer linguistic methods, aesthetics, literature studies and the development of software tools for identifying lexical, metonymic and metaphorical language forms of emotional expression. The research will use a number of digital humanities methods for the automated building of digital archives, the retrieval of media texts, digital corpus, modelling, storage, integration, analysis and visualisation of semantic - syntactic structures, computer - generated search corpus, creation of knowledge base and tools for classifying affect categories in various genres and contemporary cultural sources including: media portals, parliamentary debates, texts of pop songs. The project results will be presented on the web pages http://emocnet.uniri.hr/, seminars and scientific papers, and will enable the development of methodology, resources and tools for analysis and recognition of emotional expression in texts and empirical insights into cultural and intercultural emotional categorization and intra - cultural patterns of expression of affective phenomena.

Research into a Historical Overview of the Italo - Romance Variety in Rijeka

PROJECT MANAGER

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ABSTRACT

The main goal of the project is the study of the Italo - Romance variety of the Italian language used in Rijeka through an analysis of documentary sources. Although situated outside the Venetian territories, Rijeka was indirectly influenced (for economic reasons) by the Italo - Romance variety spoken and written on the eastern coast of the Adriatic, until the fall of the Venetian Republic. The Venetian Vulgar variety overlapped with local idioms and became a particular form of colonial Venetian. Over time, it was itself influenced by neighbouring peoples. It is, therefore, a unique case of Italian outside Italy that deserves special attention. Research team members will study the available sources to trace and describe the Italo-Romance language panorama in Rijeka from a historical, cultural and linguistic point of view. The first phase will focus on the recognition, classification, study and commentary on the documents written in Italian and its varieties which were produced in Rijeka in various historical periods. Particular attention will also be paid to lexical aspects of the variety. The research group will try to clarify what characterises Rijeka's Italo - Romance variety, from its first documented traces up until today, with the aim of establishing an Italian language history of Rijeka. The group will disseminate the results achieved both through specialised scientific writings (i.e. papers and a monograph resulting from the closing conference) and through popularisation texts. Team members will organise regular meetings with experts in Rijeka to develop and update research methods. They will also participate in conferences and workshops abroad, in order to communicate the results of the research.

Bioethical Standards of Urbanity: The City as Framework for Life Ethics (with Special Regard to Rijeka)

PROJECT MANAGER

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ABSTRACT

The project "Bioethical Standards of Urbanity: The City as a Framework for Life Ethics (with special regard to Rijeka) – (SUBethos)" has resulted from two recently completed projects ("European Bioethics in Action – EuroBioAct," 2014 - 2017, HRZZ, and "Roots of Bioethics: American and European Contributions," University of Rijeka, 2014 - 2018). Departing from the original meaning of bioethics (Jahr, 1926) and joining V. R. Potter's contribution (1970), the theoretical framework of this project considers the cultural sensitization of contemporary bioethics (particularly in Europe) identifying it in the broader sense of "life ethics," whereby the moral obligation towards humans has been extended to all living beings, surpassing the dominant bioethical paradigm narrowed down to the problems of (new) biomedical ethics. However, there are examples of bioethical application where even this approach shows its limitations. An example of this has been the range of interests of "urban bioethics," oriented towards the issues of resource availability, social and health inequalities, and the effects of public - health interventions, but ignoring a series of urban - life factors and the entwinedness of the natural and artificial, the living and non - living, so typical of the city. Consequently, the aim of the proposed project will be to analyse critically modern trends in urban bioethics and to bring them into correlation with the methodological approach of bioethical standardisation (project EuroVioAct). The revision of bioethical standards related to the city, as well as a comparison and synthesis with good urban practices in phase I aims at defining urban bioethical categories (space, water, air, culture, architecture, technology, etc.), while phase II will end with a list of bioethical standards, the SUBethos mobile application, together with Urban Bioethics standards recommendations.

Contrastive Analysis of Collocations in Croatian, German, and English

PROJECT MANAGER

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ABSTRACT

The plan for this scientific research project is to carry out a contrastive analysis of collocations in Croatian, German, and English at a lexical and a structural level on the basis of a comprehensive corpus research of the hrWaC database. Croatian is the source language and German and English are target languages. The aim of the research is to create a database that will serve as the foundation for the development of efficient approaches to, and methods for, teaching collocations in German and English as foreign languages, and that could be used by translators and lexicographers as well; the database is based on a list of incongruent collocations, meaning that they are different in the three languages. The starting point of the research is the fact that there are collocations in the three languages that do not have a directly translatable equivalent and that these should be given more attention in foreign language acquisition. Research in Croatia and abroad has so far shown that foreign language speakers use their first language to directly translate elements of the collocation into the target language, which – in cases of divergent structures – results in combinations of words that are not in line with the standard use of the foreign language; this makes natural and fluent communication in the target language difficult. For this reason, there is a dire need to create a list of incongruent collocations, and this is the aim of this research project.

Croatian Writing Heritage from the 18th to the 20th Century

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ABSTRACT

The core of this project is the previous project Croatian Written Heritage from the 17th to the 19th century. The aim is to deepen the knowledge of manuscripts and printed works of the 18th and 19th Centuries as well as to disseminate Croatian written heritage of the observed period. Research related to the 20th century is concerned with the contemporary linguistic situation, grammatical norms and (non)creative deviations from the standard language. The planned research will be linguistic in the broad sense (concerning language history, culture, identity) and linguistic in the narrow sense (concerning sociolinguistics, syntax, phraseology and textology). In 2012, members of the research team found 2 covers of 16 volumes with more than 600 handwritten pages that belonged to the Croatian linguist Šime Starčević. One of the aims of the previous project was to authenticate the manuscript and to carry out a textual analysis. This project will create the opportunity to proceed with the textual analysis of the remaining manuscripts and to inform the public of the results. It is expected that the results of the sociolinguistic research will contribute to the knowledge of the Croatian linguistic landscape and the language of advertising in the 19th and 20th centuries. Analysis of 18th and 19th century language should acquaint the scientific public with the new area of historical sociolinguistics. Syntactic research focuses on contemporary and historical syntax (such research is connected with the project at the University of Rijeka). It is expected that the results of the phraseological research will reveal the present state of phraseology as well as being the core of the contrastive linguistic research, especially concerning Croatian and German languages in contact. An additional task is to examine Croatian as the 2nd, heritage or foreign language. Financial support will enable this fundamental humanistic research. The results of such research will expand the portfolio of the core research team.

Scientific Kinds in Biology and Medicine

PROJECT MANAGER

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ABSTRACT

We offer a philosophical analysis of scientific classifications (i.e., scientific or natural categories) in biology and medicine. This issue has important practical consequences, as can be clearly illustrated by invoking some controversial examples of scientific kinds, such as human races or psychiatric conditions like Anti - Social Personality Disorder. Our aim is to formulate a philosophical account that can capture scientific kinds and distinguish them from non - scientific ones. The topic of scientific or natural kinds is extensively covered in the contemporary philosophy of biology, and to a certain degree in the philosophy of psychiatry. The received view is *pluralistic*, that is, the view that depending on the context of the investigation and the discipline in question, different accounts ought to be used. We find this view unsatisfactory as it reduces philosophy to mere science reporting and can even have problematic practical consequences. Making the account of natural kinds relative to the context of investigation and particular interests means that we do not have a general criterion for distinguishing scientific kinds from non - scientific ones. The inadequacy of pluralism is especially salient when we go from the fundamental biological sciences to the higher-level ones, such as psychiatry. The classification of the abovementioned antisocial personality disorder, for instance, can serve some practical purposes, but it is scientifically problematic as it groups together a very heterogeneous group of people. Accordingly, we develop a version of a clustering account of natural kinds, *the similarity based clustering account*, as a suitable alternative to pluralism, which can capture scientific kinds in biology and medicine. We test our account by applying it to different case studies of classifications in molecular biology and medical practice.

Critical Thinking and Society: Education, Science, Politics and Religion

PROJECT MANAGER

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ABSTRACT

The significance of critical thinking, that is, of inference and argumentation which are responsible, open to new evidence and objections, and as such are ready to revise their underlying attitudes, is an inevitable theme of theoretical and empirical research at the present time, which is abundant in partial views, biases, tendencies to polarised thinking and above all towards rash and flawed inferences. In this project we will research and refine the terms of criticality and critical thinking and after reviewing previous results of studying relevant literature, we will offer a hopefully better definition as well as normative criteria for the terms stated above. On the theoretical level, the project involves the determination of normative conditions that ought to be satisfied in some discourses in order to be able to state that critical thinking is used in them. Furthermore, in this project we will research the nature and the role of formal and informal judgement of contemplative acts like thought experimentation and the possible social consequences of such analysis. Finally, we will analyse the relevance and the role of critical thinking in the domain of practical philosophy through four basic social discourses: education, science, politics, and religion. In this context, we plan to carry out four experimental workshops concerning confrontational attitudes which will be structured, guided, and analysed afterwards through the use of the theoretical - normative frame achieved in the theoretical part of the project.

Migrations, Identities and Context of Medieval Art in the Kvarner Region

PROJECT MANAGER

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ABSTRACT

The project “Migration, Identities and Context of Medieval Art in the Kvarner Region” (MIC) focuses on research of the medieval period in the context of migrations (people, ideas, artworks), communications (routes and ways of spreading the visual language, the role of ecclesiastical and secular elites in the creation of cultural landscape) and identities (defining of the creation of "styles", their perception and use through history, especially in art history discourse). The project will explore these issues through workshops, and the use of craftsmen, commissioners, political actors and art markers and will determine the sources, influences and ways of creating visual arts from the late antiquity to the early modern age. The area under research – the Kvarner region - includes southern and eastern Istria, the Kvarner islands, Rijeka and its surroundings, and the area of Vinodol. The research will be based on works of architecture, sculpture and painting. The project will use an interdisciplinary approach and modern technology. It will: 1.) supplement, update and make available a database of medieval art works in Kvarner as a platform for further research. It will display photos, maps and other available visual material as well as all relevant data, 3D drawings and models of artefacts that have been preserved in fragments; 2.) create visual maps and reconstruct the cultural landscape of historical periods by connecting historical events with the development of the artistic language and transmission of specific artistic models; 3). interpret and discuss the ways and means of communication in its physical (routes, roads) and symbolic form (transfers of ideas and models). Here we will rely on archival research and on exploring material, construction and design techniques in a comparative method with special reference to the monuments in the region (North Adriatic, Dalmatia and Central Europe); 4.) discuss and define "style(s)” as a specific paradigm in relation to the content within art historiography.

Liber Fluminensis – Contributions to the Study of the Croatian language in the Works Printed by Printing Houses in Rijeka until the 20th Century

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ABSTRACT

Rijeka printing houses have been primarily studied as a cultural or historical phenomenon, while the language of the works they published has been somewhat neglected. This aspect should, therefore, be studied in more detail and more comprehensively, particularly with respect to the linguistic diversity of Rijeka. However, in addition to the horizontal multilingualism, which is the existence and use of more than one language, there is also the phenomenon of vertical multilingualism, which is the use of different variants of the same (Croatian) language in all its historical and sociolinguistic variants. In the early modern period, during which the first printing house, that of Šimun Kožičić Benja (1530 – 1531), operated in Rijeka, the Croatian language was realised in two variants: as an element in the common Croatian Church Slavonic language and as an independent Čakavian variant which was significantly more frequent in non - liturgical texts. In addition to the works published by Kožičić's printing house, this project also focuses on the editions of another large Rijeka printing house – the Karletzky Printing House (1779 – 1889), which operated during the most crucial period in the history of the Croatian language and its standardisation. Although less present in the language of the works published in Rijeka, the Čakavian component, which changed over time from the autochthonous Rijeka Čakavian speech to the one that was brought to Rijeka by the speakers from the surrounding areas, is a trademark element of these texts. This project will study the language in which the works are published, stress the importance of the publications in both the local and national context, and demonstrate that the choice of the type of language in the complex linguistic kaleidoscope depends on the purpose and the function of the text. This will, in turn, enable us to re - evaluate and revitalise the importance of the phenomenon of Rijeka printing houses and present its tourist potential.

Natural Sciences

The Connection between Circadian Genes and Redox Balance in Psychostimulant - induced Behavioural Change

PROJECT MANAGER

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ABSTRACT

Psychostimulant use changes neuronal functioning through mechanisms of neuronal plasticity and leads to addiction. The psychostimulants cocaine and methamphetamine bind monoaminergic transporters onto the presynaptic neuron and induce a cascade of molecular changes that leads to functional changes. A group of circadian genes, regulators of 24 hour behavioural rhythms, including reduction - oxidation (redox) reactions, mediate behavioural changes induced by psychostimulants. Because psychostimulant administration increases the amount of reactive oxidative species, while disturbing the redox balance influences neuronal plasticity, our hypothesis is that for neuronal plasticity induced by psychostimulants the key role played by interactions between circadian genes, changes in redox balance and monoaminergic release. We will use the model organism drosophila melanogaster to perform behavioural experiments in the laboratory of the principal investigator and electrophysiological recordings in the collaborator's laboratory. Using the FlyBong method, which we recently developed, we will undertake genetic screening and use it in the testing of transgenic animals. The goal is to identify genes that control redox balance and influence neuronal plasticity, and to identify brain areas and causative roles between redox and circadian genes in the regulation of neuronal plasticity. The collaborator on this project will use mutant and transgenic flies that have been identified in previous experiments as performing voltoamperometric recordings of monoaminergic release in the brain ex vivo after exposure to psychostimulants. Results from this project will lead to a better understanding of the basic principles of neuronal plasticity and could lead to the development of new strategies for treatment and prevention of addiction, some of which could be based on simple nutritional interventions.

Identification and Quantification of Neural Stem Cells with the New Method of Optimised Homogenisation

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ABSTRACT

Neural stem cells (NSC) play a key role during the embryonic development of the central nervous system (CNS). Their discovery in the adult mammalian brain represents one of the most important breakthroughs in neuroscience in the last 20 years because previously it was thought that in the adult organism neurons could not regenerate and that during a life their number progressively decreases. Therefore, adult neurogenesis opens up the opportunity to cure neurodegenerative diseases with cell therapy. NSC are tripotent, i.e. generate three main CNS cell types: neurons, astrocytes and oligodendrocytes. Their differentiation process involves the formation of transit - amplifying precursors. Many investigations have shown that NSC are a heterogeneous cell population with different differentiation potentials and that there are still no unique markers that can distinguish a certain cell type. Moreover, additional research is required in order to better understand regulatory processes that govern NSC. In this project, we propose the development of a new method for the fast and simple analysis of cell nuclei isolated from the nervous tissue in order to quantify and identify NSC and other CNS cells by using specific markers. The optimised homogenisation method represents the alternative to time - consuming and expensive traditional techniques that rely on immunostaining, and include tissue slicing, and the counting and analysis of hundreds of serial tissue slices. This method will be based on the homogenisation of the fixed nervous tissue from which the cell nuclei will be extracted and then analysed with immunofluorescence by using specific nuclear markers. The novelty of this method is in the use of additional markers in order to include all cell types of the brain, and therefore, their identification opens the opportunity for the application of diagnostics.

Codes, Groups and Combinatorial Structures

PROJECT MANAGER

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ABSTRACT

This project deals with the construction and analysis of various types of combinatorial designs and graphs, as well as codes determined by their incidence or adjacency matrices, or their orbit matrices. For the construction of combinatorial structures we will combine computational, geometric and algebraic approaches. We will also take into consideration other combinatorial objects, such as binary complementary sequences (e.g. periodic Golay pairs) and Hadamard matrices (including complex Hadamard matrices). Relations to other structures (finite geometries, association schemes, etc.) will also be taken into account. Finite group actions will have a significant role in constructing and analysing combinatorial structures. As a result of the proposed research, we expect the construction and classification of various types of combinatorial designs and graphs (e.g. new block designs and strongly/distance regular graphs) and other combinatorial objects (complementary sequences, Hadamard matrices, etc.), as well as the construction of codes with good properties (e.g. linear codes with a large minimum distance compared to the length and the dimension of the code, self - orthogonal or self - dual codes, etc.). We expect that the outcomes of this project will be of interest to researchers working in design theory, coding theory and graph theory, and for those working on the theory of finite groups.

Optoelectronic Properties of Thin Organic Films: Experimental Studies and Modelling

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ABSTRACT

This project is focused on method development for the determination of the optoelectronic properties of thin organic films (thickness 1 - 100 nm), as well as on understanding those properties on the level of quantitative physico - chemical models. In the first place, the subject is the organic semiconductor (OS) films, then molecular self - assembled monolayers (SAMs) and polymer brushes enriched with organic dyes as sensitizers, as well as noble metal nanoparticles and/or charged dopant species. Among the experimental techniques, in the foreground is Variable Angle Spectroscopic Ellipsometry (VASE) and its electrochemical variant EVASE (Electrochemical VASE) which was recently successfully developed in the laboratory of the principal investigator (PI). The primary goal is to experimentally determine the complex dielectric function (DF) of thin film in contact with an aqueous electrolyte solution (in situ), whereby the doping state of the film and its optical absorption will be regulated by application of an electric potential or addition of dye sensitizers. The experimental condition for studying the DF will be adjusted such as to imitate the operational environment of the organic electronic devices (organic electrochemical transistors, organic field effect transistors, organic light emitting diodes and photovoltaic cells). For the interpretation of the experimental DF of the studied thin organic films, the standard models of dielectric media such as the Lorentz oscillator will be implemented. Special attention will be paid to the presence of dichroism. The DF parameters will serve as fundamental data in the development of the physico - chemical model for the charge transfer in thin organic film.

An Analysis of Mathematical Models of Fluid Mechanics and Technical Systems using Data - driven Algorithms for the Koopman Operator

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ABSTRACT

Complex dynamical systems are currently one of the focal points of applied mathematics, mathematical modelling and related interdisciplinary research. Nowadays, for their analysis spectral methods using linear infinite - dimensional operators, such as Koopman operators, have been in increasing use. The potential for wider application of Koopman operators has emerged in recent years through the development of methods for numerical approximation of their spectral objects. This approach has also been successfully applied to the analysis of complex dynamical systems modelled with non - linear partial differential equations. The wide application of this approach lies in the fact that corresponding data - driven algorithms are applied to the observables of the system, even if the underlying mathematical model is unknown. In the last few years, a number of the project's associates were involved in research that expanded theories and applied algorithms as part of their work on the international project "On - Data - driven, Operator - Theoretical Framework for Space - Time Analysis of Process Dynamics" (DARPA, USA). The rest of the associates have been working on two projects supported by the University of Rijeka researching models of the micropolar continuum, which enables not only macroscopic, but also microscopic analysis of a material's behaviour, which nowadays is even more important. In this way, the connection between these two directions of research is being enabled. The aim of this project is to explore the possibilities of the prediction of dynamical systems using data driven algorithms, analysing their robustness and efficiency, and their ability to enhance the existing algorithms. Particular attention will be paid to mathematical modelling and analysis of technical systems and to the study of the characteristics of the micropolar continuum model, with emphasis on simulations of micropolar fluid flow and analysis of the influence of different physical parameters of the associated models.

Exploring the Structure of the Universe using Ground-based and Space Telescopes

PROJECT MANAGER

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ABSTRACT

Understanding the structure of the Universe on large and small scales as well as emission mechanisms from Active Galactic Nuclei (AGN) requires co - ordinated usage of different instruments measuring radiation across the entire electromagnetic spectrum, from radio to very high energy gamma rays, and other particles, using the MWL observational strategy. Computer modelling of such measurements is especially challenging as it demands a combination of different kinds of detectors and measuring conditions with and without atmospheric influence, in order to decrease systematic effects. Therefore, it is important to enable simultaneous usage of different kinds of ground - based and space telescopes, to understand their performances, and develop computer codes that consider all the factors. We will observe AGN with Cherenkov telescopes MAGIC and LST-CTA, contemporaneously to observations with instruments sensitive in lower energies. We will monitor the atmospheric conditions at La Palma using LIDAR, in order to set constraints on EBL and LIV, test isochronicity of the gravitational lensing effect, and study emission mechanisms in AGN. Working with colleagues within the international collaborations MAGIC and LST-CTA, we will develop computer codes for AGN emission modelling with and without gravitational lensing effect, and LIV testing. The codes will be tested on simulations and applied to measured data. The project will strongly contribute to internationalisation of UNIRI and the international visibility of Croatian science, to incoming and outgoing mobility, and to the education of new PhDs through the recently founded Doctoral Study in Physics. The development of advanced software and computer simulations will increase the usage of the supercomputer "Bura", and stimulate its joining of the international CTA GRID. Atmospheric modelling and LIDAR observations will initiate interdisciplinary collaboration within UNIRI, and applications to competitive international calls for proposals with applications in environmental protection.

Quantum Field Theory, Gravity and Unified Theories

PROJECT MANAGER

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ABSTRACT

Our current fundamental description of interactions in nature, based on the Standard Model of elementary particles (gauge quantum field theory) and General Relativity (geometric theory), is neither satisfactory nor complete. There are theoretical problems which are considered to be, directly or indirectly, tied to our incomplete understanding of gravity. From the experimental viewpoint, the description is incomplete as it does not include or explain dark matter. This project has the goal of improving the description and understanding of gravity, by analysing both its quantum and semi - classical domains. Fundamental aspects will be studied through constructions and analyses of gauge theories with higher spins. Such theories generically contain spin-1 and spin-2 fields, and so are of a unifying type. It is known that the presence of an infinite tower of higher spin fields can drastically improve UV behaviour so much that it may cure UV divergences of amplitudes which are present in the Feynman perturbative calculus of standard quantum field theories. An example of a theory in which such behaviour is realised is string theory. We shall also study interactions between matter and higher spin fields and analyse the influence of non - local coupling to higher spin symmetries. The semi - classical domain will be investigated through analyses of effective actions of quantised matter in the classical background consisting of standard gravity (spin-2) and also higher spin fields. The effect of quantum contributions on the solutions of the effective equations of motion will be analysed. As these contributions are non - local, it is possible that they may produce qualitative changes in some solutions. Special attention will be directed at cosmological solutions and those describing black holes. Quantum anomalies of gravitational origin will be studied, in particular, the recently discovered Pontryagin trace anomaly.

Methods of Mathematical Analysis in Pure and Applied Mathematics

PROJECT MANAGER

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ABSTRACT

Mathematical analysis represents one of the oldest and most important fields of mathematics with numerous applications in all natural sciences. The aim of this project is to develop new methods and results in several different branches of modern mathematical analysis such as differential geometry, dynamical systems, ergodic theory, harmonic analysis, numerical mathematics and probability theory. More precisely, we plan to contribute towards a better understanding of the qualitative and quantitative behaviour of non - autonomous dynamical systems, develop new numerical methods for the control of dynamical systems, prove new limit laws in probability theory and address the problem of linear independence for various systems of functions in the context of harmonic analysis. We plan to obtain new results regarding the structure of subspaces of the quon algebra. The outcomes of our research activities will be applicable in various different areas of science such as mathematical statistics, statistical physics, signal theory and transport theory. One of the aims of the project is also to establish a new research group at the Department of Mathematics, University of Rijeka by initiating collaboration between the members of the research team. By doing so, we will create an optimal training environment for new PhD students that will be mentored by a member of the research team of this project. Finally, taking into account that many international experts will be involved in research activities of this project, we plan to contribute towards the higher domestic and international visibility of the Department of Mathematics, University of Rijeka.

Phenolic Compounds Promote Glucose Transporter 4 (GLUT4) Translocation and Improve Glucose Uptake in Tissues

PROJECT MANAGER

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ABSTRACT

Glucose is the primary source of energy for most cells and an important substrate of many biochemical reactions. The entry of glucose into cells is achieved by the activation of glucokinase phosphorylation and the mediation of a series of glucose transporters (GLUTs) that differ in each other according to the specificity, distribution and mechanism of regulation. Insulin stimulates the translocation of glucose transporter 4 (GLUT4) vesicles to the plasma membrane (PM) by the activation of the signal pathway of phosphatidylinositol 3-kinase/actin (PI3K/Akt) and Cb1-CAP-CrkII-C3G-TC10 pathway. Activation of the PI3K time is not sufficient for the GLUT4 translocation, so the TC10 need to be further activated. Insulin signalling affects the structural and dynamic elements involved through the intracellular localization, mobilization, tethering, docking and fusion of GLUT4 vesicles with the PM. Rab GTPases participates in the formation of GLUT vesicles, affects its mobility/delivery along the cytoskeleton and tethering/fusion with the PM. SNARE proteins and several regulatory factors mediate this process.
The mechanism by which insulin regulates glucose uptake in peripheral tissues is still not fully clarifying, particularly in case of intake of drugs and natural compounds with hypoglycemic effects such as bioactive phenolic compounds. In addition, the impaired glucose homeostasis in insulin resistance is the result of deregulation of signal pathways PI3K/Akt, mitogen - activated protein kinase (MAPK) and AMP - activated protein kinase (AMPK). Damaged functions of Rab proteins and SNARE proteins directly affect GLUT4 translocation and fusion with the PM. Bioactive phenolic compounds can stimulate glucose uptake by inducing GLUT4 expression, affecting on GLUT4 translocation and fusion to PM. This has so far been confirmed in the studies applied resveratrol, chlorogenic, gallic, ferulic and ellagic acids and carnosol on in vitro models. This project aims to investigate the improvement of glucose uptake in insulin - sensitive and insulin - insensitive tissues through the GLUT4 translocation elements to maintain glucose homeostasis in vivo.

The Expression and Function of HSV-1 miR-H1

PROJECT MANAGER

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ABSTRACT

Herpes simplex virus 1 (HSV-1) is an important pathogen and one of the most investigated viruses. The virus is characterised by two - phase replication: productive and latent phases. While viral genes are abundantly expressed during the productive phase, in latency, viral genes are completely suppressed. The molecular mechanisms of viral gene suppression are poorly understood, and the discovery of miRNA, small regulatory RNAs, has led to a paradigm shift, introducing new possibilities for the explanation of the molecular latency mechanisms that have yet to be experimentally confirmed. Our laboratory participated in the initial discoveries of HSV-1 miRNA and is one of the leading laboratories in the world in this field. Previous studies have shown that HSV-1 expresses a large number of miRNAs, functions of which are poorly investigated, including miR-H1 which is the subject of our research. MiR-H1 is a unique HSV-1 miRNA abundantly expressed during productive infection and encoded in the same locus as another miRNA, miR-H6, but in the opposite direction (i.e. anti - sense) and thus fully complementary to this miRNA. The gene encoding miR-H1, as well as the primary transcript (pri-miR-H1), including the promoter that regulates the expression of this gene, are not known. Also, there is no known function or role of miR-H1 in HSV-1 infection. Based on our preliminary results and other research, we hypothesise that miR-H1 is encoded by a relatively small gene under the control of its own promoter and that miR-H1 plays an important role in HSV-1 infection. Therefore, the main aims of this paper are: a) identification and annotation of the gene for miR-H1 and the basic characterisation of the promoter and the biogenesis of miR-H1; to accomplish these goals we will use different molecular biology methods (gene cloning, reporter essays, mutagenesis etc.) in combination with in silico methods (bioinformatics analysis and prediction); b) Determining the function of miR-H1. In order to determine the role of miR-H1, we will use classical and molecular virology methods which will include the generation of viral mutants with dysfunctional miR-H1 expression, the characterisation of mutants in vitro and the prediction and target transcripts determination. Preliminary research is funded through the support of the University (2014 - 2017) and by the Croatian Science Foundation Project (by 2019). As part of the scientific research project, one of the goals is to support the education and training of new PhDs (3 PhD students) in the field of molecular virology and of undergraduate students at the Department of Biotechnology.

Solar and Stellar Activity

PROJECT MANAGER

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ABSTRACT

We propose a research project on solar activity and variable stars which is a continuation of our two previously concluded grants (2013. – 2018.), supported by the University of Rijeka and of our long - lasting international co - operation with prominent astrophysics' experts and institutions. The nature and evolution of a sample of young stars, as well as of symbiotic accretion and neutron stars recently studied in a scarce sample of currently known objects, will be determined by archive photometry. The physical properties of such objects, the nature of related eruptive processes and the properties of their variability will be obtained from historical light curves and spectroscopic observations. Furthermore, physical and optical properties of dust responsible for radiatively driven dusty stellar winds of symbiotic Miras will be determined. These properties are of key importance in order to determine mass loss rates, mechanisms of mass transfer, evolution of the binary system and the onset of nova outburst. Distribution of circumstellar dust will be obtained by numerical modelling and by use of spectroscopic and interferometric observations. Dust distribution will be compared with the results of hydrodynamic simulations in order to find mass transfer mechanism and to propose a general circumstellar model of symbiotic Miras. Finally, their photometric variability will be related to the variations of the properties and dynamics of dust shells. We will also study temporal variations of the differential rotation of the Sun and its relation to solar activity. Planned solar cycle prediction analysis will help to improve understanding of the solar activity cycles and of the solar dynamo. Long - and short - term solar cycle variations will be determined by the use of Wolf numbers, and then used for interpretation of the stochastic and chaotic influences on the solar cycle. One doctoral degree (PhD) will be obtained under the proposed project.

aKAD - Advanced Kinetic Astroparticle Detection

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ABSTRACT

The Advanced Kinetic Astroparticle Detection (aKAD) project is based on experience gained during the work on the Kinetic Astroparticle Detection (KAD) project. The aKAD project shares the name and experimental set - up with the previous project but its ultimate goal is to tackle different physics. The project is envisaged in two phases which share the experimental set - up and measurement methods. The first phase is a continuation of the KAD project and its goal is to measure the chameleon's particle properties if found or to cover an additional region in the available parameter space. Silicon nitride membranes coated with metal will be used. The particle flux transfers linear momentum to the membranes which change their position. The position of the membrane is read out by interferometric techniques. The expected gain is to cover a region in the parameter space with limits three orders of magnitude lower with respect to the present ones. This method does not heavily rely on chameleon models which is its advantage with respect to other methods. The expected duration of the first phase is one year during which the measurements will be completed and the coating techniques will be perfected. The coating by high density metal is of utmost importance for the first phase since it enhances the sensitivity to the particle flux, while during the second phase it prevents a build - up of residual charges on the membrane surface. The choice of coating depends also on the final optical and mechanical properties of the coated membranes. In the second phase conductive coatings will be used with the goal of measuring the Casimir effect in the plane/plane configuration at low separation distances and eventual corrections due to new types of interactions and topological effects.

Synthesis and Characterisation of Smart Polymer Nanoparticles with Nitroxide Radicals

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ABSTRACT

The modern pharmaceutical industry seeks to develop smart drugs that will act specifically on a tissue or organ affected by disease. The main objective of the proposed research will be to prepare novel "smart" polymer nanoparticles containing nitroxide radicals covalently bound to the polymer carrier. These radicals are known as scavengers of reactive oxygen species that cause oxidative stress and cell damage. It has also been found that nitroxide radicals cause apoptosis in cancer cells and suppress tumor growth. However, in "in vivo" conditions, these radicals cannot be efficiently used because of their non - specific accumulation in normal tissue and rapid excretion from the body. To overcome these difficulties, a polymeric carrier based on the poly[N- (2-hydroxypropyl)methacrylamide] (poly (HPMA)) and cholesterol will be synthesized. A 2,2,6,6-tetramethylpiperidine-1-oxyl (TEMPO) radical will be bound to the polymer carrier by a spacer that contains a hydrazone bond which can be hydrolysed in an acidic medium. The radical containing nanoparticles will be prepared by the nanoprecipitation method. Nanoparticles will be investigated by nuclear magnetic resonance (NMR), cryo - transmission electron microscopy (cryo-TEM) and dynamic light scattering (DLS). The electron spin resonance method will be used to investigate the release of TEMPO radicals from nanoparticles under physiological conditions and conditions characteristic of tumour cells. Controlled release of the radical is expected only under acidic conditions found in the tumour cells. Prepared nanoparticles will allow prolonged retention of nitroxide radicals in the body and controlled release of radicals at the site of action will enable a completely new, targeted approach to treatment of tumours and diseases caused by oxidative stress. Their potential application in the pharmaceutical industry is an expectation of the project.

The Mechanism of Action of Fungal Polysaccharides on Probiotic Bacteria of Genus Lactobacillus

PROJECT MANAGER

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ABSTRACT

The components of the human microbiome are important because of their association with all the pathophysiological conditions of the human organism. In this project we want to investigate the effects of fungal polysaccharides such as beta - glucans on the growth of probiotic bacteria. Very little is known about polysaccharides and probiotic bacteria, and research so far suggests a positive relationship. Our initial investigations with fungal extracts confirm this. Glucose control experiments have shown that this positive effect is not a consequence of more available carbon sources, suggesting a more complex biological mechanism that is completely unknown. To clarify it, in the first part of the project we will define cell structures with the most potent effects using non - invasive FTIR microspectroscopy in collaboration with G. Birarda from synchrotron Elettra,Trieste. We will also investigate the gene expression that is necessary for the transition of bacteria from the Lag Phase using the RT-PCR method, since growth curves have shown that the most prominent effect of fungal polysaccharides is at this stage. We will further examine responding genes by constructing fluorescent transcriptional reporters. In the second part of the project, using time - lapse microscopy, we will monitor the activity of fungal polysaccharides not only the Lag phase activation but also the growth and division of individual Lactobacillus cells that will be cultivated in a microfluidic chamber developed in collaboration with S. Wu from Beijing Jiaotong University. This technique also enables the analysis of the heterogeneity of bacterial behaviour by the continuous monitoring of a number of individual cells. The results of the planned experiments will give us insight into the biological activity of fungal polysaccharides with respect to different genera of Lactobacillus, which can serve as a basis for the development of innovative therapies, and will also establish solid foundations for co - operation with the pharmaceutical industry.

Preparation of Lipid - pyridylporphyrin Conjugates, their Characterisation and Photodynamic Activity

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ABSTRACT

Photodynamic Therapy (PDT) combines a photosensitiser (PS), light and molecular oxygen to produce cytotoxic singlet oxygen, and other reactive oxygen species, to destroy tumour cells and pathogenic micro - organisms. The selectivity in PDT is achieved by irradiating the targeted tissue, so PDT is more and more successful on solid and localised tumours and infections, especially on the skin and other parts of the body and organs that can be irradiated. An additional level of selectivity is achieved by preferential accumulation of PS in the diseased tissue. In our research so far, we have synthesised a series of amphiphilic tripyridylporphyrins that proved to be effective PS on different tumour cells, one of them also being successful against various bacteria and herpes simplex virus 1 (HSV1). The proposed project aims to continue the research towards the development of new PSs using anti - cancer and anti - microbial PDT. Meso - pyridylporphyrins will be synthesised and their conjugates prepared to achieve different lipophilicity and amphiphilic properties; their physico - chemical properties, particularly photophysical and photochemical properties, and the correlation of these properties with PDT efficacy will be studied. The aim is to develop a PS that easily penetrates the target cell and has a high singlet oxygen yield, is more selective for tumour cells, or pathogenic micro - organisms while having no or minimal negative effect on healthy human cells. The PDT activity of the prepared compounds will be tested in vitro on melanoma, bacterial and HSV1 cells, and the possibility of using fruit fly as an in vivo model for the cytotoxicity assay of the compounds will be explored. The research will be carried out at the Department of Biotechnology by biologists and chemists, with the collaboration with the Faculty of Medicine (University of Rijeka) and the research unit Photonics and quantum optics of the Centre of Excellence for Advanced Materials and Sensing Devices, and the Ruđer Bošković Institute in Zagreb.

The Development of New Nanotechnology - enhanced Materials Resistant to the Creation of Bacterial Biofilms

PROJECT MANAGER

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ABSTRACT

The formation of biological films due to adhesion of bacteria to implanted medical devices and prostheses by human bacterial pathogens causes increased morbidity and mortality among patients and significantly increases healthcare costs measurable in billions of dollars. Biofilm is a complex bacterial structure that is highly resistant to antibiotics and human immunity, and its development is one of the elementary problems when implants, endoprostheses and other medical devices are installed. In order to effectively prevent the emergence of biofilms and avoid infections such as sepsis and other inflammatory processes, new, innovative technological and therapeutic solutions are needed. Our research will go in the direction of the development of nanotechnically improved organic/inorganic hybrid implant-TiO2-antibiotic structures that prevent the formation of bacterial biofilms and, as well, possess a unique combination of strength and biocompatibility. The use of atomic layer deposition (ALDa) for biomedical purposes, and especially to modify the biocompatible material (eg implant), is a rarely used method in the limited number of publications in this field. The project plan is to coat the desired surface with TiO2 film by means of ALD technique and to bind one or more antibiotics to the thus modified surface. Such an innovative modification of the implant surface or other medical device and the binding of antibiotics that are in clinical use are expected to prevent the formation of bacterial biofilms, which will be microbiologically tested. Further steps will be taken to investigate the compatibility of developed techniques with the new generation of 3D print implants. The described project is related to the applied project within the Swiss - Croatian co - operation programme and to the attained HRZZ project. The research project is, therefore, a phase of development of advanced materials with the purpose of the application of new HRZZ and European Projects.

Elemental Composition of Particulate Matter

PROJECT MANAGER

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ABSTRACT

Particulate matter (PM) is the sum of all solid and liquid particles suspended in air. PM research is important not only as part of basic scientific research but also because it can potentially have a huge impact on public health and the quality of life. PM is an important cause of diseases (respiratory and cardiovascular). Insufficient understanding of the creation and dynamics of PM in the atmosphere significantly contributes to the uncertainty of climate models. In addition, PM research in the Department of Physics is important because of the recently established interdisciplinary graduate study programme, Physics and Environmental Sciences. Before that, environmental research was not a focus of the Department. In the Laboratory for Elemental Microanalysis, we have developed expertise in determining the elemental composition of PM. The basic technique, performed in the laboratory, is X - ray fluorescence (XRF). In addition, we have a long - standing collaboration with the Laboratory for Ion Beam Interactions at the Ruđer Bošković Institute where we use other techniques to determine concentrations of hydrogen (not possible with XRF) and other low atomic number elements (such as Al, Si) for which our XRF set - up is not sensitive enough. So far, we have collected and analysed more than 300 samples and performed statistical analyses to determine the fingerprints of PM sources and their relative contribution. With this project, we extend the applications of our PM analysis. The two main research activities are analysis of indoor (metal workshops) PM and detection of Sahara dust events. They correspond to the proposed PhD theses of two collaborators on the project. Besides PM analyses, project activities will include the development of experimental methods: upgrading the XRF set - up to include He atmosphere (this will increase sensitivity for low atomic number elements by tenfold); and the development of software for XRF spectra analysis.

Permutation Groups as Designs, Geometric Designs and Finite Geometries

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ABSTRACT

Up until now, our research has mainly been focused on methods for constructing 1-designs from transitive permutation groups and the applications of newly introduced methods in various classification problems. Within this project, we plan to investigate further generalisations and applications of these methods within three subject areas: construction of transitive and non - transitive 1-designs from permutation groups and self - orthogonal and LCD codes associated with constructed structures; constructions of geometric designs and q - graphs from matrix groups and subspace codes associated with constructed structures; construction of the classical projective plane from unitary groups and other families of incidence structures associated with the projective plane.

Circadian Genes in Laryngeal Squamous Cell Carcinoma

PROJECT MANAGER

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ABSTRACT

The aim of this study is to analyse the expression profiles of the key circadian clock genes and to immunohistochemically validate the expression of selected clock proteins in laryngeal squamous cell carcinoma (LSCC) patients. Taking into consideration the previous experience of the project leader relating to the study of major circadian clock genes and our previous findings showing the potential correlation between the genetic status or gene expression and human malignancies, we would like to explore in detail the role of major circadian genes and proteins in the pathogenesis of LSCC. The circadian clock acts as a multifunctional timer that provides temporal structures to a vast variety of behavioural and physiological processes. Indeed, disruption of these rhythms in mammals is associated with several pathological conditions including depression, diabetes, metabolic syndrome and cancer. At the molecular level, the mammalian circadian clock is controlled by transcriptional/translational feedback loops comprising of a set of key elements, so - called 'clock genes,' involved in the regulation of a wide range of circadian rhythms in physiological processes and behaviour. Several lines of evidence suggest that clock genes may contribute to neoplastic transformation. Recent literature data supports the transcriptional deregulation of clock genes in head and neck squamous cell carcinoma (HNSCC). However, the direct links between aberrant circadian clock gene expression and human malignancies, including laryngeal squamous cell carcinoma, remain largely unknown. The circadian clock controls the time of the cell cycle in healthy tissues and the clock disorder leads to cancer progression. Therefore, we believe that it is scientifically and clinically plausible to continue research in this direction and to analyse the expression profiles of the key clock genes and clarify the possible association with the LSCC pathogenesis.

Advanced Films of Metal Oxides for Enhanced Photocatalytic Activity

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ABSTRACT

Transition metal - oxides with semi - conducting characteristics find their potential applications in various fields of technology, which are a central focus of current scientific and technological research, such as sustainable energy conversion or prevention of environmental degradation. Current research on potential applications of metal - oxides covers diverse, mutually interconnected fields - from photovoltaics (solar cells) to novel advanced sensors and photocatalytic materials. The proposed project includes the synthesis and characterisation of metal - oxide thin films (ZnO, TiO_2, Cu_2O and CuO) which could have potential applications in photocatalysis. A stoichiometric structure of those films could be modified by introducing atoms of different elements, or by making heterostructures composed of alternating thin layers of different metal - oxides in order to obtain materials with improved physico - chemical properties. For the synthesis of thin films, with thicknesses from several nm to 200 nm, on flat and porous substrates, we will use the method of atomic layer deposition. The porous substrates with different degrees of porosity, which will allow us to vary an active area of the photocatalytic surface, will be produced using electrochemical methods. The synthesised samples will undergo structural and chemical analysis as well as measurements of their physico - chemical sensitivity after external optical excitation. In addition, their photocatalytic degradation ability will be tested in the presence of organic pollutants. Considering future applications of metal - oxide thin films as photocatalizators in a water environment, the film's surface hydrophilic properties will be monitored and controlled. A high degree of hydrophilicity of the photoactive surface is a key parameter, especially for porous substrates, where voids are of nanometre sizes and thorough wetting presents a non - trivial technological task.

Network Architecture as a Framework for Vast Areas of Human Activities Ranging from Brain Dynamics, Functionality in Physiology, Rapid Emigration, Challenges of Immigration, and New Telecom Platforms

PROJECT MANAGER

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ABSTRACT

Scientists worldwide strive to understand (i) how functionalities, such as conservation laws, emerge in complex systems. Living complex systems tend to create functionalities by pairing up complementary processes — one to build and another to correct. Of particular importance is the case when these processes are from mutually exclusive phases of a process, for which we demonstrate that when a system is near a critical point, recurrent phase transitions enable that these phase - dependent processes replace each other, spontaneously generating a statistical conservation law, such as synapse or glucose homeostasis. Second, (ii) scientists try to link phenomena existing at different scales ranging from micro to macro. For example, is it possible that a well - known macro - level power - law memory in psychology is due to similar power - law cross - correlations between neurons which are, in neuroscience, the most basic building blocks in the memory mechanism? Further, (iii) scientists try to understand how various technological and societal systems are robust when suffering external attacks. As an example, rapid emigration, but also rapid immigration may have fatal implications on a country's economic and political robustness, and finally may cause a domino effect due to interdependence of people in human networks. How to avoid immigrants living in ghettos which are treated as hubs in network theory? To describe (i)-(iii) we apply approaches and methods developed in network theory and statistical physics. Recently, a Croatian company Hyper Sphere, whose team the PI belongs to, proposed a next - generation telecommunications platform, replacing mast - based antenna systems of a classic mobile network with persistently hovering airships. The new technology significantly outperforms traditional network architectures in operational costs. We will apply this platform to the periodic recording of the urban area in the IC domain and to Rijeka Harbour for the monitoring and sanctioning of ships that discharge oil and waste directly into the sea.

Designs, Graphs and Linear Codes

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ABSTRACT

Coding theory is a branch of mathematics concerned with transmitting data across noisy channels and recovering the message. One of the tasks of this project is the construction of linear codes with good properties, especially LDPC codes and extremal Z_4- codes. For the construction of codes, we will use adjacency and incidence matrices for various types of graphs and combinatorial designs. In addition, constructed codes will be used for the construction of new combinatorial structures. For the construction of combinatorial structures, we will use already developed methods of construction based on orbit matrices and explore other possibilities for construction. In order to construct combinatorial structures and codes we will combine a theoretical and computational approach. For example, as a part of the investigation of the properties of the constructed LDPC codes, we will run computer simulations. The scope of this project will include the development of algorithms and corresponding computer programmes for the construction of extremal Z_4-codes. The results obtained will be a contribution to the classification of Z_4- codes and, as such, of interest to research in coding theory. On the other hand, results related to the combinatorial structures will be of interest to experts in design theory and graph theory.

Quality Assurance of Ultrasound Beams by Exploiting Thermochromic Materials

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ABSTRACT

Although application of ultrasound in medicine is considered as a safe technique, it is well known that propagation of ultrasound within tissue produces thermal and nonthermal (mechanical) effects. Those effects are used in physiotherapy to achieve clinical outcomes such as raising tissue temperature, stimulation of bone repair, modifying cellular activities, and decreasing pain. As ultrasonic energy is transmitted through tissue, it is attenuated due to absorption and scattering. Absorption leads to a conversion of acoustic energy to heat locally which is the primary consequence of attenuation in tissue. Regarding the safe exposure of human tissue with either ionizing or non - ionizing radiations, it is crucial to determine the spatial distribution (location) of this deposited energy. This is usually described by the applied ultrasound intensity beam profile, which is commonly assessed using small hydrophones immersed in water combined with scanning procedures that are exceedingly time - consuming. This method involves precise measurement systems and controlled (laboratory) conditions and as such is not an appropriate tool for quality control procedures to be performed in a busy clinical environment. Thus, an alternative method based on the use of thermochromic materials has been proposed. In this project we will investigate the use of thermocromic materials for visualisation of the acoustic intensity distribution generated by ultrasonic fields used in medical applications. We will also investigate if this method could be used for the determination of key parameters related to the distribution of acoustic intensity such as Effective Radiating Area (ERA) and Beam Non - uniformity Ratio (BNR). In order to compare our results with theory we will try to make accurate measurements of temperature in ultrasound fields and to compare them with theoretical predictions. We would also like to measure harmonic generation in ultrasound fields and its influence on beam intensity profile.

Biochemistry on a Supercomputer: Development of New Software, Drug - design and Analysis of Disease Development on a Molecular Level

PROJECT MANAGER

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ABSTRACT

The significance of the research: New drug design and molecular mechanisms that support disease development are complex processes that require a supercomputer for quantitative analysis and visualisation. In the past three years, we have started on supercomputer Bura, developing protocols for bioinformatics analysis of genetic activity, quantum mechanical studies of chemical processes and various molecular interaction analyses by molecular dynamics methods. The present results: 1) In silico design of new drugs for genetic reprogramming of cells based on the catalytic mechanism of human DNA methyltransferase Dnmt1 and a prototype of inhibitors with 68 accompanying modifications, 2) Molecular structure analysis of the gamma - secretase membrane protease showed that mutations induced by Alzheimer's Disease increases the distance between the aspartate in the active site of the enzyme causing potentially pathogenic reduction of proteolytic activity of the enzyme, and the activity of the genes in the aging process has shown that the decline of proteolytic activity in Alzheimer's Disease is caused by the activity of the gene in key proteins producing amyloid plaques, 3) Protein - protein interactions have shown that glycolytic enzymes can produce supra - molecular complexes that can control the metabolism of NAD (H) molecules and generate energy in cells and 4) align the open GROMACS application software for use on AMD graphics cards.
The objectives of this research: 1. Commercialisation of a new structure for inhibitors and the DNA methyltransferase activator in the market of fine chemicals to be used as reagents for genetic reprogramming of mammalian cells, 2. In silico design of new drugs for Alzheimer's disease based on laboratory and structural analysis of the membrane protease gamma 3. Development of unique computing protocols for supramolecular organisation research in collaboration with experimental laboratories and 4. Development of an open - source programme code for molecule analysis.

Technical sciences

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A Study of Rockfall Processes and Rockfall Hazard Assessment

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ABSTRACT

Rockfall is a type of landslide that includes the detachment of rock or several rock blocks, from mostly sub - vertical rock slopes followed by rapid down - slope motion with free - falling, bouncing, rolling and sliding phases. Rockfalls are extremely fast phenomena with long run - outs and because of the high velocity of the launched mass can lead to a large number of victims and significant damage to buildings and infrastructure, and cause widespread disorder. More than 40% of the territory of Croatia consists of karst area which is subject to rockfalls that cause severe damage to infrastructure facilities and settlements as well as serious injuries and fatalities. Despite the rockfall hazards and risk exposure, there is no developed methodology for rockfall hazards and risk assessment in Croatia, nor is there any systematic research of the mechanisms and processes that lead to the triggering of rockfalls which are related to the morphological, geological and climatic conditions of Croatia. The purpose of this project is to investigate rockfall phenomena using intelligent remote sensing techniques that enable the creation of real 3D maps as a basis for a rock mass discontinuity system analysis that indicates kinematic conditions of failure in rock mass. Different combinations of remote sensing techniques using UAV, UAV LiDAR and UAV IR cameras will enable the creation of a basis for rockfall analysis. 3D map construction will allow for a special kinematic analysis of rockfall triggering and the deterministic 3D simulation of rockfall propagation in the GIS environment. The aim of the project is to investigate well known rockfalls in Croatia, in order to conduct kinematic and deterministic spatial analysis of rockfall triggering and propagation; to create a classification of types, mechanisms and processes of rockfall phenomena in Croatia; to construct criteria as a basis for rockfall susceptibility, and hazard and risk assessment in Croatia, as well as constructing guidelines for the application of adequate monitoring systems and mitigation measures.

The Research and Development of Machine Learning - based Predictive Models of Design - relevant Materials' Behaviour

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ABSTRACT

Material modelling and computer simulation of a material's behaviour is a key element of modern product development which in nearly all its phases involves numerical simulations of load - bearing capacity and durability in order to improve material utilisation and reduce both expenses and the used mass. For a successful and accurate modelling of materials, detailed knowledge of their properties and parameters which define their behaviour is necessary. Determining these experimentally is the most accurate but also the most time - consuming and costly of the available options. Thus, advanced (cyclic, fatigue) material parameters are frequently determined using empirical estimation methods using simple and easily available monotonic properties. Previously conducted research has revealed numerous deficiencies and insufficient accuracy in these methods and noted the possibility of improvements. This project represents a further development and extension of the work to achieve the detailed characterisation of material behaviour and the determination of relevant factors and parameters for a more accurate and effective modelling of a material's behaviour. Previously our own proposed approaches and methods based on artificial neural networks showed promising results and confirmed significant potential for further improvement and this development will be continued. Other methods of machine learning will be included in the research to determine their applicability for the development of more sophisticated predictive models of material behaviour. Newly developed predictive models will be implemented in computer applications, and for complex and demanding machine learning - based models, and solutions tailored for performing on High Performance Computing (HPC) technology will be developed. This is expected to significantly increase efficiency, facilitate the planned application of the developed solutions in the industrial environment and increase and enable the planned transfer of knowledge and technology to the interested industrial stakeholders.

The Coastal Vulnerability of the Kvarner Area to Climate Change and Sea - level Rise

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ABSTRACT

One of the significant consequences of climate change will be the rapid increase of the mean sea - level. In addition, more frequent storm surges (acqua alta) associated with stormy weather are expected along the shores of the Adriatic Sea, including in the Kvarner area. In combination with increasing rainfall and hence river discharges, there is a high likelihood of coastal flooding along some parts of the Kvarner coast. The effects of the increasing mean and extreme sea levels on the Kvarner coast have been little investigated, and this is also the case for much of the Croatian Adriatic coast. The coast of the Kvarner area is mostly rocky and stable. Natural gravel and sandy beaches are the most vulnerable parts of the coast, and they are extremely important for tourism. They cover a relatively small part of the coast: 11.5% of the Liburnian coast, 13.5% of the Vinodol coast, 10.3% of the island of Krk, 11.2% of the island of Cres, 5.5% of the island of Lošinj and 20.7% of the island of Rab. Some beaches have completely eroded and others noticeably diminished because of man - made changes, but also due to a decreased sediment supply caused by human alterations to the torrential streams. The objective of this project is to determine the degree of vulnerability of the entire Kvarner coastline to present and future decadal timescale climatic and oceanographic conditions, but with a particular focus on the Kvarner beaches. The assessment will be based on predictions from global and regional climate models, and the analysis of newly data to be collected on the state of the Kvarner coast, which mostly belongs to the territory of the Primorje - Gorski Kotar County. Equipment from the Research Infrastructure Development Project at the University of Rijeka Campus (RISK) will be used for field measurements. Based on the vulnerability assessments, technical solutions for the reduction of the effects of climate change will be proposed. The vulnerability maps produced will be important for future integrated coastal management plans.

Non - linear Dynamic Behaviour of Rotating Machines

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ABSTRACT

Rotor dynamics is an area of engineering that investigates the dynamic phenomena of rotary machines during their operation. The demand for an increase in the efficiency of rotary machines (e.g. gas and steam turbines) with the simultaneous optimisation of their construction in order to reduce mass and save the material leads to an increased complexity of the calculation and occurrence of various non - linear phenomena during exploitation. The aim of this project is to provide insight into the essence of non - linear problems through an analysis of simplified analytical models of rotors with the inclusion of various effects. Rotors with thin elastic disks as well as rotor blades will be especially analysed. The analytical models, based particularly on Green's functions will be compared with numerical finite element method models. Experimental verification of analytically and numerically obtained results is also planned. In the last part of the project, non - linear vibrations of rotors with free flexible blades as well as their rub with the stator will be analysed. In addition, various methods for the detection of the blade tip rubbing will be tested. Characteristic signatures specific to each of these analysed rotor faults will be defined on the basis of lateral and angular vibration displacement measurements. For the analysis of non - linear and non - stationary vibration signals, Hilbert Huang's transformation and related methods will be used.

Investigation, Analysis and Modelling of the Behaviour of Structural Elements Stressed at Room Temperature and High Temperatures

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ABSTRACT

Structural elements as parts of a bearing structure, machine or device can be stressed statically or dynamically at room or high temperatures. The material for manufacturing an element is chosen in accordance with its purpose and the conditions of exploitation. In this project, the research, analysis and modelling of the behaviour of structural elements made of structural, constructional, martensite and other steel alloys, stressed at room and at high temperatures will be carried out. The numerical and experimental analyses of the behaviour of the considered material make up the essence of the research. Numerical analysis will involve the prediction/modelling of the behaviour of the element, and its verification will be supported by an experimental analysis of the same observed process. Experimental investigations of the behaviour of considered materials will include tensile stressed elements, the creep of materials at various elevated temperatures, the testing of fracture energy and high - cycle fatigue as well as the testing of the endurance limit. Experimental investigations of uniaxially stressed elements at room and high temperatures will serve to determine the mechanical and elastic properties of the material. The results will be presented in the form of engineering stress - strain diagrams showing temperature dependence of mechanical properties. Creep behaviour at different high temperatures has the aim of analysing the resistance to the creep of the considered material and will be shown in the form of creep curves. On the basis of the research of the fracture energy, the fracture toughness will be determined by a simple method. High - cycle fatigue tests will be conducted for the proposed stress ratio. The fatigue strength will be determined for a defined number of cycles and as fatigue limit. Testing of the micro - structure of individual materials for the proposed investigations to determine mechanical properties, as well as the considered creep process and fatigue, are an integral part of the overall research.

Advanced Control Structures in Modern Regulated Electric Drives

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ABSTRACT

This research project includes work on the development of novel methods in the field of induction machine control, primarily including advanced vector control structures. This applies, among other things, to the development and implementation of control structures for Active Front End converters as well as to the development and implementation of novel control structure to start a rotating induction machine after a short period of power failure. This type of control is known in the literature as a flying start and it is indispensable in electrical drives where frequent power outages occur. The proposed method should be adapted to a power converter and should work on a variety of induction machines. The project is also focused on synchronous machines as generating units and key parts of power systems. A special focus of the research is aimed at developing new, and improving the existing, methods of load angle estimation using modern algorithms. Another aspect of the research is the development and implementation of novel advanced control algorithms for special types of electric drives which include bearingless motors. The research will also include manufacturing a novel type of bearingless motor in accordance with current knowledge about bearingless motor design in order to experimentally verify the proposed control algorithms. A particular emphasis of the entire research is placed on the practical applicability of developed methods and the possible transfer of knowledge to modern industrial plants and production units of the power system.

The Development of an Intelligent Expert System for Online Bladder Cancer Diagnosis

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ABSTRACT

In the past decade, artificial intelligence (AI) algorithms have been increasingly applied in the field of medicine as a tool for processing and classifying a large database. Artificial neural networks (NN) are used in diagnostic medicine, radiology and signal processing from medical equipment. Here it should be noted that the aforementioned diagnostic medicine, using AI, enables the analysis of the output signals from medical equipment. The development of computer models is based on AI and with its implementation in supercomputing systems is increasingly used in the principles of personalised medicine.
Based on the above - mentioned goal of AI support, it is possible to carry out research that can be broken down into segments, and they are:

- Database development to be used as data for training of various artificial intelligence algorithms
- Exploration of the ability to apply algorithms in image contour detection to improve the accuracy of AI algorithms and machine learning
- Investigation of the possibility of applying various artificial intelligence algorithms to the detection of bladder cancer
- Selection of 2 or more algorithms that will be used to develop a bladder cancer detection system, based on the results of previous research
- Implementation of AI on HPC systems to solve Big Data problems

The research will be divided into several phases, namely:

- Provision of a large database (BigData) data for the construction of a computer model
- Development and selection of algorithms based on the application of various algorithms of artificial intelligence and machine learning to detect medical input parameters
- Development and implementation of an online expert system on supercomputing infrastructure

The research in this support is in line with the S3 EU and HR strategy, with the same strategic goals and the first priority thematic areas (one sub - area), and horizontal themes (KET and ICT). This support will enable co - operation with other EU projects related to the defined research goals: centre of excellence, InnoHPC (Interreg Danube), and others.

Analysis of Measures to Reduce Energy Costs and Maintenance of Public Educational Facilities through the Performance System

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ABSTRACT

As a continuation of the research into key performance indicators at the stage of construction of public social facilities within the project 13.05.1.3.10, the aim of this research is to identify problems during the exploitation of educational facilities, especially in terms of current and investment maintenance and energy consumption, and to propose measures to increase rationality and efficiency, some of which are innovative, and to calculate savings and analyse other effects of their application. Valorisation of measures will be carried out using predominantly quantitative performance indicators, which are a measure of spatial, technical and cost - effective achievement standards that educational facilities need to meet. This is the basic division of standards. Lower levels will be elaborated only to the extent necessary for research. The project will also present innovative technical solutions that allow heating energy consumption saving, and as a result, a reduction of flue gas emissions. Testing at one of the facilities in Primorje - Gorski Kotar County will be performed and possible savings calculated. This survey deals with facilities in the County, but the proposed measures may apply to other counties in Croatia. Proposals will also be made to reduce the costs of both current and investment maintenance. As the effect of the measures depends on the project and the quality of construction, the research will also address this issue. In the next phase the application of measures to certain types of educational facilities will be simulated and analysed in terms of the financial and other effects of the application. The application of measures will be analysed in both new and older types of construction. New standards should be applied to new buildings and existing facilities are expected to lead to the proposed range of indicators. The final goal is proposing solutions that will ensure the planning of results and impacts and the monitoring of their achievement through a performance indicators system, with maximum savings, using optimal, partially innovative measures and solutions.

Investigation of Alternative Cooling - lubrication Techniques for Sustainable Machining of Difficult - to - cut Materials

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ABSTRACT

Martensitic stainless steels are difficult - to - cut materials due to the presence of large amounts of chromium, which makes the material harder. Therefore, cooling, flushing and lubricating liquids or shorter cutting liquids are regularly used in their machining since reducing the heat generated in the cutting zone has a positive effect on increasing the productivity, the tool life and the quality of the finished product. However, storage and disposal of used cutting liquids opens many issues related to environmental protection and to the workers involved in the process since the liquid represents one of the most complex and dangerous types of waste in nature. Also, during the machining of difficult - to - cut materials, procurement costs for the application and disposal of cutting liquids can reach up to twenty to thirty percent of total production costs. The negative impact of conventional cutting liquids on the sustainability of machining leads to the need for development of alternative cooling, flushing and lubricating techniques. Sustainable machining based on alternative techniques strives for a system balanced between ecological and sociological acceptability and economic efficiency. Since there is still no study on the introduction of a combination of alternative techniques of cold compressed air and a minimum quantity of lubrication in the machining of martensitic stainless steel by turning, the proposed research is the first of its kind. The cold compressed air - cooling technique can replace two of the three basic functions of conventional cutting liquid: the cooling of the tool, workpiece and chip, and the removal of the chip from the cutting zone, while the main drawback is the inability to lubricate in the cutting zone. Therefore, the combination of cold compressed air and a minimum quantity of lubrication is an important scientific contribution that can be a new solution on the road to "green production".

The Mechanical Behaviour of Nanostructures

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ABSTRACT

The proposed research will be oriented towards the mechanical modelling of advanced nano - structures, and nano - beams in particular. These will be situated in a non - isothermal environment. Motivation for these investigations is the determination of size dependent (i.e. non - local effects) mechanical behaviour of nanostructures. Forces that are irrelevant at the macroscale can dominate mechanical behaviour at such small scales. As a consequence, the whole neighbourhood of a considered point contributes to the mechanical response. Thus, local formulations typically used in engineering are not suitable for the mechanical analysis of structures as small as this. The approach will be based on the recently developed integral approach. However, it can be demonstrated that the integral and gradient approaches are equivalent, if the proper boundary conditions are enforced. It should be emphasised that the frequently used gradient approach, in almost all cases published in the literature, uses inappropriate boundary conditions. This has led to a series of paradoxical results. The approach chosen in this research does not suffer from such shortcomings. It will be applied to composite materials and to problems that include inertial effects in cases where temperature changes cannot be ignored. Such an extension should enable the creation of a more general framework and the application of measurements at a nano - scale.

Interdisciplinary Research on Fluid Flow in Macro and Micro Systems Using Supercomputer Simulations

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ABSTRACT

Complex fluid flow structures in macro and micro systems will be extensively analysed using Computational Fluid Dynamics (CFD). In order to increase the accuracy of computational simulations, there are numerous challenges that result in demanding numerical calculations that are most commonly performed on a supercomputer in order to obtain the results in reasonable time with optimal CFD application. Due to the new demands for flexible production of electricity in hydro power plants, hydraulic turbine runner blade geometry will be analysed, using a supercomputer, to see the impact on an increase of water turbine efficiency within a wide operating range. The impact on diffuser vortex intensity reduction will also be analysed. In the turbine intake the impact of the protective trash - rack, which creates inevitable head losses and often causes injury to the fish that fail to escape it, will be analysed. By applying CFD, optimisation of bar shapes and configurations of trash - rack will be carried out to minimise hydraulic losses and to redirect fish to by - pass structures. Parametric rolling is caused by an uncommon combination of natural and design parameters which can cause deck load loss in new types of container ships. For the efficient solution of such a complex problem, "Virtual Towing Tank" was developed as a substitute for model testing, allowing for the observation of the phenomenon and the facilitation of hull design changes on time. Further research will focus on finding an optimal numerical model for the prediction of parametric rolling occurrences more quickly and accurately. The multi - disciplinary approach to fluid dynamics research has affirmed the numerical usage of simulations in biomedicine. Endodontic irrigation research is of exceptional scientific and clinical importance. CFD irrigation analysis modelled with the use of micro CT scans of endodontic areas, as well as the research of activated irrigations, will deepen scientific findings applicable in clinical practice.

Traffic Infrastructure as a Function of Sustainable Urban Mobility

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ABSTRACT

Sustainable urban mobility is an important element of city management in conditions where more than 70% of the European population lives in the cities. The development of sustainable urban mobility is aimed at improving various aspects of transport systems in cities, and optimising the planning, design and maintenance of transport infrastructure, as well as contributing to sustainability by achieving positive effects on society and the environment. The aim of this project is to investigate the possibilities of improving existing models of planning and design of certain segments of transport infrastructure in cities in order to contribute to sustainable urban mobility by increasing traffic safety, reducing energy consumption and using environmentally friendly and durable materials. In this project, based on extensive field measurements, speed models for different categories of urban roads and intersections will be developed. The models will enable the improvement of design through the optimisation of geometric elements that contribute to speed control, the lack of which is one of the main reasons of traffic accidents with fatal consequences. By using newly developed models, it is also possible to improve the existing simulation traffic models and get more reliable indicators of traffic impact on the environment. The second part of the project is aimed at improving the design of asphalt mixtures in order to optimise their properties in situ. It is planned to carry out laboratory testing on different types of asphalt mixtures with natural and recycled aggregates and on mixtures for porous asphalt. The aim is to determine the possibility of using a higher proportion of recycled materials in mixtures of those currently prescribed by Croatian standards, which would reduce the proportion of waste from worn - out road and pavement surfaces. A part of the research is focused on determining a method which can be used to establish a reliable relationship between the laboratory testing of mixtures and testing on built - in pavements (mixtures). This will enable development of a reliable macrotexture model for different mixtures including innovative types of asphalt mixtures. Macrotexture is an important element of traffic safety due to its impact on pavement friction. Co - operation with scientists from Slovenia, Croatia and Italy and with the City of Rijeka and other institutions involved in the network for the promotion of sustainable mobility “CIVINET” will be realised through the project activities.

Characterisation and Behaviour Research of Advanced Materials for Mechanical Components

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ABSTRACT

Nowadays mechanical engineering constructors face significant challenges in their efforts to design mechanical structures compatible with fast developing new technologies, and maintain a high level of market competitiveness. One of the most influential factors for achieving optimal construction design is the choice of the material. Due to the favourable mechanical properties per unit of mass and the ability to design mechanical structures according to specific requirements, traditional materials are being increasingly replaced by alternative advanced materials, such as composites with a polymer matrix reinforced with glass, carbon or aramid fibres. Furthermore, the development of 3D additive technology has resulted in a usage increase of printed polymers and composites in wide inter - disciplinary engineering branches. Given their high anisotropy as a result of the additive technology itself and by increasing the degree of anisotropy by the addition of fibres, designing and analysing the components produced by additive polymers and composites requires knowledge of a large number of material parameters due to the complexity of material models. To ensure a precise characterisation of such materials, their behaviour will be investigated by experimental testing on samples in controlled load conditions. Based on the results, a numerical model for predicting the damage initiation in the samples produced by the additive 3D printing technology will be developed. Inverse modelling enhanced by the finite element method and genetic algorithms will be applied to identify the material parameters and calibrate the material model and allow the modelling of the behaviour of materials in the design of mechanical constructions. Additional benefit will be provided by the validation of the proposed procedures through optical tests on designed components produced from photo elastic materials with the goal of validating the simulation of material behaviour.

Laboratory Research of Static and Cyclic Behaviour at Landslide Activation

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ABSTRACT

Shear strength of soil depends on many factors crucial for slope stability. Soil moisture is one of the soil properties which has a significant role in shear strength and shear behaviour. Due to external and internal forces, in completely saturated soil, the deformations can result in pore water pressure build - up which in turn can reduce the effective stress. The reduction of effective stress reduces the shear stress which can lead to failure. Rainfall plays a significant part in shear strength and landslide activation. Besides rainfall, an earthquake also has a significant role in landslide activation. Recent findings have shown that the weathering of rocks reduces shear strength and also results in chemical changes in the material under cycles of wetting and drying. The influence of weathering on the dynamic characteristics of a residual soil has not yet been tested. Knowledge of dynamic characteristics and cyclic behaviour in the function of weathering will represent a significant contribution to a definition of landslide activation mechanisms due to seismic forces. The goal of the proposed project is to show the influence of weathering on the static and cyclic behaviour of soil and to define the landslide activation mechanics. The research into shear behaviour will be performed on undisturbed and remoulded samples in undrained conditions under both static and cyclic loading. The soil material will be sampled from the active landslide, Valići, near Rijeka. Research will be performed in the Geo - technical Laboratory of the Faculty of Engineering at the University of Rijeka on the equipment obtained through the projects, "Risk Identification and Land - use Planning for Disaster Mitigation of Landslides and Floods in Croatia" and "Research Infrastructure for Campus - based Laboratories at the University of Rijeka", RC.2.2.06-0001, financed from European Funds for Regional Development (EFRR) and the Ministry of Science, Education and Sport, Republic of Croatia.

Computational and Experimental Procedures for the Assessment of Material Parameters in Cosserat's Continuum

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ABSTRACT

This university grant provides additional material support for the existing Croatian Science Foundation Research Project, *The Fixed - pole Concept in Numerical Modelling of Cosserats' Continuum* (HRZZ-IP-2018-01-1732 FIMCOS), to be conducted in the period 1.1.2019 - 31.12.2022. In the underlying CSF project, an alternative continuum theory known as Cosserats' or micropolar theory is considered, where a detailed analysis of the framework of the so - called fixed - pole approach is proposed. The aim of the project is to develop a family of accurate and effective finite elements. The elements will be developed following a string of research objectives including linear and non - linear static ana - dynamic analysis and parameter identification. The elements developed in this way will construct a simulation tool and enable robust and reliable identification of material parameters from laboratory tests. The finite elements will be assessed against a number of standard test cases, while the project also involves experimental testing on two specific families of problems. Within the present university grant, the existing experimental tests will be expanded through a number of additional tests of significance for micropolar elasticity, in conjunction with an alternative methodology for the identification of material parameters (the size - effect method) based on an analytical solution of particular boundary - value problems, some of which will be actually specifically developed. The objectives will be reached through a series of activities of the project team built on the previous achievements of the team in finite - element design and Cosserats' elasticity as well as through experience of performing laboratory measurements. The project results will be communicated to both professionals and the general public through publications in the scientific journals of the highest rank within the area of mechanics, presentations at highly reputable thematic conferences, and lectures aimed at popularising the project research and science in general.

Smart Jacket Development

PROJECT MANAGER

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ABSTRACT

Thanks to technological advances in the fields of micro - and nano -technologies and electronics in recent years, transforming ordinary textile garments into so - called smart clothing becomes more realistic by means of adding or embedding electronic and electric materials and components which would enable a person wearing such a smart textile a more advanced interaction with his or her surroundings to cater for various needs - from personal entertainment in the sense of more practical listening to music or traffic navigation, to monitoring body parameters during recreational activities, and for more serious purposes such as team work for civil and military needs. So far, achievements in this area of making or applying e - textiles has not been impressive due to insufficient reliability of components, insufficient air - permeability of such garments, the high cost of their manufacture and their impracticality when it comes to washing them. In addition, such garments are pretty rigid and uncomfortable and therefore impractical for everyday wear. Market analyses forecast a steady growth in this segment of the market at an annual rate of 12%, even up to 25% percent till 2022. Following up the work started by the author of the project proposal, published in 2018 in a scientific journal of the 1st quartile, it is proposed here to continue this development by means of improving the performance of the previously designed circuits and exploring possible solutions for additional features for the jacket, and also by researching the field of circuit integration for voice and data communication towards the outside world, the embedding and communication of wearable sensors with a central control unit, and finally, the use of an advanced power supply for the circuits while protecting the body from excessive radiation.

The Application of Incremental Forming Technologies in the Individual Production of Parts from Advanced Polymer Materials

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ABSTRACT

In the last few years, several innovation forming processes have been developed to produce highly individualised products at a reasonable cost of production. Incremental Forming (IF) represents one of these modern technologies that has become the focus of interest of scientists and scientific institutions since it is a forming process which is suitable for individual production or production of prototypes. The term Incremental Forming unites several forming processes: Single Point Incremental Forming (SPIF), Two Point Incremental Forming (TPIF), and Asymmetric Incremental Sheet Forming (AISF). The main advantage of IF technology is the ability to create complex products which are economically acceptable. The proposed research is based on the preparation and creation of polymer nanocomposite sheets and thermoplastic composite sheets and the purchase of commercially available biopolymer sheets. Consequently, mechanical tests on the above - mentioned materials, as well as structure tests, before and after the IF experimental process, will be performed. Also, a force and deformation analysis of the IF process will be performed. The experimental data obtained in this way will be used to establish a mathematical correlation between the input and output parameters of the IF process, and then to perform an analysis of the influence of process parameters. The conducted experimental research will provide necessary data for the application and implementation of the optimisation of the process parameters with regards to formability. The ultimate aim of the research is to define the boundaries of the technological window for the mentioned materials, which will result in the end in increased stability and manageability of the IF process.

The Implementation of Innovative Methodologies, Approaches and Tools for Sustainable River Basin Management

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ABSTRACT

The EU Water Framework Directive highlights the need to apply an integrated approach to river basin management, with the aim of the protection and sustainable use of water resources. Integrated river basin management involves water, soil and other water - related natural resources using an interdisciplinary approach that combines technical, economic, social and environmental aspects. As a basis for sustainable river basin management, it is necessary to identify the existing state in the basin and to develop strategies and management scenarios for the future. The development and analysis of strategies and scenarios, with a proposal of measures to be implemented in order to achieve a high quality of water, requires the application of various methodologies, approaches and tools. In this project: an operational research and DPSIR approach, the collection of required information based on the indicator system, machine learning, artificial neural networks, modelling with GIS tools and multicriteria analysis methods for decision making, will all be integrated into a "tailor - made" river basin model to improve river basin management methodologies. Research will focus on the management of cross - border and rural river basins, interaction with marine ecosystems, the linking of water quantity and quality in the basin, climate change impacts, rainfall and surface flow interactions with soil cover and erosion processes, as well as the impact of soil cover on erosion assessment model results. The project is expected to improve the monitoring of changes in erosion processes in the basin and to compare different methods and tools for assessment and measurement of erosion, in order to improve sustainable river basin management. New methodologies, as well as tools for field measurements, are planned to improve the existing measurement methods and to make better use of already existing equipment at the Faculty as well as using new equipment. Research will be carried out on the Sutla River, the northern Adriatic and in Dalmatia.

Research into the Environmental Impact of the Operation of Satellite Navigation Systems in Maritime Navigation

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ABSTRACT

Satellite navigation has become one of the pillars of modern society, and a crucial component of the national infrastructure, regardless of the ownership of the core satellite navigation system's (GNSS) infra - structure. Consequently, the sustained GNSS Positioning, Navigation, and Timing services quality has become the prime imperative in development of a sustainable society increasingly dependent on GNSS. This imperative may be realised through the development of the GNSS that is resilient to both natural and artificial sources of GNSS PNT services degradation and deterioration (MEMS, ECDIS, AIS ...). Introduction and proliferation of the Software - Defined GNSS receivers (SDR) has brought significant advances in GNSS resilience development (maritime navigation). With a dominant market share, GNSS SDR - based receivers allow for the development and targeted utilisation of bespoke mathematical methods and statistical learning algorithms for the classification and characterisation of individual and concerted sources of GNSS PNT performance degradation. Utilisation of GNSS SDR receivers allows for: (1) adaptability of position estimation methods and algorithms to serve requirements of targeted GNSS applications (systems and services); (2) adaptability of error correction methods, position estimation methods and algorithms, and user GNSS equipment in general to recognise and answer the challenges of positioning environment conditions, both natural (space weather, geomagnetic, ionospheric conditions, multipath effects due to local topography and micro - environment), and artificial (GNSS spoofing, considered a cyber - attack, and GNSS jamming, in particular); (3) transparency in deployment of the latest scientific accomplishments, expressed in the form of mathematical methods and models, for fast commercialisation; (4) scalable GNSS receiver characteristics, suitable for a wide range of GNSS applications. Proposed project aims are: (1) extension of the pool of relevant data sets required for a proper detection, recognition, and modelling of natural causes of GNSS positioning performance deterioration through integration of trusted Internet - based sources of space weather, geomagnetic, ionospheric and GNSS dana with our own observations (GNSS SDR raw pseudo ranges, Sudden Ionospheric Disturbances monitor (SID) data, magnetometer observations collected at sites in northern Croatia maintained and operated by project participants; (2) systematic data collection, aggregation and archiving, and statistical analysis and modelling of the observations, related to cases and scenarios of GNSS positioning performance deterioration; (3) development and validation of descriptive, correction, and forecasting models of GNSS positioning performance degradation due to related natural causes of interference (space weather, geomagnetic, ionospheric, and tropospheric disturbances, multipath effects), as well as studying the impact on position estimation methodology through evaluation of various optimisation approaches; (4) enhancement and operational sustainability of Navigation GNSS Laboratory at Faculty of Maritime Studies, University of Rijeka, Croatia; (5) capacity development, knowledge transfer facilitation and the fostering of a general understanding of GNSS resilience importance for technology and society through the selection of challenging Masters and PhD thesis topics, the exchange of visiting researchers, students and professors, the organisation of scientific events (Baška GNSS Conference in Baška, Krk Island, Croatia), the presentation and publication of the project's scientific accomplishments in scientific journals and at respected international conferences, the organisation of field work for students, post - docs and researchers, and the organisation of selected activities aimed at the facilitation of understanding of the need for GNSS resilience among the general public.

Modelling of Structures as Systems with Parameter and Loading Identification

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ABSTRACT

The analysis of engineering structures is performed by calculating displacements (indirect stresses) from some form of loading. It is assumed that the material properties, geometry and boundary conditions are known. Quite often interaction with various physical processes (temperature, corrosion, etc.) is not included in the model but is instead taken into account through various safety factors. This is the so called "forward analysis." Determination of the material or geometric characteristics of a structure enables insight into structure condition, anticipation of interventions and the assessment of durability. Insight into these characteristics is not possible using forward analysis; for complicated structures one has to completely change the paradigm of the structure's mathematical description. Determination of the internal parameters of a structure is obtained through an "inverse analysis." Formulation of the inverse model is much easier when the structure is described as a system. System formulation enables the treatment of loading as an input value and displacements as an output value with possible additional inputs and outputs. Input and output values can be obtained through measurements and internal parameters determined using (numerical) analysis of the inverse model. Also, this approach makes it easier to extend the analysis on stochastic models. In addition, it is easier to perform a sensitivity analysis and an analysis of error propagation through a system. All this enables a better insight into the structure's behaviour and into its current condition. Modern technology makes it simple to acquire a large collection of data, so describing a structure as a system is in accordance with current trends. Ever increasing numbers of sensors will result in the introduction of "big data analysis" into the engineering analysis of structures and this project can be viewed from that perspective, too.

Hybrid 2D/3D Model Development for Efficient Flow Modelling in Rivers, Lakes and Seas

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ABSTRACT

The efficient hybrid model developed within this project will combine 2D and 3D numerical models. The hybrid model is an integration of 2D shallow water numerical models and their ability to model large, real domains and numerically demanding 3D Navier-Stokes flow models which are more accurate in areas where three - dimensional effects are significant in real engineering practice, free surface flow problems. The project consists of two main parts: numerical model development and simulation software creation. The numerical model development starts with the set - up of a 3D model suitable for hybrid model use through analysis of Open Foam VOF and its test comparison with other 3D models: SPH (and other particle methods), SSIIM-3D, SCHISM-3D. Simultaneously, the 2D model of shallow water with parallelisation capabilities is set - up. A hybrid 2D/3D model development meets many numerical challenges but the main focus is on numerical problems at the 2D/3D interface, automatic creation of 3D geometry based on 2D terrain morphology, introduction of a boundary layer into the 2D model, 2D/3D interface management in case of supercritical or subcritical flow and an investigation of the possible substitution of 3D models with the machine learning based metamodels (Support Vector Machine). The project idea will be developed through the co - operation of scientists from various faculties at the University of Rijeka, with a recognised scientist from within the industry (Dr M. Nujic – creator of the most prominent 2D free surface flow simulation software in German - speaking countries) and in cooperation with the TU Munich scientists. The aforementioned collaborative concept is the guarantee of project success in its effort to create a state - of - the - art hybrid 2D/3D free surface flow model.

Numerical Modelling of FG Composite Beam Type Structures

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ABSTRACT

FG (Functionally Graded) beams are widely applied in many areas, mechanical engineering, biomechanics, shipbuilding, the aerospace industry and in civil engineering. By the term FG beam is meant the isotropic but non - homogeneous beams where thermo - elastomechanic properties vary over the cross - section. This project proposal was conceived as a contribution to the field of development of numerical tools for simulation of FG frame structures structural response. The developed finite element model, as the final goal of this project, will provide the possibility of computer simulation of the response of the FG beam structure with the prediction of exploitation in variable temperature and humidity environment regimes. The aim of the simulation will be to estimate the load carrying capacity of a structure, i.e. to predict the occurrence of the ultimate state respecting the reasons for collapse. The ability to estimate the carrying capacity of an FG beam structure during the design phase is of the utmost importance in terms of resource savings and optimisation of the total cost of performance. The aforementioned simulations will be particularly focused on the stability analysis of FG beam type structures, which are, due to their slenderness, extremely prone. A numerical model will combine the specificities of FG cross - sections such as a variable centroid or shear centre, as well as the specificity of thin - walled profiles such as wearping. The model will be based on Euler - Bernoulli's and Tymoshenko's theory of bending and Vlasov's theory of torsion. Incremental formulations, such as UL-updated Lagrangian and co - rotational formulations, will be applied. Using a non - linear displacement field will enable frame response simulations in large spatial displacements and rotation regimes.

Embedded Systems for 3D Perception

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ABSTRACT

The main objective of this project is the scientific and practical analysis of a distributed embedded system for 3D perception targeted at people and object tracking through the efficient implementation of new algorithms optimised for execution on embedded systems. The project will enable the mobility of the researchers, ensure continuous research, foster the dissemination of results and involve collaboration with domestic and international researchers and the industry.

Computer - Aided Digital Analysis and Classification of Signals

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ABSTRACT

Various natural phenomena are described by stochastic signals, the analysis of which requires utilising advanced, computationally demanding algorithms (such as simultaneous processing of signals in time and frequency domains using quadratic time - frequency distributions). Besides being stochastic, these signals are usually non - stationary and multi - componential. Hence, to process them it is necessary to develop adaptive algorithms for localisation and extraction of signal components and estimation of the instantaneous frequency of each component and this is one of the goals of the project. An additional challenge in the analysis of these signals in real - life applications is the influence of noise. Classical de - noising approaches utilise frequency domain filters. However, these filters are limited by numerous issues (e.g. amplitude and phase frequency characteristics significantly differ from ideal ones). This research aims to develop and apply algorithms in the time - frequency domain and apply them to an analysis of real - life, multi - channel, multi - componential and non - stationary signals from various fields (e.g. biomedicine, seismology, radar signals and/or ship navigation signals, etc.) As is well known, even though signals can come from different unrelated fields, they can be analysed using the same universal mathematical algorithms designed to detect their important features (further used in various classification procedures). Thus, the goal of this project is to develop such universal algorithms for the digital processing of non - stationary signals and to test their efficiency on signals in various non - related fields. Special attention is to be paid to the computational efficiency of the proposed algorithms due to the fact that nowadays signals are often captured in high resolution. Although this allows extensive insight into the considered phenomena, the analysis of these signals is rather challenging, especially when utilising advanced, computationally demanding, mathematical algorithms.

The Hydrology of Water Resources and the Identification of Risks from Floods and Mud Flows in the Karst Area

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ABSTRACT

Within the proposed scientific project and continuation of university support, the hydrological and hydraulic research will be carried out at different levels - from small catchments to general regional views of characteristic hydrological parameters, analysis of correlation of water balance elements and influencing parameters from the environment, modelling hydrological, erosion and hydraulic processes and the process created by the interaction of salty and fresh water on river estuaries. Equally, extreme hydrologic analyses will be carried out to interpret the functioning and prediction of complex hydrological behaviour with an emphasis on extreme conditions caused by climate change since hydrological processes are characterised by, and dominate the whole dynamics of water in karst, erosion, salt and freshwater interaction and the karst environment. The research will continue on three pilot areas related to the international scientific Croatian - Japanese project 1) Risk Identification and Land - Use Planning for Disaster Mitigation of Landslides and Floods in Croatia, 2) in the karst areas defined within the scientific MZOS project - Hydrology of Vulnerable Water Resources in Karst, and University project, Hydrology Water Resources and Identification of the Risk of Flooding and Mud Flow in the Karst Area, the leader of which is Prof. Nevenka Ožanić, and 3) the areas within the EU project - Networking for Safe Drinking Water Supply in Adriatic Region – DRINKADRIA - IPA, led by Prof. Barbara Karleuša. Planned hydrological and hydraulic analyses will also characterise different time discretisation of process descriptions - analysis of long time series and analysis of characteristic hydrological and hydraulic states in pilot areas. This will provide the required hydrological and hydraulic elements necessary for the management (at average and extreme conditions) and the protection of water resources primarily associated with extreme hydrological conditions.

Optimisation of Heat Pumps and Refrigeration Systems with Low Global Warming Potential Refrigerants Using Numerical Simulation

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ABSTRACT

The requirements of European regulations on the energy efficiency of buildings, the use of renewable energy sources and the phasing out of fluorinated hydrocarbons demand urgent changes in the design of refrigeration systems and heating pumps. Refrigeration systems are designed and optimised for the refrigerant they use. The majority of refrigerants currently used are fluorinated hydrocarbons, whose application by 2030 will have to be reduced to 21% of the 2014 consumption level, which poses a problem to an industry that needs to develop new systems. Costs of the development of new systems adapted to new emerging refrigerants can be reduced by applying numerical simulations, provided that detailed numerical simulation models are developed whose degree of complexity provides results that provide a good picture of the possibility of applying to some of the refrigerants in the refrigerating system or a heating pump of a certain construction and purpose. Former scientific research and the experience of the proposed project team working on the development of numerical simulation models will enable the project to achieve the goal of producing stationary and dynamic detailed modular simulation models that enable the various components of the cooling system to be included in models of different types and capacities of refrigeration units and heating pumps to obtain a new scientific contribution to the justification of the application of certain novel refrigerants in new systems or the replacement of refrigerants in existing systems. Part of the results of the developed numerical models will be tested experimentally in the laboratories of the Faculty of Engineering at the University of Rijeka, at other laboratories of other universities and in industrial laboratories. It is planned to draw up doctoral dissertations within the project, to publish course and scientific books and produce a significant number of papers for A - rated journals and international conferences.

Design Principles and Calibration Methods of Re - configurable Inspection Systems

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ABSTRACT

Two important factors that characterise modern manufacturing systems are the shortening of the product lifespan and an increase in the variety of products in order to satisfy customers' requirements. Such market conditions affect changes in manufacturing technology that must become rapidly and effectively adaptable to new requirements. Hence, the reconfigurable concept is accepted and has led to the development of reconfigurable manufacturing systems (RMS). The vital component of RMS, besides production machinery and fixtures, is quality control and inspection equipment. Therefore, in order to establish an effective RMS, inspection equipment must be designed and used in accordance with concepts of reconfigurability. At the moment research in this area is quite modest. Hence, the proposed research is focused on the development of the methodology of design and calibration procedures for the reconfigurable inspection machines (RIM) and their application in the industrial environment. In our study, a group of similar products will be selected from a given selection of mass customised products. Selected products will be analysed, based on quality requirements, in order to propose the methodology of design and calibration of RIM. The proposed methodology will be verified by the development of an appropriate RIM, equipped with required sensors and a vision system, which will provide the optimum level of flexibility and required accuracy. In order to verify accuracy, the calibration procedure of RIM will be developed and a reference object will be produced. The applicability of the developed RIM will be checked in the industrial environment. The proposed research team, that includes scientists in the area of metrology, quality control and production systems and three PhDs, provides the necessary scientific expertise and research potential for proposed research. In addition, the support of the industrial environment and co - operation with related faculties is ensured.

Advanced Methods of Simulating the Operational Preparation of Production Planning

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ABSTRACT

The preparation of the manufacturing process as well as serving that manufacturing process must be organised in a common functional unit. The operational preparation of manufacturing processes is a particularly important segment of preparation because it defines the production schedule and provides data for all the necessary resources needed. Operational preparation activities are complex, and they can directly affect production effectiveness. In the case of high - volume production of technologically complex product families in a multi - product, multi - stage manufacturing system with limited flexibility, it is common for the manufacturing system to be highly utilised. Its high utilisation narrows the possibilities of finding the most economical solution in the process of operational preparation. The basic aim of this research is to develop an advanced computing model for computing the batch size and the input order as two main areas of research in order to minimise overall production costs and fulfil delivery requirements. The computer - assisted developed model will provide a realistic model and simulation of the production process. With application of the optimisation method it will be possible to define the optimum batch size and the input order for each product. Research results will be applicable in production environments, especially those engaged in the production of a wide assortment of technologically complex products.

The Uncertainties of Ship Speed Loss Evaluation Under Real Weather Conditions

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ABSTRACT

A correct assessment of ship speed loss in conditions of exploitation is becoming increasingly important for ship owners as well as ship designers. We are witnessing an increasing concern for the environment and awareness of the necessity to preserve it as much as we can. A drop in ship speed in real environmental conditions can cause increased fuel consumption as well as increased emissions of CO_2 and other GHG (greenhouse gases) from ships. A decrease of the ship speed in real conditions is a consequence of the added resistance due to the impact of weather conditions, i.e. waves and wind, and due to aggravated working conditions of propeller, i.e. the engine system. Moreover, the solution estimation of this problem is very much affected by human factors. Ship's masters, concerned for safety, can make a judgment that, under certain adverse weather loads, is necessary to slow down or change a ship's course to moderate or by-pass the worst conditions. In addition, the loading condition of the ship is constantly changing and this governs the basic parameters of the ship: the mass and mass moment of inertia, draft and trim and, consequently, the ship's behaviour at sea. All these parameters affect the assessment of ship speed and it is necessary to be conscious of the intensity of their impact on the final outcome. At the same time, these factors cannot be predicted with absolute certainty so the purpose of this analysis is to estimate the impact of weather and operational uncertainties on the actual speed of a ship in real operating conditions. The project leader and team members are from the Faculty of Engineering, University of Rijeka and from the Graduate School of Maritime Studies, University of Kobe, Japan. There are also two PhD students enrolled in postgraduate doctoral studies at the Faculty of Engineering Rijeka. One of them works at the University of Rijeka, and the other at the University of Trieste. Hence, it is important to point out that the proposed research will mean a strengthening of scientific and professional co - operation between these institutions, as well as a wider dissemination of the possible applications of the research results in industry.

An Assessment of Climate Change Impacts on Hydrological Stability of Protected Lake Systems in Croatia's Karst Region

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ABSTRACT

Lakes are valuable and particularly sensitive water resources, specifically so in terms of hydrology and ecology. This makes their management highly complex and demanding. One of the problems is that lakes are regarded and determined mostly as static systems, with only the characteristics they had had in past times. Yet, to understand their action and foresee their behaviour in modified circumstances, they must be analysed as dynamic systems within the continuity of development of climatic and hydrological processes and changes. Unfavourable climate change impacts on most of the lakes in Croatia have already been observed in the form of reduced inflows, lowering water levels, rising water temperatures or an increasing degree of lake water salinity. These factors threaten their hydrological stability and environmental survival. Since such changes are expected to intensify by the end of the century, appropriate management responses and solutions are required for the protection of lakes. In this study, based on the project manager's numerous past research projects involving all the major lakes in Croatia's karst region (Vransko Lakes on the island of Cres and near Biograd, Plitvice, Visovac on the Krka R., Baćina Lakes near Ploče, Jezero near Njivice), hydrological modelling of climate change impacts on lake water balance will be carried out for several different climate scenarios. The risks of undesirable impacts on lake systems and their hydrological stability will be assessed and the methods of implementing these will be improved. It foresees the use of machine learning models – neural networks and regression decision trees which have during earlier research proven highly suitable for the modelling of such complex non - linear systems. Furthermore, the impacts of different quantitative human pressures (water uses, water engineering structures) on such systems will also be modelled, as well as possible adaptation measures for the protection of lake systems and their adaptation to the expected climate change.

Time - Frequency Distribution Reconstruction from the Compressively Sensed Ambiguity Function of the Analysed Signal

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ABSTRACT

Observing a signal in time is generally insufficient when it comes to information extraction, hence the need for insight into its frequency content. When analysing non - stationary signals, it is necessary to observe the signal energy distribution over time and frequency simultaneously; this is a representation commonly referred to as the signal time - frequency distribution (TFD). The energy of the ideal TFD is localised around the instantaneous frequencies (IFs) of individual components, a feature which is not easily achieved in practice. Indeed, when the observed signal is multi - component, or when it contains non - linear FM components, the TFD generates unwanted artefacts, also known as cross - terms, which make the TFD interpretation even more challenging. Classical TFD processing methods rely on the fact that highly oscillatory cross-terms are located away from the origin of the signal ambiguity function (AF), hence they can be filtered out by low - pass filters. One of the recently proposed methods for cross-terms suppression uses signal sparsity constraint, and it is based on compressive sensing (CS) of the samples near the signal AF origin. The number of CS samples is relatively small when compared to the total number of available samples. Thus, in order to obtain a high - resolution TFD, one needs to reconstruct it by solving an optimisation problem. The TFD is inherently sparse, containing only the trajectories of the signal components IF laws. Hence, by setting a sparsity inducing function as an objective function of this optimisation problem, one can obtain a high - resolution TFD. The main goal of the proposed research is to increase the efficiency of the TFD reconstruction method by considering higher - order ambiguity functions, supplemented by the accompanying adaptive reconstruction algorithms. A TFD reconstruction algorithm based on localised Rényi entropy is being developed, the performance of which, closely matches that of state - of - the - art equivalents.

The Cyber Security of Maritime ICT - Based Systems

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ABSTRACT

With the growing reliance on Information and Communication Technologies (ICT), maritime cyber risk management to secure not only data, but safe and reliable ship transport operations, becomes increasingly important. Managing maritime cyber risk will allow for, not only data protection, but safe and reliable ship operations and maritime transport. Recently, the International Maritime Organization (IMO) has published guidelines on high-level recommendations for maritime cyber risk management. In addition, the IMO has proposed to include maritime cyber risk management in the ISM Code safety management system on ships by 1st of January 2021. This project's research field is cyber security aspects of the implementation of new and existing maritime systems and devices based on ICT technologies. The focus of the project is the development and implementation of a complex set of related and interdependent actions that intersect so as to provide safeguards that are effective and correspond to challenges presented by ICT technology innovations, ship critical navigation system specifics and key shipboard operations. The research consists of 6 main parts to cover the complexity of today's ships: navigation systems, communication systems, power generation and propulsion systems, machinery systems, cargo management systems, and passenger servicing and management systems. A developed framework for cyber security assessment of critical ship's systems is conducted by interviewing ship's officers followed by cyber vulnerability scanning and penetration testing. The research is performed on research ships of leading maritime universities and national shipping companies.

Development of Machine - learning - based Techniques for Illness and Injury Detection in Medical Images

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ABSTRACT

Clinical decision - support systems are often built by manually gathering, formalising and implementing specialist knowledge. Therefore, they are limited by existing human knowledge concerning the modelling of clinical conditions, diagnosis and therapy, and can be inaccurate because of variations and the complexity inherent in medical data. In order to circumvent these limitations, following an obvious growth of publicly available collections of medical - radiology diagnostic images, machine learning has become an irreplaceable tool for solving various problems concerning radiology image analysis. The goal of this project is to utilise the strength of contemporary findings in the machine - learning and computer - vision field for building quality models for: 1) automating the process for radius bone fracture detection and localisation from arm radiograms, and; 2) automating the process for early diagnosis of arthritis from multimodal (hyperspectral, thermographic, 3D) scans of patient's hand. This will be achieved through understanding the process of clinical interpretation in medical diagnostics, developing matching physical models of mentioned phenomena for feature extraction and generating synthetic data, whilst using large collections of labelled data of learning models for tissue localisation/segmentation and detection/classification of said phenomena. The work will be conducted in co - operation with scientists from the Faculty of Medicine and Faculty of Engineering, University of Rijeka, and foreign partners from Austria (Medical University Graz, Ludwig Boltzmann Institute for Clinical Forensic Imaging, Graz), Slovenia (University of Ljubljana, Faculty of Mathematics and Physics) and the USA (University of Wisconsin, School of Medicine and Public Health). The combined work of researchers from the field of computer science, physics and medical science is expected to produce innovative foundations for solving the aforementioned complex interdisciplinary problems.

The Improvement of Design Models for Condition Assessment of Structures

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ABSTRACT

The proposed project includes a set of experimental and analytical studies with the aim of improving design models used for the condition assessment of structures and their optimal design. Besides the methodologies for condition assessment which may be applied to all types of structures, special attention will be given to proper modelling of the degradation parameters of timber, reinforced concrete, steel and masonry structures caused by mechanical, ambient or chemical action. Inverse methods that use experimental data will be employed to valorise existing design models and to propose their improvement. Improvement of the design models will be carried out by including material parameters obtained from our experimental campaigns. Special attention will be paid to improving load design models and support models of flexible structures subjected to vibrations that can contribute to the increased vulnerability of structures. Project team members have complementary interests: (a) determination of material parameters due to anisotropy, ambient effects, both chemical and mechanical actions and cyclic seismic actions, (b) determination of specific support parameters of glass façades, (c) determination of pedestrian and wind load parameters and (d) their implementation into existing design models with the aim of the adjustment and improvement of robustness and reliability.

An upgrading of existing cooperation and an advancement of knowledge gained by the previous scientific project “Damage Assessment and the Strengthening of Structures” aims to strengthen the scientific profile and aspiration of the research team in search of a research partner for joint applications for competitive Croatian and European projects.

Thermal Energy Storage and Heat Transfer in Renewable Energy Systems

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ABSTRACT

The research topics of the project are analyses of physical processes of thermal storage and heat transfer in renewable energy systems. Scientific research will be carried out through the experimental measurement of heat transfer on the renewable energy sources test system, equipped with a latent heat storage unit, and on the test line for heat exchangers. The standard measurement methodology, including calibration of sensors, estimation of measurement uncertainty as well as statistical and data analysis, will be used. For purposes of numerical analyses, considering the physical processes for each of the research problem domains for numerical calculation will be defined and a mathematical model, that includes conservation equations and initial and boundary conditions, will be set up. A numerical method will be chosen and numerical calculations will be performed. Mathematical models will be validated by comparing the results with the results of experimental research. After validation, a series of numerical simulations will be carried out to investigate the influence of different working parameters on the physical processes of thermal energy storage in the latent unit and on the physical processes of heat transfer in heat exchangers. The expected scientific contribution of the research includes the definition of guidelines for selecting optimal working parameters of analysed components and renewable energy systems in order to enhance energy efficiency.

Finite Element Models for Non - linear Analysis of Thin - walled Beam - type Structures

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ABSTRACT

Since contemporary structures usually contain slender beam members of a thin - walled cross - section, such weight - optimised structures could display very complex structural behaviour and are particularly very susceptible to the instability of deformation forms and buckling failure. Instability of beam members could occur in a pure flexural, pure torsional, torsional - flexural or lateral deformation form, respectively. Each of them belongs to so called global buckling forms. In thin - walled beam members, a local buckling form can occur, in which a cross - section deforms significantly, causing the member to collapse before the occurrence of some of the global buckling forms. Thus, in the optimal structural design an important consideration should concern the accurate prediction of the stability limit state of possible deformation forms, i.e. the buckling strength. Furthermore, the interest of researchers in various types of composite structures has been growing rapidly in the last few decades. The great potential of fibre reinforced polymer composites causes the frequent replacement of conventional materials in engineering applications, primarily in the aerospace industry and in the past few decades also in civil engineering applications, due to the various advantages, primarily their durability and lightness, and also low thermal expansion and corrosion resistance, wherever it is possible and cost - effective. The proposed research will comprise of an analysis of existing final element algorithms for modelling non - linear responses of metal and composite beam - type structures, semi - rigid frames and crack propagation problems in structural elements, as well as the improvement and upgrading of our own finite element models.

The Impact of Environmental Loads on the Characteristics of Dynamic Positioning Systems for Marine Vessels

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ABSTRACT

The proposed project is based on previous research from the fields of marine hydrodynamics, electric power, and the control systems of dynamically positioned marine vessels, with the aim of further enhancing the efficiency, reliability and safety of the propulsion systems of these vessels, as well as the consequent reduction of harmful emissions. Most of the existing procedures and proposed optimum allocation methods in dynamic positioning systems do not take into account the many effects that cause thrust losses. These effects are primarily caused by environmental loads, but also with various forms of interactions between the thrusters and their environment. Regardless of the cause, the consequences of these effects are mostly unfavourable in many aspects of dynamic positioning system characteristics such as in reduced positioning accuracy, increased power consumption, and the emergence of sudden transient phenomena that negatively affect both the operation of thrusters and the entire electric power system. Thus, appropriate hydrodynamic, electric power and control measures will be proposed and implemented in this research with the aim of eliminating or minimising the afore mentioned negative effects. The project leader and team members are from the Faculty of Engineering, the Department of Naval Architecture and Ocean Engineering, the Faculty of Maritime Studies, and from the Department of Electrical Engineering, Automation and Computing, University of Rijeka. There are also four PhD students enrolled in postgraduate doctoral studies. Two of them are from the University of Rijeka, one of them is from the University of Trieste, and one is an expert from the industry. Hence, it is important to point out the initiative that the proposed research will have in strengthening the scientific and professional co - operation between these institutions, as well as the wider dissemination of the possible applications of research results in the industry.

An Analysis of New Composite Materials and Plant Extracts by Spectroscopic Techniques

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ABSTRACT

Natural rubber composites are technical materials of wide application. To achieve good mechanical properties, rubber is usually doped with carbon black (CB), which results in obtaining the desired properties of the material. Since rubber products are subject to wear and aging, they must be replaced by new ones. Because of the high amount of Carbon Black, an environmental problem is created. CB fetters the recycling process of rubber waste, while combustion produces harmful gases. Silica, clay, calcium carbonate and some organic materials are often used as possible substitutes for CB. However, neither of them has proven to be a good substitute. In this study, zeolites as environmentally friendly (biodegradable) materials are proposed as candidates; they are cheap and act as flame retardants. Spectroscopic techniques will be applied to study the influence of zeolite particles on molecular dynamics and structure of the composite matrix, known to be key parameters in the design of material properties. Apart from bio - medicine, herbal extracts are also important in the field of technical application as ecologically acceptable agents (anti - corrosive protection, functional food packaging, disinfectants and anti - biofilm agents). Their activity depends on the concentration and composition of phenolic substances that are determined by time - consuming, destructive and environmentally harmful analytical techniques. This project proposes the use of spectroscopic techniques directly on plant material, for the development of predictive models for the assessment of anti - oxidant activity and fraction of phenolic substances, classification models for distinguishing plant material genotypes and quantification models for the phenolic content. This would allow a quick and easy choice of plant material with optimal characteristics for technical and biomedical purposes. Apart from extracts of olive leaves, the models will be applied to extracts of medicinal plants of Primorje - Gorski Kotar County.

A Failure Analysis of Materials in the Marine Environment

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ABSTRACT

This project is intended to study the failure of traditional and modern materials used in the production of structures (ships and offshore objects) exposed to marine environmental effects using a combination of experimental and numerical analyses. Materials that are to be examined are traditional in shipbuilding (mostly steel) and modern (mostly glass fibre reinforced composites). Experiments will be performed to determine properties and collect data for further analysis. Mechanical tests and failure analysis will be performed using standardised specimens exposed to sea air, fresh water, sea water, polluted sea water, oily mixtures, ballast waters, ballast sediments and compared with results of specimens unaffected by the marine environment. Failure analysis will be performed using optical and scanning electron microscopy to determine manufacturing defects and to identify failure modes. Numerical research will employ finite element analysis (FEA) to numerically model previously mentioned experiments involving multiscale effects. Results will be compared to validate numerical analysis so that further numerical models can be developed and costs of pure experimental research kept down. FEA results will help to understand the failure mechanisms of composites. Obtained results will be compared to available analytical solutions. Programmed algorithms are going to be developed to predict the properties of materials and to analyse experimentally obtained data. The project results will improve knowledge about the behaviour and failure of materials exposed to marine environment and will be useful for improving engineering design of marine structures and in estimating the economic benefit of modern materials usage in comparison to those traditionally used.

The Development of Methodology for Ship Design and Production towards the Industry 4.0. Concept

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Assoc. Prof. Tin Matulja, Ph.D., University of Rijeka, Faculty of Engineering, Rijeka
Rajko Rubeša, Ph.D., Shipyard 3. Maj, Rijeka

DOCTORAL STUDENTS

Venesa Stanić, Shipbuilding industry, Split
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ABSTRACT

The shipbuilding industry, whether large, medium or small, must be competitive in the world market. Concept Industry 4.0 provides the shipbuilding industry with the ability to respond to the changing demands of the global shipbuilding market, expressed in terms of shorter building time period, as well as increasingly personalised customer access to shipyards with individualised technical solutions that meet all ecological and ergonomic requirements in ship exploitation. This implies continuous monitoring of the development of new materials and technologies and applying them both in product design and, even more significantly, in the production phase. In order to contribute to the competitiveness of Croatian shipbuilding in the world market, special attention will be given to improving the design methodology of the shipbuilding process and to interaction with other stages of the ship's design and to the implementation of the Industry 4.0 concept that has encouraged the shipbuilding sector to consider transforming the entire shipbuilding process including the design, production, functionality of ships, inter - transport and services. It is believed that the shipbuilding industry at the beginning of the new industrial revolution needs to be stimulated by digitisation, optimisation and the linking process. The aim of the research is to develop the knowledge and methods, techniques and tools, to optimise this methodology, primarily based on the Industry 4.0 concept, in order to reduce the consumption of labour resources per unit of production and to shorten the time of shipbuilding. An additional objective of the project is the further development of a laboratory for the application of advanced technologies in small and medium sized shipbuilding and a laboratory for computation engineering, as part of the creation of a competitive engineering environment. These laboratories will develop tools for the collaborative design of products and processes to simulate and analyse the potential application of the Industry 4.0 concept.

Advanced Mechatronics Devices for Smart Technological Solutions

PROJECT MANAGER

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ASSOCIATE SCIENTISTS

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Assist. Prof. Ervin Kamenar, Ph.D., University of Rijeka, Faculty of Engineering, Rijeka
Prof. Igor Mezić, Ph.D., University of California, Santa Barbara, California; University of Rijeka, Rijeka
Assoc. Prof. Kristijan Lenac, Ph.D., University of Rijeka, Faculty of Engineering, Rijeka
Assist. Prof. Željko Vrcan, Ph.D., University of Rijeka, Faculty of Engineering, Rijeka

DOCTORAL STUDENTS

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Petar Gljušćić, University of Rijeka, Faculty of Engineering, Rijeka
Tea Arrigoni, University of Rijeka, Faculty of Engineering, Rijeka

ABSTRACT

The aim of this proposed inter - disciplinary project, that fits excellently within the scopes of the UNIRI, and the national and the EU smart specialisation strategies, and is based on the ongoing work and publications of the research team, is a systematic engineering approach to the development of innovative mechatronics devices that will: 1) use advanced control typologies to minimise and compensate the present non - linearities, 2) employ energy autonomous miniaturised components, and 3) be applied in medicine, especially for smart wearable and original active rehabilitation devices. The project will hence enable: 1) the characterisation of friction in the nano - and the micrometric domain by using state - of - the - art measurement techniques, 2) the development of advanced adaptive and predictive control, thus allowing for compensation of the influence of these and other non - linearities present in innovative mechatronics devices, 3) develop design configurations of optimised and miniaturised kinetic energy harvesting devices for human arm motion that will maximise specific energies, large bandwidths and applicability to wearable medical devices, and 4) create a mechanical design for advanced mechatronics arm rehabilitation devices, based on 3D printed components, that will be adaptable to the needs of therapists and patients and be characterised by small dimensions, high efficiency and reduced costs. One of the main goals of the project is the enhancement of the competencies, and the development of the careers, of early-stage researchers that are part of the project team, not only in the research field but also through the acquisition of skills needed for independent research work. An important instrument in this frame is the dissemination of project results that will serve to improve the team's communication and presentation skills. A suitable mobility plan will be developed, as will be the plan to enhance the collaboration with research groups at the UNIRI as well as abroad.

Arts

Land Speaking about People / Returning Home

PROJECT MANAGER

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ABSTRACT

The proposed project, is an art & research project dealing with the transformation and survival of peoples' identities. The project explores the identicality of identities and landscapes, i.e., the position of landscape and national identity in relation to a person's place of origin. If we can demonstrate that emigration awakened in emigrants the love for their home country, then we will be able to say that art, through contemporary practices and in its diversities and activism, can reveal facts that are true. Truth is the basis of knowledge that comes as an effect of enlightenment, which arises from the effects of accepting the notions of sameness and equality, both in the emotional and intellectual fields. I plan to begin my artistic research, which will deal with identities by means of language and image, in Buenos Aires, Argentina, as part of my art residency. This will be done in collaboration with the Croatian emigrants of different generations, who gather around the "Jadran" choir. The aim of the project is to get to know the interviewed people and to create dialogues that include memories and stories of their former homeland. What is the form of their memories? Are they aware of the changes in the contents and ways of presentation? Which aspects of their reality have remained the same? Is there any difference in meeting with neighbours then and meeting with neighbours now? Is their former homeland a spatial or temporal category? Is Croatia as it once was better preserved by emigrants or by people who still live in Croatia? This project is not focused on political issues and the issues of nationality, but they may be included in the final presentation of the project. Based on the stories authorised by the interviewees, we will take photos of the locations in Croatia where their ancestors once lived, or where they grew up, highlighting the emotional experience of the person who tells the story. The interpretation and transfer of the storyteller's emotions may transform desired/imaginary images into linguistic and "real" spatial images.

Interdisciplinary Research and the Usage of New Media Technologies in the Art of Virtual Reality

PROJECT MANAGER

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ASSOCIATE SCIENTISTS

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Aljoša Brajdić, Ph.D., University of Rijeka, Academy of Applied Arts, Rijeka

Mia Krneta, University of Rijeka, Faculty of Humanities and Social Sciences, Rijeka

DOCTORAL STUDENTS

Dijana Protić, University of Rijeka, Faculty of Humanities and Social Sciences, Rijeka

ABSTRACT

The present is marked by the accelerated development of digital technology and science. In international art production, interdisciplinary works of art have emerged over many years as a result of co - operation with scientists and scientific institutions. This project of interdisciplinary research in the new media technologies in art is intended for the students of the entire University of Rijeka and other interested participants. It is performed at APURI in cooperation with The Faculty of Humanities and Social Sciences, the Department of Cultural Studies, the Faculty of Engineering and the Department of Computer Engineering. The research contains three parts: the theoretical part is developed in collaboration with theoreticians. The goal is educational, aimed at describing the ethical and socio - cultural context of digital technology in virtual reality. The second part involves the practical use of film production and post - production specific to virtual reality. The objective is the creation of works of art and presentations at national and international universities, conferences and festivals. The last part refers to mobility, knowledge transfer and networking. As collaborators on the project, international and Croatian artists and theoreticians will be invited to introduce participants to the newest theoretical and technological achievements and applications in art. Such an interdisciplinary approach has lately become common practice at many international universities. The project is specific because it will apply both the artistic and scientific methodological approaches. The interdisciplinary and collaborative approach to artistic production and the remarkable mobility of scientists and artists, will increase the international visibility of the University of Rijeka.

Imprints of Memories

PROJECT MANAGER

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ASSOCIATE SCIENTISTS

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ABSTRACT

Within the contemporary and recent art scene, there are a number of artists who take the interaction of humans and machines as a starting point for the creation of their artworks arising from various art concepts. This project intends to research innovative methods in the creation of artwork, in the medium of ceramics. By the use of one's own body, through performance and artist action, by the use of hi - tech machines, human thought will be represented in the material world, with the help of the equipment which decodes human brain waves. The results of the project are directed towards personal artistic research as well as artistic expression through the collaboration of a group of artists. The methods and processes of the research, as well as the original artwork will be presented to the public.

The Artist's Book

PROJECT MANAGER

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ASSOCIATE SCIENTISTS

Dajana Radoš, University of Rijeka, Academy of Applied Arts, Rijeka
Assoc. Prof. Letricija Linardić, Ph.D., M. Art., University of Rijeka, Academy of Applied Arts, Rijeka
Assist. Prof. Melinda Kostelac, M. Art., University of Rijeka, Academy of Applied Arts, Rijeka

ABSTRACT

The artist's book is a particular form of artistic expression which develops in parallel with other propulsive art media. The artist's book is a carrier of various artistic traces, messages, texts, and other concepts accompanying the presentation of artistic ideas. The book, as a graphic product after the 19th century, became an intriguing artistic form involving the editing and binding of artworks and texts within one "reading" object. Artist's books can also represent the accompanying extension of a greater artistic cycle. The idiom of artist books almost always involves bookbinding, strongly connected to a particular aesthetic function, presenting the final product to various targeted public groups (children, adults, the disabled, minorities etc.), bringing together the uniqueness of artistic expression within drawing, printmaking, painting, sculpting, by using the traditional form of the book. Every artist's book represents a specific form of artistic expression, bringing out a new level of perception as a rare piece of art which needs direct contact, in terms of tactile, visual or other sensory components. Holding the artist's book in one's hands, culminates for the individual viewer, in the outcome of an interaction with visual knowledge and the culture of the written content. The main goals of the group of authors within the project is the creation and explanation of the value of artist's books and the cultivation of traditional knowledge in the context of a vivid, propulsive, social and artistic impact on contemporary society. Each author uses their research experience to contribute to the complex project aim of preserving antic bookbinding knowledge and displaying it as a form of practical skill and interactive artwork, which will provide the groundwork for the preservation of knowledge for new generations. The additional, but no less important, aim of the project is to form a relevant library collection of artist's books that can provide continuous insights for, and educative and cultural value to, the community.

Ceramic Modular Elements Produced by the Use of Cad/Cam Technologies

PROJECT MANAGER

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ASSOCIATE SCIENTISTS

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Natalija Bede, Ph.D., University of Rijeka, Faculty of Civil Engineering, Rijeka

ABSTRACT

This interdisciplinary project consists of artistic and scientific research into prototype production of ceramic modular elements, applicable to civil engineering, architecture and public space design. The modular elements will be produced on a 3D printer for clay, at Quark - Ceramics Centre APURI. Further testing will be carried out at the Laboratory for Materials at GF UNIRI (Faculty of Civil Engineering, University of Rijeka), and in co - operation with architectural studios from the economic sector.

39 PROJECTS

Subsidies

SUBSIDIES are lump-sum grants allocated to managers of active competitive, domestic or international scientific-research projects that make a substantial scientific and material contribution to the scientific activity of the University of Rijeka. These grants are aimed at the development of new scientific-research initiatives by researchers who have shown excellence in competitive scientific initiatives, as well as funding other purpose-specific costs outside the existing competitive projects. There are 39 approved subsidies.

PROJECT MANAGER

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NATURAL SCIENCES

Preparation of Porous Thin - layer Water Purification Materials Using the Atomic Deposition Technique

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PROJECT MANAGER

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NATURAL SCIENCES

Influence of Redox States on Neuroplasticity Induced by Psychostimulants

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PROJECT MANAGER

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TECHNICAL SCIENCES

Physical Modeling of Structural Behavior for Landslide Repair under Static and Seismic Conditions

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PROJECT MANAGER

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SOCIAL SCIENCES

Cultures of Rejection: Conditions of Acceptability in Socio - spatial and Digital Environments in Contemporary Europe [CURE]

PROJECT MANAGER

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BIOMEDICAL AND BIOTECHNICAL SCIENCES

Characterization of Aggregated Proteins in Neuropsychiatric Disorders, Including Drosophila Models

PROJECT MANAGER

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HUMANITIES

Pointing to Language (PTL18)

PROJECT MANAGER

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TECHNICAL SCIENCES

K2 Symbiotic Mechatronics

PROJECT MANAGER

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NATURAL SCIENCES

Combinatorial Objects and Codes

PROJECT MANAGER

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TECHNICAL SCIENCES

Development of Evolutionary Procedures for the Characterization of Biological Tissue Behavior

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PROJECT MANAGER

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SOCIAL SCIENCES

Automatic Recognition of Actions and Activities in Multimedia Content From Sports Domain

PROJECT MANAGER

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TECHNICAL SCIENCES

Fixed - pole Concept in Numerical Modelling of Cosserats' Continuum

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PROJECT MANAGER

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BIOMEDICAL AND BIOTECHNICAL SCIENCES

Augmenting and Broadening T-cell Responses to Glioblastoma - Therapeutic Vaccine Platform Based on HCMV Expressing of NKG2D

PROJECT MANAGER

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BIOMEDICAL AND BIOTECHNICAL SCIENCES

New Generation of High - speed Glycoservices

PROJECT MANAGER

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NATURAL SCIENCES

Roles of non-coding RNAs in regulation of herpes simplex virus 1 latency; IP-2014-09-8790

PROJECT MANAGER

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BIOMEDICAL AND BIOTECHNICAL SCIENCES

Role of Phosphoinositides in Platelet Formation – CSF Installation Project

PROJECT MANAGER

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BIOMEDICAL AND BIOTECHNICAL SCIENCES

Pathogenesis of Cytomegalovirus Infection in Ovaries, Impact on Fertility and Pregnancy Maintenance

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PROJECT MANAGER

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BIOMEDICAL AND BIOTECHNICAL SCIENCES

Scientific Center of Excellence, Bioprospecting of the Adriatic sea

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PROJECT MANAGER

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BIOMEDICAL AND BIOTECHNICAL SCIENCES

New Approach in Development of Vaccine for Congenital Cytomegalovirus Infection

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PROJECT MANAGER

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HUMANITIES

ET TIBI DABO: Commissions and Donors in Istria, Croatian Littoral and North Dalmatia from 1300 to 1800

PROJECT MANAGER

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ART

WOM@RTS /Creative Europe/

PROJECT MANAGER

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BIOMEDICAL AND BIOTECHNICAL SCIENCES

Early Stage Development of Virion - Forming Complex During Cytomegalovirus Infection

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PROJECT MANAGER

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HUMANITIES

Responding to Antisocial Personalities in Democratic Society (RAD) – CSF IP-2018-01-3518

PROJECT MANAGER

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BIOMEDICAL AND BIOTECHNICAL SCIENCES

(CSF Research Project IP-2016-06-7060) Exploring the Boundaries Between Neurodegeneration and Neuroregeneration: Identification of Key Molecules with Proteomics and Functional Tests in the Mammalian Spinal Cord (DefineREgenAgeMode)

PROJECT MANAGER

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BIOMEDICAL AND BIOTECHNICAL SCIENCES

Controlling Neurodegeneration by Modulating the Crosstalk Between Inflammation and Proteinopathy

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PROJECT MANAGER

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BIOMEDICAL AND BIOTECHNICAL SCIENCES

Single - walled Carbon Nanotubes in Experimental Traumatic Brain Injury

PROJECT MANAGER

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BIOMEDICAL AND BIOTECHNICAL SCIENCES

Immune Mechanisms in the Development of Inflammation and Metabolic Syndrome in Obesity (INFLAMETAB, HRZZ IP-2016-06-9306)

PROJECT MANAGER

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Rijeka

TECHNICAL SCIENCES

DEcision Support System for Green and safE ship RouTing DESSERT

PROJECT MANAGER

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TECHNICAL SCIENCES

Method of Adopted Deformation for Finite Elements of Layered Plates and Sheets and its Application to Delamination Problems - ASDEL

PROJECT MANAGER

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BIOMEDICAL AND BIOTECHNICAL SCIENCES

Lightening Mechanisms of Resistance to Colon Cancer Therapy with BRAF Mutation Using Integrated - Omics Approaches

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PROJECT MANAGER

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BIOMEDICAL AND BIOTECHNICAL SCIENCES

Role of Intracellular Life of Francinen Tularensis Bacteria in Experimental Tularemia Pathogenesis

PROJECT MANAGER

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HUMANITIES

Theoretical Underpinnings of Molecular Biology - ThUMB

PROJECT MANAGER

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NATURAL SCIENCES

Port IoT for Environmental Leverage (PIXEL)

PROJECT MANAGER

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TECHNICAL SCIENCES

Enhancement of the Heat Exchanger Energy Efficiency (HEXENER)

PROJECT MANAGER

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and Business, Rijeka

SOCIAL SCIENCES

Unique Information System for Measuring the Efficiency of Public Health Institutes in the Republic of Croatia

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PROJECT MANAGER

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University of Rijeka, Faculty of
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BIOMEDICAL AND BIOTECHNICAL SCIENCES

Assessing the Oncogenic Effects of Ribosomal Protein S6 Heterozygosity

PROJECT MANAGER

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BIOMEDICAL AND BIOTECHNICAL SCIENCES

Rewriting Memory; Manipulating T-cell Memory to Improve Vaccine Effectiveness

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PROJECT MANAGER

Assist. Prof. Sandra Winkler, Ph.D., swinkler@pravri.hr, University of Rijeka, Faculty of Law, Rijeka

SOCIAL SCIENCES

Personalized Solution in European Family and Succession Law – PSEFS (European Union¨s Justice Programme 2014 - 2020; n. 800821-JUST-AG-2017/ JUST-JCOO-AG-2017)

PROJECT MANAGER

Prof. Saša Žiković, Ph.D., sasa.zikovic@efri.hr, University of Rijeka, Faculty of Economics and Business, Rijeka

SOCIAL SCIENCES

A FINancial Supervision and TECHnology Compliance Programme (H2020)

PROJECT MANAGER

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BIOMEDICAL AND BIOTECHNICAL SCIENCES

Mild Repetitive Traumatic Injuri: Model for Study of TDP-43-Mediated Neuropathology and Neuroinflammation

28 PROJECTS

ECOC 2020 projects

Campus Neighbourhood

The ECOC2020 projects are scientific-popular, artistic and other creative project initiatives funded by the University of Rijeka as a partner in the *Rijeka: European Capital of Culture 2020 project*, with its own resources within the scope of the activities of the Campus Neighbourhood, ''27 Neighbourhoods'' flagship. The project proposals have been approved for funding based on the tendering process, and are managed by the Campus Creative Team, the Executive Board of the Campus Creative Team, and the ECOC2020 Programme Council of the University of Rijeka, along with the relevant institutional bodies: the Expert Council for Internationalisation, Research and Projects and the University of Rijeka Senate.

Project initiatives are to be implemented according to the established implementation plan – through preparatory activities in 2019 and central events in 2020. The ECOC2020 projects of the University of Rijeka aim to enable the active inclusion of the University and give a direct contribution to the realisation of the *Rijeka: ECOC2020 project*, the integration of the University as an institution in the regional community, the strengthening of the UNIRI Campus as a permanent social centre and the expansion of the cultural exchange network in the region and across Europe. The Campus Neighbourhood has a fraternal neighbourhood: the Trieste-based *EuroScience Open Forum 2020* as part of the *Trieste: European Capital of Science 2020* programme, so the development of joint programmes and co-operation bring an additional dimension to the activities within the scope of these institutionally supported and funded projects. There are 28 approved ECOC2020 projects from the University of Rijeka, and in synergy with them, there will be additional scientific programmes funded from international competitive sources which will be held at the University of Rijeka Campus as part of events marking the Republic of Croatia's EU Presidency.

ECOC2020 Projects
campus Neighbourhood

I & R Naval Academy in Rijeka (ex. Fiume) – The Civil Importance of Military Institutions

PROJECT MANAGER

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ABSTRACT

I & R Naval Academy in Rijeka (ex. Fiume) was the most important educational institution in the 19th century, the professors from which, also took part in scientific research. Two of them are of world fame: the physicist Peter Salcher, due to collaboration with Ernst Mach in the field of acoustics, and chemist Josef Koettstorfer, whose method known as "Koettstorfer" or "saponification number" is still used in food analyses. Emil Stahlberger also belongs to this group, as he had already, in 1874, published a book about high and low tides in the Rijeka bay, explaining the phenomenon known today as "meteotsunami".

Fruit Flies in the Classroom

PROJECT MANAGER

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ASSOCIATE SCIENTISTS

Borjanka Smojver
Prof. Melba Blažić Grubelić, Ph.D.
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Prof. Andreas Prokop, Ph.D.
Ana Filošević, Ph.D.
Students from the Natural science and graphic school Rijeka, Rijeka

ABSTRACT

This project presents a collaboration between the Laboratory for Behavioural Genetics at the Department of Biotechnology, UNIRI with educational experts and teachers in elementary and middle schools. The aim is to educate teachers about the live laboratory model, fruit fly, which students will then use through active participation and experimentation in acquiring knowledge in biology. Teachers will be educated through oral presentations, workshops and the creation of a web site. The project is based on a similar project "dros4school" in UK, whose creator is a collaborator on this project.

Sušak – Art of Memory Project

PROJECT MANAGER

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Ivan Vranjić
Tomislav Brajnović
Jasenka Alić - Tadić
Daniela Samaržija

ABSTRACT

The main aim of the "Sušak – Art of Memory Project" is to document memories of life in Sušak. The project will record and store oral accounts, collect family and other personal photographs, personal documents and other items that bear witness to the story of Sušak. The project will also analyse the different experiences of living in this "non - existent town". As a result, this project will help create an archive of oral history that might be needed for future studies and research, and will result in the mapping of Sušak's heritage.

Presenting the Work and Publication of the JA:TO Group

PROJECT MANAGER

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ASSOCIATE SCIENTISTS

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Omar Lovrić
Marina Rajšić
Paolo Ujčić

ABSTRACT

A group of young artists named the "JA: TO collective" presents their work and publications. Presentations and informal gatherings will take place in the back yard of the Academy of Applied Arts in Rijeka and include the video projection of their works. A very important part of the event is to establish a dialogue with visitors and to develop a pleasant atmosphere, so after the presentation of the works, in the afternoon there will be discussions with the authors and an informal gathering. Each visitor will receive a copy of the publication of the collective action so far.

Memories

PROJECT MANAGER

Assoc. Prof. Ingeborg Fülepp, M. Art., inga.fuelepp@gmail.com, Center for Innovative Media, Rijeka; University of Rijeka, Academy of Applied Arts, Rijeka

ASSOCIATE SCIENTISTS

Dijana Protić, doctoral student, University of Rijeka, Faculty of Humanities and Social Sciences, Rijeka
Tena Bošnjaković

ABSTRACT

The project “Memories” includes video talks with members of the local population in the neighbourhood of “Campus”. Their memories can contribute to young people’s better understanding of historical events and personal memories. The video talks will be enriched with pictures of walks through the local natural environment. The pictures are from the recorded material for the project "From the Trsat Castle to the Astronomical Centre". This project includes students and mentors who will use existing virtual and extended reality (VR I AR) technology. The project will be accomplished by students of three academies (APURI, ALU and ADU) with mentorship of professors.

Where do we come from? What are we? Where are we going?

PROJECT MANAGER

Ivona Habijanec,
ivona487@gmail.com, University of Rijeka, Academy of Applied Arts, Rijeka

ASSOCIATE SCIENTISTS

Assist.Prof. Darija Žmak Kunić, M.Art.
Students of University of Rijeka,
Academy of Applied Arts, Rijeka
Ivan Botički
Lucija Granić
Erika Močibob
Gloria Arapović
Dorian Papić
Nives Žarković
Ela Štefanac
Students - guests

ABSTRACT

"Where do we come from? What are we? Where are we going? " is the most famous work of the painter Paul Gauguin. As the title suggests, the painting represents three questions and three periods of life. We will try to answer the same questions with the exhibition and mentor Assist. Prof. Darija Žmak Kunić, M. Art. in the City Gallery Lovran and at the Campus area. The purpose of the exhibition is to introduce students of the Academy of Applied Arts and their cultural activism to people in Rijeka and the surrounding areas.

Inspirations from the Nanoworld

PROJECT MANAGER

Assist. Prof. Ivana Jelovica Badovinac, Ph.D., ijelov@phy.uniri.hr, University of Rijeka, Department of Physics, Rijeka

ASSOCIATE SCIENTISTS

Prof. Mladen Petravić, Ph.D.
Assist. Prof. Darija Žmak Kunić, M. Art.
Klaudija Lončarić, Lecturer

ABSTRACT

The aim of the exhibition "Inspirations from the Nanoworld", a joint project of the Department of Physics and the Centre for Micro- and Nano - sciences and Technologies and the Academy of Applied Arts of the University of Rijeka, is to bring together the creativity of science and art in the wider community. At the exhibition, all the interested visitors will be able to explore selected images of the nano - world, created by a scanning electron microscope, and view the new works of art of students of the Academy, inspired by these images.

Between the Lion and the Star – an Academic and Cultural Event

PROJECT MANAGER

Assist. Prof. Kosana Jovanović, Ph.D., kjovanovic@ffri.hr, University of Rijeka, Faculty of Humanities and Social Sciences, Rijeka

ABSTRACT

"Between the Lion and the Star" – an Academic and Cultural Event.
This two - fold event comprises an international scientific conference that aims at further valorisation of the Frankopan heritage as a cultural and historical patrimony, accompanied by a series of cultural events (gastro tour, historical re - enactments, info points, cultural excursions, etc.). As the Frankopan family built their relations and connections throughout Central Europe, the intent of the organisers is that this event should bring together both academics and a wider audience, and demonstrate the cosmopolitanism of medieval nobility.

Wom@rts – Women's Equal Share Presence in Arts and Creative Industries

PROJECT MANAGER

Melinda Kostelac, M. Art.,
melinda.kostelac@uniri.hr,
University of Rijeka, Academy of Applied Arts, Rijeka

ASSOCIATE SCIENTISTS

Assoc. Prof. Letricija Linardić, Ph.D.
Assoc. Prof. Aljoša Brajdić, Ph.D.
Marko Radović
Korina Hunjak
Daria Burica

ABSTRACT

"Wom@rts" is a 4 - year project proposed by 10 partners from 8 different European countries (Spain, Finland, Lithuania, France, Ireland, United Kingdom, Croatia and Slovenia) and 20 associated partners. The project consists of a transnational network and platform to develop awareness of gender inequality in cultural and creative industries and providing visibility to women artists. The project is ambitious and deals with a sensitive challenge to our contemporary society. The basic idea comes from the 70th anniversary book "Second Sex" by Simone De Beauvoir and involves the mobility fluctuations of over 180 artists from the field of comics, illustration, lens - based media, printmaking, literature and science.

Book: Imaging the Image

PROJECT MANAGER

Assoc. Prof. Nataša Lah, Ph.D.,
nlah@ffri.hr, University of Rijeka,
Faculty of Humanities and Social
Sciences, Rijeka

ASSOCIATE SCIENTISTS

Assist. Barbara Španjol
Pandelo, Ph.D.
Prof. Nina Kudiš, Ph.D.
Prof. Nadežda Elezović, Ph.D.

ABSTRACT

'Imaging the Image' is a book which gathers the writings of eighteen humanities scientists who study visual culture and art, with texts in both the Croatian and English languages. The book is a result of 'Theoretical Dialogues', an international scientific symposium that has been organised for the past ten years (2009 - 2019) at the Faculty of Humanities and Social Sciences in Rijeka. The book is a significant contribution to new orientation strategies in a time of erased borders between real and virtual, handmade and electronic, valuable and imageless images.

9th International Conference on Industrial Heritage; Rijeka, Croatia, 25th - 26th May 2020

PROJECT MANAGER

Prof. Julija Lozzi Barković, Ph.D., lozzi@ffri.hr, Pro Torpedo Association, Rijeka

ASSOCIATE SCIENTISTS

Đekić Velid, Pro Torpedo Association, Rijeka
Diana Glavičić

ABSTRACT

The main theme of the 9th conference is related to the industrial heritage of the period of socialism that seemed to, and still makes up a significant feature of the urban face of the city of Rijeka. The conference is an opportunity for a comprehensive synthesis of values, protection and restoration of industrial heritage from the aforementioned period, which is becoming more and more actual in the field of interdisciplinary research. The intention is to present a series of new pieces of information relating to Rijeka and international industrial heritage, which will help better acquaintance with, and give an impulse to raising awareness of the value of industrial heritage. It will also help to brand Rijeka as an important place of European cultural heritage. Industrial heritage is an important aspect of the promotion of Rijeka within the ECOC2020, whose programme largely relies on the attraction and internationally recognised value of abandoned industrial complexes within the port areas of the city.

Puppet Show: "Little Secrets of Professor Šifrica"

PROJECT MANAGER

Marija Maksimović, Ph.D.,
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University of Rijeka, Department of Mathematics, Rijeka

ASSOCIATE SCIENTISTS

Igor Malnar, designer
Anja Sabol, actor

ABSTRACT

The puppet show, "Little Secrets of Professor Šifrica" takes us on a journey to the "World of Cryptography". It is the world of written secret messages. On this trip you will meet Professor Šifrica and her friend Professor Kriptić. They will explain to you the basic principles of cryptography and show how their messages are hidden from Radoznalići.

Imaginary - Magical Mathematics

PROJECT MANAGER

Assist. Prof. Vedrana Mikulić Crnković, Ph.D.,
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University of Rijeka, Department of Mathematics, Rijeka

ASSOCIATE SCIENTISTS

Assist. Prof. Bojan Crnković, Ph.D.
Assist. Prof. Doris Dumičić Danilović, Ph.D.
Assist. Prof. Andrea Švob, Ph.D.

ABSTRACT

IMAGINARY is a non - profit organisation for the communication of modern mathematics. As part of the project, the Department of Mathematics, University of Rijeka organised the exhibition entitled "Imaginary - Magical Mathematics" in 2016. In 2019, there will be an outdoor exhibition "Imaginary – Magical Mathematics on the Campus Trsat". The exhibition and accompanying activities aim to promote mathematics through art, light and shadow games, interactive and hands - on demonstrations.

Introducing Activism through Non - Formal Education

PROJECT MANAGER

Brigita Miloš, Ph.D., czsrijeka@gmail.com, Center for Women's Studies at the Faculty of Humanities and Social Sciences, Rijeka

ASSOCIATE SCIENTISTS

Nataša Czerny, Lesbian organization "LORI", Rijeka, Rijeka
University of Rijeka, Rijeka
City of Rijeka, Rijeka
Katerina Manousaki, Active Rainbow

ABSTRACT

Through this workshop, which will be held in May, 2019, at the FFRI, the participants will have the opportunity to improve their skills and knowledge in the field of activism and issues related to the LGBT + spectrum. Also, this workshop is part of Smoqua 3, Festival of Queer and Feminist Culture. Different informal work tools (body work, media, games, discussions) will be used during workshop. The language of the workshop will be English, and attendees can work individually, in pairs or in smaller groups. The host for the workshop will be Aikaterini Manousaki, an experienced youth worker, facilitator, media and human rights educator. She has a background in the Faculty of Humanities and Social Sciences and shares a genuine passion for empowering people, especially youth, realising their potential and creating opportunities for themselves. The workshop is intended for the student population as well as for all interested citizens who want to learn more about queer, feminism, human rights and LGBTI rights.

Inclusive Campus

PROJECT MANAGER

Assist. Prof. Iva Mrak, Ph.D., iva.mrak@uniri.hr, University of Rijeka, Faculty of Civil Engineering, Rijeka

ASSOCIATE SCIENTISTS

Assist. Prof. Marko Franković, Ph.D.
Cela Matan, Ph.D.
Jana Puž
Assoc. Prof. Nana Palinić, Ph.D.
Prof. Aleksandra Deluka - Tibljaš, Ph.D.
Assist. Prof. Sanja Šurdonja, Ph.D.
Ivana Pranjić, Assistant
Marijana Cuculić, Senior Lecturer
Office for Disabled Students, Rijeka
Students of University of Rijeka, Faculty of Civil Engineering and other students of University of Rijeka, Rijeka
The Institute for Physical Planning of Primorje - Gorski Kotar County
University of Rijeka, Faculty of Humanities and Social Sciences, Rijeka
Society of Architects Rijeka, Rijeka
University of Zagreb, Faculty of Architecture, Zagreb
University of Split, Faculty of Civil Engineering, Architecture and Geodesy, Split

ABSTRACT

The aim of the project "Inclusive Campus" is to help render the campus space an inclusive and healthy centre for both the university and the local community. The activities of the project will include: information gathering from potential stakeholders, workshops and discussions, concept proposals composed by students on the principles of inclusive and universal design, an exhibition and the choosing of the most efficient proposals.

Self - care

PROJECT MANAGER

Petra Mrša,
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University of Rijeka, Academy of Applied Arts, Rijeka

ASSOCIATE SCIENTISTS

Sanja Miloš, Ph.D.
Sanja Bojanić, Ph.D.
Brigita Miloš, Ph.D.
Ana Ajduković
Home for the elderly and infirm Nina, Čavle

ABSTRACT

Self - care is the interdisciplinary programme of students of the Academy of Applied Arts, Faculty of Humanities and Social Sciences and the residents of the home for the elderly at Čavli. After the theoretical lecture on caring (about oneself), the practical part of the programme will start where students will help residents to use their cell phones for photographing. In that way, residents will be able to photograph the objects and actions that they find beneficial for their lives. Students will also address moments of self - care, in one of the media they choose: photography, drawing, text, painting, sculpture. The works will be shown in Čavli and in Rijeka.

A Photomarathon of Rijeka's Industrial Heritage

PROJECT MANAGER

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Centre for Industrial Heritage,
Rijeka

ASSOCIATE SCIENTISTS

Ivana Golob Mihić
Ema Makarun
Prof. Julija Lozzi Barković, Ph.D.

ABSTRACT

'A Photomarathon of Rijeka's Industrial Heritage' will call on interested photographers of Rijeka's industrial history to photograph hidden, abandoned and less accessible former industrial spaces. With Photomarathon, we want to emphasise the importance of industry and industrial heritage for today's city and its people and to promote Rijeka as an industrial city. The project will encompass areas of outstanding historical or industrial importance as part of the industrial era of Rijeka. The exhibition of photographs will be on Campus where the best will be selected and rewarded.

Culture of Memory and the Spanish Civil War - International Conference and Exhibition

PROJECT MANAGER

Assist. Prof. Vjeran Pavlaković, Ph.D.,
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University of Rijeka, Faculty of Humanities and Social Sciences, Rijeka

ASSOCIATE SCIENTISTS

Vana Gović
Ivo Mileusnić
Emanuela Berić

ABSTRACT

The international conference and exhibition entitled "Culture of Memory and the Spanish Civil War" marks the 80th anniversary of the Spanish Civil War's ending. The conference aims to present newer research on the cultural memory of the Spanish Civil War, through both European and local historical perspectives. The conference and exhibition will include the participation of students at the university. The exhibition is co - organised with the Maritime and History Museum of the Croatian Littoral. The exhibits will include a selection of a large number of photographs, promotive materials, monuments, documents, and artefacts, as well as the results of student research mentored by senior curators from the Maritime and History Museum.

In Search of the Local Superfruit - the Forgotten "Drenjula" (Cornel)

PROJECT MANAGER

Željka Peršurić, Ph.D., zpersuric@cmnzt.uniri.hr, University of Rijeka, Department of Biotechnology, Rijeka

ASSOCIATE SCIENTISTS

Vesna Lukanović, Dren Rijeka Association, Rijeka
Tomislav Pavlešić
Prof. Sandra Kraljević Pavelić, Ph.D.
Andrea Kurelac, student
Lara Saftić, Ph.D., Juraj Dobrila University of Pula, Pula

ABSTRACT

Cornel (lat. cornus mas L.), in the area of Rijeka known as "Drenjula", is a symbol of good health, acknowledged also in the old saying "Healthy as a cornel". Moreover, the city quarter Drenova in Rijeka got its name from the cornel. Unfortunately, today these red fruits are forgotten and left off of our menus. The goal of this project is to make cornel popular again, through scientific research and educational lectures that will help make people aware of its value.

Rijeka's Student Years (1968 - 1971)

PROJECT MANAGER

Assist. Andrea Roknić Bežanić, Ph.D., aroknic@ffri.hr, University of Rijeka, Faculty of Humanities and Social Sciences, Rijeka

ASSOCIATE SCIENTISTS

Prof. Darko Dukovski, Ph.D.
Assist. Prof. Marko Medved, Ph.D.
Carla Konta, Ph.D., Postdoctoral researcher
Bruno Raguž, student

ABSTRACT

The project is focused on the research of local history, student life and activism in Rijeka during the period 1968 to 1971, which has, as yet, not been sufficiently investigated or presented to the general public. Within the project, lectures will give information about student life, an exhibition will be set up and a book will be published. The aim of the project is to introduce students, scholars, and the general public to topics related to student activism in the city of Rijeka in these turbulent years. The project will offer Rijeka the opportunity to understand different tendencies within student life and their impact on the life of the city even today. The project will develop a brand and image for the campus, and highlight the significance of its students in the life of the city.

Travelling Scientists

PROJECT MANAGER

Marko Rubinić,
rubinicmr@gmail.com, Student Association, University of Rijeka, Department of Biotechnology, Rijeka

ABSTRACT

"Travelling Scientists" is a project whose main goal is to make science more popular amongst children in kindergarten and elementary schools. The way in which we accomplish that is by conducting interactive workshops or doing experiments in kindergartens and elementary schools throughout the Rijeka and Istria County, and during various scientific events. The experiments are prepared in a way that they arouse interest in science among the children, and depending on their age, we are able to explain some basic terms and concepts of biology, chemistry and physics with the experiments.

Rijeka's 19th Century Literary Heritage

PROJECT MANAGER

Prof. Diana Stolac, Ph.D.,
diana.stolac@ri.t-com.hr,
University of Rijeka, Faculty of Humanities and Social Sciences, Rijeka

ABSTRACT

Each culture has its own history deserving of attention and formal study which serves to place its complexities in the context of today's situation. A historical legacy is not only a reminder of the past but an active protagonist of contemporary culture. A city's identity is perceived in terms of its past and its present. The central component will be an exhibition of Rijeka's literary heritage in hand - written and printed texts from the 19th century that shows that Rijeka was a centre of cultural activity and part of the European cultural space of the time.

A Linguistic Landscape of Rijeka

PROJECT MANAGER

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University of Rijeka, Faculty of Humanities and Social Sciences, Rijeka

ASSOCIATE SCIENTISTS

Jim Hlavač, Monash University, Melbourne, Australia

ABSTRACT

"A Linguistic Landscape of Rijeka" – a visual image of Rijeka's public signs and texts is a book co - authored by Diana Stolac and Jim Hlavač that will feature left - hand page texts in Croatian and right - hand ones in English. The aim of the book is to systematically present the linguistic reality of Rijeka and its surroundings, focusing on mono - lingual, bi - lingual and dialect - based texts in public spaces. Photographs presented in the book will be the basis for numerous exhibitions with a number of public lectures being organised for interested members of the public.

CPR Kiosk

PROJECT MANAGER

Prof. Alan Šustić, Ph.D.,
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Cabinet of Skills – Simulation Center, Rijeka
Clinical Hospital Centre Rijeka, Rijeka

ASSOCIATE SCIENTISTS

Petra Volf Žiković
Erika Šuper Petrinjac
Ana Pičuljan

ABSTRACT

"CPR Kiosk" is a project based on similar schemes present in countries with a high cardiac arrest awareness where such kiosks may be found in public places. By placing a CPR (Cardio - Pulmonary Resuscitation) kiosk on the University of Rijeka campus we will raise the awareness of local citizens. In Croatia, only 1 out of 10 cardiac arrest victims survive. People can help change that devastating number by applying CPR because such incidents are witnessed in 2 out of 3 cases. "CPR Kiosk" will provide the chance to learn that skill.

How to go to Kindergarten and Primary School Tear - free? Support for the Socio - emotional Well - being of Children during Transition and Adaptation

PROJECT MANAGER

Assoc. Prof. Sanja Tatalović Vorkapić, Ph.D., sanjatv@uniri.hr, University of Rijeka, Faculty of Teacher Education, Rijeka

ASSOCIATE SCIENTISTS

Vesna Katić, Senior Lecturer
Assoc. Prof. Mirna Marić, Ph.D.
Anita Rončević, Ph.D., Senior Lecturer
Sonja Lefler, Director of Primary school Trsat, Rijeka
Jasna Crnčić, Kindergarten Đurđice, Rijeka
Radmila Bajić, Kindergarten Đurđice, Rijeka
Students of University of Rijeka, Rijeka
University of Rijeka, Faculty of Teacher Education, Rijeka

ABSTRACT

Given the importance and challenges of transition periods and adaptation in kindergarten and primary school, the aim of this project is to provide professional support to parents and children and to strengthen the competencies of teachers to work with children during transition and adaptation. With that aim, lectures and workshops are specifically planned for teachers, parents and children. Project co - workers are professors and students of the Faculty of Teacher Education, Kindergarten Đurđice and Primary School Trsat.

(In)visible Spaces

PROJECT MANAGER

Dražen Vitolović,
drazenvitolovic@gmail.com
Assist. Prof. Darija Žmak Kunić,
M. Art., zdarija@studioartlan.com
University of Rijeka, Academy of Applied Arts, Rijeka

ASSOCIATE SCIENTISTS

Student volunteers

ABSTRACT

Public spaces, obviously visible on an everyday basis, contain invisible potential and can be of benefit to both, the local and the wider community. This project consists of urban - architectural - sociological research, conducted by two authors/artists from the Academy of Applied Arts in Rijeka. The research will result in the construction of visual material proposals for public space interventions on the University of Rijeka campus and in the wider area of Susak. It will also take the form of a book - object, which contains essays by the authors, with an emphasis on the relations between the private and the public. Interventions and ideas will also be presented at various locations, in the form of posters, which aim to elevate the awareness of citizens and encourage their participation in the creation of varied content for future public spaces.

Smart STEM Workshops

PROJECT MANAGER

Prof. Saša Zelenika, Ph.D.,
sasa.zelenika@riteh.hr, Center for Micro and Nanoscience and Technology, Rijeka

ASSOCIATE SCIENTISTS

Assist. Prof. Ervin Kamenar, Ph.D.
Marin Trošelj
Nela Malatesti, Ph.D.
Assist. Prof. Ivana Munitić, Ph.D.
Assoc. Prof. Luca Malatesti, Ph.D.

ABSTRACT

The "Smart STEM workshops" will offer basic work on STEMI robots and notions of 3D printing and scanning to pre - school and school children (from 5 to 15 years of age), as well as a broader audience. Smart technological solutions, usage of light in medicine and therapy, immunology and the role of STEM disciplines in a democratic society will be illustrated via science broadening presentations. All involved scientists have a broad experience in research and teaching as well as in promoting science.

Inspirations from the Nanoworld

PROJECT MANAGER

Assist. Prof. Darija Žmak Kunić, M. Art., zdarija@studioartlan.com, University of Rijeka, Academy of Applied Arts, Rijeka

ASSOCIATE SCIENTISTS

Prof. Mladen Petravić, Ph.D.
Assist. Prof. Ivana Jelovica Badovinac, Ph.D.
Klaudija Lončarić, Lecturer

ABSTRACT

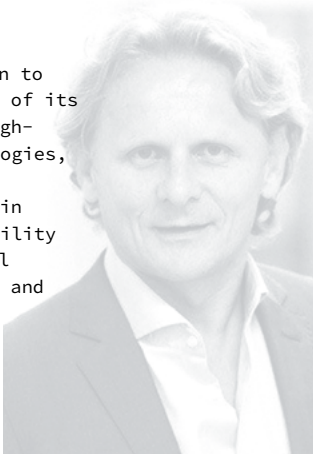
The workshops are part of the inter - institutional co - operative project, "Inspirations from the Nanoworld," organised between the Academy of Applied Arts and the laboratory for scanning electron microscopy at the Department of Physics and Centre for Micro - and Nano - sciences and Technologies at the University of Rijeka. The aim of these workshops is the promotion of both science and art by the presentation, through interactive activities, of the working principles of an electron microscope and sensations arising from the nano - world, to interested visiting adults and children of pre - school age.

RIJEKA CAN

Community's review

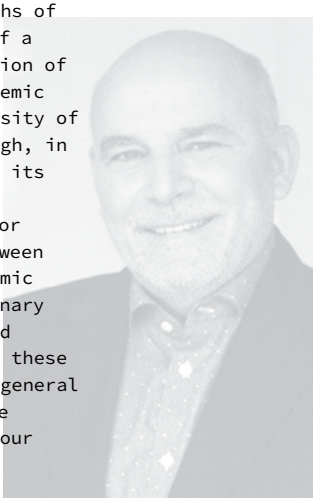
Prof. Ivan Đikić, M.D., Ph.D.

The University of Rijeka pays great attention to student education, as well as to the careers of its scientists and professors. A selection of high-quality projects, many embracing new technologies, accompanied by special programmes for young scientists, open the door to future success in Rijeka. Openness, cooperation, and responsibility for society's development are the fundamental values promoted by the University leadership and communicated to the public at large.



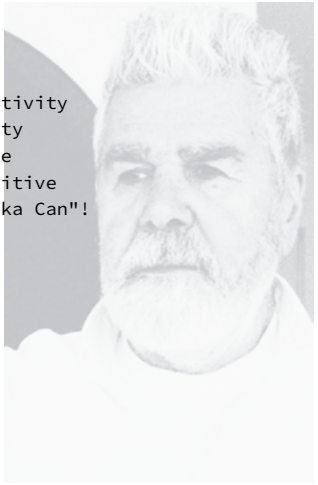
Ivo Usmiani,
President of the Board of Directors of JGL

I believe that the strengths of a city are measured in the intellectual power of its population. The University of Rijeka illustrates the strengths of the city of Rijeka. The modern development of a country is unthinkable without the contribution of science and without the foundation that academic development provides for science. The University of Rijeka team has made an important breakthrough, in accordance with European guidelines, through its linking of science and the economy.
In our company JGL, we have always striven for the strengthening of functional networks between entrepreneurs and researchers from the academic community, for the creation of interdisciplinary study programmes and the transfer of acquired knowledge to real life. I am pleased to have these projects, with their central goal being the general improvement of science for the benefit of the economy and society as a whole, communicate our common vision that "Rijeka Can"!



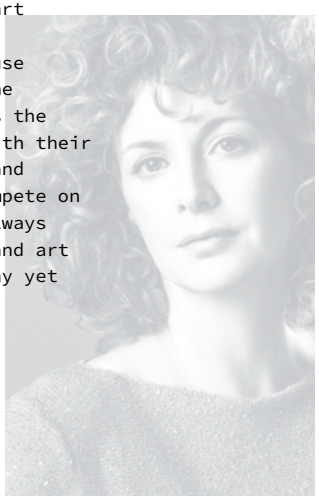
Joško Eterović,
painter and sculptor

A small town like Rijeka offers so much creativity in so many areas of research, making this city part of Europe and the world. I am glad to be part of this city and to be part of that positive contribution. I sincerely believe that "Rijeka Can"!



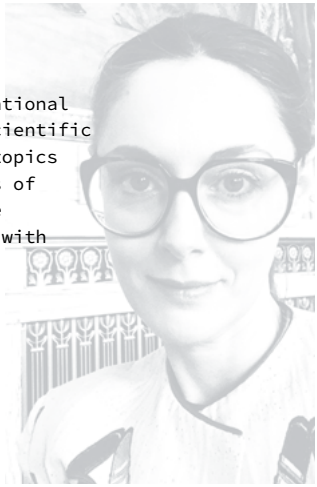
Nina Violić,
actress

I am incredibly proud of the University of Rijeka which has decided to invest all the allocated science funds exclusively into science and art projects. I think this is important for the community on a higher level, primarily because it opens up the field of research and, in the contemporary world, investing in research is the only thing that makes sense. In addition, with their research and creative projects, scientists and artists from Rijeka will thus be able to compete on the European scene. Such clever decisions always yield results, and the advances in science and art that will surely come from this decision, may yet astonish us all.



Prof. Danica Kragic Jensfelt, PhD

This is a fantastic initiative on an international level. It is important to create a strong scientific base built on competitiveness. The project topics are interesting and many include the methods of machine learning, which only proves that the experts at the University of Rijeka keep up with international trends.



Jelena Jindra, journalist

I was always interested in seeing my city from the fresh perspective of new people who find themselves here, with the intention of leaving something worthwhile to the city. Now, thanks to the University of Rijeka and all these scientific projects, I feel that Rijeka is in good hands. There are a lot of new, fresh perspectives from scientists whose work yields a curious and exciting vision of Rijeka, the unfolding of which I look forward to immensely.

1193 AUTHORS

List of authors

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219 INSTITUTIONS

List of institutions

UNIVERSITY OF RIJEKA, RIJEKA

Due to their recurrence, the University of Rijeka constituents are not numbered, and the search is enabled by the projects managers. They can multimodally be searched in online available digital variants.

University of Rijeka, Department of Polytechnics, Rijeka
University of Rijeka, Academy of Applied Arts, Rijeka
University of Rijeka, Department of Mathematics, Rijeka
University of Rijeka, Department of Biotechnology, Rijeka
University of Rijeka, Department of Informatics, Rijeka
University of Rijeka, Department of Physics, Rijeka
University of Rijeka, Faculty of Engineering, Rijeka
University of Rijeka, Faculty of Economics and Business, Rijeka
University of Rijeka, Faculty of Civil Engineering, Rijeka
University of Rijeka, Faculty of Health Studies, Rijeka
University of Rijeka, Faculty of Humanities and Social Sciences, Rijeka
University of Rijeka, Faculty of Law, Rijeka
University of Rijeka, Faculty of Maritime Studies, Rijeka
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University of Rijeka, Rijeka

UNIVERSITIES, FACULTIES AND COLLEGES – CROATIA

107	Aspira University College, Split
062,108	Croatian Catholic University of Zagreb, Zagreb
133,146	Juraj Dobrila University of Pula, Faculty for Educational and Educational Sciences, Pula
115,133	Juraj Dobrila University of Pula, Faculty of Informatics, Pula
090,162,224,279	Juraj Dobrila University of Pula, Pula
107	Međimurje Polytechnic in Čakovec, Čakovec
105,120,127,131,140	Polytechnic of Rijeka, Rijeka
218,219	Technical Polytechnic of Zagreb, Zagreb
226	University North, Varaždin
128	University of Dubrovnik, Dubrovnik
234	University of Osijek, Faculty of Civil Engineering, Osijek
148	University of Osijek, Faculty of Education, Osijek
226	University of Osijek, Faculty of Engineering, Osijek
038	University of Osijek, Faculty of Medicine, Osijek

042,043,180	University of Osijek, Osijek
275	University of Split, Faculty of Civil Engineering, Architecture and Geodesy, Split
150,157	University of Split, Faculty of Humanities and Social Sciences, Split
016	University of Split, Faculty of Medicine, Split
150,157	University of Split, Split
100,148,150,224,226,239	University of Zadar, Zadar
124,139	University of Zagreb, Croatian Studies, Zagreb
128	University of Zagreb, Faculty of Agriculture, Zagreb
275	University of Zagreb, Faculty of Architecture and Design, Zagreb
080	University of Zagreb, Faculty of Dental Medicine, Zagreb
112,115	University of Zagreb, Faculty of Electrical Engineering and Computing, Zagreb
161,162,172	University of Zagreb, Faculty of Humanities and Social Sciences, Zagreb
133	University of Zagreb, Faculty of Kinesiology, Zagreb
227	University of Zagreb, Faculty of Mechanical Engineering and Naval Architecture, Zagreb
038	University of Zagreb, Faculty of Medicine, Zagreb
016,181	University of Zagreb, Faculty of Natural Sciences and Mathematics, Zagreb
025	University of Zagreb, Faculty of Pharmacy and Biochemistry, Zagreb
112,129,151	University of Zagreb, Faculty of Teacher Education, Zagreb
040,183	University of Zagreb, Zagreb

PRESCHOOL INSTITUTIONS, PRIMARY AND SECONDARY SCHOOLS – CROATIA

119	Administrative School Zagreb, Zagreb
285	Kindergarten Đurđice, Rijeka
146	Kindergarten Matulji, Matulji
153	Kindergarten Medulin, Medulin
262	Natural science and graphic school Rijeka, Rijeka
108	Primary school Julije Benešić, Ilok
125	Primary school Nedelišće, Nedelišće
172,285	Primary school Trsat, Rijeka
157	School of Electrical Engineering Rijeka, Rijeka
125	Traffic school Rijeka, Rijeka

SCIENTIFIC AND SCIENCE AND DEVELOPMENT INSTITUTIONS AND ORGANIZATIONS, OFFICES AND ASSOCIATIONS – CROATIA

274	Active Rainbow
038	A Diabetes Association of Crikvenica, Crikvenica
151	Adult Education Institution Dante, Rijeka
284	Cabinet of Skills – Simulation Center, Rijeka
250	Center for Advanced Studies of South East Europe, Rijeka
277	Center for Industrial Heritage, Rijeka
265	Center for Innovative Media, Rijeka
287	Center for Micro and Nanoscience and Technology, Rijeka
274	Center for Women's Studies at the Faculty of Humanities and Social Sciences, Rijeka
173	Croatian Academy of Sciences and Arts, Rijeka
279	Dren Rijeka Association, Rijeka
238	Institute „Ruđer Bošković", Zagreb
238	Institute for Agriculture and Tourism, Poreč
022,028	Institute for Medical Research and Occupational Medicine, Zagreb
133	Institute of Anthropology, Zagreb
157	Institute of Philosophy, Zagreb
274	Lesbian organization "LORI", Rijeka, Rijeka
275	Office for Disabled Students, Rijeka
271	Pro Torpedo Association, Rijeka
168	Rochester Institute of Technology Croatia, Zagreb, Croatia
109,208	Smart and Sustainable Cities Support Center, Rijeka
275	Society of Architects Rijeka, Rijeka
111	Terra Association, Rijeka

HEALTHCARE INSTITUTIONS – CROATIA

057	Clinic for orthopedics and traumatology Lovran, Lovran
062,072,094	Clinical Hospital Centre „Sisters of Mercy", Zagreb
038,042	Clinical Hospital Centre Osijek, Osijek

013–015,018,025,032, 038,039,042,043, 052–054,057,061,063, 069,070,072,077, 080–085,088,092,094, 095,153,197,207,211, 241,284	Clinical Hospital Centre Rijeka, Rijeka
061	Clinical Hospital Centre Zagreb, Zagreb
013	Clinical Hospital Dubrava, Zagreb
038,043	Clinical Hospital Merkur, Zagreb
025,057	Clinical Hospital Sv. Duh, Zagreb
029	Department of Emergency Medicine of the Istrian Country, Pula
022,028,073,086,091, 135,238	Educational Institute for Public Health Pimorje - Gorski Kotar Country, Rijeka
033,073	General Hospital Karlovac, Karlovac
015,025,038,070,077	General Hospital Pula, Pula
026	General practice Jelena Sironić Hreljanović, Rijeka
057,066,080	Health Center Primorje - Gorski Kotar Country, Rijeka
150	Home for the elderly „Mali Kartec“, Krk
276	Home for the elderly and infirm Nina, Čavle
038	Hospital for Orthopedics and Rehabilitation „Prim. Dr. Martin Horvat“, Rovinj
026	Istrian health centers, family medicine Labin, Labin
026	Istrian health centers, family medicine Umag, Umag
026	Istrian health centers, family medicine Žminj, Žminj
059	Private dental practice Irena Bonifačić, Rijeka
062	Psychiatric hospital Rab, Rab
057	Special hospital for orthopedics Nemec, Matulji
026	Specialist family medicine practice Morena Butković, Pula
026	Specialist family medicine practice Spomenka Češkić, Rijeka
038	Thalassotherapia Crikvenica, Crikvenica
014,041,046,065	Thalassotherapia Opatija, Opatija
038	University Clinic for Diabetes, Endocrinology and Metabolic Diseases „Vuk Vrhovac“, Zagreb

COMPANIES, LOCAL GOVERNMENT AND SELF-GOVERNMENT UNITS AND OTHER COMMUNITY ENTITIES

239,240	3. Maj Brodogradilište d.d., Rijeka / Shipyard 3. Maj, Rijeka
128	Aura Soft d.o.o., Pazin
028	Bioinstitut d.o.o., Čakovec
240	Brodograđevna industrija Split d.d., Split / Shipbuilding industry, Split
239	Brodogradilište Viktor Lenac, Rijeka / Shipyard Viktor Lenac, Rijeka
160,274	City of Rijeka, Rijeka
130	Croatian Bank for Reconstruction and Development, Croatia
172	Croatian Restoration Institute, Croatia
221	Croatian waters, Croatia
275	The Institute for Physical Planning of Primorje - Gorski Kotar County, Rijeka
107	Domeni d.o.o., Matulji
128	Ericsson Nikola Tesla d.d., Zagreb
127	Financial agency Croatia (FINA), Croatia
122	General Court EU, Luxembourg
111,115,134,204	HEP d.d., Croatia
225	Hidro - expert d.o.o., Rijeka
122	Hrvatski telekom d.d., Zagreb / Croatian Telecom, Zagreb
111	Ideo plan d.o.o., Pula
107	Imperial d.d., Rab
211,237	INMEL d.o.o, Kostrena
219	IOLAP inc., Rijeka
225	Istarski vodovod d.o.o., Buzet / Istrian water supply, Buzet
211	KvarnerCAD, Rijeka
106	Law Firm Gajski, Grlić, Prka and partners d.o.o., Zagreb
122	Liszt i Posavec Law Firm, Zagreb
158,160	Ministry of Culture of the Republic of Croatia, Croatia
172	Museum of Croatian Archaeological Monuments, Split
066	Orto - nova d.o.o., Rijeka
109	Petrokemija d.d., Kutina
128,169	Primorje - Gorski Kotar Country, Rijeka
122	POSLuH hosting d.o.o., Zagreb

234	RI ISA d.o.o., Rijeka
204	Siemens d.d., Zagreb
110	Solana Nin, Nin / Saltern Nin, Nin
109	Tax Administration of the Ministry of Finance, Regional Office Rijeka, Rijeka
226	Teh projekt plin d.o.o., Rijeka
227	Teh - Cut d.o.o., Zagreb
204	Vulkan - Nova, d.o.o., Rijeka
070	Zelena infrastruktura d.o.o., Zagreb

INSTITUTIONS – PARTNERS OUTSIDE CROATIA

016	Amsterdam University of Applied Sciences, Faculty of health, Amsterdam, Netherlands
115,180	Autonomous University of Barcelona, Barcelona, Spain
180	Barcelona Institute of Science and Technology, Barcelona, Spain
129	Birkbeck, University of London, London, United Kingdom
157	California State University, Los Angeles, California
040	Cardiff University, Cardiff, United Kingdom
051	CRN - IOM, Trieste, Italy
187	Czech Academy of Sciences, Praha, Czech Republic
155	Dortmund University, Dortmund, Germany
018	Evangelical Hospital, Institute of Head and Neck Diseases, Vienna, Austria
133	FIEP Europe, Bratislava, Slovakia
224,233	Graduate School of Informatics Kyoto University, Kyoto, Japan
187	Harvard University, Cambridge, Massachusetts
181	Holon Institute of Technology, Holon, Israel
038	Hospital Center Zemun, Zemun, Serbia
082	Humanitas Research Hospital in Milano, Milano, Italy
127	Institut „Jožef Stefan“, Ljubljana, Slovenia
180	Institute of Nuclear Physics, Polish Academy of Sciences, Warsaw, Poland
039	Institute of Oncology, Ljubljana, Slovenia
181	International School for Advanced Studies, Trieste, Italy
229	Kobe University, Kobe, Japan
213	KTH Royal Institute of Technology Stockholm, Stockholm, Sweden
029	Leibniz Institute for Analytical Sciences, Dortmund, Germany

132	Liverpool John Moores University, Liverpool, United Kingdom
133	Masaryk University, Faculty of Education, Brno, Czech Republic
283	Monash University, Melbourne, Australia
175	Pontifical Catholic University of Chile, Santiago, Chile
062	Queen Mary University of London, Centre for Psychiatry, London, United Kingdom
180	Republic of Armenia (NASRA), Yerevan, Republic of Armenia
060	The Johns Hopkins University School of Medicine, Baltimore, Maryland
195	Tokyo Institute of Technology, Tokyo, Japan
085	University Clinic of Pulmonary and Allergic Diseases Golnik, Golnik, Slovenia
057,147	University Clinical Hospital Mostar, Mostar, Bosnia and Herzegovina
043,077	University Medical Centre Ljubljana, Ljubljana, Slovenia
110	University of Alaska, Anchorage, Alaska
095,157	University of Belgrade, Belgrade, Serbia
107,130	University of Belgrade, Faculty of Organizational Sciences, Belgrade, Serbia
159	University of Belgrade, Faculty of Philology, Belgrade, Serbia
051	University of Belgrade, Institute for Application of Nuclear Energy, Belgrade, Serbia
077,090	University of Belgrade, Vinca Institute of Nuclear Sciences, Belgrade, Serbia
179,241	University of California, Santa Barbara, California
239	University of Clermont Auvergne, Clermont - Ferrand, France
159	University of Edinburgh, Edinburgh, United Kingdom
144	University of Ljubljana, Faculty of Economics, Ljubljana, Slovenia
133,146	University of Ljubljana, Faculty of Education, Ljubljana, Slovenia
224	University of Ljubljana, Faculty of Electrical Engineering, Ljubljana, Slovenia
233	University of Ljubljana, Faculty of Mathematics and Physics, Ljubljana, Slovenia
217	University of Ljubljana, Faculty Of Mechanical Engineering, Ljubljana, Slovenia
080	University of Ljubljana, Faculty of Medicine, Ljubljana, Slovenia
040,127	University of Ljubljana, Ljubljana, Slovenia
130	University of Lodz, Faculty of Economics and Sociology, Lodz, Poland
107	University of Maribor, Faculty of Economics and Business, Maribor, Slovenia
157,171	University of Maribor, Maribor, Slovenia
146	University of Milano – Bicocca, Milano, Italy
129	University of Modena and Reggio Emilia, Department of Engineering „Enzo Ferrari“, Modena, Italy
040	University of Naples Federico II, Naples, Italy
102	University of Nova Gorica, Nova Gorica, Slovenia
146	University of Novi Sad, Faculty of Philosophy, Novi Sad, Serbia
040,057	University of Oslo, Oslo, Norway

155	University of Pavia, Pavia, Italy
017	University of South - Eastern Norway, Faculty of Technology, Natural Sciences and Maritime Sciences, Notodden, Norway
042	University of Toronto, Toronto, Canada
237	University of Trieste, Department of Engineering and Architecture, Trieste, Italy
237	University of Trieste, Integrated Ship Design Laboratory, Trieste, Italy
040,229	University of Trieste, Trieste, Italy
146	University of Virginia, Charlottesville, Virginia
224	University of Szeged, Institute of Informatics, Szeged, Hungary
135	Villa Garda Hospital, Department of Eating and Weight Disorders, Garda, Italy
038	Weill Cornell Medicine - Qatar - Cornell University, Doha, Qatar

The data for UNIRI Projects and Subsidies was generated from the project application system. Data for ECOC2020 projects was collected from project applications. All project managers are enabled to review the materials.
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