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New Trends in Sensing - Monitoring – Telediagnosis for Life Sciences

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BOOK OF ABSTRACTS

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PL1. Biosensors based on new generations of (bio)receptors and transducers for environmental monitoring and food quality control

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Continuous detection of target molecules in complex matrices is always considered as a scientific and technological challenge. Conventional methods based on chromatography are very powerful and allow detection of very low concentrations, but they require cumbersome equipment as well as highly qualified personnel. Over the last 30 years biosensors have emerged as attractive alternative analytical tools for the in-situ detection of several targets. These devices are based on the association of a biological molecule, ensuring the specific recognition of the analyte and a transducer, allowing obtaining a measurable signal.

Classical electrochemical biosensors are generally based on enzymes or antibodies immobilized on screen-printed electrodes. They present the advantage of being small, easy to use, inexpensive, and allowing real-time qualitative information about the composition of a sample with minimum preparation. However, biosensors development may be hampered by the availability of bioreceptors for some targets, and by an insufficient sensitivity of transducing techniques.

In this paper we present a range of electrochemical biosensors developed by our team for water and food monitoring, including “new generation” biosensors based on novel affinity reagents such as synthetic receptors - in particular aptamers and molecularly imprinted polymers - in combination with soft immobilisation methods, highly sensitive electrochemical measurement methods and 3D printing technologies for full biosensor cells design. Finally, the advantages of using artificial intelligence to model multi-biosensor responses will be demonstrated.

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PL2. Translational medicine for liver cancer

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Rapid advances in molecular and cellular biology, bioengineering, and bioinformatics significantly benefit drug development, including cancer drugs. Increasing knowledge in biomedical research techniques has become a substantial input, not only in the basic studies but also in the clinical studies for the diagnosis, prognosis, and, more importantly, in the development of potential treatments. However, it is important to notice that cancer is a complex disease with combined perturbations in the genetics, environmental, and risk-associated behaviour. Translational medicine, a multidiscipline concept involving collaborative approaches in basic and clinical studies (from bench to bedside, and vice versa) will accelerate the discovery of new diagnostic, treatments, and prognostic tools to combat the disease.

The presentation will focus on translational medicine for liver cancer. Hepatocellular carcinoma (HCC) is one of the most frequent cancers with a high mortality rate globally. It is caused by various risk factors such as hepatitis virus infections, extensive alcohol and chemical exposure, and obesity-related pathologies and is developed in a long-term period. These multivariable factors consequently reflect in the HCC heterogeneity of the disease, prognostic types, and therapeutic options. In order to discover new HCC biomarkers and to develop new treatments, a translational medicine approach is beneficial. In laboratory practice, the use of a simple in vitro model (e.g. cell line), in vivo animal model (e.g. genetically modified mouse), in silico (e.g. artificial intelligence), and in the end by the result validation in human clinical samples will improve the management of the disease.

1. (Tele)diagnosis, (Tele)monitoring and (Tele)management in Medicine

O.1.1. Enhancing translational research and innovation through Biobanking: Insights from the C3B project

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Biobanks are crucial infrastructures that significantly enhance translational research by facilitating the transfer of research findings into clinical practice and fostering innovation. They serve as a communal resource, benefiting both researchers and the public. Despite their importance, biobanks in Europe face numerous challenges, such as varying legal requirements across countries, lack of coordination among oversight bodies and policymakers, and the absence of flexible, binding instruments for seamless connectivity and data exchange.

The C3B project has addressed these issues by transforming region into a conducive environment for developing a biobanking system. This project promotes common healthcare solutions by encouraging public authorities to initiate cross-border collaborations in biobanking. It aims to develop a harmonized, "local" biobanking system, integrating local biobanks through a shared IT management platform, thus ensuring a sustainable and community-focused service.

The project enhances the capacity of public authorities, citizens, hospitals, and research centers in cooperation and governance in biobanking. A significant focus is on public engagement strategies, recognizing the reliance of biobanks on public support. A pilot action was conducted to assess the feasibility of integrating the biobanking system into existing clinical management systems and the virtual platform connecting biobanks, ensuring the project's long-term success and sustainability.

O.1.3. Large amounts of hydrogen cyanide released in different fire scenarios- case reports from a prospective study on the role of hydrogen cyanide in producing death

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The main source of hydrogen cyanide production is represented by fires in homes or in closed public spaces. Elevated hydrogen cyanide concentrations in blood samples indicate that the victims have survived several minutes under fire conditions and inhaled a significant amount of smoke, which suggests the role of this toxicity in producing death in fire victims.
This prospective study aimed to investigate the role of hydrogen cyanide in causing death in fire victims. A spectrophotometric analytical method, proposed by Tabian et al. (2022), was used to measure the reaction of cyanide ions with ninhydrin, to determine the concentration of hydrogen cyanide in the blood of fire victims, including thiocyanate, the metabolised form.
A total of 37 death cases in different fire scenarios were included. We observed that 82.36% of the cases with toxic HCN concentrations (HCN≥0.5 µg /mL) were deaths produced in indoor fires. Of these, we selected 4 cases with the highest concentrations of HCN: 3 deaths in prison fires and one in a train car fire. In these fires where mattresses, pillows, bedding, and other polyurethane materials burn, the amount of HCN released is significant.
The concentration of HCN should be measured in fatal confined space fires, especially in fires involving mattresses or upholstery. HCN and other factors contribute to death in different proportions depending on the type of fire and other factors.

O.1.2. Screening of prophylactic nutraceutics toward Parkinson's disease

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Parkinson's disease (PD) is a well-known neurodegenerative condition affecting 7 million people around the world, with numbers expected to double by 2024 due to population aging. Diagnosis is still reached on motor symptoms, appearing when 50-60% of the dopaminergic neurons (DOPAn) in the substantia nigra are already lost. The disease is known to have started decade before and progress almost silent. Only symptomatic therapies are available, and a cure is an unmet need.
A few years ago we identified and demonstrated the determinant role of Tnfα in DOPAn demise. Currently, we are in screening compounds with potential anti-inflammatory activity, selected both by a literature search (Google Scholar, Pub Med, for nutraceutics) and in silico approaches (Opentargets, ChEMBL, Network Analyst, for drug repurposing) by using the slow degenerating in vitro model of SH-SY5Y cells differentiated on DOPAn. Based on the first results, some nutraceutics look able to prevent DOPAn death (co-treatment) at very specific concentrations. These compounds may be suggested for the creation of functionalized foods with the aim of controlling the systemic/CNS pro-inflammatory status actually considered one of the most probable hits in PD.

O.1.4. Telemedicine in palliative care. Interventions, experiences, perceptions of patients diagnosed with cancer receiving outpatient palliative care

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Telemedicine is a technology that has long been studied to help increase access to medical services, especially during the COVID-19 pandemic.
This research aims to identify the interventions that can be provided through telemedicine (TM) consultations versus face-to-face (FF) consultations, their efficacy in terms of changing scores in the physical, pshycho-emotional, social, and spiritual domains, and the level of satisfaction regarding the care given to patients diagnosed with cancer.
Between July 2023, and January 2024, 26 patients newly diagnosed with cancer were randomized in two arms - FF consultations and TM consultations using Zoom and WhatsApp secure platforms. Participants received eight weekly physical, psycho-emotional, social, and spiritual interventions and on-demand consultations according to their needs. Analysis was performed using GraphPad Prism 10.0.3.
23 participants completed the study with an attrition rate of 11.53%, with three deaths in the TM arm. 1190 interventions were performed, 634 in the FF arm and 556 in the TMarm: on the physical domain 350 vs. 282; on the emotional domain, 215 vs. 206; on the social domain 18 for both arms; on the spiritual domain, 51 vs. 50. Higher changing scores were reported on the TM arm, with statistical significance for pain ($p=0.0055$), secretion ($p=0.0001$) and sweating control ($p<0.0001$). Both visits 4 and 8 have high satisfaction scores, comparable in both arms.
Interventions provided through TM have led to higher changing scores than FF consultations, with comparable satisfaction among participants.

O.1.5. Hepatitis viruses diagnostic platforms development

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Despite a highly efficient antiviral treatment or available vaccines, viral hepatitis is still representing a serious global health issue. Hepatitis C Virus (HCV), Hepatitis B Virus (HBV) and Hepatitis D Virus (HDV) (super)infections become chronic evolving to cirrhosis and hepatocellular carcinoma. Thus, WHO set as resolution for 2030 the reduction with 65% of the mortality rate and with 95% the hepatic viruses infection incidence rate. To accomplish that, diagnosis and access to the treatment cascade are to be improved. The reach these targets, screening and viral infection validation at point of care (POC) followed by the treatment cascade initiation will be essential. Lateral flow immunochromatography (LFA) and electrochemical immunosensing rapid diagnosis tests (RDTs) have a great potential to allow screening/confirmation at POC for hepatitis viruses infections. While for HCV and HBV, LFA RDTs for screening at POC are available, HDV infection can not be detected at POC. Hepatitis viruses infections are further confirmed by nucleic acid testing (NAT) at central laboratories which causes delays in the treatment cascade. To solve these gaps in the viral hepatitis diagnosis, we prototyped a dual LFA test for HBV/HDV screening at POC and an electrochemical sensor for HCV infection validation at POC through HCV core detection. Viral antigens were designed and produced in house. LFA strips were assembled and tested using sera from patients coinfected with HBV/HDV. The LFA strip prototype reached 100% sensitivity and 80% specificity. To detect HCV core antigen, an electrochemical immunosensor was assembled on gold surface printed electrodes (SPEs) and cyclic voltammetry was used to detect up to 10pg/ml (500 fM) of the viral antigen in patient sera which is the upper clinical relevant analyte limit.
LFA HBV/HDV dual rapid test and the immunosensor for HCV core antigen fill a gap in the hepatitis viruses infection screening/confirmation tool box. Both prototypes will be further developed into POC RDTs.

O.1.6. Diet enzymatic influence on gastrointestinal medication metabolism

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Human cytochrome P450 plays crucial roles in drug detoxification, metabolism at the cellular level, and homeostasis balance. CYP enzymes are responsible for human oxidative metabolism and more than 40% of the overall clearance of most used medication in clinical practice. The impact of CYP enzymes also influences drug responses by affecting drug action, safety, bioavailability, and lack of response to treatment in standard doses. The diet could influence the CYP enzymatic activity, acting as an inductor or inhibitor factor, thus affecting the expected therapeutic results.

O.1.7. Medical education simulation-based learning in pediatrics

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Simulation training is a student/learner-centered, participatory/active, knowledge transfer-focused educational approach which enables students to apply/develop knowledge and practical/ professional skills to/from real-world problems/experiences in a scenario-based environment. We explored the evidence on paediatrics simulation-based learning to give an overview of the characteristics of studies that used this method of teaching.
The articles published in the Web of Sciences database between 2000 and May 2024 were considered. The findings show insights regarding the specializations/programs where this method was used, the skills/competencies/knowledge that can be achieved/learned/evaluated, and the challenges/obstacles/ opportunities / new topics for future/innovative pediatric medical education.

O.1.8. New trends on sensing and monitoring malnutrition at cancer patients

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More than 40% of cancer patients are malnourished at the time of diagnosis and the frequency is higher during the specific treatment interventions, with risk for complications, early death, or reduced treatment outcomes. There are no concrete gold standards or protocols for nutritional screening, monitoring, or a complete nutritional evaluation; each country has to establish their own based on their medical system and culture.

Screening tools are the first steps in nutritional healthcare because they can detect nutritional risks, predict clinical results, or both. Favorite instruments to be used in oncological clinics, recommended also by ESPEN, are Nutritional Risk Screening Score 2002 for hospitals, Malnutrition Universal Screening Tool for the community, and Mini Nutritional item and Subjective Global Assessment tool for seniors.

The main steps for nutritional sensing and monitoring cancer patients are screening, evaluation, monitoring, communication, and audit. Each part has specific protocols and outcomes and is personalized to the patient's age, type of cancer, staging, localization, symptoms, co-morbidities, and nutritional status. These patients also need proper and personalized recommendations about food safety and food supplement usage.

Malnutrition screening is the identification process for malnourished patients or patients at risk for malnutrition. It's an easy and simple process to use. It can be applied to all patients who are checked in the hospitals following cancer treatment. It is an important tool that will ensure a better quality of life and improved treatment intervention results for patients with a balanced nutritional status.

O.1.9.Genetic counselling for cancer disease in the era of personal genomics

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Hereditary cancer syndromes (HCS) account for nearly 10% of cancers, although they are often underdiagnosed. The rapid development of genetic technologies and the use of genetic information in clinical decision-making require increased involvement of surgeons, oncologists and other health professionals in appropriate referral of patients to genetic services for genetic counselling and testing.
Genetic testing and counselling for HCS can improve outcomes for patients and their at-risk relatives by informing cancer surveillance, prevention, screening strategies and treatment, as well as reproductive decision-making.
The studies published in Pubmed in the last 5 years, identifiable through the keywords: "Genetic Counselling" AND "Hereditary Cancer" were examined with the aim of verifying the perception of health professionals, patients and family members at risk regarding the usefulness of genetic counseling in the oncogenetic field and to recover models/protocols that are easy to apply on a large scale by non-geneticists as first screening.
The 53 records found contain useful suggestions for identifying specific hereditary cancer syndromes. Two papers propose a specific questionnaire to assess familial risk by direct patient administration. These data, together with the knowledge and concerns of health professionals, are proposed for discussion.
The limited data available in the literature on how to raise awareness among patients, family members at risk, and health professionals of the need to detect genetically determined cancers underscores the need to develop intervention models to be tested in individual territories, "tailored" to the demographic, cultural, and epidemiological characteristics of those territories.

O.1.10. Biochemical status in a cohort of children with cystic fibrosis

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Cystic fibrosis (CF) is a recessively inherited disorder caused by genetic mutations in the CF transmembrane conductance regulator (CFTR) gene. It is a multisystem condition that primarily induces abnormal mucus accumulation in the respiratory system and obstructs the intrapancreatic common bile duct, reducing digestive enzymes' delivery to the intestines. Thus, maldigestion, malabsorption, and recurrent airways bacterial infections characterize CF patients. Clinical monitoring of the health status of patients with CF is mandatory for increasing the patients' lifespan.

To investigate the feasibility of clinically monitoring the quality of life (QL) of paediatric patients with CF and to correlate biochemical parameters with clinical manifestations, in our study, we evaluated the inflammatory status induced by CF, medication and pulmonary bacterial infection at 52 paediatric patients that met the diagnostic criteria for CF. The collected samples (blood and hypo-pharyngeal exudate, faeces) were analysed through clinical biochemistry, haematology and microbiology tests.

Paediatric patients exhibited laboratory values outside the normal range with significant variability of values regardless of age. Hence, the children investigated in the present study displayed vitamin (A and D) and iron deficiencies as well as alterations in the lipid status. Note that infants and children are a unique population segment, with a much more active and continuously changing metabolism than adults. Therefore, it is necessary to study these patients further to predict the course of their disease and come up with a treatment scheme which can fulfil the needs of each patient.).

O.1.11. Alcohol and other psychoactive substance abuse- a retrospective study on mechanical asphyxia in a Legal Medicine Center in Romania

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The main source of hydrogen cyanide production is represented by fires in homes or in closed public spaces. Elevated hydrogen cyanide concentrations in blood samples indicate that the victims have survived several minutes under fire conditions and inhaled a significant amount of smoke, which suggests the role of this toxicity in producing death in fire victims.
This prospective study aimed to investigate the role of hydrogen cyanide in causing death in fire victims. A spectrophotometric analytical method, proposed by Tabian et al. (2022), was used to measure the reaction of cyanide ions with ninhydrin, to determine the concentration of hydrogen cyanide in the blood of fire victims, including thiocyanate, the metabolised form.
A total of 37 cases of death in different fire scenarios were included. We observed that 82.36% of the cases with toxic HCN concentrations (HCN≥0.5 μg/ mL) were deaths produced in indoor fires. Of these, we selected 4 cases with the highest concentrations of HCN: 3 deaths in prison fires and one in a train car fire. In these fires where mattresses, pillows, bedding and other polyurethane materials burn, the amount of HCN released is significant.
The concentration of HCN should be measured in confined space fire fatalities, especially in fires involving mattresses or upholstery. HCN and other factors contribute to death in different proportions depending on the type of fire and other factors.

O.1.12. The potential role of hypoxanthine plasma concentration as a biomarker for metabolic dysfunction-associated steatohepatitis

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Plasma hypoxanthine (HypX) measured by SERS technology was reported as a putative marker of metabolic dysfunction-associated steatotic liver disease (MASLD).
Characterization of HypX pool changes in blood, liver, and Visceral Adipose Tissue (VAT) by evaluating differences in the main genes/enzymes involved in purine catabolism.
HypX concentration was quantified in plasma, liver, and VAT tissues in 132 MASLD biopsy-proven subjects stratified in fatty liver (MASL) and steatohepatitis (MASH) using a fluorometric enzymatic method and also using HPLC in a subset of samples (n=40). Several clinical-biochemical-histological parameters were correlated with plasma and intracellular HypX levels. Expression for purine catabolism genes and transporter genes by qPCR and xanthine oxidoreductase (XDH) activity analysis was also performed.
Plasma HypX was reduced in MASH patients (2.0 [IQR 1.16- 3.0] in MASL vs. 0.8 [0.5-1.9] in MASH, p-value <0.0001) according to both the enzymatic and HPLC. Plasma HypX receiver operating characteristics curve analysis demonstrated an accuracy of 0.75 for MASH diagnosis. Significant correlations among HypX levels and lobular inflammation (rho= - 0.23; p=0.010), ballooning (rho= -0.48; p<0.0001), fibrosis (rho= -0.33; p=0.0006), GGT (rho=0.18; p=0.04), and triglycerides (rho= 0.22; p=0.017) were observed. Gene expression changes were only significant in VAT of MASH patients (XDH: 18.0 ± 13.2 MASL vs 1.5 ± 9.0 MASH; PNP: 0.3 ± 0.6 MASL vs. 1.3 ± 0.9 MASH; HPRT: 11.4 ± 13.7 MASL vs. 1.8 ± 6.2 MASH, SLC43A3; 0.59±0.46 MASL vs 0.13±0.19 MASH; SLC29A2 0.67±0.86 MASL vs 0.14±0.43 MASH all p<0.05).
Plasma hypoxanthine could be used as a biomarker of MASH. Our data indicate that VAT might contribute to the hypoxanthine pool changes observed in subjects with MASLD.

O.1.13. Exposure to microplastics and its consequences on health

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Currently, plastics are crucial in producing various products such as packaging, construction materials, textiles, consumer goods, transportation components, electrical devices, and industrial machinery. However, in response to environmental concerns regarding pollution and post-consumer waste, there's a growing shift towards substituting plastics with recycled and biodegradable alternatives. Improper reuse or recycling of products can lead to the generation of micro- and nanoplastic particles.
In this review, we initially provided a concise overview of the environmental pollution caused by micro- and nanoplastic particles (MNPs), subsequently exploring their potential health impacts on our DNA, reproductive system, endocrine function, weight gain, insulin sensitivity, and possibly cancer. In addition, our review states that in recent studies, there were MNPs found in the Danube River, which are carried in the Black Sea, concluding that the population of Romania is at risk of developing diseases and health issues if the problem is not addressed in the near future.

O.1.14. Metabolic syndrome in childhood

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Metabolic syndrome, a clinical-paraclinical concept initially assimilated only with adult pathology, is more and more common in pediatric age. The objective of the study was to find the incidence of metabolic syndrome in pediatric patients with high blood pressure.
Prospective study in subjects admitted to Children's Clinical Hospital Brasov from January 2022 to January 2024 with elevated blood pressure - TA. The group comprised 72 patients, boys and girls aged between 10 and 17.11 years. The study protocol includes incidence of anamnesis (birth weight, hereditary family history - AHC: hypertension, obesity, dyslipidemia and type II diabetes), body mass index - BMI, laboratory tests (blood glucose, total cholesterol, triglyceride, LDL-cholesterol, HDL-cholesterol).
Epidemiological characteristics: 55.55% boys and 45.45% girls, 80.55% urban and 19.45% rural; AHC present at 70.83%; clinical characters: normo-ponderal 13.88%, overweight 19.44% and obese 66.66%; biochemical characteristics: glycaemia ≥ 120 mg/dL 16.66%, uric acid ≥ 50.0%, total cholesterol ≥ percentile 95th 58.33%, triglycerides ≥ 95.4% LDL-cholesterol ≥ 44.44%, HDL-cholesterol ≤ 25th percentile 52.77%. The mean TA was positively correlated with the increase in BMI, with elevated total cholesterol, LDL-cholesterol and uric acid, and the HDL-cholesterol junction.
Conclusions: The trend of aggression of cardiovascular risk factors has been observed since the second decade of life in children with elevated TA levels, the metabolic syndrome being already well-defined in them and reporting severe cardiovascular complications during the young adult.

O.1.15. Study on the resistance patterns and phenotypes of uropathogenic Gram-negative bacteria

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Uro-pathogenic Gram-negative bacteria account for a vast number of infections worldwide. Urinary tract infections affect men and women alike, the latter being more susceptible. Not only are women more prone to present clinical manifestations, but they are also more likely to develop short- and long-term complications. Gram-negative bacilli such as E. coli, Klebsiella spp. Proteus spp. and Pseudomonas aeruginosa are usually responsible for UTIs in most patients, but some species of Staphylococcus and Streptococcus have also been deemed causative agents.

The frequency with which urinary tract infections appear in patients has led to the extensive use of antibiotics and the selection of drug-resistant pathogens. In the last decade, UTIs have become harder to manage due to limited treatment alternatives, growing resistance levels, and multiple comorbidities patients present with.

This study aims to investigate the resistance patterns to the most used anti-microbial agents in a hospital setting. Urine samples from patients admitted to the Municipal Emergency Hospital Brasov were collected and analyzed using the MALDI-ToF technology for bacterial identification. For antibiotic susceptibility testing, the Kirby-Bauer disc diffusion method was used alongside minimal inhibitory concentration (MIC) determination with the help of the semi-automatic analyzer Vitek 2 Compact.

The study is important for showcasing the need to continuously monitor resistance patterns and develop more effective treatment strategies for UTI management. It also emphasizes the need for better antibiotic stewardship to win the combat against multidrug-resistant uropathogens in clinical settings.

O.1.16. Healthcare-associated infections – a reality that can be prevented through a correct early diagnosis

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Infections acquired by patients during hospitalization or the stay in another type of healthcare facility and that were absent at the time of admission represent a major global public health problem. These infections increase rates of morbidity, mortality, length of hospital stay and costs of health services.
Highlighting the importance of using molecular biology techniques in specific diagnosis to prevent the occurrence of viral infections associated with healthcare.
We present 2 clinical cases, patients admitted to the Clinical Hospital of Pneumophthisiology and Infectious Diseases in Brașov in 2024 with the diagnosis of measles, asymptomatic for other acute transmissible infections. Rapid tests for the diagnosis of other viral infections, performed at admission, were negative.
Evaluation of the patients by molecular biology techniques (RT-PCR) for possible simultaneous infections allowed the positive diagnosis of coinfection with the influenza A virus in the first case and with SARS-CoV-2 in the second case. In this context, the specific therapies were applied and the patients were isolated in separate rooms from other measles patients, in order to prevent the occurrence of healthcare-associated infections.
The use of molecular biology techniques allows the appropriate diagnosis and treatment of some viral infections and the early application of measures to prevent healthcare-associated infections.

O.1.17. Gonadotropins in second and third activation of the hypothalamic-pituitary-gonadal axis: statistical study

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Gonadotropic hormones (with stimulating action on the gonads) are represented by Follicle Stimulating Hormone (FSH) and Luteinizing Hormone (LH). The hypothalamic-pituitary-gonadal axis, as reflected in the name, includes 3 levels of secretion, with the aim of plasma release of sex steroid hormones. T
he plasma level of gonadotropin hormones varies with age and in women differs according to the time of the menstrual cycle. If the first transient pubertal period occurs in utero between the 10th and 24th week of gestation, minipuberty describes the transient activity specific to the activation of the HPG axis during the first 6 months of life in boys and the first 2 years in girls. Increases in FSH/LH and estradiol/testosterone levels are evident. Puberty is a period in which the transition to the maturation of the reproductive capacity of the adult takes place, as a result of the reactivation of the HPG axis. The analyzed serum samples were obtained by collecting them in a closed system in coagulant-free blood collection tubes.The analysis of the samples was done with the Automatic Vidas PC, using appropriate kits for this analyzer. The assay principle is an enzyme immunoassay method with a final fluorescent detection (ELFA) to 450 nm.
The results obtained for FSH and LH were grouped for both sexes in the age categories 2-6 months, 6 months-2 years, 8-12 years and 12-15 years. The average, median and standard deviation were calculated.

O.1.18. Beyond the basics: Mastering AI prompts for health

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Artificial intelligence is transforming healthcare, but its potential can only be fully realized through mastering prompt engineering. This presentation equips health educators, professionals and researchers with advanced techniques to create effective prompts tailored to the complexities of the healthcare domain. By exploring best practices, real-world case studies, and overcoming common challenges, attendees will gain the skills to optimize AI systems for diagnosis, treatment, and research. Participants will learn key strategies to keep mastering prompt engineering to enhance patient care, accelerate discoveries, and prepare for the future of healthcare.

O.1.19. The impact of health status on economic output: from general strategy to social responsibility

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Limited economic resources influence health, both through accessibility to the health system and by influencing work capacity. At the same time, there is a relationship between health and economic status. The impact of migrants' health on economic development is also on the agenda of many nations. Migrants are often seen as super-entrepreneurs, which puts a lot of pressure on them and can affect their health.

Migration is a general phenomenon, which requires the development of measures including in the field of health. The vision of migrants' needs involving aspects related to access to the labour market must be complemented by the dynamics of health – especially mental health, access to the labour market – integration into society.

We analysed articles from the main databases (Google Scholar, PubMed, Scopus) covering the last 10 years on mental health, entrepreneurship, migrants, and measures and strategies to increase social responsibility towards migrants.

From the point of view of public health, the main dilemmas that the development of a social strategy should take into account in the case of migrants, so that the state of health is a positive factor in the economic development of society and in their well-being are:

Assessing the psychological impact but also on the health status that immigration has on a person

Inclusion of immigrants in entrepreneurial education programs, which also contain health education programs especially for topics such as stress or burnout and information on how the health systems in the country where immigration has taken place

Development of social cohesion mechanisms

Reducing discrimination in the way migrants are perceived and reducing negative stereotypes

Understanding the role of the health system in integrating migrants and developing prevention strategies, as well as creating inclusion and integration mechanisms based on mentoring and networking, are essential factors in the sustainable development of society.

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O.1.20. Enhancing chronic disease management through telemonitoring

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Utilizing technology to monitor patients' health remotely and enhance results, telemonitoring is a revolutionary technique to managing chronic diseases. Continuous collection and transmission of patient data, including vital signs, physical activity, and medication adherence, is achieved via the integration of digital health solutions, such as mobile apps and wearable devices.

Telemonitoring allows for real-time monitoring, which helps identify any health concerns early on. This, in turn, allows for rapid medical intervention and individualized modifications to therapy. Studies suggest that telemonitoring can substantially reduce hospital readmissions, increase the quality of life for individuals with chronic conditions such as diabetes, hypertension, and heart disease, and enhance patient self-management. More informed and effective clinical decision-making is ensured with telemonitoring since it improves communication between patients and healthcare professionals. Telemonitoring also addresses disparities in healthcare access, particularly for patients in remote or underserved areas, due to its scalability and accessibility. However, there are also obstacles that need to be overcome, such as worries about data privacy, difficulties in adopting new technologies, and the need for defined protocols. To make healthcare systems that are more sustainable and focused on patients a reality, it is essential that research and development into telemonitoring continue at a rapid pace so that it can be best used to treat chronic diseases.

O.1.21. Discharging complex patients from the hospital

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Patients who are medically ready to be transferred outside of an acute care setting but are unable to do so due to complex social and medical needs, end up requiring a focus multidisciplinary approach to eliminate discharge barriers. The population of patients with these complex needs is growing at Duke, and these patients are spread among our many service lines without a standard handoff process or consistent approach to solving needs. This patient population would benefit from discharge planning that mobilizes resources to ensure care is not fragmented in the early days of hospital stay. Once medical stability is achieved and discharge barriers are well defined, a systematic review of the care plan and progress is needed to ensure adjustments are made if indicated.

Across all Duke facilities, efforts have been made to identify patient's needs early and have led to implementation of strong multi-disciplinary rounding. Specialty focused service lines, and case managers have all been successful in reducing length of stay and solving discharge roadblocks. Duke University Hospital Medicine has multiple interventions to address early discharge and ideally shorten length of stay.

There are ongoing projects looking for the most effective and safe avenues to not only identify these patient's early in their hospital stay but also to ensure that once they are discharge they are rehabilitated and flagged for outpatient needs proprely to prevent redmission to hospitals.

O.1.22. Pioneering a new era in biomedical research: Exploring 3D biology solutions with Molecular Devices

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Discover how Molecular Devices' latest advancements in 2D and 3D cell culture, and screening tools are empowering researchers.
This talk will highlight how Molecular Devices' cutting-edge technologies enhance research accuracy, drive breakthroughs, and support scientists in transforming 2D and 3D biology studies. Join us to see how these tools help you, the researchers.

O.1.23. The role of polyunsaturated fatty acids in reducing of oxidative stress, inflammation and endothelial dysfunction in acute coronary syndromes

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Oxidative stress, inflammation and endothelial dysfunction are important processes in atherosclerosis and acute coronary syndrome (ACS). Atherosclerosis and ACS burden can be reduced through bioactive compounds such as Polyunsaturated Fatty Acids (PUFAs) which are natural molecules with great potential to reduce inflammation, LDL-c, and oxidative stress.
The aim is to evaluate the impact of PUFAs on oxidative stress, inflammation and endothelial dysfunction in ACS. MATERIAL AND 1140 patients were admitted in Clinic County Emergency Hospital Brasov with ACS, enrolled consecutively in a prospective study and divided in 4 groups in relation with type of ACS and addition of PUFAs to optimal medical therapy (OMT). It evaluated the impact of PUFAs on top of OMT on oxidative stress (total antioxidant status (TAS), anti-ox-LDL antibodies, Ig G anti-myeloperoxidase antibodies), inflammation (C-reactive protein, fibrinogen) and endothelial dysfunction (flow-mediated dilatation, von Willebrand factor activity, at 6 months of follow up.
In ST elevation ACS (ST-ACS) and non-ST elevation ACS (NST-ACS), PUFAs added to OMT significantly decreased at 6 months the level of oxidative stress biomarkers- total antioxidant status anti-ox-LDL antibodies ($p<0.05$), with no effect on Ig G anti-myeloperoxidase antibodies. In the same time, PUFAs significantly reduced inflammation biomarkers – C-reactive protein and fibrinogen ($p<0.05$) and endothelial dysfunction parameters - flow mediated dilatation, von Willebrand factor activity ($p<0.05$) , at 6 months of follow up. In NST-ACS and ST-ACS patients, PUFAs added to OMT was followed by significantly reduction of oxidative stress, inflammation and endothelial dysfunction at 6 months of follow up.

O.1.24. Biochemical aspects in bronchiolitis wits RSV in the pediatric population

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Bronchiolitis, primarily caused by respiratory syncytial virus (RSV), is a significant respiratory illness in the pediatric population, especially among infants. Biochemically, RSV infection triggers an inflammatory response in the small airways, leading to epithelial cell damage, mucus production, and airway obstruction. This response is characterized by the release of pro-inflammatory cytokines, such as interleukin-6 (IL-6) and tumor necrosis factor-alpha (TNF-α), which exacerbate the inflammatory process. Additionally, RSV induces oxidative stress and an imbalance in antioxidant enzymes, further contributing to airway inflammation and lung tissue injury. These biochemical alterations play a crucial role in the pathophysiology of bronchiolitis, influencing the severity and progression of the disease.

O.1.25. Biochemical changes in febrile seizures

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Febrile seizures (FS) are common in the pediatric population, typically occurring in response to a rapid increase in body temperature. Biochemically, these seizures are associated with alterations in neurotransmitter systems, including glutamate and gamma-aminobutyric acid (GABA). Increased glutamatergic activity, through the N-methyl-D-aspartate (NMDA) receptors, can lead to excitotoxicity, which may contribute to seizure onset. Concurrently, a disruption in GABAergic inhibition may exacerbate neuronal excitability. Additionally, inflammatory cytokines such as interleukin-1β (IL-1β) and tumor necrosis factor-alpha (TNF-α) are elevated during febrile episodes, potentially influencing the brain's excitability and seizure susceptibility. Alterations in oxidative stress and neuronal calcium levels have also been implicated, further affecting cellular function and contributing to the pathophysiology of febrile seizures.

O.1.26. Biochemical findings in rheumatic diseases

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Rheumatic musculoskeletal diseases involve an extended spectrum of afflictions that associate multiple tissue types, affecting the musculoskeletal system the most.
This retrospective, observational, longitudinal study analyses the biochemical changes in Romanian patients with rheumatic diseases, particularly those related to lipid profiles, serum C-reactive protein (CRP) levels, and uric acid levels, and correlates these changes with disease activity. The goal is to open new avenues in managing and treating these conditions and their associated comorbidities, which significantly impact human health.
The cohort of 116 patients included in this study consists 77 patients (66%) diagnosed with an autoimmune rheumatic disease, 16 patients (14%) with a metabolic rheumatic disease and 23 patients (20%) with a degenerative rheumatic disease. The data were obtained by analysing patient observation sheets and discharge summaries using the hospital's EasyMedical information system.
Regarding serum CRP, significantly higher values are observed in patients with autoimmune rheumatic diseases compared to those with degenerative rheumatic diseases. The analysis of serum CRP levels in RA patients included in the study showed that serum CRP levels increase concurrently with rising disease activity, as indicated by the DAS28-CRP score. CRP levels in patients diagnosed with SLE included in the study, these did not correlate with disease activity.
A higher level of total serum cholesterol and LDL was observed in patients with degenerative rheumatic diseases. These serum HDL levels were lowest in patients with autoimmune rheumatic diseases. Serum uric acid levels in patients with RA included in the study could not establish a relationship between uric acid levels and disease activity. The analysis of serum uric acid levels in patients diagnosed with SLE, elevated levels were observed in only one patient, in contrast to literature data, which have shown elevated levels in 46% of patients. Additionally, no correlation could be established between serum uric acid levels and disease activity (measured by the SELENA-SLEDAI score).
CRP in patients diagnosed with autoimmune rheumatic diseases in Romania is significantly higher compared to that in patients with degenerative rheumatic diseases and increases concurrently with the activity of the disease, as measured by the DAS28-CRP score. The serum level of CRP in patients with SLE in Romania does not correlate with the extent and severity of inflammation. Patients with degenerative rheumatic diseases have significantly higher levels of total serum cholesterol and LDL.
RA patients in Romania do not show significant changes in total serum cholesterol levels based on disease activity, but they do experience a decrease in serum HDL levels concurrent with increased disease activity. SLE patients in Romania have a normal lipid profile, even if they are not on hypolipidemic medication. In patients with gout in Romania, total serum cholesterol, LDL, and TGL levels are within normal limits, but these patients have low HDL levels.

O.1.27. Biochemical aspects in acute voluntary intoxication with ethyl alcohol among adolescents

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Acute voluntary intoxication with ethyl alcohol among adolescents leads to several biochemical changes that affect the central nervous system and peripheral organs. Ethanol, upon ingestion, is metabolized primarily by the liver through alcohol dehydrogenase (ADH) into acetaldehyde, a toxic intermediate, which is then further metabolized by aldehyde dehydrogenase (ALDH) into acetic acid. The accumulation of acetaldehyde contributes to the acute toxic effects, including nausea, vomiting, and altered mental status. Ethanol also influences neurotransmitter systems, particularly by enhancing gamma-aminobutyric acid (GABA)-mediated inhibition and inhibiting N-methyl-D-aspartate (NMDA)-mediated excitatory signaling, leading to the depressant effects on the brain. Additionally, ethanol consumption increases the production of reactive oxygen species (ROS), resulting in oxidative stress and potential liver and neuronal damage. In adolescents, whose liver enzymes are still maturing, these biochemical effects may be more pronounced, increasing the vulnerability to alcohol's toxic effects.

P.1.1.Health effects and safety risks associated with edible insects: insights from Portugal and Romania

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Edible insects (EI) are consumed in many parts of the world since immemorial times, while in other regions some consumers fell some discomfort or neophobia towards insects. However, they are a good source of animal proteins of high quality and other bioactive components with potential beneficial effects for the human health.
The objective of this work was to compare the level of information of consumers in two European countries about the health effects of EI, including those beneficial and some possible hazards.
This descriptive transversal study was carried out by questionnaire survey in different countries, by online tools. For this specific study, data were collected in Portugal and Romania, only to adult citizens. Data were treated using SPSS statistical software.
The results showed significant differences between Romanian and Portuguese participants about most of the items included in the questionnaire. Specifically, it was found that the Portuguese were more informed about the existence of regulations to guarantee food safety of EI, that EI collected from the wild can be contaminated with pesticide residues, while the Romanian were more informed about the use of EI in traditional medicine and their approval in some countries as therapeutics, also about the possibility of EI being infected by pathogens or parasites, and about them being potential sources of allergens or containing aflatoxins.
This work revealed that there is a significant differences between the knowledge regarding health effects of EI, according to geographical region, even among European countries.

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P.1.2. Violence against older people during the COVID-19 pandemic - a retrospective study conducted in Brasov County Legal Medicine Service

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The COVID-19 pandemic amplified the risk of older people suffering systemic abuse and neglect. As COVID-19 had a big impact on lifestyle and economic development, people had to live with potential aggressors and faced all forms of violence.
The purpose of this study is to evaluate the prevalence of abuse among persons older than 61 years during the COVID-19 pandemic.
A retrospective study was conducted between January 2020 and December 2022 at Brașov County Legal Medicine Service. A total of 305 cases of aggression suffered by people older than 61 years were selected.
Most cases were registered in 2020, 130 subjects, of which 54.61% were women. Domestic violence was reported: 15 women were assaulted by their husbands, and 4 men were assaulted by their children. In 2021, 126 cases were reported, with 53.17% being men. In 2022, a major decrease was observed, with 49 cases. In most cases, the abuser was a close person, the child or current or ex-partner. At the beginning of the pandemic, one person in five experienced a form of abuse, a 35% increase compared to the data reported in the literature before the pandemic. The decrease in the number of cases in 2022 can be explained by the cancellation of restrictions.
This study highlights the phenomenon of aggression towards the elderly, which has seen an increase during the restrictions imposed by the COVID-19 pandemic, with a slight majority of female victims.

2. New Trends in Nutritional Sciences and Food Control

O.2.1. Characteristics of enrichment of fresh pasta with bee drone brood flour

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The fortification of staple food is one of the goals of modern technologies. Edible insects are considered a rich source of valuable nutrients and health-related compounds.
Preparation of pasta replacing wheat semolina flour with drone brood flours (F), rich in protein (27-38%), was tested.
DF was obtained by the cold (CE) and hot (HE) extraction processes. After several trials, it was possible to incorporate 10% DF-CE, and 20% DF-HE. Pastas were evaluated in terms of their technological characteristics (optimum cooking time (OCT), cooking losses, swelling index), physical characteristics (colour and texture), chemical characteristics (nutritional composition) and sensory characteristics, and compared with a control pasta (0% DF).
The addition of DF increased the OCT, cooking loss and swelling index. The water absorption increased in the case of 10% DF-CE pasta. The incorporation of DF-CE caused a darker product, however, the incorporation of DF-CE resulted in a slightly lighter product, compared with the control sample. In general, the addition of DF led to an increase in the hardness of pasta, particularly in the 20% DF-HE samples. Moreover, pasta with added DF had a higher protein and ash content, thus increasing its nutritional quality. Sensorially, the DF pasta had an overall appreciation and a preferential purchase intention by the tasters, standing out in terms of the intensity of colour and aroma compared to the control pasta.
DF is a promising ingredient in pasta production, contributing to human health and at the same time promoting economic returns.

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O.2.2. Exploring phenolic compound extraction, antioxidant activity and assessing acute and chronic toxicity of Arbutus Unedo L. (strawberry tree) for dentary applications

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The industrial processing of certain fruits inevitably generates significant waste by-products. These by-products contain substantial amounts of bioactive compounds, particularly phenolic compounds renowned for their antioxidant properties. Aqueous extracts containing phenolic compounds offer various oral health benefits, including preventing dental caries, combating periodontal diseases, accelerating oral wound healing, promoting gum health, and improving oral hygiene. This study investigates the effects of different extraction conditions on phenolic compound recovery, antioxidant activity, and cytotoxicity from Arbutus unedo Linnaeus bark, focusing on its potential utility in dental applications.

The inner (CIM) and outer (CEM) bark of the *Arbutus unedo L.* samples underwent milling and sieving to obtain a targeted fraction (<80 mesh), which underwent extraction via simple distillation utilizing various solvents (ethanol: water mixtures). Pre-hydrolysis experimentation was conducted to optimize temperature (150 and 170°C) and duration (30 to 180 minutes). Total phenolic compounds and antioxidant activity were quantified using spectroscopic methods, while cytotoxicity was assessed using the Vero cell line.

The results indicate that the employed extraction processes efficiently extracted phenolic compounds, with optimal extraction achieved at 170°C. Ethanol extraction yielded concentrations of 2210.0 and 1011.3 mg/L for CIM and CEM samples, respectively. Notably, both CIM and CEM samples exhibited significant antioxidant activity, measured at 217.73 and 210.20 µmol Trolox/g extract, respectively. Moreover, cytotoxicity studies confirmed the safety of the extract for clinical applications. These findings highlight the potential of the investigated extraction methods for obtaining phenolic compounds with significant antioxidant properties, suggesting their promising application in various industries and oral health contexts.

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O.2.3. Valorisation of Vitis vinifera L. grape pomace: phenolic profile, antioxidant capacity, and inhibitory potential on glucose metabolism enzymes

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The wine sector generates significant by-products, with grape pomace being one of the most plentiful. Traditionally used in distillates, fertilizers, and animal feed, grape pomace is recognized for its nutritional benefits and potential health advantages. Modern circular economy models aim to extend product lifecycles and make better use of food waste and by-products. This shift not only maximizes the value extracted from grape pomace but also promotes sustainability and environmental responsibility within the wine industry, transforming waste into valuable resources for different applications.

This study aimed to compare differences *in vitro* methods to evaluate the phenolic profile and antioxidant capacity of grape pomace from various *Vitis vinifera* L. varieties, and to assess their impact on enzymes involved in glucose metabolism and glycemia regulation.

Methods included Folin-Ciocalteu assay for total polyphenol content, differential pH test for total anthocyanin content, DPPH, FRAP and HPSA assay for antioxidant activity. The inhibitory effects on dipeptidyl peptidase IV (DPP-IV), pancreatic alpha-amylase, and alpha-glucosidase were also evaluated.

The findings shows that spectrophotometric methods provided valuable insights into the phenolic composition of grape pomace, showing strong correlations with antioxidant activity. Grape pomace, particularly when containing seeds, proved to be a rich source of polyphenols, exhibiting substantial antioxidant properties and potential to inhibit enzymes involved in postprandial blood sugar regulation. These findings suggest that winemaking by-products such as grape pomace could be valuable sources of bioactive compounds, useful for dietary supplements and functional products, then supporting sustainable practices within wine industry.

O.2.4. Phenol pattern and health benefits of dealcoholized and low-alcohol wines

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The growing interest in more healthy habits has increased the consumers' demand for non-alcoholic beverages, including wine. Consequently, this market has notably grown, reaching about US$ 2 billion in 2021. In 2021, the EU introduced the categories of dealcoholized and partial dealcoholized wines (EC Regulation 2117/2021). These products can be obtained using different techniques, applied in different steps of winemaking. Until now, limited research has been performed to evaluate the impact of dealcoholization processes on quality and chemical aspects of wine.

This study aims at reviewing data form the scientific literature on the most significant changes occurring after different dealcoholization processes, with particular attention to phenolic composition and the impact on health.

The literature search was performed using the most important scientific databases. The keywords used were "wine" in combination with "dealcoholization", "dealcoholized", "low alcohol", zero "alcohol", "alcohol-free" "ethanol removal", "phenolic composition" "health". Alcoholic beverages different from wine were excluded.

From the literature search, 53 papers were retrieved. Nanofiltration was the technique allowing the better preservation of polyphenols in red wines. Furthermore, ethanol reduction in the range between 1 and 4% (v/v) was associated with higher levels of polyphenol volatile compounds and a better retention of sensory characteristics than dealcoholized wines. Low- and zero alcohol wines showed also a positive impact on human health, mainly due to flavonoids.

Different dealcoholization techniques differently affect chemical composition of wine, but health benefits are generally always maintained.

O.2.5. Electrochemical biosensors for the detection of chemical food contaminants

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Food contamination poses significant health risks, with chemical contamination being particularly hazardous. Harmful chemicals, including pesticides, veterinary drugs, cleaning products, and industrial chemicals, can infiltrate food at various stages, from production to preparation. Ensuring food safety requires preventive measures, proper training for food industry professionals, strict controls, and regular monitoring. Although instrumental techniques like HPLC, GCMS, and AAS can detect these contaminants, they are time-consuming and expensive. Thus, there is a need for low-cost, continuous, real-time detection methods such as biosensors, which can be enhanced by uploading data to the internet cloud. Biosensors are analytical devices that combine bioreceptors (such as enzymes, cells, or nucleic acids) with transducers (electrochemical, optical, mass-based, or thermal) to convert biochemical recognition of targets into analytical signals. Enzyme and affinity biosensors are commonly used in food analysis. Therefore, the implementation of two biosensors developed in the BAE lab will be described: an acetylcholinesterase electrochemical biosensor for biocide detection and an aptamer biosensor for polychlorinated biphenyl (PCB) detection in food and water samples.

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O.2.6. Sustainable and functional bread and crackers

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Dairy industry releases a lot of whey, being a rich by-product that includes lactose and oligosaccharides, proteins, fats and minerals. Interest in the consumption of goat products has been growing, mainly due to the value attributed to their specific nutritional and nutraceutical characteristics.
In this work, to valorise the whey, membrane processes were used to valorise the whey, such as ultrafiltration, followed by diafiltration at constant flow, to recover its most valuable fraction: proteins. The final concentrates were used as water substitutes in the production of bread and crackers, to increase the protein concentration and improve the texture and sensory properties of these products.
The breads and crackers were produced with different hydrating solutions: nonconcentrated whey (NC), whey concentrate (CW) and water as control (C). The products were analysed in moisture content (drying), protein (Kjedahl), fat (Soxlet), ash, chlorides, texture properties (TPA) and sensory characteristics (hedonic).
The addition of whey made it possible to increase the protein, chloride and mineral levels in the bread. Regarding hardness, an increase in this property was observed in the NC and CW breads, in relation to the C bread. The tasters gave higher scores to the texture, flavour and overall appreciation attributes of the NC and CW breads, in relation to the C bread. In the crackers, no significant differences were observed in either the average nutritional composition or sensory attributes, except for firmness, which was higher in the NC and CW crackers.
This preliminary study suggests that this could be a future application of goat whey, contributing to improving the sustainability of the cheese industry.

O.2.7. A genetic alternative to nixtamalization for raising nutritional value of corn flour in pellagra pathogenesis prevention

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Corn is a widely available plant, but corn-based diets are commonly related to pellagra pathogenesis, due to the fact that vitamin B3 in corn has a low bio-availability. Pellagra is a deadly disease that affected humankind several times and was commonly associated with incorrect preparation of corn that failed to break niacin-carbohydrate and niacin-protein tight complexes, while preserving a high quantity of leucine that affects cellular conversion of tryptophan to NAD+. Latin American peoples commonly use nixtamalization or alkaline cooking when preparing corn flour, but other nutritional components are destroyed while the overall aspect and taste of maize is changed, making it rather similar to wheat.
In this study, we aim to construct a gene control protocol to obtain niacin-rich corn using a controlled infection protocol with a non-pathogenic and non-toxigenic strain of Fusarium subglutinans, a common cereal fungal pathogen. The main objectives of the study are: analyzing why a genetic solution is better than a chemical approach to pellagra pathogenesis prevention and to propose a model bioinformatical protocol to conduct a gene expression and a controlled infection of corn with Fusarium sp.
The results of the bioinformatical analysis show that gene control of Fusarium is easier to conduct, more efficient, poses fewer risks, and is more ethically acceptable than direct gene control of corn. Both are viable alternatives to classic nixtamalization, which changes the organoleptic and nutritional properties of corn flour.

O.2.8. Chemical characterisation and neuroprotective properties of invasive knotweed extracts

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Japanese knotweed (*Fallopia japonica*), Giant knotweed (*Fallopia sachalinensis*), and their hybrid, Bohemian knotweed (*Fallopia × bohemica*), rank among the most invasive vegetable species worldwide. Originally introduced as ornamental plants, these species have swiftly colonized Europe, presenting significant ecological and economic challenges over the past two centuries due to their detrimental impact on biodiversity and infrastructure.

In this study, a diverse array of bioactive secondary metabolites, such as stilbenes, flavonoids, phenolic acids, carotenoids, chlorophylls, and triterpenic acids, have been identified in these knotweeds. Ethanolic extracts were derived from freeze-dried samples of shoots and root peels from all three species, and their total phenolic content was evaluated using the Folin-Ciocalteu method. Further analysis involved ultra-high-performance liquid chromatography coupled with a hybrid quadrupole-ion trap mass detector (UHPLC-MS/MS), employing reversed-phase chromatography for separation and tandem mass spectrometry for quantification. Additionally, the extracts underwent assessment for their neuroprotective activity against induced oxidative stress in a human neuronal cell line.

The Folin-Ciocalteu method detected the highest total polyphenolic content in the root peels of Giant knotweed, whereas the UHPLC-MS/MS method identified the highest concentration of polyphenolic compounds in the shoots of Bohemian knotweed; it also revealed the presence of eight polyphenolic compounds in at least one sample. These findings emphasize the reliability of the Folin-Ciocalteu and UHPLC-MS/MS methods for assessing polyphenolic compounds in knotweeds, albeit with potential disparities in results.

Moreover, all examined extracts effectively inhibited the apoptotic and necrotic-like neuronal cell death induced by oxidative stress, thus underscoring their potential as neuroprotective compounds in the context of neurodegenerative diseases.

O.2.9. Response surface methodology for development plant-based non-dairy alternatives using Juglans regia L.

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Cow's milk is considered a staple in many diets due to its high nutritional value. However, it is not a suitable option for everyone for reasons, including lactose intolerance, milk allergy, dietary restrictions, and potential health risks. Plant-based milk substitutes and non-dairy food alternatives are good options to meet the current demand for non-dairy products.

This study applies response surface methodology (RSM), one of the most important multivariate techniques extensively used in recent years to model and optimize formulations and processing conditions.

A Box–Behnken experimental design assessed the effects of three independent factors. Walnut milk preparation was carried out essentially following the procedure: walnuts cleaning, soaking, peeling, coarse grinding, extraction at 35-40 °C, decantation, homogenization. Further walnut milk was used in development of non-dairy yoghurt and ice cream.

Measured sensory responses included: flavor, taste, texture and overall sensory acceptability (OSA) of the walnut based non-dairy alternatives. The primary factor affecting ($P<0.05$) all the responses was the walnut/water ratio used for all non-dairy alternatives samples production. Physicochemical properties included evaluation of pH, acidity, water activity, texture and antioxidant potential. The results represent an insight into successful technological utilization of walnut milk, walnut oil, fibers, and pectin in development of walnut milk-based yoghurt and ice cream alternative formulations.

The results of this work will help in understanding the role of different ingredients in formulating walnut milk based alternatives with improved nutritional profile and the impact on relevant physicochemical, sensory properties and antioxidant potential.

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O.2.10. Personalized nutrition in the digital age

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Nutrition and dietetics specialists play a crucial role in combating chronic disorders such as obesity, diabetes, and cardiovascular diseases by providing personalized, evidence-based nutritional advice. Analysing their activities through an online questionnaire can offer better insights into their practices and preferences.

We aimed to investigate the use of digital tools among the activities of professionals in nutrition and dietetics.

The study sample included licensed dietitians and graduates of the Nutrition and Dietetics program. Participants were invited to complete an online questionnaire created using Google Forms.

The questionnaire was completed by 47 respondents, of whom 74.5% were licensed dietitians and 14.9% were graduates. The main area of interest was nutrition in weight management and obesity (85.1%). The preferred sources of information were scientific literature (91.5%) and conferences (63.8%). 87.2% of respondents consider onsite consultations to be more effective, with this preference being significantly higher among licensed dietitians ($p = 0.047$). 80.9% of respondents stated that they use online platforms for meal planning, and 19.1% use artificial intelligence (AI) in dietetic practice.

Our study highlighted similar practices among licensed dietitians and Nutrition and Dietetics graduates, with a major interest in nutrition for weight management and obesity. Onsite consultations were preferred, especially by licensed dietitians, and the use of digital platforms for meal planning was widespread, although AI utilisation was not considerable.

O.2.11. Mycotoxins: Detection based on aptamers

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Mycotoxins are naturally occurring toxic, small chemical compounds (MW ~700) produced as secondary metabolites by certain fungi that contaminate food and feed during crop growth or processing products. According to a United Nations Food and Agriculture Organization report, 25% of the world's food is significantly contaminated with mycotoxins. The economic impact of mycotoxins includes perturbation of human and animal health, increased health care and veterinary costs, reduced livestock production, disposal of contaminated foods and feeds, and investment in research and applications to reduce severity.

The European Commission has set maximum levels for the mycotoxins to protect human and animal health.

The current tendency has driven the development of biosensors or bioassays as new analytical tools able to provide fast, reliable, and sensitive measurements at low cost; many of them aimed for on-site analysis. Biosensors may not completely replace the official analytical methods but can be used both by regulatory authorities and by industry to add up the information for routine testing and screening of samples. The main advantages of biosensors are short analysis times, low cost of assays, portable equipment, real-time measurements, and suitability as remote devices. These new technologies have been applied in the quantitative analysis of various target analytes.

The presentation mainly focuses on the development of the method in the sense of how mycotoxins can be detected through apta-sensors and apta-assays.

O.2.12. Innovative approaches to combat non-compliant botanical food supplements

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Food supplements made from plants, algae, fungi, or lichens are widely available on the European Union market and worldwide, but concerns remain about their quality and safety. Sold through complex globalized value chains, under varying regulatory frameworks, with no global consensus on their definition or characterization, they represent a well-known vulnerable segment regarding contamination and profit-driven adulteration. Deliberate use of fillers, plant material of inferior quality, or admixture with synthetic substances to reach the expected therapeutic effect may pose important health-threatening hazards. Misidentifications, complicated taxonomies, or incongruences in the vernacular names or scientific synonyms can lead to negative outcomes associated with ingesting botanical-based supplements.
The standard analytical tests accurately detect specific marker compounds but cannot assess the entire species composition of multi-ingredient products. New diagnostic tools have been recently developed and recommended to be applied to ensure the quality and safety of botanical food supplements. Recent research in DNA-based methods significantly contributed to the quality control of herbal products, yielding meaningful results in a regulatory framework. DNA metabarcoding has provided additional tools for assessing species diversity in complex products. Technologies, such as ddPCR, enable the absolute quantification of DNA in samples and could be used to calibrate and quantify the amount of DNA from both intended and unwanted ingredients. DNA-based molecular methods yield specific data and they are recommended to be used to complement standard analytical methods to answer particular research, monitoring, or regulatory questions.

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O.2.13. Utilising cocoa (Theobroma cacao L.) by-products for sustainable animal feed: an evaluation of polyphenol and antioxidant content

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The EU Circular Economy Action Plan aims to reduce waste and optimize resources. Cocoa processing by-products, that are rich in polyphenols, methylxanthines, dietary fibers, and lipids, can be reused in animal feed, offering a sustainable solution.
In this study, we evaluated the potential of cocoa processing by-products as a sustainable and valuable source of animal feed in line with the EU Circular Economy Action Plan.
Cocoa bean shell samples (S1: flakes, S1K: chunky flakes, and S2: pellets) from a Swiss foodstuff processor were analysed using in vitro methods (Folin-Ciocalteu assay, DPPH assay, and vanillin test) and HPTLC. These methods assessed total polyphenol content, antioxidant capacity, and flavan-3-ols concentration.
Sample S2 had the highest levels of phenolic compounds and flavan-3-ols. Samples S1 and S1K exhibited similar antioxidant activity, total polyphenols, and flavan-3-ols, although lower than S2. HPTLC analysis confirmed these findings. The physical form of the by-products (pellets vs. flakes) significantly influenced analyte concentration and antioxidant properties.
Cocoa bean shells are a valuable source of polyphenols and flavan-3-ols with antioxidant properties, suitable for use as high-quality secondary raw materials in animal feed. Future potential formulations should also consider theobromine and caffeine content, to ensure compliance with EU guidelines (Directive 70/524/EEC and Directive 2002/32/EC) for animal safety and well-being.

O.2.14. Nutritional potential of marine biomass

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The pressure on global food systems will likely increase in the coming years. Population growth, increasing urbanization and changes in eating habits are trends that set the stage for a growing demand for food. The UN's Food and Agriculture Organization (FAO) has estimated that projected demand requires a 70% increase in global food production by 2050.

A sustainable blue economy is part of the EU's strategy to increase the use of marine resources to produce new foods and food supplements. Increased use of marine resources for alternative food production will help alleviate pressure on land resources for agriculture, mitigate climate change, and ensure food security and sustainability.

The paper presents the objectives, research methodology and part of the results of the ERANET SuMaFood project (www.sumafood.eu). SuMaFood is an international partnership between 3 industrial partners, 3 universities and R&D research institutes from Greece, Norway, Romania and Spain, coordinated by SINTEF Energy Research (Norway). The project's objective is to design new and innovative processing and preservation methods, including improved solutions for fish residue separation and fractionation, low-temperature stabilization, hydrolysis and drying. In addition, macroalgae (seaweed Saccharina Latissima) raw materials were dried, analyzed and tested as a food ingredient.

The ingredients, (seaweed Saccharina Latissima and hydrolysed cod fish protein) were supplied in the form of a powder with reduced moisture and were included separately in various baking recipes, with a replacement degrees of wheat flour of 0%, 1.5%, 3 %, 4.5%, 6%. Chemical potential, rheological and enzymatic properties, as well as consumer acceptability were evaluated. Textural analyzes were performed for 96 hours of storage. The results showed great nutritional potential, given the high value of fish proteins as well as the high fiber content, Ca, Fe, P, K, Mg, I, in the case of the algae used. The rheological and enzymatic analyzes were carried out with the Mixolab equipment and the Chopin + method, according to the ICC173 standard and showed very good baking characteristics in the case of additions of a maximum of 4.5% of hydrolyzed proteins. In the case of the addition of algae, the breadability characteristics are maintained at acceptable values for a degree of substitution of a maximum of 3%. The sensory evaluation of the bakery products obtained showed a pronounced after-taste in the case of fish protein, which limited the addition to a value of 1.5%. In the case of algae, consumers penalized the sour, salty and bitter taste of bakery products by adding 4.5% and 6%.

Textural analyzes of bread samples showed an increase in firmness and gumminess over time and with increasing algae addition; in the case of fish protein, an increase in firmness and a decrease in cohesiveness were observed over time and with increasing protein addition.

Experimental research on bakery samples offers exciting possibilities for using marine resources, aiming at a safe and secure future food system.

P.2.1 Milk consumption: comparison between Portuguese and French consumers

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Milk has been consumed since immemorial times by humans as a way to provide essential nutrients from infancy to adulthood. Humans consume milk from different animals, like sheep, goat, camel or buffalo, but cow milk is by far the most consumed.
Tthis work intended to focus on the consumption of milk among citizens form two European countries, Portugal and France.
This study was undertaken questionnaire survey, distributed online among citizens from France and Portugal, following all ethical principles. Data were collected only from adult citizens after informed consent.
A high percentage of participants in both countries regularly consume milk, on a daily dose varying from 125 to 250 mL. Some participants in both counties do not consume milk because they do not feel the need to. Additionally, a high number of French participants do not consume milk because they don't like it, while in Portugal a high percentage do not consume due to reported lactose intolerance. The participants in both countries tend to consume semi-skimmed milk more often than other types of milk. Finally, significant differences were observed for the consumption of white brands, being these preferred in France, while in Portugal consumers tend to adopt more frequently the commercial brands. The results obtained allowed concluding that there are some common aspects regarding the milk consumption patterns among the participants form the two countries, but also highlighted some differences, that are relevant to better plan public policies in both countries.

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P.2.2. Polyurethane foams from Quercus Cerris bark, a possible cushing material

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Polyurethane foams are crucial in life sciences, particularly in telediagnosis. They protect delicate diagnostic equipment during transport by absorbing shocks and vibrations, ensuring devices remain undamaged and accurate. In telediagnosis, sensors and electrodes placed on patients' bodies monitor physiological parameters. They provide comfort and ensure proper skin contact for these sensors. Diagnostic devices like ultrasound machines use polyurethane foams to reduce ambient noise, improving the clarity of acoustic signals for better remote assessments.

Polyurethane foams are entirely made on fossil oil, as the essential reagents—polyol and isocyanate—are derived from fossil fuels. Quercus cerris bark, often considered a waste product in forest management, presents an alternative source. In this study, polyols derived from the liquefaction of Quercus cerris bark were utilized for foam production. The research examined how varying the contents of isocyanate, catalyst and blowing agent affected the properties of the resulting foam.

The study found that the quantity of each chemical significantly impacted the foam's density and compressive properties. Overall higher Isocyanate content led to lower mechanical resistance, probably due to the higher growth of the foams. The contrary was observed for increasing amounts of water and catalyst.

These results indicate that it is feasible to convert Quercus cerris bark residues into PU foams with characteristics similar to commercial foams, although with somewhat lower compressive strength.

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P.2.3. Sensory evaluation and quality parameters in the development of açaí-enriched mango puree and smoothie

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Fruit purees and smoothies are valued for its purity, simplicity, and nutritional benefits. Made specially of natural fruit without added sugars or preservatives, they are popular for its intense flavour and health advantages. Açaí, a native fruit from Amazon region, and mango, a popular and nutritious tropical fruit, were selected to create 100% natural fruit products. This study aims to develop and evaluate two products: a mango puree enriched with açaí, and an açaí-based smoothie made with mango, coconut water, and açaí. Both samples were assessed for physicochemical, texture, sensory acceptance, and bioactive properties, with control samples without açaí and pure açaí pulp also evaluated. Despite high-water activity (0.91-0.97), both products have an acidic pH (2.7-3.1), being the açaí-enriched products with higher water activity. Total soluble solids ranged from 9.1 to 11.7 °Brix, much lower (3.5 °Brix) in pure açaí. These samples also exhibited higher acidity, resulting in a lower total soluble solids/acidity ratio (4.4) compared to the enriched products and controls (20-22). Greater hardness was observed in the puree due to its consistency compared to the smoothie and pure açaí pulp. There was a clear decrease in lightness (L*) and yellowness (b*) when açaí was added. Sensory evaluation from 30 untrained panellists indicated both products were well-received for texture and flavour, with higher acceptability for the puree. Vitamin C content was also measured, providing further nutritional insights. This study explores the commercial potential of açaí and mango, aiming to offer versatile, nutritious products and promote healthier eating habits.

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P.2.4. Hyperspectral imaging for raw ingredients characterization: wheat flour case study

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Hyperspectral image analysis is an advanced methodology that captures information from an object in multiple spectral bands in order to retrieve specific features. When applied to wheat flour, this non-destructive analysis method offers several significant advantages such as component detec6on, evaluation of nutri6onal quality, speed and efficiency in obtaining results.
The objective of the preliminary work was to use hyperspectral images to analyse common wheat flour. The tests used a hyperspectral camera with 204 bands with wavelengths in the range of 400-1000 nm, a spectral resolution of 7 nm and a spatial sampling of 512 pixels. Physicochemical analyses were also performed using conventional methods and compared to the data obtained from the hyperspectral images of wheat flour samples, processed with a Python code developed indoors. The results of total fats obtained by the Soxhlet method (1% ± 0.07%) were comparable with the qualitative analysis of the mean spectra of the wheat flour as it was possible to correlate the laboratory data with the spectra features of the images.
These findings underscore the promise of hyperspectral imaging in revolutionising the evaluation of raw food materials, providing a rapid, non-destructive, and accurate method for assessing the quality and composition of food ingredients.

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P.2.5. Phytochemical profile and quality control of Hippophae rhamnoides (sea buckthorn) branches and herbal formulations

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Hippophae rhamnoides L. (sea buckthorn) is increasingly consumed worldwide as home remedies and used as raw material for the pharmaceutical and food industry, representing a substantial proportion of the global plant-based products market. An important step in the quality control of H. rhamnoides-herbal formulations is establishing the appropriate analytical method to identify the specific marker profile. However, the complexity and the large variation of phytochemicals in the herbal-based formulation challenge the authentication and quality control procedures. Establishing cost-efficient analytical techniques is an essential step to bypass these problems. This study aimed to establish a chemical fingerprint for extracts from H. rhamnoides branches as a reference for quality control and explore chemical variation in derived herbal formulations using high-performance thin layer chromatography (HPTLC). The plant material was extracted with methanolic solvent using heat reflux extraction. The HPTLC analysis was performed to identify the polyphenolic profile using mobile phase ethyl acetate:formic acid:acetic acid. Chlorogenic acid (Rf 0.52), kaempferol (Rf 0.98), and other polyphenolic acids (Rf 0.16, 0.25, 0.31, 0.48) were identified. A characteristic phytochemical fingerprint with clearly distinguishable fluorescent blue spots was established for H. rhmanoides branches that can be further used for exploring phytochemical profiles. Based on these preliminary results we can suggest that the performed analysis can aid in the quality control of H. rhamnoides derived herbal formulations.

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P.2.6. Development of plant-based cheese alternatives using walnuts nutritional potential

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The plant-based cheese alternatives (PBCAs) category displayed 51% growth in sales in the US between 2019 and 2022, with the market in Europe showing sales growth of 23% in 2022. Different approaches and ingredients can be employed to design PBCAs to dairy food products with enhanced nutritional value.
The aim of this study was to understand the effects of the addition of inactive yeast, walnut oil and different ratio of walnuts/water, used to develop the walnut based milk, on key physicochemical properties and quality attributes of PBCAs.
Development and optimization of the formula and technology for a PBCAs was performed using STAT-EASE 360 software. This program allows to optimize the main technological process and to find the most appropriate ratio of three studied variabilities.
This study also included the development of technological diagrams of the PBCAs, analysis of the physicochemical parameters of the developed PBCAs samples such as pH, acidity, water activity, texture, color, total polyphenol content and antioxidant activity. Sensory study of the PBCAs was carried out according to the following criteria: appearance, color, smell, taste, consistency, and an overall acceptability of the product. Based on the data obtained, the studied product samples were compared with each other, as well as with the control sample.
The results of this work will help in understanding the role of different amounts of walnut oil, walnuts/water ratio and instant yeast in formulating PBCAs with improved nutritional profile and the impact thereof on relevant physicochemical, sensory properties and antioxidant potential.

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P.2.7. Formulation of plant-based yoghurt from pecan and evaluation of physicochemical, sensory and free radical scavenging properties

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Consumer demand for non-dairy yoghurt substitutes is increasing due to large numbers of people with dietary restrictions. Previous studies have well established vital roles of these plant-based substitutes in improving of immune system, physiological functions and providing high levels of antioxidants with free radical scavenging properties.
The aim was to develop a novel plant-based yoghurt with high sensory acceptance and nutrition value, that is attractive to consumers.
Pecans were used as main ingredients for the pecan milk development. Pecan milk was subjected to pasteurisation process and plant-based yoghurt formulations were created. All formulations with different amount of pectin, protein powder and emulsifier were inoculated with live and active commercial cultures.
Fermentation improved the total phenol content (TPC) in all yoghurt formulations. Results obtained from DPPH free radical scavenging assay showed that fermentation enhanced also the antioxidant capacities. Protein powder addition improved the water activity and slightly increased the yellowness, and an increase of lightness occurred during storage. Based on the sensory evaluation, the amount of 1.65% of pectin, 1% of protein powder and 0.2 % of emulsifier presented the best formulations.
This study provided a novel and efficient way to manufacture acceptable plant-based yoghurt from pecans by commercial yoghurt starters. The fermentation performance of pH confirmed that pecan milk was innovative, attractive and effective for yoghurt production. Incorporating pectin, protein powder and emulsifier in yoghurt formulations impacted sensory properties, resulting in a variation on physicochemical properties and free radical scavenging properties.

Acknowledgments. This research was implemented by Robert M. Kerr Food and Agricultural Products Center within the Oklahoma State University and supported by the Fulbright Visiting Scholar Program of the United States Department of State's Bureau of Educational and Cultural Affairs (ECA).

3. New Trends in (Bio)engineering Sciences Applied in Life Sciences

O.3.1. Zeiss Celldiscoverer 7 with Airyscan module - adaptable automation for advanced workflows

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ZEISS Celldiscoverer 7 is a research companion for collecting statistically relevant data. It provides easy access to high-quality imaging, is adaptable to demanding experiments, and is stable over long periods of operation.
Live cell imaging requires objectives with high numerical apertures. Those objectives will only deliver high contrast and sensitivity if their optics can adapt to variations in bottom thickness or to the material of different sample carriers. The researchers can use Petri dishes, chamber slides, multi-well plates, plastic or glass, thin or thick vessel bottoms, low-skirt or high-skirt plates. Automatic sample recognition detects all relevant vessel features while loading your sample. Autocorr adjusts the correction ring of the objective to compensate for spherical aberrations.
In cell biology or screening applications, your samples mostly consist of water and / or will be mounted in aqueous solutions. Celldiscoverer 7 combines an outstanding 50x water immersion objective with rapid automated immersion supply and removal. An elastic silicon membrane simultaneously seals the sample chamber to avoid unnecessary airflow while protecting the system from potential liquid spillage. It analyze dynamic processes in living samples with photomanipulation for FRAP, FRET or related techniques. It is precisely connected widefield and confocal images.

O.3.2. SERS monitoring of the antimicrobial activity of peptide CecA on common bacteria

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Addressing the escalating challenges posed by bacterial antibiotic resistance and the limitations of existing therapies, we introduce a smart wound dressing featuring functionalized spherical gold nanoparticles (AuNPs) loaded with the antimicrobial peptide Cecropin A (CecA). These NPs are integrated into sterile cotton, harnessing both their natural antimicrobial properties and phototherapeutic capabilities to enhance soft tissue healing and combat skin infections effectively. First, the antimicrobial activity of the smart wound dressings was proved by real-time monitoring of the bacterial growth curves over 24 h. Then, the antimicrobial effect of Cec A on pathogenic bacteria was monitored by dynamic surface-enhanced Raman scattering (SERS) by analyzing the smart wound dressing.

This study represents a proof of principle, the sequentially recorded SERS spectra being preliminary tests for monitoring in real-time the CecA antimicrobial activity in various experimental conditions. For recording the spectral profiles of common bacteria as control and under treatment with CecA, the measurements were assessed with special attention dedicated to laser irradiation (exposure time, laser power and laserline used). The SERS spectra revealed specific marker bands for bacterial lysate and the purine metabolites dependent time of exposure to CecA. Moreover, principal component analysis (PCA) of the SERS data was able to differentiate the response of untreated cells from those exposed to CecA in 10-30 min post-exposure with greater than 99% accuracy.

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O.3.3. Dynamic SERS monitoring of dopamine's oxidative polymerization

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Polydopamine (PDA) is obtained with low costs by oxidation of dopamine (DA), being a valuable commercial material due to its outstanding property of adhesion to almost all types of surfaces, even under water. The chemical behaviour of PDA, mostly the kinetics of its adsorption and/or chemisorption process(es) to the metallic surface was monitored by dynamic surface-enhanced Raman scattering (SERS) analysis.
This study represents a proof of principle, the sequentially recorded SERS spectra being preliminary tests for monitoring in real-time PDA in various experimental conditions with emphasis on underlying mechanisms of adsorption onto a silver-based SERS-active substrate. For capturing the oxidative polymerization of DA, we used a sandwich structure, obtaining an intimate contact of a silver thin film with the first polymeric layer of PDA film.

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O.3.4. Effect of the electrical field on the specific binding between an aptamer and its target analyte: case study of a lysozyme aptasensor

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Aptamers are increasingly used in bioanalysis for the specific detection of various analytes. The binding between an aptamer and its target analyte is influenced by the composition of the analysed solution. In addition, for aptamers attached to a surface, the antifouling properties of the surface dictate the ratio between of the specific binding and non-specific adsorption. Lysozyme is a protein that is widely used as a model in biosensors.

Taking as example lysozyme, we studied the influence of an applied electric field on the binding of the protein to its aptamer, attached to a gold electrode.

An aptasensor and a control electrode protected against fouling by coating with mercaptoundecanol were incubated with lysozyme while being polarised at various potentials in an electrochemical cell. The binding at the sensor's surface was monitored via differential pulse voltammetry and coupled electrochemical-Surface enhanced Raman spectroscopy.

At low positive potentials (+0.2 V) the non-specific adsorption of lysozyme was the lowest while the specific binding to the aptamer remained strong. The SERS substrate and analysis protocol enabled to monitor in real time of the non-specific adsorption and the specific binding of lysozyme. Application of negative potentials to a silver nanoparticle-modified carbon electrode enabled to observe better the vibrational bands of the aptamer.

The electrical field can be used to tune the development of a specific aptasensor. The next step is to adapt this tool for determining lysozyme in real samples such as serum, cheese, and milk.

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O.3.5. Aptamers labelling with new enzyme for bioassay and biosensors: preliminary results

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Aptamer-based biosensing techniques frequently use DNA probes tagged with catalysts (enzymes, nanozymes, and DNAzymes) to provide a strong electrochemical or optical signal. In the framework of a constant search for new enzyme labels with interesting features, we investigated the possibility of a cold active aldehyde dehydrogenase from the Antarctic Flavobacterium Pl002 (F-ALDH) for the regulated labelling of a DNA aptamer for lysozyme.

To create an amplification system in which a sandwich type of biosensor would be used on a microarray plate.

We created a complex based on the histidine tag of the FALDH that exhibits affinity for the nickel-Nα,Nα-Bis(carboxymethyl)-L-lysine hydrate complex. Then, starting from a microarray plate where lysozyme was absorbed on the wells, the complex was bound to the lysozyme based on the specificity of the aptamer. The same experiment was made with the protein MMP9.

The successful attachment of F-ALDH to the aptamer was verified by checking the absorbance values at 260 nm and 280 nm in the UV spectrum. We confirm the bounding of the complex to the lysozyme by measuring the enzymatic activity of the wells where the complex was incubated and the enzymatic activity of the wells where FALDH was incubated as a blank. The properties of the aptamer were also verified to remain the same in the complex.

More tests are needed to be made to characterize the entire complex and its characteristics, but the preliminary steps including the obtaining of the complex are already done successfully.

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O.3.6. Aptamer-modified plasmonic nanoplatforms as biosensor for SERS detection of human matrix metalloproteinase

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Human matrix metalloproteinase 9 (MMP-9) is a clinical biomarker used to diagnose cardiovascular dysfunctions and several types of cancer. Biosensors for MMP-9 are urgently needed to deliver rapid and timely results in point-of-care services.
The present study is focused on designing aptamer-modified plasmonic nanoplatforms able to offer relevant solutions for medical diagnosis.
Various nanostructured and periodical patterns-based substrates were produced using nanoimprint lithography, in combination with magnetron sputtering and by electrochemical techniques. The morphology of fabricated plasmonic nanoplatforms is characterized by scanning electron microscopy. The Surface Enhanced Raman Scattering (SERS) activity is evaluated by mapping the distribution of electromagnetic hot-spots using mercaptobenzoic acid as a probe molecule. Scanning Confocal Raman microscopy and fluorescence lifetime imaging microscopy are employed to collect SERS signal and, respectively, fluorescence lifetime of Cyanine3 tagged MMP-9-specific aptamer and confirm its attachment and distribution onto the metallic surface. The optimisation of the aptamer-MMP9 binding included voltammetry and Surface Plasmon Resonance studies. The nonspecific/specific adsorption of MMP-9 on the nanoplatform is investigated by SERS measurements.
The aptamer attached onto the metallic surface of proposed nanostructured substrates specifically recognizes the target MMP-9 biomarker, while the signal transduction is based on ultrasensitive SERS measurements. In addition, the designed nanoplatforms enable direct detection of MMP-9 based on specific vibrational bands of the biomarker.
Due to the simplicity of the assay and robustness of molecular bioreceptors, the proposed nanoplatforms offers an attractive perspective in designing portable nanosensors for rapid detection of MMP9.

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O.3.7. Bioactive coatings as biomaterials for metallic orthopedic implants

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The integration of bioactive coatings on metallic orthopedic implants represents a significant advancement in biomaterials research, addressing critical challenges associated with implant biocompatibility, osseointegration, and infection control. These coatings, often composed of bioactive ceramics, polymers, and metallic glasses, are designed to enhance the biological performance of implants by promoting bone cell adhesion, proliferation, and differentiation, while simultaneously inhibiting bacterial colonization and biofilm formation. This study explores the development, characterization, and application of various bioactive coatings for metallic orthopedic implants, focusing on their potential to improve clinical outcomes and patient recovery.

By employing advanced deposition techniques such as RF magnetron sputtering and electrodeposition, we have engineered coatings that exhibit controlled degradation rates, superior mechanical properties, and enhanced bioactivity. In vitro assessments reveal that these bioactive coatings significantly enhance the osseointegration process, reduce the risk of aseptic loosening, and provide a robust antimicrobial defense. The incorporation of bioactive elements such as Si, Ag, Sr within the coatings further amplifies their osteoconductive and antibacterial properties.

EDS and XRD techniques were used to analyze the elemental and phase compositions of the films. Scratch tests and surface profilometry were used to examine hardness, adhesion, and roughness. The investigation of the film corrosion resistance played an important role. The corrosion rate was calculated after these experiments, who were carried out in SBF at 37oC. For all of the tests, uncoated Ti alloys were used as a reference sample. After electrochemical tests, the morphology of the generated films was examined.

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O.3.8. Effect of the electrical field on the specific binding between an aptamer and its target analyte: case study of a lysozyme aptasensor

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Aptamers are increasingly used in bioanalysis to detect various analytes specifically. The composition of the analysed solution influences the binding between an aptamer and its target analyte. In addition, for aptamers attached to a surface, the surface's antifouling properties dictate the ratio between the specific binding and nonspecific adsorption. Lysozyme is a protein that is widely used as a model in biosensors.

Taking as example lysozyme, we studied the influence of an applied electric field on the binding of the protein to its aptamer, attached to a gold electrode. Method: An aptasensor and a control electrode protected against fouling by coating with mercaptoundecanol were incubated with lysozyme while being polarised at various potentials in an electrochemical cell. The binding at sensor's surface was monitored via differential pulse voltammetry and coupled electrochemical-Surface enhanced Raman spectroscopy.

At low positive potentials (+0.2 V) the non-specific adsorption of lysozyme was the lowest while the specific binding to the aptamer remained strong. The SERS substrate and analysis protocol enabled to monitor in real time the non-specific adsorption and the specific binding of lysozyme. Application of negative potentials to an silver nanoparticle modified carbon electrode enabled to observe better the vibrational bands of the aptamer. The electrical field can be used to tune the development of a specific aptasensor. The next step will be to adapt this tool for determining lysozyme in real samples s such as serum, cheese and milk.

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O.3.9. Aptamers labelling with new enzyme for bioassay and biosensors: preliminary results

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Aptamer-based biosensing techniques frequently use DNA probes tagged with catalysts (enzymes, nanozymes, and DNAzymes) to provide a strong electrochemical or optical signal. In the framework of a constant search for new enzyme labels with interesting features, we investigated the possibility of a cold-active aldehyde dehydrogenase from the Antarctic Flavobacterium Pl002 (F-ALDH) for the regulated labelling of a DNA aptamer for lysozyme Aim: To create an amplification system in which a sandwich type of biosensor would be used on a microarray plate.
We created a complex based on the histidine tag of the FALDH that exhibits affinity for the nickel-Nα,Nα-Bis(carboxymethyl)-L-lysine hydrate complex. Then, starting from a microarray plate where lysozyme was absorbed on the wells, the complex was bound to the lysozyme based on the specificity of the aptamer. The same experiment was made with the protein MMP9.
The successful attachment of F-ALDH to the aptamer was verified by checking the absorbance values at 260 nm and 280 nm in the UV spectrum. We confirmed the complex's bounding to the lysozyme by measuring the enzymatic activity of the wells where the complex was incubated and the enzymatic activity of the wells where FALDH was incubated as a blank. The properties of the aptamer were also verified to remain the same in the complex.
More tests are needed to be made to characterize the entire complex and its characteristics, but the preliminary steps including the obtaining of the complex are already done successfully.

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O.3.10. Dynamic SERS monitoring of dopamine's oxidative polymerization

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Polydopamine (PDA) is obtained with low costs by oxidation of dopamine (DA), being a valuable commercial material due to its outstanding property of adhesion to almost all types of surfaces, even under water. The chemical behavior of PDA, mostly the kinetics of the its adsorption and/or chemisorption process(es) to the metallic surface were monitored by dynamic surface-enhanced Raman scattering (SERS) analysis. This study represents a proof of principle, the sequentially recorded SERS spectra being preliminary tests for monitoring in real time PDA in various experimental conditions with emphasis on underlying mechanisms of adsorption onto a silver-based SERS-active substrate. For capturing the oxidative polymerization of DA, we used a sandwich structure, obtaining an intimate contact of a silver thin film with the first polymeric layer of PDA film.

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O.3.11. SERS monitoring of the antimicrobial activity of peptide CecA on common bacteria

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Addressing the escalating challenges posed by bacterial antibiotic resistance and the limitations of existing therapies, we introduce a smart wound dressing featuring functionalized spherical gold nanoparticles (AuNPs) loaded with the antimicrobial peptide Cecropin A (CecA). These NPs are integrated into sterile cotton, harnessing both their natural antimicrobial properties and phototherapeutic capabilities to enhance soft tissue healing and combat skin infections effectively. First, the antimicrobial activity of the smart wound dressings was proved by real-time monitoring of the bacterial growth curves over 24 h. Then, the antimicrobial effect of Cec A on pathogenic bacteria was monitored by dynamic surface-enhanced Raman scattering (SERS) by analyzing the smart wound dressing. This study represents a proof of principle, the sequentially recorded SERS spectra being preliminary tests for monitoring in real-time the CecA antimicrobial activity in various experimental conditions. For recording the spectral profiles of common bacteria as control and under treatment with CecA, the measurements were assessed with special attention dedicated to laser irradiation (exposure time, laser power and laserline used). The SERS spectra revealed specific marker bands for bacterial lysate and the purine metabolites dependent time of exposure to CecA. Moreover, principal component analysis (PCA) of the SERS data was able to differentiate the response of untreated cells from those exposed to CecA in 10-30 min post-exposure with greater than 99% accuracy.

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O.3.12. Nanocellulose-based oxygen-generating systems

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Oxygen has an important role in wound healing because it prevents infections and increases cell viability. It is predicted that the incidence of chronic wounds will continue to rise due to an ageing population and the ongoing spread of obesity and diabetes. The main cause that hinders the healing process in the case of chronic wounds is long-term hypoxia, which alters the inflammatory response, causing persistent inflammation, hindering angiogenesis, wound closure and tissue remodelling. Hyperbaric oxygen therapy or O_2 carriers based on hemoglobin or perfluorocarbon have been clinically applied to heal chronic wounds. However, their effect is unsatisfactory.

Wound dressings have been widely utilized to assist in wound repair. For this purpose, hydrogen peroxide and metal peroxides have been incorporated into various substrates such as hydrogels to enhance oxygenation therapy for chronic wounds. Nanocellulose can serve as a suitable substrate for O_2 carriers, such as peroxides, to help with a more controlled oxygen release and faster healing of wounds. Nanocellulose is a valuable natural-sourced material, characterized by a high surface area and wide possibilities of chemical modification along with biodegradability and biocompatibility. Therefore, in this work, nanocellulose was modified with calcium peroxide and other peroxides to obtain a more controlled release of oxygen for wound healing.

The tests of oxygen release at room and body temperature have shown that a higher amphiphilicity of nanocellulose is beneficial for a controlled release of oxygen while the concentration of the peroxides should be correlated with the viability of L-929 cells.

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P.3.1. Pinus pinaster improvement by citric acid impregnation and sustainability in wood preservation

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Preserving wood is crucial for its durability and utility across various applications. The wood industry faces pressure to adopt sustainable practices due to environmental concerns regarding traditional preservation methods involving harmful chemicals. This study explores the potential of citric acid as a wood preservative, either alone or in combination with sorbitol, to address these sustainability challenges. Specifically, we investigated its ability to enhance dimensional stability and resistance to termites and decay fungi.

Pinus pinaster sapwood was treated with citric acid at concentrations of 5%, 10%, and 15%, followed by curing at 140°C for 10 hours. Swelling behavior was monitored over three wet and dry cycles, and bending strength was measured according to the EN 310 standard. Additional tests evaluated dimensional stability, resistance to termites, decay fungi, and the toxicological effects on seed germination. Citric acid treatment notably improved dimensional stability, especially at higher concentrations, although subsequent wet-dry cycles showed diminishing improvements. Samples treated with 15% citric acid displayed a substantial reduction in swelling compared to untreated wood after three cycles. However, bending strength decreased with higher citric acid concentrations, and toxicological analysis revealed adverse effects on seed germination and growth, particularly noticeable with increased citric acid concentration and its combination with sorbitol. In conclusion, citric acid shows promise as a wood preservative, enhancing dimensional stability and protection against termites and decay fungi. However, careful consideration of its effects on seed germination and plant growth is necessary when determining treatment concentrations to ensure a sustainable approach to wood preservation.

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P.3.2. Electrochemical detection and quantification of melatonin using a graphene oxide-peroxidase-based biosensor

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Melatonin is a hormone primarily released by the pineal gland that regulates sleep-wake cycles. Beyond its role in sleep, melatonin is known for its antioxidant properties and potential therapeutic effects in various conditions, such as insomnia and some neurodegenerative diseases [1-3]. Accurate detection and quantification of melatonin are crucial, particularly in pharmaceutical formulations, to ensure efficacy and safety.

This work aims to detect and quantify melatonin extracted and purified from pharmaceutical products using cyclic voltammetry with a graphene oxide-peroxidase-based biosensor.

A biosensor was developed by immobilizing 10 microliters of peroxidase solution (concentration 1mg/mL) on a graphene oxide-modified electrode. Specific volumes of 2×10^{-3}M melatonin solution were added to the electrochemical cell using the standard addition method. The cyclic voltammograms obtained were analyzed to determine melatonin's detection and quantification limits.

To achieve sensitive and accurate detection of melatonin, the study focused on the preparation of the biosensor and the optimization of experimental conditions. Based on cyclic voltammograms the calibration linear model was developed and a detection limit of 1.19 µM and a quantification limit of 3.99 µM for melatonin were obtained. This indicates that the developed biosensor is capable of detecting melatonin at low concentrations, which is essential for pharmaceutical applications.

This study contributes to developing efficient electrochemical methods for monitoring melatonin in pharmaceutical products. The graphene oxide-peroxidase-based biosensor demonstrated high sensitivity and accuracy, making it a valuable tool for ensuring the quality and safety of melatonin-containing pharmaceutical formulations.