

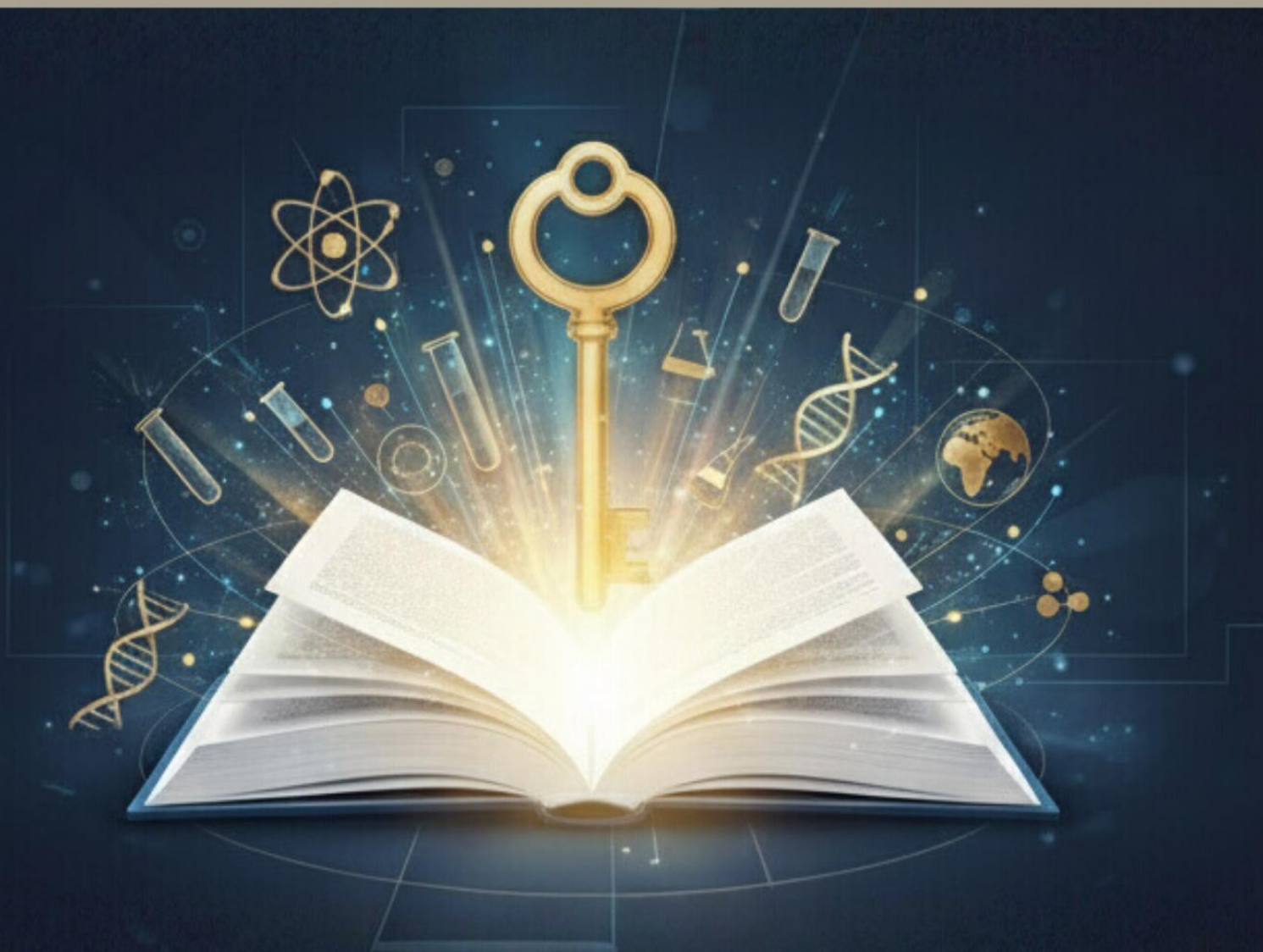
NATIONAL SCIENTIFIC CONFERENCE

# *Knowledge - Key to Success*

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**„Knowledge – Key to Success”**

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ABSTRACTS OF  
**PRESENTATIONS**



**HUMANITIES  
SCIENCES**



## **THE ROLE OF SPOLOK SLOVÁKOV V POĽSKU (ASSOCIATION OF SLOVAKS IN POLAND) AND ŽIVOT (LIFE), THE ONLY SLOVAK MAGAZINE IN POLAND, IN PRESERVING SLOVAK HERITAGE**

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Based in Poland, holds a master's degree in Ethnology from the University of Ss. Cyril and Methodius in Trnava. He is dedicated to preserving Slovak culture and pursuing a PhD on the Slovak minority in Poland, while also working as an educator.

### **Abstract:**

The current study examines the role of Spolok Slovákov v Poľsku (Association of Slovaks in Poland) and Život, the only Slovak periodical published in Poland, in preserving the cultural identity of the Slovak minority in Poland. The paper identifies the processes through which these two institutions have maintained linguistic practices, cultural memory, and community cohesion from the late 1950s to the present, using historical, sociocultural, and institutional analytical perspectives. According to the findings, both the Association and Život have played a crucial role in documenting traditional practices, supporting minority education programs, and facilitating intergenerational cultural transmission, as well as in reinforcing symbolic expressions of Slovak identity within the Polish sociocultural context. The study also outlines contemporary challenges related to demographic decline, assimilation pressures, financial instability, and changing cultural expectations. Finally, the paper concludes that the long-term viability of Slovak heritage in Poland depends on institutional renewal, increased engagement of younger generations, and adaptation through the use of modern communication technologies.

### **Keywords:**

Slovak minority in Poland; Spolok Slovákov v Poľsku; Život magazine; cultural preservation; minority identity; language maintenance; heritage continuity; Central Europe



**DIGITAL PRISON AS A VARIANT OF SERVING A PRISON SENTENCE.  
MODERN TECHNOLOGIES IN THE SERVICE OF LAW:  
THE DEVELOPMENT OF ELECTRONIC MONITORING**

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Patryk Frankiewicz, M.A., Doctoral candidate at Cardinal Stefan Wyszyński University in Warsaw. His interests include psychology, resocialization, and sexology.

**Abstract:**

The aim of this article was to present and systematize the legal and pedagogical aspects related to the operation of the electronic monitoring system (ESM), with particular emphasis on the changes effective from January 1, 2023, and the proposed amendments planned for 2025, including the possibility of using EMS for pretrial detainees. The paper utilizes a literature review and empirical research, focusing on the effectiveness of EMS, the evolution of legal regulations since 2007, and potential practical implications. The analysis indicates that EMS is an effective alternative to solitary confinement. Based on the opinions of researchers and practitioners, the conclusion is drawn regarding the continued and broader use of EMS, including as a preventive measure, for longer sentences, and for individuals working outside prison. The article confirms the high effectiveness of EMS and highlights the need for further research into its development and application in the future.

**Keywords:**

electronic monitoring; electronic supervision system; criminal justice system; alternative sanctions; penal policy



## **THE IMPORTANCE OF BRANDING IN FAMILY BUSINESSES AS A SOURCE OF COMPETITIVE ADVANTAGE**

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The author is a PhD student at the Poznań University of Technology in the discipline of management and quality science. Her research interests include brand management and factors influencing succession in family businesses.

### **Abstract:**

Branding is one of the key intangible resources of an enterprise and gains particular importance in the context of family businesses. The specific characteristics of family firms, rooted in family ties, transgenerational values, and a long-term strategic orientation, influence the processes of brand creation and perception. The importance of branding in family businesses as a source of competitive advantage is associated with the development of a coherent family identity, the strengthening of reputation, and the building of stakeholder trust. A strong family business brand supports market differentiation, enhances customer relationships, and contributes to the creation of long-term firm value. At the same time, brand management in family firms involves challenges related to succession, managerial professionalization, and dynamic market conditions.

### **Keywords:**

family business branding; competitive advantage; brand equity



## VAT DEDUCTION RULES IN THE LEASING OF PASSENGER CARS AND COMMERCIAL VEHICLES

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Iwona Izdebska is an undergraduate student of Economics. Her academic interests focus on taxation, leasing as a form of business financing, and the practical application of VAT regulations in economic activity.

### **Abstract:**

Leasing is one of the most commonly used forms of vehicle financing in business activity, mainly due to its flexibility and tax advantages. A key factor influencing the actual cost of leasing is the value added tax (VAT) and the rules governing its deduction. The purpose of this paper is to analyze the principles of VAT deduction in the leasing of passenger cars and commercial vehicles under Polish tax law.

The study discusses the legal framework regulating VAT deductions, with particular emphasis on the distinction between passenger and commercial vehicles. In the case of passenger cars, the paper presents the limitations on VAT deduction resulting from mixed use and the conditions required for full deduction, such as vehicle registration and mileage records. In contrast, the leasing of commercial vehicles generally allows full VAT deduction without additional formal requirements.

The paper also includes practical examples illustrating how vehicle classification and usage affect VAT settlement. The analysis highlights common risks and errors related to incorrect VAT deductions and emphasizes the importance of proper documentation and compliance with tax regulations.

### **Keywords:**

VAT; vehicle leasing; passenger cars; commercial vehicles; tax deduction



## MOTIVATION AND MODERN APPROACHES IN FOREIGN LANGUAGE LEARNING

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### **A few words about the author(s):**

Maja Kubik is a student and researcher at the John Paul II Catholic University of Lublin. Her academic interests focus on German language learning, learner motivation, and contemporary methods of language education.

### **Abstract:**

Foreign language learning plays a crucial role in contemporary education and professional development. This abstract addresses the importance of motivation and modern teaching approaches in the process of learning foreign languages. It discusses key motivational factors that influence learners' engagement and persistence, such as personal goals, self-confidence, and learning environment. Additionally, the abstract examines the use of modern educational tools, including digital platforms, mobile applications, and interactive materials, as effective support in language acquisition. Emphasis is placed on the role of the teacher as a facilitator who guides learners in selecting appropriate strategies and resources. The analysis suggests that combining strong learner motivation with innovative teaching methods can significantly improve language learning outcomes and foster long-term language development.

### **Keywords:**

foreign language learning; motivation; modern teaching methods; digital tools; language education



## **A SOCIO-EDUCATIONAL LITERATURE REVIEW OF THE DORMITORY LIVING OF THE RURAL SECONDARY SCHOOL STUDENTS IN RURAL AGRICULTURAL POLAND**

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Arthur S. Laskowski studied, lived and taught in the USA and South Korea. He gained over 25 years of classroom experience as a ESL, EFL, special education teacher and dormitory educator. He works at a rural agricultural secondary school in Poland.

### **Abstract:**

Dormitory institutions (plural: internaty) have long played a significant role in the Polish education system, particularly in rural and agricultural regions where access to secondary and vocational schooling is limited by geography and infrastructure. This paper presents a socio-educational literature review examining the internat as a developmental environment that supports academic achievement, socialization, and personal growth among rural youth. Drawing on Polish pedagogical literature and broader sociological research on rural education and residential schooling, the study situates internaty within their historical, structural, and socio-economic contexts. The review highlights key functions of internaty/internat, including educational support, social capital formation, and the mitigation of rural-urban educational inequalities. At the same time, it identifies persistent challenges and gaps in existing research, particularly the lack of longitudinal and comparative studies focused on agricultural regions. The paper concludes by proposing directions for future research and policy development aimed at strengthening the role of internaty/internat as inclusive and growth-oriented educational environments.

### **Keywords:**

internat/internaty; dormitory living; rural education; agricultural regions; educational inequality; secondary school students; Poland



## **FAMILY SYSTEM AND MENTALIZATION IN THE CONTEXT OF YOUNG ADULTS' MENTAL HEALTH: A RESEARCH PROJECT**

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Psychologist and psychotherapist, independent researcher. Her academic interests include psychotherapy, family systems, romantic and marital relationships, and the mental health of young adults.

### **Abstract:**

Early adulthood is an important stage of psychosocial development, during which family relationship patterns and reflective abilities, including mentalization, are consolidated. Previous research suggests that family functioning is related to young adults' mental health; however, the mechanisms underlying this relationship require further investigation.

The aim of the planned study is to examine the relationship between family system functioning and mental health in young adults and to test the mediating role of mentalization ability. A quantitative, cross-sectional correlational study is planned with a sample of 120–150 individuals aged 18–25. Data will be collected using an online survey. The study will employ the Polish version of the Family Adaptability and Cohesion Evaluation Scales (FACES IV), the Mentalization Scale (MentS), and the General Health Questionnaire (GHQ). Statistical analyses will include correlation, regression, and mediation analyses.

It is assumed that balanced family cohesion and flexibility will be positively associated with higher levels of mentalization and better mental health, whereas unbalanced family functioning patterns will be associated with greater psychological difficulties. It is further expected that mentalization ability will partially mediate the relationship between family system functioning and mental health.

### **Keywords:**

family system functioning; mentalization; young adulthood; mental health; family relationships



## **REGIONAL DEVELOPMENT – CASE STUDY: POLAND AND THE LUBLIN PROVINCE**

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### **A few words about the author(s):**

My science interests focus on socioeconomic geography, service geography, crime geography, migration, political geography and geopolitics. My research focuses on these areas. Currently, I am working on cybersecurity issues, including cybercrime.

### **Abstract:**

To implement the class topic on 26 May 2025, concerning EU cohesion policy and regional development, cooperation was established with the Marshal's Office of the Lubelskie Province in Lublin, specifically with the Department of Regional Programme Management. As a result, it was shown how the effects of the ERDF and ESF+ indicators are measured in practice during the 2021-2027 cohesion policy funding period and what challenges employees face when settling projects. An analysis of maps from scientific reports was carried out, e.g. Śleszyński (2023) 'Territorial differences and the effects of cohesion policy in Poland (2015-2021)', presenting, among other things, the value of the indicated EU funds for municipalities in Poland. On this basis, it was concluded that thanks to EU subsidies, peripheral municipalities in the Lublin Province can develop, and thanks to significant investments in road infrastructure connecting Lublin with Warsaw, the city of Lublin has gained in importance. The presentation aims to show the development of the Lublin Province based on cooperation with the Marshal's Office of the Lublin Province in Lublin, Department of Regional Programme Management. The results of analyses of available materials from the Department will be presented.

### **Keywords:**

regional development; cohesion policy; product indicators; projects



## THE SIGNIFICANCE OF KNOWLEDGE AND INFORMATION IN THE STATE'S INTERNAL SECURITY SYSTEM

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The author is a 3<sup>rd</sup> year undergraduate student in Internal Security at the Radom Academy of Economics. Academic interests focus on public security, identification of contemporary threats.

### **Abstract:**

Knowledge and information are key resources of the contemporary internal security system, determining its effectiveness, efficiency, and ability to adapt to a dynamic security environment. The rapid development of information and communication technologies, the digitalization of public life, and the growing importance of non-military threats—such as terrorism, cyber threats, organized crime, and crisis situations—have significantly strengthened the role of information in security activities. Effective collection, processing, and analysis of information directly influence the quality of decision-making by public authorities and security services.

Knowledge, understood as the result of interpreting information, experience, and analytical assessments, enables accurate identification of threats, proper risk evaluation, and the selection of appropriate preventive and response measures. Particularly important is cooperation and integration of information resources within the internal security system, supported by well-trained personnel, strong analytical capabilities, and a high level of information awareness.

### **Keywords:**

internal security; information management; knowledge-based decision-making; interagency cooperation



## **ECONOMIC GROWTH AND INFLATION**

**Karolina Szaśiadek**

*Jan Grodek State University in Sanok*

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### **A few words about the author(s):**

A 1<sup>st</sup> year Master's student in Economics, Chair of the Student Research Club "HOSSA – It Pays Off with Us".

### **Abstract:**

This presentation examines the relationship between inflation and economic growth, with particular emphasis on its importance for macroeconomic stability. The first part discusses the concept of inflation, its types, and methods of measurement, highlighting the effects of price level changes on households and businesses. The next section introduces economic growth, its main indicators, and key determinants, including the role of labour, capital, technology, and economic policy. A central element of the presentation is a theoretical analysis of the relationship between inflation and economic growth, covering the Keynesian and monetarist approaches as well as the Phillips curve concept. Special attention is paid to the differences between short-term and long-term effects of inflation on the economy and to the role of moderate and stable inflation as a factor supporting economic development. The presentation also discusses the role of monetary and fiscal policy in controlling inflation and fostering sustainable economic growth.

### **Keywords:**

inflation; economic growth; macroeconomic stability; price level; inflation measurement



## **UNEMPLOYMENT IN POLAND – CAUSES, EFFECTS AND LABOUR MARKET POLICIES**

**Magdalena Szmyd**

*Jan Grodek State University in Sanok*

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### **A few words about the author(s):**

I am a student of economics-related studies at the State University of Applied Sciences im Sanok. My academic interests focus on the Labour Market, unemployment and the analysis of socio-economic phenomena using statistical data

### **Abstract:**

The presentation focuses on unemployment as an important socio-economic phenomenon affecting the Labour Market and economic development. It discusses the definition, types, causes, and effects the Central Statistical Office. The study also outlines methods of measuring unemployment and presents selected Labour Market Policies aimed at reducing unemployment at both National and European Union levels.

### **Keywords:**

unemployment; Labour Market; unemployment rate; employment policy; European Union



## **ABSTRACT ART**

**Leon Tabor**

*University of the National Education Commission in Krakow*

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### **A few words about the author(s):**

With a background in design, I am transitioning toward fine art and painting. My practice is driven by a strong interest in contemporary art and cultural studies.

### **Abstract:**

Abstract art represents a major aesthetic shift of the twentieth century, characterized by the rejection of mimetic representation in favor of form, color, and composition as autonomous means of expression. The abstract outlines the origins of abstraction and its main tendencies, including geometric and expressive approaches, with reference to artists such as Wassily Kandinsky and Jackson Pollock. Emphasis is placed on abstraction as a means of conveying emotion and spiritual experience, as well as on the active role of the viewer in the process of interpretation. Abstract art remains an influential element of contemporary visual culture.

### **Keywords:**

abstract art; abstraction; modern art; visual form; viewer interpretation



## **SELECTED ISSUES FROM SOCIAL PATHOLOGY AND PREVENTION – AGGRESSIVE BEHAVIOUR**

**Joanna Zacharska**

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### **A few words about the author(s):**

I am a 3<sup>rd</sup> year student of social work. I like to help others and give support to people who are in a difficult life situation. I am guided by empathy, sensitivity and the desire to provide real help.

### **Abstract:**

In the presentation, I raise the topic of aggression and aggressiveness in the context of social pathology. Aggression can be seen as an instinct, which is an innate tendency of danger or conflict. I also discuss aggression as a reaction to frustration, which occurs when an individual cannot meet his needs. I would like to point out that aggression can be an acquired drive, shaped in the process of socialisation, and repeated aggressive behaviour can become a habit over time.

### **Keywords:**

aggressiveness; aggression; instinct; flustration; habit



## EDUCATION LAW IN RELATION TO VOCATIONAL AND CONTINUING EDUCATION

**Monika Żakowicz**

*Cosinus*

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### **A few words about the author(s):**

Master of law, expert in the education industry and educational law, over 15 years of experience in the education sector, author of numerous publications.

### **Abstract:**

Education law plays a key role in shaping the system of vocational and continuing education, ensuring its coherence, accessibility, and adaptation to labor market needs and socio-economic development. The aim of the presentation is to analyze the basic regulations of education law in relation to vocational and continuing education in Poland. In particular, it discusses solutions arising from the Act – Education Law – and executive acts regulating the organization of schools and institutions providing vocational education, forms of continuing education, as well as the principles for confirming professional qualifications and competencies. Attention has been drawn to the role of cooperation between schools and employers, the importance of market-relevant qualifications, and the flexibility of educational pathways that allow adults to supplement and update their skills. The conclusions indicate that the current legal regulations support the development of lifelong learning, strengthen the connection between education and the labor market, and create a framework for effective vocational preparation and skills enhancement in changing socio-economic conditions.

### **Keywords:**

educational law; adult education; vocational education

# ABSTRACTS OF **POSTERS**



**HUMANITIES  
SCIENCES**



## **BRIDGES, NOT WALLS: SOCIAL SKILLS IN SCIENCE AND WORK**

**Wiktoria Krakowiak**

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### **A few words about the author(s):**

Wiktoria Krakowiak, PhD student in pedagogy at UMCS in Lublin. Co-organizer of conferences and leader of workshops developing social skills. Co-author of scientific publications, two-time recipient of the UMCS Rector's scholarship.

### **Abstract:**

The contemporary scientific environment shows that knowledge leading to success is not limited solely to substantive skills. Social skills such as empathy, effective interpersonal communication and teamwork are becoming increasingly important. The poster shows how these skills become a key resource for young researchers, influencing the quality of relationships in project teams, the effectiveness of academic activities and opportunities for scientific career development. The need for systematic and conscious support for social skills in the process of higher education will also be emphasised as an integral part of preparing for work in the dynamically changing world of science.

### **Keywords:**

social skills; empathy; interpersonal communication; teamwork; scientific career development



## **SAFETY EDUCATION AS THE FOUNDATION OF A RESPONSIBLE SOCIETY**

**Bartosz Krakowiak (1)\*, Wiktoria Krakowiak (2)**

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*(2) Maria Curie-Skłodowska University in Lublin*

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### **A few words about the author(s):**

Bartosz Krakowiak, National Security student at the Jagiellonian University, Wiktoria Krakowiak, PhD student in Pedagogy at UMCS.

### **Abstract:**

Contemporary societies face a growing number of threats – from social and economic crises and military threats to cyberattacks and disinformation. In this context, security education takes on critical importance, aiming to shape citizens who are aware, responsible, and prepared to act. Security education constitutes a key element in building a responsible and conscious society. Its essence lies in developing the knowledge, skills, and attitudes that enable individuals and groups to respond effectively to modern threats.

The presented poster discusses the fundamental definitions and significance of security education, outlines its key thematic areas, and analyzes the impact of the educational process on the functioning of society – both in individual and collective dimensions. Particular attention is devoted to forms of educational influence, including institutional actions and civic activities, which together strengthen social resilience and a culture of responsibility. The poster highlights the necessity of a systemic approach and cooperation among various entities for the sake of public security.

### **Keywords:**

education; security; society; threat



## **DISINFORMATION AND FAKE NEWS AS A THREAT TO STATE SECURITY**

**Weronika Kurnyta**

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### **A few words about the author(s):**

Student at the Jan Grodek State University in Sanok, the field of study: Internal Security, and a member of the scientific club.

### **Abstract:**

Disinformation and fake news pose a serious threat to modern state security, especially in the era of rapid technological advancement and social media. The rapid spread of false information can lead to political, social, and economic destabilization, and may also be exploited by external entities to create confusion and division among citizens.

### **Keywords:**

disinformation; fake news; security

ABSTRACTS OF  
**PRESENTATIONS**



**MEDICAL  
SCIENCES**



## **THE ROLE OF MODERN RADIOLOGICAL PROCEDURES IN DIAGNOSING BLUNT LIVER INJURIES MANIFESTED BY UPPER GASTROINTESTINAL BLEEDING**

**Bartłomiej Białas (1)\*, Piotr Tomasz Arkuszewski (2),  
Maciej Rybicki (1), Konrad Szymczyk (3)**

*Faculty of Medicine, Medical University of Lodz, Narutowicza 60, 90-136 Lodz, Poland:*

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*(2) Department of Biomedicine and Experimental Surgery*

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### **A few words about the author(s):**

An interdisciplinary team of researchers from the Medical University of Łódź focusing on rare abdominal injuries and their complications.

### **Abstract:**

Posttraumatic upper gastrointestinal bleeding (UGIB) is a very rare consequence of blunt liver trauma. It can pose a significant diagnostic challenge for physicians, as symptoms may not appear until many weeks after the injury or may be very sparse. This presentation is based on an analysis of clinical cases of 13 patients with blunt liver trauma whose main symptom was gastrointestinal bleeding through the biliary tree. It provides an overview of the published medical literature focusing the impact of modern diagnostic methods such as CT, ultrasound and scintigraphy, on the diagnosis and long-term survival of patients with upper gastrointestinal bleeding through the biliary tract caused by blunt liver damage. The cases are divided into two groups: before the introduction of modern diagnostic procedures and after their introduction. The cases were compared with each other. The research shows important conclusions that liver damage can cause symptoms of upper gastrointestinal bleeding, even after minor abdominal trauma and with delayed and atypical symptoms. Modern diagnostic methods facilitate rapid diagnosis of these injuries and selection of appropriate treatment, reducing the risk of death.

### **Keywords:**

blunt liver trauma; upper gastrointestinal bleeding; haemobilia; USG; CT



## COMPLICATIONS FOLLOWING TRANSCATHETER AORTIC VALVE IMPLANTATION PERFORMED UNDER ANALGOSEDATION

**Kinga Brzuszkiewicz-Łozowska**

*Medical University of Lublin*

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### **A few words about the author(s):**

I am a physician and a PhD student in the Department of Cardiology. My doctoral thesis is on complications following structural procedures.

### **Abstract:**

**BACKGROUND:** Transcatheter aortic valve implantation (TAVI) has become the preferred treatment for patients with severe aortic stenosis across all surgical risk categories. Along with the development of transcatheter technologies, procedural strategies have evolved toward a minimalist approach, including the increasing use of conscious sedation instead of general anesthesia.

**AIM:** To evaluate the incidence and spectrum of periprocedural and in-hospital complications in patients undergoing transfemoral TAVI under conscious sedation.

**Methods:** We conducted a single-center, retrospective observational study including consecutive patients who underwent transfemoral TAVI under conscious sedation between 2024 and 2025.

**RESULTS:** A total of 78 patients were included. The study population was characterized by advanced age and a high burden of cardiovascular comorbidities. Procedural success was achieved in the majority of cases. The most frequently observed complications were conduction disturbances requiring permanent pacemaker implantation, vascular access-related complications, and transient hypotension requiring vasoactive support.

**CONCLUSIONS:** In this real-world single-center experience, transfemoral TAVI performed under conscious sedation was associated with a low rate of serious periprocedural and in-hospital complications. Conscious sedation appears to be a safe and feasible anesthetic strategy for TAVI, with an acceptable complication profile.

### **Keywords:**

transcatheter aortic valve implantation; conscious sedation; periprocedural complications; in-hospital outcomes



## **EVENING PRIMROSE OIL (EPO) SUPPLEMENTATION ON SKIN PARAMETERS**

**Mia Ocean Dunajewska**

*University of Bordeaux, France*

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### **A few words about the author(s):**

Neuroscience & Nutrition graduate, science aficionado, interested in impact of diet on one's health.

### **Abstract:**

Evening primrose oil (EPO) is a plant-derived oil rich in gamma-linolenic acid (GLA), an omega-6 fatty acid that plays a role in epidermal barrier integrity and inflammatory regulation. The aim of this presentation is to summarize the available evidence on EPO supplementation in diseased skin and to contrast it with findings from studies conducted in healthy populations. There are several systematic reviews and meta-analyses where oral EPO did not provide consistent clinical benefit in atopic dermatitis. Although some earlier randomized controlled trials reported improvements in symptoms, the pooled analyses demonstrate no significant overall effect. Due to heterogeneity, a clear conclusion cannot be given.

A randomized, double-blind, placebo-controlled trial in healthy adults showed significant improvements in multiple skin parameters after 12 weeks of oral EPO supplementation. Effects included increased skin moisture, elasticity and firmness, reduced trans-epidermal water loss, and decreased skin roughness. It's worth noting effects were visible only at 12 weeks, and no significant changes were observed during previous follow-ups, suggesting a slower response typical for dermatological studies.

Further well-designed randomized controlled trials are required to confirm these findings and to better define the role of EPO in skin health.

### **Keywords:**

evening primrose oil; skin; supplementation



## **EPITHELIAL–MESENCHYMAL TRANSITION AS A CENTRAL MECHANISM REGULATING TUMOR PROGRESSION AND MICROENVIRONMENTAL INTERACTIONS**

**Joanna Kubik (1)\*, Maja Kubik (2)**

*(1) Doctoral School, Medical University of Lublin*

*(2) Student of Catholic University of Lublin*

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### **A few words about the author(s):**

I am a PhD student conducting research in cancer biology at the Independent Medical Biology Unit.

### **Abstract:**

Epithelial–Mesenchymal Transition (EMT) is a biological process involving the reprogramming of epithelial cells toward a mesenchymal phenotype, characterized by reduced cell–cell adhesion and increased migratory capacity. In oncology, EMT is a key mechanism driving tumor progression, therapy resistance, and interactions between cancer cells and the tumor microenvironment (TME). Recent studies indicate that EMT comprises intermediate states with high phenotypic plasticity.

EMT induction is regulated by signaling networks activated by factors present in the TME, including transforming growth factor  $\beta$  (TGF- $\beta$ ), hypoxia, and pro-inflammatory cytokines. These pathways induce EMT-associated transcription factors such as SNAIL, TWIST, and ZEB, which modulate genes involved in cell adhesion and extracellular matrix interactions. EMT also promotes cancer stem cell–like properties and stress adaptation.

The relationship between EMT and the tumor microenvironment is bidirectional. Stromal and immune cells sustain EMT, while tumor cells undergoing EMT remodel the TME through immunomodulatory mediators and proteolytic enzymes, promoting invasion and immunosuppression. EMT is reversible; Mesenchymal–Epithelial Transition (MET) enables distant organ colonization and metastatic outgrowth.

EMT is a central focus in cancer research, integrating tumor progression, phenotypic plasticity, and tumor microenvironment interactions, and represents a promising diagnostic and therapeutic target.

### **Keywords:**

EMT; tumor microenvironment; phenotypic plasticity; tumor progression



## **THE FUNCTIONING OF THE FAMILY OF A CHILD WITH TYPE 1 DIABETES – THE IMPORTANCE OF DIABETES EDUCATION IN EVERYDAY LIFE**

**Sylwia Pucel**

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### **A few words about the author(s):**

The author is a PhD student at the Doctoral School of the Medical University of Białystok.

### **Abstract:**

Type 1 diabetes in children is a chronic autoimmune disease that affects not only the patient's somatic functioning, but also the daily life of the entire family. This disease requires constant blood glucose monitoring, insulin therapy, and lifestyle modifications, which place a significant burden on the child and their caregivers. According to the literature, the family of a child with type 1 diabetes plays a key role in the therapeutic process, and their level of knowledge and competence directly affects the effectiveness of treatment and the patient's quality of life. According to scientific reports, diabetes education is one of the basic elements of therapeutic management in type 1 diabetes. It includes, among other things, providing knowledge about the nature of the disease, the principles of insulin therapy, blood glucose self-monitoring, nutrition, and emergency management. Studies show that systematic and age-appropriate education of the child and their family promotes better metabolic control, reduces the number of episodes of hypo- and hyperglycemia, and lowers the level of stress and anxiety in caregivers. The literature also emphasizes the importance of an interdisciplinary therapeutic team consisting of a diabetes specialist, an educational nurse, a dietitian, and a psychologist. The team's cooperation with the family enables more effective implementation of therapeutic recommendations and supports the process of adaptation to chronic disease.

### **Keywords:**

type 1 diabetes; diabetes education; everyday life

# ABSTRACTS OF **POSTERS**



**MEDICAL  
SCIENCES**



## THE EFFECTIVENESS OF THE EXTERNAL ACTION OF THE ANTIBIOTIC – CEFIDEROKOL IN COMBINATION WITH POLYGLUTAMIC ACID AND NANO SILVER PARTICLES ON GRAM-NEGATIVE BACTERIA E. COLI AND P. AERUGINOSA

**Żaneta Binert-Kusztal (1)\*, Agata Krakowska (1, 2), Tomasz Skalski (3),  
Joanna Zontek-Wilkowska (4)**

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*(2) AGH University of Krakow, Department of Analytical Chemistry and Biochemistry, Faculty of Materials Science and Ceramics, Al. Mickiewicza 30, 30-059 Krakow, Poland*

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*(4) Jagiellonian University Medical College, Doctoral School of Medical and Health Science, Department of Inorganic Chemistry and Pharmaceutical Analytics, Faculty of Pharmacy, 9 Medyczna Street, 30-688 Kraków, Poland*

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### **A few words about the author(s):**

Scientific interests include antibiotics from the cephalosporin group and other active substances that enhance the bactericidal effect.

### **Abstract:**

This research investigated the combined effects of polyglutamic acid ( $\gamma$ -PGA), cefiderocol, and AgNPs within multilayer wound dressings on selected Gram-negative pathogens, namely E. coli and P. aeruginosa. The results revealed that  $\gamma$ -PGA markedly enhanced bacterial survival, with approximately 40% of cells remaining viable even under the highest antimicrobial exposure. Statistical analyses using generalized linear models and random forest regression demonstrated that  $\gamma$ -PGA concentration was the dominant determinant of bacterial viability, surpassing the influence of both cefiderocol and AgNPs. The antimicrobial response to cefiderocol varied among species, with P. aeruginosa showing the greatest tolerance, highlighting interspecies differences in susceptibility. In contrast, AgNPs exerted a consistent inhibitory effect on bacterial growth across all tested strains. Additionally, the spatial placement of  $\gamma$ -PGA within the dressing architecture significantly affected microbial persistence, as higher concentrations and direct exposure favored bacterial survival. Collectively, these findings indicate that although  $\gamma$ -PGA contributes beneficially to wound hydration and tissue regeneration, it may simultaneously attenuate antimicrobial activity and promote bacterial protection or biofilm development. Consequently, careful optimization of  $\gamma$ -PGA content and multilayer dressing design is essential to enhance antimicrobial performance and improve therapeutic outcomes in wound management.

### **Keywords:**

cefiderocol;  $\gamma$ -PGA, AgNPs; Gram-negative bacteria; wounds; bacterial infections



## APPLICATION OF VOLTAMMETRY IN THE ANALYSIS OF IRON SORPTION IN THE PRESENCE OF CEFIDEROKOL

**Żaneta Binert-Kusztal (1)\*, Małgorzata Suchanek (2), Alicja Matyjewicz (2), Przemysław Dorożyński (1), Agata-Krakowska (1, 2)**

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*(2) AGH University of Krakow, Department of Analytical Chemistry and Biochemistry, Faculty of Materials Science and Ceramics, Al. Mickiewicza 30, 30-059 Krakow, Poland*

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### **A few words about the author(s):**

Scientific interests include antibiotics from the cephalosporin group and other active substances that enhance the bactericidal effect.

### **Abstract:**

The active substance in Fetroja is cefiderocol, whose unique mechanism of action involves penetrating bacteria together with iron molecules, exploiting the natural need of microorganisms for this element, using bacterial transport systems to enter the cell, and subsequently leads to the inhibition of bacterial cell wall synthesis. The introduction of cefiderocol, as the latest antibiotic exhibiting activity against Gram-negative bacteria with a unique “Trojan horse” penetration mechanism, is an important aspect in the fight against existing drug resistance. In order to determine this mechanism and the effectiveness of iron sorption, which is variable over time, a highly sensitive voltammetric methodology using a mercury electrode was applied. For this purpose, the specific iron binding efficiency was determined using 2 mg of the drug and iron (III) solution in three concentrations (25  $\mu\text{M}$ , 50  $\mu\text{M}$ , 100  $\mu\text{M}$ ). It was shown that the efficiency is related to the incubation time, and the highest differences were obtained after 1 hour: 44%, 47%, and 31.5%, respectively. The studies are a prelude to detailed analyses that will allow this active substance to be used in controlled conditions as well as in surface applications.

### **Keywords:**

cefiderocol; iron; sorption; electrochemical method; voltammetric method



## DIFFERENTIATION OF PEAK POWER GENERATION IN THE CONTEXT OF SELECTED ANTHROPOMETRIC INDICATORS

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*Department of Individual and Team Physical Activities,  
University of Health and Sport Sciences in Wrocław*

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### **A few words about the author(s):**

Assistant in the Department of Individual and Team Physical Activities at University of Health and Sport Sciences in Wrocław. He also works as a personal trainer, strength and conditioning coach, and instructor. he trained in the decathlon.

### **Abstract:**

One of the factors that may influence the ability to generate mechanical power are anthropometric and somatic features, which shape the biomechanical conditions of movement and the effectiveness of the stretch-shortening cycle (SSC) during sprint running.

The aim of this work was to characterize selected anthropometric indicators and examine their impact on maximum power during a dynamic strength exercise (CMJ) in athletes competing in speed-strength disciplines, in the context of sprint running. Measurements included body mass, height, limb lengths, and BMI calculation. Peak power ( $\text{W}\cdot\text{kg}^{-1}$ ) was measured during a CMJ on a Kistler Type 9286B force platform; Kistler Instruments AG, Winterthur, Switzerland. The group was characterized by moderate variability in anthropometric features, typical for athletes in speed-strength athletics. Differences in body segment lengths, especially in the lower limbs, were observed, although analysis did not reveal significant differences in relative peak power between groups with different segment lengths.

The results may suggest that the influence of anthropometric features on lower limb power is indirect or related to other functional factors, rather than an independent determinant.

### **Keywords:**

peak power; sprints; anthropometry; CMJ



## NATURE VS. PATHOGENS: THE POTENTIAL OF CHITOSAN IN BIOMATERIALS ENGINEERING

Karolina Czajkowska (1)\*, Karol Kamil Kłosiński (1), Radosław Aleksander Wach (2)

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Medical University of Łódź, Narutowicza 60, 90-136 Łódź, Poland*

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### A few words about the author(s):

The authors belong to an interdisciplinary group researching hydrogels. They focus on the synthesis, modification, and physicochemical and biological characterization of biomaterials for tissue engineering and medicine.

### Abstract:

Chitosan hydrogels constitute a distinct class of polymeric biomaterials derived from chitin, highly valued in biomedical engineering due to their biocompatibility, biodegradability, and structural versatility. This work focuses on their broad spectrum of antibacterial activity, highlighting their potential in combating the growing resistance of microorganisms.

The basic mechanism of action involves electrostatic interactions between the polycationic structure of chitosan and the negatively charged surfaces of microbial cells, resulting in cell membrane damage, leakage of intracellular components and inhibition of mRNA synthesis. Critical analysis shows that this effectiveness is inextricably linked to physicochemical parameters; in particular, a higher degree of deacetylation (DD) generally correlates with increased cationic charge density and bactericidal activity. However, the influence of molecular weight (MW) varies depending on the target organism, and efficacy is strongly pH-dependent, favouring acidic environments where amino groups are protonated.

To enhance these properties, substances that can be classified as natural additives, synthetic reinforcers, or antibiotics are increasingly being used. Concluding the review, future prospects for wound dressings, while emphasising the critical need to balance microorganism mortality with host cytotoxicity and the need to standardise manufacturing protocols to ensure reproducibility in clinical settings.

### Keywords:

chitosan hydrogels; antimicrobial activity; degree of deacetylation; molecular weight; biomaterials



## SERUM REDOX STATUS REFLECTS STONE LOCATION IN UROLITHIASIS: A COMPARATIVE ANALYSIS OF NEPHROLITHIASIS AND URETEROLITHIASIS

Marek Biesiadecki (1), Sabina Galiniak (1)\*, Julia Poleć (1), Krzysztof Balawender (2),  
Agnieszka Mołoń (1), Mateusz Mołoń (2)

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(2) Faculty of Biology, Nature Conservation and Sustainable Development, University of Rzeszów

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### A few words about the author(s):

Sabina Galiniak is an associate professor at the University of Rzeszów. Her research focuses on oxidative stress, redox biomarkers, and metabolic disturbances in clinical and experimental medicine.

### Abstract:

Urolithiasis is a multifactorial disease in which oxidative stress plays an important role in stone formation and systemic metabolic disturbances. The aim of this study was to evaluate whether serum redox status differs between patients with nephrolithiasis and ureterolithiasis.

Serum levels of advanced oxidation protein products (AOPP), malondialdehyde (MDA), thiol groups, total antioxidant capacity (TAC), total oxidant status (TOS), and oxidative stress index (OSI) were assessed in patients with kidney or ureteral stones and in healthy controls.

Patients with urolithiasis showed significantly increased serum AOPP, MDA, TOS, and OSI, accompanied by reduced antioxidant capacity compared to controls. Distinct differences were observed between stone localizations. Nephrolithiasis was associated with a higher systemic oxidative burden, while ureterolithiasis was characterized by lower antioxidant capacity and increased Amadori product levels.

Serum redox markers may reflect stone location in urolithiasis and could serve as non-invasive tools supporting disease differentiation and personalized clinical management.

### Keywords:

urolithiasis; nephrolithiasis; ureterolithiasis; oxidative stress; serum biomarkers



## MICRO- AND NANOPLASTICS AS EMERGING ENVIRONMENTAL RISK FACTORS IN CARCINOGENESIS

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Łukasz Duda (1), Zbigniew Pasieka (1, 2)**

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### **A few words about the author(s):**

The authors conduct research on bioactive materials and substances for biomedical applications and their impact on organisms, collaborating with domestic and international institutions. Currently, focusing on detecting microplastics in tissues.

### **Abstract:**

Microplastics (MPs, <5 mm) and nanoplastics (NPs, <1000 nm), collectively referred to as micro- and nanoplastics (MNPs), are ubiquitous environmental contaminants detected in air, water, food, and human tissues. Human exposure occurs mainly through ingestion, inhalation, and dermal contact, leading to accumulation in organs such as the lungs, liver, gastrointestinal tract, brain, and lymphatic system. Growing evidence suggests that MNPs may contribute to carcinogenesis through multiple mechanisms, including oxidative stress induction, chronic inflammation, endocrine disruption, mitochondrial dysfunction, DNA damage, and interference with cellular signaling pathways regulating proliferation, apoptosis, and cell cycle control.

Moreover, MNPs can adsorb toxic environmental pollutants, acting as carriers that enhance cellular exposure to carcinogens. The potential cancer risk depends on particle size, composition, concentration, and duration of exposure, with chronic high-level exposure posing a greater threat than short-term exposure. Although a direct causal relationship between MNP exposure and cancer development has not yet been conclusively established, available experimental and epidemiological data indicate a plausible role for MNPs in cancer initiation and progression. Further interdisciplinary research is required to clarify long-term health effects and underlying molecular mechanisms.

### **Keywords:**

microplastics; nanoplastics; cancer, environmental pollution; carcinogenesis



## **SAFETY CHARACTERIZATION OF SELECTED PROTEOLYTIC TARGETS IN CHRONIC MYELOID LEUKEMIA USING IN SILICO APPROACHES**

**Natalia Kubryń\*, Alicja Nowaczyk**

*Collegium Medicum im. Ludwika Rydygiera in Bydgoszcz University Nicolaus Copernicus in Torun*

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### **A few words about the author(s):**

I am a PhD student at the Doctoral School of the Collegium Medicum, Nicolaus Copernicus University.

### **Abstract:**

PROTACs (PROteolysis TARgeting Chimeras) represent an innovative therapeutic strategy based on the selective degradation of disease-related proteins and may offer a novel approach for the treatment of chronic myeloid leukemia (CML). CML is a hematological malignancy characterized by uncontrolled proliferation of immature leukocytes resulting from malignant transformation of bone marrow cells. The mechanism of action of PROTAC molecules relies on targeted elimination of oncogenic proteins, leading to inhibition of cancer cell proliferation and induction of apoptotic pathways. According to available literature, this strategy has the potential to enhance therapeutic efficacy while reducing adverse effects, thereby constituting a promising alternative, particularly in cases resistant to conventional treatment.

In this study, six PROTAC compounds with potential anticancer activity in CML therapy were analyzed. Computational in silico methods were applied using the admetSAR and DataWarrior software platforms. The analysis included evaluation of key physicochemical parameters, such as molecular weight, polarity, lipophilicity (logP), solubility, and the number of hydrogen bond donors and acceptors, as well as prediction of safety and toxicity profiles. The obtained results indicate that the probability of respiratory toxicity for the analyzed compounds reaches approximately 90%, while the risk of drug-induced liver injury was estimated to be in the range of 60–70%.

### **Keywords:**

in silico; safety; chronic myeloid leukemia



## INNOVATIVE APPLICATIONS OF HYDROGELS IN CONTEMPORARY MEDICINE

**Maciej Rybicki (1)\*, Karolina Czajkowska (2), Agata Grochowska (1),  
Bartłomiej Białas (1), Michał Dziatosz (1), Igor Karolczak (1), Julia Kot (1),  
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### **A few words about the author(s):**

Interdisciplinary team from the Medical University of Łódź and the Łódź University of Technology focuses on biomaterials, their properties, modification and clinical potential, with particular emphasis on applications in various fields of medicine.

### **Abstract:**

Hydrogels are hydrophilic, soft polymer networks with high water content, tunable mechanical properties, and good biocompatibility, making them attractive biomaterials. This work discusses their key clinical applications. Chemical, physical, or hybrid crosslinking of synthetic or natural polymers enables precise control of physicochemical properties and features such as stimuli-responsiveness, drug release, and biodegradability. In gynecology, hydrogels support endometrial regeneration, treat infections, and prevent pregnancy. In cardiology, they show promise in myocardial infarction therapy as injectable scaffolds, cardiac patches, and drug carriers. In rheumatoid arthritis, they function as delivery systems, lubricants, scaffolds, and immunomodulators. They are also being developed as antimicrobial stent coatings and radiotherapy barriers in urology. Ophthalmology uses hydrogels in contact lenses, corneal bandages, and vitreous implants. In oncology, they serve in chemoembolization, tumor models, and drug delivery, with Gliadel wafers already in clinical use. Abdominal surgery applications include hydrogel-coated meshes for hernia repair and Janus hydrogels to prevent adhesions. Clinical and preclinical studies highlight their versatility, though challenges remain with mechanical stability, long-term safety, and large-scale production. Overall, hydrogels represent next-generation biomaterials for regenerative and personalized medicine.

### **Keywords:**

hydrogels; medical applications; drug delivery; regenerative medicine; tissue engineering



## **MOTIVATION FOR PHYSIOTHERAPY AND ITS EFFECTIVENESS**

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### **A few words about the author(s):**

Janina Danuta Rzeszot physiotherapist.

### **Abstract:**

This comprehensive literature review examines the critical relationship between patient motivation and the effectiveness of physiotherapy interventions. Drawing from 30 highly relevant studies including randomized controlled trials, systematic reviews, and cost-effectiveness analyses, the evidence demonstrates that physiotherapy is clinically effective and cost-effective across diverse conditions when patients maintain adequate adherence. Patient motivation emerges as a pivotal mediator of treatment success, with theory-based interventions—particularly those grounded in Self-Determination Theory, Protection Motivation Theory, and the Health Action Process Approach—showing promise in enhancing adherence rates that typically range from 30-77%. Enhanced behavior change interventions combined with physiotherapy demonstrate superior cost-effectiveness, with some studies reporting cost savings of €850-5,000 per patient while improving quality-adjusted life years. The review identifies self-efficacy, perceived treatment value, autonomy support, and barrier management as key modifiable factors that healthcare providers can target to optimize patient outcomes and healthcare resource utilization.

### **Keywords:**

physiotherapy; patient; motivation



## HOW TO PREPARE 'HERBAL TEA'? MODIFICATION OF INFUSING TIME AND THE CONTENT OF REDUCING COMPOUNDS IN HERBAL INFUSIONS

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### **A few words about the author(s):**

Kinga Stempińska is a cosmetology and biotechnology student and chairwoman of the Scientific Club. The Scientific Club is supervised by Agnieszka Godela, MSc. Karol Maksymilian Górski, PhD in Medical Sciences and Health Sciences, is a pharmacist.

### **Abstract:**

Patients rarely refer to the information contained in the leaflets accompanying medicines. The aim of the study was to check whether changing the infusion time of herbs in relation to the manufacturer's recommendations affects the content of compounds with potential antioxidant properties. For this purpose, infusions were made from three selected herbs (*Matricaria recutita*, *Viola tricolor*, *Salvia officinalis* - registered as medicinal products) in accordance with the manufacturer's recommendations, then the steeping time was reduced fivefold and increased fivefold. In addition, a decoction was prepared using the same time as for the infusion with a 5-fold extension of the infusion time, and an additional infusion was prepared using ultrasound also with a fivefold increase in time. For all extracts, the total phenolic content was checked using the Folin-Ciocalteu method. It was observed that for individual medicinal products, the infusion time affects the content of reducing compounds with potential antioxidant activity.

### **Keywords:**

herbal infusion; total phenolic content



## THE ANTIBACTERIAL ACTIVITY OF TREMELLA FUCIFORMIS CHITIN-GLUCAN COMPLEX (CGC-TFM) - LITERATURE REVIEW

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### A few words about the author(s):

A scientific team conducting research on the properties of pharmaceutical biomaterials.

### Abstract:

The chitin-glucan complex (CGC-TFM) from *Tremella fuciformis* shows effective antibacterial activity primarily against *Escherichia coli*, derived from its fermentation residue and characterized by a GlcN:Glc ratio of 26:74,  $\beta$ -chitin structure, and high N-acetylation (70.52%). The polysaccharides complex CGCs from other mushrooms, such as *Aspergillus niger* and *Mucor rouxii*, demonstrate antibacterial effects against *Salmonella typhimurium*, while general fungal CGCs exhibit improved activity over pure chitin, often linked to their cell wall-derived immunostimulant and structural properties. The study analyzed literature data regarding to the relationship between the extraction method and the presence of CGC complexes and antibacterial properties.

### Keywords:

chitin-glucan complex; *Tremella fuciformis*; antibacterial activity; extraction method



## **PORIA COCOS (WOLFIPORIA EXTENSA) THE UNIQUE MUSHROOM WITH HEALTH-PROMOTING PROPERTIES – LITERATURE REVIEW**

**Joanna Zontek-Wilkowska (1)\*, Agata Krakowska (2, 3), Maja Tomczyk (2),  
Przemysław Dorożyński (2), Bożena Muszyńska (4)**

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### **A few words about the author(s):**

A scientific team conducting research on the properties of pharmaceutical biomaterials.

### **Abstract:**

*Poria cocos (Wolfiporia extensa), is also known as "Fuling" in traditional Chinese medicine and has been known for over 2,000 years for its diuretic, sedative, and tonic properties in treating conditions like nephrosis, gastritis, and edema. The literature data highlight Poria cocos multifaceted bioactivities, including anticancer effects via NF- $\kappa$ B inhibition and angiogenesis suppression, anti-inflammatory modulation of cytokine secretion, antioxidant protection, immunomodulation by enhancing immune stimulators, hepatoprotective and nephroprotective roles, as well as neuroregulatory and gut microbiota benefits. Triterpenoids, presented in P. cocos complement these actions, contributing to anti-hyperglycemic and anti-rejection effects, underscoring its potential in functional foods and adjuvant therapies. This review analyzed chemical structures, extraction methods (e.g., hot water, alkali, ultrasonic), and pharmacological evidence, advocating for harness P. cocos polysaccharides in biomaterials.*

### **Keywords:**

Poria cocos; biomaterials; polysaccharides; extraction



## THE INFLUENCE OF FUNCTIONAL KINEMATIC ASYMMETRY ON MAXIMUM SPEED PERFORMANCE IN REPEATED SPRINTS

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### **A few words about the author(s):**

Mateusz Jopek, PhD, researches sprint biomechanics and movement asymmetry. Professor Krzysztof Maćkała is a leading expert in sprint science with extensive publications and major contributions to training and performance.

### **Abstract:**

The study aimed to determine the influence of functional asymmetry on the kinematic parameters of the 50m run and its significance in shaping maximum speed in sprinters at various sports levels. The analysis included 18 Polish sprinters (elite:  $\leq 10.40$  s, sub-elite:  $\leq 11.10$  s per 100 m) who performed four 50 m runs with 5-minute breaks. Kinematic parameters were recorded using the OptoJumpNEXT system and WittyGate photocells. The fastest and slowest run of each athlete was selected for analysis. The results showed that kinematic asymmetry has a significant impact on sprint performance. Elite sprinters had less asymmetry in stride length, frequency, and ground contact time, which correlated with better results. The key findings indicate that in the acceleration phase (0–20 m), stride length and contact time symmetry were crucial, while in the maximal speed phase (20–50 m), the symmetry of stride frequency was important. A higher sports level was associated with a more optimized running technique, as evidenced by lower kinematic asymmetry. The results suggest that minimizing kinematic asymmetry may be a crucial factor in optimizing the sprinting technique and enhancing performance, offering practical insights for coaches and athletes and empowering them to make informed decisions in their training programs.

### **Keywords:**

sprinting; asymmetry; maximum speed; kinematics; biomechanics

ABSTRACTS OF  
**PRESENTATIONS**



**TECHNICAL AND  
NATURAL SCIENCES**



## **BIKE-SHARING DEMAND PREDICTION USING WEATHER, TIME SERIES, AND SPATIAL DATA**

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### **A few words about the author(s):**

I am a 3<sup>rd</sup> year student at Lodz University of Technology, studying Modelling and Data Science. I am passionate about Python programming, machine learning, and data science, and I am an engaged student and scholarship holder.

### **Abstract:**

This presentation focuses on predicting bike-sharing demand using data-driven methods. The analysis combines weather data, time-series information, and spatial location features to better understand patterns in bike usage. Factors such as temperature, precipitation, seasonality, and time of day are examined to capture both short-term and long-term demand fluctuations. Machine learning models are applied to identify relationships between external conditions and user behavior, allowing for accurate demand forecasting. The results demonstrate how integrating temporal and environmental variables can significantly improve prediction performance. Such predictions can support bike-sharing operators in fleet management, station rebalancing, and infrastructure planning, contributing to more efficient and sustainable urban transportation systems.

### **Keywords:**

bike-sharing; demand prediction; machine learning; time series analysis; weather data



## **APPLICATION OF INTELLIGENT ALGORITHMS IN THE AUTOMATION OF LOGISTICS PROCESSES IN WMS SYSTEMS**

**Krzysztof Boryczko, Krzysztof Zajda, Ryszard Ćwirko, Bartłomiej Miska, Tomasz Brom\***

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### **A few words about the author(s):**

Krzysztof Boryczko – Research worker, modeling and simulation specialist. Krzysztof Zajda – Head of the research team. Ryszard Ćwirko – Project Manager. Bartłomiej Miska – Innovation Manager. Tomasz Brom – Senior Project Specialist.

### **Abstract:**

The functioning of a company in a complex logistics structure implies a number of problems: processing large amounts of information from various sources (e.g., the use of different IT systems in different “links” of the supply chain), separate management of different parts of the supply chain, insufficient and delayed information about physical events affecting the operational level of processes, difficulty in assessing the significance of events, chaotic information about the physical state of the flow of goods makes it difficult to assess the situation.

The above prompted the company to carry out research and development work on the automation of logistics processes using intelligent algorithms and device prototypes in a distributed structure of distribution centers. The main objective of the project was to increase the efficiency of the integrated supply chain. This objective was achieved through the development and implementation of the results of the research and development project, which are:

- new methods of picking heterogeneous loading units using prototypes of digitally controlled automation devices;
- a modern decision-making module for the WMS system using intelligent algorithms that automate and support the global decision-making process in a distributed structure of distribution centers.

### **Keywords:**

logistics; automation; machine learning; distribution centers; decision-making



## INTEGRATION OF THE INTERNET OF THINGS AND DATA ANALYTICS IN SALES PREDICTION

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### **A few words about the author(s):**

Joanna Fajto-Pierzchała – Research worker, Business Process Optimization Specialist.  
Ireneusz Prus – Head of the research team. Bartłomiej Miska – Innovation Manager.  
Tomasz Brom – Senior Project Specialist.

### **Abstract:**

Innovative prototype of an analytical platform using Internet of Things mechanisms. The research and development project is a response to the company's ongoing need for growth and the search for innovative, practical solutions. The company identified the issue of DIRP (Data Rich Information Poor), noting that although it receives vast amounts of data from retail points, it lacks effective models to assess the value of this information. It processes large volumes of varied, unstructured data to better understand customer purchasing behaviors. The abundance of data makes it difficult to distinguish valuable, explanatory information from data without market significance.

To address this, the company undertook R&D efforts to create a prototype of an innovative platform for analyzing distributed and heterogeneous Big Data, leveraging Internet of Things (IoT) mechanisms. The platform also supports individualized promotional activities in traditional sales channels, helping the company compete effectively with foreign networked retailers. As a result, the analytical platform was developed with:

- a hardware layer – smart IoT devices (telemetric shelves and modules) for collecting data from various sales channels;
- a software layer – specialized software for analyzing the gathered data.

### **Keywords:**

automation; machine learning; IoT; data analysis; retail



## AN INTELLIGENT RECOMMENDATION SYSTEM TO SUPPORT THE SELECTION OF CULINARY RECIPES

**Łukasz Wala, Dariusz Wyźga, Bartłomiej Miska, Tomasz Brom\***

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### **A few words about the author(s):**

Łukasz Wala – Head of the research team. Dariusz Wyźga – Project Manager. Bartłomiej Miska – Innovation Manager. Tomasz Brom – Senior Project Specialist.

### **Abstract:**

The main expectation of users is personalization, which is a key trend in e-commerce and beyond. According to various reports, personalized activities and content will play a crucial role. Personalization is understood not only as a market need generated by customers and users, but also as an opportunity for marketers. The company conducted a research and development project, which resulted in the Intelligent Cooking Planner (ICP) based on artificial intelligence solutions. The project was carried out with the overarching goal of increasing contact time with the company's brands through the uwielbiam.pl website, where the aforementioned result of the project was implemented.

The Intelligent Culinary Planner works on the basis of a machine learning (ML) model developed in the course of R&D work, which is used to personalize and recommend culinary content tailored to the user's preferences and needs. The IPK reduces the time users spend searching for the desired recipe, thus bringing the company a long-term benefit in the form of users returning to the uwielbiam.pl website (a place that is attractive to users in terms of satisfaction with personalized content drawn from the website).

Thanks to R&D work, it was possible to develop the architecture of the solution and a machine learning (ML) model for the purpose of customizing (personalizing) culinary content for users of the uwielbiam.pl website.

### **Keywords:**

personalization; machine learning; recommendation; culinary platform; user data



## OPTIMIZATION OF RETAIL STORE DISPLAYS USING MACHINE LEARNING METHODS

Alicja Moleń, Anna Skibińska, Bartłomiej Miska, Tomasz Brom\*

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### **A few words about the author(s):**

Alicja Moleń – Research worker, Category Management Expert. Anna Skibińska – Project Manager. Bartłomiej Miska – Innovation Manager, Tomasz Brom – Senior Project Specialist.

### **Abstract:**

Development of a solution automating the store display management process. The main research challenge in the project was to create an application that would recommend the optimal placement of products on store shelves, thereby automating the process of creating planograms, i.e., graphical representations of sales space including store fixtures and the products displayed on them. Planograms are used in retail to optimize display and assortment, usually during product category management projects. Developing an application that recommends the most effective planogram possible is a complex issue.

The work resulted in the creation of a system that automates the store display management process, using artificial intelligence (machine learning) in the decision-making process based on data received from IoT devices. In addition, the developed planograms were visualized in the virtual store space. The use of machine learning helped identify the optimal placement of products by category to achieve the best possible sales.

### **Keywords:**

personalization; machine learning; automation; recommendation; planogram



## THE FOURIER TRANSFORM: ANATOMY OF A SIGNAL

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### **A few words about the author(s):**

I am a student of Applied Mathematics at the Faculty of Computer Science, Białystok University of Technology. My primary research interest is cryptography.

### **Abstract:**

The Fourier Transform serves as the cornerstone of modern signal processing, bridging the gap between theoretical mathematics and practical engineering. This presentation offers a comprehensive view of signal analysis, transitioning from the intuitive time domain to the revealing frequency domain. Beginning with the historical context of Jean-Baptiste Joseph Fourier's work on heat conduction, we explore the rigorous mathematical foundations of the transform, including the integral formula and the crucial concept of orthogonality.

A significant portion of the discussion is dedicated to the challenges of the digital realm, specifically the transition from continuous functions to the Discrete Fourier Transform (DFT). We examine the implications of the Nyquist-Shannon sampling theorem and the computational revolution brought by the Fast Fourier Transform (FFT) algorithm. The presentation concludes by demonstrating how these abstract concepts form the backbone of contemporary technologies, from audio compression and medical imaging (MRI) to modern telecommunications, proving that complex reality can be effectively understood as a symphony of simple vibrations.

### **Keywords:**

Fourier Transform; signal processing; harmonic analysis



## MATHEMATICAL DECONSTRUCTION OF ASYMMETRIC SECURITY: A CASE STUDY OF WEAK KEYS IN THE RSA ALGORITHM

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### **A few words about the author(s):**

I am a student of Applied Mathematics at the Faculty of Computer Science, Białystok University of Technology. My primary research interest is cryptography.

### **Abstract:**

The RSA algorithm remains a cornerstone of modern asymmetric cryptography, relying on the computational difficulty of integer factorization and the discrete logarithm problem. However, the security of this cryptosystem is not absolute but conditional, heavily dependent on the proper selection of key parameters. This presentation provides a rigorous analysis of RSA's resilience against algebraic attacks, focusing on implementation vulnerabilities that compromise its theoretical strength. We begin by establishing the mathematical foundations of the cryptosystem, including modular exponentiation and the generation of public and private keys based on large prime numbers. The core of the discussion centers on specific scenarios where improper key generation leads to catastrophic failures. We examine the mechanics of Fermat's Factorization, demonstrating how prime factors that are too close to each other expose the system to rapid decryption<sup>1</sup>. Furthermore, we analyze Pollard's  $p-1$  algorithm, which exploits primes with smooth predecessors. Finally, the presentation addresses the Discrete Logarithm Problem (DLP) and illustrates the Baby-Step Giant-Step algorithm<sup>3333</sup> as a method for recovering private keys. The study concludes that the mathematical robustness of RSA is inextricably linked to the quality of its implementation, emphasizing that even theoretically sound algorithms can fail due to "weak keys".

### **Keywords:**

RSA algorithm; cryptanalysis; Integer Factorization



## **ANTIBIOTICS – WHAT DO WE REALLY KNOW ABOUT THEM? A STUDY AMONG SOCIAL SCIENCES STUDENTS**

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### **A few words about the author(s):**

By education, a medical laboratory diagnostician, a graduate of the Pomeranian Medical University in Szczecin. Five years of professional experience working in medical microbiology laboratories.

### **Abstract:**

Increasing bacterial resistance to antibiotics is a serious public health challenge. This study assessed social science students' knowledge of antibiotics and basic microbiology. Ninety-five students aged 18–30 participated, most being 19 years old (44%). The questionnaire had 12 open-ended questions. Results showed 94% knew bacteria and viruses are different, 87% recognized that bacterial and viral infections require different treatments, though 48% justified this incorrectly. Only 28% answered and explained correctly. Differences between influenza and streptococcal tonsillitis were known to 22%. Thirty-nine percent correctly defined antibiotics, 35% identified when they are effective, and 51% knew when not to use them. Forty-three percent had never heard of “antibiotic resistance” or “multidrug resistance.” Only 39% understood the consequences of resistance, 74% did not know what a microbiological test is, 18% understood “physiological microbiota,” and 48% knew about probiotics. Health education for non-medical students needs strengthening.

### **Keywords:**

antibiotics; antibiotic resistance; multidrug resistance; knowledge of basic microbiology



## THE COIN ROTATION PARADOX

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### **A few words about the author(s):**

I am a 3<sup>rd</sup> year Computer Science student and a 1<sup>st</sup> year Applied Mathematics student at Białystok University of Technology in Poland. Mathematics is my passion, which is why I decided to pursue it as a second major.

### **Abstract:**

This presentation explores the coin rotation paradox, a classic geometric puzzle where a coin rolling around an identical stationary coin completes two full rotations instead of one. We explain the mathematical reasoning behind this phenomenon by analyzing the path traveled by the center of the rolling coin. Furthermore, we generalize the problem to other shapes, such as squares and triangles, and present a general formula  $(N+1)$  for calculating the number of rotations based on the ratio of perimeters. Finally, the presentation discusses real-world implications of this paradox in mechanics and astronomy.

### **Keywords:**

coin rotation paradox; geometry; path of the center; geometric puzzles; mechanics



## **BENFORD'S LAW: MATHEMATICAL ANOMALIES IN FRAUD DETECTION**

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I am a 3<sup>rd</sup> year Computer Science student and a 1<sup>st</sup> year Applied Mathematics student at Białystok University of Technology. Mathematics is my passion, which is why I decided to pursue it as a second major.

### **Abstract:**

This presentation discusses Benford's Law, a probabilistic observation stating that in many real-life datasets, the leading digit is likely to be small. While intuition suggests a uniform distribution of digits 1-9, Benford's Law demonstrates that the number 1 appears as the leading digit in approximately 30% of cases, following a logarithmic distribution. We will present the mathematical formulation of this law ( $P(d) = \log_{10}(1 + 1/d)$ ) and demonstrate its practical applications in data science, specifically in forensic accounting and algorithmic fraud detection.

### **Keywords:**

Benford's Law; probability theory; data science; Fraud detection; mathematical statistics



## ENVIRONMENTAL AND GENETIC DRIVERS OF FEATHER KERATIN COMPOSITION AND STRUCTURE IN LAYING HENS

**Dominika Krakowiak (1)\*, Karolina Wengerska (2), Kamil Drabik (2)**

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### **A few words about the author(s):**

Dominika Krakowiak is a researcher at the University of Life Sciences in Lublin. She studies the biological and physicochemical properties of animal-derived products, mainly poultry eggs, combining biophysics, biology and food science.

### **Abstract:**

Feather keratin in laying hens is a complex protein that reacts to environmental conditions and species traits. Feathers are increasingly used as a model for assessing welfare, protein metabolism and long-term stress. Studies show that housing systems shape keratin content and structure, with differences observed between cage, litter and free-range systems. Conditions influence feather growth, keratinization, disulfide bond organization and the ratio of alpha-helical to beta-sheet structures, which affects mechanical stability.

Research also reports clear variation among lines and species. Differences include amino acid profiles, proportions of type I and II keratins and gene expression patterns linked to production level. Environmental stress, oxidative balance, skin microbiota and nutrient availability contribute to feather maturation and fiber resistance.

Genotype–environment interactions strongly determine keratin quality. Feathers are easily accessible material, making them a practical indicator of welfare and long-term physiological changes. The available evidence points to the need to integrate biochemical, spectroscopic and genomic methods to better explain the relationships between housing systems, species-specific traits and keratin properties.

### **Keywords:**

keratin; feathers, assessing welfare



## PROJECTILE MOTION IN A GRAVITATIONAL FIELD

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### **A few words about the author(s):**

I am passionate about physics and I really enjoy presenting seemingly difficult concepts in the simplest possible way.

### **Abstract:**

A mathematical description of vertical, horizontal, and oblique projectile motion. The presentation includes a detailed analysis of the equations of motion in a uniform gravitational field, with particular attention to initial velocity, acceleration due to gravity, and time of flight. A graphical representation of projectile trajectories is provided, illustrating the characteristic shapes of motion paths for different types of throws. The study also involves drawing and interpreting velocity vectors at various stages of the motion, showing how both direction and magnitude change over time. In addition, special emphasis is placed on performing calculations using the International System of Units (SI) and on correctly converting and operating with physical units to ensure accuracy and consistency in problem-solving.

### **Keywords:**

projectile motion; gravitational field; velocity vectors; motion trajectories; SI units



## **ELECTROMAGNETIC INDUCTION**

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### **A few words about the author(s):**

I am passionate about physics and I really enjoy presenting seemingly difficult concepts in the simplest possible way.

### **Abstract:**

The presentation will focus on electromagnetic induction, which is the generation of electric current in a conductor as a result of changes in magnetic flux. We will discuss the left-hand and right-hand rules, which allow us to determine the direction of the force acting on a conductor and the direction of the induced current. We will show how sliding a conductive frame into a magnetic field increases the magnetic flux, causing voltage and induced current. We will also illustrate the effect of bringing a magnet closer to a coil, which changes the magnetic flux and induces current. The presentation will include simple experiments and diagrams that help understand how the movement of a conductor in a magnetic field leads to current generation and the physical laws governing this phenomenon.

### **Keywords:**

electromagnetic induction; magnetic flux; induced current; left-hand rule; right-hand rule



## **NEW SOLUTIONS IN PRODUCTION PROCESS OF CONCENTRATED FRUIT JUICES WITH UPGRADED HEALTH PROPERTIES**

**Bartłomiej Mielniczuk\*, Włodzimierz Zieliński, Piotr Kapera, Anna Socha, Daniel Stokłosa, Zbigniew Hochół, Paweł Koczurkiewicz**

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### **A few words about the author(s):**

Experienced specialists in project management, investment projects, technical analysis and testing, product manufacturing, technological process organization in stamping, and data collection planning for algorithm development.

### **Abstract:**

The aim of the project was to develop a technological process for producing concentrated, cloudy and clarified fruit juices, utilizing new solutions previously unavailable in Poland. Switching from hydro-unloading the raw material to dry unloading and transport allowed for improved physical parameters and new parameters at the procurement stage. The introduction of dosing tools for complete raw material identification from unloading to the finished product will also be implemented. Automation of enzymatic and clarification processes will be implemented. The developed technology for producing concentrated, cloudy and clarified fruit juices ensures maximum raw material utilization and minimizes losses. Improvements in production technology ensure higher process efficiency, better productivity, increased yield (kg of concentrate/kg of raw material), lower media levels, and greater product stability under repeatable process conditions. Automation and visualization of individual stages allowed for the minimization of human error, continuous data collection, test licensing, and selection of the most appropriate operating conditions. The solutions used, which have concentrate oxidation properties, directly translated into improved physicochemical and sensory parameters. As part of the project, research and development work was also carried out on the use of the obtained fruit concentrate in various applications.

### **Keywords:**

concentrated juice; fruit batching; concentrated cloudy apple juice; automation of enzymation and clarification; algorithms in juice production



## **INNOVATIVE TECHNOLOGICAL SOLUTIONS IN PRODUCTION PROCESS OF PRODUCTS AIMING TO RECEIVE BETTER SENSORY PARAMETERS AND HIGHER LEVEL OF VITAMINS**

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### **A few words about the author(s):**

Specialists in project management, verification of work results, planning and conducting experiments, product manufacturing process development, verification of critical production process parameters, and analysis of obtained research results.

### **Abstract:**

The main goal of the project was to conduct comprehensive industrial research aimed at increasing the attractiveness of products: fruit juices, fruit and vegetable juices, vegetable juices, nectars, and beverages. This goal was achieved by implementing new solutions in the technological process. The water used in product preparation was effectively deaerated, the deaeration process was optimized before bottling into cartons, and the thermal processing (pasteurization) temperature was reduced. The second goal was to develop an algorithm that enabled optimization of the production process, with particular emphasis on the deaeration process. For a specific product type, the algorithm enabled the interpretation of intermediate process parameter results. This allowed for the demonstration of correlations between the input database and proposed deaeration process parameters through automatic correction. Ultimately, the product achieved the desired results. The project resulted in a product with a higher vitamin content and improved organoleptic characteristics.

### **Keywords:**

juices; drinks; pasteurization; degassing; algorithm



## IS THERE A FORMULA FOR PRIME NUMBERS? ANALYSIS OF C.P. WILLANS' SOLUTION

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### **A few words about the author(s):**

A student of Computer Science and Applied Math at Białystok University of Technology. He is passionate about the synergy between these fields, specifically the application of mathematics in computer science.

### **Abstract:**

The question of whether a formula exists to generate prime numbers is fundamental in number theory. While intuition suggests that the distribution of primes is too chaotic to be described by a simple function, explicit formulas for the  $n$ -th prime number do exist in mathematical literature. The aim of this presentation is to analyze one such result - the formula published by C.P. Willans in 1964 – and to explain why its existence fails to solve any practical problems in mathematics or computer science.

During the presentation, we will examine Willans construction, which cleverly utilizes Wilson's Theorem and the floor function to create a primality indicator. We will demonstrate that this formula is not a "natural" discovery of the structure of prime numbers, but rather an artificial arithmetic construction.

A key focus will be a critique of the formula's feasibility from the perspective of computational complexity. We will show that determining the  $n$ -th prime using this method requires factorial operations, making calculations exponentially difficult even for small values of  $n$ . The conclusion will emphasize that while Willans' formula is theoretically correct, from a utility standpoint, it remains merely a mathematical curiosity rather than the efficient prime generator sought by science.

### **Keywords:**

number theory; prime numbers; Willans Formula; Wilsons Theorem; computational complexity



## THE PAGERANK ALGORITHM: APPLICATION OF LINEAR ALGEBRA AND GRAPH THEORY IN SEARCH ENGINES

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A student of Computer Science and Applied Math at Białystok University of Technology. He is passionate about the synergy between these fields, specifically the application of mathematics in computer science.

### **Abstract:**

The modern Internet consists of billions of interconnected pages, making efficient information ranking one of the key challenges in computer science. The PageRank algorithm, which became the foundation of Google's success, revolutionized the search engine market by introducing an approach based on the global analysis of link structure. The aim of this presentation is to discuss the mathematical model behind this solution.

The presentation will interpret the World Wide Web as a massive directed graph. We will show how this structure can be represented in matrix form and used to simulate the behavior of a "random surfer" navigating the web. We will explain how simple iterative matrix operations (multiplying a vector by a matrix) allow us to determine the "weight" of each page. We will also discuss the intuitive solution to technical issues, such as pages without outgoing links (so-called dead ends), using a damping factor.

### **Keywords:**

PageRank Algorithm; linear algebra; matrices; Google; WWW



## **EFFICIENT MONITORING OF THE POTATO PURÉE ENRICHED WITH MICRO- AND MACROALGAE, AGAR, AND PECTIN USING ARTIFICIAL INTELLIGENCE FOR INNOVATIVE FOOD PRODUCT DEVELOPMENT**

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### **A few words about the author(s):**

Ewa Ropelewska – Associate Professor on a scholarship at the Universitat Politècnica de Catalunya BarcelonaTech (UPC). Interests: Living Labs, image processing, artificial intelligence, food product development, food quality monitoring.

### **Abstract:**

The development of innovative functional foods requires reliable, rapid, and non-destructive tools for monitoring formulation changes and product quality. The aim of this study was to evaluate the capability of image-based artificial intelligence (AI) to identify and differentiate potato purée enriched with hydrocolloids and micro- and macroalgae. A reference purée and samples supplemented with agar, pectin, and selected algae (*Arthrospira platensis*, *Chlorella vulgaris*, *Scenedesmus* sp., and *Ulva ohnoi*) at two enrichment levels: 1% and 3% (w/w) were prepared and analyzed using digital imaging. Texture descriptors extracted from images were processed with various artificial intelligence algorithms to classify enrichment type. The applied AI models achieved very high recognition performance. For samples enriched at 1%, the most accurate models achieved classification accuracies above 91%, while for 3% enrichment, accuracies exceeded 97%. Algae-enriched samples showed the highest classification stability. The proposed approach supports continuous quality monitoring and offers strong potential for application in industrial functional food development and formulation verification.

Funding: This research on the use of artificial intelligence and image analysis to distinguish potato purée samples was funded by a scholarship from the Polish National Agency for Academic Exchange (NAWA) under the Bekker NAWA Programme (2024 edition), as part of the project no. BPN/BEK/2024/1/00256.

### **Keywords:**

fortified potato purée; food monitoring; image texture analysis; artificial intelligence algorithms; classification



## COMPREHENSIVE RAMAN AND HIGH-RESOLUTION LUMINESCENCE SPECTROSCOPIC INVESTIGATION OF A $\text{Lu}_{1.5}\text{Y}_{1.5}\text{Al}_4\text{ScO}_{12}:\text{Pr}^{3+}$ GARNET

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### A few words about the author(s):

Research group with expertise in vibrational spectroscopy, specializing in Raman and luminescence investigations of crystalline materials and single-crystalline film (SCF) systems.

### Abstract:

Garnet crystals with the general formula  $\text{RE}_3\text{B}_5\text{O}_{12}$ , grown by the Czochralski or micro-pulling-down methods, are currently the subject of intensive research due to their favorable stoichiometry and crystal structure, which enable efficient doping with rare-earth ions. These features allow the design of materials with tailored physicochemical properties. Garnets attract considerable interest because of their potential applications in high-energy physics, highly sensitive luminescence thermometry, and nuclear medicine as scintillation materials [1, 2].

Mixed garnet crystals  $\text{Lu}_{1.5}\text{Y}_{1.5}\text{Al}_{5-x}\text{Sc}_x\text{O}_{12}$  doped with praseodymium ions ( $\text{Pr}^{3+}$ ) represent an important step in the development of new materials, allowing for the investigation of processes related to crystal lattice engineering and the control of structural defects in real crystals. These aspects are crucial for optimizing parameters such as luminescence efficiency and scintillation decay time.

In this study, the vibrational and optical properties of a  $\text{Lu}_{1.5}\text{Y}_{1.5}\text{Al}_4\text{ScO}_{12}:\text{Pr}^{3+}$  garnet were investigated using Raman and high-resolution luminescence spectroscopy. The combined techniques allowed spatial characterization of dopant distribution, revealing dopant segregation effects, which are important for further optimization of crystal growth and material properties.

[1] Bartosiewicz K. et al., *J. Mater. Chem. C*, 2025, 13, 13691-13712.

[2] Bartosiewicz K. et al., *ACS Omega*, 2025, 10(19), 19817-19831.

### Keywords:

garnets; Raman spectroscopy; Luminescence spectroscopy; Czochralski method



## **BREED PREDISPOSITION TO DISEASES IN DOGS – BREEDING GENETICS**

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### **A few words about the author(s):**

4<sup>th</sup> year Biotechnology students at the University of Life Sciences in Lublin. Authors and co-authors of scientific publications, active in conferences and symposia. Interests: biotechnology, veterinary medicine, genetics and physiology.

### **Abstract:**

The aim of this study is to analyze breed predispositions to diseases in dogs with reference to breeding genetics. Breed predispositions to numerous diseases in dogs are a significant problem in veterinary medicine and breeding genetics. Intensive breeding selection and the creation of closed breeding populations have led to a reduction in the genetic diversity of many dog breeds, increasing the incidence of hereditary diseases. Many studies have shown that certain dog breeds have a more pronounced tendency to develop specific genetic diseases, including blood clotting disorders, various neurodegenerative diseases, and hereditary eye diseases. We are already seeing significant developments and innovations in the field of molecular genetics and genomic analysis, which have enabled the identification of disease-related variants, thereby improving diagnostic and therapeutic tools, which in turn has improved the early detection of genetic risk. Awareness of genetic predispositions for a given breed is of progressive importance for the development of reliable breeding strategies aimed at reducing the incidence of hereditary diseases while ensuring the health of the breeding population as a whole. Engaging and educating breeders to incorporate more frequent breeding reviews in genetic testing is imperative and an extremely important tool for improving dog welfare.

### **Keywords:**

veterinary genetics; canine genetic disorders; breed predisposition; dog breeds; hereditary disorders



## **OPTIMIZATION OF OYSTER MUSHROOM (PLEUROTUS OSTREATUS) CULTIVATION IN A BIOREACTOR**

**Marta Wołoszyn (1), Paulina Żarnowiec (1), Anna Zawierucha (2)**

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### **A few words about the author(s):**

We are a research team from Jan Kochanowski University of Kielce, focused on fungi, mainly *Pleurotus ostreatus*. In our free time, we explore microbiology and biology, creating innovative and interdisciplinary projects.

### **Abstract:**

*Pleurotus ostreatus* (oyster mushroom) is an edible fungus with high nutritional value and significant biotechnological potential, used, among others, in enzyme production, waste bioconversion, and research on sustainable cultivation systems. The aim of this study was to optimize the cultivation process of *P. ostreatus* through stepwise scaling of the process – from laboratory cultivation to cultivation under controlled conditions.

The initial stage of the research involved mycelial cultivation on Petri dishes, which enabled the assessment of growth rate, mycelial morphology, and the selection of an appropriate growth medium. Subsequently, cultivation was carried out in containers and bags, allowing for the analysis of the influence of culture volume and environmental conditions on mycelial development, as well as the evaluation of the feasibility of semi-technical process scaling. Based on the obtained results, conditions for transferring the cultivation to a bioreactor system were developed.

At the bioreactor stage, the effects of selected process parameters, such as aeration, agitation, and medium composition, on the dynamics of *P. ostreatus* biomass growth were analyzed. The results indicate that bioreactor cultivation provides better process control, higher growth efficiency, and greater reproducibility compared to the earlier cultivation stages. The conducted research provides a basis for further process optimization and potential industrial applications.

### **Keywords:**

*pleurotus ostreatus*; cultivation; optimization

# ABSTRACTS OF **POSTERS**



**TECHNICAL AND  
NATURAL SCIENCES**



## **GREEN EMULGELS: FROM SUSTAINABLE EXTRACTION TO ADVANCED TOPICAL DELIVERY**

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### **A few words about the author(s):**

2<sup>nd</sup> year student at the Poznań University of Technology, Faculty of Chemical Technology. Personally interested in unconventional processes for the extraction of medicinal compounds from plants.

### **Abstract:**

Contemporary dermatology and cosmetology show an increasing demand for effective, safe, and sustainable formulations based on natural active ingredients. Plant extracts, rich in polyphenols and terpenoids, represent a promising group of substances with proven anti-inflammatory, antioxidant, and regenerative properties. However, conventional extraction methods often rely on toxic and flammable organic solvents, which contradicts the ethics of sustainable development and the principles of green chemistry. Furthermore, the therapeutic efficacy of many extracts is limited by poor solubility and insufficient bioavailability upon skin application. This study aims to demonstrate a holistic approach to designing advanced active delivery systems by combining innovative green extraction techniques with the development of a modern, biodegradable emulgel matrix. The primary objective was to design the entire process—from obtaining the bioactive extract of field horsetail (*Equisetum arvense* L.) to creating a stable and application-effective dermatological formulation. To achieve this, a series of analyses were conducted, including microscopic examination, physicochemical characterization, and stability assessment. The resulting emulgels are stable, environmentally friendly, and ensure the protected delivery of thermolabile active ingredients. These achievements represent a significant step toward the sustainable production of modern dermocosmetics and pharmaceuticals.

### **Keywords:**

emulgel; extraction; skin care; herbs; plants



## **SEMA4D AND SEMA5A UNDEREXPRESSION IN DEPRESSION – A PRELIMINARY STUDY**

**Łukasz Kołodziej (1, 2)\*, Piotr Czarny (3), Katarzyna Bliźniewska-Kowalska (4),  
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### **A few words about the author(s):**

Łukasz Kołodziej is a 4<sup>th</sup> year PhD student in BioMedChem Doctoral School of the University of Lodz and Lodz Institutes of the Polish Academy of Sciences.

### **Abstract:**

Semaphorins are a family of membrane proteins involved in neuroplasticity – alteration of brain structure and function, which is necessary for its homeostasis. Deficits in these processes are connected to mood disorders, including major depressive disorder. This preliminary study explores mRNA expression levels of SEMA4D (Semaphorin 4D) and SEMA5A (Semaphorin 5A) within peripheral blood of depressed patients. The control group consisted of people not prescribed antidepressants and not suffering from mental disorders. The studied genes were chosen based on their known activity in axon guidance as well as their twofold impact on neurons forming new connections, since current study aims to expand the state of knowledge on molecular-based pathogenesis of depression. Both of the studied genes were expressed lower in group of patients suffering from depression compared to healthy controls. Nevertheless, there was no correlation between age, BMI (body mass index), sex, time since diagnosis, severity of depression (Hamilton scale) and expression level of both genes. Collected results prove that expression of neuroplasticity-related genes occurs not solely within brain, but also in peripheral blood.

### **Keywords:**

depression; neuroplasticity; gene expression



## RESEARCH ON STRUCTURAL MODIFICATIONS OF NATURAL (2E,6Z,8E)-N-ISOBUTYL-2,6,8-DECATRIENAMIDE ISOLATED FROM ACMELLA OLERACEA

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### A few words about the author(s):

My name is Dawid Liberek. I am a second degree student at the Faculty of Chemistry of the Silesian University of Technology. I am interested in organic synthesis and my research is focused on chemistry of natural compounds.

### Abstract:

(2E,6Z,8E)-N-isobutyl-2,6,8-decatrienamide commonly known as spilanthal (SPL), is a natural compound isolated from *Acmella oleracea*, a plant belonging to the Asteraceae family. This species is characterized by a high content of biologically active substances, particularly N-alkylamides, among which spilanthal exhibits the highest bioactivity. Spilanthal shows a broad spectrum of biological properties, including analgesic, anti-inflammatory, antifungal, bacteriostatic, and potential anticancer activities.

Due to valuable properties SPL is used as a component of cosmetics and dental care products. Its effectiveness against selected bacterial strains such as *Escherichia coli* and *Bacillus subtilis*, as well as fungi, has also been confirmed.

Scientific research indicate that spilanthal undergoes oxidation in vitro within the mitochondria to form a cyclic peroxide: (2E,7Z)-6,9-endoperoxy-N-isobutyl-2,7-decadienamamide (SPLE), which is responsible for inhibiting the development of *Chlamydia trachomatis*. SPLE is also found in small amounts in plants of the Asteraceae family, such as *Acmella oleracea*. Moreover, it can be obtained in the Diels-Alder reaction, as a result of addition an oxygen molecule to the conjugated system of double bonds, but a known synthesis method is low efficiency.

The aim of our research was to search for an effective method of structural modification of spilanthal using the Diels-Alder reaction.

### Keywords:

spilanthal; oxidation; cyclic endoperoxide; Diels-Alder reaction



**CONDUCTING RESEARCH AND DEVELOPMENT WORK:  
OPTIMIZATION OF BIOLOGICAL TREATMENT OF MUNICIPAL  
AND INDUSTRIAL WASTEWATER FOR THE PURPOSE OF REUSING  
TREATED WATER IN A CLOSED CYCLE  
AT TYMBARK-MWS SP. Z O.O. SP.K.**

**Sebastian Duciak, Danuta Ciechańska, Maria Pyrc, Jakub Stuglik\***

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**A few words about the author(s):**

Sebastian Duciak – research worker, specialist in chemistry. Danuta Ciechańska – research worker, circular economy specialist. Maria Pyrc – head of the research team. Jakub Stuglik – project manager.

**Abstract:**

The increasing and variable nature of production on production lines, social and economic conditions such as drinking water shortages, energy production from renewable sources, and the development of the circular economy have led the Company to optimize the process by setting the following research directions for the project: stabilizing the operation of the IC bioreactor and the aerobic reactor in the context of changing operating conditions determined by high and low loads of wastewater flowing into the treatment plant, reduction of sulfate ions, and biogenic compound deficits during the wastewater treatment process.

The R&D work carried out made it possible to optimize the wastewater treatment process by:

- stabilizing the operation of the IC anaerobic bioreactor and the aerobic reactor in the context of changing operating conditions – control of the COD load directed to the IC reactor was achieved;
- achieving the optimal ammonium ion concentration to keep the IC reactor in a state of continuous excitation, ensuring the acceptance of large loads of pollutants;
- reduction of sulfate ions flowing into the treatment plant with wastewater. The reduction contributes to a change in the structure of the IC reactor sludge granules, thus affecting the quality of the reactor's operation, the amount of biomass growth, and the amount of biogas produced.

**Keywords:**

circular economy; anaerobic bioreactor; biomass



## DIFFERENCES IN THE DETERMINATION OF THE CRITICAL MICELLE CONCENTRATION OF IONIC SURFACTANTS USING SELECTED MEASUREMENT TECHNIQUES

**Natalia Swoboda (1)\*, Anna Mielńczyk (1), Oliwia Chojecka (1), Zofia Witkowska (2), Adrianna Hadyk (3), Szymon Siedlaczek (4), Artur Bal (5)**

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### **A few words about the author(s):**

Natalia Swoboda is a chemistry student at Silesian University of Technology. Her interests include the study of critical micelle concentration and its determination.

### **Abstract:**

Surfactants are chemical compounds that are widely used in various branches of industry. They are amphiphilic molecules composed of hydrophilic and hydrophobic parts. At a certain concentration, called critical micelle concentration (CMC), aggregation into micelles can be observed. Surfactants, depending on the presence of electrical charge, can be divided into nonionic and ionic (cationic, anionic, amphoteric) compounds. Each of the groups exhibits beneficial properties in different industrial sectors. CMC can be measured by different methods such as fluorescence spectroscopy, conductometry, and tensiometry. In this study, CMC of sodium dodecyl sulfate (SDS) was measured by different CMC determination methods.

Acknowledgment: This work was supported by the Silesian University of Technology (Poland) in the XIII edition of the Project-Based Learning, project title: „Analiza wpływu techniki pomiarowej na wyznaczenie krytycznego stężenia micelizacji jonowych surfaktantów o zróżnicowanej masie cząsteczkowej” and „Wykorzystanie metod obrazowania mikroskopem elektronowym do oceny przebiegu procesu tworzenia miceli z wybranych polimerów amfifilowych”.

### **Keywords:**

CMC, SDS, surfactants



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