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NATIONAL SCIENTIFIC CONFERENCE
"e-FACTORY OF SCIENCE"

NOVEMBER • 22 • 2025

**THE BOOK
OF ABSTRACTS**

National Scientific Conference
„e-Factory of Science”

XIV edition

The Book of Abstracts

November 22, 2025



14 th edition
National Scientific Conference
"e-FACTORY OF SCIENCE"
November 22, 2025

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Address:

17/19/28 Kamińskiego st.
90-229 Lodz, Poland

KRS: 0000628361

The papers included in this Book of Abstracts have been published in accordance with the submitted texts. The authors of individual papers are responsible for the lawful use of the materials used.

e-mail: fundacja@promovendi.pl
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ISBN: 978-83-973073-8-4

Open access



14 th edition
National Scientific Conference
"e-FACTORY OF SCIENCE"
 November 22, 2025

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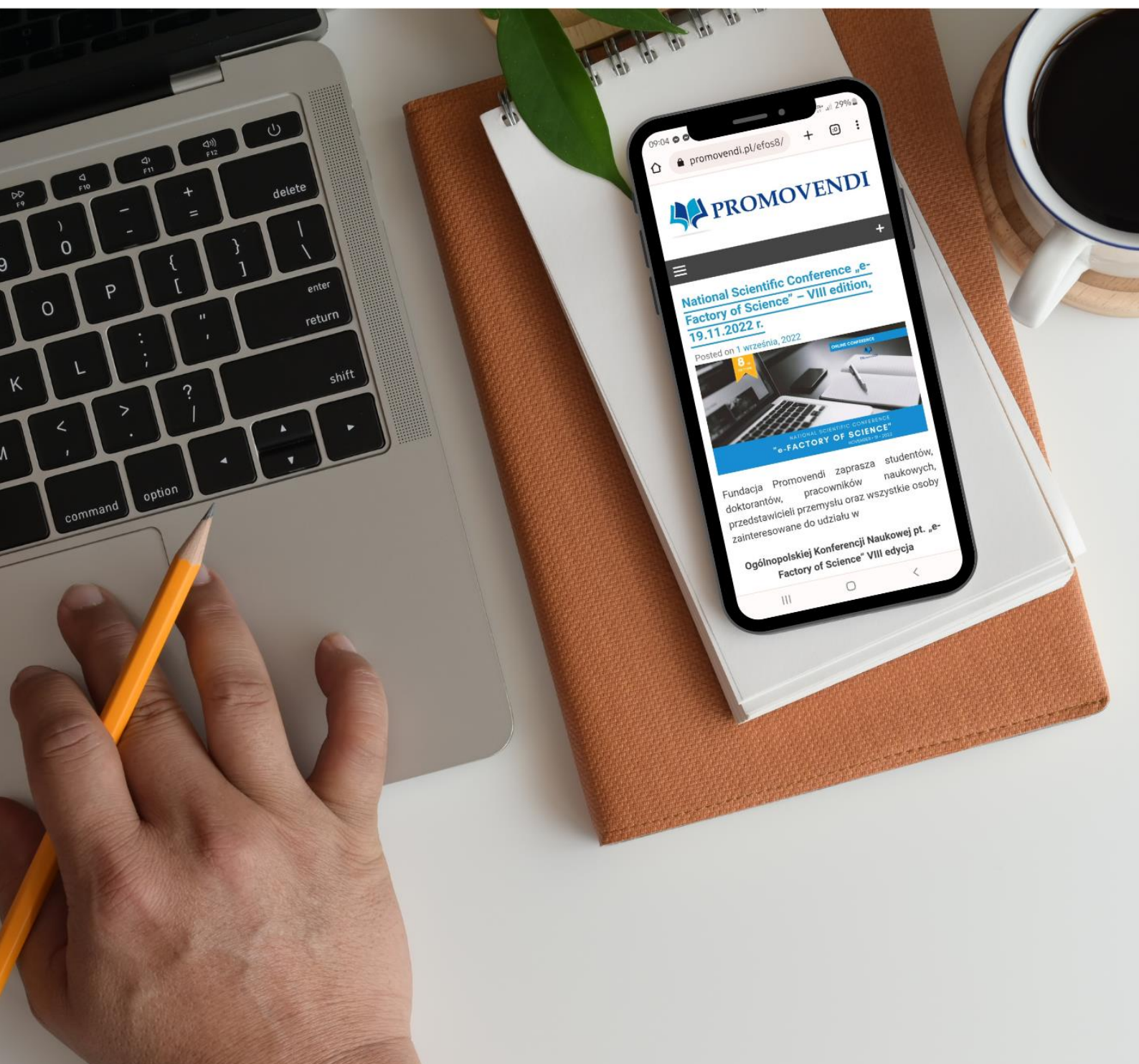
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ABSTRACTS OF PRESENTATIONS





FUNCTIONAL PVD COATINGS FOR FOOD INDUSTRY KNIVES FROM R&D TO INDUSTRIAL IMPLEMENTATION

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A few words about the author(s):

Piotr Brzeski specializes in nonlinear dynamics, machine and vibration damper design, and the application of modern technologies in the food industry. He participated in a project focused on developing new PVD coatings dedicated for butcher knives.

Abstract:

The presentation discusses the results of research on functional PVD coatings designed for knives used in the food industry. It highlights the achieved durability, corrosion resistance, and hygienic properties of the developed solutions, which have reached the stage of industrial readiness.

Keywords:

PVD coatings; food industry knives; surface engineering; durability; corrosion resistance; industrial implementation



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THE NEGATIVE ROLE OF LINGUISTIC CREATIVITY IN THE PROCESS OF LEARNING THE ENGLISH AND THE GERMAN LANGUAGE

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A few words about the author(s):

A 2nd year master's student in Applied Linguistics (English-German). Actively engaged in academic and scientific life at his university. His research interests include dialects, Internet language, linguistic errors and descriptive grammar.

Abstract:

This presentation addresses the issue of the negative impact of linguistic creativity on the process of acquiring foreign languages (English and German). Although linguistic creativity is often perceived as a factor that supports communication and the development of language competence, in teaching practice it can also lead to various disruptions and errors.

In the theoretical part concepts such as linguistic creativity, language error, and language norm will be defined. Furthermore, a typology of language errors will be presented, providing a foundation for the empirical part of the study. The analysis focuses on cases in which an excessive tendency among learners to create neologisms results in the consolidation of incorrect patterns, cross-linguistic interference, or a reduction in the precision of expression. Specific examples will be provided, illustrating situations in which learners, despite having good language proficiency, formulate their utterances incorrectly and use words which do not exist. The probable causes of these errors will be discussed as well.

The aim of the presentation is to identify situations in which linguistic creativity becomes a barrier to effective foreign language acquisition and to indicate ways in which teachers can balance a creative approach to language with attention to accuracy and linguistic norms. The analysis is based on didactic observations conducted among learners of German and English as foreign languages.

Keywords:

linguistic creativity; linguistic error; neologism



E-WASTE AS A SOURCE OF CRITICAL RAW MATERIALS

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A few words about the author(s):

I am a 3rd year student majoring in Renewable Energy Sources and Waste Management at the University of Agriculture in Krakow. I am interested in topics related to sustainable development in recycling and efficient resource management.

Abstract:

Used electronics (e-waste) are the fastest-growing fraction of municipal waste, containing precious metals, rare metals, and valuable plastics, the extraction of which is costly and environmentally harmful. This paper analyzes the potential of e-waste as a source of critical raw materials such as gold, silver, cobalt, lithium, and neodymium. The study discusses mechanical, chemical, and thermal recovery technologies, as well as practical examples, including smartphone recycling and industrial-scale solutions. The environmental and economic benefits are highlighted, including reduced CO₂ emissions and decreased extraction of primary raw materials, along with implementation challenges such as costs, lack of awareness, and regulatory barriers. The conclusions emphasize the importance of the circular economy, education, and technological development in fully harnessing the potential of e-waste.

Keywords:

e-waste; municipal waste; raw materials; recycling



TOXICITY OF COMBUSTION AND PYROLYSIS PRODUCTS DURING UNCONTROLLED ACCIDENTS INVOLVING LITHIUM-ION BATTERIES

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A few words about the author(s):

A graduate of the Fire University in Warsaw and an officer of the State Fire Service. A chemistry student at the Faculty of Chemistry of Adam Mickiewicz University in Poznań.

Abstract:

Electric vehicles, in theory, represent progress in the field of environmental protection. Excluding the aspects of production and disposal, their use reduces the emission of exhaust gases into the atmosphere. However, problems arise when, as a result of an accident or malfunction, the battery powering an electric vehicle catches fire. The issue concerns not only the toxic products of combustion and pyrolysis of the cells but also the post-fire residues. Among the various types of batteries, lithium-ion batteries are the most commonly used in electric vehicles. Due to the diversity of chemical compounds that make up a battery's composition, the spectrum of hazards caused by the release of cell contents and their combustion products into the environment is extremely broad. Battery fires pose a threat to battery users, rescue personnel, and the environment. The dangers include not only toxic smoke but also the risk of explosion. Another significant problem is extinguishing the batteries themselves. Because of the characteristics of cell combustion, interrupting the burning process is practically impossible. The issues described constitute a challenge both for engineers developing new battery technologies and for scientists concerned with environmental protection.

Keywords:

electric vehicles; lithium-ion battery; thermal runaway



NUTRITION AND THE SKIN – THE IMPACT OF DIET ON THE COURSE OF ATOPIC DERMATITIS

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A few words about the author(s):

As a dietetics student, I focus on showing that proper nutrition is not only essential for health but also achievable in everyday life. My goal is to encourage people to make informed food choices that promote long-term well-being and vitality.

Abstract:

Atopic dermatitis (AD) is a chronic, non-infectious skin disease caused by genetic, immune, and environmental factors. It usually appears in early childhood and has periods of flare-ups and remission. The main symptoms include dry, itchy, and red skin, as well as inflammatory lesions that can strongly affect the quality of life. In recent years, scientists have paid more attention to how diet can influence the course of this disease.

The diet of people with AD should be personalized and based on observing how the body reacts to different foods. A balanced diet can help rebuild the skin barrier, reduce inflammation, and improve skin condition. Important nutrients include omega-3 fatty acids, vitamin D, antioxidants, prebiotics, and probiotics. On the other hand, eating too many sweets, saturated fats, or processed foods may make the symptoms worse.

The aim of this presentation is to show how diet affects atopic dermatitis and to discuss practical nutrition tips that can help manage the disease. Proper nutrition can support treatment, reduce symptoms, and improve overall well-being.

Keywords:

atopic dermatitis; diet; nutrition



VIRTUAL MUSEUMS AND EXHIBITIONS – A NEW ERA OF ACCESS TO CULTURE

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A few words about the author(s):

With a background in design, the author is now focused on artistic practice and cultural exploration, seeking connections between creative disciplines and contemporary art.

Abstract:

In recent decades, there has been a dynamic development of museums and exhibitions operating in the virtual space. By using modern technologies such as the internet, mobile devices, virtual reality (VR), and augmented reality (AR), cultural institutions are breaking physical boundaries and enabling global access to artistic heritage. The COVID-19 pandemic accelerated this process, making virtual museums an important tool for education and cultural engagement. Virtual exhibitions offer interactive ways of experiencing art – from 3D tours to online lessons and immersive projects. This phenomenon promotes the democratization of culture by eliminating geographical and social barriers. At the same time, the digitization of collections brings legal, financial, and technological challenges. In the future, VR, AR, and artificial intelligence technologies may further integrate art into the digital space, redefining the way people participate in culture.

Keywords:

virtual museums; digital culture; cultural accessibility



ANALYSIS OF THE RESILIENCE OF THE RSA ALGORITHM TO CONTEMPORARY CRYPTOGRAPHIC ATTACKS

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A few words about the author(s):

I am a student of Applied Mathematics at the Faculty of Computer Science, Bialystok University of Technology. My scientific interests include cryptography, number theory, and their practical applications in information security.

Abstract:

The RSA algorithm remains one of the cornerstones of modern asymmetric cryptography, widely used in secure data transmission, digital signatures, and public key infrastructures. Its security relies on the computational difficulty of factoring large composite numbers and the efficiency of modular exponentiation. However, with the rapid advancement of computational power and analytical techniques, the classical assumptions regarding RSA's resilience require renewed examination.

This paper presents the mathematical foundations of the RSA algorithm and discusses implementation flaws that can undermine its security. Particular attention is given to attacks exploiting the properties and distribution of prime numbers, such as Fermat's factorization and Pollard's $p-1$ method. The study also analyzes attacks based on the discrete logarithm problem, including the Baby-Step Giant-Step algorithm, which may pose a theoretical threat to poorly constructed RSA keys.

The aim of the presentation is to demonstrate that RSA's resistance depends not only on key length but, more importantly, on the quality of prime number generation and proper implementation. The analysis indicates that, despite being over forty years old, RSA remains secure when rigorous cryptographic standards are maintained. Nonetheless, its long-term reliability may be challenged by the continuous growth of computational capabilities and the emergence of quantum technologies.

Keywords:

RSA; cryptography; asymmetric encryption; factorization



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BIOPUAP – CLOUD-BASED BIOMETRIC AUTHENTICATION SYSTEM

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A few words about the author(s):

Karol Kot and Bogusław Sadowski are professionals at PKO Bank Polski, serving as key members of the project team for the BIOPUAP initiative – a pioneering effort to develop a cloud-based biometric authentication system within the banking sector.

Abstract:

PROJECT TITLE: “BIOPUAP – Cloud-Based Biometric Authentication System” (Project No. POIR.01.01.01-00-0092/19), co-financed by the European Union through the National Centre for Research and Development under the Smart Growth Operational Programme.

PROJECT GOAL: To enable bank customers to use multimodal biometrics both in bank branches and via mobile channels. The project resulted in solutions allowing customers to submit biometric samples either at a physical branch or through mobile channels.

TECHNOLOGY BASIS: The developed technology incorporates five biometric modalities, including behavioral biometrics:

1. Behavioral authentication based on eye movement tracking.
2. Facial recognition using visible light camera images.
3. Facial recognition using 3D photogrammetric imaging.
4. Speaker recognition via distinctive voice feature analysis.
5. Palm vein pattern recognition.

RESEARCH PHASES: The project was conducted in four research stages – two industrial research phases and two development phases:

Stage I: Concept and architecture development of the Biometric Authentication Center (CUB) for banking infrastructure and secure access to the trusted profile.

Stage II: Development of biometric identity verification algorithms.

Stage III: Construction of an experimental biometric identity verification system (SUB).

Stage IV: Development of a prototype biometric authentication system under real-world conditions.

Keywords:

eye movement tracking for behavioral authentication; facial recognition using visible light imaging; 3D photogrammetric facial recognition; speaker recognition based on voice features; palm vein pattern recognitio



LAUNCH OF TOKEN AND SMART CONTRACT-BASED SERVICES USING BLOCKCHAIN TECHNOLOGY AT PKO BANK POLSKI S.A.

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A few words about the author(s):

Karol Kot and Mariusz Ziemia are employees of PKO Bank Polski, actively involved in the development and implementation of the project titled: “Launch of Token and Smart Contract-Based Services Using Blockchain Technology at PKO Bank Polski S.A.”

Abstract:

PROJECT TITLE: “Launch of Token and Smart Contract-Based Services Using Blockchain Technology at PKO Bank Polski SA” (POIR.01.01.01.00-0756/19).

OBJECTIVE: To develop a platform for services based on tokens representing financial instruments and smart contracts using blockchain. Warsaw University of Technology was a subcontractor.

RESEARCH AND DEVELOPMENT PHASES:

- Selection and launch of blockchain platform in test environment
- Token issuance and trading research
- Smart contract functionality research
- Prototype platform development
- Tokenization functionality implementation
- Smart contract functionality implementation
- Acceptance testing with selected bank clients

RESULTS: A blockchain-based service platform for tokens and smart contracts. All milestones and goals were achieved.

Implementation Dimensions:

- Technological: Platform and functionality development.
- Legal: Compliance with evolving regulations (e.g., MiCA, national crypto asset law).
- Business: Alignment with on-chain finance trends; ~5 million users in Poland, ~700 million globally.
- Significance: A bold, unprecedented concept in Polish banking, challenging the traditional centralized system paradigm with blockchain-based digital assets.

Keywords:

blockchain; token; smart contracts; data lake



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RESEARCH AND DEVELOPMENT WORKS OF ZPE ZAPEL S.A. TO DEVELOP INNOVATIVE CERAMIC SHIELD TECHNOLOGY FOR ULTRA-HIGH UHV VOLTAGE

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A few words about the author(s):

Employees of the “ZPE ZAPEL S.A.” company from the Technology, IT and R&D Division.

Abstract:

The result of the work under the project is the development of technology for the production of multi-segment ceramic shields, with maximum dimensions \varnothing 800 mm x H 10000 mm, for maximum voltages of 1050 kV. These types of insulators must meet high requirements in terms of mechanical strength and very advanced parameters in terms of shape and position deviations. The research and development work, divided into seven stages, was carried out in the following areas: properties of ceramic material, special technological processes, parameters of the semi-finished and finished product. The obtained results allow to expand the assortment offered by ZPE ZAPEL SA and provide the basis for further improvement of the production technology of the most advanced insulation bushings. The project was co-financed by the National Centre for Research and Development under the Operational Programme Smart Growth No. POIR.01.01.01-00-1258/20.

Keywords:

ultra-high-voltage; porcelain; insulators



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THERAPEUTIC POTENTIAL OF PROTAC DEGRADERS IN DISORDERS ASSOCIATED WITH EXCESSIVE STRESS HORMONE ACTIVITY

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A few words about the author(s):

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

Abstract:

Overactivation of the hypothalamic–pituitary–adrenal (HPA) axis leads to elevated cortisol levels and excessive stimulation of the glucocorticoid receptor (GR), contributing to the pathophysiology of depression, anxiety, metabolic, and neurodegenerative disorders. PROTAC (Proteolysis Targeting Chimera) degraders represent a novel therapeutic strategy enabling selective degradation of overactive proteins, including steroid receptors. KH-103, a GR-targeting PROTAC combining a dexamethasone-derived ligand with a cereblon-recruiting E3 ligase ligand, was evaluated using SwissADME. The compound shows a high molecular weight (833 g/mol), large polar surface area (191 Å²), and low water solubility (Log S \approx -7 to -10), suggesting limited oral bioavailability. Pharmacokinetic modeling indicates low intestinal absorption, no blood–brain barrier penetration, and no inhibition of major cytochrome P450 isoforms. The toxicological assessment revealed only a phthalimide motif typical for cereblon-based degraders. In summary, KH-103 displays a favorable safety and selectivity profile but limited bioavailability, consistent with PROTAC molecules. These findings highlight the therapeutic potential of GR degraders in disorders associated with excessive stress hormone activity.

Keywords:

PROTAC; chimera



DIGITAL STRATEGY AND RESPONSIBLE LEADERSHIP: THE RDP AND LDS INDICES

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A few words about the author(s):

Karolina Lemieszkiewicz-Sosnowska, MA, is a doctoral candidate at the Doctoral School of SGH Warsaw School of Economics. Her research centers on leadership. She is professionally active in the fast-moving consumer goods (FMCG) sector.

Abstract:

This study aims to verify whether a formal digital strategy translates into responsible digital practices and learning support among leaders in Poland. Using secondary data from a cross-sectional survey, two indices were operationalized: RDP (responsible digital practices that include: data-informed decisions, awareness of technology implications, cybersecurity capability, digital maturity assessment) and LDS (learning & development support that includes: regular upskilling, peer learning/mentoring, self-directed learning). Organizations with a strategy showed higher levels on both indices. Time and pace pressure were negatively associated with learning support and work outcomes, whereas learning support was positively associated with work outcomes. The strategy's effect on learning support remained after controlling for time pressure. The findings highlight the value of institutionalizing capability-building and tracking RDP/LDS as actionable metrics.

Keywords:

digital strategy; responsible digitalization; digital leadership; learning & development



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MOLECULAR DETECTION OF ANTIBIOTIC RESISTANCE GENES IN ANIMAL-DERIVED BACTERIA

**Weronika Marchlewska (1)*, Weronika Szczędor (1), Katarzyna Michalak (2),
Dorota Pietras-Oźga (2)**

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A few words about the author(s):

We are Veterinary Analytics students. We research how various substances affect mealworms, study antibacterial properties of Cordyceps fungi, and identify microorganisms with MALDI-TOF, enhancing our lab skills and scientific passion.

Abstract:

Antimicrobial resistance (AMR) is one of the most serious global threats to public health, veterinary medicine, and food safety. Bacteria isolated from farm and companion animals can serve as important reservoirs of antibiotic resistance genes, which may be transmitted to humans through direct contact, environmental exposure, or the consumption of animal-derived products. Traditional phenotypic methods, such as disc diffusion or MIC determination, are still widely used in laboratories; however, they often fail to identify the specific genetic mechanisms responsible for resistance. Molecular methods, including PCR and qPCR, enable rapid, sensitive, and precise detection of resistance genes such as bla_TEM, bla_SHV, and bla_CTX-M, which encode extended-spectrum beta-lactamases (ESBLs). In addition, the presence of integrons (genetic elements capable of capturing and expressing gene cassettes) facilitates horizontal gene transfer among bacterial species, contributing to the rapid spread of multidrug resistance. Recent studies have demonstrated that Escherichia coli strains isolated from dogs and their owners share highly similar ESBL and integron profiles, suggesting possible interspecies transmission of resistance determinants. The implementation of molecular diagnostic techniques in veterinary microbiology allows for faster detection, improved epidemiological surveillance, and better understanding of the mechanisms underlying antimicrobial resistance.

Keywords:

AMR; veterinary microbiology; ESBL genes; resistance genes; molecular diagnostics



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FROM AUTHORITY TO EMPATHY – THE NEW FACE OF LEADERSHIP IN ESTABLISHED COMPANIES

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A few words about the author(s):

Martyna M. Rosa is a PhD candidate at the Jagiellonian University and a researcher exploring new forms of leadership in organizations that are shifting from authority to empathy.

Abstract:

This presentation explores the transformation of leadership styles in established companies, focusing on the shift from traditional authority-based approaches to empathy-driven and participatory models. Using a multiple case study design, three Polish companies (InPost, LPP, and IngLOT) were analyzed to examine how younger generations of leaders implement changes in organizational culture, communication, and team engagement. The findings reveal that contemporary leadership blends transformational, servant, and emotionally intelligent practices, fostering collaboration, trust, and innovation while preserving core organizational values. The study underscores the significance of generational adaptation in leadership succession and offers practical insights for family-owned and long-standing enterprises aiming to balance tradition with modern management practices.

Keywords:

leadership transformation; empathy in management; generational change; organizational culture; emotional intelligence; family businesses



DIFFICULT PATIENT IN PHYSIOTHERAPY, HELP IN REGAINING FITNESS BY A PHYSIOTHERAPIST

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A few words about the author(s):

Master Phisioterapy Janina Danuta Rzeszot.

Abstract:

INTRODUCTION: A difficult patient, defining one of the patient categories, standing out in terms of relationships.

METHODS: Descriptively based on other articles.

RESULTS: Patient participation and goal setting seems to be difficult in the daily practice of physiotherapy and lack of practical methods. The study collected data from 51 physiotherapists and 218 patients and analyzed 38 recordings and 219 patient documents. PSG is a six-step method, in the facility patients are encouraged to participate in the process of setting improvement targets, identifying problematic activities, setting their priorities, assessing their capabilities, setting goals, planning and evaluating. PSG is a feasible method and tends to increase goals. In physiotherapy practice, patients and therapists exchange views on skeletal health problems and their relevance to both parties.

RESULTS: In the cited articles, the full potential of joint goal setting has not yet been fully exploited. Sharing targets between patient and specialist benefits, but evidence shows that patient participation in goal setting is not maximised, particularly in a hospital setting.

Keywords:

difficult patients; physioterapists; practice of physiotherapy



14 th edition
National Scientific Conference
"e-FACTORY OF SCIENCE"
November 22, 2025

STRESS BIOMARKERS IN WILD BIRDS AND MAMMALS – MODERN TOOLS FOR ASSESSING WELFARE AND ENVIRONMENTAL IMPACT

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A few words about the author(s):

We are Veterinary Analytics students. We study the effects of various substances on mealworms, test the antibacterial properties of Cordyceps fungi, and identify microorganisms using MALDI-TOF, developing lab skills and scientific passion.

Abstract:

Stress in wild animals represents a significant ecological and health concern, affecting not only individual welfare but also population dynamics and ecosystem stability. Exposure to environmental stressors, including pollution, habitat loss, climate change, and human activity, triggers complex physiological and behavioral responses. Current research increasingly focuses on identifying biomarkers – measurable physiological, biochemical, and behavioral indicators that reflect adaptive or maladaptive responses to stress. This paper discusses the importance of hormonal stress biomarkers (cortisol, corticosterone), oxidative stress markers (SOD, CAT, GSH, MDA), and behavioral indicators in wild birds and mammals. Examples include studies on the great tit (*Parus major*), white stork (*Ciconia ciconia*), brown bear (*Ursus arctos*), South American primates, and wild felids. Particular attention is given to the growing use of non-invasive methods, such as fecal, hair, and feather analysis, which enable ethical and low-impact monitoring of wildlife. The findings confirm that stress biomarkers provide a powerful diagnostic and prognostic tool for assessing animal welfare and the effects of environmental changes, supporting effective conservation and management strategies for threatened species.

Keywords:

stress biomarkers; wildlife; cortisol; oxidative stress



DETERMINANTS OF FAMILY BUSINESSES' READINESS TO IMPLEMENT ESG REPORTING

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PhD student at Czestochowa University of Technology, with a Master's degree in Management focused on entrepreneurship and SME management. Research interests include sustainable development, ESG, and small and medium-sized enterprises.

Abstract:

Family businesses, a key part of Poland's SME sector, are facing growing demands for ESG non-financial reporting. While regulations mainly target large firms, market and supply chain pressures are pushing smaller companies to adapt. The unique traits of family firms - value alignment, long-term focus, and local roots - make ESG both a challenge and an opportunity to build trust and competitiveness.

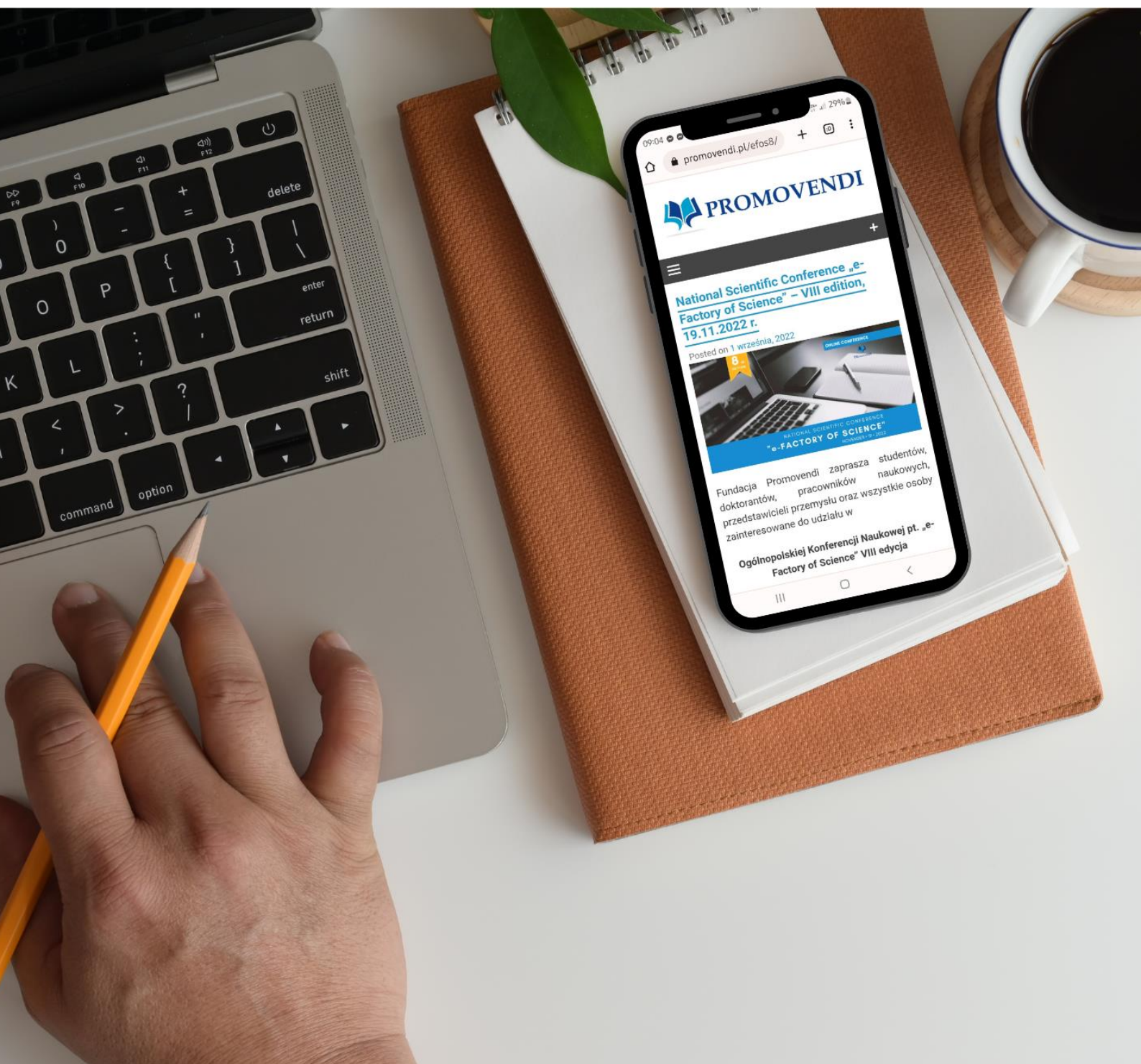
This study evaluated the readiness of family firms to engage in ESG reporting, analyzing: the relevance of ESG factors, their practical implementation, and awareness of regulations, barriers, and motivations. A custom survey was conducted among ten family firms of varying sizes. Results show a focus on basics such as legal compliance, employee safety, and customer service. Transparency, ethics, and environmental efforts are secondary, with circular economy and ESG documentation ranked lowest. Most firms are at an early stage of ESG maturity, limited to compliance-driven actions. Awareness of standards like CSRD or the EU Taxonomy is low; respondents more often cite UN Global Compact, SDGs, or GRI. Main barriers include lack of knowledge, limited resources, and unclear business benefits, while motivations involve regulatory compliance, reputation, and competitiveness.

The study concludes that advancing ESG maturity in family firms requires education, advisory support, and a shift from compliance to strategic sustainable management.

Keywords:

family firms; non-financial reporting; ESG; small and medium-sized enterprises (SMEs); sustainability management

ABSTRACTS OF POSTERS





14 th edition
National Scientific Conference
"e-FACTORY OF SCIENCE"
November 22, 2025

COMPREHENSIVE OCCLUSAL REHABILITATION IN A PATIENT WITH ADVANCED TOOTH WEAR AND COEXISTING TYPE 1 DIABETES

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Adam Beben – research and teaching assistant in the Department of Prosthodontics at the Medical University of Gdansk. Izabela Maciejewska – professor of medical sciences at the Medical University of Gdansk. Specialist in dental prosthodontics.

Abstract:

The aim of this study is to present a comprehensive rehabilitation of a patient with advanced tooth wear resulting from bruxism, occlusal disorders, and coexisting type 1 diabetes. The patient presented with pain in the masseter muscles, a feeling of overload, and a significant loss of occlusal vertical dimension. Clinical examination revealed hypertrophy of the masseter muscles, pathological tooth wear in both anterior and posterior segments, and symptoms suggesting eating disorders. Diagnostic procedures included model analysis, intraoral and extraoral photographs, temporomandibular joint examination, and articulatory analysis. The rehabilitation began with a muscle deprogramming phase and establishment of a new occlusal vertical dimension using a relaxation splint, followed by temporary restorations (mock-up). After an adaptation period, definitive prosthetic restorations were performed using composite materials with the flow injection technique and ceramics. The treatment allowed for the restoration of proper occlusal conditions, improvement of esthetics and function, as well as reduction of muscle tension. This case highlights the importance of an individualized, staged approach to occlusal rehabilitation in patients with systemic diseases and parafunctional habits.

Keywords:

tooth wear; bruxism; occlusal rehabilitation; vertical dimension loss; type 1 diabetes



14 th edition
National Scientific Conference
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November 22, 2025

REENDODONTIC TREATMENT AND FIBER POST RECONSTRUCTION OF A FRACTURED MAXILLARY LATERAL INCISOR – A CASE REPORT

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Adam Beben – research and teaching assistant in the Department of Prosthodontics at the Medical University of Gdansk. His interests include microbiology of prosthetic restorations of oncology patients.

Abstract:

A 45-year-old patient presented to the dental office with a fracture of tooth 12. Radiographic examination revealed inadequately performed previous endodontic treatment without signs of periapical pathology. After removal of the old root canal filling, reendodontic treatment was performed using modern techniques of canal preparation, disinfection, and obturation under a dental operating microscope. During the same visit, the tooth was restored with a fiber-reinforced post and reconstructed with composite resin. The single-visit reendodontic and restorative approach allowed for complete functional and aesthetic rehabilitation of the tooth. This case highlights the effectiveness of minimally invasive, one-step treatment protocols in the management of anterior teeth after endodontic failure.

Keywords:

reendodontic treatment; fiber post; single-visit dentistry; tooth fracture; aesthetic restoration



BDNF AND NTN4 MRNA OVEREXPRESSION IN DEPRESSION – A PRELIMINARY STUDY

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Abstract:

Neuroplasticity can be described as brain's ability to change both its structure and function. Such adaptability is crucial for maintenance of CNS (central nervous system) homeostasis and healthy every-day functioning. Neuroplasticity deficits are implied in patients suffering from mood disorders, including major depressive disorder. Hence, this preliminary study explores expression levels of neuroplasticity-related genes within peripheral blood collected from people with depression. The results were compared to healthy controls not suffering from mental disorders, and not prescribed antidepressant medication. Studied genes, chosen based on their known involvement in neural circuits formation, were NTN4 (Netrin 4) and BDNF (Brain-derived neurotrophic factor). NTN4 is most known for its participation in axon guidance and adhesion-based processes, while BDNF, a well-established growth factor, is a crucial element in LTP (long term potentiation). Current study aims to expand the state of knowledge on the pathogenesis of depression at a molecular level. Both of the studied genes were expressed higher in group of patients suffering from depression compared to healthy controls. However, there was no correlation between sex, age, BMI (body mass index), severity of depression (Hamilton scale), time since diagnosis and expression of both genes. Obtained results show that significant changes of neuroplasticity-related genes expression happen not only within CNS, but also in blood.

Keywords:

depression; neuroplasticity; gene expression



DEVELOPING A FINISH THAT GIVES TEXTILE BAGS AND COVERS DUAL FUNCTIONAL PROPERTIES

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A few words about the author(s):

The authors, members of the R&D Department – Dr. Adam Łoś (PhD, Pharmaceutical Sciences), MSc Marta Niemiec-Pysz, and MSc Eng. Ewelina Kowal – combine expertise in pharmacy, biology, and chemical technology to create innovative solutions.

Abstract:

The aim of the study was to develop durable, dual-functional textile finishes (hydrophobic and antimicrobial) for fabrics used in the transport of medical linen.

The influence of fabric type, chemical composition, and application method on the resulting protective properties was analyzed. The effectiveness of hydrophobic finishes (fluoropolymers, silica) and antimicrobial finishes (quaternary ammonium salts, Ag, ZnO) was evaluated using both mixed and separate application methods.

Under laboratory conditions, the treated fabrics achieved liquid penetration resistance of ≥ 20 cm H₂O (EN 20811), microbial reduction $\geq 90\%$ (AATCC 147, AATCC 100), and resistance to wet bacterial penetration above IB ≥ 2.8 .

At the next stage, the technology was scaled up from the laboratory to semi-technical and industrial conditions by applying the finishes to finished textile products – transport bags and trolley covers. The durability of the obtained properties was assessed, indicating the need for reapplication after a defined number of washing cycles.

The proposed solution represents an alternative to single-use plastic transport bags in hospital circulation, contributing to reduced plastic consumption and improved microbiological safety.

The research was co-funded under the project “Innovative finishing service maintaining the barrier and antimicrobial properties of transport bags and covers above the minimum guaranteed protection level” (No. POIR.01.01.01-00-0410/21-00).

Keywords:

dual-functional textile finishes; hydrophobic; antimicrobial; medical fabrics



CHEMICAL CONTAMINANTS IN FROZEN VEGETABLES

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The authors conduct research and development work in the field of food production technologies and techniques and food waste prevention. They deal with issues related to environmental protection, sustainable development and the circular economy.

Abstract:

Frozen vegetables (e.g. green beans, broccoli, cauliflower, onions, carrots, green peas, corn) and mixed vegetables available on the market in Poland were analysed for pesticides (PN-EN 15662:2018) and heavy metals - cadmium (Cd), lead (Pb) (EU Regulation 2023/915). Cyprodinil was found in frozen green beans in an amount of 0.01-0.03 mg/kg (NDP, MRL – Maximum Residue Level, according to Regulation (EC) No 396/2005, is 2 mg/kg), azoxystrobin was identified in broccoli in an amount of 0.03 mg/kg (NDP 5 mg/kg), boscalid – 0.01 mg/kg (NDP 5 mg/kg), and pyrimethanil – 0.01 mg/kg (NDP 0.01 mg/kg). Boscalid was found in 25% of frozen vegetables and mixed vegetables samples. Other frozen vegetables, single and mixed, presented pesticides levels below the limit of quantification, LOQ <0.01 mg/kg. The Cd content ranged from <0.001 to 0.02 mg/kg DM, and the Pb content was between <0.001 to 0.002 mg/kg DM. Our results showed that all of the frozen vegetables were contaminated with both cadmium (Cd) and lead (Pb), with lead concentrations exceeding the permissible levels (Cd shall not exceed 0.3 mg/kg DM in leafy vegetables and 0.1 mg/kg DM in other vegetables; Pb limits are set at 0.2 mg/kg DM for leafy vegetables and 0.01 mg/kg DM for stem vegetables). The highest concentrations of Cd and Pb were found in green beans, broccoli and onions.

The research was commissioned by the Ministry of Agriculture and Rural Development according to DRE.prz.070.2.2024 and DRE.prz.070.1.2025.

Keywords:

frozen vegetables; pesticides; heavy metals; quality standards



14 th edition
National Scientific Conference
"e-FACTORY OF SCIENCE"
November 22, 2025

MODERN CHEMOINFORMATICS APPROACHES IN ANALOGUES OF NATURAL PRODUCTS

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A few words about the author(s):

3rd year students at Poznań University of Technology, under the supervision of Piotr Michałowski, develop their expertise in the field of fungal secondary metabolites, combining laboratory research with innovative predictive approaches.

Abstract:

In the contemporary conception of natural product analogues, chemoinformatics occupies a pivotal role. This is due to the fact that it facilitates the integration of structural, biological and pharmacokinetic data, which in turn enables the identification of compounds that exhibit significant therapeutic potential. Natural products and their secondary metabolites represent a fundamental source of inspiration for the field of drug discovery. However, the complexity of their structures necessitates the utilisation of advanced computational methods. In the contemporary era, there has been a notable advancement in the field of chemoinformatics, with the integration of sophisticated methodologies such as molecular modelling, protein-ligand docking, QSAR analysis and ADME property prediction. These advanced approaches enable the rational design of analogues by optimising ligand–receptor interactions through molecular flexibility and conformational dynamics, while AI and ML support accurate prediction of biological activity and toxicity. The integration of chemoinformatics platforms within the design process has been demonstrated to facilitate the elimination of ineffective structures at an early stage, thereby reducing both time and experimental costs. In summary, the utilisation of contemporary chemoinformatics instruments is imperative for the rational conceptualisation of natural product analogues that exhibit enhanced pharmacokinetic properties.

Keywords:

chemoinformatics method; natural products; secondary metabolites; designing analogues



14 th edition
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INNOVATIVE IN SILICO STRATEGIES FOR THE DEVELOPMENT OF SECONDARY METABOLITE ANALOGUES

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A few words about the author(s):

3rd year students at Poznań University of Technology, under the supervision of Piotr Michałowski, develop their expertise in the field of fungal secondary metabolites, combining laboratory research with innovative predictive approaches.

Abstract:

Secondary metabolites of living organisms constitute a unique class of chemical compounds with high biological activity. However, their complex structure and limited bioavailability hinder their direct pharmacotherapeutic application. In response to the aforementioned challenges, innovative in silico strategies are being developed to enable the rational design of analogues of these compounds. These strategies employ advanced simulation, predictive, and generative methods, such as hybrid QSAR models combining quantum chemical and topological descriptors, multi-step docking supported by molecular dynamics, and generative algorithms based on artificial intelligence (AI-driven ligand design). This study focuses on strategies for optimising pharmacokinetic and toxicological properties. These strategies employ ADME/Tox prediction and PBPK modelling, enabling the selection of structures with high clinical potential prior to the synthesis stage. In silico technologies have been demonstrated to accelerate the development of secondary metabolite analogues, whilst concomitantly increasing the effectiveness of identifying compounds capable of overcoming biological barriers and modulating specific molecular targets.

Keywords:

chemoinformatics method; natural products; secondary metabolites; designing analogues



14 th edition
National Scientific Conference
"e-FACTORY OF SCIENCE"
November 22, 2025

A VALUABLE SOURCE OF BIOACTIVE COMPOUNDS – SECONDARY METABOLITES OF FUNGI

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3rd year students at Poznań University of Technology, under the supervision of Piotr Michałowski, develop their expertise in the field of fungal secondary metabolites, combining laboratory research with innovative predictive approaches.

Abstract:

Fungi represent a strategic source of bioactive secondary metabolites of significant importance to medicine and biotechnology. Compounds such as penicillin have potent antibacterial properties, a factor that is of particular significance in the context of mounting microbial resistance to antibiotics. Lovastatin, derived from *Aspergillus terreus*, has been shown to inhibit cholesterol synthesis, while polysaccharides such as grifolan and lentinan have been found to activate the immune response. The mycological study of *Herichium erinaceus* has revealed the potential of its erinacines and hericenones to stimulate neuronal regeneration and to exhibit efficacy in the prevention of neurodegeneration. Secondary metabolites, including polyketides, terpenoids, and alkaloids, are synthesised via intricate biosynthesis pathways that are governed by gene clusters. These clusters can be activated in conditions of environmental stress. The employment of genomic engineering and metabolomics facilitates the identification of latent biosynthesis pathways, thereby fostering the acquisition of novel molecules that possess antiviral, anticancer, and antioxidant properties. In the context of global health challenges, fungal secondary metabolites are emerging as a pivotal instrument in the development of innovative pharmaceuticals and alternatives to conventional antibiotics.

Keywords:

secondary metabolites; natural products; NPs; programmable bioproduction of natural analogues



14 th edition
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"e-FACTORY OF SCIENCE"
November 22, 2025

PRIMARY VS SECONDARY METABOLITES – NATURAL PRODUCTS WITH BROAD APPLICATION POTENTIAL

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3rd year students at Poznań University of Technology, under the supervision of Piotr Michałowski, develop their expertise in the field of fungal secondary metabolites, combining laboratory research with innovative predictive approaches.

Abstract:

The study of fungal metabolites reveals a complex biological system, comprising primary and secondary compounds that are indispensable for fundamental life processes. These compounds coexist with metabolic by-products that facilitate adaptive and ecological functions. Primary metabolites, including citric acid, adenosine triphosphate (ATP), and glucose, are involved in various processes within cells, such as cellular respiration, protein biosynthesis, and cell division. Secondary metabolites, exemplified by compounds such as cyclosporine, mycotoxins (e.g. aflatoxin), beta-glucans, and pleurotin, have been demonstrated to play a pivotal role in interspecies communication, colonization of new ecological niches, and protection against predation and microbial competition. The biosynthesis of these compounds is subject to regulation by specialised gene clusters, which are activated in response to environmental signals. This enables fungi to adapt dynamically to changing conditions. The integration of functional genomics and metabolomics data has revealed the potential for manipulating metabolic pathways to obtain new substances with immunosuppressive, antioxidant, and phytoprotective properties. A comparison of the two groups of metabolites indicates that their synergistic action determines not only the development of fungi, but also their importance as a source of innovative natural products used in medicine, agriculture, and environmental biotechnology.

Keywords:

primary metabolites; secondary metabolites; natural products; NPs



UNIVERSITIES OF THE THIRD AGE AS A RESPONSE TO THE CHALLENGES OF AN AGEING SOCIETY

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A few words about the author(s):

Oliwia Miernik – holds a BA in Social Policy Management from Jagiellonian University and is currently pursuing an MSc in Tourism and Sport Management. Active member of the UJ Sports Management Scientific Circle and Student Council Sports Committee.

Abstract:

The ageing of populations is one of the key social challenges of the 21st century. As life expectancy rises and birth rates fall, societies seek effective ways to promote active ageing and social inclusion of older adults. Universities of the Third Age (U3A) play an essential role by providing educational, social, and cultural opportunities for seniors.

This study used a quantitative method based on a paper questionnaire distributed among students of the U3A in Iłża. The survey contained closed- and open-ended questions, enabling participants to express their views on how U3A activities affect their life engagement. Data were collected in April 2025 during regular classes, ensuring reliability through direct distribution and collection by authorized staff.

The findings show that participation in U3A supports seniors' well-being, cognitive vitality, and sense of belonging, while reducing social isolation. Despite the non-representative sample, the results provide valuable insights into how U3A contributes to the social activation of seniors and addresses the broader challenges of an ageing society.

Keywords:

University of the Third Age; senior policy; active ageing; lifelong learning for older adults; population ageing; social policy in Poland



STUDY OF METABOLISM AND INHIBITION OF CYTOCHROME P450 ISOENZYME ACTIVITY BY A NEW XANTHINE DERIVATIVE

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The author's research interests include studying the use of phosphodiesterase inhibitors in asthma, chronic obstructive pulmonary disease, and studying the metabolism of novel xanthine derivatives.

Abstract:

The primary objective of the conducted study was to develop a rapid method for determining the cytochrome P450 isoenzymes responsible for the metabolism of novel xanthine derivatives. Another goal was to establish a screening method enabling the assessment of the potential influence of the tested compounds on the activity of selected P450 isoenzymes. The developed methods were subsequently applied to identify the isoenzymes responsible for the metabolism of the compound AT-24 and to estimate its potential inhibitory properties toward selected isoenzymes. Compound AT-24 is a xanthine derivative with PDE inhibitory activity and was synthesized at the Chair of Pharmaceutical Chemistry, UJ. In the first part of the experiment, the tested compound was incubated in the presence of mouse microsomes, NADPH, and either solvent or selected selective isoenzyme inhibitors. Subsequently, the concentration of the tested compound was determined at 0, 15, 30, and 45 minutes after the start of incubation using the LC-MS/MS technique. In the second part of the experiment, AT-24 was incubated under the same conditions together with a mixture of selective substrates of the chosen P450 isoenzymes. The substrate depletion over time was then determined. Based on these data, the degradation rate constants were calculated. From these results, it was estimated that compound AT-24 is metabolized mainly by CYP3A4 and CYP1A2, and additionally exhibits inhibitory properties toward CYP2D6 and CYP3A4.

Keywords:

xanthine derivatives; in vitro metabolism; P450 inhibitors; PDE inhibitors



LIGHT AGAINST POLLUTION – A SMART COATING FOR THE FUTURE

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Abstract:

Photocatalytic coatings offer a modern and sustainable approach to improving air quality and surface hygiene. Activated by both natural and artificial light, they exhibit strong oxidative properties, enabling the degradation of organic pollutants and the inhibition of microbial growth on treated surfaces and in the surrounding air. The developed coating is based on titanium dioxide (TiO₂) nanoparticles, predominantly in the anatase crystalline form, dispersed in a water-based film-forming medium. Once applied, it forms a transparent and ultrathin layer that remains active for up to 30 days without the need for chemical agents. Laboratory tests confirmed high antimicrobial efficiency against *Staphylococcus aureus*, *Escherichia coli*, *Candida albicans*, and *Aspergillus brasiliensis*, as well as antiviral activity against Adenovirus type 5, Influenza A virus (H3N2), and Human coronavirus 229E. The coating also demonstrated up to 99% removal of volatile organic compounds (VOCs) within 24 hours. Owing to its safety, durability, and ease of application, the photocatalytic coating is a promising solution for residential and public spaces, contributing to cleaner air, healthier surroundings, and improved environmental safety.

Keywords:

photocatalytic coating; VOCs removal; antimicrobial activity; indoor air quality; photocatalysis



COSMETIC ACUPUNCTURE

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Abstract:

Cosmetic acupuncture is a modern, natural method of skin rejuvenation, offering an alternative to aesthetic medicine treatments. It requires specialized training, as it affects not only the condition of the skin but also the functioning of the entire body. Each treatment should be considered individually and should not be combined with other invasive procedures. Before beginning the treatment, it is recommended to gently stimulate the skin, for example, with a manual massage. The treatment stimulates microcirculation, improves tissue nourishment, and stimulates fibroblasts to synthesize collagen, resulting in increased skin density and elasticity. The therapy uses sterile pins or needles of varying lengths and thicknesses, selected depending on the type and depth of the skin defect. Indications for this treatment include loss of skin firmness, reduction of wrinkles, scars, and stretch marks, and reduction of swelling and dark circles under the eyes. Side effects associated with needle use may include redness, bleeding at the injection site, local swelling, and even marks left after needle removal or, after a few days, minor bruising.

In summary, cosmetic acupuncture is a safe, non-invasive method of skin biostimulation, activating regenerative processes and delaying the signs of aging. A properly performed treatment, while maintaining aseptic technique, results in visible improvement in skin firmness and structure, providing an effective form of anti-aging prevention.

Keywords:

skin; beauty treatments



THE USE OF GUA SHA STONE IN FACIAL SKIN CARE

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Abstract:

During a Gua Sha stone facial massage should be applied a light pressure, but the most important factor is the direction of movements, which helps drain accumulated fluid into lymph nodes. Studies have shown that Gua Sha stimulates immune and anti-inflammatory responses that persist for many days after the treatment. Furthermore, the treatment alleviates menopausal symptoms, improves overall skin condition, and improves the quality of life of mature women.

This treatment can be applied in a beauty salon as a complement to kobido massage or cosmetic acupuncture. It can also be performed independently at home.

The cosmetics market offers stones in rectangular, triangular, fish-shaped, or smooth shapes. The choice depends on the intended use and technique. Furthermore, massage can be applied with one or two stones at a time. To achieve satisfactory results, repeat this massage 1-2 times a week. Stone treatment primarily drains, cleanses, strengthens, smoothes, reduces bags under the eyes and puffiness, and nourishes the tissue. Results depend on age, skin type, and comorbidities. This therapy is intended for individuals suffering from bruxism who have experienced the first signs of skin aging, such as wrinkles, or who have gray, dull, or oily skin.

Common contraindications to the treatment include: epidermal rupture, pigmented moles, rosacea and acne vulgaris with inflammatory lesions, fever, and viral and bacterial infections in the treatment area.

Keywords:

skin; massage



14 th edition
National Scientific Conference
"e-FACTORY OF SCIENCE"
November 22, 2025

SUSTAINABLE SYNTHESIS OF ZINC, COPPER AND IRON COMPLEXES FOR MICRONUTRIENT FERTILIZER APPLICATIONS IN PLANT SUPPLEMENTATION

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A few words about the author(s):

Researchers from the Coordination Chemistry Group at the Silesian University of Technology, focusing on ligand design and coordination complexes for agricultural, medical, and advanced technology applications, generally grounded in green chemistry.

Abstract:

Zinc, copper, and iron are essential plant micronutrients. Iron mediates electron transport, chlorophyll formation, and redox catalysis; zinc regulates dehydrogenases, maintains auxin homeostasis, and supports membrane integrity; copper functions in redox proteins and contributes to lignification. Deficiencies cause physiological disorders, chlorosis, and reduced photosynthesis. Bioavailability is especially limited in alkaline soils by precipitation and ionic competition. Metal chelates are widely applied to improve stability and uptake, yet their manufacture often relies on energy-intensive processes and extensive purification, which conflicts with green-chemistry goals.

A solvent-free, low-energy synthesis of zinc, copper, and iron chelates consistent with green chemistry was developed. Tight control of stoichiometry, temperature, and reaction time yielded phase-pure, compositionally uniform solids of high chemical purity. Independent series showed reproducible outcomes and storage stability.

The resulting properties indicate suitability as micronutrient sources with enhanced resistance to environmental factors relevant to soil application. Relative to conventional chemical routes, the process reduced specific energy demand and waste. This work combines an environmentally responsible synthesis with function-oriented materials design, supporting sustainable crop supplementation.

FUNDING: This work was supported by the SUT, Grant for Young Scientists (04/020/BKM25/1123).

Keywords:

iron chelates; zinc chelates; solvent-free synthesis; plant nutrition; sustainable fertilization



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ISBN: 978-83-973073-8-4



ISBN 978-83-973073-8-4



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