BOOK OF ABSTRACTS

ChemBiotIC

Chemistry & Biotechnology International Conference

June 24–25 2021

Wrocław University of Science and Technology,
Wrocław, Poland

Table of contents

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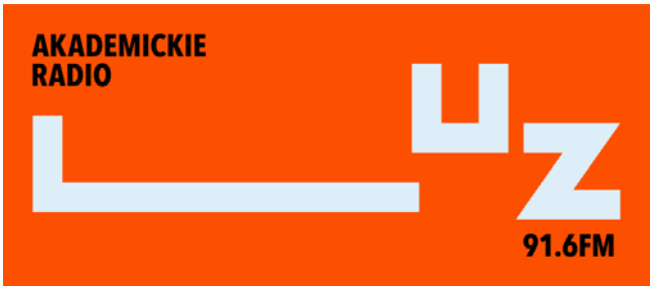

Conference programme

24TH OF JUNE (FIRST DAY)				
	9:00–9:20	Opening ceremony		
	Time (CEST)	Presenting author	Subject of the presentation	Affiliation
Opening lecture	**9:20–9:50**	**Marcin Drąg**	**Proteases as medical targets**	**Wroclaw University of Science and Technology**
YS I	9:50–10:03	Dariusz Kulus	Application of gold nanoparticles in the cryopreservation of in vitro-derived shoot tips of bleeding heart (*Lamprocapnos spectabilis* (L.) Fukuhara)	UTP University of Science and Technology in Bydgoszcz
	10:03–10:20	Rimene Dhahri	Kinetics and mechanisms of Congo red dye removal from aqueous solution using activated carbon prepared from Olive waste wood	University of Gafsa
	10:20–10:38	Aleksandra Marczewska	Macromolecules of meadowsweet flowers with pro-health potential - isolation from biomass pre-treated with CO2 in supercritical condition	Wroclaw University of Science and Technology
	10:38–10:56	Alicja Tymoszuk	Silver nanoparticles induce genetic, biochemical, and phenotype variation in chrysanthemum	UTP University of Science and Technology in Bydgoszcz
	10:56–11:14	Sylwia Grabska-Zielińska	The influence of squaric acid on the properties of chitosan-based films	Nicolaus Copernicus University in Toruń
	11:14–11:32	Kinga Szkaradek	Electron-driven proton-transfer channel in the hypothetical prebiotic RNA base pairs	Wroclaw University of Science and Technology
	11:32–11:50	Karolina Krautforst	Technologies for the management of marine algae biomass into products useful for sustainable agriculture and clean environment	Wroclaw University of Science and Technology
	11:50–12:08	Veronika Stoilkovska Gjorgievska	Monitoring technical maturity of Cannabis cultivar by trichome morphology analysis and HPLC phytocannabinoid content	Ss. Cyril and Methodius University in Skopje
	12:08–12:30	Coffee Break		
PL I	**12:30–13:00**	**Armando Silvestre**	**Nanocellulose fibers: unique biobased sources for the development of sustainable functional materials**	**University of Aveiro**

YSII	13:00–13:18	Chaima Ouled Amor	Microstructure, thermal behaviour and Optical properties of Sm-doped TiO2 nanoparticles	University of Gafsa
	13:18–13:36	Dominika Benkowska-Biernacka	Phospholipid-based lyotropic mesophases doped with luminescent carbon nanodots	Wroclaw University of Science and Technology
	13:36–13:54	Tlili Imen	XRD, NMR, FT-IR, RAMAN and structural characterization of a novel organic-inorganic hybrid material	University of Sfax
	14:00–15:30	Nanotemper Workshop		
PL II	**15:30–16:00**	**Maciej Kozak**	**BioSAXS - some practical examples from lab and synchrotron sources**	**Adam Mickiewicz University in Poznań**
	16:00–16:15	Coffee Break		
PL III	**16:15–16:45**	**Andrzej Żak**	**Imaging of biomacromolecules – negative staining versus cryoEM**	**Wroclaw University of Science and Technology**
	16:45–17:15	Poster Session I		
PL IV	**17:15–17:45**	**Wladek Minor**	**Rapid response to biomedical challenges and threats**	**University of Virginia**
YS III	17:45–18:03	Franz Steppeler	2-Azabicyloalkane-1,2,3-triazole assemblies – Synthesis and antiproliferative activity	Wroclaw University of Science and Technology
	18:03–18:21	Nina Tarnowicz-Staniak	Bioinspired, Cellulose-supported, and AuPd-nanorod-assisted Photocatalysis	Wroclaw University of Science and Technology
	18:21–18:39	Radosław Gładysz	Determination of human proteasomes substrate specificity profiles	Wroclaw University of Science and Technology
	18:39–18:57	Juan Antonio Llorens Molina	Ultrasound-assisted extraction/dispersive liquid–liquid microextraction (UAE--DLLME) method to study the volatile composition of *Mentha longifolia* L. *inflorescences.*	Universitat Politècnica de València

24TH OF JUNE (FIRST DAY)				
	Time (CEST)	Presenting author	Subject of the presentation	Affiliation
	8:00–8:18	Matylda Kubacz	Generation of a diffuse large B-cell lymphoma (DLBCL) rituximab-resistant cell line as a model to investigate the efficacy of novel antitumor strategies	Medical University of Warsaw
	8:18–8:36	Aleksandra Kusowska	Generation of CD20 knockout non-Hodgkin lymphoma cell lines as a model to study molecular changes related to rituximab resistance	Medical University of Warsaw
	8:36–8:54	Aleksandra Orzech	Complex microcarriers based on hydrogel and food gums for encapsulation of hydrophobic substances: fabrication and characterization	Wroclaw University of Science and Technology
	8:54–9:12	Manuela Grelich-Mucha	Transthyretin (105–115) peptide – a correlation between the structure and optical properties of enantiomers and the racemate	Wroclaw University of Science and Technology
YS I	9:12–9:30	Patrycja Ledwoń	Design, synthesis and structural investigations of novel peptide-based elastase inhibitors with fluorescent properties	Wroclaw University of Science and Technology
	9:30–9:48	Joanna Markowicz	Biotin labelled PAMAM G3 dendrimers as a delivery system for α-mangostin into squamous carcinoma cells	Rzeszow University of Technology
	9:48–10:06	Katarzyna Dziergowska	Sorption of Cr(III) ions by CuO nanoparticles biosynthesized from macroalgal extract	Wroclaw University of Science and Technology
PL I	**10:10–10:40**	**Nicola D'Amelio**	**The selective recognition of biological membranes by antimicrobial peptides**	**Université de Picardie Jules Verne**
	10:40–10:58	Dominik Terefinko	The impact of direct and indirect non-thermal plasma treatment on the biological activities of human breast cancer cell lines	Wroclaw University of Science and Technology
	10:58–11:16	Maria Błaszczyk	The effect of antipsychotic drugs on membrane domains enriched in cholesterol and sphingomyelin.	Wrocław Medical University
	11:16–11:34	Henryk Kozłowski	Immunomodulatory and anticancer properties of fever-range hyperthermia	Nicolaus Copernicus University in Toruń
	11:34–11:52	Marlena Surówka	Biotechnology in service of patients – T cell bispecific antibody development for cancer immunotherapy	Roche Innovation Center Zurich
YS II	11:52–12:10	Kornelia Gladysz	Casting light on the impact of the origins of acute myeloid leukaemia (AML) stem cells in leukaemia development and effectiveness of treatment	King's College London

	12:10–12:30	Coffee Break		
PL II	**12:30–13:00**	**Lukáš Žídek**	**Structure, dynamics, and function of intrinsically disordered proteins**	**Masaryk University**
YS III	13:00–13:18	Natalija Atanasova-Pancevska	Probiotic lactic acid bacteria in probiotics drinks: are they trustable?	Ss. Cyril and Methodius University in Skopje
	13:18–13:36	Karolina Mielko	Comparison of drug-resistant and drug-sensitive *Pseudomonas aeruginosa* strains – metabolomics studies	Wroclaw University of Science and Technology
	13:36–13:54	Joanna Jadczyk	Myconanotechnological biosynthesis of silica nanoparticles	Wroclaw University of Science and Technology
	13:54–14:12	Agnieszka Krawczyk Łebek	Glycosylation of flavones in cultures of entomopathogenic filamentous fungi *Beauveria bassiana* KCH J1.5	Wrocław University of Environmental and Life Sciences
	14:12–14:30	Mateusz Jackowski	Microorganisms potential for non-alcoholic beer production	Wroclaw University of Science and Technology
	14:30–14:48	Dominika Szczęsna	Regulation of transcription in fungi based on the example of *Aspergillus*	Wroclaw University of Science and Technology
	14:48–15:05	Alicja Surowiak	Low molecular weight oxime ethers as potential fragrances	Wroclaw University of Science and Technology
	15:05–15:23	Agnieszka Śliżewska	Catalytic potential of cyanobacteria	Wroclaw University of Science and Technology
PL III	**15:25–15:55**	**Werner Kuhlbrandt**	**High-resolution cryoEM of energy-converting membrane protein complexes**	**Max Planck Institute of Biophysics**
	15:55–16:05	Coffee Break		
	16:05–16:35	Poster Session II		
Closing lecture	**16:35–17:35**	**Dennis E. Discher**	**'Marker of Self' peptides as soluble antagonists and as agonists on viruses and particles**	**University of Pennsylvania**
	17:35–17:50	Closing ceremony		

Poster session I

Number	Presenting author	Subject of the presentation	Affiliation
P01	Anna Skorupska	Zinc-dependent oligomerization propensity of Nucleobindin-2 from *Gallus gallus*	Wroclaw University of Science and Technology
P02	Klaudia Bielak	Counter-diffusion system as an in vitro calcium carbonate biomineralization method	Wroclaw University of Science and Technology
P03	Nikola Sozańska	The propensity of human FKBP25 for formation of liquid condensates	Wroclaw University of Science and Technology
P04	Piotr Krężel	The fungistatic activity of phthalide lactones from natural sources and their analogues on growth mould of Botrytis cinerea	Wrocław University of Environmental and Life Sciences
P05	Natalia Bagińska	Specific phages against Acinetobacter baumannii- search, isolation and characterization	Polish Academy of Sciences
P06	Anna Pałko-Łabuz	Phenolic acids-phosphatidylcholine conjugates as promising agents in metastatic melanoma therapy	Wroclaw Medical University, Department of Biophysics and Neurobiology
P07	Paulina Majewska	Biotransformation of 1-butyryloxy-1-carboxymethylphosphonates by lipases.	Wrocław University of Science and Technology
P08	Natalia Pudełko-Malik	Comparative metabolomic analysis in mice brain regions by 1H nmr spectroscopy – young vs old	University of Science and Technology
P09	Paula Przygoda-Kuś	Glycosylation of flavonols using entomopathogenic filamentous fungi	Wrocław University of Environmental and Life Sciences
P10	Natalia Tyszkiewicz	Isolation of electroactive bacteria from microbial fuel cells operated with petroleum products and waste frying oil	Wrocław University of Science and Technology
P11	Marta Kolonko-Adamska	Intrinsically disordered regions of the bHLH-PAS proteins are involved in disease development	Wrocław University of Science and Technology
P12	Paulina Sławenta	Biotransformation of dimethyl 1-butyryloxy-1-carboxymethylphosphonate with whole fungal cells	Wrocław University of Science and Technology,
P13	Juan Lizandra Perez	From WW-domains to foldameric mini-proteins, suitable scaffolds for PD-1/PD-L1 interaction inhibitors.	Wrocław University of Science and Technology,
P14	Agnieszka Ciesiołkiewicz	Optimization of foldameric scaffold based on EEHEE motif and its use for construction of PD-1/PD-L1 inhibitors.	Wrocław University of Science and Technology,
P15	Paweł Noceń	An approach to design and synthesize mini-proteins binding to PD-1 receptor	Wrocław University of Science and Technology,
P16	Martyna Kazimierz	The preparation of DNA vector for the expression of the zebrafish protein omp-1 in a bacterial system.	Wrocław University of Science and Technology

P17	Zoran Zhivikj	Development of a liquid chromatography method for screening of herbal weight loss supplements for adulteration	Ss. Cyril and Methodius University, Macedonia
P18	Aleksander de Rosset	Characterization and comparison of the performance of three different cathode materials for miccrobial fuel cells	Wrocław University of Science and Technology
P19	Patrycja Ziuzia	Application of lipases in the kinetic resolution of racemics ionon derivatives	Wrocław University of Environmental and Life Sciences
P20	Tomasz Tronina	Microbial glycosylation of flavonoids	Wrocław University of Environmental and Life Sciences
P21	Kinga Halicka	Nanofiber-based sensors for the electrochemical detection of biomedically relevant compounds	Wroclaw University of Science and Technology
P22	Marcelina Mazur	Comparison of chemo-enzymatic Baeyer–Villiger oxidation carried out in esters and DES as a medium	Wrocław University of Environmental and Life Sciences
P23	Natalia Stachowiak	Degradation test of microparticles based on sodium alginate and gellan gum under different conditions	Nicolaus Copernicus University in Torun
P24	Sylwia Grabska--Zielińska	Polylactide films with addition of olive leaves extract	Nicolaus Copernicus University in Toruń
P25	Rafał Taf	New concept of controlled release fertilizers for precision agriculture	Wroclaw University of Science and Technology

Poster session II

Number	Presenting author	Subject of the presentation	Affiliation
P26	Jakub Warachim	Singlet vs. Triplet Channel of [2+2] Photocycloaddition of Nitrostyrene to Indene	Wrocław University of Science and Technology
P27	Oktawia Korcz	Possibilities in the biotransformation and biodegradation of estrogens by microalgae	Wrocław University of Environmental and Life Sciences
P28	Łukasz Uram	Celecoxib substituted biotinylated poly(amidoamine) G3 dendrimer as therapeutic agent for temozolomide resistant glioma therapy	Rzeszów University of Technology
P29	Daria Kocek	The effect of cold plasma on phytopathogenic fungi	Wrocław University of Science and Technology
P30	Ewelina Wanarska	Gold nanoparticles as an enhancement factors in photodynamic therapy	Wrocław University of Science and Technology
P31	Bartosz Widera	Increasing MFC performance through operational and design parameters	Wrocław University of Science and Technology
P32	Denis Kopiec	Application of modified carbon nanomaterials in lithium-air cells	Wrocław University of Science and Technology
P33	Karolina Lula	Volatile organic compounds – an important part in beer aroma profile	Wrocław University of Science and Technology
P34	Przemysław Grygier	DYRK1A, a new light for diabetes	Jagiellonian University
P35	Marta Maślanka	Synthesis of multifunctional organophosphorus compounds as new urease inhibitors with dual mechanism of interaction with the enzyme	Wrocław University of Science and Technology
P36	Kaja Kowalczuk	The role of SPA proteins in fungi	Wrocław University of Science and Technology
P37	Ivana Cvetkovikj Karanfilova	Estimation of measurement uncertainty for quantitative determination of cannabinoids in dry cannabis flower using HPLC method	Ss. Cyril and Methodius University, Macedonia
P38	Adrianna Sosik	Bio-studies of scaffolds based on chitosan/tannic acid cross-linked by glyoxal	Nicolaus Copernicus University in Toruń,
P39	Jakub Litewka	Androdiploid lines in the creation of original genetic variability of Capsicum spp.	UTP University of Science and Technology,
P40	Emilia Witkowska	In vitro micropropagation of established and hybrid Capsicum spp. genotypes	UTP University of Science and Technology,
P41	Iwona Jędrzejczyk	Flow cytometry and SCoT molecular markers as tools for identification and genetic diversity assessment in fenugreek species	UTP University of Science and Technology,
P42	Damian Semba	Hydrogels drug delivery carriers with functional coating	Wrocław University of Science and Technology
P43	Aleksandra Modzelewska	The many faces of the wild yeast strain - Dekkera bruxellensis	Wrocław University of Science and Technology
P44	Agnieszka Raczyńska	Antioxidants biosynthesis by whole-cell biocatalysts	Wrocław University of Science and Technology
P45	Monika Serafin--Lewańczuk	Application of whole cell biocatalyst in biotransformation of heterocyclic phosphonates	Wrocław University of Science and Technology

P46	Viktor Markuliev	Predicting of citronellol, nerol and geraniol content in Bulgarian rose oil samples by NIR spectroscopy	Bulgarian Academy of Sciences, Sofia, Bulgaria
P47	Aleksandra Mazurek	Polysaccharides of flax-seed isolated using natural deep eutectic solvents (NADES)	Wrocław University of Science and Technology
P48	Ewa Górska	Polysaccharides of Echinacea purpurea – isolation by deep eutectic solvent and chemical characterization	Wrocław University of Science and Technology
P49	Weronika Prus-Walendziak	Examination of skin barrier quality, hydration and colour after the application of freeze-dried emulsions	Nicolaus Copernicus University in Torun
P50	Alicja Tymoszuk	Zinc oxide and zinc oxide nanoparticles impact on in vitro germination and seedling growth in Allium cepa L.	UTP University of Science and Technology in Bydgoszcz
P51	Lidia Zasada	The characterization of tannic acid-enriched hydrogels	Nicolaus Copernicus University in Torun

Invited speakers

Proteases as medical targets

Marcin Drąg[1]

[1] *Department of Chemical Biology and Bioimaging, Wroclaw University of Science and Technology, Poland*

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Type of presentation: oral presentation

Diseases such as cancer, diabetes or viral and bacterial infections are one of the main causes of human mortality, regardless of age and origin. Perfect methods of treatment have still not been found. Much hope is placed on research into the origin of a disease, usually involving tens or hundreds of biological macromolecules called enzymes. From this point of view, one of the most important groups of enzymes are proteases, the increased or decreased level of which allows for rapid clinical diagnosis using specific markers, and also gives the opportunity for rational, rapid research on drug discovery based on protease activity. An excellent reason for research on proteases are commercially available anti-cancer, anti-diabetic and anti-viral HIV drugs that rely on the inhibition of protease activity. Unfortunately, these drugs can only be used for a limited number of diseases, and many other proteases (around 650 proteases have been described in humans to date) involved in various disorders in humans and other living organisms require further research. Proteases are key players in the development of viral diseases. Recent studies show that proteases operate in a network that involves the activity of many different proteolytic enzymes at the same time. Given the fact that more and more proteases are actively involved in viral diseases, there is an urgent need to develop new chemical tools that, thanks to the activity of enzymes, can be used for their precise monitoring or the search for drug candidates. Moreover, in order to detect the active form of the protease, one should use chemical tools called activity-based probes. The lecture will present modern techniques of creating tools for the study of viral proteases.

BioSAXS – some practical examples from lab and synchrotron sources

Maciej Kozak[1,2]

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[2] *National Synchrotron Radiation Centre SOLARIS, Jagiellonian University, PL 30-392 Kraków, Poland*

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Type of presentation: oral presentation

In the last two decades, the small-angle X-ray scattering (SAXS) technique has been appreciated by many structural biologists. It offers a complementary and supplementary view of the structure of biomacromolecules in relation to protein crystallography (PX), NMR spectroscopy or even single particle cryo-EM. It allows the analysis of the structure of biomacromolecules in solution, especially in conditions as close to physiological as possible. Currently, bioSAXS experiments are conducted mainly with the use of synchrotron radiation, but the application of novel high brilliant laboratory X-ray sources and the development in X-ray detector technology allows for carrying out these measurements also in the laboratory. The lecture will present basic information on the SAXS data techniques collection and data analysis as well as selected examples of applications of the bioSAXS technique in the study of the structure and organisation of protein complexes, modular and semi-ordered proteins and also lipid nanosystems used as innovative carriers of genetic material in gene therapy or new generation vaccines. The technical parameters of the new beamline SOLCRYS located in the SOLARIS National Synchrotron Radiation Centre, which, apart from the installation of the SAXS endstation, will also include the construction of the PX endstation will also be presented.

Imaging of biomacromolecules – negative staining versus cryoEM

Andrzej Żak[1]

[1] *Faculty of Mechanical Engineering, Wrocław University of Science and Technology, Wybrzeże Wyspiańskiego 27, 50-370 Wrocław, Poland*

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Type of presentation: oral presentation

The 2017 Nobel Prize "for developing cryo-electron microscopy for the high-resolution structure determination of biomolecules in solution" sealed the position of cryoEM as the most intensively developed method of imaging proteins and their complexes. We are just observing further improvements to the method – automated microscopes, direct electron detectors, phase plates, energy filters – each of these devices bring us closer to the true atomic resolution of the model. However, is this high-tech approach the only established method?

The method of negative staining will be introduced – known since the 1940s and still used as a standard for the initial evaluation of the quality of cryoEM protein samples. It has several benefits – it's two orders of magnitude faster, and its reduced resolution can also be a blessing. Thanks to its limitations, an imaging session lasting less than an hour is enough to classify the occurring shapes of molecules and to attempt to roughly model the structure. When studying basic biochemical phenomena with many samples and limited resources, this approach may be quite appropriate.

The basic limitations and limitations of the method will be described, the basic working procedure discussed, and a few variables necessary to make the respective samples and images will be compared. We will find out why not every preparation is suitable for negative contrast imaging and what is the difference between the obtained results and those with cryoEM.

Rapid response to biomedical challenges and threats

Wladek Minor[1]

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Type of presentation: oral presentation

Structural information, mainly derived by X-ray crystallography and Cryo-Electron Microscopy, is the quintessential prerequisite for structural-guided drug discovery. However, accurate structural information is only one piece of information necessary to understand the big picture of medical disorders. To provide a rapid response to emerging biomedical challenges and threats like COVID-19, we need to analyze medical data in the context of other in-vitro and in-vivo experimental results. Recent advancements in biochemical, spectroscopical, and bioinformatics methods may revolutionize drug discovery, albeit only when these data are combined and analyzed with effective data management framework like Advanced Information System proposed in 2017. The progress on AIS is too slow, but creating such a system is a Grand Challenge for biomedical sciences. By definition, a Grand Challenge is a challenging and extremely difficult long-term project that is not always appreciated by those looking for immediate returns.

The potential of antimicrobial peptides in the fight against microbial resistance

Francisco Ramos-Martín[1], Claudia Herrera-León[1], Thibault Annaval[1], Morgane Adélaïde1, Viviane Antonietti[2], Sébastien Buchoux[1], Pascal Sonnet[2], Catherine Sarazin[1], Nicola D'Amelio[1]

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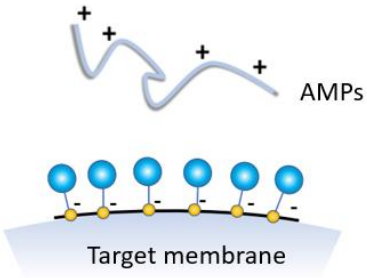
Type of presentation: oral presentation

Antimicrobial peptides (AMPs) display an impressive wide range of activities: antibacterial, antiviral and antiparasitic but also immunomodulatory and anticancer. Since they mainly act on microbial membranes, in this presentation we show how we can get structural information on AMPs in the presence of membrane models of increasing complexities. The analysis of molecular dynamic (MD) trajectories highlight key interactions at the basis of AMP activities, allowing to draw a detailed description of the mechanism of action supported by solution and solid state NMR data. A critical preliminary step in this work was the development of the ADAPTABLE web-server (http://gec.u-picardie.fr/adaptable/) by which we were able to select meaningful antibacterial AMPs active against WHO priority ESKAPE bacteria, antifungal AMPs for food preservation and crop protection, and anticancer AMPs as agents against esophageal cancer.



Structure, dynamics, and function of intrinsically disordered proteins

Lukáš Žídek[1]

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Type of presentation: oral presentation

The biological importance of intrinsically disordered proteins (IDPs), especially in regulation of cellular processes, has been recognized in the past two decades. As conformational heterogeneity of IDPs makes application of current crystallographic and electron-microscopic methods to IDPs very difficult or impossible, nuclear magnetic resonance (NMR) plays a major role in atomic-resolution studies of IDPs, providing residue-specific description of their structural features, dynamic properties, and intermolecular interactions. Examples of NMR studies will be presented for two regulatory IDPs: (i) delta subunit of bacterial RNA polymerase, making transcription of certain genes sensitive to nucleotide triphosphase concentrations, and (ii) microtubule associated protein 2c, regulating dynamics of microtubules in developing brain neurons. Correlation of molecular properties (transient structural features and dynamics) with biological function will be discussed for both proteins.

High-resolution cryoEM of energy-converting membrane protein complexes

Werner Kühlbrandt[1]

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Type of presentation: oral presentation

In a very short time, electron cryo-microscopy (cryoEM) has developed from a niche technique to a mainstream method in structural biology. This lecture will focus on our recent high-resolution structures of energy-converting membrane protein complexes from mitochondria and chloroplasts, obtained by single-particle cryoEM. CryoET of membranes and membrane-associated proteins adds valuable context at lower resolution. The lecture will end with a brief outlook on future prospects of cryoEM in biology.

‘Marker of Self’ peptides as soluble antagonists and as agonists on viruses and particles

Dennis E. Discher[1]

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Type of presentation: oral presentation

Particles of any type, upon injection in vivo, adsorb serum proteins including non-specific antibodies which promote engulfment by macrophages, but nearby ‘self’ cells are spared due to a ‘marker of self’ membrane protein that potently inhibits phagocytosis. We have studied this system in multiple biological, biophysical, and biotechnology contexts. Past studies of particles and viruses with ‘self’ peptide confirmed inhibition of uptake, and so we more recently made soluble antagonists that greatly increase phagocytosis of IgG opsonized cells including cancer cells. We use similar strategies in macrophage-based cell therapies against challenging solid tumors, finding durable cures with generation of cancer-specific antibodies.

Oral presentation

Application of gold nanoparticles in the cryopreservation of *in vitro*-derived shoot tips of bleeding heart (*Lamprocapnos spectabilis* (L.) Fukuhara)

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Type of presentation: oral presentation

The aim of the study was to evaluate the usefulness of gold nanoparticles (AuNPs) in cryopreservation, i.e., storage of tissues in liquid nitrogen (LN). *In vitro*-derived shoot tips of *Lamprocapnos spectabilis* were cryopreserved with the encapsulation-vitrification method. Gold nanoparticles were added during various steps of the cryo-protocol (preculture, encapsulation or recovery). The influence of AuNPs on the cryopreservation efficiency was determined by evaluating the recovery rate of explants and their morphogenetic response; the membrane stability index (MSI); the concentration of pigments in shoots; and the antioxidant enzymes activity. The genetic stability of the plants was evaluated using Start Codon Targeted Polymorphism (SCoT) markers. It was found that 10 ppm of AuNPs added into the alginate bead matrix improved the recovery rate of cryopreservation-derived shoot tips by 20% compared to the control. Conversely, the presence of nanoparticles in the recovery medium had a deleterious effect on the survival of explants. AuNPs usually had no impact on the MSI (73.9–85.9%), except for those added into the recovery medium at the concentration of 30 ppm (decline to 55.8%). All LN-derived shoots were shorter and contained less chlorophyll and carotenoids than the untreated plants. The application of AuNPs affected also the enzymatic activity in *L. spectabilis*. Minor genetic variation was found in 8.6% of plants if AuNPs were added either into the preculture medium (at 10 and 20 ppm) or to the alginate matrix (at 30 ppm). In conclusion, AuNPs added at a lower concentration (10 ppm) into the protective bead matrix can significantly improve the cryopreservation efficiency in *L. spectabilis* without affecting its genetic integrity.

Kinetics and mechanisms of Congo red dye removal from aqueous solution using activated carbon prepared from Olive waste wood

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Type of presentation: oral presentation

Olive waste wood was used as a precursor for preparation of eco-friendly adsorbent for removal of Congo red (CR) dye from aqueous solution. Phosphoric acid was used for the chemical activation. Obtained activated carbon was characterized through scanning electron microscopy (SEM) and Fourier transform infrared spectroscopy (FTIR). For batch adsorption, obtained data from effect of contact time on CR dye-uptake were applied on pseudo-first- and second-order kinetic models. Adsorption kinetics was seen to be best fitted with pseudo-second-order model with the highest value of correlation coefficient. Adsorption kinetics parameters confirmed removal of CR dye from aqueous solution through chemical and physical adsorption on activated carbon.

Macromolecules of meadowsweet flowers with pro-health potential – isolation from biomass pre-treated with CO_2 in supercritical condition

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Type of presentation: oral presentation

Promotion of greener and sustainable methods of obtaining biologically active compounds from medicinal plants is strongly important. Flowers of a herbal plant meadowsweet (*Filipendula ulmaria* (L.) Maxim.), contain compounds with pro-health effects such as anti-inflammatory, antioxidant, and hepatoprotective. Moreover, their polyphenolic-polysaccharide macromolecules are able to inhibit blood clotting process (I. Pawlaczyk et al., *Carb. Polym.*, 2009, 77, 568). The efficient extraction of polyphenolic-polysaccharide macromolecules from dry flowers of meadowsweet required pre-treatment of degreasing of biomass. Extraction with CO_2 in supercritical condition was used as a clean method. The procedure was repeated, but the degreasing process was carried out with hexane. Each degreased plant material was extracted in 0.1 M NaOH. Then each water soluble extract was condensed, dialysed against water (MWCO $\geq$ 12 kDa), and dried to obtain the macromolecular product. The isolated macromolecules were characterized spectrophotometrically as well as using FT-IR method. The major goals for modifying the conventional technologies of isolation of biologically active compounds, next to application of green methods, are limitation of organic solvents consumption, and increasing or keeping on a similar level the isolation yield and bioactivity of the final product. The use of CO_2 in supercritical conditions gave a cleaner macromolecular product with polyphenolic-polysaccharide chemical nature and with high pro-health potential.

Silver nanoparticles induce genetic, biochemical, and phenotype variation in chrysanthemum

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Type of presentation: oral presentation

Novel and user-friendly techniques of plant improvement are desirable. The study aimed to analyze the usefulness of silver nanoparticles (AgNPs) in chrysanthemum breeding. *In vitro* regeneration of adventitious shoots from internodes of chrysanthemum 'Lilac Wonder' was induced on the Murashige and Skoog medium supplemented with 0.6 mg·L^{-1} 6-benzylaminopurine (BAP), 2 mg·L^{-1} indole-3--acetic acid (IAA) and AgNPs at 0, 5, 10 and 20 ppm concentration. The efficiency of regeneration was analyzed after 10 weeks of culture. The concentration of chlorophylls, carotenoids, and phenolic compounds in shoots and calli were estimated. Plants obtained from 20 ppm AgNPs treatment were additionally analyzed on the genetic level using randomly amplified polymorphic DNA (RAPD) and inter sequence simple repeat (ISSR) markers. *In vitro* rooted shoots were acclimatized in the glasshouse and subjected to biochemical and phenotype stability evaluation. AgNPs at the highest concentration (20 ppm) suppressed both callogenesis and caulogenesis *in vitro*. The concentration of metabolites in callus was stable, regardless of AgNPs treatment, except for carotenoids which production was enhanced by 20 ppm AgNPs. In contrast, the content of chlorophyll *a* and *b* in shoots varied depending on AgNPs treatment. Polymorphic *loci* were detected in 12 and 9 AgNPs-treated-plants by RAPD and ISSR markers, respectively. Phenotype alternations were detected in six plants; one from 10 ppm AgNPs treatment and five from 20 ppm treatment. They included variation in pigment content and/or inflorescence shape. No genetic or phenotype variation was detected in the control plants. In conclusion, AgNPs can be used in chrysanthemum breeding.

The influence of squaric acid on the properties of chitosan-based films

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Chitosan is a polysaccharide and it is obtained mainly due to the deacetylation of chitin, which is one of the most abundant renewable natural product. It occurs in marine crustaceans armor, armor of insects and the cell walls of fungi. Chitosan can also occur naturally in some species of mushrooms, but its content is much lower than that of chitin [1]. Chitosan, due to its interesting properties (biological, physical, chemical ones) is used in various kinds of fields: medicine, engineering, water treatment, food industry, agriculture, cosmetic industry [2]. Due to the low physico-chemical properties of single biopolymers there is a need to modify materials by cross-linking agents addition. They stabilize the structure through the formation of new interactions. After the cross-linking process improvement of the mechanical properties and stability in water environment is expected [3]. The aim of the present study was to obtain a series of new crosslinked chitosan-based films by solvent evaporation method. Squaric acid was used as a safe crosslinking agent. The influence of the squaric acid on the physico-chemical properties of the formed films was determined. It was established that the addition of the squaric acid significantly improved Young's modulus, tensile strength, and thermal stability of the obtained materials. Moreover, it should be stressed that the samples consisting of chitosan and squaric acid were characterized by a higher swelling than pure chitosan. The detailed characterization proved that squaric acid could be used as a new effective crosslinking agent. It can be assumed the obtained films can find potential application in food packaging industry.

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Electron-driven proton-transfer channel in the hypothetical prebiotic RNA base pairs

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Type of presentation: oral presentation

Significant photostability of canonical DNA/RNA nucleobases and their base pairs was one of the main reasons for their selection as building blocks of the informational polymers, due to ultrafast non-radiative deactivation after photoexcitation. This hypothesis seems valid irrespective of whether protonucleotides were indeed assembled from nucleobases, ribose and phosphates or appeared in a direct synthesis from prebiotic feedstock molecules [1]. We do not really know whether RNA and DNA simply appeared in the Archean and remained unchanged since then or, what is more likely, they precursors did undergo a sort of prebiotic evolution. To validate the latter, several groups suggested and investigated in this context a large number of hypothetical prebiotic protonucleobases [2, 3]. Since the excited state electron-driven proton-transfer process (EDPT) was suggested as one of the key relaxation channels in canonical base pairs [4] we decided to investigate whether it is also accessible in selected Watson-Crick-like pairs of such alternative nucleobases using state-of-the-art ab initio calculations utilizing adiabatic diagrammatic construction to second order [ADC(2)].

The examined tally contains hydrogen-bonded dimers of 11 perspective proto-RNA analogues, like 8-oxo-guanine as the main product of oxidative damage of DNA, or barbituric acid [2,3]. The potential-energy profiles computed using ADC(2)/cc-pVTZ suggest quite high probability of the barrierless electron-driven inter-base proton-transfer deactivation proceeding through peaked S_1/S_0 conical intersections, however the role of $n\pi^*$ states in this mechanism is greater than it is commonly recognized. Moreover, investigation of guanine-cytosine base pair under UV radiation revealed a significant WC-to-wobble change of pairing, which has not been yet described in the literature.

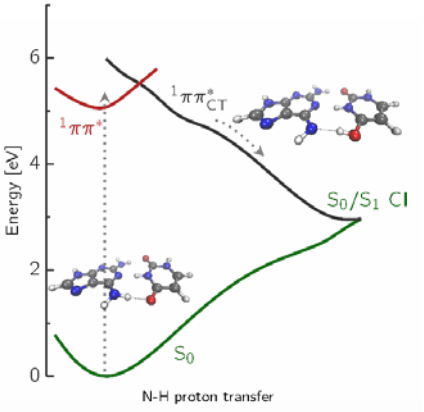

Fig 1. Potential energy cut for the usual case of CT state crossing the bright $^1\pi\pi^*$ state and the ground state along proton transfer coordinate.

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Technologies for the management of marine algae biomass into products useful for sustainable agriculture and clean environment

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Type of presentation: oral presentation

In many countries, the marine algae found on the beach is a waste that needs to be disposed of. On the other hand, they are a source of valuable active ingredients [1]. An environmentally friendly solution is the use of this biomass as a raw material in the extraction process to obtain plant growth biostimulants or the direct addition of dry algae biomass to the soil. Applying the principles of "circular economy", the waste from the extraction process can also be applied to soil. Algae biomass, in addition to its biostimulating properties, can also be used in the bioremediation (purification) processes of soil contaminated with heavy metals [2,3].

For the production of algae extracts from the brown algae Fucus vesiculosus, ultrasound-assisted extraction, which is a "green technology", was used. Germination tests for radish and sorghum were performed to evaluate the efficacy and potential phytotoxicity of algae extracts and soil additive of dry algae biomass/post-extraction residue. The pan tests and Phytotoxckit tests made it possible to select the concentration of the extract that best stimulates plant growth – 20% (desirable result due to the saving of biomass). In addition to the biostimulation of plant growth using algae extracts, the same property was demonstrated in the Phytotoxckit tests for dry algae biomass and post-extraction residue. The best results were obtained for the post-extraction residue (2 g/kg), which is a desirable result for economic reasons and also because of the possibility of waste management in accordance with the principles of "sustainable development". The proposed technologies for the management of marine algae biomass enabled the production of products useful for sustainable agriculture.

Acknowledgments: The work was carried out as part of the project: "Environmentally friendly technologies for the management of seaweed biomass into products useful for sustainable agriculture and biosorbents used to remove heavy metal ions from the environment" (No. 2019/33/B/NZ9/01844, National Science Center).

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Monitoring technical maturity of *Cannabis* cultivar by trichome morphology analysis and HPLC phytocannabinoid content

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Type of presentation: oral presentation

The historic prohibition of cannabis (*Cannabis sativa* L.) has stunted scientific research on its production, leaving growers to rely on guides and online resources based heavily on anecdotal information [1]. During flowering stage, the inflorescence of the female plant accumulates phytocannabinoids, mostly produced and sequestered in glandular trichomes [2–4]. This study aims at determining technical maturity through analyzing phytocannabinoid content and morphological changes of trichomes in cultivated medical Cannabis (strain T-492), during final maturing period. Phytocannabinoid content in fresh flowers was assessed with HPLC-DAD according German Pharmacopoeial Cannabis inflorescence method. Morphology analysis was performed using Zeiss Stemi 508 stereomicroscope. HPLC analysis revealed that total THC (%) in the samples from 3 plot spots in greenhouse (3600 m^2) from southeast (13.14%), central (12.38%) and northwest (9.14%) position is declining. Regarding time line of sampling, total THC (%) was the highest starting at H-10 days = 13.14% and then decreasing at H-7days = 11.78%; H-2days = 11.56% and 10.0% at harvest (southeast spot). Analysis of capitate-stalked and capitate-sessile trichomes revealed changes in all samples from translucent to orange trichomes and some with dark brown glands indicating start of senescence stage. Anthocyanin coloration was weak, barely identifiable in some of the samples, hence in others coloration was intense. This anthocyanin coloration can be induced by environmental stress [5]. This research leads directions for future conceptualization of correlational studies of cannabinoid content and changes in trichomes and anthocyanin coloration in different *Cannabis* cultivars.

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Microstructure, thermal behaviour and Optical properties of Sm-doped TiO_2 nanoparticles

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Type of presentation: oral presentation

Rare earth (RE) have been used as dopants for TiO_2 due to their high fluorescence efficiencies and the availability of the 4f orbital which results in interesting optical and electrical properties. Among the various RE samarium doped with titania not only extends the photoresponce but also improves the separation efficiency of charge carriers. However, more efforts are required to develop an efficient photocatalyst with an excellent stability and better separation of charge carrier efficiency for efficient catalytic applications. The current work reports modified sol gel preparation of pure TiO_2 and Sm_3^+ ion-doped TiO_2 nanoparticles and the influence of samarium ion doping in the TiO_2 host lattice. The as-synthesized both pure and Sm_3^+-doped TiO_2 nano samples were characterized by spectroscopic techniques (UV-vis and photoluminescence), micrograph techniques (SEM and TEM), energy dispersive X-ray spectroscopy (EDX), thermal behaviour followed by thermogravimetric and differential thermal analysis (TG-DTA) and X-ray diffraction. XRD pattern of nanomaterials indicates Sm doped TiO_2 primarily consist of anatase phase with spherical shape. It is also found that the crystallite size of Sm doped TiO_2 is much smaller than undoped TiO_2. The incorporation of Sm in TiO_2 is confirmed by EDX. The UV-vis spectroscopic studies indicated that Sm doping increased the visible light absorption ability of the Sm-doped TiO_2 nanoparticles and a redshift for the Sm-doped TiO_2 nanoparticles appeared when compared to TiO_2 nanoparticles. An enhancement in the optical absorption of the Sm-doped TiO_2 nanoparticles indicated that it can be used as an efficient photocatalyst under a visible light irradiation.

Phospholipid-based lyotropic mesophases doped with luminescent carbon nanodots

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Type of presentation: oral presentation

There has been a growing interest in research on lyotropic liquid crystals of biological importance. The examples of mesophases are observed in the biologically relevant structures, for instance in cell membrane and myelin sheath [1]. The combinations of luminescent nanostructures with a biological component, such as phospholipids [2], gain considerable attention due to potential application in bioimaging. The important advantage of the hybrid material made of a single type of biomacromolecules is obtaining a simplified model of biological system. In this study, we present formation and analysis of lyotropic myelin figures (MFs) composed of zwitterionic phospholipids doped with strongly-emitting triangular carbon nanodots. Using polarized light microscopy and confocal microscopy allowed us to investigate the morphology of multilayered structures. Furthermore, we determined possibility to use two-photon fluorescence microscopy to examine MFs.

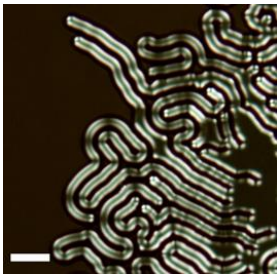

Fig. 1. The polarized light microscopy image of myelin figures doped with CNDs. Scale bar is 25 µm.

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XRD, NMR, FT-IR, RAMAN and structural characterization of a novel organic-inorganic hybrid material

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Type of presentation: oral presentation

A novel crystalline organic–inorganic hybrid antimoniate material was successfully synthesized using 2-aminothiazolium cation as the organic part. The X-ray diffraction analysis, of the crystals showed a 0-dimension structure consisting of Sb_2Cl_8 dimers separated by 2-aminothiazole cations. The cohesion and stabilization between these entities is performed via N-H…Cl hydrogen bonds. The samples was characterized also by powder X-ray diffraction (PXRD). The functional groups in the complex were confirmed by Fourier transform IR and FT-Raman spectroscopy. The NMR spectrum is in agreement with the X-ray structure.

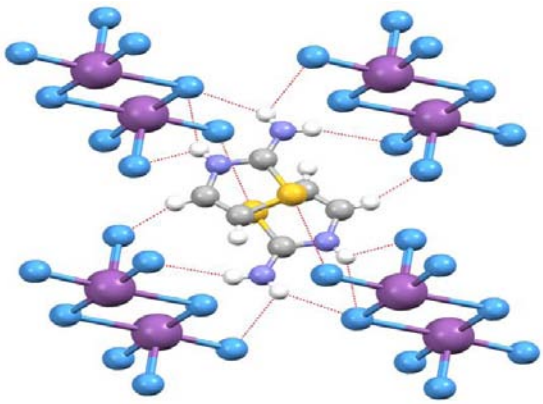

Fig.1. Hydrogen bonds of the $[C_3H_5N_2S]SbCl_4$ compound (the red lines represent hydrogen bonds).

2-Azabicyloalkane-1,2,3-triazole assemblies – Synthesis and antiproliferative activity

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Type of presentation: oral presentation

As rigid analogues of pyrrolidine, piperidine and azepane, 2-azabicycloalkanes have found versatile applications and exhibit promising biological activities. Their intrinsically chiral scaffold is easily synthetically available and can be conveniently functionalized. In this work, 2-azabicycloalkanes were coupled with 1,2,3-triazoles, which are known for their various applications due to their bioactivity and for their use as functional materials. A library of 21 novel chiral 1,2,3-triazole-based 2-azabicycloalkane conjugates was designed and synthesized using copper-catalyzed click reaction (CuAAC). The obtained hybrids were tested for their antiproliferative activities against selected human cancer cell lines, showing moderate to potent activity and good to very good selectivity indices. These promising results and structure-activity analysis offer a promising insight for further investigations in the search for drug candidates.

Bioinspired, Cellulose-supported, and AuPd-nanorod-assisted Photocatalysis

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Type of presentation: oral presentation

One of the essential characteristics of plasmonic nanocrystals is their ability to harvest light in the visible spectral range. This makes them valuable components of materials designed for light conversion into useful chemical fuel [1]. However, the intrinsic need for using surfactants (e.g., cetyltrimethylammonium bromide, CTAB) as ligands assuring colloidal stability of nanoparticles limits photochemical properties of nanocrystals. The origin of this limitation lies in the insulating character of the surfactant shell, which hinders carrier transport [2]. Using UV-Vis-NIR absorption spectroscopy measurements and Transmission Electron Microscopy, cellulose fibers were found to serve as a robust substrate for the immobilization of plasmonic nanorods, primarily thanks to their abundance in various functional chemical groups. The functionality of the obtained composite material, consisting of AuPd bimetallic rod-like nanoparticles and cellulose fibers, was subsequently evaluated in a bioinspired photocatalytic process. The process of interest was focused on the photoregeneration of cofactor molecules (NADH – nicotinamide adenine dinucleotide) and simultaneous dehydrogenation of sodium formate [3] with visible light acting as an energy source. Photocatalytic and thermocatalytic properties of the composite were compared, while systematic screening of the experimental parameters enabled the evaluation of the role of palladium co-catalyst [4].

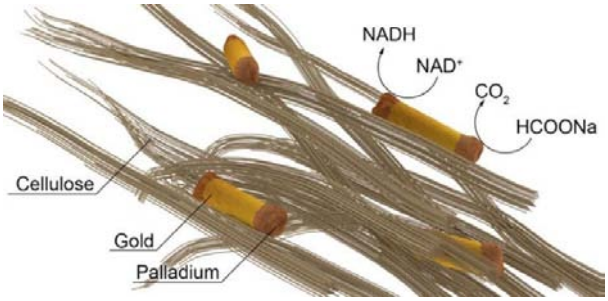

Fig. 1. Schematic representation of hybrid photocatalyst consisting of Pdcoated gold nanorods (AuPdNRs) immobilized onto the cellulose fibers. Plasmonic nanoparticles catalyze the reduction of cofactor molecules and simultneous dehydrogenation of sodium formate in the presence of the visible light as an energy source [4]

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Determination of human proteasomes substrate specificity profiles

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Type of presentation: oral presentation

The human proteasomes play a key role in protein degradation and are involved in many crucial processes such as apoptosis, cell proliferation, tissue remodeling and antigen presentation. Constitutive proteasome (CP) and immunoproteasome (IP) are large, barrel-shaped protein complexes. Each one bears 3 distinct proteolytic active subunits named β1c, β2c and β5c for CP and β1i, β2i and β5i for IP, respectively. Abnormal activity of human proteasomes has been linked to many diseases, most notably multiple myeloma and mantle cell lymphoma. Different inhibitors of proteasomes activity have been developed and clinically used (Bortezomib, Carfilzomib, Ixazomib), however they can cause severe side effects and prolonged exposure leads to the development of treatment resistance. One of the approaches to evercome afromentioned issues is to develop novel highly selective substrates towards each catalytic subunit of both proteasomes. In this study, two approaches were taken: hybrid combinatorial substrate libraries (HyCoSuL) and internally quenched fluorescent (IQF) peptide substrate libraries. Substate specificity of each subunit in P5 and P6 position was determined by HyCoSuL technology and P1′ and P2′ specificity was determined by (IQF) substrate libraries containing natural and unnatural amino acids. Extention of the peptide backbone beyond P1–P4 positions should result in obtaining a set of selective substrates that can be further converted into inhibitors or activity-based probes.

Ultrasound-assisted extraction/dispersive liquid–liquid microextraction (UAE-DLLME) method to study the volatile composition of *Mentha longifolia* L. inflorescences.

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Type of presentation: oral presentation

The volatile composition of the inflorescences of aromatic plants is a decisive factor to understand the plant-insect interactions. To monitor its diurnal changes, a method based on ultrasound-assisted extraction / dispersive liquid – liquid microextraction (UAE-DLLME) coupled with GC / MS and GC / FID was adapted and applied to study diurnal changes in volatile composition of inflorescences of M. longifolia (chemotype piperitenone oxide). To check its usefulness, the GC / MS profiles were compared with those obtained "in vivo" by static solid phase microextraction (SPME) and hydrodistillation (HD). Three samples from each of the five tested individuals were collected at three times per day: 8 AM, 2 PM and 8 PM and analyzed at once. Average values for each sampling time were subjected to one-way variance analysis.

High intraindividual variability was found in piperitenone oxide, which did not show significant changes (69.1, 75.5, 61.3%). Nevertheless, some minor but ecologically relevant components showed a significant decrease over the morning which was similar for the five monitored plants: piperitone oxide (3.3, 0.1, 0.0%), menthalactone (2.1, 0.3, 0.1%) and nepetalactone (2.1, 0.3, 0.5%). Limonene (2.0, 2.5, 6.0%) and germacrene-D (1.4, 2.1, 3.6%) showed the opposite behavior.

The results have confirmed its usefulness as alternative to hydrodistillation since it allows processing small samples. This way, the plants can be monitored without producing noticeable impact on them. In addition, the prolonged effect of boiling water in hydrodistillation can be avoided. When compared with SPME, the possibility of applying UAE-DLLME as previous approach to study volatile emissions from inflorescences can also be useful.

Generation of a diffuse large B-cell lymphoma (DLBCL) rituximab-resistant cell line as a model to investigate the efficacy of novel antitumor strategies

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Type of presentation: oral presentation

Rituximab (RTX), employed in the treatment of several B-cell malignancies, is an anti-CD20 monoclonal antibody (mAb) engaging effector mechanisms of the immune system to eliminate cancer cells. Its efficacy is unquestionable, yet a considerable percentage of patients develop resistance. Therefore, the thorough investigation of mechanisms involved in RTX resistance is of utmost importance. The aim: Generation of RTX-resistant DLBCL cell line as a model to investigate the efficacy of novel antitumor strategies. DLBCL DHL-4 cell line was incubated for 24h with increasing concentrations of RTX in the presence of human serum as a source of complement. The procedure has been repeated 5 times. The cytotoxic effect of RTX was assessed by ATP quantification with CellTiter-Glo®. The expression of selected antigens in rituximab-resistant cells was anal yzed using flow cytometry and western blotting (WB). Generation of DLBCL rituximab-resistant cell line (RRCL) DHL4 was confirmed by comparing the sensitivity of parental and RRCL to rituximab-mediated complement-dependent cytotoxicity. Furthermore, the levels of CD20 and other surface molecules that serve as potential therapeutic targets were analysed with cytometry. RTX-resistant DHL4 cell line phenotype is substantially different from parental cell lines. These cells can serve as a model to further investigate the efficacy of antitumor strategies. To broaden the scope of this study and confirm the observed changes the production of new RRCLs arising from other DLBCL cell lines is planned.

Generation of CD20 knockout non-Hodgkin lymphoma cell lines as a model to study molecular changes related to rituximab resistance

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Type of presentation: oral presentation

CD20 is a molecular target for monoclonal antibodies (mAbs) widely used in hematooncology. Regimens comprising anti-CD20 mAbs exhibit high efficacy as the first-line treatment, however, they are often followed by the acquirement of resistance. One of the main mechanisms of rituximab (RTX) resistance is CD20 downregulation.The aim of the study was to investigate molecular changes in RTX-resistant lymphoma and CD20 knock-out (CD20KO) cell lines. Materials and methods: RTX-resistant cell lines generated by incubations with increasing concentrations of RTX +/– human serum were kindly provided by Prof. Czuczman from MD Anderson, USA. CD20KO cells were established with CRISPR/Cas9 technology. CD20 sgRNA was designed using Brunello and Brie library and cloned into Lenti-CRISPR-V2 plasmid. B-cell lymphoma cell lines – Raji, SU-DHL-4, and OCI-Ly1 were transduced with the plasmid. CD20 expression was determined using flow cytometry (FCM), western blotting, and qPCR. The expression of membrane proteins was evaluated by FCM. Cytotoxicity of mAbs was assessed by FCM upon propidium iodide staining and in alamarBlue assay. Results: CD20KO cell lines were successfully generated. They demonstrated decreased sensitivity to RTX in complement-dependent cytotoxicity mechanism. CD20KO cell proliferation was unimpaired, however, changes in the membrane protein expression were observed. Conclusions: CD20 loss does not affect the cytotoxicity of small-molecule inhibitors, but may lead to a downregulation of cell-surface proteins, and therefore diminish the efficacy of targeted immunotherapies. The biological significance and mechanisms underlying this phenomenon require further studies.

Complex microcarriers based on hydrogel and food gums for encapsulation of hydrophobic substances: fabrication and characterization

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Type of presentation: oral presentation

The development of hydrogel carriers providing protection, stability and controlled release of the hydrophobic bioactive payload, is important in their application as a potential drug delivery system. The aim of this study was to fabricate and characterize clove oil-loaded complex microcarriers based on polysaccharides (sodium alginate or carboxymethylcellulose) and a food gum (arabic or xanthan gum). Microcarriers were fabricated by means of extrusion coupled with external ionic gelation resulting in 22 types of microparticles differed at concentration ratios of the core polymers. The encapsulation efficiency was determined by spectrophotometric method. The morphology and size of the particles were examined via an optical microscope. The payload release profiled were studied under gastrointestinal conditions *in vitro*. The smallest microparticles were those composed of caboxymethylcellulose and arabic gum, while the largest one were those composed of alginate and xanthan gum. The most compelling differences were observed for morphology of carriers based on carboxymethylcellulose with xanthan gum compared to carriers based on carboxymethylcellulose only. The payload release profiles form the studies microparticles indicate prolonged release of the oil depending on the carrier composition. The results obtained allow to conclude that the food gums influenced considerably properties of the carriers. In order to determine the optimal carrier composition to fabricate a microcarrier of the most desirable features and performance, it is necessary to continue the research considering the internal interactions between the polysaccharides used as a core material, as well as the other food gums.

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Transthyretin (105-115) peptide – a correlation between the structure and optical properties of enantiomers and the racemate

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Type of presentation: oral presentation

Amyloid fibrils refer to organized peptide or protein aggregates sharing a common underlying structure, namely cross-β-sheets. Their presence *in vivo* is associated with some neurodegenerative disorders including Alzheimer's or Parkinson's disease.[1] They possess a peculiar property, intrinsic fluorescence. Upon excitation at ~360 nm they emit in the visible range of wavelengths, with a maximum at 430-450 nm [2, 3]. We have synthesized *L*- and *D*-transthyretin (TTR) (105–115) fragment peptide sequences using solid phase peptide synthesis. Enantiomers and their equimolar mixture were incubated at acidic conditions. AFM imaging, fluorescence and ATR-FTIR spectroscopy approaches were used to investigate the morphology, optical and structural properties of studied samples, respectively. The outcomes revealed the formation of amyloid fibrils in all samples. We correlated the differences in H-bonding network between both enantiomers and the racemic mixture with the differences in the position of excitation and emission bands. Interestingly, fluorescence emission-excitation maps suggested the presence of dityrosine cross-links in all samples even before the incubation period. ESI-MS analysis spectra evidenced the absence of dityrosine covalent cross-links and emphasized strong noncovalent interactions between tyrosine residues in the neighboring peptide sequences.

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Design, synthesis and structural investigations of novel peptide-based elastase inhibitors with fluorescent properties

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Proteases, a group of enzymes responsible for various biochemical functions, include neutrophil elastase – a serine protease involved in collagen breakdown in cells. This ability prompted many researchers to develop new elastase inhibitors, able to control its activity in order to prevent skin-aging or pathophysiological dermal processes [1]. We describe design, bioinformatic analysis, synthesis and enzyme inhibition assays of new compounds, as possible effective inhibitors of neutrophil elastase. Starting from already known and characterized elastase inhibitors, [1] we designed a library of novel, modified peptides, based on the previously described MGKVVNPTQK sequence [2,3]. In particular, a fragment of this peptide was used as the core of the new molecules, while structural modifications, including the incorporation of a heterocyclic moiety [4], provides unusual interactions and fluorescence. The inhibition pathway comprises the formation of specific interactions between the peptide and elastase active site, e.g., through hydrogen bonds. The planarity and non-peptide character of the heterocyclic portion render these molecules less amenable to be cleaved by elastase and other proteolytic enzymes. We performed molecular docking studies of these peptidomimetics, followed by synthesis and characterization, while conformational analysis, including NMR studies, and enzymatic assays are in progress. Synthesized peptidomimetics are about to be examined as potential neutrophil elastase inhibitors, followed by *in vitro* experiments on cell cultures to check their potential applicability in the cosmeceutical field.

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Biotin labelled PAMAM G3 dendrimers as a delivery system for α-mangostin into squamous carcinoma cells

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Type of presentation: oral presentation

α-Mangostin, one of the major xanthones, exhibits a wide range of pharmacological activities including antioxidant, anti-inflammatory, and anticancer. However, based on our studies, the main weakness of α-mangostin anticancer activity is the lack of its selectivity. Therefore to improve α-mangostin antineoplastic potential, the targeted third generation poly(amidoamine) dendrimer (PAMAM G3) delivery system was proposed. PAMAMs are hyperbranched polymers, studied as drug delivery agents due to their good solubility, high biocompatibility and low immunogenicity. A multifunctional nanocarrier was prepared by attaching α-mangostin (M) to the surface amine groups of dendrimer via amide bond in the ratio 5 or 17 residues per 1 dendrimer molecule. Twelve remaining amine groups were modified by conjugation with D-glucoheptono-1,4-lactone (gh) to block the amine groups and two biotin (B) residues as a targeting moiety. Biological activity of obtained conjugates was studied on SCC-15 cancer cells compared to normal fibroblasts (BJ). Dendrimer vehicle G312gh2B showed no toxicity against both cell lines. The attachment of α-mangostin to vehicle significantly increased the cytotoxic effect of xanthone, even to 4- and 30-times for G312gh2B5M and G310gh2B17M, respectively. Stronger inhibition of cell viability and changes in other metabolic parameters (proliferation, ATP and Cas-3/7 level) was observed for G310gh2B17M than G312gh2B5M. Both bioconjugates were internalized efficiently into the cells. The proposed α-mangostin delivery system proved higher efficacy of anticancer activity than drug alone.

Sorption of Cr(III) ions by CuO nanoparticles biosynthesized from macroalgal extract

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Type of presentation: oral presentation

Metal and metal-oxide nanoparticles (NPs) biosynthesized with natural extracts can be used as a new generation of sorbents for removal of heavy metal ions from solutions. In the present study, extract produced from freshwater macroalga – *Cladophora glomerata* by ultrasound assisted extraction was used to biosynthesize CuO NPs. The results of sorption capacity of CuO NPs towards Cr(III) ions were compared for different values of pH (3, 4 and 5), initial Cr(III) ions concentrations (C_0 – 100, 200 and 300 mg/L), sorbent dose (C_S – 0.5, 1 and 2 g/L) and temperature (20, 40 and 60°C). The sorption kinetics was carried out for 3 hours. Pseudo-second-order kinetic model was applied to analyse the obtained results. The highest sorption capacity at equilibrium (151.5 mg/g) was received for pH 5, C_0 300 mg/L, C_S 0.5 g/L and 60°C and the lowest (23.8 mg/g) for pH 5, C_0 100 mg/L, C_S 0.5 g/L and 20°C. This work proves that macroalgae based bioproducts, such as NPs, can be applied in wastewater treatment as sorbents.

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The impact of direct and indirect non-thermal plasma treatment on the biological activities of human breast cancer cell lines

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Type of presentation: oral presentation

Along with the increasing incidence of breast cancer among females, the encouraging scope of research studies remains the development of non-invasive and highly selective anti-cancer modalities. One of the novel and promising methods for breast cancer treatment is using of non-thermal plasma (NTP). In this view, a unique and effective method for human breast cancer treatment was developed. In more details, human non-metastatic breast adenocarcinoma MCF7 cell line and human metastatic MDA-MB-231 cell line were directly exposed for NTP treatment as well as indirectly *i.e*. culturing the cells in medium activated by NTP, resulting in the plasma-activated media production (PAM). Additionally, a non-cancerous human normal MCF10A cell line was chosen as *in vitro* model. The induced biological effect of NTP treatment was evaluated by performing MTT assay, scratch test, as well as Annexin V and Propidium Iodide staining. Finally, the concentration of reactive oxygen and nitrogen species (RONS), which are involved in biological response was analyzed. For these assays, the colorimetric methods were used. It has been found that the tailoring of PAM composition, such as an addition of FBS to culture media before or after NTP treatments, leads to the production of different concentration of RONS, i.e., H_2O_2 production in DMEM, DPBS, and Opti-MEM was elevated by 16, 17, and 25% respectively. In addition, it resulted in different anti-cancer efficiency. Conclusively, the proposed direct and indirect NTP treatment of human breast cancer cell lines consequences in significant metabolic activity, motility and induction of programmed cell death, especially prominent in the case of MDA-MB-231.

The effect of antipsychotic drugs on membrane domains enriched in cholesterol and sphingomyelin

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Type of presentation: oral presentation

Antipsychotic drugs are used in the treatment of mental disorders. The benefits of neuropsychiatric treatment are unfortunately outshone by their side effects. The most common are weight gain and increased risk of developing diabetes and cardiovascular diseases. It seems that undesirable side effects may be associated with the ability of neuroleptics to disrupt biosynthesis pathways of fatty acids and cholesterol in cells. To study the influence of drugs on microdomains enriched in cholesterol and sphingomyelin we used giant unilamellar liposomes (GUV) as a biomimetic model of membranes. GUV can be produced from various lipids and their mixtures with electroformation. Lipids rafts are the examples of domains presented in the outer layer of cell membrane enriched with cholesterol, sphingomyelin and glycolipids. Their supposed function in cells is to create platforms that interact with proteins involved in cell signaling. The most commonly used model for studying the properties of such microdomains is composed of equimolar mixtures of unsaturated phosphatidylcholine, cholesterol and sphingomyelin (raft-mimicking mixtures). Such systems are characterized by the occurrence of lateral phase separation. We have studied the influence of ten antipsychotic drugs and two compounds known for their ability to decrease the level of cholesterol in blood on morphology of lipid microdomains. Statin have been shown to double the number of lipid domains present in GUVs while reducing their surface area. The results obtained for statins served as a benchmark. The addition of antipsychotic drugs to lipid formation slightly changed the number of lipid domains as compared to liposomes made from pure lipid mixture. However the area of the domains was significantly reduced. The biggest changes in the surface area were observed for fluphenazine, flupentixol and risperidone. These changes could be a result of selective accumulation of drugs in border regions of domains between liquid ordered and liquid disordered phase. The used model of lipid bilayer allowed us to study the influence of psychiatric drugs on lipid rafts, microdomains involved in signal transduction forming platforms for interaction of signal proteins.

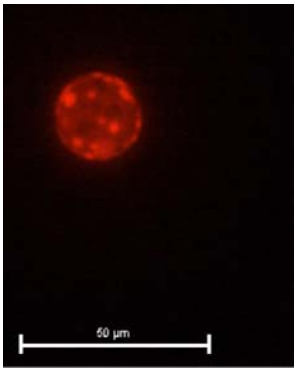

Fig.1. Photo of GUVs made with a microscope Nikon Eclipse TE2000-E with 40× magnification. $DiIC_{18}$ was used as a dye. Scale bar 50 µm

Immunomodulatory and anticancer properties of fever-range hyperthermia

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Type of presentation: oral presentation

The febrile response is one of the most commonly recognized features of inflammation and infection. Thus therapeutic opportunities of the thermal factor are used since ancient times. Fever-range hyperthermia (FRH) exerts a variety of immunomodulatory effects on various immune cells. Furthermore, whole-body hyperthermia (WHB) between 38–40°C has been used to treat widespread metastatic tumors combined with chemotherapy and/or radiotherapy. Therefore, the aim of our study was to check the immunomodulatory properties of fever-range hyperthermia both *in vitro* and *in vivo*. Furthermore, we wanted to verify the anticancer properties of fever-range hyperthermia in combination with Mistletoe Extract *in vitro*. We used breast cancer cell lines MCF-7 and 4T1 and macrophages cell line RAW264.7. Cells were simultaneously stimulated with ME and subjected to fever-range hyperthermia (39°C or 41°C). After co-treatment, cell viability was measured by MTT assay. Additionally, the generation of reactive oxygen species (ROS) was evaluated using carboxy-2'-7'-dichlorodihydrofluorescein diacetate (carboxy-DCF_DA) followed by flow cytometry. The cell cycle distribution was analysed by propidium iodide staining and flow cytometry. Finally, the production of pro-inflammatory factors (interleukin (IL)-1β, IL-6, and cyclooxygenase (COX)-2) was measured using two-step RT-qPCR. The proteome profiler for human cytokines was used to analyze the expression of selected cytokines in patients treated with WHB. Two-step RT-qPCR was used to check the expression of miRNA-155 in the serum of patients. Our results indicate that fever-range hyperthermia has strong immunomodulatory properties. We observed a beneficial effect of heat treatment for ME therapy. We observed changes in cytokines in the serum of patients treated with whole-body hyperthermia.

Biotechnology in service of patients – T cell bispecific antibody development for cancer immunotherapy

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Type of presentation: oral presentation and poster

Cancer is the leading cause of death worldwide, with an estimated 10 million deaths caused by this disease in 2020 worldwide [1]. Despite continuous progress in pharmaceutical approaches and improved clinical outcomes for the patients, many types of cancer remain hard to treat. In the recent decades, cancer immunotherapy has shown remarkable efficacy in the clinics across many malignancies. Among several categories of immunotherapeutics, T cell bispecific antibodies (TCBs) emerged as highly potent agents redirecting the patient's T cells towards the tumor. TCBs are monoclonal IgG-like bispecific antibodies, binding simultaneously to a tumor target protein and a CD3e subunit of the T-cell receptor, resulting in recruitment and activation of T cells at the tumor site and subsequent T cell cytotoxicity. Here, I will introduce the mode of action of TCBs in the context of tumor cells, as well as the process of pharmaceutical development of this biological class of cancer drugs. I will describe the R&D process comprising the target selection, antibody engineering, immune response evaluation, *in vitro* and *in vivo* efficacy evaluation, as well as clinical assessment. Additionally, I will present the current focus areas for the next-generation TCBs and the potential future directions for cancer immunotherapy.

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Casting light on the impact of the origins of acute myeloid leukaemia (AML) stem cells in leukaemia development and effectiveness of treatment

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Type of presentation: oral presentation

Although the origin of MLL-AML is well studied in mouse models, it remains uncertain how it can be translated into human cancer. One of the major challenges about cells-of-origin in human leukaemia is an establishment of a model, which will allow reconstructing the disease on human somatic cell populations, which phenotype and function will be well defined, during various stages of normal cell development. Studying such a model allows answering specific questions such as: Which cells in a human are the origin of AML driven by MLL fusion? How much influence on the treatment response depends on the cells-of-origin and how to overcome treatment resistance? How to detect cells-of-origin in patients with already developed leukaemia?

This project will focus on HSC- and CMP-derived AML with MLL rearrangement, which will provide novel insights into the disease biology, and in longer term will facilitate the development of more effective treatments.

To this end, a novel humanized mouse model was created by transplantation of hematopoietic cell's populations expressing MLL fusion into NOD scid gamma mouse, which provide an unprecedented opportunity to study the molecular and cellular biology of human AML derived from different cells-of--origin. Currently I have been applying established pipelines for data analysis (BS-seq, ChIP-seq, ATAC-seq, RNA-seq) and answer the questions about epigenetic and transcriptional differences between HSC- and CMP-derived AML. After that, I want to compare the obtained results with available patient data.

I believe that finding epigenetic and transcriptional dissimilarities in my data analysis will lead us to relevant biological pathways that reflect cells-of-origin and at the same time explains differences in the biology of HSC- and CMP-derived AML. In collaboration with my lab members, we are planning to check the hypothesis that these variations in the cells-of-origin may have an impact on drug sensitivity.

Probiotic lactic acid bacteria in probiotics drinks: are they trustable?

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Type of presentation: oral presentation

Probiotics used in the production of fermented food must be recognized as safe, holding the GRAS (Generally Recognised As Safe) status. However, due to inadequate quality control and misleading content labeling of probiotic products, it is of utmost importance to characterise and identify the presence of lactic acid bacteria (LAB) in probiotic products. In this study the number of LAB in different probiotic drinks from markets were compared with the information stated on the product labels. The total amount of LAB in five probiotic drinks (A, B, C, D and E) was first measured. Probiotic drink A was found to contain the highest LAB count, followed by probiotic drink B; no viable lactobacilli were found in probiotic drink D, even though the label claimed that the product contained high numbers of various LAB. In probiotic drinks C and E numbers were below the declared content on label. In order to optimize the therapeutic effects of probiotic products, sufficient amount of viable probiotic must reach the intestines. Also, the isolated LAB were tested for tolerance at the pH of gastrointestinal tract (GIT). All of the isolates were highly tolerant to pH 4 and 5. Conclusively, the study has shown that different probiotic drinks contain various amounts of LAB that behave differently in the pH tolerance test. Therefore, it is crucial in educating consumers on the choice of probiotic products as their selections may affect their health.

Comparison of drug-resistant and drug-sensitive Pseudomonas aeruginosa strains – metabolomics studies

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Type of presentation: oral presentation

Pseudomonas aeruginosa is the Gram negative bacterium, a common pathogen, which occurs in the environment and is isolated in the patients who suffer from respiratory tract of cystic fibrosis (CF). The presence of this bacterium in a chronic infections associated with increased morbidity and mortality rate. The reason of this fact is high resistance for antibiotics treatment [1]. The aim of this study were to compare the intra- and extracellular metabolites of drug-resistant and drug-sensitive *P. aeruginosa* strain. To verification metabolic changes in antibiotic resistance, metabolomics profiles of two *P. aeruginosa* strains were compared. Firstly, the antibiotic resistance of each strain were checked. One strain is resistance to all tested antibiotics, the second one is sensitive to all (aminoglycoside and β-lactam antibiotic were checked). The statistical and chemometrical analysis were performed for intra- and extracellular metabolites. The principal component analysis showed nonoverlapping group (the differences between both investigated strain) both in terms of the intracellular and extracellular profile. The statistical analysis allowed to obtain statistical important metabolites (for extracellular – nine, intracellular – sixteen). The most significance metabolites, differencing both strains are: histidine, alanine, pyruvate, valine, isoleucine, leucine, betaine, formate, glycine, threonine. This compounds are involved in ABC transporters and amino acids metabolism pathways. Metabolome analysis complements transcriptomic and genomic studies and may provide a better understanding of the causes of antibiotic resistance in bacteria.

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Myconanotechnological biosynthesis of silica nanoparticles

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Type of presentation: oral presentation

Because of the physical, chemical, optical, and mechanical properties of nanosilica, it has rapidly found applications in medicine, supercapacitors, batteries, fiber optics, and concrete materials [1]. Chemical synthesis of silica-based materials is not only relatively expensive and environmentally hazardous, but also often requires extreme temperature, pressure and pH, so it is important to find an alternative method to obtain this valuable product. [2] Biological waste materials rich in phytoliths, or disordered silica bodies, are excellent candidates for bioconversion processes to obtain silica nanoparticles [3], [4], [5]. The chosen substrates that were ideal for this reaction were rice husks (RH) [6] and corn cobs husks (CCH) [7]. These were used in fungal biotransformation processes to synthesize nanosilica particles with defined size and shape. Two fungal strains, Aspergillus parasiticus and Fusarium culmorum, proved to be effective biocatalysts in this reaction. The obtained results were confirmed by SEM, TEM, EDX and FTIR analysis. In both cases, spherical silica nanoparticles were received. The advantages of silica nanoparticles include effective reinforcement of products with excellent mechanical strength, their thermal stability, reduced shrinkage coefficient, thermal expansion and residual stress, enhanced wear resistance, and improved optical and electrical properties. Controlling materials at the nanometer level can accelerate the development of new types of products with improved properties and functions for environmental, industrial or medical applications [8].

Keywords: biotransformation, corn cobs husks, rice husks, silica nanoparticles, waste materials.

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Glycosylation of flavones in cultures of entomopathogenic filamentous fungi Beauveria bassiana KCH J1.5

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Type of presentation: oral presentation

Flavonoids are plant secondary metabolites with a broad range of biological activities such as anti-inflammatory, antioxidant, and antimicrobial. Flavonoids with glycosyl moiety are the most common and more bioavailable then their aglycone forms. Extraction of natural glycosylated flavonoids or their chemical synthesis is usually inefficient. However, synthesized flavonoid aglycones can be efficiently glycosylated in cultures of entomopathogenic filamentous fungi.

In presented studies, a few flavones were synthesized: 6,8-dichloroflavone, 2'-chloroflavone, 6-methylflavone, and 2'-metylflavone. These compounds were derived from oxidative cyclizations of corresponding chalcones that had been received in Claisen-Schmidt condensation reactions between 2'-hydroxyacetophenone and benzaldehyde derivatives. The obtained flavones were biotransformed in cultures of entomopathogenic filamentous fungi Beauveria bassiana KCH J1.5. Products were extracted from the post-reaction mixtures and separated with the use of thin layer chromatography (TLC). Their structures were established by Nuclear Magnetic Resonance spectroscopy (1H NMR, 13C NMR, COSY, HSQC, and HMBC). 6,8-Dichloroflavone, 2'-chloroflavone, and 6-methylflavone were biotransformed into their glycosylated forms in an efficient manner. Only 2'-methylflavone was not glycosylated.

The conducted studies indicates that B. bassiana KCH J1.5 is able to glycosylate flavonoids. The location and type of functional group attached to the flavonoid core affects the course of biotransformation and reaction products. All obtained compounds are new and can be used in biological activity studies as potential antimicrobial agents.

Microorganisms potential for non-alcoholic beer production

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Beer is the world's third most popular drink (after water and tea). In 2019 in EU 34 billion litres of beer were produced. Moreover EU produced 1.4 billion litres of beer which contained less than 0.5% alcohol or had no alcohol content at all. Beer production starts with the grinding of malt grains and unmalted materials (if used). Such raw material is mixed with water and heated up to the temperatures optimal for enzymes activity. This phase is named mashing, and its purpose is to extract sugars from grains. The essential enzymes during that stage are alpha and beta amylases present in malt. Beta-amylase cleaves every second a-1,4 bond in starch chains starting from its non-reducing end. Alpha-amylase cleaves mentioned bonds in random order. Mashing ends with heating the mixture up to 78ºC in order to denature remained enzymes and stop their activity. Next step is lautering. During that process, the wort is being separated from spent grains. Subsequently, the filtrate is being boiled with hops. Purpose of that step is to sterilise the wort, add hop bitterness and aroma. Finally, the wort has to be cooled down, and yeasts are added prior to the fermentation. After fermentation and maturation beer is ready for shipping to customers. There are two main approaches to obtain non-alcoholic beer. First is to remove alcohol from standard beverage. This is mostly done by thermal processes like evaporation or rectification. Second method is based on biochemistry of beer brewing. There are possible changes in mashing regime that allow to obtain wort with small amount of fermentable sugars. Finally it is possible to change biocatalyst of the fermentation into other yeast strain than standard *S. cerevisiae* or *S. uvarum*. Among yeasts there are various species like Saccharomycodes ludwigii, Torulaspora delbrueckii, Candida tropicalis that are potentially useful for low-alcoholic beer production. During research lab-scale fermentation was performed with S. ludwigii and standard brewing yeasts as reference. Fermentation was conducted for 7 days. Research done on S. ludwigii showed that alcohol level of fermented beer reached 0,9% vol versus 1,6% vol. for standard ale yeasts. Results show that S. ludwigii produce about 35% less ethanol than standard *S. cerevisiae*. This experiment indicate that there is an opportunity to produce beer with alcohol content lower than 0,5% using *S. ludwigii* and changed mashing regime.

Regulation of transcription in fungi based on the example of *Aspergillus*

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The regulation of transcription is a key process in the life and functioning of organisms. Transcription regulation would not be possible without the participation of a specific group of proteins, which we know today as transcription factors. Their study allows us to understand the dynamic changes in protein synthesis and their influence on the ability of organisms to adapt to changing environmental conditions. In literature, there are still reports about new, so far undescribed (or poorly described) transcription factors, which allow to explain functioning of *Aspergillus niger* organisms in specific environmental conditions. We are talking about bHLH family protein – *ino2* of *Aspergillus niger* which is responsible for the regulation of phosphatidylinositol, fatty acids and chitin synthesis and thus takes part in the maintaining of the endoplasmic reticulum homeostasis balance. Recently, genetic and physical interactions between AtfA, AtfB, AtfC, and AtfD factors of *Aspergillus fumigatus* have also been described, which are related to the processes of trehalose and glycogen accumulation, and assimilation of various carbon sources. Further examples from the literature include a recently identified transcriptional activator-repressor module responsible for controlling gene expression of proteins associated with tannic acid degradation in *Aspergillus niger*. The aim of this presentation is summarizing of knowledge about transcription factors and how transcription is regulated in fungi, using *Aspergillus fungi* as example. Understanding of functioning basics allows us not only to elucidate how these fungi respond to environmental conditions, but also to describe mechanisms relevant to the use of these fungi in industry and their role as opportunistic pathogens.

Low molecular weight oxime ethers as potential fragrances

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Fragrances are a large group of chemicals that occur most frequently in nature as secondary metabolites. The synthesis of fragrances contributes greatly to the cosmetics, perfume, and pharmaceutical industries. The synthesis of oxime ethers for compounds that were derivatives of benzaldehyde, cinnamaldehyde, ionone, jasmine, citral, *p*-menthane was carried out. Then, the antimicrobial activity of oxime ethers, corresponding oximes and carbonyl compounds was evaluated on pathogenic strains, as well as those cosmetics related. Then, selected compounds were analyzed for their odor properties, detection thresholds, eco-toxicity, and genotoxicity. Generally the *O*-alkylation reaction did not increase the antimicrobial activity. The oxime ethers presented almost no antimicrobial activity. The best result was obtained for *p*- and *o*- anise *O*-ethyl oxime ether against *C. albicans* (MIC = 0.21 μM). Sixteen of the synthesized compounds showed interesting aroma profiles and relatively low detection thresholds. In studies on *Spirodela*, all compounds showed very acute toxicity (class V). In the studies on algae, the least toxic was *O*-methyl ether of β-cyclocitral oxime. *O*-methyl ether of *p*-tolualdehyde oxime was the least toxic – it showed low acute toxicity (class III). As for the tests on *Daphnia*, the ethers showed acute toxicity (class III), the least toxic was also *O*-methyl ether of *p*-tolualdehyde oxime. The combination of fragrance properties with antimicrobial activity may be a valuable feature in application of newly synthesized compounds in the cosmetics industry and in the production of cleaning agents. The toxicity of the compounds was comparable or lower than commercially used compounds. From the genotoxicity results, it can be concluded that these compounds will not induce genetic diseases such as cancer and can be safely used as fragrances in the perfumery and food industries.

Catalytic potential of cyanobacteria

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Cyanobacteria are a numerous and morphologically diverse group of prokaryotes of high catalytic potential. They produce a number of secondary metabolites that are biologically active and are interesting from utilitarian point of view, especially considering applying in medicine. Due to the possibility of photosynthesis, they constitute an economically competitive group of biocatalysts compared to other microorganisms or to chemical synthesis. In order to study the catalytic potential of cyanobacteria, biotransformations were carried out using the following compounds as substrates: 1-(*R, S*)-phenylethyl acetate , 1- (*R,S*)-phenylethyl butanoate, styrene and epoxy styrene. In the case of two substrates – esters – catalytic activity, and more specifically hydrolytic activity, was confirmed in the case of all seven tested cyanobacteria strains: *Limnospira maxima* (CCALA 27), *Kamptonema animale* (CCALA 138), *Leptolyngbya foveolarum* (CCALA 76), *Nodularia sphaerocarpa* (CCALA 114), *Nostoc cf-muscorum* (CCALA 129), *Synechococcus bigranulatus* (CCALA 187), *Nodularia moravica* (CCALA 797). The reactions resulted in the kinetic resolutions of chiral alcohols with receiving enantiomers (unreacted esters and alcohols) of high enantiomeric excess (up to 99%). Styrene and epoxy styrene have not been converted at all. The experiments were carried out employing the only one strain *Synechococcus bigranulatus* (CCALA 187) and the process lasted for 48 and 72 hours. Research with the use of flow cytometry were carried out to determine the influence of the concentration of the applied substrates on the vital functions of biocatalysts during the biotransformation processes. This was exemplified as the percentage of dead cells in the cultures. Biotransformation products were identified by the use of GC. The resulting compounds were compared to commercially available standards.

Poster session

Zinc-dependent oligomerization propensity of Nucleobindin-2 from *Gallus gallus*

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Nucleobindin-2 (Nucb2) is a multifunctional protein, that consists of several domains, i.e. DNA-binding domain (DBD), two EF-hand domains and a leucine zipper motif. Additionally, Nucb2 possesses one putative Zn^{2+} binding motif in N-terminal half. Nucb2 is implicated in various biological processes, for instance carcinogenesis and food intake inhibition. Interestingly, extensive expression of Nucb2 was found in heart, adipose tissue, reproductive system and digestive tract. Our previous research revealed that Nucb2 belongs to intrinsically disordered protein Ca^{2+} sensors. Interestingly, our preliminary results showed that also Zn^{2+} has an impact on the secondary and tertiary structure of Nucb2. The aim of our current research was to test if and in which way Zn^{2+} affects the quaternary structure of Nucb2. Sedimentation velocity analytical centrifugation (SV-AUC) analysis demonstrated that the presence of Zn^{2+} induces formation of high molecular weight oligomers of Nucb2. Additionally, Nucb2 in the presence of higher Zn^{2+} concentration (≥ 300 µM) tends to precipitate. Interestingly, the AUC data revealed that soluble Nucb2 in the presence of 300 µM Zn^{2+} is still presents as high molecular weight oligomers. Furthermore, we utilized transmission electron microscopy (TEM) technique to show the morphology of aggregates isolated from both, precipitate and the supernatant collected after centrifugation. We observed that in the presence of 300 µM Zn^{2+}. the isolated supernatant fraction contains spherical aggregates and elongated particles. However, in the precipitate of Nucb2, we observed the presence of characteristic amorphous aggregates. The formation of Nucb2 aggregates and elongated particles upon Zn^{2+} addition might be significant for fulfill physiological or pathological function. However, the importance of Nucb2-Zn^{2+} interaction requires further research.

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Counter-diffusion system as an *in vitro* calcium carbonate biomineralization method

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Type of presentation: poster

Biomineralization is a biologically controlled process in which minerals are formed in living organisms. The process is strictly controlled by cellular activity. The formation of biocrystals is directly driven by macromolecules, of which distinct proteins show modulatory effects on their nucleation and growth. Here we present a developed system for calcium carbonate biomineralization *in vitro* in presence of proteins. The system is based on mineralization in a gel-like environment by counter-diffusion of calcium and carbonate ions. The method utilizes commonly used gels in which embedded proteins can be investigated in the means of their effects on the calcium carbonate formation. The preliminary study on Stm-l protein shows the advantage of the system in the studies on the function of biomineralization-related proteins by the ease of diffusion control and further crystals investigation. The formation of biocrystals in gel imitates the natural, dense mineralization environment and provides the regulation of the ion supply. Counter-diffusion system can be easily adapted to experimental setups, introducing new possibilities for the studies of the role of proteins in calcium carbonate biomineralization

The propensity of human FKBP25 for formation of liquid condensates

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Type of presentation: poster

A nuclear chaperonin FKBP25 is a 25 kDa member of the FK-506 binding proteins family. The protein is involved in many functions, including transcription and regulation of chromatin structure. Moreover, its interaction with polyribosomes and nucleolin suggests that the protein is involved in ribosome biogenesis. FKBP25 has a structurally unique N-terminus, a hydrophilic Basic Tilted Helical Bundle (BTHB) domain, which binds nucleic acids and a conserved C-terminal FK-506 binding domain (FKBD). These domains are linked by intrinsically disordered region (IDR). Proteins possessing IDRs are often found to drive spontaneous liquid-liquid phase separation (LLPS). In the process, membraneless organelles (MLOs), important intracellular structures formed during various stages of a cell life, are formed. The aim of the study was to determine the propensity of FKBP25 to provoke spontaneous LLPS in order to determine whether this protein has the potential ability to form MLOs. Recombinant FKBP25 from *Homo sapiens* was expressed in *Escherichia coli* and purified using affinity chromatography and gel filtration. *In vitro* analyses of full-length FKBP25 and FKBP25 in fusion with yellow fluorescence protein (YFP-FKBP25) expressed in COS-7 cells were performed using microscopic techniques. Here we show that FKBP25 can form liquid condensates in the presence of nucleic acids. Studies of the cellular distribution of YFP-FKBP25 show clusters of YFP-derived signal in the cell nucleus, which are likely to be FKBP25 liquid condensates, but the exact material properties of these clusters remain to be investigated.

The fungistatic activity of phthalide lactones from natural sources and their analogues on growth mould of *Botrytis cinerea*

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Type of presentation: poster

Botrytis cinerea is a necrotrophic fungus, known as grey mould, belonging to the Ascomycota phylum. It causes a plant disease known as grey mould. It is not specialised, as it attacks a wide range of plants. There is also no specific developmental stage of the plant in which the fungus affects. It can occur at various stages of development from seed to fruit. In vegetable plants, *B. cinerea* has been found in tomato, bean, raspberry, currant, grapevine, among others, while in strawberries it can reduce harvests by up to 30–60%. Unfortunately, infections can occur even during cold storage significantly reducing the shelf life. We are particularly interested in reducing *B. cinerea* infection on grapes used for wine production. In our research, we tested the fungistatic activity of nine compounds with lactone function. In the first step, we tested four phthalide lactones with structures identical to those naturally occurring in celery, lavage and parsley. These compounds are active and inhibit mycelial growth by 50% at concentrations below 100 µg / mL. In the next step, we tested analogues natural lactones in which two n-butyl substituents are present or absent on the γ-carbon of the ring. For the most active compound, 3-butylidenephthalide, we continued our research on white grapes and observed inhibition of *B. cinerea* mycelium growth.

Specific phages against *Acinetobacter baumannii*- search, isolation and characterization

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Type of presentation: poster

Acinetobacter baumannii have been classified as critical priority pathogens due to their resistance to antibiotics. These opportunistic bacteria most often cause nosocomial infections which are associated with the presence of catheters (e.g., central venous catheter) on which bacterial biofilm forms, interfering with the treatment of infection. The resistance of *A. baumannii* strains to the therapeutics currently used has forced the search for new, effective and safe methods of combating these bacteria. Phage therapy has the potential to offer such alternative. Phages active against *A. baumannii* were searched for in 478 environmental samples on bacterial strains belonging to *Acinetobacter spp* (n = 6) and (n = 4) belonging to other species. Phage isolation, lytic spectrum, adsorption, activity as well as phage titer were evaluated with the use of the standard plate method. From the tested material 12 potentially lytic phages specific for *A. baumannii* strains were obtained. Their morphology, biological properties and storage stability have been determined. Phages displayed species specificity, and their lytic spectrum was 15–38%. The adsorption rate of phage particles to host cells after 10 min. of incubation reached even 99%. The titer of bacteriophages after 1 month of incubation at 4°C, as well as at –70°C with or without addition of 25% glycerol decreased slightly, whereas phage titers after 1 month of incubation at 25°C decreased 1–3 orders in magnitude. Our phages specific for *A. baumannii* isolated from environmental samples have a therapeutic potential. Our studies will allow for the development of a phage cocktail to be used in a mouse model of urinary tract infection caused by *A. baumannii* and treated with phage therapy.

Phenolic acids-phosphatidylcholine conjugates as promising agents in metastatic melanoma therapy

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Type of presentation: poster

Low bioavailability of therapeutic agents is the major barrier in the effective treatment. However, conjugation of the drug with lipids constitutes promising step in the enhancing of their activity. Lipid--drug conjugates demonstrate several advantages including improved oral bioavailability, enhanced tissue targeting, and reduced toxicity. Phosphatidylcholine (PC) is the most effective and important phospholipid as the major component of cell membranes. As a result of its biocompatibility PC can be successfully applied in the development of amphiphilic prodrugs. Conjugates can be prepared by attaching hydrophobic or hydrophilic drugs through ester bonds to PC at the position *sn*-1 and/or *sn*-2. In our research, selected phenolic acids, which are currently of great interest due to their antioxidative and anticarcinogenic activities, were incorporated into the phosphatidylcholine structure (PC). The biological activity of the conjugates against metastatic melanoma cells (Me45, 1205-Lu and 451-Lu) and normal skin fibroblasts (NHDF) was investigated. We proved that conjugation of therapeutics with PC increases antioxidant, antiproliferative and proapoptotic activity of pure acids in selected cell lines. Notably, the effects of conjugates were more significant in cancer cells as compare with normal cells. Our results show that the studied compounds may constitute a promising alternative in the selective as well as effective treatment of metastatic melanoma.

Biotransformation of 1-butyryloxy-1-carboxymethylphosphonates by lipases

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Type of presentation: poster

Enantioselective biocatalysis has long been used as an alternative to traditional methods of obtaining pure chemical isomers in many industrial fields [1]. In particular, the use of whole-cell biocatalysts and enzymes has become common methods of producing enantiomeric active drugs [2, 3]. This is due to high regioselective and enantioselective reactions carried out mainly in water under mild conditions [4]. Lipases can be used as biocatalysts for obtaining hydroxyphosphonates with good enantioselectivity.[5]. This compounds have a wide range of biological properties such as: antibacterial, antiviral and anticancer and they also can be used as precursors of other biologically active compounds [6]. The main objective of this study was to achieve carboxyhydroxyphosphonates **1** with high enantioselectivity by lipase-catalyzed reactions. For this purpose, racemic dimethyl, diethyl and dibutyl 1-butyryloxy-1--carboxymethylphosphonates **2** were synthesized and hydrolyzed using a wide spectrum of commercially available lipases from different sources like fungi and bacteria. The performed reaction was more or less stereoselective Enantioselectivity reached up to 126 for hydrolysis of dimethyl 1--butyryloxy-1-carboxymethylphosphonate **2a**, 15.5 for hydrolysis of diethyl 1-butyryloxy-1--carboxymethylphosphonate **2b** and 8.6 during hydrolysis of dibutyl 1-butyryloxy-1--carboxymethylphosphonate **2c**. The absolute configuration of the products after biotransformation was also determined. In most cases lipases hydrolyzed (*R*) enantiomers of all compounds.

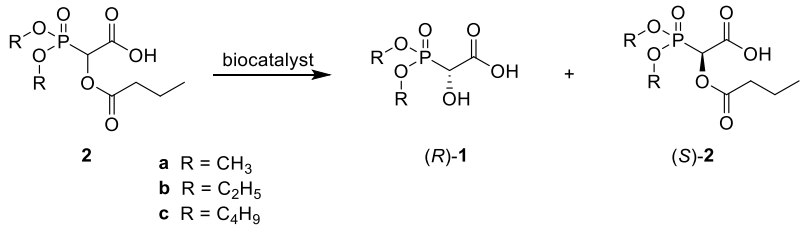

Fig. 1. Biotransformation of 1-butyryloxy-1-carboxymethylphosphonates

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Comparative metabolomic analysis in mice brain regions by ^{1}H NMR spectroscopy – young vs old

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Type of presentation: poster

Introduction: Many of the analyses of the tissue, aimed at precise understanding of changes induced by metabolic modulations or metabolic profiles, allow a better understanding of the pathogenesis of numerous diseases, likewise allow observing an individual metabolic fingerprint of the examined organ [1]. The presented study attempts to analyze the image of the physiology of nervous tissue at different ages. The assumption that the astrocyte-neuron metabolic coupling plays a key role in the phenomenon of plasticity of neural networks and the formation of memory traces is quite attractive [2]. Therefore, getting to know metabolomes indirectly estimates the condition and function of nervous tissue. Method: The one-month year and two-year mice were compared. The frozen tissues were extracted under Folch's procedure. The polar tissue extracts were resuspended in 580 µl of PBS buffer and 550 µl were taken and transfer to 5 mm NMR tubes. The samples were measurement immediately after preparation. Results: Metabolomic analysis identified 27 metabolites involved in various biochemical pathways (energy metabolism, neurotransmitter metabolism, cell membrane metabolism, and astrocyte-neuron metabolism). The found metabolites were common for all three analyzed regions of the brain (hippocampus, cortex, and cerebellum) The comparison of the experiment groups allowed for the identification of 9 from 27 metabolites with statistically significant changes in their relative concentrations ($p < 0.05$). Interestingly, we observed decrease signals for γ-aminobutyric acid, glutamate, and aspartate in the old mice group. Clear differences between neurotransmitters, in compared animal groups, may indicate the implications of changes in cognitive abilities and the formation of new memory traces implicated with age.

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Glycosylation of flavonols using entomopathogenic filamentous fungi

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Type of presentation: poster

Flavonoid compounds belong to polyphenols composed of two aromatic rings joined by a heterocyclic pyran ring to form a structure C6-C3-C6 [2]. Flavonoids have antioxidant, anti-inflammatory, antibacterial, antiviral and antifungal properties [4], thanks to which they have the potential to be used as pharmaceuticals. Biotransformations are the metabolic conversion of endogenous or xenobiotic chemicals. These processes involve enzymes contained in cells of microorganisms, mammals or plants. Biotransformations are highly chemo-, regio- and stereoselective [1]. Entomopathogenic filamentous fungi include various species that have a common feature of parasitizing insects [5]. To this group of microorganisms belong *Beauveria bassiana*, *Isaria farinosa*, and *Isaria fumosorosea* KCH J2 – the subject of the presented research. Biotransformations of flavonoids in cultures of entomopathogenic filamentous fungi usually result in glycosylation. The obtained products show increased bioavailability and are more stable and better soluble in water [3]. Substrates used in the presented research were 3-hydroxyflavone and quercetin. The biotransformations were carried in 2 L flasks with 500 mL of the modified Sabouraud liquid medium on a rotary shaker (140 rpm) at 25 °C. Products were extracted using ethyl acetate. Product separation was carried out using preparative TLC plates. The product's structures were determined by NMR spectroscopy.

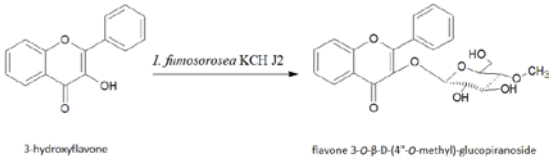

Fig. 1. Biotransformation of 3-hydroxyflavone in *I. fumosorosea* KCH J2 culture

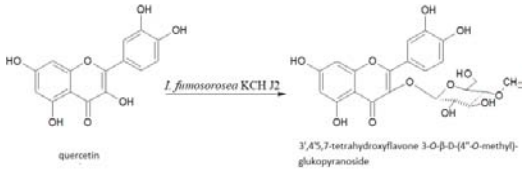

Fig. 2. Biotransformation of quercetin in *I. fumosorosea* KCH J2 culture

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Isolation of electroactive bacteria from microbial fuel cells operated with petroleum products and waste frying oil

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Type of presentation: poster

Microbial fuel cell (MFC) is a bioelectrochemical system that converts energy from organic compounds into electrical energy. This phenomenon is possible due to the activity of microorganisms called electricigens. MFC consists of an anode and cathode compartments separated often by a cation exchange membrane. Electroactive microorganisms carry out oxidation reactions in anodic chamber and generate electrons and protons [1–3].Various carbon sources can be used as a fuel [4]. This work focuses on the use of two types of wastes: petroleum hydrocarbons and waste frying oil. After few weeks of operation of MFCs inoculated with activated sludge, samples were taken for microbiological analysis. Isolation was carried out using serial dilution method, followed by spread plate technique using solid LB medium. Acquired pure cultures were tested in MSM supplied with waste carbon sources to determine biodegradation kinetics. Eight pure cultures of bacteria derived from electroactive communities were isolated and cultured using anaerobic techniques. Further work requires identification of obtained isolates. Applied approach provided pure bacterial strains for further studies of their fundamental metabolic capabilities in MFC-driven reactions towards degradation of hydrophobic waste products.

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Intrinsically disordered regions of the bHLH-PAS proteins are involved in disease development

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Type of presentation: poster

The basic helix–loop–helix/Per-ARNT-SIM (bHLH-PAS) proteins are a family of transcription factors (TFs) responsible for the regulation of developmental and physiological events occurring in mammals and insects. The most known family representatives are: AhR, acting as environmental toxicity and stimuli receptor, Hif-1α acting as oxygen level sensor and Bmal1 regulating circadian rhythms of the organism. The domain organization of bHLH-PAS proteins is highly conserved: the bHLH domain responsible for DNA binding is located at the N-terminus of protein and is followed by PAS fold ensuring specificity and selectivity. In contrast, C-terminal regions of bHLH-PAS TFs present significant variability and are predicted as intrinsically disordered regions (IDRs). Moreover, these regions are suggested as crucial for bHLH–PAS proteins' action modulation. The aim of this study was to perform comparative analysis of the frequency of known disease-associated missense mutations distribution between ordered and disordered regions of selected bHLH-PAS family members. We asked also if missense mutations present conserved pattern of more frequent location in the regions prone to post-transcriptional modifications (PTMs), liquid-liquid phase separation (LLPS) or aggregation. To answer the question, extensive analyses of the presence of IDRs and LLPS propensities combined with the analyses of human polymorphism and PTM databases were conducted. The results show the co-localisation of mutations inducing disease states with ID regions. Importantly, these mutations are located usually close to the regions important for LLPS regulation and/or susceptible to PTMs. Specific mutations can induce protein aggregation, causing serious diseases.

Biotransformation of dimethyl 1-butyryloxy-1-carboxymethylphosphonate with whole fungal cells

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Type of presentation: poster

In recent years, the use of stereoselective biocatalysis in organic chemistry, mainly in the synthesis of optically active compounds, has become an increasingly popular solution [1]. In most cases, the biocatalysts used are isolated enzymes or whole-cell microorganisms and fungi with specific enzymatic activity. [2] Hydroxyphosphonates are one of the groups of organophosphorus compounds in the synthesis of which biocatalysts participate. These biologically active compounds can be used as enzyme inhibitors and due to their anti-tumor, antibacterial and antiviral properties, are also used in the pharmaceutical industry. [3] Dimethyl 1-butyryloxy-1-carboxymethylphosphonate was biotransfomated by 3 types of fungi: *Aspergillus niger*, *Penicillium citrinum* and *Penicillium commune* used as biocatalysts. The performed reaction was more or less stereoselective.

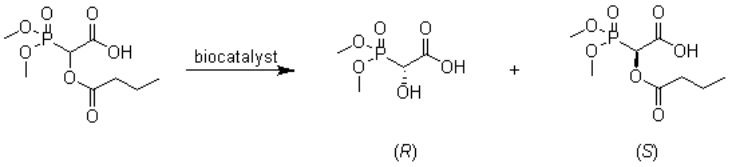

Fig. 1. Biotransformation of dimethyl 1-butyryloxy-1-carboxymethylphosphonate

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From WW-domains to foldameric mini-proteins, suitable scaffolds for PD-1/PD-L1 interaction inhibitors

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Type of presentation: poster

Immune checkpoints, such as PD-1/PD-L1, have become valuable targets for immunotherapy treatments, and monoclonal antibodies are FDA-approved drugs in these therapies [1]. The biological functions of these antibodies are limited by their size and side effects as immunogenicity. To have an adequate control over the specificity and affinity to the target, we propose the use of foldameric mini-proteins [2]. These scaffolds have the potential to supply the benefits of already available protein therapeutics, while conquer those disadvantages as, low cell membrane penetration, oral administration and/or susceptibility for protease degradation. To reach our goal, design of foldameric mini-proteins, which comprise a tertiary structure with a EEEH motif, will be done with the support of Rosetta FastDesign protocol. This motif is attained by fragment assembling of a WW-domain (PDB:1e0m), with addition of β-amino acid containing helix. The tertiary structure is expected to be controlled by hydrophobic interactions in the core. These designs have a large surface in the beta sheet, to generate interaction with PD-L1 without the loss of the mini protein conformation.

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Optimization of foldameric scaffold based on EEHEE motif and its use for construction of PD-1/PD-L1 inhibitors

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Type of presentation: poster

Cancer is the leading cause of death worldwide which led to approximately 10 million deaths in 2020 [1]. Recently, immunotherapy has been identified as a very promising approach in cancer treatment. Blocking of immune checkpoints such as PD-1/PD-L1 is one of the immunotherapy forms extensively studied in recent years. PD-1/PD-L1 interaction inhibition is a favorable but difficult target, because of the large, flat, hydrophobic interacting surfaces [2]. In this project, the goal is the use of *de novo* designed mini-proteins containing cycloalkane-based amino acids for PD-1/PD-L1 interaction inhibition. In this work, mini-proteins were designed *de novo* based on the structural motif EEHEE containing two β-strands, a helix, and two β-strands. The surface of β-strands was utilized to interact with PD-L1 at the PD-1 binding site. The foldameric helix was obtained by incorporation of cycloalkane-based β-amino acid (*trans*-ACPC) into the helix using αβααβααβ pattern. Peptide structures were analyzed using circular dichroism. Binding kinetic analyses and inhibition measurements were carried out using BLI and HTRF.

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The preparation of DNA vector for the expression of the zebrafish protein omp-1 in a bacterial system

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Type of presentation: poster

Biomineralization is a biological process that allows the building of crystalline structures in many organisms. The mineralized structures include, among others: teeth, bones, shells, otoconia and otoliths. Otoliths are calcium carbonate biocrystals. They play a key role in maintaining balance and orientation in space in fish and vertebrates. Many proteins are responsible for the otolith biomineralization, including: Starmaker, otolin-1 and omp-1. Omp-1 has a transferrin structural domain, which coordinates bicarbonate ions during precipitation. The protein is involved in otolith growth and controlling the formation of the crystal lattice. The aim of the presentation is to show the steps of preparation of a recombinant plasmid for the expression of omp-1 from zebrafish in a bacterial system. First, a vector was prepared in a way to link to the zebrafish omp-1 cDNA sequence. For this purpose, it was multiplicated in E. coli cells, purified and "sticky ends" were generated by digestion with the restriction enzymes KpnI and XhoI. Then the cDNA zebrafish omp-1 sequences were prepared. The cDNA sequences of the omp-1 protein were amplified by PCR. The purified PCR product was digested by mentioned restriction enzymes in order to generate "sticky ends" complementary to the ends of the vector. The appropriately prepared vector and cDNA sequences were subjected to a ligation reaction. The resulting vector derivatives were propagated in E. coli cells, isolated, purified and sequenced to choose correct constructs. The obtained sequencing results confirm the obtaining of the recombinant pET-32b(+)/omp-1 vector. The construct will be used for testing of expression and further research on the protein structure and function.

An approach to design and synthesize mini-proteins binding to PD-1 receptor

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Type of presentation: poster

Discovery of the PD-1/PD-L1 interaction and understanding of its influence on tumour development and cell microenvironment [1] opened a new way for scientific considerations about anti-cancer drug design. Attachment of PD-L1 ligand, the protein which is present on the surface of various tumour cells, to PD-1 receptor which occurs on the surface of T-cells, makes the latter one unable to prevent the host via the apoptotic pathway. As it is very challenging to efficiently inhibit this interaction, there is a need to work on novel structures of higher effectiveness to enhance the curative benefits. Hereby, we propose the way in which peptides might be purposefully designed to serve as potentially effective anti-cancer agents. Our aim is to synthesize a peptide foldamer targeted towards PD-1 receptor, which would be characterized by high affinity, in order to disrupt the PD-1/PD-L1 interaction. Remodelled structure basing on a scaffold derived from MvaT mini-protein [2] (pdb: 2mxe) is in use for that purpose. The idea is to make use of spatial arrangement of residues that build up the synthesized peptide to improve the parameters of the final product. It is also highly important to monitor the thermal stability of its conformation. A set of sixteen peptides had been obtained so far using microwave-assisted solid phase peptide synthesis. The structural analyses were done owing to circular dichroism spectroscopy. Biolayer interferometry technique was the primary method to investigate binding of the products to PD-1 protein.

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Characterization and comparison of the performance of three different cathode materials for microbial fuel cells

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Type of presentation: poster

The overall performance of microbial fuel cell(MFC) depends on selection of appropriate electrode materials, design of the MFC, microorganisms, and optimization of the operating parameters [1]. The interaction between these elements determines the efficiency of power generation and organic matter removal in the MFC [2]. In this study, 3 different types of activated carbon were used as cathode catalysts to improve the performance of a single-chamber microbial fuel cell. The maximum power density of MFC's equipped with a cathode made of commercial activated carbon CWZ-22, with a specific surface area of 850 m^2 g^{-1}, activated carbon CWZ-35 with a specific surface area of 1050 m^2 g^{-1} and a silicone-modified activated carbon CWZ-22 were investigated through real time temporal analysis, cyclic and linear voltammetry measurements. The MFC equipped with the CWZ-22 activated carbon cathode with an internal resistance of 227 Ω, revealed maximum power density of 16.1 W m^{-3} after 64 days of operation. The modification of CWZ-22 with silicone particles resulted in reducing the maximum power generation by 29% to 11.4 W m^{-3}, while increasing the internal resistance of the MFC by 45.8% to 331 Ω. On the other hand, the use of CWZ-35 as a cathode material led to increased power generation by 14% to 18.4 W m^{-3} and lowered the internal resistance by 16.3% to 190 Ω. Moreover, the shape of the polarization curves indicated an increased efficiency of the cathode material in the following order: CWZ-22/silicone<CWZ-22<CWZ-35. The obtained results proved the possibility of using cheap and easily available commercial activated carbons as high-performance cathode materials and indicate unfeasibility of silicone as a binder.

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Development of a liquid chromatography method for screening of herbal weight loss supplements for adulteration

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Type of presentation: poster

The safety of herbal weight loss supplements (HWLS) is a raising concern, with reference to their popularity and advertisement. Adulteration of these products, with illegally added pharmaceutical substances, in order to provide quick slimming effect and to increase sales, have been practiced by some manufacturers. Considering potentially health risks to consumers, development of analytical techniques for accurate, quick and effective screening and identification of substances used for adulteration, has become an emerging issue. Sibutramine, fluoxetine, phenolphthalein, caffeine and theobromine are the most frequently identified substances, among the wide pool of pharmacologically active adulterants [1, 2]. For screening of these five target adulterants in selected commercially available HWLS, an isocratic HPLC-DAD method was developed. Homogenised samples were sonicated with a mixture of phosphate buffer and acetonitrile in ratio 64:36 (v/v), which was subsequently used to elute the target analytes, separated on LiChrospher® 60 RP-select B column (125 mm × 4 mm, 5.0 µm) and detected at 225 nm. Five adulterants were rapidly separated and simultaneously identified using relative retention time and spectral properties matching with standard substances. The most common adulterant, identified in some of the HWLS, was fluoxetine. The developed method is specific, sensitive and repeatable; it is easily applicable and relatively inexpensive and can be used to evaluate the safety as well as authenticity of HWLS. Furthermore, the method may be adopted for routine laboratory use to address fraudulent practice of marketing HWLS, thus contributing to more effective control by the competent authorities.

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Application of lipases in the kinetic resolution of racemics ionon derivatives

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Type of presentation: poster

An increase of interest in secondary metabolites produced by plants is noticed, nowadays. Their exceptional properties make them usable in a food, cosmetics and pharmacological industry. Among all of them, irones naturally occured in the rhizomes of *Iris pallida* or *I. florentina* deserve special attention [1]. These cyclic monoterpenoids have a characteristic scent of violet and cedar wood [2]. Due to the long and low efficient process of obtaining irons in a natural way, perfumes containing these compounds are considered as exclusive products [3]. It is believed that using recombinant enzymes in the production of optically active derivatives of ionols is economically and environmentally competitive to classical chemical synthesis and might be further applied to obtain optically pure irone derivatives.

This work focuses on identification of recombinant lipases, known of high enantioselectivity, that will be used to produce opticaly pure irone derivatives. Since the ionols: α-ionol and β-ionol are close derivatives of irones, we decided to use them as model substrates. They are believed to indicate similar olfactory properties as irones what also makes them desirable for the perfume industry.

The results of the kinetic resolutions held by selection of commercially available lipases were analysed by Thin Layer Chromatography (TLC), Gas Chromatography – Mass Spectrometry (GC-MS) and chiral GC methods. Among the analyzed enzymes, it was found that the most efficient was Novozyme Lipase.

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Microbial glycosylation of flavonoids

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Flavonoids are a diverse group of ubiquitous plant secondary metabolites, which exhibits potent biological activities such as: anticancer, antioxidant, anti-inflammatory, antibacterial, antiviral, and antifungal. Health benefits associated with them resulted in a significant increase of interest in this class of compounds. However, a limitation of therapeutic potential of flavonoids is their poor solubility in water and low bioavailability. Due to better solubility, greater stability and functionality compared to aglycones, glycosylated forms of flavonoids have recently been gaining increasing attention.

Biotransformations of flavonoids are useful tool to obtain their glycosylated derivatives. Application of microorganisms as biocatalysts allows to obtain these compounds in sufficient amounts for research, e.g., the effect of a glycoside group on compound properties as well as for further application, e.g., ingredients of dietary supplements and pharmaceuticals. Biotransformation of flavonoids by selected filamentous fungi, known by their ability to glycosylation was investigated. As a result of biotransformation series of glycosylated products were obtained. Fungi *Absidia coerulea* and *Absidia glauca* were able to attach glucose molecule whereas *Beauveria bassiana* converted all tested flavonoids to 4″-O-methyl-glucosides. The preferred site of sugar moiety conjugation was the C-7 hydroxyl group of substrates, however C5-O-glucoside was also observed. The studies showed that, the position of glycosylation depends on presence and positions of hydroxyl and methoxyl groups in flavonoid molecule.

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Nanofiber-based sensors for the electrochemical detection of biomedically relevant compounds

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Type of presentation: poster

An electrochemical sensor transforms chemical information resulting from a reaction between the analyte and modified electrode into an electrical signal, which can later be interpreted. In a biosensor, the recognition reaction involves biomolecules. To improve the performance of detection platforms, nanomaterials (such as nanofibers) are incorporated, as they introduce new properties.

Various molecules can be detected with nanofiber-based electrochemical sensors. Ratlam et al. fabricated a sensor for the detection of dopamine based on polyaniline/carbon quantum dots composite, with the detection limit (LOD) of 0.1013 μM [1]. Polyaniline nanofibers were also applied to detect an enzyme – COX-2, with the LOD of 0.01 pg/ml [2].Chauhan et al. developed a biosensor for vitamin D3 detection using cellulose acetate nanofibers and achieved the LOD of 10.0 ng/ml [3]. Using NiO-Au hybrid nanofibers, progesterone was detected with the detection limit of 1.86 pM by Samie and Arvand [4].

Monitoring of certain biomolecules presence and concentration is essential for proper patient care. The use of nanomaterial-based sensing platforms allows the detection of even trace amounts of various medically relevant molecules, enabling good healthcare and quality control.

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Comparison of chemo-enzymatic Baeyer-Villiger oxidation carried out in esters and DESs as a medium

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Type of presentation: poster

Lactones are an interesting group of compounds exhibiting many valuable biological properties, such as antimicrobial, antifeedant, anti-inflammatory, or antiproliferative. One of the methods used to obtain compounds with a lactone moiety is the chemical Baeyer-Villiger oxidation. The substrates in this reaction are cyclic ketones, and the oxidation process is carried out using organic peroxyacids and traditional solvents such as toluene or dichloromethane. An alternative to chemical synthesis is the use of enzymes, including lipases. Lipases, with the participation of hydrogen peroxide, catalyze the formation of the corresponding peroxyacids, which are then utilized in the oxidation reaction of ketones to lactones. Typically, these reactions are carried out in conventional organic solvents such as ethyl acetate or toluene. Alternatively, the use of deep eutectic solvents – DESs as a medium for chemo-enzymatic synthesis of lactones can be considered. DESs are generally considered as "green" solvents that are easily biodegradable, nontoxic, cheap, and easy to prepare.

The chemo-enzymatic Baeyer-Villiger oxidation carried out in conventional solvents such as esters and in deep eutectic solvents were compare. The substrate for this processes was benzylcyclopentanone. The effect of reaction conditions on process efficiency was determined. The parameters such as temperature, type of lipase, and type of oxidant were tested. Of the esters tested, the highest conversion was obtained in ethyl acetate. DES consisted of choline chloride and UHP can be considered as a best among the tested deep eutectic solvents.

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Degradation test of microparticles based on sodium alginate and gellan gum under different conditions

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Type of presentation: poster

Wet wipes have become an increasingly popular item of everyday use at homes, workplaces, and especially when traveling. They were initially offered as personal care baby products. However, their success has led to the development of many domestic and industrial products for cleaning, sanitizing, and polishing [1]. The pH of the cleanser is important for the effective removal of dirt and other contaminants. The pH value plays a crucial role in selecting a product according to its intended use. Acidic agents are used to dissolving limescale and rust. On the other hand, alkaline products dissolve fats and grease primarily [2]. The aim of my research was to obtain microparticles based on biodegradable polymers using the extrusion method. The degradation of the prepared microparticles was examined under different conditions: at acidic, neutral, and alkaline pH. Images of the microparticles during the degradation process were taken and their sizes were measured using an optical microscope. The next stage of this study is introducing the obtained microparticles containing surfactant (washing agent) to polymer matrices. It is expected to produce a biodegradable and eco-friendly replacement for wet wipes, effective and suitable for household and industrial applications as well as personal care products. Commercially available wet wipes made of non-woven fabric could be considered as a possible source of microplastic pollution in the environment [3].

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Polylactide films with addition of olive leaves extract

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Type of presentation: poster

Epidemiological studies indicate that the number of food-borne illness caused by pathogens has increased [1]. Controlling pathogens could help significantly reduce food-borne epidemics and provide consumers with safe and healthy packaged food products. It can be found that active substances obtained from natural sources have antimicrobial and antibacterial activity. Such substances can serve as packaging additives to inhibit the action of food-borne microorganisms [2]. They can be found in essential oils, herbs and plants. Antimicrobial food packaging is one of the most innovative concepts of active packaging, where interactions with the product are envisioned to reduce, inhibit or delay the growth of microbes, which may be present in the packed food or on the surface of the packaging materials, and extend the shelf life of the preserved foodstuffs. Polylactide (PLA) is an aliphatic polyester obtained from renewable sources. It is of interest to scientists because it is fully biodegradable and it has comparable mechanical properties to a conventional polymers, e.g. polystyrene [3]. PLA is used to produce bottles for drinks, as well as disposable dishes that break down within 75–80 days [3]. The use of biodegradable polymers in the packaging industry is particularly important because of the growing environmental pollution. The aim of this work was to obtain PLA films with addition of poly(ethylene glycol) as plasticizer and olive leaves extract. The films were obtained by solvent evaporation method. The total content of phenolic compounds and antioxidant activity of materials were evaluated. Additionally, the physico-chemical properties, especially mechanical properties, thickness and water evaporation rate were observed.

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New concept of controlled release fertilizers for precision agriculture

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Type of presentation: poster

Fast demographic growth is associated with increased food production. This situation also necessitates increased agricultural activity. Agriculture, therefore, requires intensive fertilization, which results in nutrients leaching into ground and surface waters. This results in pollution of the environment, which is evident, among other things, through the eutrophication of surface waters. In traditional fertilizers, nutrients are supplied to plants in the form of easily soluble mineral salts or synthetic chelates. The consequence of their use is a rapid increase in concentration in the soil solution after a period of precipitation, followed by rapid leaching from the surface layers of the soil. In this case, the plants do not receive the required doses of nutrients, and multiple fertilizer applications per sowing are necessary. This significantly increases crop production costs. Furthermore, high concentrations of biogenic compounds in soil cause eutrophication of surface waters, disturbance of animal growth, and consequently negatively impact human health and life [1]. A solution to this problem may be using controlled-release fertilizers (CRF) or slow-release fertilizers (SRF). The use of this type of fertilizer reduces the environmental impact of nutrients and allows the dose to be tailored to the plant's growth needs at each stage of vegetation. One of the innovative products belonging to this group is fertilizers based on hydrogel materials. The trapped nutrients are gradually released into the soil environment, preventing excessive nutrient accumulation [2]. Controlled release of nutrients can also be achieved by using biomass enriched by biosorption. Biomass, in this case, serves as a biological carrier of micronutrients. By binding micronutrient ions to carboxyl groups exposed on the surface of the biosorbent, controlled-release fertilizer properties are achieved [3].

The new concept of controlled-release micronutrient fertilizers for precision agriculture includes the technology of immobilizing biological residues in a hydrogel matrix and enriching the prepared structures with micronutrient ions (Zn, Mn, Cu) in the sorption process. The materials were characterized by high micronutrient content, at 0.165% Cu, 0.114% Mn and 0.100% Zn. The high bioavailability of fertilizer ingredients has been proven *in vivo* and *in vitro* tests. It has been shown that with a 100% application rate of ingredients, 19% higher biomass growth is observed compared to the group fertilized with commercial fertilizer. However, the application of a dose above 100% had a phytotoxic effect. The use of enriched hydrogel capsules for fertilizer purposes was found to lead to the biofortification of plants in selected micronutrients.

Acknowledgments:

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Singlet vs. Triplet Channel of [2+2] Photocycloaddition of Nitrostyrene to Indene

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Type of presentation: poster

In recent years, organic synthesis with the use of ultraviolet and visible radiation has become increasingly more popular among the scientific community. For instance, light-induced cycloaddition of the [2 + 2] type is probably the simplest method of synthesizing compounds containing the cyclobutane structural motif found in many natural products and drugs and photolesions in DNA generated through photo-damage [1–6].

The presented poster reports the results of thorough investigations of one of such reaction mechanisms, namely [2 + 2] stereoselective photocycloaddition of nitrostyrene to indene using ab initio quantum chemistry methods. Although this reaction has been investigated experimentally, it's exact mechanism has not been studied using computational quantum chemistry. It has only been proposed that it may occur on the potential energy surface of the low-lying triplet state [7].

The mechanism of the title reaction is proposed based on Kohn-Sham Density Functional Theory calculations assuming ωB97XD exchange-correlation functional as well as Møller-Plesset perturbation theory and algebraic diagrammatic construction to second order (MP2 and ADC(2), respectively) results. MP2 and ADC(2) calculations were performed assuming the spin-component-scaling (SCS) variants of these methods. The Def2TZVPP or aug-cc-PVDZ basis sets were assumed in all calculations.

One of the most interesting and unexpected findings is availability of a singlet manifold channel for the reaction path via the charge-transfer π-π* state that has been found and characterized. The triplet channel has also been characterized and their interplay has been discussed.

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Possibilities in the biotransformation and biodegradation of estrogens by microalgae

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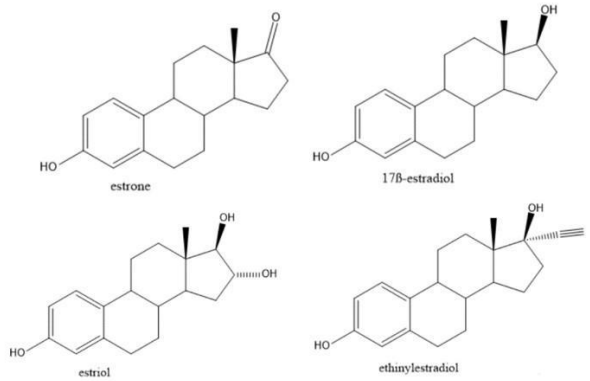
Type of presentation: poster

Pharmaceutically active compounds introduced into the environment are of broad interest due to their activity even at low concentrations (ng/L). Incomplete elimination of estrogens from wastewater treatment plant effluents, the pharmaceutical industry, and agricultural production caused contamination of surface waters and posed a real global threat to the fauna of sensitive aquatic ecosystems [1]. The transfer of these compounds to surface waters may manifest itself in developmental pathologies in some aquatic vertebrates. These include feminization of seminal ducts in male fish [2] and behavioural changes, leading to reduced reproductive success [3]. Biotransformations using microalgae offer interesting perspectives on the removal of estrogen pollution from surface waters. Among the species that have carried out efficient enzymatic catalysis of estrogens, some can degrade them in the environment [4, 5].



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Celecoxib substituted biotinylated poly(amidoamine) G3 dendrimer as therapeutic agent for temozolomide resistant glioma therapy

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Type of presentation: poster

Glioblastoma multiforme (GBM) is a central nervous system tumor, the most commonly diagnosed and difficult to treat. The current therapy consisted of radiotherapy and temozolomide (TMZ) chemotherapy faces development of TMZ resistance. Therefore, it is important to search for new therapeutics and drug delivery methods. Most types of GBM reveal increased expression of cyclooxygenase-2 (COX-2) and production of prostaglandin E2 (PGE2), that are considered as valuable therapeutic targets. In these studies, the anti-tumor properties of the biotinylated third generation poly(amidoamine) dendrimer substituted with 31 celecoxib residues (G3BC31) on TMZ-resistant U-118 MG glioma cells were examined and compared with the effect of celecoxib (CXB) alone. Cells viability, proliferation, migration and apoptosis, as well as the expression of COX-2, ATP level, and PGE2 production were studied. G3BC31 revealed 25-fold higher cytotoxicity against U-118 MG cells than CBX alone. This was due to the induction of apoptosis and inhibition of proliferation and migration, accompanied by reduction of PGE2 production, but not COX-2 expression. The fluorescently labeled G3BC31 analog efficiently accumulated in U-118 MG cells and localized in lysosomes but not nuclei. In vivo studies on the model organism Caenorhabditis elegans indicated high anti-nematode activity of G3BC31 compared to CXB, confirming the usefulness of this organism for the estimation of anti-cancer drug toxicity. The investigated conjugate may be a promising candidate for therapy of TMZ-resistant GBM, although applicable in local treatment, since our previous study of G3BC31 did not show selectivity against glioma cells compared to normal human fibroblasts.

The effect of cold plasma on phytopathogenic fungi

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Type of presentation: poster

Plasma is commonly referred to as the fourth state of matter in which an increase in the energy level of a material transforms its state into ionized gas state [1]. Electrical discharges disintegrate the gas, resulting in a mixture of active antimicrobial substances such as electrons and ions, reactive oxygen species (ROS) and reactive nitrogen species (RNS), as well as high-energy UV radiation, visible and infrared radiation, charged particles, etc. [2]. The combination of different factors makes plasma attractive because it is almost impossible for pathogens to develop resistance to these different types of plasma stressors [3, 4]. The aim of the study was to investigate the effect of cold plasma on phytopathogenic fungi and to evaluate the efficiency of this method in the decontamination of porous surfaces contaminated with fungal spores. Plasma treatment was carried out using a dielectric barrier discharge plasma reactor (DBD) operating at atmospheric pressure with air as the working gas. The minimum plasma treatment time required to remove 90% of the fungus spores from the surfaces was 2 min 52 s and 3 min 22 s for cardboard and wood, respectively. Cold plasma has been shown to be highly effective in removing fungus spores from porous surfaces in a short processing time. This method requires further research, but it has been shown that this method has the potential to be used, for example, in the food industry for the decontamination of materials used in food storage.

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Gold nanoparticles as an enhancement factors in photodynamic therapy

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Type of presentation: poster

Resistance of pathogenic strains (AMR, antimicrobial resistance) to antibiotic therapy is a widely spread problem of 21st century. Acronym "ESKAPE" bacteria (*Enterococcus faecium, Staphylococcus aureus, Klebsiella pneumoniae, Acinetobacter baumannii, Pseudomonas aeruginosa*, and *Enterobacter* spp.) are responsible for a number of difficult-to-treat diseases [1]. Researches, searching new methods to fight with microorganisms, focused on the antimicrobial photodynamic therapy (aPDT) as a complement or alternative to conventional medicaments. This therapy uses non-toxic dyes (photosenistizers), light and oxygen. Photosensitizer excited by light, is able to generate reactive oxygen species (ROS) including singlet oxygen [2]. Exposure of microorganisms to this multi-target form of treatment cause photoinactivation of cells and negatively affects virulence factors [3]. There is a growing interest in the search for new generation of photosensitizers. Nanotechnology, as the discipline of creating particles in nanoscale, has shed new light on the improvement of photodynamic therapy. Particular attention was paid to metallic nanoparticles, that can increase the effectiveness of destroying pathogens [4,5]. In the present study, the effectiveness of photodynamic therapy against *Staphylococcus aureus* using methylene blue as a photosensitizer was examined. Gold nanoparticles were used as an enhancement factor. It was shown that exposition of *S. aureus* to LEDs diode light (630 nm) for 30 min caused 92% of cell mortality. Addition of gold nanoparticles to the mixture caused 96% of mortality. The mechanism of this enhancement was studied and it was found that gold nanoparticles cause increased accumulation of methylene blue by bacterial cells.

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Increasing MFC performance through operational and design parameters

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Type of presentation: poster

Microbial fuel cell (MFCs) is a technology that allows production of green energy. Many researchers around the world try to understand not only the metabolomic behavior of exoelectrogenic microorganisms, but also try to use the acquired knowledge to optimize the processes of obtaining electricity [1]. The MFC consist of two electrodes connected together to an external circuit. These electrodes are placed in a two-chamber or single-chamber housing, separated by a porous separator (e.g., a membrane) [2]. At the anode, the catalytic oxidation of the organic substance by microorganisms occures, while at the cathode, oxygen is reduced to water or hydrogen peroxide. In this study, the influence of modification of the fuel cell structure on current density was tested. The following variables were investigated: type of the inoculum, type of the cathode, design of the cell's and the operating mode. The MFCs were investigated by using: linear sweep voltammetry (LSV) and real-time data monitoring (RTM). The highest value of current density was obtained for a cell with an activated sludge inoculum and a cathode made of active carbon CWZ-22. The current density of this cell was 1.10 mA, and the cell power was 160 +/– μW, ten weeks after inoculation. Moreover, it was found that the anode surface, cathode surface and the cell volume had a large influence on the power density obtained by the cell. MFC with a larger area of the cathode and the anode generates more power, but the larger the volume of the cell, the lower current densities are achieved. The obtained research results used to design further experiments focused on obtaining biosurfactants in the process of oxidation of petroleum substances by bacteria from soils contaminated with petroleum substances.

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Application of modified carbon nanomaterials in lithium-air cells

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Type of presentation: poster

Due to the dynamic increase in the demand for energy storage capacity, researchers are investigating new technologies that would allow to develop a new system to meet the growing requirements. One of the most promising solutions are lithium-air cells due to their high specific energy. One of the critical factors influencing the development of lithium-air cells are cathode materials. In this area, the main attention is focused on carbon nanomaterials due to their extraordinary properties, such as high electric conductivity, large specific surface area and facility of structure modification by doping with heteroatoms or introducing structure defects. Due to aforementioned characteristic, carbon nanomaterials can improve efficiency of lithium-air cells. This paper briefly describes the basic principles of lithium-air cells and reviews carbon nanomaterials used as cathode materials. The influence of doping and modification of the structure of carbon nanomaterials on the operation of lithium-air cells was also presented.

Volatile organic compounds – an important part in beer aroma profile

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Type of presentation: poster

Beer is one of the oldest food products in the world. The beginnings of brewing date back to 6,000 years. Currently, beer, after water and tea, is considered the most popular and consumed alcoholic drink. The brewing process is based on four main ingredients, such as: malt, water, yeast and hops. Beer is a complex drink containing a wide variety of compounds including, but not limited to, carbohydrates, proteins, ions, organic acids, and polyphenols. In addition, it contains a number of different chemical ingredients that can affect the quality of the beer. Volatile organic compounds are responsible for the organoleptic proprties of beer. They origin from the raw materials used, may be byproducts of yeast metabolism, and are produced under the influence of oxygen and sunlight during storage of the product. Moreover there are still undiscovered compounds present in beer. Due to the complexity of mentioned beverage, a number of techniques are used to identify individual components such as: gas chromatography, liquid chromatography, mass spectrometry, ultraviolet-visible spectroscopy, matrix assisted laser desorption/ionization, capillary electrophoresis. This work covers just a small part of beer compounds spectrum and is focused on volatile organic compounds such as higher alcohols that are responsible for characteristic beer aroma.

DYRK1A, a new light for diabetes

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Type of presentation: poster

Diabetes is a long-term condition, that recently has become one of the leading causes of death globally. Two main types of diabetes, T1D and T2D, share a common feature: β-cell disfunction. Insulin supplementation, the most commonly used therapy, is treating the symptoms, but does not provide the remedy. Restoring functional β-cell mass is seen as a goal to the cure. Recently, dual-specificity tyrosine phosphorylation-regulated kinase 1A (DYRK1A) was identified as a potential target in diabetes treatment. DYRK1A gene is located in chromosome 21, Down syndrome (DS) critical region. DYRK1A suppresses the proliferation and activity of β-cell through translocation of NFAT transcription factors, which acts as a cell cycle activator. DYRK1A inhibition leads to a higher proliferation of β-cells and may help in the treatment of diabetes. A library of both natural and synthetic small-molecule compounds was tested against DYRK1A. ATP competitive kinase activity assay (Cook assay) was used for screening. Hits were later validated in vitro using Microscale Thermophoresis (MST) and in vivo by nuclear factor of activated T-cells (NFAT) activity assay. Cytotoxicity was measured using MTT assay. Selected compounds were later cocrystallized with DYRK1A.

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Synthesis of multifunctional organophosphorus compounds as new urease inhibitors with dual mechanism of interaction with the enzyme

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Type of presentation: poster

Urease, a hydrolytic enzyme catalyzing decomposition of urea, is the main virulence factor of microorganisms responsible for multiple bacterial and fungal infections, such as gastritis caused by *Helicobacter pylori* [1,2]. Problems in humans health caused by ureolytic bacteria concern also the urinary tract, wound and bloodstream infections which are mostly acquired upon hospitalization. As currently applied antimicrobials have limitations in use due to the development of bacterial resistance to the available antibiotics, conducting research on new inhibitors is still an extremely challenging scientific area. The aim of our research is the synthesis of multifunctional organophosphorus compounds as a new class of urease inhibitors. These hybrid structures are planned to show a dual mode of action by simultaneous use of both known binding mechanisms with two key sites for enzymatic activity (Scheme 1) [3,4]. The target organophosphorus compounds contain catechol or benzisoselenazol-3(*2H*)-one fragments dedicated to form a covalent bond with the cysteine residue at the entry to an active site, while the presence of phosphonic or phosphinic groups should simultaneously increase interaction with the catalytic nickel ions.

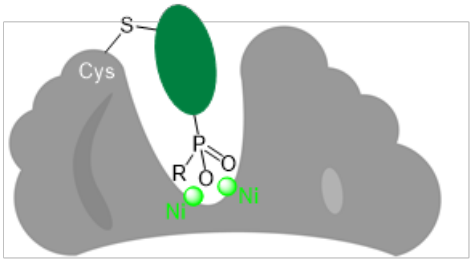

Fig. 1. Model of binding of a new class of enzyme inhibitors to the active site of urease

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The role of SPA proteins in fungi

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Type of presentation: poster

Transfer of information between different cells is indispensable for multicellular organisms functioning. Multicellular fungi developed a direct method of cell-to cell communication by a stable intercellular bridge. During the rapid growth of hyphae, in contrast to animal cells, complete separation between cells after cytokinesis does not occur. The cells of hyphae can later aggregate to form spore-dispersing fruiting bodies. Cell walls, also called septa, are produced by apical cells and which divide hyphae into compartments. In each septum there is a centrally located pore which allows for intracellular transport, by cytoplasmic mixing between cells. This allows the cells to cooperate and promotes rapid tip growth of hyphae. The fungal septa and septum-associated structures are imperative for the maintenance of an intrahyphal homeostasis. There is a heterogeneous group of proteins called septal pore associated (SPA) proteins. They possess not homologous primary sequence and intrinsically disordered regions (IDRs). SPA proteins can aggregate to form intercellular channels and regulate the connection of the cells. Structural plasticity of pore gating is associated with various diameters of pores due to aggregation of these proteins. SPA proteins perform manifold functions and present differentiated localisation such as Woronin bodies in Ascomycota or septal pore cap in Basidiomycota. The aim of the presentation is to present current state of knowledge concerning the group of SPA proteins.

Estimation of measurement uncertainty for quantitative determination of cannabinoids in dry cannabis flower using HPLC method

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Type of presentation: poster

Identification of the uncertainty components and estimation of measurement uncertainty in analytical testing is highly important for the reliability of quantitative results. The aim of this work was to identify the sources of variability of the results and to quantify the uncertainty arising from the relevant components, in order to estimate the overall uncertainty of the results obtained from quantitative determination of four cannabinoids: cannabidiolic acid, CBDA; cannabidiol, CBD; Δ9--tetrahydrocannabinol, Δ9-THC and tetrahydrocannabinolic acid, THCA extracted from dry cannabis flower. The quantitative determination of these cannabinoids was performed using HPLC method with UV detection, according to monograph for Cannabis inflorescence, in German Pharmacopoeia (DAB). The values for the slope and the intercept of the calibration curves and sample preparation are the most relevant components affecting the value of the measurement uncertainty of the results. Since the value of the parameter loss on drying is included in the calculation of the result, uncertainty determination of this value is also identified as relevant uncertainty component. Taking into account these contributors, the values for measurement uncertainty (U) for approximately 95% level of confidence (k = 2) were estimated for the testing results: 8.64% ± 0.95% for CBDA; 0.27% ± 0.12% for CBD; 0.05% ± 0.07% for THC and 0.22% ± 0.18% for THCA.

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Bio-studies of scaffolds based on chitosan/tannic acid cross-linked by glyoxal

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Type of presentation: poster

Scaffolds based on natural polymers have to be modified to improve their stability [1]. The primary method is the addition of a cross-linker that reacts with functional groups of polymers [2]. Our study aimed to determine the biological properties of novel scaffolds based on chitosan and tannic acid cross-linked by glyoxal addition. Chitosan and tannic acid were dissolved at 1% concentration (0.1 M acetic acid). They were mixed in the different ratio (80/20, 50/50, 20/80), frozen, and lyophilized (ALPHA 1–2 LDplus, CHRIST, –20 °C, 100 Pa, 48 h). The biological properties of obtained scaffolds were tested as blood and cell compatibility. The blood compatibility studies were carried out by the method described by us previously [3]. We used periodontal ligament stromal cells for the studies and tested cell viability in contact with material by MTS test [3].

Table 1
The rate of hemolysis for the scaffolds based on chitosan and tannic acid with glyoxal.

Specimen	Hemolysis rate [%]
80CTS/20TA	0.30 ± 0.17
80CTS/20TA + 1%GO	0*
80CTS/20TA + 5%GO	0*
50CTS/50TA	0.18 ± 0.07
50CTS/50TA + 1%GO	0*
50CTS/50TA + 5%GO	0*
20CTS/80TA	0*
20CTS/80TA + 1%GO	0*
20CTS/80TA + 5%GO	0*

* measured values for material were lower than for control.

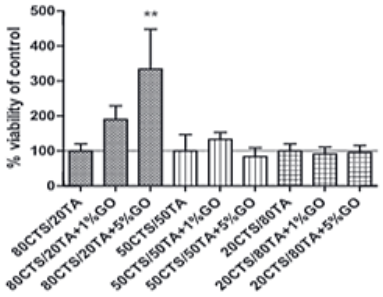

Fig. 1. Cells viability in contact with scaffolds in different proportions of chitosan and tannic acid, with the addition of either 1 or 5% of glyoxal.

The rate of erythrocytes hemolysis decreases with an increasing amount of tannic acid (Table 1). The addition of glyoxal as a cross-linker improves the biocompatibility of scaffolds as the hemolysis rate is equal to 0 (Table 1). The addition of 1 and 5% glyoxal to the scaffolds (base of 80CTS/20TA) increased PDLSCs viability. Cell metabolic activity is higher for the cross-linked scaffold. The addition of 5% glyoxal shows statistical differences in comparison to control. The addition of neither 1% nor 5% changes the viability of PDLSCs on 50CTS/50TA and 20CTS/80TA materials. It is important to consider the appropriate rate of cross-linker to obtain safe and nontoxic material. The most suitable scaffolds are obtained from 80CTS/20TA + 5% GO. Such scaffolds are safe and may find application in tissue regeneration purposes.

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Androdiploid lines in the creation of original genetic variability of *Capsicum* spp.

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Type of presentation: poster

The purpose of this research was to evaluate hybrid progeny obtained as a result of androgenic hybridization of soft-flesh lines and sweet hard-flesh cultivars of *Capsicum* spp. Soft-flesh forms of bell pepper are characterized by soft pericarp flesh. During the production process, it can be separated from other parts of the fruit by mechanical separation without the use of high temperatures. This allows to preserve the taste and dietary-anticancerogenic properties of the obtained nutraceutical products. Nine bell pepper genotypes were used as research material in the experiment: maternal line '9', which resulted from interspecific hybridization of *Capsicum frutescens* × *C. annuum*, thanks to which it gained the soft-flesh trait and high capsaicinoid content, pollinators: 'Sono', 'Mino', 'Luba', 'R' and their hybrid progeny. Biometric evaluation of fruits of all genotypes was performed. Technological efficiency in production of puree was determined for hybrids and the obtained yield was calculated. Dry matter content and capsaicinoid content were determined in the obtained material using the HPLC method according to the procedure described by Collins et al. Dried material from different parts of the fruit was flooded with acetonitrile and then extracted in a water bath at 80°C for 4 h. The obtained supernatant was filtered through 0.45 µm filters. The fruits of the hybrids were found to have soft-flesh characteristics and significantly higher capsaicinoid content compared to the pollinator plants. Their weight ranged between 29–52 g, which significantly exceeded the fruit weight of the maternal line. The obtained mixtures of F1 generation will be the starting material for induction of androgenic regenerants in in vitro anther cultures.

In vitro micropropagation of established and hybrid *Capsicum* spp. genotypes

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Type of presentation: poster

The aim of the study is to develop the methodology of in vitro micropropagation of hybrid genotypes of the F1 generation and the line of *Capsicum* Double Haploids. The research material consists of nine genotypes of pepper. The maternal form – the '9' line, was created as a result of the interspecific hybridization of *Capsicum frutescens* × *Capsicum annuum*, in the experiment, sweet pepper varieties were used as pollinators: 'Sono', 'Mino', 'Luba' and the androgenic 'R' line. The analysis also included hybrid offspring of the F1 generation. The so far in vitro research on paprika is limited to work on very young material. In this study, an attempt was made to sterilize the material consisting of mature, fruiting plants. Before taking samples for establishing an in vitro culture, the plants were topped by removing the growth tips of some shoots, and then, after 4–5 weeks, the refreshed material was the basis for further work. Various concentrations of commercially available hypochlorite (10%, 20%, 30%) and different sterilization times (10 minutes, 15 minutes, 20 minutes) were tested. The initial medium for the obtained explants was MS medium [Murashige and Skoog, 1962]. Regenerated plants were transferred onto MS media supplemented with 0.05 mg/l and 0.1 mg/l BAP or 0.5 mg/l, 0.75 mg/l, and 1 mg/l meta-topoline, the control was medium without growth regulators. The level of ploidy of regenerated plants and calli was determined cytometrically

Flow cytometry and SCoT molecular markers as tools for identification and genetic diversity assessment in fenugreek species

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Type of presentation: poster

The fenugreek (*Trigonella*) genus belongs to the Fabaceae family and includes about 135 species that are widespread in the regions of the Mediterranean Sea, Southern Europe, Africa and West Asia. The species contain active compounds and essential oils, thus they are used in cosmetics, food and pharmaceutical industries. A low morphological diversity of the species leads to incorrect taxonomy classification. The aim of the study was to assess genetic diversity and identify 20 fenugreek species based on flow cytometric genome size estimation combined with SCoT molecular markers. Plant material for flow cytometric measurements was chopped with the presence of nuclei isolation buffer, supplemented with propidium iodide, ribonuclease A and 1.0% (w/v) polyvinylpyrrolidone. The suspension was analyzed using a CyFlow SL Green flow cytometer. Leaves of *Vicia villosa* 'Minikowska' and *T. corniculata* were used as internal standards. Genomic DNA was isolated using the GeneJET Plant Genomic DNA Purification Mini Kit. 13 primers were used for the SCoT-PCR reactions. The nuclear DNA content ranged from 1.10 to 5.76 pg/2C, which indicates the presence of genotypes with very small and small genomes. The size of the DNA bands generated by individual primers ranged from 174 bp to 2929 bp. SCoT markers revealed a high polymorphism between the studied species, which ranged from 97 to 100%. The smallest genetic distance (0.44) was observed between *T. coerulescens* and *T. macrorrhyncha*, and the highest (0.84) between *T. corniculatus* and *T. spicata*. The species were grouped into three clusters. The results revealed that both methods: flow cytometry and SCoT-PCR, allow for identification and genetic diversity assessment of species from *Trigonella* genus.

Hydrogels drug delivery carriers with functional coating

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Type of presentation: poster

Most of the drugs currently used are administered orally or by injection – they are absorbed very quickly into the gastric mucosa, or the tissues surrounding the injection site and eventually transferred into the bloodstream. For this reason, obtaining the desired dose in the target area within the time required to achieve a pharmacological response is difficult. Drug delivery systems (DDS) are a solution to this problem. Drug delivery systems are methods to transport pharmaceutical formulations into the patient body as needed to safely achieve their desired therapeutic effect. Using hydrogel matrix to compounds entrapment is one of the basic strategies for its delivery. Polysaccharides coated by ethylcellulose [1] could prolong the release rate of pharmaceutical formulation and sustain a constant concentration of drug in the blood with minimum fluctuations [2]. The above application could also ensure predictable release rates over a long period, which has a great influence on treatment quality and effectiveness. The main aim of the conducted research was to determine the potential application of coated hydrogels microcapsules in drug delivery systems. Hydrogels used for those purposes were polysaccharides: carrageenan and sodium alginate [3]. The functional coating was made from ethylcellulose. The result of encapsulation and coating efficiency were examined to determine the usefulness of obtained carriers.

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The many faces of the wild yeast strain - Dekkera bruxellensis

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Type of presentation: poster

Brewing is a multi-stage process which requires four main components: malt, hop, water and yeast. The main idea of brewing is the usage of yeast in order to produce ethanol from carbohydrates contained in malt. Brewers mostly stick to two basic types of brewing yeasts: top-fermenting ale yeasts (Saccharomyces cerevisiae) and bottom-fermenting lager yeasts (Saccharomyces pastorianus). These, combined with precisely selected hop types, allow brewers to produce a wide range of beer styles characterized by many different tastes, aromas and alcohol contents. However, it is also possible to use non-conventional types of yeast, such as Dekkera bruxellensis. Dekkera bruxellensis (or its anamorph - Brettanomyces bruxellensis) is one of the several members of the genus Brettanomyces, belonging to the order Sacharomycetales and Kingdom Fungi. It is mostly considered a spoilage organism in wine due to producing excessive levels of ethylphenols [1],[2]. It is known to be responsible for many off-flavours of red wines aged in oak barrels, described as medicinal, horse sweat, band-aid, stable etc., which consequently increases the economic losses in wine industry [3],[4].While being a huge threat to wine quality, Dekkera bruxellensis appears to have a huge potential in brewing. This inconspicuous yeast strain is involved in the spontaneous fermentation that is the basis of production of Belgian Lambic beer [4]. It's responsible for the beer's original character, taste and aroma. This makes Dekkera bruxellensis a very unique yeast strain, although its whole potential is yet to be discovered.

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Antioxidants biosynthesis by whole-cell biocatalysts

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Type of presentation: poster

Plant-derived antioxidants such as resveratrol, tyrosol or hydroxytyrosol have a lot of applications. They mainly show antioxidant, anticancer and antimicrobial activity. Thanks to their properties they can be used in the pharmaceutical, cosmetic and food industries [1, 2]. Whole-cell biocatalysis – simple, environmental friendly, low-cost method – can be an alternative to currently used processes to obtain desired antioxidants. Simple substrate as 2-phenylethanol can be transformed to derivatives with antioxidant properties [3]. For this purpose, microorganisms with mono- or dioxygenase activity can be used. Then, appropriate optimization of the process parameters can allow to obtain desired products with high efficiency.

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Application of whole cell biocatalyst in biotransformation of heterocyclic phosphonates

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Simple heterocycles belong to one of the most important classes of compounds in medical chemistry due to the wide range of biological activities such as anti-bacterial, anti-viral, anti-fungal, anti-inflammatory, and anti-tumor properties [1]. The combination of a phosphonic group with heterocyclic systems may result in the formation of compounds with interesting chemical and biological properties [2], and therefore the development of procedures enabling the efficient synthesis of optically pure compound is particularly desirable. In the conducted research phosphonates with the heteroatom incorporated in their side functionalities – thienyl and imidazole phosphonate derivatives – were used as substrates in biotransformation. Yeasts and filamentous fungal cell were successfully applied for the obtaining product with high enantiomeric excess. The most effective biocatalyst for biotransformation of tested compounds was *Rhodotorula mucilaginosa*. 1-amino-1-(3-thienyl)methylphosphonic acid with enantiomeric excess over 98% was obtained after 24–48 hours of biotransformation. While imidazole derivative (1-amino-1-(4-imidazole)methylphosphonic acid) was effectively transformed (93–95% *e.e.*) after 24 hours of biotransformation. Modification of process conditions, especially the culture medium and the introduction of the starvation step before bioconversion was the crucial stage for the activity and selectivity of applied biocatalyst.

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Predicting of citronellol, nerol and geraniol content in Bulgarian rose oil samples by NIR spectroscopy

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Type of presentation: poster

Near-infrared (NIR) spectra of 100 Bulgarian rose oil samples were measured in parallel with gas--chromatographic analysis by mass-selective and flame ionization detection (GC/MS/FID). Chemometric analysis was applied to the spectra and chromatographic data in order to build regression models for determination of the three main terpene alcohols in the rose oil – citronellol, geraniol and nerol. As a first step principal component analysis (PCA) was carried out on the spectra in order to detect outliers. Cross-correlation statistic between the NIR data and the GC/FID determined components allowed to find the spectral ranges strongly related to content of the analytes of interest. Twenty two samples were chosen for creating the models. Partial least squares regressions (PLS) was carried out for each of the 3 components and correlations >0.91 for all of them was achieved, along with root mean square error (RMSE) values <1.2. The test of the model prediction of all samples (except the outliers) has shown less than 10% deviation from experimentally estimated values. These preliminary results indicate the capability of the NIR spectroscopy for fast and nondestructive analysis of the essential components in the rose oil, responsible for the rose oil quality and authenticity.

Acknowledgements: The financial support from Bulgarian Science Fund (project KP-06-OPR01/5 BG ROSEnsing) is gratefully acknowledged.

Polysaccharides of flax-seed isolated using natural deep eutectic solvents (NADES)

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Type of presentation: poster

Natural deep eutectic solvents (NADES) can be safely released into the environment and do not generate any toxic waste, making them the excellent green solvents. Flax-seed is widely known for its beneficial properties, used to fight ulcers of the digestive system, and colon cancers. Therefore, in this study, natural deep eutectic solvents (NADES) were used to extract polysaccharides from linseeds. The main aim of the study was comparison of the extraction efficiency of polysaccharides from flax-seed using different extractants, i.e., distilled water, 10% citric acid solution (w/w), and NADES: citric acid / glucose / water (1:1:3), choline chloride / citric acid (1:1 and 1:2). Solid-phase extraction, vacuum evaporation, and dialysis were done. To the chemical characterization of the obtained products phenol-sulfuric assay and Folin-Ciocalteu method, were applied. It was noticed that NADES composed of citric acid, glucose, and water was the most efficient extractant in obtaining dietary fiber of flax-seed. Further studies need the optimization of the extraction process, as well as increasing its efficiency, possibly through supporting of the extraction process by some physical factors such as microwaves or ultrasounds.

Polysaccharides of *Echinacea purpurea* - isolation by deep eutectic solvent and chemical characterization

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Type of presentation: poster

Purple coneflower (*Echinacea purpurea* L.) is a medicinal plant already known as containing compounds with anti-inflammatory, antioxidant, antibacterial, and antiproliferative activity. Further, it was considered that its polyphenolic-polysaccharide complexes have immunostimulating and anti-asthmatic properties (M. Šutovská et al., *J. Ethnopharm*., 2015, 175, 163). The extraction of the macromolecular complexes using green solvent was the aim of the experiments, i.e. based on NADES (Natural Deep Eutectic Solvents). In the model of the experiment three types of NADES were used: mixture of choline chloride (CC) / citric acid (CA) (1:1), CC:CA (1:2), CA / glucose (Glc) / water (1:1:3). Each NADES was dissolved in distilled water (1:9), and then the solution was used as an extraction medium for the dry plant material. Each liquid extract was collected, and its volume was reduced using rotary evaporator. The strongly polar compounds were precipitated in the presence of methanol, dissolved in water and dialysed against distilled water to obtain the macromolecular products. Thereafter, they were characterized using colorimetric analyses and FT-IR method. The extraction of polyphenolic-polysaccharide complexes from *E. purpurea* succeeded, regardless of solvent type. NADES fit in assumptions of sustainable development because of many advantages, e.g., they are biodegradable, non-toxic, safe for the environment, and could be an alternative to classic organic solvents. The extraction procedure needs optimization of the process parameters, and may be improved by physical methods (e.g., ultrasounds, microwaves).

Examination of skin barrier quality, hydration and colour after the application of freeze-dried emulsions

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The skin covers the entire human body and is its largest organ. Human skin performs numerous functions, including protection from excessive water loss [1]. Therefore, it is crucial to maintain the integrity of the epidermal barrier and improve the skin condition with the use of cosmetic products [2]. Researchers are constantly searching for innovations that can be applied to the cosmetic industry. Production of porous materials stored in a freeze-dried form and swollen directly before use may be beneficial considering their facilitated packaging, transport, and storage. The main goal of the current work was to prepare and optimize the composition of three-dimensional materials, as well as assess the impact on skin condition after their application to the skin. Emulsions based on sodium alginate, gelatin, glycerol, and lipids (cottonseed oil and beeswax) were frozen and lyophilized. Afterwards, they were cross-linked by immersion in a calcium chloride solution and re-lyophilized. The skin surface hydration, skin colour and skin barrier quality (manifested as transepidermal water loss – TEWL) after applying the swollen materials were examined using Courage+Khazaka probes. The skin condition after the application of obtained emulsion matrices had improved. Therefore, the prepared materials can be considered for designing new cosmetic forms, such as cosmetic masks.

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Zinc oxide and zinc oxide nanoparticles impact on *in vitro* germination and seedling growth in *Allium cepa* L.

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Zinc oxide nanoparticles (ZnO NPs) are ones of the most commonly manufactured nanomaterials worldwide. The aim of this study was to investigate and compare the effects of ZnO submicron particles (ZnO SMPs) and ZnO NPs on the process of *in vitro* seed germination and seedling growth in onion (*Allium cepa* L. 'Sochaczewska'), and to indicate the potential use of these compounds in onion production. ZnO NPs were characterized by a homogeneous spherical morphology and their average size was 30 ± 2 nm. ZnO SMPs had a heterogeneous morphology and a wide size distribution from 100 nm to 2000 nm, where the average particle size was 240 ± 30 nm. In the experiment, disinfected seeds were inoculated on the modified Murashige and Skoog (MS) medium and poured with ZnO SMP or ZnO NP water suspension, at the concentrations of 50, 100, 200, 400, 800, 1600, and 3200 $mg \cdot L^{-1}$. The highest share of germination was recorded for seeds treated with 800 $mg \cdot L^{-1}$ ZnO SMPs and ZnO NPs (52% and 56%, respectively). After the application of ZnO SMPs and ZnO NPs at the highest tested concentration (3200 $mg \cdot L^{-1}$), the share of germinating seeds was only 19% and 11%, respectively. Interestingly, seedlings obtained from control seeds and seeds treated with ZnO SMPs and ZnO NPs did not differ statistically in terms of length, fresh weight, and dry weight of leaves, and roots. Both ZnO SMPs and ZnO NPs, in the concentration range from 50 to 1600 $mg \cdot L^{-1}$, can be used to stimulate the germination process of onion seeds, without negative effects on the further growth and development of seedlings. There were no differences found between the action of ZnO NPs and ZnO SMPs, which suggested that the most important factor influencing seed germination was in fact the concentration of zinc ions, not the particle size.

The characterization of tannic acid-enriched hydrogels

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Polymers may be proposed as raw compounds for the preparation of the hydrogels. They should be biocompatible without the cytotoxicity effect for surrounded cells as well as optimal tissue integration [1]. The novelty of the present work is the preparation of hydrogels based on sodium alginate cross-linked with calcium ions and enriched by tannic acid on the other side. Sodium alginate (SA) and tannic acid (TA) were dissolved separately in 0.1 M acetic acid at the final concentration of 2%. They were mixed in the weight ratio 90/10, 80/20, 70/30. Next, mixtures were placed in the dialysis tube (MWCO12000–14000) and dialysis was carried out for 1 week against 5% $CaCl_2$ solution, which was changed every 3 days. Hydrogels were immersed in SBF solution (pH = 7.4). They were weighed before and after 1, 4, 8, 24, and 48 h immersion. The percentage weight change in time was calculated. The tannic acid release was carried out in three different types of conditions – simulated body fluid (SBF; pH = 7.4). The total content of polyphenols was determined by the Folin–Ciocalteu method with the use of a UV-Vis spectrophotometer (UV-1800, Shimadzu, Reinach, Switzerland) [2].Weight loss of hydrogels immersed in SBF is the result of the material degradation process. The highest weight loss after 48 h was noticed for hydrogels obtained from raw sodium alginate (Fig. 1). The small addition of TA (10%) results in stability improvement. The released TA concentration depends on the initial tannic acid content in the hydrogel (Fig. 2). The maximum was detected after 90 min immersion [2].

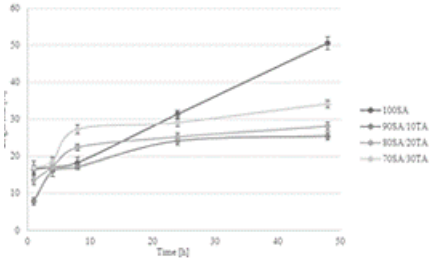

Fig. 1.Weight loss [%] of hydrogels immersed in SBF for 1. 4. 8. 24. and 48h.

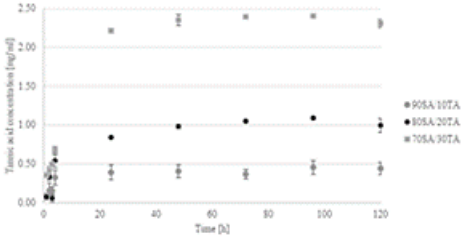

Fig. 2. The concentration of tannic acid released from hydrogels when immersed in phosphate buffered saline (PBS).

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Index of presenting authors

Chaima Ouled Amor
Natalija Atanasova-Pancevska
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Kinga Szkaradek
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Rafał Taf
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