Natural Cosmetics International Meeting

Book of Abstracts

September 20-22, 2023
Center for International Education
University of Information Technology and Management
Kielnarowa/Rzeszów

UNIVERSITY of INFORMATION TECHNOLOGY and MANAGEMENT in Rzeszow, POLAND

Ministry of Education and Science
Republic of Poland

Rzeszów 2023

Welcome address by Prof. Kazimierz Głowniak, Chairman of The NCIM Corganizing Committee

Ladies and Gentlemen,

Dear Participants of the 2nd Natural Cosmetics International Meeting,

On behalf of the Scientific and Organizational Committees and the Authorities of the University of Information Technology and Management: Mr. President, prof. Tadeusz Pomianek, Rector prof. Andrzej Rozmus and Vice-Rector for Science and International Cooperation, Prof. Agata Jurkowska-Gomułka, I would like to warmly welcome the participants of the 2nd International Meeting of Natural Cosmetics, which took place at the International Education Center in Kielnarowa near Rzeszów. The conference is organized by the Department of Cosmetology of the University of Information Technology and Management and co-financed by the "Excellent Science" Program of the Ministry of Education and Science.

I also would like to warmly welcome the Scientific Patrons of the Conference, the **Austrian Drug Screening Institute in Innsbruck**, represented by Prof. Günther Bonn, dr Thomas Jakschitz and Gokhan Senli; the **Phytochemical Society of Europe**, represented by Prof. Franz Bucar and Dr Simon Vlad Luca and the **Polish Academy of Science**, represented by Prof. Jan Pachecka. The support of such distinguished Patrons guarantees the high scientific level of this meeting. On behalf of the Organizing Committee I also would like to thank the Austrian Drug Screening Institute for sponsoring the Welcome Reception and Phytochemical Society of Europe for funding two awards of 250 Euro – for the Best Oral Presentation and Best Poster Presentation.

The aim of this Meeting is to cover all aspects related to natural products and modern research methods in obtaining active natural ingredients isolated mostly from plant material. We would like to join the scientific community and the representatives of the cosmetic industry in order to find a common field for cooperation. The conference gathers prominent researchers and experienced industry representatives from Austria, Australia, Belgium, Croatia, France, Germany, Greece, India, Mongolia, Slovakia, Türkiye and Poland.

The Meeting is covering the following topics: “Innovative sources of natural cosmetic ingredients”, “Modern technologies in natural cosmetic formulations”, “Methods of extractions and isolation of natural cosmetic ingredients”, “Global trends in natural cosmetics”. During the two days of the Meeting we will have the opportunity to attend **23 plenary lectures** given by outstanding specialists in the field of natural cosmetic research, formulations and regulations. The conference participants will also present the results of their research work, giving **6 short presentations** and displaying **68 posters**. The participants of the meeting will also have a unique opportunity to participate in three workshops organized by companies: MatTek, Urtica Technologies and Orcideo as well as an unique workshop on the Formulation of natural cosmetics, prepared by the employees of the Department of Cosmetology, UITM .

The aim of the Organizers of the 2nd Natural Cosmetics International Meeting was to support young scientists working on all aspects of natural cosmetology. Therefore, three awards were granted for the Best Posters of Young Science (students and doctoral students).

We are very grateful to all the authors of plenary lectures, short and poster presentations, and to all participants for choosing this Meeting and coming to Rzeszów to present the results of their scientific work. Without your presence, it would not be possible to organize this conference, during which such interesting plenary lectures, fruitful discussions and the establishment of new scientific and business cooperations would take place. We believe that it was a very good opportunity to collect wonderful memories from your stay in the Old Town of Rzeszów and at the Kielnarowa Campus, located in the beautiful Podkarpacie region.

I also would like to warmly invite you already to the 3rd Natural Cosmetics International Meeting, planned for September 2025!

Chairman of the Organizing Committee

Prof. dr hab. Kazimierz Głowniak

Natural Cosmetics International Meeting

Financial Support

The conference 2nd Natural Cosmetics International Meeting was co-financed by the state budget under the program of the Minister of Education and Science called "Excellent Science" (project no. DNK/SN/549082/2022, co-financing amount PLN 112,200.00).

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Natural Cosmetics International Meeting

Conference Venue

Center for International Education
The University of Information Technology and Management in Rzeszów
Kielnarowa 386A
36-020 Tyczyn, Poland

https://wsiz.edu.pl/uczelnia/infrastruktura/centrum-edukacji-miedzynarodowej/

UNIVERSITY of INFORMATION TECHNOLOGY and MANAGEMENT in Rzeszow, POLAND

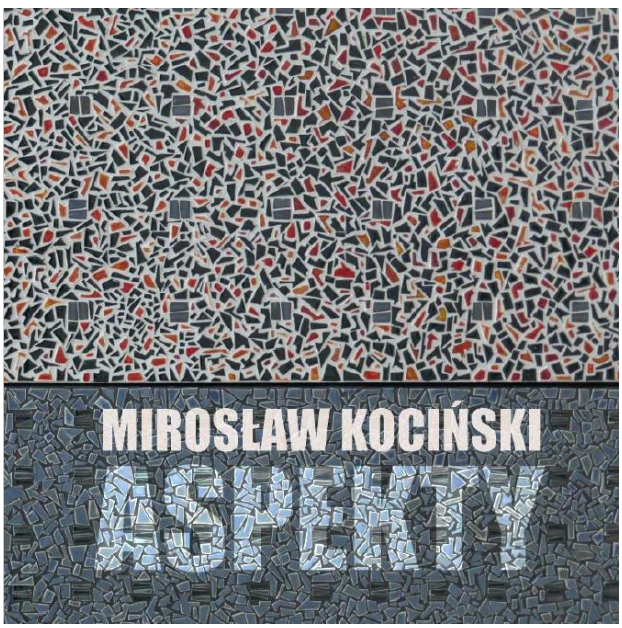
Natural Cosmetics International Meeting

Ministry of Education and Science
Republic of Poland

Welcome Reception

20th September 2023
Art Exhibition Office (Biuro Wystaw Artystycznych) in Rzeszów

BIURO WYSTAW ARTYSTYCZNYCH
W RZESZOWIE



Welcome Reception has been sponsored by Austrian Drug Screening Institute

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Conference Programme

Day 1: 20/09/2023

18:30-20:00 Registration

18:30 -22:00 **Welcome Reception - Art Exhibition Office** (Biuro Wystaw Artystycznych), Jana III Sobieskiego 18, Rzeszów city center (https://www.bwa.rzeszow.pl/)

Day 2: 21/09/2023

08:30 – 12:00 Registration

09:00 – 09:25 **Opening Ceremony**: **Prof. Agata Jurkowska-Gomułka**, Vice-Rector for Science and International Collaboration, UITM in Rzeszów; **Prof. Kazimierz Głowniak**, Head of the Department of Cosmetology UITM in Rzeszów and the Chairman of the NCIM Organizing Committee; **Prof. Franz Bucar**, The Phytochemical Society of Europe

09:25 – 9:50 Opening lecture: ***Austrian Drug Screening Institute - Bridging Basic Research and Industry*** **- Prof. Günther K. Bonn** (Austrian Drug Screening Institute, University of Innsbruck, Austria)

9:50 – 11:50 Session I "Innovative sources of natural cosmetic ingredients"
Chair: Dr hab. Katarzyna Gaweł-Bęben, Dr Simon Vlad Luca

09:50 – 10:15 ***Classic and innovative biotechnological methods for obtaining of cosmetic raw materials from exotic plant species*** - **Prof. Halina Ekiert, Dr hab. Agnieszka Szopa** (Jagiellonian University, Kraków, Poland)

10:15 - 10:45 ***Evolving trends in extracting, fractionating, and separating natural bio-active ingredients from green herbal biomass of potential importance to phyto-cosmetic industry worldwide*** - **Prof. Henry O. Meissner** (NICM, TTD International, Sydney, Australia)

10:45 – 11:05 ***Biological photoprotectives from fruit rinds of Garcinia indica: an approach beyond sun protection factor*** - **Dr Manjushri A. Deodhar** (University of Mumbai, India)

11:05 – 11:25 ***Urolithin A - a postbiotic metabolite of natural ellagitannins as an innovative molecule for skin inflammations*** - **Prof. Sebastian Granica** (Medical University of Warsaw, Poland)

11:25 – 11:45 ***Innovations - the possible sources of inspiration*** - **Dr Danuta Raj** (Wrocław Medical University, Poland)

11:45 - 12:30 Coffee Break + Poster Session

12:30 – 14:30 Session II "Modern technologies in natural cosmetic formulations"
Chair: Prof. Wirginia Kukuła-Koch, Prof. Rudolf Bauer

12:30 – 13:00 ***Challenges in cosmetic formulations - our studies focused on nanocosmetics*** - **Prof. Ilkay Erdogan Orhan** (Gazi University, Ankara, Türkiye)

13:00 - 13:30 ***CosmoGreen Project: active green solvents for eco-friendly, high-value cosmetic products*** - **Prof. Marijana Zovko Končić** (University of Zagreb, Croatia)

13:30 – 13:50 ***Reconstructed human skin models and cosmetics safety*** - **Dr Silvia Letasiova** (MatTek, Bratislava, Slovakia)

13:50 – 14:10 ***The effectiveness of the selected plant secondary metabolites as the functional ingredients in cosmetic formulations*** - **Dr Magdalena Malinowska** (Cracow University of Technology, Poland)

14:10 - 14:30 ***Nanoformulated essential oils for cosmetic applications*** **- Dr hab. Elwira Sieniawska** (Medical University of Lublin, Poland)

14:30 – 15:30 Lunch

15:30 – 17:20 Session III "Methods of extraction and isolation of natural cosmetic ingredients"
Chair: Prof. Marijana Zovko Končić, Prof. Sebastian Granica

15:30 – 16:00 ***Polyphenols as preventive agents for viral infections*** - **Prof. Rudolf Bauer** (University of Graz, Austria)

16:00 – 16:20 ***Probing Greek flora towards the discovery of novel cosmetic entities employing chemical and biological profiling approaches*** **- Prof. Maria Halabalaki** (National and Kapodistrian University of Athens, Greece)

16:20 – 16:40 ***Identification of novel bioactive natural compounds, using in vivo zebrafish phenotypic assays*** - **Dr Dimitris Beis** (University of Ioannina, Greece)

16:40 – 17:00 ***Extraction and analysis of cosmetically relevant alkylamides*** - **Prof. Franz Bucar** (University of Graz, Austria)

17:00 – 17:20 ***Exploring phytocannabinoids as potential cosmeceuticals*** - **Dr Simon Vlad Luca** (Technical University of Munich, Germany)

19:00 - 23:00 **Conference Dinner** - Taberna pod Sosnami, Kielnarowa (http://tabernapodsosnami.pl/pl/)

Day 3: 22/09/2023

09:00 – 11:00 Session IV "Global trends in natural cosmetics"
Chair: Prof. Agnieszka Szopa, Prof. Maria Halabalaki

09:00 – 09:30 ***Discovering of novel raw materials for cosmetics industry: fruit and vegetable seed oils*** - **Prof. Nazim Şekeroğlu** (University of Gaziantep, Türkiye)

09:30 – 10:00 ***2023 trends and changing requirements for natural cosmetics*** **- Viktoria Potko** (NaTrue, Brussels, Belgium)

10:00 – 10:15 ***Skin-health promoting properties of natural products coming from plants of the Greek flora*** - **Dr Aikaterini Argyropoulou** (PharmaGnose, Athens, Greece)

10:15 – 10:30 ***Cosmetic and antiglycation potential of Spirulina platensis extract*** – **Dr Ahmad Ali** (Univeristy of Mumbai, India)

10:30 – 10:45 ***Cinnamic acid derivatives as emerging ingredients of cosmetic formulations for hyperpigmentation disorders*** **- Dr hab. Agnieszka Gunia-Krzyżak** (Jagiellonian University, Kraków, Poland)

10:45 - 11:00 ***Study of obtaining the ointment base from livestock fat*** - **Dr Daariimaa Khurelbat** (Mongolian National University of Medical Sciences, Ulaanbaatar, Mongolia)

11:00 - 11:15 ***Microbiome Stimuli Base, innovative solution for psoriasis skin care*** – **Dr Magdalena Biesiadecka** (Orcideo, UITM, Rzeszów, Poland)

11:15 – 12:00 Coffee break + Poster Session

12:00 – 13:00 Session V – Short presentations of selected posters
Chair: Prof. Halina Ekiert, Prof. Franz Bucar

12:00 - 12:10 ***Changes in the biological activity of Hamamelidis cortex extract after incubation with skin microbiota*** **- Weronika Skowrońska** (Medical University of Warsaw, Poland)

12:10 - 12:20 ***The assessment of polyphenolic content and biological activities of the extracts from in vitro cultures of selected Vitis vinifera cultivars*** - **Marta Sharafan** (Cracow University of Technology, Poland)

12:20 - 12:30 ***Development of an in vitro test method for irritation of medical devices used in the oral cavity*** **- Marek Puskar** (MatTek, Bratislava, Slovakia)

12:30-12:40 ***Potential cosmetic application of extracts from aerial parts of eight Hemerocallis cultivars*** - **Dr hab. Katarzyna Dos Santos Szewczyk** (Medical University of Lublin, Poland)

12:40 - 12:50 ***Nanoencapsulation of bioactive compounds from plant by products to produce sensitive skin cosmetics*** - **Dr Stefan Martens** (Edmund Mach Foundation, Italy)

12:50 - 13:00 ***Anti-proliferative potential of β-damascenone and related C13-norisoprenoids*** - **Dr Teresa Pirker** (University of Graz, Austria)

13:00 - 13:10 **Award ceremony**

13:10 – 13:20 **Closing remarks**

13:20 - 14:00 Lunch

14:00 – 15:15 **MatTek Workshop** (for registered participants)

15:15 – 16:15 **Urtica Technologies/Orcideo Workshop** (for registered participants)

16:30 – 17:30 **Formulation of Natural Cosmetics Workshop** (for registered participants)

Opening Lecture

em.o.Univ.-Prof. Mag. Dr. Dr. hc. Günther K. Bonn

Professor Günther K. Bonn is the founder, CEO and Scientific Director of the ADSI – Austrian Drug Screening Institute GmbH, Austria, which bridges the gap between basic research and industry. He is also Chair of the Foundation Board of Trustees of the Michael A. Popp Nature Science Foundation and initiator and founder of the Phytovalley-Tirol initiative.
Professor Bonn is co-author of over 400 scientific publications, 29 patents and two books. Professor Bonn has been awarded many prestigious awards, including Halasz´ Award (2003), Honorary Ring of the Austrian Academy of Sciences, Vienna (2009), EUSSS Nernst-Tswett Award (2010), Csaba Horváth Memorial Award (2011), UPV – Wissenschaftspreis, University of Innsbruck (2012) and A.J.P. Martin – Medal (2013). In 2014 he received the Honorary Doctorate Degree from the Medical University Lublin and the "Austrian Cross of Honor for Science and Art, 1st Class" in 2022. He is also Editorial Board member of several journals, e.g. Journal of Chromatographic Science, LC-GC Europe, Current Medicinal Chemistry, Current Analytical Chemistry, Bioanalytical Reviews, International Journal of Analytical Chromatography, Clinical Phytoscience and Biomedical Chromatography (Editor for Europe).
Professor Bonn's research interests include analytical chemistry, synthesis of new materials for enrichment and separation technologies, e.g. chromatography, electrophoresis, mass spectrometry and bioanalysis (genomics, proteomics, metabolomics, phytomics), especially in phytopharmacy, phytocosmetics, nutrition and food-supplements.

Austrian Drug Screening Institute - Bridging Basic Research and Industry Innovative methods for evaluation of efficacy, safety and quality of raw materials and final products in the phyto-area

Guenther K. Bonn,
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Innovative approaches in analytical chemistry and cell-biology have become increasingly imperative for natural product research, *e.g.,* the latest developments in chromatography enable research in otherwise inaccessible areas of natural product analysis and isolation. Since plant extracts consist of several hundred to thousands of diverse compounds in very different concentrations, the use of novel enrichment and purification methods based on advanced solid-phase extraction techniques in combination with high-resolution chromatographic separation and mass spectrometric detection is of utmost importance for the establishment of reliable phytochemical extract profiling besides the accurate quantification of specific plant metabolites. Significant progress is accomplished in developing new stationary phases that can be personalized to a particular application, thus offering endless possibilities for optimizing selectivity. Additionally, combining separation science with spectroscopy allows for merging various technologies in phyto-pharmacy and phyto-cosmetics. Near- and mid-infrared (IR) spectroscopy enables swift and non-invasive qualitative and quantitative analyses of raw plants and extracts. All of these approaches offer advanced strategies not only for R&D but also for quality control in phyto-analysis. Alongside analytical studies to identify and quantify profiles or specific compounds, comprehensive biological studies are used to identify biological activities and perform the necessary safety assessment.

In a case study, Longan fruit concentrates were obtained through milling, pressing, heating/cooling, and subsequent vacuum distillation at elevated temperatures and were qualitatively and quantitatively analyzed through UHPLC-qTOF/MS. In addition, in vitro antioxidant assays, anti-enzyme assays, two-dimensional HaCaT-based in vitro assays, and assays in the three-dimensional reconstructed human epidermis (3D-RHE) were performed.
The comprehensive investigations demonstrated high antioxidant potential, a significant reduction in collagenase activity, and dose-dependent skin whitening effects. Skin-soothing effects were demonstrated on 2D-HaCaT and 3D-RHE models. The in vitro skin irritation and corrosion tests performed according to OECD guidelines and the patch test performed according to ICDRG guidelines also confirmed excellent skin tolerance.

The results obtained by these highly sophisticated analytical and biological techniques demonstrate the highly effective anti-aging properties of longan fruit concentrate. Combined with the safety assessment, these positive effects offer high potential in phytocosmetic formulations.

Keywords: Phytocosmetics, anti-aging, 3D-RHE, UHPLC-qTOF/MS, Dimocarpus Longan

Literature:
[1] Huber S. et al. Separations 7.3 (2020): 45.
[2] Kreidl M. et al. Analytica Chimica Acta 1101 (2020): 211-221.
[3] Desprez B. et al. Toxicology in Vitro, 29(8), 2055-2080.

Invited Speakers

Prof. dr hab. Halina Ekiert

Professor Halina Maria Ekiert is the Head of Chair and Department of Pharmaceutical Botany at Pharmaceutical Faculty, Medical College, Jagiellonian University in Cracow. Her areas of scientific interests are associated mainly with pharmaceutical sciences with strong background in plant biotechnology, phytochemistry, analysis of natural products and biological activity of plant secondary metabolites. Her biotechnological interests include medicinal and/or cosmetic plant in vitro cultures, endogenic production of bioactive plant secondary metabolites and biotransformations of exogenic substrates in in vitro cultures. Her scientific achievements include app. 140 + published articles with total number of citation of app. 2100 and H-index of 27 (acc. to Web of Science), 14 book chapters (published in Springer, Science Publisher and Studium Press) and the role of co-editor and /or editor in Springer Nature (Reference Series in Phytochemistry and Reference Series in Sustainable Development and Biodiversity), since 2023 the Editorial Board member in Reference Series in Phytochemistry in Springer Nature and also guest-editor in the MDPI journal – Molecules.
She is an academic teacher with extensive and broad experience in pharmaceutical botany, plant biotechnology, cosmetology (in area of cosmetic plants and natural cosmetic raw materials) and phytochemistry.

Dr hab. Agnieszka Szopa, prof. UJ

Professor Agnieszka Szopa is an assistant professor at the Chair and Department of Pharmaceutical Botany, Faculty of Pharmacy, Jagiellonian University, Collegium Medicum in Cracow, Poland. Her research interests are focused on plant biotechnology, phytochemistry and phytotherapy as well as phytocosmetology.
Her scientific activity especially has been devoted to many pharmaceutical aspects of plant biotechnology of medicinal and cosmetic plants. She specializes mainly in the endogenic accumulation of bioactive metabolites. Her research is also focused on the study of the biological activities of studied plant species (from in vitro and in vivo). She completed numerous international scientific and didactic internships. She is academic teacher in pharmaceutical botany, cosmetic plants, plant biotechnology and phytochemistry.
Her scientific activity is documented by above 140 research articles and 7 book chapters. Her number of citations: 1600, a total impact factor: 340, an h-index: 23.

Classical and innovative biotechnological methods for obtaining of cosmetic raw materials from exotic plant species

Ekiert H., Szopa A.

Chair and Department of Pharmaceutical Botany, Faculty of Pharmacy, Jagiellonian University, Collegium Medicum, 9 Medyczna Street, 30-688 Cracow, Poland
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In Central-East European countries the cosmetic raw materials from exotic plant species could be obtained from the plants cultivated in open-air on the commercial scale (e.g. *Echinacea purpurea, Arnica chamissonis,* Oenothera sp.) [1]. Some cosmetic plant species cultivated in glasshouses could be the source of raw materials, too (e.g. Aloë sp., *Passiflora incarnata*). A lot of plant raw materials must be imported, most of all: gums (e.g. arabic gum), waxes (e.g. jojoba wax), fatty oils (e.g. cocoa butter, avocado oil), essential oils (e.g. tea tree oil), and many others, e.g. *Centellae asiaticae herba, Panax ginseng radix*. Cultivations and import are the common, classical methods of obtaining the cosmetic raw materials. Currently innovative plant biotechnological methods of obtaining raw materials for phytocosmetology are becoming more and more popular [2,3].
In the CosIng database (Cosmetic Ingredients) maintained by European Commission *in vitro* cultures of many exotic cosmetic plants are listed as a source of valuable cosmetic raw materials [4].
Numerous cosmetological companies, among others French, Spanish, Italian and Korean produce bioactive cosmetological substances using *in vitro* cultures of e.g. *Camellia sinensis*, *Centella asiatica*, Coffea sp. and *Panax ginseng* [5,6].
Some products could be obtained in plant *in vitro* cultures *via* biotransformation of exogenous substrates into expected valuable products. The good example could be the production of arbutin *via* β-D-glucosylation of hydroquinone [7].
For many cosmetic plant species micropropagation protocols (multiplication using plant *in vitro* cultures) were elaborated (e.g. for *Ginkgo biloba, Centella asiatica*, Citrus sp.). Such propagation methods guarantee the obtaining of a lot of high-productive, genetic unified copies of valuable cosmetic plant species.
Our team has a big experience and successes in biotechnological production of antioxidants, e.g. lignans, flavonoids, depsides and verbascoside using *in vitro* cultures of Schisandra sp., Scutellaria sp. and Aronia sp. [8], and also in production of arbutin *via* biotransformation of hydroquinone in *in vitro* cultures of different plant species, e.g. Aronia sp., and *Schisandra chinensis* [7].

References:
[1] Senderski M. Prawie wszystko o ziołach i ziołolecznictwie. Podkowa Leśna 2015.
[2] Barbulova A, Apone F, Colucci G. Plant cell cultures as source of cosmetic active ingredients. Cosmetics, 2014, 1, 94-104.
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[5] Georgiev V, Slavov A, Vasileva I, Pavlov A. Plant cell culture emerging technology for production of active cosmetic ingredients. Eng Life Sci, 2018, 18, 779-798.
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[8] Ekiert H, Kubica P, Kwiecień I, Jafernik K, Klimek-Szczykutowicz M, Szopa A. Cultures of medicinal plants *in vitro* as a potential rich source of antioxidants. In: Ekiert H, Ramawat K, Arora J (eds.): References Series in Phytochemistry. Plant Antioxidants and Health. Springer Nature, Switzerland 2022, p. 267-309.

Invited Speakers

Prof. Dr. Marijana Zovko Končić

Marijana Zovko Končić, PhD is a full professor at the Department of Pharmacognosy, Faculty of Pharmacy and Biochemistry, University of Zagreb. She teaches graduate courses Pharmacognosy II and Phytotherapy, as well as postgraduate specialist study subjects of Herbal drugs in cosmetics, Dietary supplements for athletes, Biotechnological drugs of plant origin, Rational phytotherapy and Natural products in dermatopharmacy. Her scientific interests include natural products, their extraction using sustainable and "green" procedures and solvents as well as in optimization of extraction and solubilization procedures by using experimental design. Special emphasis of her work is on use of secondary metabolites and plant extracts as active ingredients in natural cosmetic. She is currently principal investigator in the project "Bioactive plant principles extraction using green solvents-a step towards green cosmeceuticals", (CosmoGreen) funded by Croatian Science Foundation. She co-authored more than 70 research papers.

CosmoGreen Project: Active green solvents for eco-friendly, high-value cosmetic product

Zovko Končić M.[1]

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Growing concern for the future of our planet has led to an increase in research both on the activity of medicinal plants and the design of green and sustainable methods for the extraction of their bioactive principles. Besides the high yield of the desired natural products and low energy consumption, the ideal extraction procedure should employ solvents that are safe, not only for the human organism but also for the environment. Such solvents should be biodegradable, non-flammable and easily obtained from renewable sources. This lecture will give insight into eco-friendly ("green") extraction solvents and procedures developed within the frame of CosmoGreen Project (HRZZ IP-2018-01-6504), their use for the extraction of plant material and preparation of natural extracts with cosmetic and dermatologic potential. Examples using various medicinal plants, such as *Helichrysum italicum*, *Glycyrrhiza glabra*, *Echinacea purpurea*, and many others will be described. The presentation will specifically focus on the solvents, including water and its mixture with glycerol or cyclodextrins, as well as natural deep eutectic solvents that were utilized within the frame of the project. The main research results related not only to their good extraction potential and their ability to increase the stability of the prepared extracts but also their biological activity related to the dermatologic and cosmetic potential will be presented.

Invited Speakers

Dr Manjushri Arun Deodhar

Dr. Mrs. Manjushri Arun Deodhar was an Associate professor and Head of the Botany Department in KETs V. G. Vaze College, Autonomous, affiliated to Mumbai University till 2020.And now she is working as adjunct professor in Botany in the same institute. She has guided more than 20 students for their PhD degree in the field of Botany and Biotechnology. Her topic of interest and current research fields are Plant tissue culturing of endangered plant species for their conservation. Algal Biotechnology for new generation biofuels, CO2 sequestration and Neutraceuticals. She is extensively engaged in screening photoprotective anti-ageing Cell rejuvenating abilities of natural metabolites and their applications in cosmetics. She has completed many government as well as private companies funded major and minor research projects. She has more than 40 publications as a co-author in her name. She was the member of many honourable committees in the university itself.

Multiple cosmetic benefits of Fruit rind extracts of GARCINIA INDICA.

Deodhar M.

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Garcinia indica is an underutilized tree species confined to Western ghats of Maharashtra, India. The fruit rinds contain an array of important metabolites. The hydroxy citric acid is known for its anti obesity property. The red coloured anthocynidines are antioxident. And Isoprenylated Benzophenones are anti cancerous.
Last few years in V G Vaze college UV protective ability of the fruit rinds have been evaluated. The preliminary experiments suggested that the fruit rind extracts in nonpolar solvents like ethyl acetate are potent UV absorbers. [1]. Though the ethyl acetate extract(EA)contained Garcinol as a major compound responsible for a broad spectrum UV protection, the extract also contained epi Garcinol which had ability to absorb UV B rays and responsible for increasing SPF of formulation. The ethyl acetate being mid polar it also extracted large amount of hydroxy citric acid and made the extracts substantially acidic which hindered the stability of cream formulation. Hence the fruit rinds were subjected hydroalcoholic treatment and then subjected to ethyl acetate extraction. The treated ethyl acetate extract TEAEthus obtained ,has desired proportion of Garcinol and epigarcinol and had decreased% of hydroxy citric acid in extract. The TEAE at very low concentration range of 5 to 25 ug/ml was found to be effective in ameliorating UV induced photo oxidative cell damages in fibroblasts in vitro and protected the cells from UV induced inflammation and melanogenesis [2]. The hydroalcoholic extract of Garcinia fruit rinds rich in pectin content had fibroblast rejuvenating and antielastase ability needed for skin rejuvenating formulation.

References:

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[2] Dhaval P, Deodhar M. Natural photoprotective antioxidants from Garcina indica fruit rinds: An approach beyond sun screen. SOFW journal. Home and personal care ingredients and Formulations.2023.149,6/23.24.

Invited Speakers

Prof. dr. hab. Sebastian Granica

Prof. Sebastian Granica serves as a Head of Department of Pharmaceutical Biology at Medical University of Warsaw. He received his doctoral degree in 2014, his habilitation only 2 years later, and since 2021 he has held the title of professor. His work includes over 110 scientific papers. He has been the PI of projects funded by the National Science Center and the Ministry of Science and Higher Education.

In 2014 he was awarded by the Foundation for Polish Science in the START program, and in 2015 he received a prestigious scholarship of the Ministry of Science and Higher Education for outstanding young scientists. As part of his scientific activities, he has completed several internships and study visits in Germany, Italy, the Czech Republic, Austria or Ukraine, among others. He conducts active scientific cooperation with domestic and foreign centers. His scientific interests include phytochemical analysis of plant materials, identification of compounds and development of methods for quantitative and qualitative determination of secondary metabolites in plants and biological material. Recently, his research has been focused on interactions of natural products with human microbiota.

Urolithin A - a postbiotic metabolite of natural ellagitannins as an innovative molecule for skin inflammations

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Urolithin A (UroA) is a metabolite produced by intestinal microbiota from tannins belonging to the ellagitannins group found in many food products and medicinal plant materials. Several studies *in vitro* showed that UroA can be considered as a potent anti-inflammatory agent. The current research proved that topical application of UroA can be effective approach to decrease inflammation in the context of atopic dermatitis. UroA in the form of ointment (0.2 and 1.0%) was applied to ear of Wistar rats with inflammation induced by the treatment of 15% 2,4-dinitrochlorobenzene [1]. 1.0% hydrocortisone was used as a positive control. Several parameters including ear thickness, scratching frequency, white blood cells count were checked using standards methods. UroA was also tested in cell models using human keratinocytes or fibroblasts stimulated by bacterial factors or TNFalpha/INFgamma. Influence on the production of selected cytokines was checked by ELISA method. Topical application of UroA resulted in a decrease in ear edema and scratching frequency, which was associated with a decrease in the number of immune cells responsible for the progression of inflammation. UroA was also potent inhibitor of the inflammatory response in skin cell models in vitro. The results obtained indicate the possibility of using a composition containing urolithin A in local therapy of skin inflammations.

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Invited Speakers

Dr Danuta Raj

Assistant Professor at the Department of Pharmacognosy and Herbal Medicines, Wrocław Medical University, Poland. Her research interests began with the biotechnology of medicinal plants. After the PhD she focused on phytochemistry with particular emphasis on chromatographic analyses, including eutectic chromatography. She is involved in development and application of qualitative and quantitative chromatographic methods.
Currently, she is the principal investigator in the interdisciplinary, historical-pharmaceutical project on reconstruction of medicines used in Europe in 16th – 18th c. (funded by the Polish National Science Centre), that falls within the assumptions of the knowning-by-doing research trend.

Innovations - the possible sources of inspiration

Raj D.

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The inclusion of innovation is now a prerequisite in the majority of grant funding applications. Moreover, also editors of renowned and less renowned journals highly value innovative and groundbreaking concepts (at least in theory). However, the question remains: What truly constitutes an innovation? How can we determine when we have encountered one? This issue is inseparable from the next, maybe even more important matter: where to look for innovative ideas? What can be a possible source of inspiration? The presentation will explore real-world examples and case studies that highlight the transformative power of innovations. Additionally, the potential benefits (or risks) associated with drawing inspiration from diverse fields will be discussed.

Invited Speakers

Prof. Dr. Ilkay Erdogan Orhan

Prof. Dr. Ilkay Erdogan Orhan holds a Pharmacist degree (1993) from Gazi University (Ankara, Turkey), 1st M.Sc. degree at Department of Pharmacognosy at the same Faculty in 1996 with young scientist scholarship provided by TUBITAK (Scientific and Technological Research Council of Turkey). Then, she was awarded her second M.Sc. degree in Marine Natural Product Chemistry in 1998 at the University of the Ryukyus in Japan supported by Monbusho scholarship. She earned Ph.D. degree in Pharmacognosy at Faculty of Pharmacy, Gazi University (Ankara, Turkey) in 2002 and visited Department of Chemistry at University of Winnipeg (Canada) in 2003 as post-doc under NATO-TUBITAK fellowship program. She was promoted to Assoc. Prof. position by Higher Education Council of Turkey in 2004 and became full professor in 2009. Dr. Orhan was appointed as "Dean" of Faculty of Pharmacy at Eastern Mediterranean University in the Northern Cyprus for the period of 2011-2014. She is Dean of Faculty of Pharmacy, Gazi University since 2016. She is also member of Traditional Chinese Medicine (TCM) Experts Group in European Pharmacopeia and the International Scientific Board of Austrian Drug Screening Institute (ADSI).

Dr. Orhan received several awards such as Young Woman Scientist Award in Asia continent by OWSD (Organization of Women in Science in Developing Countries) & Elsevier, Science Award in Biology by COMSTECH (OIC Standing Committee on Science and Technological Cooperation) in 2010, Young Woman Scientist Award (in Life Sciences) by L'Oreal & Turkish Academy of Sciences in 2011, and Honor Award by Gazi University in 2011, Innovation Award for Women in Turkey in 2015, Science Award by Turkish Association of Pharmacists in 2016, Golden Mortar Science Award in Pharmacy in 2017, Silver Medal for Patent in International Invention Fair by Turkish Ministry of Science and Technology in 2017 as well as Best Academic Invention Medal by International Federation of Invention Associations (IFIA) in 2018. She is also recipient of TWAS (The World Academy of Sciences) Science Award in chemistry.

She was selected as the principal member of Turkish Academy of Sciences (TÜBA) as well as the Representative of Southeast Europe & Turkey Region for Phytochemical Society of Europe (PSE) in 2019. She is author of more than 287 scientific papers listed by SCI, 46 papers in other scientific journals, 23 book chapters, 3 patents (Turkish, US, & EP), 6 patent applications, and 3 books. Her h index is 50 (Web of Science) and 56 (SCOPUS) with over 11500 citations. Her research interests are chemistry and bioactivities of natural products, phytocosmetics, phytotherapy, and aromatherapy. She is currently Associate Editor of Phytomedicine and Editor-in-Chief of Turkish Journal of Pharmaceutical Sciences.

Challenges in Cosmetic Formulations – Our Studies Focused on Nanocosmetics

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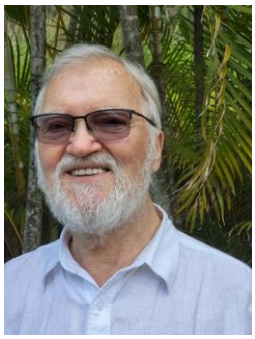
Natural and/or organic cosmetics are getting more trendy all over the world concerning consumer preferences. Since last a few decades, more people opt out for cosmetics with phyto- or other natural ingredients. Relevantly, cosmeceuticals are a subclass term of cosmetics, whose share and product diversity increases in world cosmetic market. In fact, green technology points out to not only the ingredient, but also whole production process of a cosmetic

goods as consumers demand more such kind of cosmetics. Nowadays, cosmetics/cosmeceuticals are expected to be innovative, more effective, safer, and environmentally-friendly. Besides, their estimated efficacy must be approved in scientific base. On the other hand, cosmeceuticals based on nanotechnology are attracting researchers for R&D studies towards cosmetic industry.

Therefore, we have been working on research and development of novel phyto-based cosmeceuticals *via* extensive screening studies on plant extracts and pure natural substances using *in vitro* (enzyme inhibition, etc), *in silico* (molecular docking and toxicity screening), and cell-based assays. Some active extracts we identified could be exemplified as the extracts from *Cotinus coggygryia*, *Geranium glaberrimum*, *Garcinia mangostana*, etc., which led us to design noisome, nanofiber or nanoemulsion formulations. In this regard, an anti-acne formulation based on a number of plant extracts tested against *Propionibacterium acnes* has been developed by our group, and applied for patent. For wound healing, we have been studying on nanofiber formulation loaded with the plant extract. Our enduring analyses on ascertaining novel effective natural ingredients for possible cosmeceutical use have so far yielded 3 patents, and 4 patent applications with cosmetic formulations. In this talk, our recent outcomes on phyto-based nanocosmeceuticals will be highlighted.

Acknowledgements: The authors would like to thank to Scientific Research Unit of Gazi University for providing financial support to our projects (coded as 02/2019-31, 02/2016-01, and 02/2020-11) as well as partial financial funding for IEO from Turkish Academy of Sciences (TÜBA).

Invited Speakers



Prof. Henry O. Meissner

Professor Henry O. Meissner is a Research Director of Therapeutic Research, TTD International Pty Ltd in Sydney, Australia, with prior long-term engagements with Government research institutions and Universities in Australia, NZ, USA, Japan, China and historically in Poland. With his life-time involvements in applied research covering biochemical aspects of dietary imbalances and metabolic disorders in relation to environmental influences, he provides research consultancies to pharmaceutical companies worldwide. Over last 20 years, Professor Meissner's research interest in medicinal plants has focused on the use of standardized Peruvian plant maca (Lepidium peruvianum, synonym L. Meyenii) and its prime phenotypes in alleviating gender-related health disorders and designing lines of standardised, clinically-tested phyto-pharmaceutical products for a wide range of gender- and age-related health symptoms. He has published over 300 peer-reviewed scientific papers, books and textbook chapters on wide spectrum of research topics, related to his professional interest.

Evolving trends in extracting, fractionating, and separating natural bio-active ingredients from green herbal biomass of potential importance to phyto-cosmetic industry worldwide

Meissner H. O.[1, 2]

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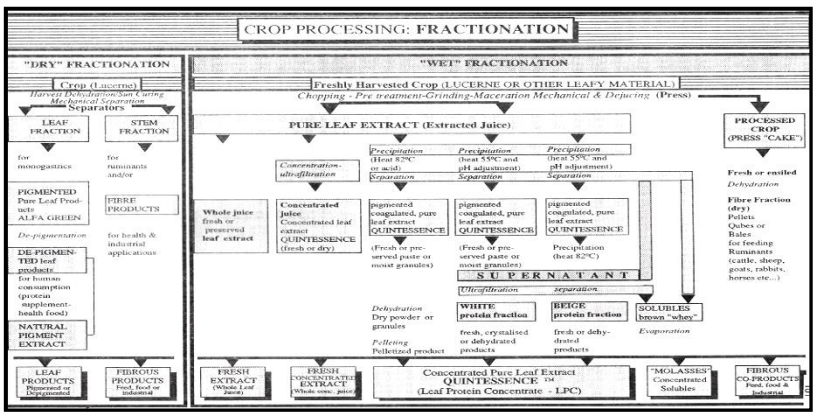
Some 250 years ago French chemist Hilaire M. Rouelle [1] has noticed that juices extracted from variety of herbal biomass, when heated, can produce solid green sediment (green coagulum - fécule). It was not until some 65 years later, when Berzelius assigned this separated substance to more precise chemical category, we know it by now as "protein" [2. During the 2nd World War British scientists explored renewable local herbal resources to survive in the case of blockade, extending their interest into establishment of International Biological Programme (IBP) coordinated by N.H. Pirie, who was instrumental in stimulating international interest in leaf protein extract as the novel protein resource, with the 1st International Meeting in 1966 at Warsaw, followed by Stockholm (1968) and Coimbatore (1970) devoted specifically to leaf protein [3]. Eventually, commercial and economically run large-scale "wet extraction" operations were established in New Zealand followed by the USA and France. However, as opposed to the IBP principle, the NZ plant was initially designed to recover extracted protein with entrapped valuable bioactive compounds present in Alfalfa (*Medicago sativa*) applied as an example of renewable cultivated herbal crop according to several fractionation options used by the author in his work and outlined in diagram below [4].



Recently observed trend in development of plant-based formulations for personal care and beauty "from within–out" and "outside–in" category of marketable products is focusing on extracts from great many individual herbs known for centuries being used to beautify the skin and protecting it from environmental stress. It is accepted by now that combining the use of oral and topical cosmeceuticals products (topical creams and lotions) the skin would carry a stronger defence mechanism against environmental damages as it is featured in several anti-wrinkle lines of cosmeceuticals, topical sunscreens, anti-aging moisturizing creams and lotions. A long list of bioactive herbal components embedded in the matrix of slow releasing Alfalfa protein extract, may be an example of an ideal base to formulators developing efficacious lines of cosmeceutical products, standardised dietary supplements, functional foods and beverages or novel quality cosmeceuticals for targeted use.

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Invited Speakers

Dr. Silvia Letasiova

Silvia Letasiova is the managing director and senior scientist at MatTek In Vitro Life Science Laboratories, Bratislava, Slovakia. She has background in biochemistry and microbiology and holds a doctoral degree in biochemistry. She joined MatTek in 2008 as a project manager and scientist and since then her main field of interest is the development and production of highly reproducible and predictive in vitro 3D reconstructed tissue models for in vitro topical toxicity testing. She is actively involved in the development and validation of assays aiming in reduction & replacement of in vivo testing. She is responsible for R&D projects in the area of skin/eye irritation, corrosion, phototoxicity and sensitization. Silvia is a member of ESTIV, SETOX, EUSAAT and a full member of US SOT. She is a co-author of more than 30 publications (> 1200 cited references, h-index 17) and presents the innovative science in more than 100 oral and poster presentations at national and international meetings.

RECONSTRUCTED HUMAN SKIN MODELS AND COSMETIC SAFETY

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During the past decades, a great progress has been achieved in the development of in vitro reconstructed human skin tissue models and the methods which can reduce or even completely avoid in vivo experimentation for cosmetic safety testing. A major step forward in recognition of these models and methods as reliable alternative tools in toxicology was their full regulatory acceptance for in vitro skin corrosion testing in 2004 as OECD Test Guideline 431 (OECD TG 431) and for in vitro skin irritation testing in 2009 as OECD 439. This presentation will describe three commercially available skin tissue models, EpiDerm, EpiDerm Full Thinckness (EpiDerm FT) and MelanoDerm that can be used for development of new cosmetic products and their safety testing. EpiDerm, produced from normal human keratinocytes, is widely used for assessment of corrosion, irritation, percutaneous absorption, phototoxicity and cytokine release. EpiDermFT is a full thickness in vitro skin equivalent produced from primary keratinocytes and primary fibroblasts containing a functional barrier and fully developed basement membrane. This model is well suited for evaluating cosmeceutical endpoints such as UV protection, skin hydration and skin aging biomarkers related to extracellular matrix (ECM) remodeling. MelanoDerm, a tissue containing primary keratinocytes and melanocytes, can be used to evaluate skin lightening following treatment with topically or systemically applied cosmetic ingredients allowing for measurement of macroscopic darkening and melanin production. Utilization of these tissue models for cosmetic product testing can be highly valuable in streamlining product development efforts and reducing the use of animals for testing purposes.

MATTEK
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Invited Speakers

Dr inż. Magdalena Malinowska

Dr Eng. Magdalena Malinowska works as an assistant professor at Cracow University of Technology, the Faculty of Chemical Engineering and Technology. She defended her PhD in 2017 in chemical engineering. In her research, she focuses on the evaluation of plant extracts biological activity for their application in the skin care topical formulations. Her studies cover the purification of the active compounds and their structural analysis, the evaluation of their activity and the chemical modification of the particular molecules to discover new structures dedicated for skin regeneration. Dr Malinowska places a particular emphasis on the evaluation of the new plant derived plant material safety of use, as well as their ability to penetrate skin protective barrier. Her work includes multidisciplinary articles combining chemical engineering, technology, analytical chemistry and cosmetology. She is also the author of patents on the novel active compounds and formulations having a significant potential in pharmaceutical and cosmetic industry.

The effectiveness of the selected plant secondary metabolites as the functional ingredients in cosmetic formulations

Malinowska M.A.[1*], Billet K.[2], Drouet S.[3], Munsch T.[2], Unlubayir M.[2], Ferrier M.[2], Sikora E. [1], Giglioli-Guivarc'h N. [2], Hano C.[3], Lanoue A. [2]

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The physiological effects of naturally occurring plant metabolites have been recognized and harnessed for millennia, not just in skincare, but also in addressing various skin disorders and conditions [1]. Nowadays, the development of novel formulations encounters challenges concerning the efficacy of active compounds. This challenge stems not solely from the bioactive characteristics of the molecules, but also from their capacity to permeate the outermost skin layer, the controlled releasing profiles of plant metabolites from the cosmetic matrix, and even their interactions with other ingredients of the skincare formulation. The rate at which substances are absorbed through the skin, as well as the kinetics of the release process, depend on various factors, including the physical and biological properties of the active molecule and the cosmetic base [2]. Additionally, an increasing number of empirical and experimental methods are available for evaluating skin permeability and also its acceleration [3]. Importantly, innovative cosmetic formulations are currently being developed to achieve a controlled process of releasing active molecules from the cosmetic matrix [4]. This review presents modern tools and techniques for accelerating percutaneous absorption and improving the kinetics of release profiles for naturally occurring active molecules. The outcomes of these studies enable the selected plant metabolite to be most effective as active cosmetic ingredient even at lower concentration. Moreover, the innovative solutions for topical formulations frequently offer the potential to protect natural ingredients from harmful environmental factors, for instance oxidation or ultraviolet light.

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Invited Speakers

Dr hab.
Elwira Sieniawska,
prof. UM

Dr hab. Elwira Sieniawska received her Ph.D. in pharmaceutical sciences from Medical University of Lublin in 2012. She currently is a Professor at the Department of Natural Products Chemistry at Medical University of Lublin in Poland.
Her scientific experience is based on phytochemistry. She worked on isolation and utilization of components of essential oils, characterization of plant extracts and formulations with phytoconstituents.

During her research she published more than 80 scientific papers and several book chapters, participated in numerous scientific conferences relevant to natural products and obtained 6 polish patents. Since 2011 she served as a principal investigator and co-investigator of research projects, and supervised numerous students.

Nanoformulated essential oils for cosmetic applications

Sieniawska E.[1], Pajic-Lijakovic I.[2], Zora Dajic Stevanovic[3]

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The physicochemical properties of essential oils (EOs) (high volatility, intense odor and taste), as well as high biological activity and known dose-dependent toxicity are the reasons of the development of EOs nanocarriers. The encapsulation prevents EOs from degradation and protects skin from irritating effects of EOs [1]. Moreover, entrapping of EOs enhances their bioavailability. Development of various techniques of encapsulation ensures wide use of EOs in cosmetics [2-3]. Engineering optimization of delivery process includes choice of carrier matrix and encapsulation efficiency. Moreover, the preferred carrier matrix components should be sustainable. Polysaccharides, such as pectin, inulin, starch, cellulose, and hemicelluloses, are widely used in the form of single hydrogels as well as their blends. These macromolecules can be extracted from wastes of agricultural and industrial processing and can be re-used in cosmetic formulations containing functional EOs nanocarriers. Such examples of nanoformulated essential oils will be presented [4].

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Invited Speakers

Prof. Dr. rer.nat. DDr. h.c.
Rudolf Bauer

Prof. Rudolf Bauer studied pharmacy and received his PhD at University of Munich, Germany; 1993 he became Associate Professor at University of Düsseldorf, Germany; since 2002 he is head and full professor of pharmacognosy at University of Graz, Austria. He has acted as Head of the Institute of Pharmaceutical Sciences from 2004–2020.
He is expert in natural product chemistry, analysis, and activity-guided isolation of plant constituents. His current research focuses on phytochemical and pharmacological investigations of traditionally used medicinal herbs, identification of the active constituents, plant metabolomics and interactions with gut microbiota.
He acted as president of the International Society of Ethnopharmacology from 2015-2017, of the Society for Medicinal Plant and Natural Product Research (GA) 2002-2007, and as founding president of GP-TCM Research Association during 2012-2014.
He has published more than 400 research papers (h-index 66) and has edited several books. He is currently chairman of the expert groups 13A and TCM of the European Pharmacopoeia Commission. He received several awards, like the Qihuang International Prize of China Association of Chinese Medicine, the Outstanding International Scientist Award (Pranab Banerji Memorial Award) of Society for Ethnopharmacology India (SFE), the Varro Tyler Prize of the American Society of Pharmacognosy, the Government Friendship Award of the Peoples Republic of China, and the honorary doctorates of the universities of Helsinki/Finland and Szeged/Hungary.

Polyphenols as preventive agents for viral infections

Bauer R.

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Polyphenolic compounds have been produced by plants since the early days of their evolution mainly in order to prevent from fungi and bacteria, but probably also against viruses [1,2]. Since respiratory viruses pose a significant threat to global health, which has in particular been realized during COVID-19 pandemic, the antiviral effect of polyphenol containing preparations should be studied in more detail. Respiratory viruses initially infect the naso- and oropharyngeal regions. Preventing initial infection or reducing viral loads upon infection might soothe symptoms, prevent dissemination into the lower airways, and transmission to other individuals.
We have investigated the potential of polyphenol containing products to inactivate respiratory viral pathogens and determined the antiviral activity of black chokeberry (*Aronia melanocarpae* [Michx.] Elliott), elderberry (*Sambucus nigra* L.), and pomegranate (*Punica granatum* L.) juice, as well as green tea (*Camellia sinensis* [L.] Kuntze) on the infectivity of the surrogate-modified vaccinia virus Ankara, and the respiratory viruses SARS-CoV-2, influenza A virus (IAV), and adenovirus Type 5. Black chokeberry and pomegranate juice, as well as green tea reduced SARS-CoV-2 and IAV titers by ≥80% or ≥99%. Oral rinsing with these products may therefore reduce viral loads in the oral cavity and might prevent viral transmission [4]
The use of green tea polyphenols in the in the management of COVID-19 has recently intensively discussed [5]. We

therefore have investigated the effects of a standardized green tea extract (sGTE) including the biological mechanisms of virus blockade in a VeroE6 cell culture model, using the Wuhan type of SARS CoV-2 as well as its beta- and delta-mutations. In addition, the qualitative and quantitative tannin profile present on the oral mucosa after application of spray has been investigated by LC-MS/MS and HPLC-DAD analyses of (-)-epigallocatechin-3-O-gallate (EGCG) and related catechin derivatives. The results demonstrated that sGTE has strong neutralizing activity on SARS-CoV-2. The interaction with mucosa proteins seems to be direct and non-specific. By HPLC-DAD analysis, eight catechins were identified in sGTE, with EGCG and (-)-epicatechin-3-O-gallate as the most abundant. LC-MS/MS and HPLC-DAD analyses of throat swabs after application of a sGTE spray have shown that the concentrations of green tea tannins in the pharyngeal mucosa are higher than the effective dose found in the in vitro studies with SARS-CoV-2, even 1 h after the last application [6].

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Invited Speakers

Prof. Maria Halabalaki

Maria Halabalaki: Assoc. Professor, Division of Pharmacognosy and Natural Products Chemistry, Department of Pharmacy, National and Kapodistrian University of Athens (NKUA). To date, she has been the author of > 140 papers in peer-reviewed journals and her work has been also presented in more than 70 international conferences. Also, she belongs at the coordinating team of several EU (>20) and National (>40) research programs. In 2015, she was awarded Egon Stahl in silver, an EU medal, recognizing and promoting young scientists working in the field of Pharmacognosy (Pharmaceutical Biology) and Analytical Phytochemistry. Also, in 2023 she was awarded with the prestigious Bionorica Phytoneering award acknowledging outstanding research in the field of development and application of phytopharmaceutical products She is a member of several National and International committees and societies e.g. in the BoD of GA society (Medicinal Plant and Natural Products Research) and Group of Experts in European Pharmacopoeia (EDQM – working group 13A for Herbal Drugs and Herbal Drug Preparation). The recent years, her scientific interests focus on the development and application of analytical methods for qualitative and quantitative characterization of plant extracts, foods, nutraceuticals, cosmetics and cosmeceuticals, dereplication methods; quality control aspects; quantification of small molecules in biological fluids; metabolomics approaches for the discovery of biomarkers and investigation of mechanism of action of small molecules as well as metabolization studies.

Probing Greek flora towards the discovery of novel cosmetic entities employing chemical and biological profiling approaches

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Plant preparations have been used in medicine since ancient times, due to their known medicinal properties[1]. Nowadays, the use of these “natural ingredients” for cosmetic formulations is in growing development and demand, since an extensive number of natural compounds are being used in products for skin care treatments and protection, among others. Greece, with more than 6000 species of higher plants is an area of high conservation, with a ~22% of its flora being endemic [2]. Thus, Greek flora has become a target of study since several varieties of bioactive constituents can be discovered [3]. Furthermore, technology outbreak today, is offering valuable tools and methods with speed, sensitivity, specificity, and efficiency, able to unfold the active compounds of complex natural extracts in a more comprehensive and rational manner. In this scope, the objective of the current research project is the investigation of numerous plant extracts from biodiversity hotspots around the globe as well as Greece, for the discovery of novel cosmetic agents.
Plant materials were collected and extracted using advanced extraction techniques such as Supercritical Fluid Extraction (SFE-CO2) and Accelerated Solvent Extraction (ASE). The metabolite profiling of the obtained extracts was performed using an array of complementary methods (HPLC-DAD, HPTLC, LC-HRMS/MS and NMR). Promising extracts were evaluated towards their cytotoxicity, antioxidant and UV-protective activity, possible tyrosinase, elastase and collagenase inhibitory activity as well as anti-ageing properties. Furthermore, the photoprotective properties in cellular models were assessed together with anti-melanogenesis profile in zebrafish

Invited Speakers

models. Certain plant species and extracts have been distinguished so far and specific chemical classes and/or secondary metabolites have been prioritized as promising candidates due to their biological properties profile. As an indicative example, the chemistry and biology of Chios Mastic Gum (*Pistacia lentiscus* var Chia resin) is presented [4].

Keywords: cosmetics, metabolite profiling, Greek flora, UV-protective activity, anti-ageing properties, Chios Mastic Gum

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Invited Speakers

Prof. Dimitris Beis

Dr. Dimitris Beis is an Associate Professor of Biological Chemistry at the Medical School, University of Ioannina and an affiliated researcher and head of the Zebrafish Disease Model laboratory at the Biomedical Research Foundation, Academy of Athens. Dr. Beis is a founding member of the European Zebrafish Society and was the first to introduce zebrafish biomedical research in Greece in 2006. Since then, he has been collaborating with several groups and trained numerous people to use zebrafish as an experimental model system.
Although the main focus of his lab is in cardiovascular disease and development, he participates in several projects involving *in vivo* phenotypic screens to identify new bioactive compounds from natural sources.

Identification of Novel Bioactive Compounds, Using *in vivo* Zebrafish Phenotypic Assays

Theodoridi A[1], Tsata V[1], Katraki-Pavlou M[1], Agalou A[1] and Beis D[1,2], on behalf of the European Venom Network (EUVEN) – COST Action CA19144

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Identifying new Bioactive Natural Products (BNPs) that may serve as potential drug lead compounds or cosmeceuticals is a constant challenge. We are performing an extensive high-throughput screening of NPs isolated from various sources including plants, algae and venom extracts aiming to identify novel bioactive molecules with potential antiangiogenesis, anti-aging, wound healing and/or cosmeceutical properties. Venomous organisms produce complex mixtures of bioactive compounds that have evolved through million years of natural selection in evolutionary arms races. Therefore, venoms are highly specialised molecules with many potential applications, especially in pharmaceutical and biotechnological field.

Zebrafish embryos allow *in vivo* monitoring of complex cell behavior and physiological parameters. Abnormal pigmentation correlates with various aesthetic problems, as well as health diseases, including melanoma. We use melanogenesis inhibition during early embryo development to identify natural compounds that block melanogenesis. Based on the responses to the different targets, the extracts were compared, prioritized, and correlated with the extracts' chemical composition. I will present our screen results as well as the activities of EUVEN, a European COST action that aims to promote venom research. Within EUVEN, we aim to foster venom research in the Europe and beyond by removing the organisational and technical obstacles and bringing together different stakeholders and therefore unleashe the potential of animal venoms.

Invited Speakers

o.Univ.-Prof. Mag. Dr.rer.nat.
Franz Bucar

Franz Bucar is Deputy Head of the Department of Pharmacognosy, Institute of Pharmaceutical Sciences, at the University of Graz, Austria and Associate Professor in Pharmacognosy. Major research activities focus on drug discovery from traditional medicinal plants including extraction, isolation, structure elucidation and analysis of plant constituents with antibacterial activity as well as plant natural products as modulators of bacterial resistance.

Extraction and analysis of cosmetically relevant alkylamides

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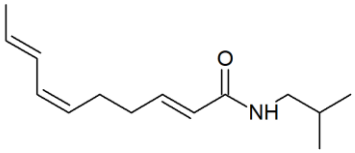
Acmella oleracea (L.) R.K.Jansen, (Asteraceae) and its major alkylamide spilanthol have gained high attention in cosmetics due to anti-wrinkle effects based on relaxation of subcutaneous (face) muscles [1,2]. Hence, several attempts have been undertaken to optimize the extraction of alkylamides or spilanthol [2,3].
In our studies, by analyzing a dichloromethane extract, we confirmed the occurrence of the alkylamides spilanthol, (*2E*)-N-isobutyl-2-undecen-8,10-diynamide and homospilanthol as well as the long chain ketoester acmellonate as major constituents after isolation and structure elucidation by GC-MS, LC-PDA-MS and NMR in the flower heads of cultivated *A. oleracea*.
Due to their biological sustainability and low toxicity, Natural Deep Eutectic Solvents (NADES) are becoming more and more important as an alternative to organic solvents [4]. The simplicity of their production could be confirmed in the course of this work, so numerous different NADES combinations were produced and tested for their stability.
The extraction capacity of different NADES regarding spilanthol was compared to extraction by ethanol. Dried flower heads of *A. oleracea* served as the starting material, the extracts of which were quantitatively analyzed using UHPLC-PDA.
Best results were achieved with the two NADES choline chloride: 1,2-propanediol and choline chloride: methyl urea which were used for the optimization phase. The NADES choline chloride: 1,2-propanediol was able to extract larger amounts of spilanthol than ethanol.



Spilanthol

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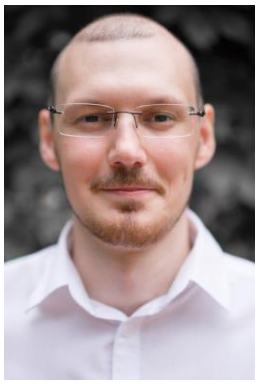
Invited Speakers



Dr Simon Vlad Luca

Dr Luca is a Scientific Assistant at the Technical University of Munich (Germany). In 2019, he obtained the title of Doctor of Pharmacy at the Grigore T. Popa University of Medicine and Pharmacy of Iasi. During his doctoral period, he also worked for 2 years at the Medical University of Lublin (Poland). His main expertise is in natural product isolation with various preparative chromatographic techniques, especially liquid-liquid chromatography (e.g., centrifugal partition chromatography, countercurrent chromatography).

Dr. Luca has authored over 65 papers published in ISI journal, four book chapters, and more than 50 abstracts in International Scientific Meetings. He is involved in international and national projects. He co-authors one approved patent and two patent applications at the Polish Patent Office. He is Editorial Board Member at Plants (MDPI), Chemistry & Biodiversity (Wiley), and eFood (Wiley). Since May 2022, he has been the General Secretary of the Phytochemical Society of Europe (PSE). His latest awards include Dra. Mariola Macías Award 2022, awarded by the PSE, and Egon Stahl-Award in Bronze 2020, awarded by the GA-Society for Medicinal Plant and Natural Product Research.

Exploring phytocannabinoids as potential cosmeceuticals

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Currently, there is an increased interest from both scientists and consumers in the application of cannabis/hemp/(phyto-)cannabinoids in skin-related disorders. This work aimed to develop liquid-liquid chromatography (LLC) separation processes to purify various cannabinoids from hemp extracts and test their bioactivity (anti-melanoma, anti-melanogenic, and anti-tyrosinase). In addition, in an attempt to explore the formulation possibilities of cannabinoids for skin applications, the solubility of a representative cannabinoid in natural plant oils as well as newly-designed deep eutectic solvents (DESs), was studied. Using batch conventional and trapping multiple dual mode, a flow-reversal semi-continuous advanced LLC operating mode, high-purity cannabidiol (CBD), cannabigerol (CBG), cannabinol (CBN), and cannabichromene (CBC) were isolated [1]. Among the tested human malignant melanoma cells, A375 cells were highly susceptible to the treatment with the four cannabinoids. CBD, CBG, and CBN significantly decreased the extracellular and intracellular melanin content in murine B16F10 melanoma cells, with CBN inhibiting both mushroom and murine tyrosinase [2]. Lastly, when the solubility of CBD in different plant oils and DESs was studied, a higher CBD solubility in mixtures containing short-chain and medium-chain fatty acids than long-chain unsaturated fatty acids was noticed [3]. Thus, this work can constitute the scientific basis for further investigating cannabinoids as potent cosmeceuticals.

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Invited Speakers

Prof. Dr.
Nazım Şekeroğlu

Prof. Dr. Nazım Şekeroğlu was born 02 October 1972 in Kilis, Turkey, he holds an MSc (1997) and PhD (2003) in Agricultural Engineering on Medicinal and Aromatic Plants. He is the author or co-author of more than one hundred peer-reviewed scientific articles, book chapters and conference presentations as an invited speaker. Until now, he visited about eighty (80) different countries all over the world for scientific purposes. His main research interest are: Medicinal and Aromatic Plants (MAPs) Conservation Strategies, their sustainable wild collection and domestication, developing Good Agricultural Practices for MAPs, postharvest processing of MAPs for high quality drug production, manufacturing and marketing of herbal medicinal products, natural and herbal cosmetics, regulatory issues of herbal products, research on pharmaceutical properties of MAPs and their active ingredients, he can achieve these researches cooperated with colleagues from different national and international scientist from all related disciplines. In addition to scientific activities, he has some positions at University Management and Ministerial Duties in capital of Türkiye.

Prof. Dr. Nazım Şekeroğlu is a manager of Gaziantep University, Phytotherapy and Medicinal Aromatic Plants Application and Research Center (FITOTABAUM), Gaziantep University, Uluğbey High Technology Application and Research Center (ULUTEM) and Gaziantep University, Vocational School of Technical Sciences. He is also a President of "Association of Medicinal and Aromatic Plants of Mediterranean – AMAPMED", General Coordinator of "Global Federation of Medicinal and Aromatic Plants – GOFMAP". He is a Chairman of MESMAP Symposiums and Scientific Committee Member of The International Cosmetic Congress – KUAD, Chief Editor of Current Perspectives on Medicinal and Aromatic Plants (CUPMAP), Scientific Board Member – President of SPICES & COFFEE at Turkish Ministry of Agriculture. Prof. Dr. Nazım Şekeroğlu was also granted with "Late Smt. Kamal Ben Vavia Memorial Award – 2015" at "Pharmacy Institution of Madhya Paradesh, DAVV Auditorium, Takshash Campus, Indore – INDIA.

Discovering of novel raw materials for cosmetics industry: Fruit and vegetable seed oils

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Medicinal and aromatic plants and their natural products are of the valuable source for cosmetics industry. Fatty oils rich in valuable fatty acids are important ingredients of the cosmetics products. Plant based, well known, fatty oils like olive oil, almond oil, apricot kernel oil, coconut oil, sesame oil have been used solely or mixed in many cosmetics products. Development in cosmetics industry and related to interest in herbal cosmetics, scientific researches have been focused on new natural resources for the novel products. Thus, novel natural products with unique chemical compositions and amazing protective or beauty effects have been reexplored, recently. However,

common and well-known fatty oils have been produced crop byproducts, many seed and kernel oils have been rediscovered by means of traditional knowledge and/or scientific studies. Of these oils, grape seed oils have been used in the last decades, but pomegranate and fig seed oils have widely been used nowadays. Besides these oils, some fruit seed oils (melon, watermelon, olive kernel oils), and vegetable seed and kernels oils (chili, tomato) are being focused for novel products. The seeds and kernels covering the seeds contain fatty oils rich in unsaturated fatty oils, which are rare ones. In this context, nervonic acid, a unique fatty acid, in the olive kernels was firstly reported by Sekeroglu and Gezici (2021). Further scientific studies of our team shows that olive kernels could be good source for Omega-7 fatty acids which would be important ingredients of the novel cosmetics products (Sekeroglu and Gezici, 2020). Of these fatty acids, Paullinic Acid, a key fatty acid of the guarana seeds, was found in the Kilis Yaglik cv. olive kernels, in the first time by our research group. We believe that fruit and vegetable seed/kernel oils as byproducts are waiting for exploring in order to create novel and efficient cosmeceuticals.

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Invited Speakers

Viktoria Potko

Viktoria Potko holds a Bachelor's degree in Public Relations and Communications and a Master's degree in International Relations in addition to her 6+ years of experience in personal care business. Before joining NATRUE in July 2020 as Label Certification and Events Officer, Viktoria worked for well-established cosmetic companies in Estonia and Russia. In her previous roles, Viktoria was involved in the new product development, launching brand marketing campaigns on the international markets, organizing events, and managing trade marketing activities. Currently in her role Viktoria is responsible for the certification process and the management of the NATRUE Label. In this role she leads the coordination of the certification process to the natural and organic cosmetic levels, NATRUE Label growth and international market trends.

2023 trends and changing requirements for natural cosmetics

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The presentation explores the trends and changing legal requirements EU impacting natural cosmetics in 2023. As the demand for natural and organic beauty products continues to rise, it is crucial for businesses operating in the cosmetics industry to stay informed about the evolving landscape. This presentation highlights the key trends shaping the market, such as increased consumer awareness, and reveals some insights from the latest consumers studies commissioned by NATRUE. Moreover, it explores the proposed changes to the regulatory framework for cosmetic products and environmental claims as part of the European Green Deal.

Invited Speakers

Dr Katerina Argyropoulou

Dr Argyropoulou holds a M.Sc. and B.Sc. in Agricultural Biotechnology from the Agricultural University of Athens and a Ph.D. in Pharmacognosy and Natural Product Chemistry from the Department of Pharmacy (University of Athens). She gained an in-depth knowledge in the separation and isolation of natural products using chromatographic techniques and structure elucidation of natural products via spectroscopic methods. She was also involved in phytochemical profiling and development and application of qualitative and quantitative methods. She continued with a Post Doc in the same field, specializing in the phytochemical study of edible plants of the Mediterranean diet that contribute to healthy aging. She has participated in the submission and implementation of European, National and Private sector/Public organizations grants. She is the author of 38 peer-reviewed publications, 6 oral and 58 poster presentations in National and International Conferences. From 2017 she is in charge of the R&D department of PharmaGnose S.A., a spin-off company of the University of Athens and responsible for all scientific research projects.

Skin-health promoting properties of natural products coming from plants of the Greek flora

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Cosmetic products are far from being used just for cleansing, beautifying, perfuming, or changing the appearance. Cosmetic research targets to products that are efficient and effective, taking into consideration novel concepts such as personalization, while it embraces environmental protection, circular economy and sustainability [1].
PharmaGnose is a spin off company that specializes on plant natural products. Among its activities is research on active ingredients that can be incorporated in cosmetics. The development of a cosmetic product, ever more, requires high-level research in a variety of fields combining chemistry, biology, biotechnology, etc.
Aromatic and medicinal plants and their phytochemicals are multifunctional. They possess various properties like photoprotection, antiaging, moisturizing, antioxidant, astringent, anti-irritant, and antimicrobial activity. Healing, softening, rejuvenating and sunscreen effects have been attributed to herbal extracts. Greece has great floristic wealth, having a rich heritage in aromatic and medicinal plants. It consists of approximately 6.000 species of higher plants. Furthermore, valuable products can be obtained from by-products of the agricultural activity, like olive and wine [2, 3].
Herein, the study of various plant species of the Greek flora (Cistus, Rosa etc) as well as by-products (olive, wine) will be presented towards their development in cosmetic ingredients. The raw materials were extracted with various techniques, focusing on the use of “green” extraction procedures. Their chemical profile, specifically their content in bioactive compounds was studied with analytical methodologies such as HPTLC, HPLC-DAD/ELSD and UPLC-HRMS. Furthermore, the potential of the plants/extracts in skin care was evaluated. The extracts were screened for their antioxidant, anti-melanogenic, anti-elastase, anti-collagenase and anti-hyaluronidase properties. It was found that the plants/extracts contained promising natural products with high structural diversity that could be of great value for the cosmetic industry, since they combine interesting chemical profiles and promising properties against specific targets involved in skin aging.

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Invited Speakers

Dr Ahmad Ali

Dr. Ahmad Ali is currently working as Assistant Professor in the Department of Life Sciences, University of Mumbai, Mumbai, India. Earlier he worked in the National Institute of Pharmaceutical Education and Research (NIPER). He studied at Jamia Hamdard and University of Mumbai obtaining his M. Sc. and Ph. D. degree in Biochemistry and Life Sciences respectively. He has over 17 years of teaching and research experience. Presently he is heading the Molecular Biochemistry Laboratory in the Department where he is supervising MSc and PhD students. His areas of research are Protein and DNA Biochemistry with special contributions on Glycation of biomolecules, DNA damage, antiglycating and anti-aggregating properties of natural products. He has also made significant contributions in the area of artificial sweeteners and their role in the process of glycation. Cyanobacterial systems are another thrust area in his lab where researchers are exploring various applications of these organisms in the field of bioremediation, cosmetics and health benefits. He has received several extramural grants from Government and private funding agencies. He has collaborators from National and International laboratories. He is also a recipient of EMBO Travel Grant to attend European Molecular Biology Organization (EMBO) Research Course and CSIR Travel grant to attend International conference. He is serving as the Reviewer and member of Editorial board of various international journals like Chemosphere, Frontiers in Plant Sciences and Microbiology, Glycobiology, International Journal of Biological Macromolecules, Annals of Phytomedicine and other journals of Elsevier and Springer. He has contributed more than 70 research articles in peer-reviewed national and international journals. He is also author of one book and several book chapters from Springer and Elsevier publishing houses. He has presented his work in many international and national conferences as Invited Speakers and Resource persons. He has also worked as Member of organizing committee for many of these conferences.

Cosmetic and Antiglycation Potential of *Spirulina platensis* Extract

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Objective: The aim of this study was to investigate the cosmetic and antiglycation potential of an extract prepared using *Spirulina platensis* PCC 7345.

Methods: Cyanobacteria (*S. platensis* PCC 7345) was cultivated in a sterile environment, and an aqueous extract was prepared using cells in the logarithmic growth phase. The extract was then used to formulate a skin cream. The antioxidant, antityrosinase, antiglycating and anti-inflammatory activities of the cream were assessed using established methods.

Results: The skin cream exhibited antioxidant activity, which was compared to the antioxidant properties of gallic acid and ascorbic acid. The cream efficiently reduced the activity of the tyrosinase enzyme, indicating its potential for skin lightening effects. The cream demonstrated anti-inflammatory activity by reducing the activity of the proteinase enzyme, which was comparable to the standard anti-inflammatory drug Diclofenac. The physical properties of the cream were determined. Furthermore, the antiglycation potential of the extract was evaluated.

The extract exhibited significant antiglycation activity by inhibiting the formation of advanced glycation end products (AGEs), which are associated with skin aging. This suggests that the extract may have anti-aging effects by preventing glycation-induced skin damage.

Conclusion: The skin cream formulated with *S. platensis* PCC 7345 showed promising in vitro results, indicating potential health benefits such as anti-inflammatory, antioxidant, and skin-lightening effects. Further studies and clinical trials are warranted to explore its efficacy and safety for use in skincare applications.

Invited Speakers

Dr hab. Agnieszka Gunia-Krzyżak

Dr hab. Agnieszka Gunia-Krzyżak works as an assistant professor at the Laboratory of Cosmetic Chemistry, Faculty of Pharmacy, Jagiellonian University Medical College in Krakow. She received her PhD in pharmaceutical sciences in 2013. Her research interests are focused on pre-clinical evaluation of active ingredients of drugs and cosmetic products. She also perform studies on safety of drug and cosmetic candidates in alternative in vitro methods.

She possess experience as a principal investigator as well as a co-investigator of research projects within pharmaceutical sciences. She also works as an academic teacher of subjects related to cosmetology. She is a co-author of 47 publications and 3 Polish patents.

Cinnamic acid derivatives as emerging ingredients of cosmetic formulations for hyperpigmentation disorders

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Cinnamic acid (3-phenylprop-2-enoic acid, beta-phenylacrylic acid) constitutes widely distributed plant metabolite which is involved in multiple internal cell processes. Cinnamic acid and its derivatives, both from natural and synthetic sources, are well known cosmetic ingredients serving as perfuming, flavouring, denaturing, and/or skin conditioning agents. Especially important derivatives are phenolic compounds (such as ferulic acid and caffeic acid) which may be used as antioxidants in cosmetic products. Moreover, some chemically obtained cinnamic acid esters are utilized as UVB filters. Several cinnamic acid derivatives have been also identified as possible melanogenesis modulators. They could be used for the treatment of hyperpigmentation disorders, which result from the incorrect deposition and/or the increased production of melanin [1]. Tyrosinase inhibitory activity was proved for several naturally derived compounds, among others cinnamic acid, 4-hydroxycinnamic acid, 4-methoxycinnamic acid, 3-hydroxy-4-methoxycinnamic acid (isoferulic acid), and cinnamaldehyde. They showed activity at concentrations of millimoles [1,2]. 4-Hydroxycinnamic acid (p-coumaric acid) was tested both *in vitro* and *in vivo* as depigmenting agent. In humans it was able to reduce skin hyperpigmentation and erythema when applied twice daily on the forearm skin exposed to ultraviolet radiation [3]. However, evaluation of molecular mechanism of action of 4-hydroxycinnamic acid revealed that this molecule is not a tyrosinase inhibitor but rather a suicide substrate of tyrosinase [4]. Moreover, chemically modified compounds showed even more promising properties. Especially derivatives of cinnamic acid amide (cinnamamide) tested in tyrosinase inhibitory assay and melanogenesis inhibitory assay in mouse melanoma cell line showed IC_{50} values in the range of few micromoles [5].
In conclusion, naturally derived and synthetic cinnamic acid derivatives may be considered as emerging ingredients of cosmetic formulations for hyperpigmentation disorders.

The work is supported by Jagiellonian University Medical College subvention funds (N42/DBS/000275).

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Invited Speakers

Dr Daariimaa Khurelbat

Associate professor, Dr. Daariimaa Khurelbat works in the School of Pharmacy, MNUMS as head of the Department of Pharmaceutical Chemistry and Pharmacognosy.

She received her doctoral degree in 2006 and did her postdoctoral research at Fukuyama University, Japan. Her research is focused on Mongolian Natural Products and their identification of chemical properties. She is experienced with phytochemistry, and biotechnology including herbal cosmetic studies. In addition, she works on quality assurance and safety of medicines as a secretary of the Pharmaceutical and pharmacological sub-counsel at the Ministry of Health of Mongolia since 2015. She presented 110 oral and poster presentations at National and International conferences, 53 publications in international and Mongolian journals as well as 7 Mongolian patents.

Study of obtaining the ointment base from livestock fat

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Background:
According to the livestock census of Mongolia, 31,087,000 sheep were counted in 2021. This is 2.6% of the world's total sheep flock and it means we have 36.7 thousand tons of wool resource. From this, 32.6% or 13.3 thousand tons of wool was prepared and processed by factories. According to this, the majority of wool remains unprocessed. Sheep wool is very oily and contains a thick oil called "lanolin". Wool grease (wool wax) is similar to human skin oil, so it is used in many fields such as medicine, beauty, and household use.
Our country does not produce lanolin raw materials domestically. We provide the lanolin raw materials demand by importing. Therefore, there is a need to study the possibility of obtaining raw materials suitable for the characteristics of the country, develop technological methods, and introduce them into production.
Aim of the study:
Develop a technological method for extracting wool grease from Mongolian sheep wool and evaluate the quality of the grease.
Materials and methods:
Sheep wool raw materials were collected from the provinces of Mongolia in June-July 2020 and 2021 and used as research materials.
Results:
We used 3 different organic solvents in different time ranges in order to extract wool grease by the Soxhlet method from both one-year-stored wool and new sheared wool. Research results showed that new sheared wool gave more grease content than other samples, when it was processed by ethanol in 3 hours. Few double bonded unsaturated oil acids in the wool oil composition were 26.26% when the fatty acid composition was determined by

gas chromatography. From this highest was oleic acid which was 13.66%. Other acids detected were Palmitoleic acid 9.11% and Erucic acid 3.49%. Multiple double bonded unsaturated fatty acid in the wool grease was 7.14%. Also, there were omega-3 type linoleic acid which was 6.43%, and omega-6 linoleic acid which was 0.71%.

Conclusion:

A suitable time for extracting wool grease from sheep wool by the Soxhlet method is 3 hours. Ethanol (99.6%) was suitable as the extraction fluid. A technological procedure for the separation of wool grease has been developed. We found that wool oil content was higher in Gobi sheep's wool, and new sheared wool had a higher yield than old stored wool.

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Invited Speakers

Dr. Magdalena Biesiadecka

Director of the Center for Biomedical Research and Services, assistant professor at the Department of Cosmetic and Pharmaceutical Products Technology, Medical College of the University of Information Technology and Management in Rzeszów. Doctor of natural sciences in the discipline of Biological Sciences (University of Rzeszów, Faculty of Biotechnology, 2019). Master of Science in Biotechnology (Rzeszów University of Technology, Faculty of Chemistry, 2011) Engineer of Biotechnology (Rzeszów University of Technology, Faculty of Chemistry, 2010). Scientific interests focus on: microbiology of microorganisms used industrially in cosmetology and food industry, including brewing, distilling and baking. Author of several innovative solutions and process optimizations for the food and cosmetics industries. Trainee and employee in such companies as: Lallemand (Biotechnology Research Institute in Montreal), Nestle NQAC (Rzeszów), Sylveco (Rzeszów) Huzar (Nowy Sącz) SGL Carbon Company (Nowy Sącz).
President of the Orcideo company, producing cosmetics and cosmetic raw materials since 2020. Editor in the popular science magazine “Piwowar” since 2017. Nature lover and rollerblading enthusiast.

Microbiome Stimuli Base, innovative solution for psoriasis skin care

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Psoriasis affects approximately 3% of the global population. Essentially, it is an autoimmune disease that causes a rash with itchy, scaly patches. Moreover, there is plenty of research about harmful microbiota that appears in psoriasis, which might impact the frequency of scaly patches [1,2,3]. One of the most common pathogens occurring on skin with psoriasis is S. aureus, a pathogen that is highly harmful and triggers an immune response. The main goal of the project was to evaluate the bioferment from probiotic bacteria and yeast, which inhibits the reproduction of S. aureus. A variety of species and strains were utilized, and numerous experiments were conducted to examine the effectiveness of pathogen inhibition as well as safety for human use. Microbiome Stimuli Base is the first commercial product that focuses on inhibiting S. aureus, which in theory helps limit the frequency of psoriasis patches.

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Orcideo

Poster presentations

P1: The cosmetic potential of dragon's blood extracts

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The market of natural cosmetics is systematically gaining popularity and to meet the growing demand for new natural cosmetics, manufacturers are looking for innovative ingredients. One such ingredient is dragon's blood, a resin from the *Croton lechleri* tree. This latex is known in the culture of South American countries and has been used for centuries in traditional medicine due to its anti-inflammatory, wound-healing and anti-microbial properties. [1] Dragon's blood extracts are also recently used as active ingredients in cosmetics. [2]

The aim of the study was to experimentally investigate the antioxidant properties and the content of polyphenolic content of aqueous, hydroethanolic (50 %, *v/v*) and ethanolic extracts from dragon's blood and to evaluate the effect of dragon's blood extract on the stability of a prototypic cosmetic emulsion.

The extracts were prepared by ultrasound-assisted extraction, filtered and compared for the total polyphenolic content using the spectrophotometric method with Folin-Ciocalteu reagent and sodium carbonate. The antioxidant potential was compared using DPPH scavenging assay. The stability test of prepared cosmetic emulsion was carried out by storing it at various temperatures (4°C, 25°C, 40°C and -10°C) for 28 days. The study included measurements of pH, density, viscosity and organoleptic evaluation of color, odor and consistency of the cosmetic. Among prepared extracts the ethanolic extract showed the highest polyphenolic content (1330.55 µg gallic acid equivalents, GAE/mL) and antioxidant potential (DPPH radical scavenging at 0.39% was above 90%). The weakest antioxidant activity was detected for the aqueous extract. This extract contained also the lowest concentration of polyphenols (23.15 µg GAE/mL). The addition of 0.5% (m/m) dragon's blood extract to the formulation of a prototypic cosmetic emulsion did not influence it's stability during the storage at various temperature conditions.

Obtained results indicate that Dragon's blood extracts are potentially promising active ingredients of cosmetics, however their multifunctional effects on the skins cells and safety of long time application require further investigation.

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Poster presentations

P2: Characterization of chitosan films modified by shellac for further potential cosmetic applications

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Chitosan, produced by the deacetylation of chitin, is a film-forming biopolymer used in biomaterials and cosmetics, which is characterized by wound healing or antimicrobial properties. Chitosan film properties can be modified with many types of substances, nowadays, especially natural ones, which are also readily used in the cosmetic industry. One of the natural compounds, which can be added to modify chitosan film can be shellac, which is a lac-based product obtained from insect secretion mainly *Kerria lacca* living on special types of trees growing in India and Thailand. Shellac, which also has film-forming properties, is a complex compound consisting mainly of polyester resin with a small amount of dyes and waxes [1]. Shellac is widely used in different industries such as food or pharmaceutical, but it is also applied in the products such as paints, varnishes, polishes or textile dyes. In cosmetic formulations, shellac can be found in shampoo, hair spray, nail polish, or mascara acting as a binder [1]. Furthermore, this compound can be used in the encapsulation process for example in perfumes or lipstick [1,2]. The aim of the study was to characterize chitosan films incorporated with shellac. Thus, selected amounts of shellac solution were added to the chitosan solution and films were obtained by solvent evaporation method. The mechanical properties of films were studied by a mechanical testing machine. Moreover, FTIR spectra were registered and swelling properties were analyzed. For obtained film colorimetric measurements were performed by a colorimeter. Performed analysis indicated that shellac addition influences chitosan film properties.

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Poster presentations

P3: Effect of the solvent on the phytochemical content and antioxidant properties of extracts from selected blue flowers

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Flowers are valuable herbal raw materials known for their rich content of active compounds with various beneficial effects. The dominant active substances in flowers can sometimes be identified based on their color. Blue flowers, like cornflower (*Centaurea cyanus*) and Butterfly Pea Tea (*Clitoria ternatea*), are particularly interesting due to their unique composition and properties. Cornflower is a popular herbal raw material with well-known anti-inflammatory properties, while Butterfly Pea Tea, a tropical plant from Africa, has gained popularity recently for its strong antioxidant properties [1].

The aim of this study was to compare antioxidant properties and content of polyphenols in the extracts from *Centaurea cyanus* and *Clitoria ternatea* prepared using water (H2O) or 50% (*v/v*) ethanol (50% EtOH) and ultrasound-assisted extraction. To determine the antioxidant properties, DPPH and ABTS free radical scavenging assays were performed and the content of polyphenols was assessed through spectrophotometric measurement using Folin-Ciocalteu reagents and sodium carbonate [2].

Obtained data indicate that the choice of solvent significantly influences the content of polyphenols and the antioxidant properties of blue flower extracts. *Centaurea cyanus* 50% EtOH extract exhibited better antioxidant properties and a higher content of polyphenolic compounds compared to its aqueous extract. In respect of *Clitoria ternatea* H2O extract contained more polyphenolic compounds and showed stronger antioxidant effect.

This research highlights the crucial role of solvent selection in the extraction process, even when working with herbal raw materials with similar properties, such as those with similar colors. Both *Centaurea cyanus* (50% EtOH) and *Clitoria ternatea* (H2O) extracts are rich in polyphenolic compounds and possess strong antioxidant effects, making them suitable for use in cosmetics for the skin with signs of aging or exposed to harmful external factors.

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Poster presentations

P4: Utilizing *Plantago major* L. in acne management: research insights and applications

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Acne (*Acne vulgaris*) is one of the most common dermatological disorders, affecting a significant portion of the global population. In recent years, there has been a notable increase in interest in utilizing natural skincare products. This study presents research findings regarding the potential use of Plantago major (commonly known as plantain) as an adjunct in combating acne.

Application of Plantain Tonic: The conducted research has shown that extracts obtained from plantain contain substances characterized by anti-inflammatory and antibacterial properties. These bioactive components may play a crucial role in the eradication of bacteria responsible for the development of acne lesions. A personally formulated facial tonic based on plantain has been prepared, demonstrating potential in reducing redness and blackheads, and contributing to overall skin improvement.

Proprietary Formulation of Skincare Products using Plantain Juices: Homemade skincare formulations based on plantain juices and extracts may prove to be an effective and cost-efficient measure in supporting acne-prone skin care. This formulation includes a facial mask and a tonic prepared from plantain leaf juice. The method's significant advantage lies in the easy accessibility of the plant and the absence of complicated preparatory procedures.

Analysis of Effects on Fibroblast Cells: The final section of the study is dedicated to analyzing laboratory-confirmed effects of plantain utilization on fibroblast cells. These specific cells play a pivotal role in collagen and elastin synthesis in the skin. Research indicates that plantain extracts can stimulate fibroblast activity, thereby supporting the healing and regeneration process of acne-affected skin.

Conclusion: The described study suggests that utilizing plantain as a tonic or in a homemade mask formulation may present a promising approach to non-invasive and non-chemical acne management. Additionally, research results on fibroblast cells provide scientific groundwork for plantain's action in skin regeneration processes. However, further clinical investigations are required to fully comprehend the potential of plantain in acne treatment and compare its effectiveness to traditional pharmaceutical anti-acne agents.

Poster presentations

P5: Potential cosmetic application of extracts from aerial parts of eight *Hemerocallis* cultivars

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The *Hemerocallis* (daylily) genus belongs to the *Asphodelaceae* family and *Hemerocallidoideae* subfamily [1]. These taxa are mainly cultivated as ornamental plants in China and American and European countries [2,3]. However, daylilies also possess nutritional and health value [3,4], and are used, especially in Asian traditional medicine [5].

As a response to the growing demand for high-quality cosmetics, one can see an increasing interest in products containing natural plant extracts that are rich in many active substances. As part of the effort to discover new functional components for anti-aging and skin-whitening preparations, eight *Hemerocallis* cultivars cultivated in Poland were investigated, estimating their antioxidant, anti-collagenase, anti-elastase, anti-tyrosinase and antimicrobial properties as well as flavonoid and phenolic acid content.

The flowering aerial parts of eight *Hemerocallis* cultivars [*H. fulva* (L.) L. var. *kwanso* Regel, *H. "Aten"*, *H. "Bożena"*, *H. "Catherine Woodbuery"*, *H. "Chicago Apache"*, *H. "Danuta"*, *H. "Jaskółka"*, *H. "Rebel Cause"*] were collected in the Botanical Garden of Maria Curie-Skłodowska University in Lublin, Poland.

For chemical composition estimation, LC-ESI-MS/MS analysis and spectrophotometric assays were performed. The results show the presence of sixteen compounds in all analyzed species. Among the investigated cultivars, it was found that *H. "Chicago Apache"* and *H. fulva var. kwanso* have the highest total phenolic acid and flavonoid content. The most abundant compounds in all analyzed extracts were chlorogenic acid (209.8 to 1010.0 µg/g of DE) and quercetin-3-*O*-rutinoside (114.7 to 1049.7 µg/g of DE). The studied extracts exhibited moderate to high skin-related activities. These properties were correlated with a high concentration of polyphenols.

The present study demonstrated that *Hemerocallis* cultivars contain significant amounts of phenolic compounds with good skin-related activities and could be interesting as novel sources of bioactive agents for the pharmaceutical, food and cosmetic industries.

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Poster presentations

P6: Phenolic composition and skin-related properties of the aerial parts extract of *Alchemilla peristerica* Pawł.

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The genus *Alchemilla* L. (F. Rosaceae Juss., subfam. Rosoidae Focke) includes a large number of species. Over 300 species have been described in Europe, where large mountain ranges such as the Caucasus, the Alps, the Carpathians, and others with numerous endemic species are likely their main centers of distribution [1]. *Alchemilla* herb has long been used in the folk medicine of Europe and Asia for conditions caused by poor metabolism, as well as in the treatment of eczema, wounds, ulcers, and gynecological issues [2,3].

Due to the significance of the *Alchemilla* species in traditional medicine, the purpose of this research was to assess the skin-related properties of various extracts from the aerial parts of *Alchemilla peristerica*. Additionally, qualitative and quantitative analysis of these extracts was conducted using LC-ESI-MS/MS.

The flowering aerial parts *A. peristerica* was collected in the Botanical Garden of Maria Curie-Skłodowska University in Lublin, Poland. For chemical composition estimation, LC-ESI-MS/MS analysis was performed. All antioxidant (DPPH$^{\bullet}$, ABTS$^{\bullet+}$, Metal Chelating Activity) and enzyme inhibitory (cyclooxygenase-1, cyclooxygenase-2, lipoxygenase) assays were conducted in vitro in 96-well plates. The antimicrobial activity was tested in vitro against i.a. strains as *Cutibacterium acnes*, *Staphylococcus aureus* and *S. epidermidis* bacterial strains.

The results show the presence of thirty six compounds in all analyzed species. The most abundant compounds in all analyzed extracts were protocatechuic acid, gallic acid and isoquercetin. The studied extracts exhibited high skin-related activities. Moreover, they show promise as anti-acne preparations, but importantly, they have antibacterial properties against hospital strains of *E. coli* and resistant MRSA and *Enterococcus* sp.

Based on our results, it can be inferred that *A. peristerica* is a rich source of health-beneficial secondary metabolites. It seems evident that comprehensive future research on phenolic compounds from this species will be of great significance in pharmacy and medicine.

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Poster presentations

P7: Production of phenolic acids important in phytocosmetology in bioreactor cultures of *Aronia x prunifolia* using two biotechnological strategies, precursors feeding and elicitation – preliminary results

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Phenolic acids are antioxidants which exhibit a lot of biological activities important in phytocosmetology, e.g. antioxidant, anti-inflammatory, antibacterial and also antifungal. These plant metabolites could be produced in high amounts in plant *in vitro* cultures [1]. *Aronia x prunifolia* microshoots cultured in different *in vitro* systems produced high amounts of phenolic acids, especially depsides [2].

The aim of present study was to test in bioreactor cultures of *A. x prunifolia* the simultaneously supplementation of the culture medium with biogenetic precursor of phenolic acids – cinnamic acid (CA, 1 mmol/l) and with methyl jasmonate (MJ, 50 µmol/l) as the elicitor. For comparison separately the addition of CA and MJ, on the production of phenolic acids was investigated.

The cultures were maintained in PlantForm bioreactors (Sweden) on the Murashige-Skoog medium [3] with 1 mg/l BAP and 1 mg/l NAA. Precursor and elicitor were added after 14 days of the growth cycles. Microshoots were collected 4 days later. In methanolic extracts from biomasses the HPLC analyses of 26 phenolic acids was performed [4].

In all extracts the presence of the same 9 compounds were confirmed. Their total content in control culture was high – 604 mg/100 g d.w. The main compounds were: 3,4-dihydroxyphenylacetic acid and two depsides, chlorogenic and isochlorogenic acids (110, 178, 168 mg/100g d.w., respectively). The addition of CA resulted in 1.18-fold increase in total content of compounds and influenced high 2.5-fold increase in 3,4-dihydroxyphenylacetic acid content. The addition of MJ resulted in lower, 1.13-fold total content. After simultaneously addition of precursor and elicitor 1.04-fold increase in total content of phenolic acids were confirmed. The main compound was also 3,4-dihydroxyphenylacetic acid (190 mg/100 g d.w.).

On this stage of research the feeding with CA could be proposed as the best strategy for stimulation of phenolic acid production in *A. x prunifolia* microshoot cultures.

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Poster presentations

P8: The effect of two biotechnological strategies, precursors feeding and elicitation on the production of phenolic acids important in phytocosmetology in agitated microshoot cultures of *Aronia x prunifolia* – preliminary results

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Different types of microshoots cultures of *Aronia x prunifolia* established by our team produced high amounts of phenolic acids, especially depsides [1].
Phenolic acids and also depsides possess a lot of biological activities important in phytocosmetology, e.g. antioxidant, anti-inflammatory, antibacterial and also antifungal.
The aim of present investigations was the testing of separate and simultaneously feeding of agitated cultures of *A. x prunifolia* with cinnamic acid (CA) or/and elicitation with methyl jasmonate (MJ) in concentrations: 1 mmol/l and 50 µmol/l, and 0,5 mmol/l and 25 µmol/l, respectively. *In vitro* cultures were maintained on Murashige and Skoog medium with 1 mg/l BAP and 1 mg/l NAA [2].
Precursor and elicitor were added into the culture medium after 14 days of growth cycles. Microshoots were harvested 1,2,4 and 6 days later. In the methanolic extracts 26 phenolic acids were estimated using HPLC method [3].
All studied extracts were found to contain 4 simple phenolic acids: protocatechuic acid, 3,4-dihydroxyphenylacetic acid, caffeic acid, and syringic acid, and 5 depsides: neochlorogenic acid, chlorogenic acid, cryptochlorogenic acid, isochlorogenic acid, and rosmarinic acid. Chlorogenic, isochlorogenic, cryptochlorogenic and neochlorogenic acids were the main compounds.
Control cultures produced high amounts of total phenolic acids (568-706 mg/100g d.w., depending on the duration of growth cycles). CA supplementation significantly increased (1.8-fold) the contents of the studied compounds. The maximum content was documented 2 days after precursors feeding (1027 mg/100g d.w.). MJ supplementation enhanced phenolic acid content also 1.8-fold. The maximum amounts of compounds was observed 6 days after elicitation (1275 mg/100g d.w.).
Combined treatment with the precursor and elicitor stimulated phenolic acid production (1.6-fold). The maximum content of phenolic acids was evidenced after 1 day (1155 mg/100g d.w.).
The best strategy for stimulation of phenolic acid production were separate feeding with CA (1mmol/l) or separate elicitation with MJ (50 µmol/l).

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Poster presentations

P9: Oxytree as a source of natural components for cosmetics

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Paulownia Clon in Vitro 112, also called the Oxytree, is a fast-growing hybrid of two trees belonging to the *Paulowniaceae* family – *P. elongata* and *P. fortunei*. The name Oxytree comes from the fact that this tree emits ten times more oxygen than any other tree.The plant material used for the research was leaves from a private Oxytree plantation located in the village of Łęka, Lublin Province, Poland (21◦ 54'N, 51◦27'E). The owner—Professor Anna Stochmal—has a certificate for cultivation of trees. Leaves, twigs, flowers and fruits were examined for the content of secondary metabolites. The ground plant material was extracted with 5% methanol (*v/v*) and the crude methanol extract was purified stepwise using various chromatographic. Extracts of Paulownia leaves, flowers, fruits and twigs were analyzed by UHPLCESI-MS/MS, using a Thermo Ultimate 3000RS methods. The analysis of the extract from Paulownia Clon in Vitro 112 leaves, shows that the main secondary metabolite was the verbascoside (acteoside), which belongs to the phenylethanoid glycosides. It contained also other phenylethanoides. Iridoids such as catalpol, 7-hydroxytomentoside, as well as flavonoids: glycosides of luteolin, and apigenin, were also found.

Class of Compounds	Concentration [mg/g DM]			
	Leaves	Twigs	Flowers	Fruits
Iridoids	6.73	9.96	3.08	7.36
Phenylethanoid glycosides	10.69	27.21	2.85	19.83
Flavonoids	1.61	+	1.99	+

+ trace amount

Iridoids - (aucubin, katalpol) have antibiotic, bacteriostatic, anti-inflammatory and antiviral properties.
Phenylethanoid glycosides show strong biological and pharmacological activities, such as antioxidant, antibacterial and neuroprotective effects.
Flavonids - they support the protective functions of the skin, protecting it against the harmful effects of UV radiation. They are mainly found in creams and other face skin preparations, with soothing, moisturizing and anti-aging properties. They soothe the ailments of couperose skin.

Poster presentations

P10: The content of polyphenols and antioxidant activity of wines from Pogórze Przemyskie

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Wine is not a typical cosmetic product, however recently it has been gaining interest in this field because of the high content of organic acids and phenolic compounds exhibiting high antioxidant properties. Some "wine-containing" cosmetics appear in the market while the interest of others focuses on the re-use of wine industry by-products. However, the chemical composition of grapes and their antioxidant properties depends mainly on the geographic location, soil type, and environmental and climatic conditions [1].
This study aimed to evaluate the phenolic content and the antioxidant activity of red, white, and rosé wine varieties produced in a small-family Vineyard in Pogórze Przemyskie, Poland. The diatomaceous earth and rainy weather during fruit maturation determine quantitative and qualitative wine polyphenolic content and its antioxidant activity.

Polyphenol content was estimated by measuring total polyphenols, total tannins, total flavan-3-ols, total proanthocyanidins, total hydroxycinnamic acid, and total anthocyanins. Antioxidant activity was determined by DPPH (2,2-diphenyl-1-picrylhydrazyl) and phosphomolybdate tests. The polyphenolic content was evaluated by measuring the total polyphenol, total tannin, total flavan-3-ols, total proanthocyanidins, total hydroxycinnamic acid, and total anthocyanin contents. The antioxidant activity was established in the DPPH (2,2-diphenyl-1-picrylhydrazyl) and molybdenum-reducing activity assays.

Samples of different grape cultivars (red: Izabela, Leon Millot, Rondo, Regent; white: Cristali, Bianca, Seyval Blanc, Aurora, and rosé: Alden, Svenson) and the vinification conditions were analyzed. The highest content of polyphenols (2.09 g/L in terms of gallic acid equivalents), tannins (0.89 g/L in terms of gallic acid equivalents), proanthocyanidins (2.16 g/L), anthocyanins (923.53 mg/L in terms of malvidin-3-glucoside equivalents) and hydroxycinnamic acids (799.70 mg/L in terms of caffeic acid equivalents) was found in the wine obtained from the Rondo. On the other hand, the highest content of flavon-3-ols (155.22 mg/L in terms of (+)catechin equivalents) was observed in the wine from the grape variety Regent. The vinification conditions influenced the resveratrol content in the wine from the Rondo variety. Rondo- and Regent-derived wines displayed high antioxidant capacity in the DPPH assay.

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Poster presentations

P11: Antifungal activity of green tea extracts obtained by different extraction techniques

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Green tea has been known for its health-promoting properties for centuries. This "green gold" comes from China, but is also grown in Japan, Indonesia, Turkey, and India. This is a raw material rich in active ingredients, which, after appropriate isolation, can perform a healing function and help in many infections, especially nowadays, when resistance of microorganisms to drugs is progressing rapidly [1,2].

The aim of this study was to analyze five extracts (E1-E5) obtained by different extraction techniques at the Łukasiewicz Research Network-New Chemical Syntheses Institute in Puławy from Chinese green tea *Gunpowder* in terms of antifungal activity.

The antimicrobial activity of the five extracts was studied against a panel of reference fungi strains from the ATCC (American Type Culture Collection): *Candida albicans* ATCC2091, *Candida albicans* ATCC10231, *Candida auris* CDCB11903, *Candida glabrata* ATCC90030, *Candida glabrata* ATCC15126, *Candida krusei* ATCC14243, *Candida lusitaniae* ATCC3449, *Candida parapsilosis* ATCC22019, *Candida tropicalis* ATCC1369, and *Geotrichum candidum* ATCC34614. Using the double-microdilution method in a liquid medium according EUCAST (European Committee for Antimicrobial Susceptibility Testing) recommendation [3], the MIC (minimum inhibitory concentration) and MFC (minimum fungicidal concentration) values were determined.

The tested E1-E5 extracts showed activity against fungi with MIC=0.06-8mg/mL and MFC=4-8mg/mL. *C. parapsilosis* ATCC22019 and *C. albicans* ATCC2091 were most sensitive (MIC=0.06-0.125mg/mL) to extracts E1,E5 and E1,E3, respectively. However, extracts E4 and E5 inhibited most fungal strains with MIC=0.5-8mg/mL and MIC=0.125-8mg/mL, respectively. While, the extract E3 showed the weakest activity (MIC=2-4mg/mL) against most fungi, except for *C. albicans* ATCC2091 (MIC=0.125mg/mL) and *C. parapsilosis* ATCC22019 (MIC=0.25mg/mL).

Our results showed that the extracts obtained from the Chinese green tea *Gunpowder* had significant fungal inhibiting properties, which indicates their use as potential pharmacological agents.

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Poster presentations

P12: Potential use of essential oils in antifungal skin care

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The allarming development of resistance of microorganisms to antimicrobial drugs makes the search for effective, inexpensive, and readily available natural substances more desirable. Natural products such as essential oils (EOs) can be a potential alternative to antibiotics/chemiotherapeutics and may reduce the negative impact of development of microbial drug resistance [1].

The purpose of this review was to highlight the relevance of researches on antifungal activity of EOs, incluted in herbal cosmeceutics as active substances.

EOs: lavender, spike and tea tree, widely available on the market, were used in the creams. Minimum inhibitory concentration (MIC) of the creams with EOs for reference strains American Type Culture Collection (ATCC), including fungi: *Candida albicans* ATCC 10231, *Candida glabrata* ATCC 90030, and *Trichophyton mentagrophytes* ATCC 9533 was performed by the microdilution broth method according to the EUCAST guidelines [2].

As our results showed, the creams with EOs were characterized by different activity against tested fungi (MIC = 2.5-10 mg/mL) regardless of the concentration of these oils (0.5% or 1%). Cream with lavender EO of was most effective against *T. mentagrophytes* ATCC 9533 (MIC = 2.5 mg/mL), which causes mycosis of the scalp (tinea capitis), beard (tinea barbae), limbs (tinea corporis), face (tinea faciei) and skin of the trunk.

This research only confirms our previous reports, that lavender oils from different species of this plant have a very good antifungal effect [1]. Whereas, differences in the antifungal activity of EOs may be due to the physical, molecular, and chemical properties of essential oils, and the sensitivity of pathogens to quantitative differences in oil components [3]. This studies demonstrated that the use of EOs in both cosmetic products (creams) and those associated with dermatology may lead to satisfying results in the treatment of numerous fungal skin infections.

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Poster presentations

P13: Liquid culture of *Salvia bulleyana* as a source of rosmarinic acid, a compound with interesting cosmetic applications

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Salvia bulleyana Diels. is a folk medicinal plant native to Chinese Yunnan Province. This species has therapeutic potential in relation to vascular and heart diseases. It has been also used in the treatment of liver fibrosis, osteoporosis, inflammatory diseases, and insomnia [1]. The pharmacological properties of the plant are mainly due to the presence of polyphenolic acids such as rosmarinic acid, caffeic acid, and salvianolic acids [1].

The aim of the study was to obtain liquid shoot culture of *S. bulleyana*, which would provide a high amount of raw material rich in rosmarinic acid in a short time. *S. bulleyana* shoot tips were cultivated in MS medium (Murashige and Skoog) [2] supplemented with 0.1 mg/l IAA (indole acetic acid) and 1 mg/l m-Top (meta-topolin) in various liquid systems: liquid shaken medium, liquid stationary medium without support, and with cellulose or polyurethane as support and, for comparison, on a solid medium. After 5 weeks of cultivation, culture biomass, and rosmarinic acid accumulation were determined.

It was found that shoots of *S. bulleyana* are sensitive to continuous immersion in the medium and shaking, and require support materials for effective growth and proliferation in a liquid medium. The medium, when cellulose was used as supported material, turned out to be the most beneficial for biomass accumulation and shoot proliferation. The liquid system with cellulose also proved beneficial for the production of polyphenols including predominant rosmarinic acid. Its content under these conditions, amounting to 42.85 mg/g dry weight, was about 2 times higher than that found in the control shoots grown on the solid medium and 7 times higher than in aerial parts of field-grown *S. bulleyana* plants [3].

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Poster presentations

P14: Polyphenol profiling of agitated microshoot cultures of *Schisandra henryi*

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Schisandra henryi C.B. Clarke (Schisandraceae) is an endemic species that occurs naturally in China Yunnan Province. This species, which is extremely valuable in traditional Chinese medicine and is difficult to obtain, can be grown alternatively through plant biotechnology [1]. Modern cosmetology has high hopes for receiving substances of natural origin through biotechnology methods [2].

The aim of our study was to evaluate the polyphenol compounds production in agitated microshoot cultures of *S. henryi*.

As part of the research, agitated cultures of *S. henryi* were initiated and carried out on a liquid medium acc. to Murashige and Skoog [3] containing plant growth regulators: 2 mg/l indolyl-3-butyric acid and 0.5 mg/l 6-benzyladenine. The experiment was carried out in flasks on an Ohaus shaker (120 rpm). The duration of the breeding cycle was 30 days (3 series).

The polyphenolic compounds were determined qualitatively by UHPLC-DAD-ESI-MS and quantitatively by HPLC-DAD in the methanolic extracts from experimental cultures [4]. Qualitative analyzes confirmed the presence of 8 phenolic acids: chlorogenic, 3,4-dihydroxyphenylacetic, gallic, neochlorogenic, protocatechuic, syringic and vanillic, and derivatives: protocatechuic acid *O*-hexoside and coumaroylquinic acid isomer; 7 flavonoids: hyperoside, kaempferol, quercetin, quercitrin, rutoside and trifolin, 1 flavanol: catechin; and procyanidins: dimeric, trimeric, tetrameric, and penatmeric. Quantitative analyzes were performed for the main compounds. The highest content was found for 3,4-dihydroxyphenylacetic acid - 293.36 mg/100g. The obtained results suggest that agitated cultures of *S. henryi* can be proposed as an alternative source of polyphenols for cosmetic use.

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Poster presentations

P15: Polyphenols profiling and antioxidant activity of extract from *Schisandra henryi* suspension cultures

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Polyphenols are plant derived compounds of high desired in the cosmetic industry. They show high antioxidant, anti-inflammatory and antimicrobial activities [1]. One of the innovative sources of bioactive compounds are plant *in vitro* cultures. Our previous studies have shown that the phytochemical profile of *S. henryi* microshoot culture extracts contain compounds from the group of flavonoids and phenolic acids [2].

The aim of this study was to quantify polyphenolic compounds, to evaluate the total antioxidant potential and the total polyphenol content of *S. henryi* suspension culture extracts.

Studies were carried out on *S. henryi* suspension cultures which were carried out in the liquid medium acc. to Murashige and Skoog [3] containing plant growth regulators: 2 mg/l of indolyl-3-butyric acid and 0.5 mg/l of 6-benzyladenine. The experiment was carried out in flasks on an orbital shaker over 10, 20 and 30 days breeding cycles (3 series).

From the obtained biomass, methanol extracts were prepared. The polyphenols were determined by the DAD-HPLC method [4]. DPPH (1,1-diphenyl-2-picrylhydrazyl) and Folin-Ciocâlteu methods were used to determine the total antioxidant activity and total polyphenol content, respectively. The results of biological activity of extracts from suspension cultures were compared with the parent plant assays.

Qualitative and quantitative analyzes confirmed the presence of 8 phenolic acids: gallic, caftaric, neochlorogenic, 3,4-dihydroxyphenylacetic, chlorogenic, vanillic, caffeic and syringic, and 6 flavonoids: hyperoside, rutoside, quercitrin, trifolin, quercetin and kaempferol.

The total antioxidant potential of *in vitro* cultures was equal to 75.54% of oxidation process inhibition, and was comparable to the results from leaves (76.13% oxidation inhibition). The total polyphenol content of *in vitro* cultured biomass was equal to 2.40 mg GAE/ml, and was comparable to the results obtained for the leaf extracts (2.79 mg GAE/ml).

The results indicated high potential of *S. henryi in vitro* cultures as the source of antioxidant compounds.

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Poster presentations

P16: Hybrid derivatives of cinnamic acid and amino acids as promising new depigmentation raw materials

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Skin hyperpigmentation can have various causes, it is an aesthetic problem that negatively affects self-perception and thus the quality of life. Melanogenesis is a multi-stage process of melanins formation. We can distinguish three main stages of this process. The first is the synthesis of tyrosinase, the key enzyme that catalyzes the first two reactions of melanin formation. The second - the conversion of dopachinone to eumelanins and pheomelanins. The last, involves the transfer of melanins from menanocytes to surrounding keratinocytes [1].

Numerous substances showing a brightening effect on discoloration are used in the pharmaceutical and cosmetic industries. They mainly affect the metabolic pathway of melanogenesis related to melanin synthesis (by inhibiting tyrosinase) and its distribution. Despite this, they still show limitations, not only technological but also biological [2]. Cinnamic acid is a substance of natural origin, extracted from cinnamon essential oil, commonly used in cosmetics and pharmacy, most often as a fragrance. Cinnamic acid has an (E)-β-phenyl-α,β-unsaturated carbonyl group in its molecule, which plays an important role in tyrosinase inhibition [3].

The aim of the study was to obtain an effective tyrosinase inhibitor substance of natural origin – hybrid derivatives of cinnamic acid and amino acid. For this purpose, the N-acylation reaction yielded derivatives of which purity and identity were confirmed by spectrophotometric and chromatographic methods LC-MS. The inhibitory activity of the derivatives against tyrosinase was then tested using mushroom tyrosinase and L-DOPA as a substrate. Table 1. presents tyrosinase inhibitory activity of compound A-104 in various concentrations.

Concentration [μM]	Inhibition [%]	SD	IC_{50} [μM]
500.0	66.48	1.59	144.37 ± 7.09
250.0	58.51	0.78	
125.0	48.58	0.94	
62.5	37.24	1.36	

Table 1. Mushroom tyrosinase inhibition assay by compound A-104.

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Poster presentations

P17: Phenolic profile and antioxidant potential of extracts from bioreactor grown *Naturtium officinale in vitro* culture

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Nasturtium officinale R. Br. (Brassicaceae) is an aquatic, partially protected perennial plant in Poland. It possesses scientific proven e.g. antioxidant, hepatoprotective and anticancer activities[1].
The aim of the studies was to evaluate the influence of secondary metabolites biogenetic precursors - phenylalanine (Phe) and tryptophan (Trp) supplementation into culture media on the antioxidant potential of extracts from *N. officinale* microshoot cultures grown in bioreactors.
N. officinale microshoots were cultivated in the Plantform™ temporary immersion systems containing 500 mL of the Murashige and Skoog (MS)[2] medium with 1 mg/L 6-benzyladenine and 1 mg/L 1-naphthaleneacetic acid. Phe or Trp were added to the experimental cultures at the beginning (day 0) or on day 10 of the 20 days growth periods. The following concentrations of Phe and Trp were tested: 0.05, 0.1, 0.5, 1.0, and 3.0mM. Control cultures grown without the precursors. The qualitative and quantitative analysis was performed using HPLC-DAD method[3,4]. Samples were tested for antioxidant potential by CUPRAC[5], DPPH[6] and FRAP[7] assays.
Two phenolic acids (*p*-coumaric and ferulic) and one flavonoid (rutoside) were estimated in extracts of the experimental *N. officinale* microshoot cultures. The highest *p*-coumaric acid content (29.11 mg/100 g DW) was obtained after cultivation with 0.5mM Trp (day 10). For ferulic acid, the best result (27.76 mg/100 g DW) was obtained for 3.0mM Phe (day 0). For rutoside, the highest amount (16.03 mg/100 g DW) was obtained for 0.1 mM Trp (day 10). Antioxidant potential increased the most for 0.1 mM Phe (day 0) (CUPRAC - 3.05 mmol Trolox equivalent (TE)/100 g DW, FRAP - 0.94 mmol TE/100 g DW), and with 0.5 mM Trp (day 10) (DPPH – 0.90 mmol TE/100 g DW).

Studies showed the stimulating effect of precursors supplementation in Plantform bioreactors on the production of polyphenols and antioxidant activity of *N. officinale in vitro* cultures.
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Poster presentations

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Poster presentations

P18: The studies on glucosinolates production and antimicrobial properties of extracts from bioreactor grown *Naturtium officinale in vitro* culture

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Nasturtium officinale R. Br. (Brassicaceae) - watercress, is an aquatic plant, partially protected in Poland. *N. officinale* herb is a valuable medicinal and cosmetic raw material. Extracts from the *N. officinale* herb are increasingly used in cosmetic preparations, due to antimicrobial, anti-inflammatory and anti-aging effects [1]. The aim of the study was to evaluate the influence of secondary metabolites biogenetic precursor - phenylalanine (Phe) supplementation into culture media of *N. officinale* microshoot cultures grown in bioreactors on the glucosinolates production and antimicrobial properties.

N. officinale microshoots were cultivated in the Plantform™ temporary immersion systems containing 500 mL of the Murashige and Skoog (MS) [2] medium with 1 mg/L 6-benzyladenine and 1 mg/L 1-naphthaleneacetic acid. Phe (3.0 mM) was added to the experimental media at the beginning (day 0) of the 20 days growth period. Control cultures grown without the precursors. The qualitative and quantitative analysis was performed using UHPLC-DAD-MS/MS method [3,4]. The antibacterial potency (disc diffusion assays [5]) of microshoot extracts was evaluated using bacterial strains causing skin diseases, such as: *Staphylococcus aureus, Staphylococcus epidermidis, Propionibacterium acnes* and *Propionibacterium granulosum*. The extracts were subjected to a cell culture experiment using normal human fibroblasts. The cells viability was assessed using the MTT assay [6].

Phe stimulated the most production of 4-methoxyglucobrassicin (149.99 mg/100 g DW) and gluconasturtiin (36.17 mg/100 g DW) and it was respectively 11.7 and 2.3 times higher than in control cultures.

The extracts of microshoots showed the most promising bacteriostatic activity against *P. acnes* strains (MIC 250–500 µg/mL). No extract was cytotoxic to normal human fibroblasts over the tested concentration range (up to 250 µg/mL). The study showed innovative cosmetic possibilities of utilization of extracts from *N. officinale* bioreactor grown cultures.

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Poster presentations

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Poster presentations

P19: Safety determination of extract from Inonotus obliquus as a potential anticancer additive to cosmetics

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Inonotus obliquus belongs to fungus, which is classified as a tree parasite. Extract from I. obliquus are comonnly used in folk medicine for hundreds of years, which is based on its pro-health properties. Given the reports, *Inonotus obliquus* extracts show strong antioxidant activity , manifesting inter alia by affecting the antioxidant enzymes and reactive oxygen species (ROS) levels. Moreover, the anti-inflammatory, and anticancer properties of *I. obliquus* have been shown. The purpose of our study was to determine the effect of two extracts from *Inonotus obliquus* fruiting body - aqueous (A) and alcohol (B) ones on an antioxidant activity, impact on metabolism and certain gene expression in hepatoma cells (Hep-G2) .

Firstly, the antioxidant properties of the extracts were determined, using the DPPH method. Moreover, protein and polyphenol content were also measured in obtained extracts. Next, the metabolic activity of Hep-G2 cells was measured using resazurin reduction assay. In the last part of our study the expression of *KI67*, *HOX*, *PXR*, *NFKB2*, and *CYP1A1* genes were measured by RT-qPCR method. The results showed that both extracts reduced the proliferation of Hep-G2 cells, which was also confirmed by a decrease in *KI67* mRNA expression (well-established marker of proliferation). Additionally, both extracts increased *NFKB2* mRNA expression, which suggests an anticancer effect of the tested extracts in Hep-G2 cells [1]. On the other hand, the decrease in *HOX* mRNA expression correlated with the intracellular ROS level confirm the mitigating effect of tested solutions on oxidative stress.

In conclusion, the tested extracts from *Inonotus obliquus* exhibit oxidative stress-mitigating effects and may be a safe addition to cosmetics with a potential anticancer mechanism of action.

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Poster presentations

P20: : Centrifugal partition chromatography (CPC) as a tool for the isolation of natural products with cosmetic significance: an example of magnoflorine.

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Centrifugal Partition Chromatography (CPC) is an analytical technique that uses two immiscible solvents (liquids) to separate single constituents or provide enriched fractions from rich mixtures of components, like plant extracts. Lack of solid support, low operational costs, simple upscalability, high selectivity and – most importantly – high recovery rate, make this technique a leading one for an industrial production of active ingredients [1].

To prove the efficiency of this technique in the recovery of single constituents of plant extracts, an application of CPC for the isolation of magnoflorine from the methanolic root extract from the commonly distributed shrub: *Berberis vulgaris* L. will be presented.

Magnoflorine is a quaternary aporhine alkaloid, well known from its various pharmacological activities, including the antifungal properties, the inhibitory potential against Candida strains [2], the antioxidant activity induced by the presence of phenolic groups in its structure, or tyrosinase inhibitory potential [3] all of which can be useful in the production of cosmetics. So far, various plant extracts were indicated as sources of magnoflorine, including plants that belong to very distant botanical families like Berberidaceae or Papaveraceae and Magnoliaceae.

For the separation, the CPC instrument was operated in the selected biphasic solvent system composed of chloroform: methanol: water (4:3:3 v/v) in the descending elution (50 min) – extrusion (36 min) mode [4]. Magnoflorine was isolated with high purity exceeding 96.2% after 60 min of the analysis from the crude extract. The method that was developed on an analytical 250 mL-volume column can be easily upscaled to preparative or industrial conditions.

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Poster presentations

P21: Fractionation of polyphenols from *Reynoutria japonica* extract by centrifugal partition chromatography (CPC)

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Reynoutria japonica is a rich source of polyphenols, anthraquinones and stilbenes, in particular emodin, which has anticancer, anti-inflammatory, antioxidant, antimicrobial, and neuroprotective properties [1].
The purpose of our research was the development of the optimal methodology for the fractionation of extract and isolation of single molecules that can have application in the cosmetic and pharmaceutical industry. For this purpose counter-current chromatography was used that enables high loadings, selectivity and repeatability of separating conditions.
Crude methanolic extract from 50 g of finely crushed plant material of *Reynoutria japonica* was used for the preparation of a biphasic solvent system for a succeeding CPC separation. For the selection of the best system and the calculation of partition coefficient values HPLC chromatography was used. The most promising conditions of separation were achieved for the solvent system composed of petroleum ether:ethyl acetate:methanol:water (4:5:4:5). During the 120-minute-long separation, the upper phase was used as mobile phase, whereas the lower phase – as the stationary phase. The isolation conducted with help of CPC chromatograph (SCPC-250-L, Armen Instruments) resulted in 50 fractions that were later characterized by HPLC-ESI-QTOF-MS/MS instrumentation. The most pure ones were directed to preparative HPLC and purified to the value exceeding 90 % - and were used for bioactivity determination. Among the isolates glucosides of emodin were found in the fractions.

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Poster presentations

P22: Rose essential – storage effect on essential oil content in rose petals

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Rose essential oil is one of the most valuable fragrance substances of natural origin. It is obtained from rose petals and widely used within cosmetics and personal care sectors as well as in aromatherapy, medical applications. The use of essential oils from natural sources is preferable over artificial ones, year by year increasing the demand. In 2022 the global market of rose oil reached US$ 2.4 billion and is supposed to grow by 6.72% till 2028.

The quality and content of rose essential oil depends on species, climate, soil, stage of flower development, weather, or even the daytime. Drying and storage processes also significantly influence the quality of rose petals due to volatilization and degradation of the compounds.

In the presented studies, 5 different Rosa species: *R. x alba*; *R. x damascena* 'Rose de Resht'; *R. gallica* 'officinalis'; *R. x portlandica* 'Comte de Chambord' and *R. centifolia* 'Tour de Malakoff' were analyzed. Fresh, dry (35°C, 12h), and long-time stored (4 years) petals were analyzed using the GC-MS method. The extraction process was carried out using HS-SPME, solvent extraction (hexane), and stem distillation.

The strong rose fragrance was palpable in each of the tested raw materials. Rose oxide (cis- and trans-) was detected in all analyzed species, while it was the most abundant in fresh petals of *R. portlandica*. Citral and neral were the main components of fresh *R. damascena*, *R. portlandica*, and *R. gallica*, while during drying content of both compounds significantly decreased. Rosefuran, perillene, and rose oxides were detected in each specie in fresh petals. Drying caused a loss of perillene in all samples, although rosefuran and rose oxides were still detectable in *R. damascena* and *R. portlandica*. In the long term stored petals hydrocarbons were the most abundant compounds (more than 60%) but in *R. damascena* rose oxide was still detected.

Poster presentations

P23: The fruits of selected Cotoneaster species as a source of valuable ingredients with skin related properties used in cosmetology

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Fruits of plants belonging to the Rosaceae family, including *Cotoneaster* genus, are of great interest to dermatology researchers and cosmetologists, due to their diverse pharmacological and biological effects on the skin. Moreover, these plants are abundant in active ingredients. Increasingly, studies are being conducted on various *Cotoneaster* species used in traditional Asian medicine; however, data on fruits of *Cotoneaster nebrodensis* and *C. roseus* are still lacking.

Taking this into account, the main purpose of this research was to fill the aforementioned knowledge gap by providing information regarding the chemical composition and valuable biological activities of 60% ethanol and methanol-acetone-water (3:1:1; MAW) extracts obtained from the fruits of two *Cotoneaster* cultivars collected in the Botanical Garden of Maria Curie-Skłodowska University in Lublin, Poland.

The total flavonoid content (TFC) and total phenolic content (TPC) were determined using colorimetric assays. The chemical composition of the extracts was determined using LC-MS method. Antioxidant assays, namely DPPH, ABTS and CHEL (Metal Chelating Activity), were conducted spectrophotometrically. Among the enzyme inhibition tests, inhibitory activity against cyclooxygenase-1 (COX-1), cyclooxygenase-2 (COX-2), lipoxygenase and hyaluronidase was evaluated.

The research showed that investigated plant material was rich in phenolic compounds. Flavonoids (especially (+)-catechin) and phenolic acids (chlorogenic acid, 3-*O*-*p*-coumaroylquinic acid) were found to be predominant. The tested extracts exhibited moderate concentration-dependent scavenging activity. The MAW extract from the fruits of *C. roseus* demonstrated significant inhibition of lipoxygenase activity, higher than indomethacin used as a positive control. The MAW extract from the fruits of *C. nebrodensis* showed significant activity against COX-2. The mentioned extracts were also noted for their noteworthy hyaluronidase inhibition.

Understanding the chemical composition and skin related properties of the investigated *Cotoneaster* fruits will be crucial for expanding our knowledge of traditional Asian medicine and will be useful for the application of new plant-based materials in the cosmetic industry.

Poster presentations

P24: Rosmarinic acid production in transformed shoots of *Salvia bulleyana* cultivated in temporary immersion systems

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Medicinal plants are used for centuries and they gain in popularity. Their applications are due to the presence of bioactive metabolites, among which polyphenols are particularly valuable. One of the more recognized polyphenols is rosmarinic acid (RA). Its strong antioxidant effect related to the scavenging of free radicals and the inhibition of lipid peroxidation is used not only in the medicine, but also in cosmetology. It was confirmed that RA can provide cytoprotection against the adverse effects of UV radiation, enable skin regeneration and delay the aging processes. The compound scavenged free radicals, increased the activity of antioxidant enzymes, and attenuated UVB-induced macromolecular damage [1].

Due to the high RA value, the demand for this compound is constantly increasing, which prompts the search for its alternative sources. Plant *in vitro* systems offer many opportunities for obtaining high-quality raw materials. Due to the optimization of culture conditions and up-scaling of cultivation, a consistent and high concentration of RA in plant material can be achieved.

The aim of this study was to increase the scale of *Salvia bulleyana* shoot cultivation in temporary immersion systems: PlantForm and Rita to obtain a high content of rosmarinic acid. The cultivation lasted 5 weeks, and the shoots were immersed in the growth medium for 3 minutes, every 90 minutes. RA accumulation in the culture was determined by HPLC analysis.

Growth of the transgenic *S. bulleyana* culture in both types of bioreactors was very effective which was manifested by high proliferation ratios and biomass accumulation. RA content in shoots growing in PlantForm bioreactor achieved 48.3 mg/g DW (dry weight) and was 10% higher than in those from Rita system (43.9 mg/g DW). Finally, cultivation in bioreactors allowed to reach almost 7-8 times higher amount of RA than in the shoots of 2-year-old mother plants [2].

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Poster presentations

P25: Establishment of transformed *Salvia yangii* roots for high production of polyphenolic compounds

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Salvia yangii Drew (family Lamiaceae) is a perennial shrub whose natural habitat range from East of Iran to Tibet and South-West China. The plant has antibacterial activity, it is used to heal wounds and as a remedium in the treatment of fever. The water extract of *S. yangii* has been considered a strong remedy against dermatitis and sunburn. To date, biological studies on the species and its phytoconstituents are few, but they show its promising potential [1]. The activity of species can be attributed to the presence of polyphenolic compounds, especially rosmarinic acid (RA). The strong antioxidant and anti-inflammatory properties of RA have been used to protect the skin against the unfavorable impact of external factors [2]. Cosmetic formulations which contain in their composition polyphenolic compounds improve skin elasticity and smoothness, accelerate regeneration and delay the aging processes [3].

The aim of the study was to obtain transformed roots of *S. yangii*, characterized by stability, fast growth and high content of polyphenols, especially RA. In the experiment, hairy roots were initiated by pricking the shoots with a needle immersed in a suspension of two strains of Rhizobium rhizogenes bacteria: ATCC15834 and A4. Roots were formed in both cases, but the effectiveness of their formation depended on the strain used. A higher efficiency of transformation was noted when the A4 strain was used (41.3% vs. 30.2%). Then, the obtained roots were transferred to a liquid WP medium [4] containing cefotaxime to eliminate bacteria. Finally, 8 lines characterized by intensive growth were selected and their transgenic character was confirmed by PCR (Polymerase Chain Reaction). The content of RA and total phenols in 4-week-old roots was determined using the HPLC (High-Performance Liquid Chromatography) method ranged depending on the root line between 0.96 - 10.83 mg/g dry weight (DW) and 2.81-15.42 mg/g DW, respectively.

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Poster presentations

P26: The authentication of some essential oils for quality control by using spectroscopy methods combined with chemometric tools

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The ability to quickly identify the chemical composition of plants is important, especially for the natural essential oils, and can be used in the food, cosmetic, perfumery, pharmaceutical and medicine industries. The natural essential oils are often adulterated by using diluted essential oil solutions or by adding cheaper synthetic ingredients, that may impact on the quality of product [1].

In the quality control, the most commonly are used methods of analysis for the identification of chemical compounds, such as: nuclear magnetic resonance spectroscopy (NMR), infrared spectroscopy (IR), Raman spectroscopy, mass spectrometry (MS) and chromatographic methods (GC, GC-MS). By using a combination of spectroscopic methods and chemometric tools, false declarations of producers and adulterations used in the production of essential oils can be detected [1,2].

The authentication of essential oils from lavender, citronella, peppermint, pine, rosemary, patchouli, neroli, orange, sandalwood, rose was subjected. The spectroscopy methods combined with chemometric tools such as hierarchical cluster analysis (HCA), principal component analysis (PCA), discriminant analysis(DA), partial least squares-discriminant analysis(PLS-DA) were able to classify of the authentic samples from adulterated [2,3].

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Poster presentations

P27: *Boswellia serrata* as an active ingredient in emulgel formulations designed for post-radiotherapy skin care

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The use of herbal extracts as the source of antioxidant substances capable of neutralizing free radicals and providing protection from ionizing radiation appears to be an alternative therapy for radiodermatitis [1]. Due to presence of boswelic acid one of the most promising herb is *Boswellia serrata* [2].

The aim of the study was to develop an emulgel – formula known for easy application and fast absorption, which are vital in post-radiation skincare to address pain and skin damage, containing *Boswellia serrata* extracts.

The obtained emulgels were stable. They were white in color, with homogeneous smooth and creamy-gel consistency. They also had an intense herbal smell. They belonged to the group of non-Newtonian shear-thinning fluids with a flow limit, which is beneficial when applied to the skin affected by the disease. Their pH was in the range of 4.57-6.12, which makes them suitable for sensitive skin. Among the prepared preparations, the emulgel containing the extract obtained by the Soxhlet method (1.25 wt%) and essential oil (1 wt%) turned out to be particularly promising (sample Em_SO). It showed high antioxidant activity (inhibition percentage 11.69%) and high content of polyphenols (3.63 mg/dm^3) compared to the placebo sample, where the percentage of inhibition and polyphenol content was 4.67% and 1.63 mg/dm^3, respectively. Sensory studies also showed that Em_SO was well rated in terms of consistency (4.00), absorption (4.43) and hydration (4.71).

Boswellia serrata with anti-inflammatory, antioxidant, antibacterial and regenerative properties have great potential to become key ingredients in the formula of onco-cosmetics, intended for the care of skin affected by radiodermatitis.

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Poster presentations

P28: Cosmetic formulations based on konjac glucomannan

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Polymers of natural origin are a group of biocompatible, biodegradable and non-toxic substances with broad application potential. They are used in biomedicine, food and cosmetics because of their safety.
Konjac glucomannan (KGM) is a polysaccharide obtained from the tuber of *the Amorphophallus konjac* plant [1]. This polymer consists of D-mannose and D-glucose units linked by a β-1,4-glycosidic linkage in a ratio of 1.6:1 or 1.4:1, depending on the species [2]. It is water soluble, has a high viscosity, the ability to absorb water, forms a gel, and exhibits film-forming properties [2, 3]. In the cosmetic industry, this biopolymer can be used as a carrier for active ingredients and as a thickener in various types of formulations. The film-forming properties of glucomannan result in a material that can be easily applied to the skin. By enriching the polymer matrix with active ingredients, a product with new properties can be obtained.
In this study, a formulation for topical application on the skin was developed based on glucomannan with the addition of an L-ascorbic acid derivative. Polymer films with 3 different concentrations of the active ingredient were obtained by solvent evaporation method. FTIR spectra of the obtained materials were performed and the materials were evaluated for their mechanical properties, swelling capacity and effect on skin parameters. The properties of films with different additive concentrations were compared.

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Poster presentations

P29: *Houttuynia cordata* – the source of antioxidant compounds

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Houttuynia cordata is a perennial plant that has been widely used in traditional Chinese medicine and folk medicine in Asian countries for centuries. It is a rich source of many biologically active metabolites such as flavonoids, alkaloids and volatile oil. It shows multidirectional properties, including antioxidant, anticancer, anti-inflammatory, immunomodulatory, anti-allergic, antiseptic, antidiabetic, and diuretic. In addition, this species is used as a food product and as cosmetic raw material in Asia. Currently, it is increasingly used in conventional medicine [1].

The purpose of the study was to analyse the polyphenolic profile of the extract of the plant and establish *in vitro* cultures of *H. cordata* to use them as a source of phenolic acids and flavonoid compounds. Shoot cultures were maintained on Murashige and Skoog agar medium variants enriched with plant growth regulators, 6-benzylaminopurine and naphthyl-1-acetic acid. Qualitative and quantitative chromatographic analysis of the extracts was performed using high-performance liquid chromatography (DAD-HPLC).

The presence of flavonoids (quercetin, quercimeritrin, hyperoside, rutoside, isoquercetin, quercitrin), phenolic acids (protocatechuic, chlorogenic, neochlorogenic, cryptochlorogenic acid) and catechins (epigallocatechin) was detected in each extract analysed from the parental plant, *in vitro* culture biomass, and commercially available herb of *H. cordata*.

The total content of flavonoids (1020.08 mg/100g DW), phenolic acids (423.63 mg/100g DW), and catechins (max. 144.84 mg/100g DW) in the parental plant extract was very high. This shows the potential of the studied species. Quercetin and its glycosides, present in the highest amounts in the extracts (quercitrin, max. 705.53 mg/100g DW, parental plant) have, among other properties, a strong antioxidant potential. Nevertheless, the amount of secondary metabolites in *in vitro* cultures was lower than in the plant material. Further optimization of a growth condition, type of culture and medium choice conducive to the biosynthesis and accumulation of secondary metabolites *in vitro* is required.

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Poster presentations

P30: Polyphenolic metabolites production in *in vitro* cultures of *Scutellaria brevibracteata* subsp. *subvelutina* (Rech.f.) Greuter&Burdet

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Scutellaria brevibracteata subsp. *subvelutina* (*Lamiaceae*) is one of the lesser-known plants of the skullcap genus. Occurs in rocky habitats in the region of Palestine, Syria, Lebanon, Turkey, and Saudi Arabia. Based on the results of earlier studies on the chemical composition of other *in vitro* cultures of *Scutellaria* species, it was recognised that they are a promising research object and, like other species, can be a source of metabolites with medicinal and cosmetic applications [1].

The aim of this study was to assess the usefulness of bioreactor cultures of *S. brevibracteata* subsp. *subvelutina* for the production of secondary metabolites *in vitro*. Shoot cultures in PlantForm bioreactors were maintained for four weeks on Murashige and Skoog medium with the addition of various concentrations of 6-benzylaminopurine and 1-naphthylacetic acid. Qualitative and quantitative analysis of the content of secondary metabolites in the biomass extracts was performed by DAD-HPLC. Obtained results were compared with the results of agar cultures maintained under the same conditions.

The presence of six phenolic acids, two phenylpropanoid glycosides and seven flavonoids characteristic of the genus *Scutellaria* was confirmed in the extracts tested. The quantitatively dominant metabolites were ferulic acid, verbascoside, wogonoside, chrysin and scutellarin. In bioreactor cultures, the highest total content of phenolic acids (121.82 mg/100 g DW) and phenylpropanoid glycosides (541.46 mg/100 g DW) was obtained (7.9 and 1.2 times higher than in agar cultures, respectively). While flavonoid content (298.99 mg/100 g DW) was 1.9 times lower than in agar cultures. Important is that the increase in biomass of bioreactor cultures was 2.2 times higher than in agar cultures [2].

The evaluation of the obtained results allows us to conclude that *in vitro* shoot cultures of the tested species maintained in bioreactors are a valuable source of secondary metabolites of phenolic structure.

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Poster presentations

P31: Lipid nanoparticles as carriers of selected representatives of polyphenols with potential therapeutic effect in the treatment of skin disorders

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The aim of the study was to obtain stable systems of lipid nanoparticles (NLC) with a selected polyphenol – quercetin as an active ingredient showing potential activity for skin disorders.
Nanostructured lipid carriers (NLC) were obtained by ultrasonification technique (HPH). The systems stability was assessed by microscopic observation and viscosity measurements. The physicochemical properties of both incorporated and non-incorporated carriers were examined. In vitro release studies of active were performed using cellulose membrane and the mixture of PBS/ethanol as a receptor solution.
The influence of individual solid and liquid lipids in various weight ratios on the viscosity of the systems was determined. Moreover, the influence of quercetin on systems with different solid lipids and thus liquid lipids and the influence of the increase in quercetin concentration on the viscosity of the tested sample were analyzed.
Release study of quercetin from NLC indicated its prolonged and controlled release profile. On this basis, a mathematical model that best describes the kinetics of the active substance release from the tested carriers were fitted.
The conducted research gave promising results allowing to conclude that the obtained NLC may be a potential carrier of quercetin which possess the therapeutic effect in the treatment of skin disorders.

Poster presentations

P32: Coastal plant extracts - potential ingredients of skin care and protective cosmetics

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Coastal plants are characterized by their existence in challenging environmental conditions, exposing them to strong wind, sunlight and high soil salinity. For these reasons, they have developed special adaptive traits that help them survive in unfavorable environments. One such feature is the biosynthesis of metabolites with multidirectional protecting effects from abiotic stress. The content of such active components makes coastal plants an interesting raw material for cosmetic preparations that protect the skin from the negative effects of harmful environmental factors [1].

The aim of the presented research was to analyze the cosmetic potential of aqueous and hydroethanolic (70%, *v/v*) extracts from the leaves and flowers of costal plants grown in Croatia: sea fennel (*Crithmum maritimum* L.) and sea lavender (*Limonium vulgare* Mill.). The extracts were compared for antioxidant activity (DPPH and ABTS scavenging), polyphenolic content, tyrosinase inhibition and cytotoxicity against HaCaT keratinocytes *in vitro*. For both plants the hydroethanolic extracts contained higher amounts of polyphenols than aqueous extracts. Among the parameters compared were the determination of antioxidant capacity by neutralizing synthetic DPPH free radicals, the content of polyphenolic compounds, and the determination of cytotoxicity of the extracts against keratinocytes - a human epidermal cell line (HaCaT).

Based on the conducted research, it was found that extracts of sea lavender showed higher cosmetic potential than extracts of sea fennel. All analyzed extracts have high antioxidant capacity. The highest content of polyphenolic compounds was determined in the aqueous-ethanolic extract of sea lavender flowers. Extracts from coastal plants do not show high toxicity to epidermal cells, but the greatest decrease in cell viability was observed for the aqueous extracts from sea lavender flowers and the aqueous-ethanolic extract from sea fennel flowers.

To sum up, extracts from sea lavender have a high potential for action on the skin and can be used as active ingredients in care and protective cosmetics.

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Poster presentations

P33: Hydroalcoholic green coffee bean extract effectively protects human skin fibroblast against UVA-induced photodamage

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Chronic skin exposure to solar ultraviolet (UV) radiation, particularly its profoundly penetrating UVA rays, is a pivotal environmental factor for cutaneous damage resulting in photoaging and photocarcinogenesis. The UVA-induced photodamage is associated with enhanced apoptosis DNA instability, and hyperactivated signal transduction cascades that trigger oxidative stress and inflammation by up-regulating the secretion of pro-inflammatory cytokines or enzymes in skin cells. As synthetic photoprotective agents can exhibit various adverse effects in humans or the environment, natural products represent a valuable alternative for skin care. Therefore, this study investigated the photoprotective potential of the methanol-water extract (7:3, *v/v*) from green coffee beans (GCBE) – a commercially available functional plant material.

The GCBE was fully standardized by LC-MS^3 and HPLC-PDA. The activity tests were conducted in UVA-irradiated (8 J/cm^2) human dermal fibroblasts (Hs68) at 5-25 µg/mL of GCBE. The influence on cell viability, ROS production, antioxidant thioredoxin reductase (TrxR) expression and MMP-1, -3, -9 levels was analyzed by fluoro/colorimetric, immunoenzymatic and electrophoretic techniques. The apoptotic cell level (flow cytometry), DNA damage (comet assay), and activity of caspases (-3, -8 and -9) as the markers of apoptosis and senescence (colorimetry), were also measured. Eventually, the expression of signaling proteins (NF-κB, p53, KL, AP-1) involved in inflammation development, cell aging and apoptosis was assessed immunoenzymatically.

The study proved that GCBE has a significant protective potential against UVA-induced skin damage. Even at a low concentration of 5 µg/ml, the extract decreased the percentage of fibroblasts undergoing apoptosis by more than 50%, reduced the activity of caspases to 65%, limited the expression of MMPs to 60%, caused a 1.7-fold increase in the level of TrxR, and significantly modulated intracellular signaling pathways. The observed effects encourage further in vitro and in vivo studies on the molecular mechanisms, effectiveness, and safety of GCBE as an ingredient of photoprotective cosmetics.

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Poster presentations

P34: Harnessing the potential of poplar hairy roots for the sustainable production of natural compounds with cosmetic applications

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To fulfill the ever increasing consumers demand for natural products for daily health and skin care routine, cosmetic industries are looking for various alternative sources of plants to acquire natural ingredients to be used in various formulations. The CosmetoPop research project, funded by the region Centre-Val de Loire (ARD Cosmetoscience), France, is aimed to explore poplar roots to obtain bioactive compounds to be used as a source of preservatives for cosmetics. Poplar is a fast growing, emblematic tree of Centre-Val de Loire region, France. The objective of the present study was to develop hairy root cultures of hybrid poplar (clone 717-1B4; *P. tremula*♀ x *P. alba* ♂) and *P. nigra* using different *Rhizobium rhizogenes* strains for the sustainable production of natural compounds with biological activities and to perform their chemical characterization. Total phenolics and flavonoids contents and antioxidant activities (using DPPH and FRAP assays) in hydro-ethanolic extracts of hairy roots were assessed using colorimetric tests. UHPLC-HRMS analyses were carried out to analyze the compounds in root extracts. Transformation efficiency varied depending on the *R. rhizogenes* strain used and *Populus* species, achieving 100% frequency with MSU 440 in hybrid poplar. Hairy root cultures were up-scaled from 250 to 2000 mL shake flask. The hydro-ethanolic extracts of all the lines possessed antioxidant activities when compared to Trolox. Chemical analyses of hairy root extracts revealed the presence of compounds with antioxidant, anti-inflammatory and antimicrobial properties including; catechin, nigracin, salireposide, trichocarpin and tremulacin. The present protocol for the development of hairy roots and production of bioactive compounds within a short span of time may be employed successfully in other woody plant species. It is therefore concluded that poplar hairy root cultures could be a promising tool for the sustainable production of specialized metabolites with antioxidant activities to be utilized in various cosmetic formulations.

Poster presentations

P35: Grape cane extract as new functional ingredient in bigel system dedicated for skin barrier protection

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Bigels are semi-solid dispersion systems obtained by combining the functional and utility benefits of aqueous hydrogels and lipophilic organogels [1-3]. Unlike emulsions, these cosmetic forms do not require the use of emulsifiers and possess numerous advantages: possibility of introducing polar and non-polar active substances, strong cooling and moisturizing effect, good spreadability, the ease of preparation and washing after application, increased permeability of active ingredients, high stability and the ability to manipulate their properties through adjustments of individual phases content and structural distribution [4-5]. Grape cane extracts are active ingredients exhibiting enormous potential in skin care products. They have been found to be rich in a vast range of metabolites with proven beneficial effects on the skin, for instance antioxidative, rejuvenating and brightening properties [6,7].

The aim of this research was to obtain bigel systems containing grape cane extract and to evaluate their physicochemical, rheological and organoleptic properties as well as to determine releasing profiles of the active ingredient. All the properties were compared with the reference bigel sample without grape cane extract to evaluate the influence of the active ingredient on the formulation quality and properties. The measurements of pH value, viscosity, stability, and FT-IR spectra allowed for the overall evaluation of the bigels quality and rheological characteristics, epifluorescence micrographs represented the structure of the formulations, and the releasing profiles showed that the form of bigel allows for the controlled release of active substances of various polarity. Skin analyser tests allowed for the evaluation of the formulation impact on skin barrier condition. The resulting formulations are an innovative combination of both the physicochemical form and the active substance to be used as effective products for the protection of the skin barrier due to the possibility of introducing a mixture of various metabolites and the possibility of their controlled release.

Acknowledgements: this research was prepared thanks to the financial support of the project PHC Polonium 2022, joint research projects between France and Poland, entitled 'Cosmetic potential of viticulture byproducts as novel functional ingredients for skin barier recover"

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Poster presentations

P36: Nanoencapsulation of bioactive compounds from plant by-products to produce sensitive skin cosmetics

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NanoCosmos (www.nanocosmos.eu) is a collective international approach from the research community and industry to participate in the transformation of bioeconomy through bioscience and nanotechnology. The main aim of the **NanoCosmos** project is to create a multidisciplinary and intersectoral network to harness the recovery of valuable bioactive compounds from post-harvest by-products, such as Saffron petals (*Crocus sativus*), Chamomile (*Matricaria chamomilla*) and Lavender (*Lavandula angustifolia vera*) post distillation biomass and *Rhodiola rosea* leaves including flowers. The application of green extraction techniques and the production of nanocosmetic products for sensitive skin applications will be the major innovative outcomes of **NanoCosmos** following the circular economy rules and will ensure:

- the exchange of knowledge on bioactive properties of compounds derived from plant by-product matrices,
- the development and optimization of "GREEN" extraction methods of bioactive compounds from plant by-product biomass,
- the creation of innovative biocomponents for application in the cosmetics industry by means of nanoencapsulation technology.

To achieve the ambitious goals of the project plant biodiversity, cropping technologies and different sources of by-products will be evaluated and explored by application chemical analysis and of green extraction technology. Recovered bioactive compounds/extracts will be analyzed by state-of-the art metabolomics tools and supported by bioactivity and efficiency testing's. The impact of drying process of original plant material but also the by-products on chemical profile will be analyzed. Finally, bioactive extracts/compounds will be implemented by nano-technology resulting in the development of novel formulations for skin cosmetics.

Beside the scientific part **NanoCosmos** will maximize research value by fostering long-term network relationships between academic institutions and industry. Best-practice technologies will be disseminated, with research focusing on emerging developments in recovery techniques as well on the nanotechnological application of the recovered compounds or mixtures.

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Poster presentations

P37: *Rhodiola herba* – new source of bioactive extracts for sensitive skin cosmetics??

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Rhodiola rosea L. (Golden Root; Crassulaceae) is a perennial herbaceous plant, widely spread in the mountainous regions in the Northern Hemisphere. Roots and rhizomes have been used in traditional and modern medicine as an adaptogen over centuries [1]. Medicinal use of the plant is mainly concentrated on the underground part of the plant that contains its main bioactive phenylpropanoids, rosarin, rosin, and salidroside [1]. Although the aerial parts of the plant are less studied, they can be found occasionally in health stores as food supplements due to the described radical scavenging activity [2 and references therein]. However, in most commercial cultivations of *R. rosea* the herba is not exploited and left on the field after harvest which takes place usually in autumn. As the highest concentration of the active metabolites is during blooming stage in early summer [3] a harvest at this time will give the opportunity to utilize leaves and flowers as by-products for the development of novel products (e.g., food supplements, natural cosmetics). The recently funded MSCA-RISE project **NanoCosmos** aims to recover valuable bioactive compounds from *Rhodiola* herba (mainly highly decorated flavonoids) to develop novel nano-encapsulated biocomponents for cosmetic formulations supported by green extraction technologies. A small field plot of two years old seedlings of the variety "Mattmark" together with six accessions obtained from German nurseries was established at FloraMare Farm in Madrano (Italy, ca. 700 masl). Aerial parts were harvested in July 2023 and air dried. To evaluate the chemical composition of bulk material different green solvents were used. A chemical fingerprint analysis was performed using UPLC-DAD. The total phenolic and flavonoid content were determined together with antioxidant. Together with the results obtained from Tyrosinase inhibition assay first knowledge upon the suitability of *Rhodiola* Herba extracts for the further development of skin cosmetic are obtained.

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Poster presentations

P38: Polyphenols from the invasive Asian knotweeds and their potential for oral health

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The rhizomes of giant knotweeds – *Reynoutria japonica* Houtt., *R. sachalinensis* (F.Schmidt) Nakai, and their hybrid *R.* x *bohemica* Chrtek & Chrtkova contain a variety of phenolic phytochemicals such as stilbenoids (including resveratrol and piceid), flavan-3-ols (such as free catechins and oligomeric proanthocyanidins), quite unique hydroxycinnamic sucrose esters (mainly vanicoside A and B) as well as several hydroxyanthraquinones (e.g. emodin, chrysophanol). Numerous studies demonstrated the antiinflammatory, antimicrobial, antiviral and cytoprotective properties, among others. In oral health, gum diseases, (e.g. periodontitis) are a serious threat for public health and a risk factor for systemic disorders such as cardiovascular or gastrointestinal. Hence, good oral hygiene is an important issue in healthcare and plant natural substances are considered a safe and efficient alternative to such oral cosmetic products as mouth rinses, gum gels etc. Our studies on various extracts and fraction from *Reynoutria* proved their efficacy for example in reducing periodontic bacteria growth and stimulating gingival fibroblasts regeneration [1,2]. The resveratrol containing fractions from *R. japonica* were among the most active but the traditional decoction, rich in proanthocyanidins and carbohydrate fraction was even more potent [3,4]. It suggests the combination of polyphenols and other constituents, previously overlooked can be essential for the positive effect on gum health. The future research is envisaged to elucidate the carbohydrate fraction composition and obtain a formulation combining the most active constituents for testing as an oral hygiene product.

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Poster presentations

P39: *In faenum salus, in prato pulchritudo* – on the health and beauty potential of cultural relict medicinal and aromatic plants from the Polish-Bohemian frontier grasslands.

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The massive population exchanges following the World War Two in the former East German lands annexed by Poland or returned to Czechoslovakia, caused significant alterations in the natural and cultural landscape, especially in open habitats, such as arable fields, meadows, orchards and gardens. The population who immigrated to the Lower Silesia (including the westernmost part of historical Lusatia) and was mostly ethnically Polish, came across various plants, a usage of which they had no idea or regarded as weeds. For example, there were some medicinal and aromatic species planted by the German, Czech, Silesian and Lusatian people in their home gardens as well as wild growing herbs used in folk medicine. An important part of the Sudeten foothill dwellers were also various liqueurs, tinctures and homemade ointments containing local herbs. Within this study, we assessed the distribution of medicinal plants in various grassland communities, such as transition bogs, mountain and lowland hay meadows, Nardus grasslands, megaforbs and fringe communities. Among the interesting, often vanishing cultural relict species there are: *Myrrhis odorata*, *Peucedanum ostruthium*, *Ligusticum mutellina* (Apiaceae), *Cicerbita macrophylla* i *Tanacetum parthenium* (Asteraceae). Likewise, among the wild herbs important for local ethnobotany, *Meum athamanticum* is worth mentioning. Its roots (*Mei athamantici radix*, German – Bärwurz) were used as medicine for cardiac and digestive complaints and as an ingredient of popular schnapps. Our studies confirmed a presence of large amounts of *Z*-ligustilide – a phthalide with formidable pharmacological activities. Roots of the related species – under the same German name (Bärwurz, in Silesian dialect – Kopernik) – *L. mutellina* (*Mutellinae radix*) were also used but its phytochemical composition is different.

In conclusion, the natural resources of local cultural landscape flora in the South-West territories form a rich supply of plant material for sustainable exploitation in the ecologically vulnerable areas. It would also contribute to the development of extensive economy maintaining the cultural and natural heritage of bygone generations.

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Poster presentations

P40: Anti-inflammatory activity of standardised *Gaultheria procumbens* L. leaf, stem, and fruit extracts in LPS-stimulated human dermal fibroblasts

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Introduction: *Gaultheria procumbens* L. is an ericaceous evergreen shrub naturally occurring in North America [1]. In traditional medicine, different plant parts (leaves, stems, and fruits) are applied externally and internally to treat various inflammation-related disorders, including skin inflammation [2]. Moreover, the leaf extract is used for skin care in anti-ageing and anti-wrinkle cosmetics [3]. However, the impact of *Gaultheria* extracts on human dermal cells is unknown. Therefore, the present study evaluated the anti-inflammatory effects of the *G. procumbens* leaf, stem, and fruit extracts in cellular models, including human dermal Hs68 fibroblasts and THP1-Blue™ NF-κB monocytes.

Materials and Methods: The analyses were performed using fully standardised dry extracts of *G. procumbens* leaves (methanol-water, 75:25, *v/v*), stems (acetone), and fruits (acetone). Cells (both lines) were pre-treated (24h) with the extracts (0.5-100 µg/mL) or reference compound (dexamethasone), followed by LPS-stimulation (Hs68 fibroblasts only). The pro-inflammatory potential (NF-κB transcription factor activation) was checked using THP1-Blue™ NF-κB cells, and the anti-inflammatory activity was studied by measuring IL-8, ICAM-1, and NF-κB levels and phosphorylation of Erk kinase in LPS-stimulated Hs68 cells by spectrophotometry and confocal microscopy.

Results: All extracts in a wide concentration range (0.5-100 µg/mL) did not activate monocytes or induce the NF-κB transcription factor in LPS-stimulated Hs68 fibroblasts. On the other hand, a statistically significant reduction of IL-8, ICAM-1, and NF-κB levels by up to 88%, 43%, and 39%, respectively ($p < 0.001$) and strong suppression of Erk kinase activation was observed for the extracts (25-50 µg/mL) in LPS-stimulated human fibroblasts.

Conclusions: The *G. procumbens* extracts effectively diminish the LPS-induced inflammation in skin fibroblasts. The fruit and stem extracts revealed the strongest anti-inflammatory activity. The observed effects support the traditional use of aerial plant parts (leaves, stems, and fruits) in treating inflammation-related skin disorders and their cosmetic application.

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Poster presentations

P41: Antioxidant and photoprotective activity of standardised *Gaultheria procumbens* L. leaf, stem, and fruit extracts in UVA-irradiated human dermal fibroblasts

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Introduction: Chronic UVA exposure triggers the production of intracellular reactive oxygen species and generates massive oxidative stress [1], which may lead to accelerated premature skin photoaging and photocarcinogenesis [2]. *Gaultheria procumbens* L. is a polyphenolic-rich ericaceous shrub whose leaves, stems, and fruits are traditional anti-inflammatory and antioxidant herbal medicines [3] and anti-ageing cosmetic ingredients [4]. However, the impact of *Gaultheria* extracts on irradiated human dermal fibroblasts is unknown. Therefore, the study evaluated the antioxidant and photoprotective effects of *G. procumbens* extracts in UVA-irradiated human dermal Hs68 fibroblasts.

Materials and Methods: The analyses were performed using fully standardised dry extracts of *G. procumbens* leaves (methanol-water, 75:25, *v/v*), stems (acetone), and fruits (acetone). Hs68 cells were pre-treated (24h) with *G. procumbens* extracts (0.5-100 µg/mL) or reference compounds (quercetin, ascorbic acid) followed by UVA-irradiation (8 J/cm^2). Cell viability and metabolic activity were measured by CCK-8 and MTT assays in human Hs68 and mouse L929 fibroblasts, respectively. The ROS level, SOD, and GST activities were estimated by fluorescence and spectrophotometric techniques. The UVA-induced DNA damage was evaluated by comet assay.

Results: The extracts (0.5-100 µg/mL) did not affect the metabolic activity of mouse L929 fibroblasts and the viability of unirradiated Hs68 cells but enhanced the viability of irradiated Hs68 cells. The extracts (5-25 µg/mL) restored the activity of endogenous antioxidant enzymes (SOD, GST) in the UVA-irradiated Hs68 cells up to 120-140% ($p < 0.001$). Moreover, the ROS level and total DNA damage in irradiated cells were reduced by up to 80% and 69% ($p < 0.001$) at 50 µg/mL, respectively.

Conclusions: The *G. procumbens* extracts effectively protect human dermal fibroblast from UVA irradiation. The leaf and stem extracts were the most potent antioxidants. The observed effects support the topical application of *Gaultheria* extracts as anti-ageing agents in skin care.

Acknowledgements: Medical University of Lodz (503/3-022-01/503-31-001).

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Poster presentations

P42: *Chelidonium majus* extracts as potential active ingredients of natural cosmetics with antioxidant activity

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Greater celandine (*Chelidonium majus* L.) is a common weed, growing e.g. in meadows, roadsides, and wastelands. It is a perennial plant growing in temperate climate regions, mainly in Europe, Asia, North America, and the northwestern Africa. This plant exhibit a choleretic, diastolic, and antibacterial activity. The characteristic milky juice has been used in folk medicine to remove viral warts [1]. The antioxidant potential of this plant is proven [2,3], which depends on many factors, including the vegetation period of the plant or the method of extract preparation.

The aim of the study was to evaluate and compare the antioxidant activity and total polyphenol content of extracts from the dried herb *Ch. majus*, collected from the natural state, in three growing periods. Antioxidant activity was determined using the DPPH, ABTS, and FRAP methods, while the total content of polyphenols was determined using the Folin-Ciocalteu technique. Plants were harvested in three vegetation periods: before flowering (second half of April), during flowering (mid-May), and during fruit setting (second half of August). The extracts were prepared using ethyl, methyl, and isopropyl alcohols in different concentrations (40%, 70%, and concentrated). The extracts were prepared using ethyl, methyl and isopropyl alcohol in different concentrations (40%, 70% and concentrated) during ultrasound-assisted extraction, classified as "green extraction technique" for 15, 30 and 60 minutes.

The extracts showed varied antioxidant activity depending primarily on the vegetation period, as well as the solvent used and the extraction time. The most favorable time for harvesting was the flowering phase (mid-May). The ethanolic extracts (in 70% and 96% (v/v) ethanol) from the herb harvested in this phase of vegetation obtained in an hour-long process showed the highest antioxidant potential.

Due to the high antioxidant activity of *Ch. majus*, collected during the flowering period, can be a valuable ingredient in natural cosmetics.

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Poster presentations

P43: The application of mangiferin in hyperpigmentation disorders

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Mangiferin is a natural C-glucosylxanthone, that occurs abundantly in the nature. The main source of this compound is mango (*Mangifera indica* L., *Anacardiaceae*). Mangiferin is capable to pass stratum corneum and penetrate to the epidermis and dermis. Among the living parts of the skin mangiferin inhibits enzymes responsible for the skin degradation and ageing process: collagenase and elastase [1].

The aim of our study was to evaluate, the influence of mangiferin on tyrosinase, an enzyme responsible for melanin synthesis. The research included both the kinetics and molecular interactions between tyrosinase and mangiferin. The research proved that mangiferin inhibits tyrosinase activity in a dose-dependent manner with IC_{50} 290 ± 6.04 μM,
(the standard kojic acid IC_{50} 217.45 ± 2.54 μM). The mechanism of inhibition was described as mixed inhibition. The interaction between tyrosinase enzyme and mangiferin was identified with capillary electrophoresis (CE). The analysis indicated the formation of two main, and four less significant complexes. These results have also been supported by the molecular docking studies indicating, that mangiferin binds both in the active center and peripheral site.

The presented analysis confirmed the ability of mangiferin to inhibit L-DOPA oxidation caused by tyrosinase. Therefore, mangiferin can be used to inhibit the unwanted overproduction of melanin in the skin, and in dermatology and cosmetology to fight with discoloration of the skin [2].

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Poster presentations

P44: Evaluation of antioxidant properties, cytotoxicity and inhibition of melanogenesis by extracts from *Inonotus obliquus* mycelial cultures obtained from various hosts

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Inonotus obliquus, species of arboreal fungus, possesses the ability to biosynthesize bioactive compounds with a broad spectrum of health-promoting effects. Nowadays, there is an increasing trend in conducting experiments using mycelial cultures. The advantage of this method is the reduced interference with the environment and the relatively rapid multiplication of mycelium, which serves as the material for research. The objects of the study were mycelial cultures of *Inonotus obliquus*, derived from fruiting bodies collected from three species of deciduous trees: *Betula pendula*, *Alnus glutinosa*, and *Carpinus betulus* [1].

The aim of the study was to evaluate the antioxidant properties, cytotoxicity, and inhibition of melanogenesis by extracts from *Inonotus obliquus* mycelial cultures obtained from various hosts.

The extracts of the biomass obtained from *Alnus glutinosa* and *Betula pendula* exhibited antioxidant properties in the DPPH assay, indicating their scavenging capacity. At a concentration of 4.5mg/mL, the extract from *Alnus glutinosa* inhibited radical formation by 22.6±5.4%, while the *Betula pendula* extract inhibited it by 15.7±0.6%. At a concentration of 2.5mg/mL, both extracts also inhibited the oxidation of L-DOPA to L-dopachinone by tyrosinase, with inhibitions of 27.7±2.3% and 26.4±10.5%, respectively. Furthermore, the extracts were subjected to cytotoxicity evaluation in the B16F10 murine melanoma cell line at a concentration range of 0.2-0.05 mg/mL. Based on the obtained results, we tested the mentioned extracts in a melanogenesis inhibition assay in B16F10 cells at safe concentrations. Twenty-four hours after seeding cells in 24-well plates, both α-melanocyte stimulating hormone (α-MSH) and extracts were added to the incubation medium. After 48 hours of incubation, the cells were lysed in 1M NaOH, and the absorption of the cell lysates was measured at 405 nm. The obtained results indicated that extract from biomass of *Alnus glutinosa* effectively inhibited α-MSH-induced melanogenesis, especially at a concentration of 0.1 mg/mL.

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Poster presentations

P45: Substances of natural origin in photoprotection. Is it possible?

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Applying of photoprotective formulations with UV filters is necessary for protection of skin against acute and chronic consequences of ultraviolet radiation exposure. Unfortunately, many of the currently used sunscreening agents have some limitations related to systemic absorption, endocrine disruption, contact and photocontact allergy induction and low photostability. These facts encourage research groups to search for an alternative to unsafe UV filters. These studies are primarily conducted in the area of new synthetic compounds. Considering that certain group of consumers is looking for natural alternatives to chemical UV filters efforts also focus on substances of natural origin [1]. Some authors reported that herbal oils provide favourable photoprotection with SPF values ranged from 0.248 to 22.4 [2,3]. These studies were performed with *in vitro* method based on spectrophotometric analysis of dilute solutions (Mansur's method).

The aim of the study was to evaluate the *in vitro* photoprotective activity of commercially available herbal oils (raspberry seed oil, carrot seed oil, wheat germ oil, jojoba oil, shea butter).

The study demonstrated that tested herbal oils were deprived of photoprotective activity. The obtained $SPF_{in\ vitro}$ and UVA PF values were around 1.0. Our results are consistent with previous study where it was shown that overestimated SPF values of herbal oils reported in some publications resulted from not strictly following of the Mansur's methodology [4].

In conclusion, the use of formulations containing organic and inorganic UV filters are still the best way of photoprotection. For example, the available on the market cometic product with carrot oil and declared SPF 15 contains additionally four organic UV filters. Despite the fact that substances of natural origin may contain compounds which absorb UV radiation, their concentration is too low to provide sufficient protection. Photoprotective formulations providing high or very high protection contain several sunscreening agents at concentration reaching 10%. The searching for natural alternatives to chemical UV filters should focus on research among compounds isolated from raw natural material in sufficiently high concentrations.

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Poster presentations

P46: Anti-proliferative potential of β-damascenone and related C13-norisoprenoids

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The structurally related C13-norisoprenoids β-damascenone and β-ionone, commonly referred to as "rose ketones", are known as key aroma compounds in roses and red wine. Up to date, studies have focused on the anti-proliferative activity of β-ionone and its analogues as well as their structural modification in order to increase activity [1], but little is known about the abilities of β-damascenone. Few studies deal with its anti-inflammatory potential, including the reduction of nitric oxide release and COX-2 mRNA expression. In both studies, the effects of β-damascenone were superior to those of β-ionone [2, 3]. Since a recent study linked the anti-proliferative activity of β-ionone to reduced COX-2 levels [4], our study aimed at the evaluation of the potential anti-cancer activity of β-damascenone and the comparison of its activity to other C13-norisoprenoids, especially β-ionone.

To address this question, various cancer cell lines, including human leukemia cells and melanoma cell lines, were treated with β-damascenone and β-ionone in rising concentrations. After 72h, the number of viable cells was evaluated using the XTT-assay. Indeed, β-damascenone was more effective than β-ionone in all tested cell lines. Furthermore, data obtained from non-malignant cell lines showed only moderate toxicity of β-damascenone, which indicated a selective mechanism.

Additional experiments investigated the anti-proliferative effects of damascenone and ionone analogues. Among the tested compounds, β-damascenone was still the most effective, achieving IC50 values between 8 and 30 µM. Mechanistical studies performed on CCRF-CEM indicated that the anti-proliferative effect of β-damascenone is linked to caspase 3/7-dependent apoptosis.

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Poster presentations

P47: Development of an in vitro test method for irritation of medical devices used in the oral cavity

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The irritation of any medical device (MD) contacting oral tissues (gingival, buccal, lingual, etc) needs to be evaluated. The objective of this project is to develop and validate in vitro assay to assess the oral irritation of MDs. This assay is intended to replace historical in vivo assay performed on Syrian hamsters. The ISO 10993-23 standard requires that MDs be evaluated using an in vitro irritation test based on reconstructed human epidermis (RhE) prior to animal or human patch testing is performed. However, RhE models are not appropriate for MDs designed for use in oral cavity, therefore ISO recommends use of other in vitro models with relevant cells or tissues. The EpiOral tissue model consists of normal, human-derived oral epithelial cells cultured to form multilayered, highly differentiated model of the human buccal tissue. Produced commercially for more than 15 years, several methods have been developed to study oral penetration, drug delivery, and irritancy of oral care products such as toothpastes, mouthwashes, and orthodontic devices. To assess the feasibility of an in vitro method, initial experiments tested solutions of irritant chemicals contained in MDs used in oral cavity. Increasing concentrations of ethanol, lactic acid, methyl methacrylate, sodium dodecyl sulfate, phosphoric acid, sodium hypochlorite, hydrogen peroxide, and chlorhexidine digluconate in NaCl or sesame oil were applied to the EpiOral model. The time required to reduce tissue viability by 50% (ET-50), was determined. The results showed a clear relationship between tissue viability and exposure time and between ET-50 and concentration of the irritant chemical. Compared to historical in vivo data, the in vitro method classified the samples containing an irritant at the expected concentration. In addition, the ET-50s allowed differentiation between strong and mild irritants. The data demonstrate that this in vitro assay has equivalent or superior performance to in vivo method.

Poster presentations

P48: The phytochemical profile and tyrosinase inhibition potential of *the Vitis vinifera* cv. Johanniter *in vitro* cultures

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Plant secondary metabolites are significant substances, which exert wide range of biological effects on skin. The innovative source of such compounds could be *in vitro* cultures [1-2].
Vitis vinifera L. (grapevine) is widely exploited in food industry, medicine and phytocosmetology. There is an increasing number of studies, which confirm the wide-ranging biological activities of various *V. vinifera* cultivars, determined by their chemical composition. However, there is still an urgent need to focus more on their tyrosinase inhibition ability [3].
The aim of the study was the comprehensive insight into phytochemical composition of the *V. vinifera* cv. Johanniter *in vitro* cultures and their tyrosinase inhibition potential. The cultures were maintained over 10-20-30-day growth cycles on two media: Murashige and Skoog (MS) and Schenk and Hildebrandt (SH) with various concentration of plant growth regulators. The tested media were: 'W1' (MS, 0.9ml/l BA and 0.1 ml/l IBA), 'W2' (MS, 1.5ml/l BA and 0.2 ml/l NAA), 'W3' (SH, 0.9ml/l BA and 0.1 ml/l IBA) and 'W4' (SH, 1.5ml/l BA and 0.2 ml/l NAA). The UPLC-MS/MS method was used for metabolite analysis. The principal component analysis (PCA) was performed to testify the influence of time on the metabolic content. The skin-brightening activity was evaluated using tyrosinase inhibition *in vitro* assay.
In all tested extracts identification and tentative concentration of 45 compounds (6 amino acids, 4 phenolic acids, 13 flavan-3-ols, 3 flavonols and 19 stilbenoids) were measured. Based on PCA, MS media induced the amino acids (e.g. L-leucine, L-phenylalanine), procyanidins (e.g. B1, B3) and flavan-3-ols (catechins) with the time of culture. The strongest tyrosinase inhibition capacity was showed for extracts after 10-day growth on W1 media with inhibition of 21.33%. The obtained results confirmed that *V. vinifera* cv. Johanniter *in vitro* cultures could be proposed as an alternative source of biological activities, including potential tyrosinase inhibitors.

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Poster presentations

P49: The assessment of polyphenolic content and biological activities of the extracts from selected *Vitis vinifera in vitro* cultures

Sharafan M.[1], Malinowska M.A.[1] Ferrier M.[2], Gemin M.P.[2], Abdallah C.[2], Lanoue A. [2], Giglioli-Guivarc'h N.[2], Sikora E.[1], Szopa A.[3]

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Modern phytocosmetology is a rapidly growing field. Its main aim is associated with the search for the unique raw materials and isolation of biologically active compounds. Such possibilities create plant biotechnology and obtaining of biomass of different plant species *in vitro* cultures [1,2]. Grapevine (*Vitis vinifera* L.) is a unique plant with a wide-range application in food, pharmaceutical and cosmetic industries. It has rich phytochemical composition, which determines its varied biological activities [2,3].

The aim of the present study was the initiation and optimization of *in vitro* cultures of various *V. vinifera* cultivars (cvs): Chardonnay, Hibernal, Riesling, Johanniter, Solaris, Cabernet Cortis and Regent. The cultures were maintained during 28-day growth cycles on two different media: Murashige and Skoog (MS) and Schenk and Hildebrandt (SH) with various concentration of plant growth regulators (PGRs).The tested media were: 'W1' (MS, 0.9ml/l BA and 0.3ml/l IBA), 'W2' (MS, 1.5ml/l BA and 0.2ml/l NAA), 'W3' (SH, 0.9ml/l BA and 0.3ml/l IBA) and 'W4' (SH, 1.5ml/l BA and 0.2ml/l NAA).The biological activity of obtained extracts were determined for its antioxidant capacity assessment by free radical scavenging ability (DPPH method) and ferrous ion-chelating assay. Phenolic content was quantified by HPLC-DAD analysis.

In all tested extracts the presence of phenolic acids, catechins and flavonoids were confirmed. The best results were obtained for catechins with the total content of 94.23-1135.31 mg/100g DW. Among tested extracts the best DPPH results were obtained for cv. Johanniter carried out on W1 and W2 media with values of 33.57% and 31.15%, respectively. The chelating activity results showed that the most potent cultivar was Cabernet Cortis (W2) with a chelation ability of 50.93 %. Based on the collected data, *V. vinifera in vitro* cultures could be proposed as an alternative source of plant material with a potential use in cosmetic industry.

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Poster presentations

P50: Anti-inflammatory activity of *Serpylli herba* on human skin cells

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The *Thymus serpyllum* L. herb has been used topically in folk medicine to treat wounds, burns, and skin inflammation. The aim of the study was to analyse the chemical composition and to investigate the effect of the *Serpylli herba* extract of the Kozioł population on skin cell inflammation and wound healing.
The chemical composition of the 60% (*v/v*) methanolic extract and its fractions (dichloromethane – FR1, diethyl ether – FR2, ethyl acetate – FR3, n-butanol – FR4, and aqueous residue – FR5) were investigated using UHPLC-DAD-MS^n. Inflammation of immortalised human dermal keratinocytes (HaCaT) and normal human dermal fibroblasts (NHDF) was induced by UVB (20 mJ/cm^2) and lipoteichoic acid from *S. aureus* (10 µg/mL), respectively. The effect on wound healing was tested *in vitro* on HaCaT cells (scratch assay).
The extract and its fractions reduced the secretion of interleukins IL-6 and IL-8 by keratinocytes and fibroblasts. In addition, the extract and fractions FR2 and FR3 had a beneficial effect on wound healing, reducing the scratch area by 20.7%, 20.4%, and 23.6%, respectively. The extract was dominated by flavonoids - derivatives of luteolin, quercetin, apigenin, and phenolic acids - rosmarinic acid and its derivatives (mainly salvianolic acids). In the FR3, which inhibited cytokine secretion and strongly regenerated the scratch, rosmarinic acid and methyl rosmarinate were dominant.
Performed experiments revealed that the *Thymus serpyllum* herb exhibits potent anti-inflammatory properties, and the compounds responsible for these properties may be rosmarinic acid and its derivatives.

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Poster presentations

P51: Changes in the biological activity of *Hamamelidis cortex* extract after incubation with skin microbiota

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Hamamelis virginiana bark (*Hamamelidis cortex*) is a traditional herbal medicinal product indicated for use in inflammation of the skin and mucous membranes of the oral cavity, dry skin, and hemorrhoids. The aim of the study was to investigate the effect of the *Hamamelidis cortex* extract on the inflammation of cells involved in wound healing and to analyse its chemical composition and changes in composition during incubation with skin microbiota (SM). In addition, the effect of the primary metabolite formed during incubation on skin cell inflammation was investigated.

The chemical composition and changes in chemical composition during *ex vivo* incubation with SM collected from volunteers were examined with UHPLC-DAD-MS^n. The main component of the extract was isolated by preparative HPLC. Inflammation of neutrophils, keratinocytes, and fibroblasts was induced by lipopolysaccharide from *E. coli*, a mixture of tumour necrosis factor α with interferon γ, and lipoteichoic acid from *S. aureus*, respectively.

The chemical compounds of the extract were mainly gallotannins, and the dominant constituent was hamamelitannin, the structure of which was elucidated based on NMR spectra (^1H, ^{13}C, COSY, HMBC, HSQC). The extract and hamamelitannin reduced the secretion of IL-1β and IL-8 by human neutrophils *ex vivo*. Moreover, they inhibited the secretion of IL-6 and IL-8 by human dermal keratinocytes and fibroblasts *in vitro*. The primary metabolite formed as a result of incubation of the extract and hamamelitannin with the SM was ellagic acid (EA). In contrast to the components of the extract, EA increased the secretion of IL-6 and IL-8 by skin cells.

The SM influences the phytochemical changes of the *Hamamelis virginiana* bark extract, which may lead to changes in its biological activity.

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Poster presentations

P52: Fungal degradation of selected organic UV filters by *Cunninghamella* species: transformation products ecotoxicity and mutagenicity

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The growing use of organic UV filters has raised concern regarding their safety to human and environmental health [1]. *In vivo* and *in vitro* studies of organic UV filters have revealed a wide variety of adverse effects on the exposed organisms, related to their endocrine, neurologic, and developmental toxicity, and bioaccumulation potential [2,3]. Thus, the development of techniques capable of reducing their release into the environment has become an important issue. Biodegradation and biotransformation are processes that exploit the ability of microorganisms such as fungi to break down, transform and remove hazardous pollutants from the environment [4].

The aim of this study was to test the removal efficiency of two organic UV filters *i.e.* 4-methylbenzylidene camphor (4-MBC) and ethylhexyl methoxycinnamate (EHMC) using *Cunninghamella* species. Moreover, transformation products ecotoxicity and mutagenicity were assessed.

Biotransformation processes *were carried out* using *C. echinulata, C. blakesleeana* and *C. elegans* for 7 days. Biodegradation products were analyzed through liquid chromatography coupled with tandem mass spectrometry (LC-MS/MS) analysis. Ecotoxicity was evaluated with the use of the Microtox system, whereas mutagenicity was assessed with the Ames test.

The study demonstrated that all tested *Cunninghamella* strains completely removed EHMC. The biodegradation rates of 4-MBC reached up to 94% in the presence of *C. blakesleeana*, 84% in the presence of *C. echinulata* and 64% for *C. elegans*. According to the Microtox assay results, ecotoxicity of UV filters decreased through the fungal degradation process. Additionally, the obtained fungal transformation products were nonmutagenic in the Ames test.

Tu sum up, all these results evidently reported the biodegradation potential of *Cunninghamella* species, thereby establishing the scope for further advanced studies towards mitigating organic UV filters pollution.

Acknowledgements: The project was supported by the National Science Center Grant No 2020/37/B/NZ7/02546.

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Poster presentations

P53: Evaluation of the effect of *Coleus amboinicus* on the viability of *Demodex folliculorum*

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Demodicosis is a parasitic skin disease caused by mites of *Demodex* species. It can occur in adults and children. The presence of *Demodex* spp. is often asymptomatic, however it can be related to the pathogenesis of numerous dermatoses. The treatment of demodicosis is difficult due to the limited number of preparations available on the market. In this study, we estimated *in vitro* the effect of ethanolic extracts and essential oil of *Coleus amboinicus* Lour. (syn. *C. aromaticus*, *Plectranthus amboinicus*) - a succulent aromatic perennial from Labiatae family - on the viability of *Demodex folliculorum*. The herb is used in medicinal applications as well as in culinary preparations in South America, Africa, Indonesia, India and South East Asia. The plant has antimicrobial, insecticidal, anti-inflammatory, antioxidant and antitumor properties. In this study, fresh leaves of the plant species were fragmented and macerated with 95% and 50% (*v/v*) ethanol for 24 h at RT. The extracts were filtered, concentrated under reduced pressure, and lyophilized. Furthermore, essential oil from fresh leaves was obtained with distillation in Deryng apparatus. Volatile components in all the extracts were analyzed with SPME (solid phase microextraction) and GC (gas chromatography). The extracts and essential oil were applied on *D. folliculorum* mites obtained from the eyelashes of patients of Dermatology Outpatient Clinic from the University Clinical Centre in Gdansk. The mites were treated with the extracts and essential oil for 2 h and observed under optical microscope. The obtained results showed that the essential oil was the most active on *D. folliculorum*. The concentrated and 10% (*v/v*) oil caused total and 40% killing of the mites, respectively. The phytochemical analysis revealed that the major components in *C. amboinicus* essential oil were p-cymene (49.3%), γ-, α-terpinene (13.3 and 7.8%, respectively), 1,8-cineole (3.7%), and linalool (3.6%). In turn, thymol and linalool were the main components in both ethanolic extracts showing a much weaker effect on the mites.

Poster presentations

P54: Establishment *of Aralia spinosa in vitro* cultures for production of potent anti-aging compounds

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Aralia spinosa (Araliaceae) [1], is a deciduous shrub or small tree to 2–8 m tall, native to the eastern United States along the Atlantic coast [2]. Therapeutic properties of plant raw material and preparations obtained from species of the genus *Aralia* are attributed to three main groups of secondary metabolites: triterpenoids and triterpenoid saponins, sterols and diterpenoid. The valuable group is also phenolic acids, their glycosides and depsides [3, 4]. Among them the considerable anti-aging potential was described for oleanolic acid as well as phenolic compounds. For the first time the *in vitro* cultures of embryogenic and non-embryogenic callus were established. The Murashige et Skoog (MS) [5] medium was used supplemented with 2,4-D (0.125 – 2 mg/L). Furthermore, efficient micropropagation procedure was developed and hairy root cultures were initiated by infection with *Rhizobium rhizogenes* agropine type strain. For the optimalization of hairy root growth various hormone-free media were tested: Gamborg et al. [6] (B5), MS, Schenk et Hildebrandt [7], Lloyd et McCown [8]. Resulted from *in vitro* cultures plant material was examined using UHPLC-DAD-ESI-MS^3 method. In addition the effect of plant extracts on viability of keratinocyte cells (HaCaT) using MTT test was performed. The induction of direct somatic embryogenesis allowed to regenerate about 30 plants form 1 g of callus. No somaclonal variation was detected based on ISRR and SCoT markers. The growth index of hairy roots fresh weight ranged from 7.5 to 10. Phytochemical analysis revealed the presence of 30 secondary metabolites, classified as: triterpenoid saponins and phenolic acids. Among others: araloside A, calenduloside E and araloside C were confirmed. None of the tested extracts demonstrated cytotoxic effect on HaCaT cells. This may indicate that the plant material of *A. spinosa* produced *via* biotechnological methods could serve as a source of anti-inflammatory and anti-aging compounds.

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Poster presentations

P55: Establishment of *Oldenlandia diffusa* (Willd.) Roxb. (Rubiaceae) suspension cultures as a source of antioxidant metabolites

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Oldenlandia diffusa (=Hedyotis diffusa Spreng) [1,2], belongs to Rubiaceae family. It is an annual herb, widely distributed in SouthEast Asia [2]. This species has been used in Traditional Chinese Medicine for centuries. It exhibits a number of properties, most frequently used for antioxidant, anti-inflammatory and anticancer activities.

The aim of this study was to initiate *in vitro* suspension cultures of *O. diffusa* as a source of secondary metabolites of significant antioxidant potential. Two types of primary explants were used: leaf or stem; MS [3] liquid medium supplemented with phytohormones: 2,4-D (1 mg/L), NAA (2 mg/L), kinetin (1 mg/L), BAP (1 mg/L) was used. Total phenolic and total flavonoid content was determined for extracts of collected plant material, as well as UHPLC-DAD-ESI-MS^3 analysis was performed. The antioxidant potential of extracts was also examined.

High degree of cell dedifferentiation in the medium containing 2,4-D and BAP was observed, while fine cell suspension cultures were developed in media with 2,4-D and kinetin, NAA and BAP or kinetin. The highest content of phenolic compounds (3.7±0.,84 mg GA/g DW) and flavonoids (1.9±0.76 mg QE/g DW) were noted in extracts from cultures initiated from stem explants in medium containing 2,4-D + kinetin. The highest antioxidant capacity detected with DPPH method was exerted by extracts from leaf-derived cultures in medium containing 2,4-D and BAP. The FRAP method indicated the highest antioxidant potential of extracts form stem initiated suspensions in medium supplemented with NAA and kinetin. Phytochemical analysis using UHPLC-DAD-ESI-MS^3 method showed three groups of compounds: ferulic acid glycosides, apigenin derivatives and oleanolic acid derivatives. Presented results provide the basis for further biotechnological and biological research of *O. diffusa* cell suspension cultures as an efficient source of plant material with significant antioxidant properties and with potential use ex. with enhancing skin antiaging properties of plant based cosmetic formulations.

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Poster presentations

P56: The antioxidant, anti-inflammatory and antimicrobial properties of *Schisandra sphenanthera in vitro* cultures related to phenolic compounds production

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The plants for *in vitro* cultures are increasingly used in the production of innovative cosmetics as a new source of compounds of natural origin [1]. The object of research was biotechnological studies on species of the genus Schisandra known from traditional Chinese medicine - *Schisandra sphenanthera* Rehder & E.H. Wilson [2]. Under the work the initiation and optimization of the microshoot, callus and suspension cultures of *S. sphenanthera* were carried out. Two variants of the MS (Murashige-Skoog) medium containing 1 mg/l BA (6-benzyladenine) and 1 mg/l IBA (indolylbutyric acid) (variant A) and 2 mg/l BA and 1 mg/l IBA (variant B) were tested, and culture growth cycle of 30 and 60 days.
For comparative purposes, extracts from the leaves of the parent plants were analyzed.
An HPLC-DAD analysis of phenolic acids in methanolic extracts from experimental cultures was performed. The highest total contents of phenolic acids were: for microshoot cultures 78.72 mg/100g d.m. (variant A, 30 days), for callus cultures - 127.2 mg/100g d.m. (variant A, 30 days), and for suspension cultures - 79.07 mg/100 g d.m. (variant A, 30 days). Quantitatively dominant individual compounds were neochlorogenic acid (max. 63.49 mg/100g d.m.) and chlorogenic acid (36.25 mg/100g d.m.).
As part of the study, the antioxidant potential (CUPRAC, FRAP and DPPH methods), anti-inflammatory activity (15-LOX, COX-1, COX-2 and sPLA2 inhibition tests), as well as antibacterial (vs. *S. aureus, S. epidermidis, E. coli, P. aeruginosa, H. pylori*) and antifungal (vs. *C. albicans, C. parapsilosis, C. glabrata, A. niger*) activities, were determined. The extracts from experimental cultures and leaves of the parent plant showed similar parameters.
Results proved that *S. sphenanthera in vitro* biomass could be a new source of bioactive compounds.

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Poster presentations

P57: *In vitro* cultures of *Salvia hispanica* enriched with key elements as a new raw material with high potential of cosmetic use

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Plant *in vitro* cultures provide a valuable model for the development of new techniques into the use of plant biomass in medicine and cosmetology industry [1]. Fortification with bio-nutrients is one of the modern techniques for enriching foods with essential macro- and micro-nutrients [2]. *In vitro* cultures of *Salvia hispanica* L. (chia) may have the ability to bioaccumulate elements that are crucial from a health and cosmetic point of view [3].

The aim of this study was to evaluate the bioaccumulation capacity of the health-promoting metal ions: magnesium (Mg), calcium (Ca), zinc (Zn), iron (Fe), chromium (Cr), selenium (Se) and lithium (Li).

Microshoot cultures of *S. hispanica* were maintained in medium according to Murashige-Skoog without plant growth regulators. Macronutrient salts were added to the media: $CaCl_2$ x $6H_2O$ and $MgSO_4$ x $7H_2O$ and micronutrients: FeNaEDTA x $2H_2O$, $ZnSO_4$ x $7H_2O$, Na_2O_3Se, $K_2Cr_2O_7$ and Li_2SO_4 x H_2O in concentrations: 5, 10, 25, 50 (mg of element per liter of medium). The control were microshoots conducted without supplementation. Cultures were grown under continuous white light (LED) for 14 days (3 series). Elemental content was analyzed using ICP-MS method.

A high accumulation capacity for bio-elements was found in the *in vitro S. hispanica* culture model. The highest accumulation for the majority of the elements tested was obtained after supplementation at a concentration of 50 mg/L; this was for Mg - 263.33, Fe - 126.54, Zn - 580.66, Se - 248.5, Cr - 969.22 and Li - 48.83 [mg/100 g DW].

In vitro culture of *S. hispanica* can be used as an independent model to study the enrichment of food with valuable elements necessary to maintain healthy hair, skin and nails.

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Poster presentations

P58: Exploiting the Greek microbial diversity for the discovery of novel anti-ageing molecules with applications in cosmeceuticals

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Greek ecosystems are a fertile yet under-explored ground for the study of Actinobacteria which are known producers of bioactive compounds. By exploring the under-investigated biodiversity and chemodiversity of Greek actinobacterial strains (mostly of *Streptomyces* sp.) the "Anti-Aging" project aims to discover novel natural products (NPs) that can be formulated as cosmeceuticals. In total, 3000 isolates belonging to the National and Kapodistrian University of Athens (NKUA), Greece, bacterial and Archaea Culture Collection (ATHUBA; some originating from unique environments such as caverns, volcanoes, thermal springs, etc.) were studied. A customized *in-house* library of 2000 extracts was generated (EtOAc and MeOH/H_2O) all of which were investigated for potential bioactivity. Biological evaluation was initially performed though elastase (anti-ageing activity) and tyrosinase (whitening activity) inhibition cell-free assays. A small number of extracts demonstrated >50% elastase inhibitory activity, whereas a considerably larger number exhibited >50% tyrosinase inhibitory action; in some cases, the bioactivity exceeded 80% inhibition at cell-free assays. Of the top 100 extracts showing the highest inhibitory activity, 30 were found to be non-cytotoxic when tested on cell-based assays. The biological properties of the non-cytotoxic extracts were tested at human diploid fibroblasts (BJ cells) for their anti-ageing activity and on melanocytes (B16F10 cells) for their whitening activity. The most promising isolates were subjected to a scale-up process (2L) and fractionation (~120 fractions) and their bioactivity for elastase and/or tyrosinase inhibition was reassessed; finally the most active fractions were used for compound identification and isolation. Our promising results reveal a hidden yet powerful potential of harnessing Greek microbial wealth in the context of anti-ageing.

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Poster presentations

P59: The potential use of essential oils of *Lavandula* sp. in skin problems

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Lavender is a plant belonging to the Lamiaceae family, commonly found in the Mediterranean coast, valued primarily for its intense aroma. Lavender (genus *Lavandula* L.) comprises 41 species of flowering plants in the family Lamiaceae [1]. Due to numerous biological properties, essential oil from *Lavandulae angustifolia* Mill. is commonly used. However, research and literature data indicate that the antimicrobial properties of the essential oils obtained *Lavandula* sp. raise hopes related to their use in phytotherapy of skin diseases [2]. They have antibacterial, antifungal properties and they are also often used as ingredients of creams due to their regenerating or smoothing and anti-inflammatory properties [3].

The aim of the research was to demonstrate the effectiveness of the use of essential oils obtained from different varieties of the *Lavandula* sp. as active ingredients of creams, which can be used in skin diseases. For this purpose, creams containing lavender essential oil (LOE) and spica essential oil (SEO), obtained from *Lavandula latifolia* Medik, have been prepared. The antimicrobial activity of EO was tested on a microbial panel from the American Type Culture Collection (ATCC), which consisted of Gram-positive bacteria (*Staphylococcus aureus* ATCC 29213 and *Staphylococcus aureus* ATCC BAA-1707) and Gram-negative bacteria (*Escherichia coli* ATCC 25922 and *Pseudomonas aeruginosa* ATCC 27853). This study enabled the estimation of the MIC (minimum inhibitory concentration) and MBC (minimum bactericidal concentration).

This results showed, that the tested EOs can be used against skin infections caused by staphylococci, including MSSA (methicillin sensitive *Staphylococcus aureus*) and MRSA (methicillin resistant *Staphylococcus aureus*) and wounds infected with *P. aeruginosa*. In the experiment, better activity against Gram-negative bacteria (MIC = 10-20 mg/mL) was observed compared to Gram-positive bacteria (MIC = 20-40 mg/mL). The obtained results may be used in the future to develop a recipe for dermatological preparations based solely on natural ingredients.

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Poster presentations

P60: Comparison of anti-tyrosinase activity of oenothein B and *Cuphea ingrata* extract

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Hyperpigmentation is not only considered an aesthetic problem but is also associated with skin diseases such as cancer. Tyrosinase is a key enzyme in the synthesis of melanins, groups of natural pigments found in the skin. While their role is to protect against UV radiation, their uncontrolled production occurs in pathological conditions. As some standard tyrosinase inhibitors, e.g., hydroquinone, have been shown to be highly toxic, there is still an unmet need to find better and safer blockers of melanin production [1].
Many polyphenols of natural origin have been reported to have lightening activity. One of interesting examples are ellagitannins from *Eucalyptus globulus* which have been shown to have anti-tyrosinase potential [2]. *Cuphea ingrata* is yet another plant species abundant in ellagitannins, and a member of the *Cuphea* genus, which is of the significant importance in the cosmetic industry [3]. Extracts from this plant have already shown interesting pharmacological activity, but little is known about their anti-tyrosinase activity [4]. Therefore, we decided to evaluate the tyrosinase blocking activity of the ellagitannin-rich *n*-butanol fraction of the methanolic extract obtained from the aerial parts of *C. ingrata* (fB). Furthermore, we compared its activity to oenothein B, a highly active dimeric ellagitannin, constituting 2.73% of fB [5].
In our study, the *in vitro* tyrosinase-blocking activity was assessed using *L*-DOPA or- *L*-tyrosine as substrate for the enzyme. The experiment revealed that both the extract and oenothein B are moderate tyrosinase inhibitors, while the anti-monophenolase activity of fB appears to be stronger than that of oenothein B, with IC_{50}=31 µg/mL *vs* 196 µg/mL, respectively. Nevertheless, the activity of both was weaker than that of kojic acid, which was used as the reference compound.
In conclusion, *C. ingrata* extract may be regarded as a potential natural ingredient in skin-lightening products.

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Poster presentations

P61: The effect of essential oils on the growth and development of allergenic fungi *in vitro*

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Good health is one of the most important values in life of each of us. Recently, there has been an increase in reports on the incidence of respiratory diseases. About 80 genus of fungi have been shown to cause allergies, and allergy-causing proteins have been identified in 23 genera. The cause of allergies may also be species of fungi causing diseases of plants i.e. *Alternaria* spp., *Aspergillus*, *Cladosporium* spp. *Bipolaris, Botrytis, Candida, Culvularia, Penicillium,* as well as a lot of species from *Fusarium* genera [1, 2, 3]. Due to the frequent occurrence of problems related to the contamination of plant raw materials and the toxicity of chemical substances used in plant protection, there is a growing demand for non-toxic natural alternatives. Essential oils are crucial compounds commonly used in human and animal therapy. As the latest research shows, essential oils are frequently used agents in the control of various pests [4,5].

The aim of the study was to determine the effect of four different essential oils on the sensitivity of allergenic fungi i.e. *Alternaria alternata, Botrytis cinerea, Cladosporium cladosporioides* and *Fusarium oxysporum*. The tested oils were added to Potato Dextrose Agar medium at the concentrations of 0.1 mg/mL, 0.25 mg/mL and 0.5 mg/mL. The activity of the oils on the inhibition of the linear growth of mycelium was evaluated by measuring of fungal colonies and also their fungistatic activity was evaluated on the basis of the percentage growth inhibition of fungal colony. The sensitivity of the tested isolates of fungi was variable and depended on the type and concentration of the studied essential oils. The most effective antifungal effect on all tested fungi was shown by oregano essential oil. Moreover, oregano essential oil caused degradation and decay of mycelium and spores. Essential oils are potential and promising antifungal agents used as bio fungicides in plant protection and indoor air disinfection.

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Poster presentations

P62: Biotic stress elicitors as modulators of isoquinoline alkaloid profile of *Chelidonium majus in vivo & in vitro*

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Chelidonium majus L. is a rich source of highly bioactive isoquinoline alkaloids and has been used in folk herbalism for treating skin disorders, such as warts. By using cell culture technology and hydroponic systems, we examined the plant metabolic response to biotic stimuli *in vivo* and *in vitro*.

For the *in vitro* studies *C. majus* cells were introduced into non-purified bio-nanocellulose matrices derived from 3 day-old *Komagataeibacter xylinus* cultures [1]. Three microbial strains such as *Candida albicans*, *Staphylococcus aureus* and *Pseudomonas aeruginosa* were used as bio-elicitors in *in vitro* experiments. They were inoculated at the top or the bottom of non-purified cellulose discs.

In an hydroponic cultivation system, *P. aeruginosa* in three different concentrations (1, 10, 50 ml/L) as well as methyl jasmonate (50 ml/L) were used for the stimulation of isoquinoline alkaloids production in *C. majus* seedlings. After the biotic elicitors treatment the metabolic profiles were examined using LC-MS/MS and MALDI-MS imaging. Growth promoting bacteria stimulation was an effective method for alkaloid accumulation. MALDI MSI chemical maps showed higher content of coptisine, sanguinarine, berberine, chelerythrine, chelidonine and allocryptopine in BNC containing *S. aureus* compared to *C. albicans* and *P. aeruginosa* or elicitor-free cellulose carriers. In hydroponic experiments, the concentration of 10 ml/L of lyophilized *P. aeruginosa* was the most effective in terms of protoberberine and benzophenanthridine stimulation in the *C. majus* seedlings.

Further research is needed to verify the mechanism of action of individual microbial strains, their most effective concentration and the exposure time, both for plants grown *in vitro* and in hydroponic systems, and then in conventional cultivation.

Poster presentations

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Poster presentations

P63: We are what we eat – beneficial properties of Malabar spinach

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Basella alba L., called Malabar spinach, is a leaf vegetable native to South and Southeast Asia. It exists in two forms - *B. alba* f. *alba* and *B. a.* f. *rubra* differing in the level of pigmentation, both rich in betalains and polyphenolic compounds which are commonly used in nutrition and cosmetic products.
Driven by the unique phytochemical profile, we introduced *B. alba* to *in vitro* culture to facilitate experimental control over the metabolic profile and up-scale biomass production. Physical and chemical stimuli were used to obtained cell and organ cultures. The basal liquid culture media were supplemented with various combinations of plant growth regulators (PGRs) and the morphogenetic and metabolic response was examined every 4-weeks of culture. All cultures were maintained under the photosynthetic active radiation light LEDs. The photosynthetic pigments and the total phenolic contents (TPCs) were determined using spectrophotometry. The antioxidant capacity was estimated using DPPH, ABTS and FRAP assays. Detailed phytochemical analysis was performed using UHPLC-DAD-QTOF-MS.
The addition of 6-benzylaminopurine (BA) and kinetin (KIN) significantly increased the shoot multiplication rate of both forms. The highest biomass production was noted for *B. rubra* on BA 1.0 and 2.0 mM. Supplementation with 1.0 mM KIN promoted rhizogenesis. PGRs affected chlorophyll content in a concentration-dependent manner. In all tested conditions, polyphenolic content was 2-5-fold higher in roots than in leaves, with *B. rubra* being the TPCs-richer form. All samples displayed moderate antioxidant potential. Depending on the PGRs treatment, such betalains as gomphrenin, isogomphrenin, malabarin, gandolin, isogandelin, basellin, and isobasellin were found in the plant material in different proportions. Further studies on the cell, tissue and organ cultures of the species are needed to optimize the culture conditions for effective specialized metabolites production and their bioactive potential.

Poster presentations

P64: Cosmetic properties of extracts from various morphological organs of elderberry (*Sambucus nigra* L.)

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Elderberry (*Sambucus nigra* L.) is a plant rich in biologically active compounds with great therapeutic and cosmetic potential. Thanks to the content of active compounds such as polyphenols, flavonoids, tannins, vitamins C and B as well as minerals, elderberry extracts have anti-inflammatory, regenerative, moisturizing, anti-swelling, whitening and sealing properties [1]. Currently, skin care cosmetics use extracts, powders, juices, waxes, oils and waters from flowers, buds, seeds, twigs and ripe elderberries [2]. Leaves and unripe berries of *Sambucus nigra* are treated as technological waste, suggesting insufficient use of the potential of this valuable plant. Literature data indicate a similar phytochemical composition and selected properties of aqueous and methanolic extracts from leaves and unripe fruits [3], therefore nothing stands in the way of using them at the production stages, in accordance with the currently prevailing "Zero Waste" trend.

The aim of the presented research is to compare the content of bioactive compounds (polyphenols, flavonoids) and the antioxidant properties of hydroethanolic (50% EtOH) and hydroglycolic (20% HG) extracts from inflorescences, leaves, twigs, ripe and unripe fruits of elderberry. The content of polyphenolic compounds and flavonoids was measured using spectrophotometric methods, and the antioxidant activity was determined by measuring the ability to neutralize DPPH and ABTS radicals in comparison with vitamin C. The extracts were also assed for their potential sun protective activity (*in vitro* sun protection factor, SPF) and cytotoxicity against human dermal keratinocytes HaCaT. The obtained results allow to assess the potential use of extracts from the so far unused morphological organs of elderberry as a valuable source of active ingredients in cosmetics and incorporate them in prototypic cosmetic formulations.

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Poster presentations

P65: Comparative study on the cosmetic potential of commercially available products and extracts from various morphological organs of immortelle (*Helichrysum spp*. Mill)

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Natural cosmetics are constantly gaining in popularity worldwide, causing constant increase in the natural cosmetic market. Unfortunately, due to the environmental pollution and urbanization of green areas, the collection of plant cosmetic raw materials from natural sites is becoming a rarity. One way to meet increasing demand in plant-based active ingredients is to make the most of the collected raw material, including utilization of the plant parts that are usually considered as by-products or waste (the so-called "Zero Waste" trend) [1]. An example of a natural resource that can potentially be better used are herbs and flowers of immortelle species (*Helichrysum arenarium, Helichrysum italicum),* rich in bioactive compounds with medicinal and cosmetic properties [2]. Commercially available cosmetic products contain mostly hydrolate and essential oil from the flowers of immortelle, whereas the other morphological organs (e.g. leaves, stems) of immortelle plants are not being extensively used by the cosmetic industry. The aim of the presented study was to compare total phytochemical content and selected cosmetic properties (antioxidant, sun-protecting, skin-lightening and cytotoxic) of commercial products (hydrolate, essential oil) with aqueous and hydroethanolic (70%, *v/v*) extracts obtained from the flowers and herbs (leaves + stems) of *H. italicum* and *H. arenarium*.

Conducted research showed that the hydroethanolic extract obtained from the herbs of *H. italicum* contains more polyphenols and flavonoids than the extracts from *H. italicum* and *H. arenarium* flowers and shows higher radical scavenging activity in DPPH and ABTS radical scavenging studies. The extracts from immortelle herbs were also effectively inhibiting tyrosinase – an enzyme involved in the formation of hyperpigmentation disorders [3] and showed significant sun protection factor (SPF) *in vitro*.

To summarize, conducted study showed that leaves and stems of immortelle species are valuable raw material for cosmetics protecting the skin from the harmful environmental impact.

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Poster presentations

P66: Applications of Everlasting Flowers (*Helichrysum* spp.) with Anti-Aging Properties in the Cosmetic Industry

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Helichrysum species, due to a large distribution and diversity, have been known since ancient times and cited as effective remedies for various pathologies. Among the species of this genus, a special importance was given to *Helichrysum arenarium* (L.) Moench, which is the most popular species, and has been used in folk and modern medicine since antiquity. The genus *H. arenarium* belonging to the Asteraceae family, is also known as bee flower, chickpea flower, goldenrod, kudama flower, evergreen, vetiver, sun flower, mantuvar flower. In Europe, it is known as "immortal, everlasting", which means "immortal, eternal". It is native to South Africa, Madagascar and southern Europe, especially Turkey, Italy, Spain, Portugal, Bosnia and Herzegovina. Historically, people have used teas prepared from the everlasting flowers as diuretic, sand reducing, stomach relaxant, blood sugar reducer, bile stimulant, and spasmolytic. The yellow flowers of *H. arenarium* are rich in flavonoids, phenolic acids, terpenes, pyrones, phloroglucinols, and essential oils. Essential oils obtained from various species of immortelle are used in aromatherapy and perfumery. Due to its skin repairing and supporting properties, it is used in many creams in cosmetics and shows anti-aging effects by supporting collagen synthesis. In addition, it is used in the treatment of diseases such as acne, eczema and psoriasis, thanks to its cell renewal, wound healing, antiseptic, and antibacterial properties Besides potential pharmacological applications, everlasting flowers (*Helichrysum* spp.) are valuable sources for the cosmetic industry, as they are capable of promoting collagen synthesis, elastin production and extracellular matrix remodeling, resulting in a more youthful and healthier skin appearance.

Keywords: *Helichrysum* spp., cosmetic, herbal formulations, skin anti-aging.

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Poster presentations

P67: The use of hyperspectral imaging for the quantitative assessment of natural preparations in skin care affected by acute radiation dermatitis

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Acute radiation dermatitis (ARD) is the most common side effect reported by more than 90% of patients undergoing radiation therapy [1]. Currently, the evaluation of the effectiveness of preparations used in ARD therapy is carried out using qualitative analyzes based on visual assessment of the skin.

The aim of the study was to quantitatively assess the effectiveness of new preparations based on plant raw materials used in ARD.

This two-arm, randomized, controlled clinical trial was designed to evaluate the feasibility of using hyperspectral imaging in a clinical conditions to assess radiation exposure and to compare the effectiveness of a natural oil-based spray emulsion and powder with allantoin in reducing the intensity of ARD. Hyperspectral imaging supported by image analysis and processing methods GLCM (Grey Level Co-Occurrence Matrix) was used to assess the severity of changes in the course of ARD.

Twenty-six patients treated with radiotherapy for breast cancer randomly received spray (natural product) or powder (containing allantoin) to use on irradiated area of skin, twice daily starting at the first day of radiotherapy till the end of course. The obtained results indicate that the skin treated with the natural products containing emulsion shows lower contrast and higher homogeneity for the wavelength characteristic for melanin and hemoglobin at the fourth and fifth control points, which indicates a lower intensity of the radiation reaction.

Hyperspectral imaging is a sensitive and specific method of analyzing the content and distribution of chromophores in the skin, including hemoglobin, so it can be treated as an objective method for assessing the effectiveness of preparations applied topically to the skin, including preparations containing ingredients of natural origin.

Poster presentations

P68: Comparison of physicochemical properties and antioxidant activity of selected plant hydrolates

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Hydrolates (hydrosols) are considered by-products of distillation obtained during the extraction of essential oils from herbal or aromatic plants. However, they contain certain amounts of bioactive molecules, such as water-soluble components of essential oils and other polar compounds with valuable biological activities. Many caring properties of hydrolates make them suitable for use in cosmetic products as water substitutes in lotions, creams, soaps and tonics. Due to the wide range of potential applications, their popularity is still growing, especially in the cosmetics industry and aromatherapy [1, 2].

The aim of this study was to analyze properties of 16 hydrolates from different plant species available on the Polish market. Some physicochemical parameters (electroconductivity, pH) and antioxidant indicators (antioxidant activity by DPPH method, total content of phenolic compounds and flavonoids) were determined. The tested products were characterized by a slightly acidic pH in the range of 3.21-6.18. In addition, it was found that their electrical conductivity varied greatly (from 27.3 to 1153 µS/cm). In turn, their antioxidant potential, expressed as % reduction of DPPH, ranged between 5.6-32.8% with the lowest value recorded in the witch hazel hydrolate and the highest in the olive hydrolate. The highest concentration of phenolic compounds and flavonoids was also found in the olive hydrolate, while the lowest in witch hazel and geranium hydrolates. The research shows that these products are characterized by beneficial properties and due to their natural origin, mild effect, and appropriate pH they can be directly applied to the skin or can be used as semi-finished products in cosmetic industry.

References:

[1] Jakubczyk K, Tuchowska A, Janda-Milczarek K. Plant hydrolates – antioxidant properties, chemical composition and potential applications. Biomed Pharmacother, 2021, 142, 112033.

[2] Prusinowska R, Śmigielski K, Stobiecka A, Styczyńska A. Hydrolates from lavender (*Lavandula angustifolia*) – their chemical composition as well as aromatic, antimicrobial and antioxidant properties. Nat Prod Res, 2015, 30, 386-393.

Workshops

3D Epidermal Models Workshop

The EpiDerm Workshop will provide a brief overview of in vitro 3D reconstructed human tissue models and their use in toxicology and pharmacology as well as the **practical demonstration of EpiDerm Skin Irritation Test** (SIT) according to OECD test guideline 439 9TG 439).
EpiDerm, the 3D human skin model is used across a diverse range of applications including safety and risk assessment, and biological efficacy. Simple protocols and the evaluation of early cellular endpoints allow researchers to acquire data in just few days. EpiDerm, a Reconstructed Human Epidermis (RHE), is a ready-to-use, highly differentiated 3D tissue model consisting of normal, human-derived epidermal keratinocytes (NHEK) cultured on specially prepared tissue culture inserts and cultured at the air-liquid interface (ALI). EpiDerm allows for the evaluation of topically applied compounds, chemicals, cosmetic/personal core product ingredients, and final formulations. With multiple ECVAM validations and OECD-accepted test guidelines, EpiDerm is a proven *in vitro* model system for chemical, pharmaceutical, and skin care product testing. EpiDerm SIT is a validated and accepted method under OECD TG 439, as well as the EpiDerm Skin Corrosion Test under OECD TG 431, and the EpiDerm Phototoxicity Test under OECD TG 498.
Participants will have a **hands-on opportunity to practice the Skin Irritation Test with actual EpiDerm Tissue Kits**. The workshop is suitable for anyone who would like to practice the method, consult the specific problem, and to receive valuable information as well as those who are just considering the use of *in vitro* models in their research.

MATTEK
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Formulation of Natural Cosmetics

The popularity of natural cosmetics is constantly growing. This is due to the growing awareness of consumers about the negative impact of synthetic substances on the human body and the natural environment, as well as the growing knowledge about the high effectiveness and multidirectional effects of natural raw materials on the skin.
Plant extracts are an important group of active ingredients used in formulation of natural cosmetics. Due to the varied physicochemical properties, various types of plant extracts require the use of an appropriate method of introducing them into the cosmetic product. The Workshop presented the types of plant extracts used in the cosmetics industry. Participants had the opportunity to independently **prepare a formulation for a washing cosmetic and a cosmetic emulsion**, as well as learn the methods of introducing plant extracts into the recipe depending on their physicochemical properties.

The workshop was conducted by the employees of the Cosmetology Department and scientists working within the Biomedical Research and Service Center of UITM in Rzeszów, Poland.

Workshops

Innovative Cosmetic Ingerdients by Orcideo

The workshop had focused on innovative cosmetic ingredients that support the skin microbiome, obtained by biofermentation. The topics of the workshop was based on the principles of appropriate selection of biofermented raw material for the type of skin and possible commercial use. Biofermented products are an increasingly common group of raw materials, which includes both the fermentation of plant raw materials and microbiome stimulants that give very interesting properties to cosmetics. Appropriate selection of bioferment therefore seems crucial to give the cosmetic better care properties, and the proposed workshops are the best opportunity for this.

The Workshop was held by representatives of Orcideo – Polish company based in Tyczyn, Poland, specialized in the production cosmetics containing traditional active ingredients as well as innovative bioferments supporting skin microbiome . Please see the company website for more information: https://orcideo.pl/.

Innovative Cosmetic Ingerdients by Urtica Technologies

The history of using plant-based ingredients in cosmetics goes back many centuries. For millennia, various botanicals were used to prepare infusions, oils, tinctures, baths and other preparations of which many are useful until now. What is more, these days they are appearing in modern cosmetic formulations more frequently, among others, as a result of customer anxiety about chemical and synthetic ingredients.
The main emphasis of the workshop will be unveiling the potential of botanical extracts as a new generation of cosmetic ingredients, with an effort to provide deeper knowledge about types of bioactive substances, methods of extraction, biological activities and use of plant extracts in cosmetic formulations.

The Workshop was held by representatives of Urtical Technologies – Polish company based in Gdańsk, Poland, specialized in the production of plant extracts, hydrolates and essential oils for cosmetic formulations. Please see the company website for more information: https://urti-tech.pl/.

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