

# PROCEEDINGS OF THE INTERNATIONAL SOPOT YOUTH CONFERENCE 2021



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# Proceedings of the International Sopot Youth Conference 2021: Where the World is Heading

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## PATRONAGE



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Katarzyna Romancewicz, SSA/IO PAN, Poland

Anna Zdunek, IGF PAN/GeoPlanet, Poland

## FOREWORD

Nowadays, science is revolutionized and has to address global societal challenges, such as health and environmental protection. Providing global society with appropriate information and tools is a must for all researchers independent of their discipline.

We now realize that environmental changes drive social transformations while these drive environmental changes in return. Societies are and will always be impacted by environmental processes such as e.g. climate change.

Therefore, citizens must be provided with reliable sources of information that can empower them to add to their scientific knowledge, engage others, influence policy making and strengthen their community capacity to address environmental challenges.

With the International Sopot Youth Conference, we provide a platform for interdisciplinary and multidisciplinary discussions and exchange of information across all scientific disciplines. We are confident that this annual opportunity is a step forward to create a generation of researchers, who think and work in terms of sustainable science.



Tymon Zielinski

Chairman of the Sopot Science Association

## AGENDA

11 JUNE 2021

- 9:00 Conference start
- 9:00 – 9:10 Welcome by Jan Marcin Weslawski, IO PAN Director  
and Tymon Zielinski, IO PAN, Sopot Science Association Chair
- 9:10 – 9:40 Where the world is headed: The future is female, Rebbeca Daniel, *The Marine Diaries*
- 9:40 – 10:00 Break

### Parallel Sessions I

- 10:00 – 11:00 Session 1a  
Session Chair: Aleksandra Koroza
- 10:00 – 10:15 COVID-19 Lockdown Impact on Columnar and Surface Aerosol Properties over South-Eastern Italy  
Valentina Catanzaro, University of Salento
- 10:15 – 10:30 Electrochemical DTT detection to assess the oxidativa potential of PM  
Maria Pia Romano, University of Salento
- 10:30 – 10:45 Fish gills as an inspiration to create new, effective catalytic carriers  
Katarzyna Sindera, PAN
- 10:45 – 11:00 Have the green roofs an impact on the atmosphere?  
Beatrice Sorrentino, ENEA

10:00 – 11:00 Session 1b

Session Chair: Natalia Szymanska

10:00 – 10:15 Late Quaternary Paleoceanography of the northeastern Indian Ocean:  
Implication for primary productivity and water mass changes

Dhanushka Devendra, PAN

10:15 – 10:30 Measured Heating Rate due to light-absorbing aerosols between mid-latitudes and  
the Arctic

Niccolò Losi, University of Milano Bicocca

10:30 – 10:45 Gelatinous zooplankton distribution and diversity off the northeast Greenland coast

Karol Mazanowski, University of Gdansk

10:45 – 11:00 How can we model composition of plankton in the West Spitsbergen coastal waters  
in an era of intensified glacial melting?

Marlena Szeliowska, PAN

11:00 – 11:10 Coffee break

### Parallel Sessions II

11:10 – 12:10 Session 2a

Session Chair: Szymon Smolinski

11:10 – 11:25 Interspecific competition modifies the main morpho-cyto-physiological traits of alien  
and native macroalgae of the genus *Caulerpa*

Sarah Caronni, University of Milano Bicocca

11:25 – 11:40 Impact of the hydrodynamic conditions on the recent diatom flora in the  
Puck Lagoon (southern Baltic Sea)

Dominika Hetko, University of Gdansk

**11:40 – 11:55** Fossilized plant remains as a source of knowledge about the history of meadow and pasture communities. The example from early medieval islands of the Lubusz land

Karolina Maciejewska, University of Gdansk

**11:55 – 12:10** Mucilaginous blooms in deep gorgonian forests of Tavolara Punta Coda Cavallo Marine Protected Area: involved species determination and mortality assessments

Francesca Panizzuti, University of Gdansk

**11:10 – 12:10** Session 2b

Session Chair: Katarzyna Romancewicz

**11:10 – 11:25** New Insights from the Structure and Biodiversity Seasonality of the Airborne Eukaryotic Community in PM10 Samples over South-Eastern Italy

Mattia Fragola, University of Salento

**11:25 – 11:40** Phylogeography of Gyrodactylus gasterostei Gläser, 1974 (Platyhelminthes, Monogenea)

Mateusz Pikula, University of Gdansk

**11:40 – 11:55** Cloning, overproduction and purification of Escherichia coli RNA polymerase sigma factors

Aleksandra Stodolna, University of Gdansk

**11:55 – 12:10** The role of sRNAs molecules in an antirepressor-mediated initiation of the phage lytic cycle

Wojciech Wesolowski, University of Gdansk

**12:10 – 12:45** Lunch Break

Parallel Sessions III

12:45 – 13:45 Session 3a

Session Chair: Ahmad Reshad Jamalyar

12:45 – 13:00 In search for wisdom— reconnecting with literature as a life guidance for the young

Nastaran Fadaei Heidari, University Besyol

13:00– 13:15 Marine mammals in the crowded marine traffic seas and oceans

Aleksandra Koroza, PAN

13:15 – 13:30 Effects of PVC-microplastics contaminated soil on two wild plant species

Lara Qualigni, University of Milano-Bicocca

13:30 – 13:45 Detection of microplastics in Maldivian coral reef invertebrates

Clarissa Barbara Raguso, University of Milano Bicocca

12:45 – 13:45 Session 3b

Session Chair: Marta Konik

12:45 – 13:00 Indoor air quality assessment for the Cultural Heritage preservation

Alessandra Bigogno, University of Milano Bicocca

13:00– 13:15 Physico-chemical characteristics of precipitation in the coastal zone of the Gulf of Gdansk at the turn of 2019 and 2020

Joanna Buch, University of Gdansk

13:15 – 13:30 Non-destructive testing of structures by means of elastic waves

Damian Mindykowski, Institute of Fluid-Flow Machinery Gdansk

**13:30 – 13:45** Contemporary transformation of post-pandemic city centers. City of Gdynia as a case study

*Sylwia Rozanska*, University of Gdansk

**13:45 – 14:00** Coffee break

#### Parallel Sessions IV

**14:00 – 15:00** Session 4a

Session Chair: Luca Ferrero

**14:00 – 14:15** NG-Nitro-L-arginine Methyl Ester (L-NAME) as a potential drug for Sanfilippo disease

*Julian Guzowski*, University of Gdansk

**14:15– 14:30** The role of the CHIP/STUB1 pathway in mechanisms of neurodegeneration

*Dominika Pankanin*, International Centre for Cancer Vaccine Science

**14:30 – 14:45** The Importance of Being Earnest - a student-produced radio play Act I

*Krzysztof Lukaszuk*, *Martyna Zdrojewska*, Ateneum Gdansk

**14:00 – 15:00** Session 4b

Session Chair: Dorota Majewicz

**14:00 – 14:15** "Spawning zones" in Atlantic cod otoliths: underutilized life history and maturity recorders?

*Côme Denechaud*, Institute of Marine Research, Norway

**14:15– 14:30** Integrating a Human Rights-Based Approach into Economic Growth through the realization of the Right to Development. Inevitable conflict or a place for common ground?

*Klaudia Szabelka*, University of Glasgow

**14:30 – 14:45** Pharmaceuticals in the aquatic ecosystems

*Lilianna Sharma*, PAN

**14:45 – 15:00** Benthic efflux of dissolved organic carbon (doc) and its bioavailability – what is returning from the Baltic sea sediments? Biogeochemical perspective

*Monika Lengier*, PAN

**15:00 – 15:10** Break

**15:10 – 15:30** Poster session summary (Posters will be available on Padlet from 9<sup>th</sup> June)

**15:30 – 16:45** Women and Girls in Science

**16:45 – 17:00** Announcements of winners

**17:15** Closing of the conference

## ORAL PRESENTATION ABSTRACTS

### *COVID-19 Lockdown Impact on Columnar and Surface Aerosol Properties over South-Eastern Italy*

*V. Catanzaro, F. Paladini, M.R. Perrone, S. Romano*

Mathematics and Physics Department "E. De Giorgi", University of Salento, via per Arnesano, Lecce (Italy), 73100.

The lockdown measures established by the Italian Government to reduce the circulation and contagiousness of the SARS-CoV-2 virus started in Italy on March 9, 2020 and lasted until May 4, 2020. All commercial and retail activities were closed, except for grocery shops and pharmacies. All non-essential industrial production activities were suspended and it was forbidden to move outside the place of residence, except for health issues or work. Similar measures have been implemented in several European countries in different time intervals of the year 2020. Therefore, the worldwide 2020 COVID-19 lockdown measures have provided a unique opportunity to determine how the adopted measures have likely affected air quality at the surface and along the whole aerosol column. The aim of this work is to analyze the effects of the COVID-19 2020 lockdown measures on the columnar and surface air quality over south-eastern Italy. To this end, measurements from the AERONET lunar/sky photometer operating in Lecce (denoted Lecce-University) and of the mass concentrations of PM10 and PM2.5 and main polluting gases (NO<sub>2</sub>, CO, SO<sub>2</sub>, and O<sub>3</sub>) have been analyzed. All parameters were analysed before, during, and after the lockdown measures. It is shown that the lockdown measures affected the mass concentrations of main polluting gases since their implementation, while their impact on PM10 and PM2.5 mass concentrations and on the columnar aerosol properties was delayed of a few months.

## *Electrochemical DTT detection to assess the oxidativa potential of PM*

*Maria Pia Romano<sup>1</sup>, Maria Elena Giordano<sup>2</sup>, Roberto Caricato<sup>2</sup>,  
Anna Rita De Bartolomeo<sup>2</sup>, Daniele Contini<sup>3</sup>, Maria Giulia Lionetto<sup>2</sup>,  
Maria Rachele Guascito<sup>2</sup>*

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The electrochemical sensors are useful in many fields connected with the human life, such as the environmental analysis and the monitoring of air quality. In this work an innovative electrochemical sensor for thiols detection is described. This sensor can be considered a device for the measurement of OP (Oxidative Potential) of PM (Particulate Matter). The term “particulate” refers to the solid and liquid particles dispersed in the atmosphere and it’s responsible for the generation of the biological oxidative stress. Long and short-term exposure to atmospheric particulate matter (PM) has detrimental effects on human health being associated with morbidity and mortality. Over the years, multiple cellular and acellular assays have been developed to quantify the OP in order to predict the potential toxicity of PM. Among them, the acellular dithiothreitol (DTT) assay is one of the most frequently used methods. The sensor described in this work can be considered an alternative to the classic spectrophotometric methods. In parallel, the cytotoxicity and the induction of oxidative stress by the particulate have been evaluated respectively by MTT assay and use of the fluorescent probe sensitive to reactive oxygen species, CM-CM-HD2CFDA. The DTT-based chemical reactivity is indeed a quantitative probe for assessment of the capacity of a PM sample to catalyse ROS generation which will result in induction of oxidative stress.

## *Fish gills as an inspiration to create new, effective catalytic carriers*

Katarzyna Sintera

Institute of Chemical Engineering, Polish Academy of Sciences, Baltycka 5, 44-100 Gliwice, Poland

Every year, several million people die globally because of air pollution. These deaths are caused indirectly by diseases of the respiratory system (such as cancer and chronic obstructive pulmonary disease), the heart or stroke. Heterogeneous catalytic processes enable effective elimination of toxic emissions in the air. Catalysts consist of two main elements: a substance that allows neutralization or significant reduction of pollutants (the catalytic phase) and a carrier, on which this substance is deposited. Therefore, a well-designed catalytic carrier should perform intensive heat and mass exchange. The conducted research deals with the improvement of the properties of catalytic supports by changing their geometry. The change mentioned can be done by applying the fish gills morphology due to effective heat and mass transport properties commonly occurring in nature. Thanks to natural selection and evolution, they are constantly improved. The research was carried out with the use of CFD (Computational Fluid Dynamics) software. Firstly, CAD models of the structures inspired by the construction of the gills were created. Then, following by the computational simulations, their transport and flow properties were investigated. The post-processing results indicated that the proposed carriers are characterized by more intense heat and mass transport than monoliths and lower flow resistance in comparison with the packed bed.

## *Have the green roofs an impact on the atmosphere?*

*Beatrice Sorrentino*

ENEA, Via Anguillarese 301, 00123, Roma, Italy

Today, the use of a sustainable approach to mitigate climate change is more fundamental than ever. Many solutions can be adopted to face socio-environmental challenges through a sustainable use of nature and to implement the relationship between man and nature. The VEG-GAP project works on the study of the characteristics of urban vegetation ecosystems to produce new information that can be integrated into the design of urban air quality plans. In particular, the subject of study is the impact that the increase of green roofs could have in the city of Milan. Because contrary to what one might think, vegetation not only brings benefits on air quality and the reduction of anthropogenic emissions, but also emits, in a very different way from species to species, volatile organic compounds (BVOCs) such as isoprene and monoterpenes. These compounds react in the atmosphere with nitrogen oxides (NO<sub>x</sub>) to form ozone, which is a very toxic pollutant for humans. Therefore, the importance of conducting research in this area emerges, to give answers with solid scientific bases, from which to start to better design the choice of plants to be included in urban green areas and to improve the quality of our life. Furthermore, I believe that this kind of approach, which considers the processes involved in an overview, is the approach that should be taken in order to manage the progress of humanity while respecting "world ecosystem".

## *Late Quaternary Paleoceanography of the northeastern Indian Ocean: Implication for primary productivity and water mass changes*

*Dhanushka Devendra<sup>1,2</sup>, Rong Xiang<sup>2</sup>, Pavani Vithana<sup>3</sup>,  
Marek Zajaczkowski<sup>1</sup>*

<sup>1</sup>Laboratory of Sedimentology, Stratigraphy, and Micropalaeontology, Institute of Oceanology, Sopot 81-712, Poland

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We examined the core from the Bay of Bengal (BoB) to understand the last glacial paleoceanographic changes. The rapid  $\delta^{18}\text{O}$  decrease observed at the onset of deglaciation and during the mid-Holocene indicate the decrease in SSS in the BoB, likely due to enhanced summer monsoon precipitation. The planktic  $\delta^{18}\text{O}$  shift from the LGM to the Holocene (1.64‰) exceeds the ice volume effect by 0.42‰ due to the decrease in glacial SST by 1.5°C and 0.5‰ increase in SSS. Depletion of  $\delta^{13}\text{C}$  in glacial deep water indicates a significant reduction in NADW intrusion and a progressive influx of AABW. The large  $\delta^{13}\text{C}_{\text{Planktic-Benthic}}$  offset during the glacial indicates sluggish deep water circulation, while the low  $\delta^{13}\text{C}_{\text{Planktic-benthic}}$  offset during the Holocene indicates active deep water circulation. Productivity was higher during the glacial than the Holocene. Productivity gradually increased during the MIS 3. Dominant occurrence of *Melonis* spp. and *O. umbonatus* correlated with moderate productivity and bottom water ventilation. Increased productivity and low bottom water ventilation during MIS 2 are suggested by benthic  $\delta^{13}\text{C}$  and faunal records. The dominant occurrence of *U. peregrina* suggests continued phytodetritus flux to the bottom through surface water productivity and low bottom water ventilation. The minimal occurrence of *U. peregrina*, the dominance of low productivity indicating fauna, and higher benthic  $\delta^{13}\text{C}$  values indicate low productivity and active deepwater ventilation during MIS 1.

## *Measured Heating Rate due to light-absorbing aerosols between mid-latitudes and the Arctic*

*N. Losi<sup>1</sup>, L. Ferrero<sup>1</sup>, M. Rigler<sup>2</sup>, A. Gregorič<sup>2,3</sup>, G. Močnik<sup>3,4</sup>,  
P. Markuszewski<sup>5</sup>, V. Drozdowska<sup>5</sup>, P. Makuch<sup>5</sup>, T. Zielinski<sup>5</sup>,  
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<sup>4</sup>Department of Condensed Matter Physics, Jožef Stefan Institute, 1000 Ljubljana, Slovenia

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The Arctic region has warmed more than twice as fast as the global average, leading to the expression “Arctic Amplification (AA)”. The reasons behind this phenomenon are not entirely clear. One of the most uncertain aspects is the role of aerosols. Black (BC) and Brown (BrC) Carbon absorb solar radiation and warm the atmosphere: they can act as direct local forcers in the Arctic, or as indirect ones through the energy gradient induced by their forcing between mid-latitudes and the Arctic. Two summer AREX cruises (2018, 2019) allowed to experimentally verify, for the first time, the atmospheric heating rate (HR) due to Light Absorbing Aerosols (BC and BrC) from 45 to 80 °N at high time resolution, by means of an innovative methodology (Ferrero et al. 2018). The determined HR allowed to calculate the energy gradient, due to the LAA induced heat storage at mid-latitudes, which contributes to AA through the atmospheric transport towards the Pole. The results show that the latitudinal averages of BC and global radiation progressively decrease moving northward; accordingly the latitudinal behaviour of HR is similar: the highest values are in Milan and Gdansk, followed by Baltic and Norwegian Sea and lowest values in the Arctic. Also the energy density added to the system by this positive forcing strongly decreases towards the Pole, showing the presence of a great energy gradient between mid-latitudes and Arctic and thus of a transport of energy (heat) towards the north.

## *Gelatinous zooplankton distribution and diversity off the northeast Greenland coast*

*Karol Mazanowski<sup>1</sup>, Maciej K. Manko<sup>1</sup>, Eva F. Møller<sup>2</sup>,  
Agata Weydmann-Zwolicka<sup>1</sup>*

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The average globe temperature has been rising continuously for two centuries, which effects are clearly visible in the sensitive Arctic environment. It causes the melting of Greenland ice cover, what results in rapid freshening of coastal waters and affects primary production. These changes also influence the vertical distribution of gelatinous zooplankton (GZ), which also increases its share in the local zooplankton communities, making GZ a good indicator of climate change. Our goals were to recognize some of the parameters of gelatinous zooplankton communities and determine how they were shaped by environmental conditions. Samples were collected by a MultiNet plankton sampler from selected water layers in 2017 at 10 stations, in the Greenland northeast shelf and adjacent waters. The further step was analyzing GZ quantitatively, qualitatively, and morphometrically. The results showed domination of 3 GZ species. *Aglanthadigitale* were only observed on the shelf and in the exterior zone, where they dominated. They were also the most numerous in deep Arctic-origin waters. In the Atlantic-origin waters, they were the only present species. *Plotocnide borealis* were the main species on the shelf and the only one present offshore, and dominated the Arctic waters influenced by Atlantic ones. *Dimophyesarctica* did not dominate any zone and any water mass. The off shelf area was the richest in the species.

## *How can we model composition of plankton in the West Spitsbergen coastal waters in an era of intensified glacial melting?*

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Arctic fjords represent highly dynamic systems which are particularly sensitive to climate changes. Accelerating glacial retreat and freshwater discharge have so far unknown consequences for ecosystem dynamics in the Arctic coastal waters. Thus, datasets with adequate resolution are required to provide reliable projections. Our comprehensive investigation performed in the West Spitsbergen fjords in summer 2019 allowed us to observe a sharp distinction in living conditions for plankton between 'muddy' waters influenced by glacial and/or riverine runoffs and 'clear' fjordic waters. To examine the impacts of freshwater discharge on planktonic communities from a modelling perspective, we divided protists and zooplankton into functional groups typically used in the biogeochemical models. Despite using such coarse classification, we could indicate groups which were less abundant in seawater with increased turbidity and hence responsive to horizontal and vertical environmental gradients. Our analyses showed that seawater darkening due to high turbidity can negatively affect various trophic levels including tactile predators. Thus, we recommend adding gelatinous zooplankton to ecological models. Marine aggregates should also be included as an important component of the glacially influenced sites. Currently, we are designing numerical experiments that will link these key components of the Arctic coastal waters to understand impact of terrestrial matter on planktonic communities.

## *Interspecific competition modifies the main morpho-cyto-physiological traits of alien and native macroalgae of the genus *Caulerpa**

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Seaweeds responds to biological competition changing their morpho-cyto-physiological characteristics. The aim of this study was to highlight the main differences in the morpho-cyto-physiological traits between the alien macroalga *Caulerpa cylindracea* Sonder and its native congeneric *Caulerpa prolifera* (Forsskäl) J.V.Lamouroux, in relation to inter and intraspecific competition. A manipulative experiment was conducted in NE Sardinia. The abundance of the two species was manipulated in the field, according to 10 treatments simulating different levels of competition. Nine response variables were considered: blade length, area, density and substratum cover, chlorophyll and carotenoid content, photosynthetic activity, chloroplast and nucleus size. Some differences between the species were highlighted, especially in case of interspecific competition. Higher values were recorded for all the variables for *C. cylindracea* (only the nuclei were bigger for *C. prolifera*). In case of interspecific competition, the photosynthetic activity, the content of pigments and the size of chloroplasts increased in both the species while the blade length, density and cover were higher only for *C. cylindracea*, for which also a reduction in the size of nuclei was observed. These results show that the interspecific competition induces a different response in the considered native and alien *Caulerpa* species.

## *Impact of the hydrodynamic conditions on the recent diatom flora in the Puck Lagoon (southern Baltic Sea)*

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The aim of this study was to analyse impact of hydrodynamic conditions to the diatom flora occurring in the Puck Lagoon. A total of 129 surface sediment samples were taken from the area using Van Veen Grab sampler in August and September 2019. The diatomological analysis was prepared following the standard procedure (Batterbee 1986). The counting method of Schrader and Gersonde (1978) were used. Concentration of diatoms valves per 1 g of dry sediments was estimated according to method developed by Bodén (1991). The analysis of diatom flora occurring in the Puck Lagoon allowed to designate three regions with different hydrological conditions. In the northern part, the higher frequency of euhalobous species *Opephoraguenterrassii*, *O. horstiana*, *O. mutabilis* and mesohalobous taxa *Nanofrustulumkrumbeinii*, was observed. It is caused by the inflow of salt waters from the Outer Puck Bay along the Hel Peninsula. In the central part of the study area river waters (Reda, Gizdepka and Plutnica) flowing into the bay caused a decrease in salinity. This is indicated by the increase frequency of oligohalobushalophilous species *Achnantheslemmermannii*. The third region located in the southern part of the Puck Lagoon is characterized by an increase in salinity. The mesohalobous taxa *Catenulaadhaerens* were observed abundantly in this region. Moreover, the urban infrastructure located close to the coastal zone resulted a higher frequency of anthropogenic taxa *Cyclotella choctawhatcheeana*.

*Fossilized plant remains as a source of knowledge about the history of meadow and pasture communities. The example from early medieval islands of the Lubusz land*

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Due to habitat fragmentation and the cessation of traditional management, meadows and pastures are increasingly protected. There are numerous studies on the phytosociological changes and floristic composition of contemporary meadows and pastures, but there is not enough data on their past. Significant information on the history of these plant communities can be obtained through the archaeobotanical analysis on the archaeological sites. A great example of excavations where the numerous plant remains represented meadows and pastures were preserved are the early medieval artificial lake islands from the Lubusz land (task No 539-D040-B855-21 and DS 531-D040-D581-21). The analysis of the phytosociological affiliation of the studied material showed that around the studied objects meadows and pastures developed in various habitats and with a different degree of transformation by humans. Among the numerous plants that have been identified, several species are now rare or protected due to declining habitats and declining populations. The conducted research will provide important data on the history of meadow and pasture communities and will provide useful information for the protection of species and entire plant communities.

*Mucilaginous blooms in deep gorgonian forests of Tavolara Punta Coda Cavallo Marine Protected Area: involved species determination and mortality assessments*

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Microalgal benthic mucilaginous blooms had increased in frequency through the past three decades affecting, in particular, gorgonian populations. The mucilaginous aggregates suffocate the gorgonian polyps and, after degradation, induce a condition of benthic anoxia. The aims of the project were to assess the impacts on the gorgonian species *Eunicellacavolini* (Koch, 1887) and *Paramuriceaclavata* (Risso, 1826) of some recent mucilaginous blooms in TPCC MPA (NE Sardinia), and to identify the responsible microalgal species. To assess the impacts on gorgonians, the living branches, those covered with epibionts and the denuded ones were evaluated by means of image analysis on photograms obtained in the field in the MPA. For the identification of microalgal species, the analysis were conducted with an inverted microscope, according to Utermöhl's sedimentation method. The obtained data highlighted no differences in gorgonian abundance, damage and typology of damage for both the considered species, whose colonies resulted to be more than 50% healthy. The investigated bloom appeared to be monospecific and caused by the diatom *Cylindrothecaclosterium* (Ehrenberg) Lewin & Reiman, 1964. The obtained results suggest that population recovery can still occur in the area despite the frequency of blooms, even though a future threat to the subsistence of gorgonian-dominated ecosystems can not be excluded.

## *New Insights from the Structure and Biodiversity Seasonality of the Airborne Eukaryotic Community in PM10 Samples over South-Eastern Italy*

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Seasonal changes of the Eukaryotic community structure and biodiversity in PM10 samples collected over a one-year period were investigated in this study. We analyzed 37 PM10 samples collected at the Mathematics and Physics Department of the University of Salento in Lecce (South-Eastern Italy), a site representative of the Central Mediterranean and thus affected from different sources of both natural and anthropogenic aerosols. The Eukaryotic structure characterization was performed using the 18S rRNA gene metabarcoding approach applied to the DNA extracts. We focused our analyses on Viridiplantae and Fungi because they represented the prevailing kingdoms in all the seasons. Within Viridiplantae kingdom, we identified two phyla, Chlorophyta and Streptophyta, while within Fungi kingdom, three phyla were detected, i.e. Ascomycota, Basidiomycota, and Microsporidia. Plant and fungal diversity was evaluated by the number of Operational Taxonomic Units and genera, in addition to the Shannon and Simpson indices in each sample. Bray-Curtis dissimilarity between the analyzed sample species was also investigated, as well as relationships between genera, PM10 concentration, and meteorological parameters by Spearman coefficients and PCA-PCoA analyses. All these analytical techniques allowed us to point out that seasonal variations of both fungal and plant airborne communities were affected by long-range transported air masses and partly by air pollutants and meteorological conditions.

*Phylogeography of Gyrodactylus gasterostei Gläser, 1974  
(Platyhelminthes, Monogenea)*

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Phylogeny of *Gyrodactylus gasterostei*, an ectoparasite of the three-spined stickleback *Gasterosteus aculeatus* has been investigated using two genetic markers – ITS rDNA and *cox1* gene. Specimen of *Gyrodactylus* have been collected from 15 locations, mostly (12) from the northern part of Pomorskie voivodeship. In total 24 sequences of ITS rDNA and 64 sequences of *cox1* gene belonging to *G. gasterostei* have been obtained. Additionally a single sequence of ITS rDNA and *cox1* gene has been obtained for *Gyrodactylus* cf. *aphyae* from Labe river system in Czech Republic, serving as an outgroup due to close genetic relationship with *G. gasterostei*. Four new *cox1* haplotypes have been discovered, increasing the number of known mtDNA haplotypes of *G. gasterostei* to nine. Minimum spanning network was constructed for *cox1* gene haplotypes. Haplotypes 2 and 3 were considered ancestral and globally distributed, forming two separate mtDNA lineages, with the rest of haplotypes belonging to either of them. Nucleotide and haplotype diversities for *cox1* have been estimated, yielding low values in both cases. These values, alongside results of molecular clock analysis based on *cox1*, may indicate that *G. gasterostei* is a relatively young species, which diverged from a common ancestor with *G. aphyae* approximately 0,03 mya due to host switch from the European minnow *Phoxinus phoxinus* to the three-spined stickleback and favours reproduction via proliferation or parthenogenesis over the sexual mode.

## *Cloning, overproduction and purification of Escherichia coli RNA polymerase sigma factors*

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Escherichia coli is a bacterial model organism that allowed many scientific discoveries and is still actively employed for gaining understanding of such basic processes as DNA replication, transcription or translation, that are relevant in many biotechnological applications. As such, E. coli serves as a host for many experiments aiming to analyze gene expression, including transcription regulation. An enzyme that catalyzes transcription, i.e. synthesis of RNA based on the DNA template, is RNA polymerase (RNAP). RNAP core is composed of 5 subunits,  $\alpha 2\beta\beta'\omega$ . An additional subunit, sigma ( $\sigma$ ), is responsible for the enzyme's specificity and binding to promoter DNA. Promoters are DNA sequences that are localized at a beginning of a given gene. Each bacterium has a different set of  $\sigma$  factors that by recognizing different sets of promoters allow precise gene expression regulation. E. coli has 7  $\sigma$  factors, named according to their molecular weight  $\sigma 70$ ,  $\sigma 54$ ,  $\sigma 38$ ,  $\sigma 32$ ,  $\sigma 28$ ,  $\sigma 24$  and  $\sigma 19$ . Here, we present a unified protocol for their cloning, overproduction and purification that we believe is superior to the ones previously available. Unlike other protocols where  $\sigma$  refolding is necessary due to their aggregation during overproduction, here we employed fusions of the  $\sigma$  factors with a his6-SUMO tag that allowed their purification in the native form. This tag is then easily removed yielding proteins ready to be used in in vitro experiments aimed to study E. coli gene expression regulation.

## *The role of sRNAs molecules in an antirepressor-mediated initiation of the phage lytic cycle*

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Recently discovered microRNA-type molecules, named UpRoi1 and UpRoi2, come from Shiga toxin-converting bacteriophage  $\Phi$ 24B. Bioinformatic analyses indicated many binding sites for these molecules, not only in the genome of bacteriophage but also of the *Escherichia coli* host. They occur within bacterial genes coding important proteins e.g. inner membrane protein. In turn, the predicted binding sites of phage origin are localized mainly in genes encoding antirepressors, which are essential during phage switch from lysogenic to lytic development. In addition, the analyses showed that UpRoi1 and UpRoi2 could be both trans-acting and cis-acting sRNAs molecules. In order to verify the supposed role of these molecules in the regulation of the phage lytic cycle, we decided to experimentally investigate the phage development in bacteria. We observed that overexpression of UpRoi 1 and 2 decreased the growth of *E. coli* culture and also the efficiency of bacteria lysogenization with phage  $\Phi$ 24B. Importantly experimental results overlap with bioinformatic analyses, and suggest role of UpRoi molecules in the antirepressor-mediated  $\Phi$ 24B prophage induction and its further lytic development in *E. coli* bacteria. At this stage of research, we cannot exclude that UpRoi1 and UpRoi2 may also regulate many bacterial transcripts, however, this requires further confirmation. To our knowledge, these molecules are one of the first candidates of functional microRNA-type molecules of phage origin.

*In search for wisdom— reconnecting with literature as a life guidance for the young*

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A significant number of young people lack proper support and guidance within their family or immediate circle, whom they can rely on. In the process of making important decisions or choosing their life direction, they might ask more charismatic and popular peers, risk involvement in shady groups or sects, or fall for extremist ideologies. Mindfulness, meditation or their often-random search for wisdom appear insufficient if the doubtful young lack the basic knowledge, be it sources or people that may offer assistance, advice, or relief. In consequence, they seemingly accept ideas and take up activities that are supposed to help them, while it is hardly possible without proper introduction, practice, and guidance. The popularity of “inspirational memes” and “wisdom ideas” prove that there is a great need for life guidance and wisdom exemplars, which are, in fact, available in literature. Thus, we observe a necessity for extracurricular activities that will involve young people and re-introduce to them the long-lived approaches and values which already exist in literature. In our presentation we have chosen three poems by a contemporary Iranian poet Sohrab Sepehri, whose works present us with the need to search for the truth—a non-materialistic world view, where humans unify with nature and reconnect together as human beings.

## *Marine mammals in the crowded with marine traffic seas and oceans*

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Marine mammals are becoming more and more recognized by society. The cultural development towards an eco-friendlier environment and a changed approach towards animals such as dolphins has brought new times. Nevertheless, every year with more tourist activities offered, personal crafts being more affordable and growth in commercial usage of the oceans by boats has increased and become a new threat to cetaceans. How dolphins may respond to our boat activities (fast driving and reverse actions like slowing down in their presence) might be variate depending on many factors. To discuss this, I will use my Master thesis conducted in collaboration with Sea Watch Foundation in 2018 on habitat use and boat traffic effect on bottlenose dolphin in Cardigan Bay, New Quay, Wales. In this study, it was found that dolphins response varied with boat types (e.g., small motorboat and sailing boat). The frequency of recordings of each boat was not meaningless for the type of dolphin response observed. This study observed some short-term and long-term changes in dolphin behaviour. Dolphins were also observed in smaller numbers during the highest periods of boat traffic. The results of my Master's thesis research indicated that changes in dolphin behaviour might be caused particularly by motor vessels (speed boats, small motorboats) that do not comply well with marine traffic regulations and are often observed at this location.

## *Effects of PVC-microplastics contaminated soil on two wild plant species*

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Microplastics (MPs) are heterogeneous plastic particles smaller than 5 mm that are considered as emerging micropollutants persistent in the environment. MPs contamination is found ubiquitously and while it has largely been studied in marine environments, their presence and effects in terrestrial soils is still poorly investigated. Soil is likely a major sink of MPs derived from sewage sludge applications, waste-water irrigation and plastic mulching films. MPs contamination can affect soil structure and microbial diversity, with potential adverse effects on plants. In this study, we have investigated the effects of polyvinyl chloride microplastics (PVC-MPs) on morphological traits and photosynthetic efficiency of two wild plant species, *Centaurea cyanus* L. and *Senecio inaequidens* DC. Plants were grown in 1% PVC-MPs w/w contaminated and non-contaminated (control) soil. MP-polluted treatments exhibited a reduced growth in comparison with controls for both species (controls grew higher and larger than treatments). Photosynthetic efficiency was reduced in *C. cyanus* plants grown in polluted soil while was almost unaltered in *S. inaequidens*. From our preliminary results, it seems that the invasive species *S. inaequidens* responded better than the Mediterranean *C. cyanus* to soil microplastic contamination, although further studies are necessary to investigate for the reasons of such trend.

## *Detection of microplastics in Maldivian coral reef invertebrates*

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Coral reefs are one of the most productive and biodiverse ecosystems in the ocean. Nowadays these ecosystems are threatened by different stressors, among which pollution by plastic. It has been noticed that the global surface load of plastic is well below that expected from input rates and that there is an important gap of plastic debris smaller than 1 mm. Corals and sponges could be important players in the removal of microplastics, since they screen huge volumes of water, through suspension-feeding. There is evidence of plastic ingestion by corals, even if in almost all the performed studies the ingestion rate is potentially altered, not providing alternative food. Adhesion of microplastic to reef surfaces is a possible mechanism of plastic removal. In this study we optimize and apply methods to detect microplastics in coral reef invertebrates, combining optical and spectroscopic techniques. Analyses were carried out on 22 scleractinian corals sampled in the water surrounding Magoodhoo island, Faafu Atoll, Maldives and on a total of 7 sponges collected from Magoodhoo island and Thudufushi island, South Ari Atoll, Maldives. We have detected microplastics, from various synthetic polymers, with size range between 134-25  $\mu\text{m}$ , both in corals and sponges. This study shows that microplastic pollution already represents an important stressor also in remote areas like the Maldives.

## *Indoor air quality assessment for the Cultural Heritage preservation*

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Environmental conditions of Cultural Heritage (CH) are among the most crucial aspects to be considered in a reality of environmental global change. Atmospheric particles and gaseous pollutants can more affect CH, especially works in a precarious conservational state. Here, three of the greatest Italian museums were investigated: the protected filtered system of the national museum of Leonardo da Vinci's "Last Supper" (LS) in Milan, the not-filtered glass case of "Quarto Stato" in Museo del '900 (QS) in Milan, and the not-filtered "Apollo e Dafne" room at Galleria Borghese (GB) in Rome. A specific experimental setting performed continuous high-time resolution (1 min), monitoring activity with a combination of instruments for the complete investigation of atmospheric particles and main gases in the three museums. The diurnal cycle of primary/secondary particles was investigated using the apportionment of particle concentration based on the N/BC ratio (Rodriguez et al., 2007). The comparison of air quality in the cases study pointed out relevant differences: [PM 10] in GB reached the highest value ( $43.5 \pm 4.85 \mu\text{g}/\text{m}^3$ ); [BC] were similar at GB ( $770 \pm 60 \text{ ng}/\text{m}^3$ ) and QS ( $670 \pm 50 \text{ ng}/\text{m}^3$ ), quite the opposite, filtered LS showed the lowest value ( $35.8 \pm 2.4 \text{ ng}/\text{m}^3$ ) and the total gases reduction (NO<sub>x</sub>, O<sub>3</sub>). These results evidence how an air filtration system and visitor restrictions would ensure better conditions in CH conservation.

## *Physico-chemical characteristics of precipitation in the coastal zone of the Gulf of Gdansk at the turn of 2019 and 2020*

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The rainfall was collected in Gdynia, on the roof of the building of the Institute of Oceanography (University of Gdansk). Precipitation samples were collected using Bulk collector, in a daily cycle, from 1/10/19 to 1/10/20. The volume, pH and conductivity of precipitation were measured. Measurements of meteorological parameters were carried out. The aim of the study was to determine the degree of contamination of collected based on their pH and relative conductivity. The meteorological conditions that prevailed during the sampling of precipitation were subjected to the characteristics. The average pH of the precipitation collected in Gdynia was 5.8. According to Jansen's classification, it was non-polluted precipitation. The obtained value was comparable to the results from the previous measurement years. Almost half of the precipitation samples were contaminated with alkaline compounds. The pollution in the rainfall could have come from agricultural activity and combustion of coal, wood and biomass. Precipitation with the lowest pH was recorded during the early September. Then the role of communication in shaping the quality of wet deposition increased. Over 40% of rainfall was heavily polluted, their mean EH=61  $\mu$ S. However, the conductivity of precipitation was similar to that obtained at the same measuring station in previous measuring years. Research indicated that higher EH values were recorded in the non-heating period.

## *Non-destructive testing of structures by means of elastic waves*

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In the presentation non-destructive testing (NDT) idea is revealed, underlying NDT importance in the industry. An issue of destructive testing is mentioned. Example software correlated with NDT applications is depicted. The consequences of lack or improper application of NDT are presented. Historical aspect of NDT branch is specified, including development of selected NDT methods. Various NDT methods are described, focusing on the most common ones. An emphasis is put on elastic waves-based methods, including the methods based on phenomenon of elastic waves propagation combined with non-contact excitation using air-coupled transducer. The author's everyday work scope (including the used equipment, software and work specification) is characterised after theoretical background provision. The research scope is clearly divided into experimental and numerical part. Aluminum and carbon fibre-reinforced polymer plates are taken into account as evaluated specimens. Example results and issues considered during analysis of phenomena referred to the used NDT method are then shown, in form of appropriate animations or figures. An application of the method in case of different defects detection in the thin-walled solid structures is presented.

## *Contemporary transformation of post-pandemic city centers. City of Gdynia as a case study*

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The overall aim of the presentation is to analyze the condition of the center in a contemporary post-pandemic city. The author has attempted to re-understand the changes in the structure of Gdynia's central areas in terms of functionality and society. The crisis shows the essence of observing public spaces and modeling its development in relation to the needs of the community. Ordering a "lockdown" at the beginning of 2020 gave an opportunity to try to identify the quality of relations between Gdynia residents and the city center. An analysis of the surveys conducted with residents led to the conclusion that theoretically, the city center is an important part of their everyday life. In reality, however, it is an unstable relation without solid foundation alike strong sense of identity and connection with the place. The main reason is the overwhelming commercial and service function of this area. Local neighborhoods gained popularity during lockdown, and continue to do so. So main city centre should be created for a specific structure, related to specific types of meeting, which will stimulate the real development of this area. The exchange of knowledge and experiences is crucial to strengthen a sense of identity and thus create a high-quality central space that people will miss.

## *NG-Nitro-L-arginine Methyl Ester (L-NAME) as a potential drug for Sanfilippo disease*

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Sanfilippo disease is one of mucopolysaccharidoses, a group of lysosomal storage diseases characterized by accumulation of partially degraded glycosaminoglycans. It is caused by mutations in genes coding for lysosomal enzymes involved in the degradation of glycosaminoglycans. Neurodegenerative changes in the central nervous system are major problems in Sanfilippo disease. They cause severe cognitive disabilities and behavioral disturbances. So far, have been tried several therapeutic strategies for Sanfilippo disease, but neither of them are quite effective. In this work L-NAME has been tested. It is known activator of autophagy process. Moreover, L-NAME has the ability to penetrate the blood-brain barrier, so it can contribute to the increased degradation of excess glycosaminoglycans in the nerve cell. The effect of L-NAME on the level of heparan sulfate in the fibroblast taken from patients with Sanfilippo disease was investigated. Obtained results showed that L-NAME significantly decreases the level of heparan sulphate in the cell of a person suffering from MPS IIIC and D. In addition, this compound does not affect the viability of cells, so it can be a promising alternative for patients suffering for Sanfilippo syndrome.

## *The role of the CHIP/STUB1 pathway in mechanisms of neurodegeneration*

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Neurodegenerative diseases affect millions of people worldwide. Until now no effective treatment have been developed and currently available options are targeted to reduce symptoms and relieve patient's pain. C terminus of HSC70-Interacting Protein (CHIP) is acknowledged as a protector of neurons and cells of central nervous system (CNS) from oxidative stress which plays fundamental role in common pathophysiology of neurodegenerative diseases. Previous studies have shown that CHIP regulates cellular membrane integrity under conditions of acute stress, at the same time acting as a proteostasis sensor that models the proteome. Protein misfolding and aggregation are hallmarks of age-related proteinopathies. To determine the role of CHIP in the process of neurodegeneration, we proposed 'network level' view on signalling in SH-SY5Y cell models. Our team investigated protein homeostasis inside the WT and CHIP KO SH-SY5Y cell models. The key readout of changes in proteostasis obtained with use of liquid chromatography mass spectrometry (LC-MS) showed overexpression of key neuromodulatory peptides in the absence of CHIP. This study could be fundamental for development of effective anti-neurodegeneration treatment therapies.

*The Importance of Being Earnest - a student-produced radio play Act I*

Krystian Lukasik, Martyna Zdrojewska, Arkadiusz Janczylo

Ateneum-University in Gdansk

The presentation concerns a project prepared by a group of seven MA students. The idea was to explore different ways of learning and mastering the English language and we decided to prepare a radio play based on Oscar Wilde's "The Importance of Being Earnest". The play will also be aired on The Ateneum Radio. The project required all of us to pull a variety of linguistic, organisational and team-work skills which are paramount in today's world and job market.

## *"Spawning zones" in Atlantic cod otoliths: underutilized life history and maturity recorders?*

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Specific changes identified in the otolith macrostructure of Atlantic cod, generally called "spawning zones", have long been presumed to represent spawning events. Despite their alleged properties, these zones have seen very little use and interest outside of Norway. Recent experimental studies have also challenged their relationship with spawning, raising questions about their origin. In this study, otoliths from multiple Atlantic cod populations with different life history and environmental traits were first examined to see if spawning zones could be identified as a general characteristic of cod. Then, a large archival collection of NEA cod otoliths was used to investigate temporal changes in the occurrence of spawning zones and compare maturity at age derived from otoliths and from gonad maturity stages. This study shows that spawning zones likely are a universal trait of Atlantic cod and not limited to certain environments or migratory behaviors. Maturity at age derived from spawning zones showed trends consistent with those from gonad examinations. However, spawning zones appear to form with a one- or two-year lag with sexual maturity, which is suspected to reflect a stabilizing of energy partitioning after the first spawning events. Our results illustrate the potential for use of spawning zones, for example in species or populations with limited available maturity data, and highlights the need for addressing the physiological processes behind their formation.

*Integrating a Human Rights-Based Approach into Economic Growth through the realization of the Right to Development. Inevitable conflict or a place for common ground?*

Klaudia Szabelka

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After formalizing the notion of the Right to Development by the UN in 1986 as a realization of the rapidly increasing importance of international human rights over time, there is a call for a new, human rights compatible measure of economic growth. Integration of such measures would allow for economic growth that enables wide poverty and income inequality reduction at the same time. However, is such an idealistic concept possible? Even though there is a common understanding in favour of the idea and the intellectual debate established a normative framework, not enough attention has been given to the costs and feasibility of such an approach. As a result, human rights are only recognized as the obligation of states to demonstrate reasonable efforts to achieve it and not a progressive realization of the human rights framework. Economics is at its heart primarily focused on efficiency and growth. In human rights compatible measures of economic growth, we are, however, faced with the trade-off between efficiency and equity which must be considered at first. Next, the empirical research established two causal effects, one supports the hypothesis that human rights foster economic growth; the other supports that human rights hinder economic growth. Thus, it is important to recognize specifically which indicators and why condition states follow one of these two paths. Only then it is possible to consider its policy implications that enable wide-scale sustainable development.

## *Pharmaceuticals in the aquatic environment*

*Lilianna Sharma*

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Emerging contaminants including pharmaceuticals have been widely recognized as a potential factor contributing to the deterioration of aquatic ecosystems. The increasing rate of medicines consumption, linked to rapid advances in medical sciences, population growth and aging, and relatively low removal efficiency of conventional wastewater treatment plants are some of the reasons for the widespread presence of pharmaceuticals in the aquatic environment. Large loads of drug residues enter coastal waters via sewage treatment plants effluents and river inputs leading to seawater contamination. Unlike many other pollutants, medicines are continuously released into the environment at low concentrations, which results in so-called pseudo-persistence and may contribute to the rise in their overall toxicity. Pharmaceuticals are specially contrived to induce specific biological effects and resist inactivation. Paradoxically the same properties are accountable for their toxicity in ecosystems. The presentation aims to give a general overview of the challenges and potential risks associated with the presence of drug residues in the aquatic environment. The marine and estuarial environments and especially the Baltic Sea ecosystem are under intense anthropogenic pressure. Therefore, investigating the possible impacts of multiple emerging contaminants on marine communities is necessary to understand the related changes in ecosystem dynamics and finally to prevent its further degradation.

*Benthic efflux of dissolved organic carbon (DOC) and its bioavailability – what is returning from the Baltic Sea sediments? Biogeochemical perspective*

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Organic matter, a complex mixture of organic compounds, enters the Baltic Sea by riverine discharge and comes from primary production induced by high input of nutrients from anthropogenic sources. Organic matter is gradually transported towards deeper parts of the sea, where it is finally deposited to the bottom sediments. Decay of organic matter, namely remineralization and hydrolysis, occur mainly in the sediments of the Baltic Sea. Sediments are enriched with the organic matter. It results in the release of, among others, dissolved organic carbon (DOC), which is the product of organic matter decay. We decided to assess the amount of DOC coming back from the sediments to the water column in different regions of the Baltic Sea. Moreover, since little is known about the fate of released DOC from the sediment, the second aim was to assess the characteristics of DOC: the bioavailability, degradation rate constants and half-life time. These studies have significant contribution in better understanding the functioning of the Baltic Sea ecosystem and gives new insight on the Baltic Sea carbon cycle and oxygen consumption in deeper water layers.

## POSTER PRESENTATION ABSTRACTS

### *Study of guided wave coupling phenomena in optical fibers*

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A guided waves propagation approach using optical fiber Bragg Grating (FBG) sensors were analyzed. The piezoelectric transducer (PZT) was used as the actuator and the FBG as sensors for analyzing the guided wave directionality studies. The analysis was performed numerically using Abaqus software and the results obtained are checked with the dispersion curve values obtained theoretically. Thus, a numerical guided wave study was utilized on structural health monitoring of aluminium structures using FBG sensors. Keywords: Guided waves, material testing, FBG, aluminium structures.

## *Family functioning during the COVID-19 pandemic in perception of young adults*

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All of us have lately undergone a quarantine induced by the COVID-19 pandemic. It is indisputable that it has affected almost every part of human life. The study aimed to identify the typical features of the functioning of a family during the COVID-19 pandemic. The preliminary study involved 20 people with an average age of 19. Family functioning was assessed using the David Olson Family Adaptability and Cohesion Evaluation Scale (FACES-IV). The research was divided into two phases. The first stage was a retrospective study. Subjects completed the questionnaire relating to the condition of their families before the pandemic. The second stage was an introspective study. In the light of the performed research, we can assume that some of the elements of family life have improved during the pandemic. I noticed an increase in Family Satisfaction and Flexibility scales. Families are coping with the COVID-19 crisis and are ready to create new patterns of problem solving. Although I discovered that pandemic situations may be difficult for adult children, the analyzed families were defined by an increasing level of Enmeshment. While high cohesion in certain circumstances may be adaptive, it may pose a threat to the development of the children's autonomy and delay their entering adulthood. Keywords: COVID-19 pandemic, family functioning, flexibility, cohesion, family satisfaction, emerging adulthood.

## *Relevant metals for neurotoxicity in particulate matter: A case study*

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Background Particulate matter is known to be classified as a carcinogen but recent studies have shown that may be associated with neurotoxicity and neurodegeneration with mechanisms still unknown. This study is focused on urban and rural areas located in the Po Valley, where the industrial settlements release heavy metals into the atmosphere and in which the orography causes the accumulation of pollutants. Methodological Approach A database of metals (e.g., Cu, Fe, Zn, Al, As, Cd, Ni) in PM10 and PM2.5 was created, consisting of the average daily concentrations (years 2008-2020). The seasonality, monthly and annual trends were analysed, the enrichment factors were quantified considering the local soils and the time series were subjected to cluster analysis. Observed evidence High levels of PM10 and PM2.5 were found in the winter season, in relation to the Planetary Boundary Layer trend; the normed metals were below the legal limits. The cluster analysis highlights the common behaviour of some elements indicators of specific sources (Si, Al, Ca for the terrigenous component, Zn for the traffic, K for the biomass, S for the inorganic secondary component of particulate matter). For the terrigenous elements, the importance of precipitation in inhibiting resuspension is highlighted. Inhaled metals can be translocated to the brain through olfactory bulb thus playing an important role in neurotoxicity. The possible mechanisms of metal neurotoxicity are discussed.

*Effects of genistein on disturbed cytoskeleton in fibroblasts derived from patients suffering from mucopolysaccharidoses*

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Mucopolysaccharidoses (MPS) belong to group of lysosomal storage diseases and are caused by the lack or reduced activity of lysosomal enzymes involved in the degradation of glycosaminoglycans (GAG). As a result, they accumulate in cells, gradually preventing the proper functioning the entire body. Until recently, it was believed that GAG accumulation is the primary and only cause of symptoms. Reports from recent years suggested that it is not accumulation of GAG itself, but cellular processes damaged by it, that is the basis of MPS pathogenesis. To date, no method has been developed that can eliminate all symptoms of MPS. The aim of this work was to determine the effectiveness of the substrate reduction therapy accompanied with stimulation of autophagy on the morphology and organization of the tubulin cytoskeleton. Transcriptomic analyses were followed by microscopic studies reflecting structure of the cytoskeleton. Levels of specific proteins were assessed by Western-blotting. We found significant disturbances in levels and morphology of tubulin cytoskeleton in some types of MPS. Genistein therapy largely improved organization of tubulin cytoskeleton, which may counteract the harmful effects of GAG accumulation. Our results suggest that MPS cells are defective in the cytoskeleton structure, and may exhibit deficiencies in mitotic division and/or vesicular transport. These defects can be alleviated by substrate reduction therapy and autophagy stimulation.

*Molecular characterization of a family A DNA polymerase from *Thermus thermophilus* MAT72 phage vB\_Tt72, an enzyme with strong proofreading activity*

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DNA replication relies on a set of specialized proteins that can coordinate and execute the entire process in a highly concerted manner. A central role is played by DNA polymerases, which are incredibly diverse multifunctional enzymatic entities that copy, and faithfully transmit genetic information through generations. Here we present a structural and functional analysis of DNA polymerase of phage Tt72 (Myoviridae) of thermophilic bacterium *Thermus thermophilus*. The molecular model reveals the spatial architecture of an enzyme with two active sites associated with separate functional domains. The smaller, globular N-terminal domain contains a catalytic site for 3'-5' exonuclease composed of three acidic residues (D15, E17, and D184). It seems that 3'-5' exonuclease activity obeys two metal ion mechanism reaction. The larger nucleotidyltransferase domain adopts the shape of a right hand with three subdomains consisting of the palm, thumb, and fingers. Their spatial arrangement contributes to the cleft that houses the enzyme active site. It contains the two conserved acidic residues D384 and D615. Despite the source of origin, the polymerase has proven not to be highly thermoresistant, retaining its activity only up to 60°C. Above that, the rapid loss of function follows with no activity above 75°C. A midpoint of thermal denaturation at  $T_m=74.57^\circ\text{C}$  ( $\Delta H_{\text{cal}}=2.05 \times 10^4 \text{ cal}\cdot\text{mol}^{-1}$ ), and circular dichroism spectra  $>60^\circ\text{C}$  indicate its low thermal stability.

## *Minocycline attenuates spatial memory impairment in rats with streptozotocin-induced sporadic form of Alzheimer's disease model*

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A sporadic form of Alzheimer's disease (sAD) causes neuroinflammation leading to cognitive deficits. Here we investigated neuroprotective and immunomodulatory effects of minocycline (MINO) at a dose of 35 mg/kg b.w., administered intraperitoneally (i.p.) for 7 consecutive days, on spatial memory changes in streptozotocin-induced sAD. Thirty three male Wistar rats were divided into groups: STZMINO (intracerebroventricular, i.c.v., streptozotocin (STZ) and i.p. MINO injections), VEHMINO (i.c.v. vehicle (VEH) and i.p. MINO injections), STZSAL (i.c.v. STZ and i.p. saline (SAL) injections) and VEHSAL (i.c.v. VEH and i.p. SAL injections). To evaluate spatial memory changes, we used the Morris water maze (MWM) before (basal) and 7 days after the sAD model induction. Following three day training, the latency to reach the critical annulus (CA) was measured. Data is presented as mean  $\pm$  SD. The latency to reach CA was significantly ( $p < 0.05$ ) lower in the STZMINO ( $5.8 \pm 2.51s$ ) group as compared to the STZSAL ( $40.53 \pm 19.46s$ ) group 7 days after the sAD model induction. Moreover, the latency to reach CA in STZMINO and VEHMINO ( $13.00 \pm 0.8s$ ) groups 7 days after the STZ administration were statistically insignificant in comparison to their basal counterparts: STZMINO ( $3.4 \pm 1.61s$ ) and VEHMINO ( $3.28 \pm 1.54s$ ). Our results suggest that minocycline may have neuroprotective properties and attenuates STZ-induced spatial memory impairment, as indicated by the shortened latency to reach the CA in the MWM.

## *A Meal in the Flesh – An Impact of Individualization (versus Categorization) on Instrumental Use of Animals*

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People tend to perceive individually those people who belong to their social group. On the other hand perception of those beyond our community is rather general and based on overall traits. Similarly, the relationship might relate to the perception of animals. We ascribe individual characteristics to pets rather than breeding animals, because we consider them as family members. The aim of our research was to check whether the manipulation of individualised (versus categorised) perception of pigs decreases approval of an instrumental use of animals. Individualization (versus categorization) was manipulated with modified newspaper cutting. In the first condition (individualization) participants read a story of a single pig Betsy and her life in a slaughterhouse. The other group was given an article about a slaughterhouse life of pigs as a group. The dependent variables were an acceptance of instrumental use of pigs and an acceptance of instrumental use of animals in general. (measured by Speciesism Scale). The results confirmed our hypothesis. The participants in the condition of individualisation were less likely to accept instrumental use of pigs and animals in general than the second group which perceived pigs as a category. The results encourage us to think that the individualized way of animal perception is one of the factors that have an impact on their subjective treatment.

*Rediscover the Bible and gain a deeper and more profound understanding of the Holy Scriptures. Read the Hebrew Bible in its original language and uncover hidden secrets that have been lost for centuries*

*Naira Karapetyan*

The Hebrew University of Jerusalem, Mt. Scopus, Jerusalem Zip code: 91905

It's very essential to know the original text to understand the real meaning of the scriptures if one is really interested in the Bible, otherwise, without knowing the truth, the achieved knowledge will be nonsense.

## *The role of small, non-coding RNA molecules in the regulation of repression-antirepression system of phage $\Phi$ 24B*

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The ability of Shiga toxin-producing *E. coli* (STEC) strains to release dangerous for human health Shiga toxins is a result of Stx bacteriophages infection as toxin genes (stx) are located in phage genome. Importantly, the expression of stx genes is suppressed during a lysogenic state and mature toxins are produced only during phage lytic development in bacterial cells. To prevent the Shiga toxins effects for human body it seems to be essential to stop the phage transition from lysogenic cycle to lytic cycle. Newly discovered microRNA-size molecules of Stx phage origin, called Up\_dant1 and Up\_dant2, seem to be important in the regulation of phage life cycle switch. Their sequences are located in the  $\Phi$ 24B phage genome, near to the gene encoding D\_antantirepressor – a protein which probably counteracts Ci, the main repressor of lytic pathway. Bioinformatic analysis indicate that these RNA molecules may regulate expression of both bacterial and phage genes. Among them there are genes coding for antirepressors, ferrichrome outer membrane transporter, transcriptional regulator, oxidoreductase and fimbrial-like adhesin protein. Besides, the results of experimental research show that under Up\_dant1 or Up\_dant2 overexpression conditions, phages more frequently choose the lysogenic state and more bacteria survive the infection. The obtained results confirm the existence of microRNA-size molecules in prokaryotic systems and indicate on their likely role in the phage cycle switching.

## *Therapeutic implications of targeting heat shock protein 70 by immunization or antibodies in experimental skin inflammation*

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Abstract Heat shock proteins (Hsp) are constitutive and stress-induced molecules which have been reported to impact innate and adaptive immune responses. Here, we evaluated the role of Hsp70 as a treatment target in the imiquimod-induced, psoriasis-like skin inflammation mouse model and related in vitro assays. We found that immunization of mice with Hsp70 resulted in decreased clinical and histological disease severity associated with expansion of T cells in favor of regulatory subtypes (CD4<sup>+</sup>FoxP3<sup>+</sup>/CD4<sup>+</sup>CD25<sup>+</sup> cells). Similarly, anti-Hsp70 antibody treatment led to lowered disease activity associated with down-regulation of pro-inflammatory Th17 cells. A direct stimulating action of Hsp70 on regulatory T cells and its anti-proliferative effects on keratinocytes were confirmed in cell culture experiments. Our observations suggest that Hsp70 may be a promising therapeutic target in psoriasis and potentially other autoimmune dermatoses.

## *Environmental DNA: a case study of marine biodiversity monitoring on past and present*

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Until now, the assessment of marine biodiversity and its response to past environmental change was based on taxa preserved in the fossil record. However, most of marine species disappeared without leaving any fossil traces. Hence, the current view of the evolution of marine biodiversity is fragmentary and limited to a few skeleton-bearing taxa. Marine environmental DNA biomonitoring is an efficient method to trace biodiversity changes over time and space. The new molecular tools overcome some limitations of traditional biomonitoring and allow broad taxonomic coverage, ensure high sensitivity. Our project proposes a novel way to study the past and modern environment using the DNA preserved in marine sediments to reconstruct the history of marine life in Nordic Seas. We will follow changes in composition of different groups of organisms by using multiple genetic markers. By combining historical biodiversity data with information about environmental change, the results of our study will increase the knowledge of marine biodiversity and its response to climate change in the past and whether this response is like what we observe today. This work was funded through the Norway and EEA Grants 2014–2021 under the Basic Research Programme operated by the National Science Centre (grant agreement no. 2019/34/H/ST10/00682) in the frame of project “Sedimentary ancient DNA - a new proxy to investigate the impact of environmental change on past and present biodiversity in Nordic Seas”.

## *Dynamics of telomere length in diploid and triploid rainbow trout (*Oncorhynchus mykiss*) at different developmental stages*

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Telomeres are structures that occur at the end of chromosomes. They contain a specific non-coding DNA sequence (TTAGGG) which is repeated several times. The main functions of telomeres are to protect the chromosome from losing genetic information during replication, prevents chromosome fusion. In mammals including humans, telomeres shorten with age while in zebrafish length of telomeric DNA increases during early development and starts to decrease in the adult individuals. In the present research, the length of the telomeric DNA was assessed in rainbow trout specimens at the early developmental stages and in the one, two and three years old fish from diploid (2n) and triploid (3n) stocks. Triploid fish are sterile, they growth is not inhibited during puberty and spawning. The length of telomeric DNA was estimated using Q-FISH (Quantitative Fluorescent In Situ Hybridization) and PNA probe. Differences in telomeric length between 2n and 3n specimens at the particular stages of development were not significant. However, significant different lengths of telomeric DNA were observed within fish of the same ploidy but different developmental stages. The longest telomeres were observed in the larvae while two years old individuals exhibited the shortest telomeres. Interestingly, the length of the telomeric DNA after depletion observed in two years old fish, was then increased. In rainbow trout, unlike in mammals telomeric DNA shortens and lengthens depending on the development stage.

## *Galactooligosaccharides improves social novelty preference in rats disturbed by long-term electrical stimulation of the central amygdala*

Natalia Piekarczyk

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The human gastrointestinal tract contains about 4 million microorganism's genes that have mainly modulating effect on host cells. Gut microbiota, especially probiotic species, are now known to have a crucial role in proper development and functioning of the immune response, central nervous system and can also affect the social behaviour of the host. This is possible due to the ability of microbiota to produce neurotransmitters and neuroactive short chain fatty acids. Galactooligosaccharides (GOS) are prebiotics that stimulate the growth of probiotic microbiota. The amygdala is closely related to receiving, integrating and processing signals from the gut microbiome. The central nucleus of the amygdala (CeA) is also one of the key brain structures regulating the stress response and social interaction. The electrical stimulation (ES) of the CeA induces hyperactivity of the amygdala and may resemble symptoms of psychiatric disorders related to anxiety and stress. 28 male Wistar rats were subjected to 14-day ES of the CeA and 21-day supplementation with GOS. Social novelty preference was assessed by three-chamber test. We found that the stimulated and non-supplemented animals avoided contact with a nonfamiliar animal, while stimulated rats with GOS supplementation and control groups preferred contact with an unknown rat. The work is the result of the research project No. UMO-2019/35/N/NZ4/00908 funded by the National Science Center.

## *Seasonal variability of mercury concentration (Hg) in soft tissue of zebra mussel (*Dreissenapolyomorpha*) in Vistula Lagoon*

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The aim of this study was to determine the level of total mercury concentration (HgTOT) in alien species *Dreissenapolyomorpha*. This is very important because it is likely that this species will become more common and thus may become an important part of the diet of the food web organisms of the Vistula Lagoon. The median concentration of total mercury in zebra mussel was 25,1 ng g<sup>-1</sup> d.w (average = 26,9 ng g<sup>-1</sup> d.w). HgTOT concentration in *D.Polyomorpha* organisms was differed statistically significantly ( $p>0,05$ ) between males and females. Taking into account the analyzed seasons, the concentration of total mercury was the lowest in summer 2019 in the soft tissue of the studied organisms, and the highest in autumn 2019. The results obtained for the cold spring (April 2020) were similar to autumn 2019, while the spring 2019 season was similar to the summer 2019. The factor determining the variability of mercury decomposition was, among others temperature of water. In effect of the fact in spring 2019 and summer 2019 the water temperature was higher than in autumn 2019 and spring 2020 and the metabolism of *D.Polyomorpha* was higher. As a result, the mussels were able to filter water more efficiently and take up food for energy for growth and respiration. The negative correlation of HgTOT with the mass and length of mussels in spring 2019 and summer 2019 indicates that *D.Polyomorpha* organisms grew faster in warmer water than accumulated mercury from food.

## *The general mood of psychology students during the COVID-19 pandemic*

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The question of the COVID-19 pandemic's impact on students' well-being is indubitable. Remote learning is a challenge that young individuals confront in order to progress with their aims despite obstacles induced by a public health crisis. The study aimed to compare the reported mood of the students concerning the beginning of the academic year and the middle of the second semester. The study involved 30 first-year psychology students aged 19-21: 26 females and 4 males. The general sensation was assessed using the Bogdan Wojciszke and Wieslaw Baryla General Mood Scale. The first stage of the research was an introspective study. Subjects completed the questionnaire relating to their current state. The second stage was a retrospective study. The subjects were supposed to answer the same questions concerning the beginning of the academic year. In the light of the performed research, the general mood of the students deteriorated in relation to the beginning of the academic year in October 2020. The most significant difference can be observed in 'drabness and bleakness', where subjects reported the biggest increment. Therefore, it seems that remote studies decrease the willingness to express their individuality. However, students also present higher level of relaxation now than in the beginning of remote learning. This can be the result of an efficient process of readjustment that has been gradually advancing.

## *Leaving from a coal-based economy in Europe*

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The depletion of energy resources such as coal and the tightening of regulations related to the protection of the natural environment mean that the volume of electricity produced from renewable sources is systematically increasing. The development of energy technology based on renewable sources, however, depends on the natural conditions in a country, continent and financial outlays destined for its development. The aim set by the authors of the poster is to find the advantages and disadvantages of RES in Europe and to prove that the production of electricity from RES is beneficial. The authors used in thesis the literature that forms the canon of natural science sources at the University of Lodz, in particular the one devoted to environmental protection. Additionally, there is used information from scientific and popular science articles and also own observations.

## *The effect of age and dimethyl fumarate therapy on neurogenesis in the rat model of Alzheimer's disease*

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Alzheimer's disease (AD) is one of the most common forms of dementia and is characterized by learning and memory impairment. The pathophysiological factors of AD are beta-amyloid accumulation, tau protein hyperphosphorylation, oxidative stress and inflammation which lead to microglia hyperactivation and impaired neurogenesis. Intracerebroventricular injections of streptozotocin (STZICV) induces memory impairment and biochemical changes in rats, reflecting symptoms in AD patients. Dimethyl fumarate (DMF) is an approved drug in relapsing-remitting multiple sclerosis and has been shown to be effective in other neurodegenerative diseases through anti-inflammatory effects and inhibiting cellular apoptosis as well as improving cognitive and motor functions. 40 Wistar rats divided into age groups (young and old) were subjected to STZ-ICV or buffer-ICV (Sham groups) and fed standard or DMF containing chow. All rats were subjected to intraperitoneal injection of BrdU – marker for labelling new cells. Learning and memory skills were measured in the Moriss water maze. Rats were sacrificed and brain were subjected to immunofluorescent BrdU and doublecortin (DCX, marker of immature neurons) labelling. STZ-ICV causes negative changes in the formation of new nerve cells. DMF therapy promotes neurogenesis in the dentate gyrus of the hippocampus. Age enhances the adverse effects of STZ on neurogenesis and also - to some extent - the beneficial effects of DMF therapy.

## *Autologous extracellular Hsp70 exerts a dual role in rheumatoid arthritis*

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Extracellular heat shock proteins (Hsp) influence the adaptive immune response and may ameliorate pathogenesis of autoimmune diseases. While some preclinical observations suggest that highly conserved bacterial and/or murine Hsp70 peptides have potential utility in treatment of rheumatoid arthritis (RA) via induction of T regulatory cells (Treg), the role of extracellular inducible human Hsp70 in adaptive immune processes requires further investigation. The present study evaluated Hsp70 influence on inflammatory cytokine-mediated modulation of T cell immunophenotype in ways that influence RA onset and severity. Here we found that serum levels of Hsp70 are approximately 2-fold higher in RA patients versus healthy control subjects. To explore the effect of extracellular Hsp70 on key processes underlying the adaptive immune system, the effects of human Hsp70 on polarization of the T helper cell subpopulations were studied in human PBMC cultures. While Hsp70 treatment increased Th17 frequencies and Th17/Treg ratio, the frequency of Th1 cells and the Th1/Th2 ratio were significantly decreased in the Hsp70-treated PBMC cultures. Moreover, data shown here provides preliminary suggestion that major contributing Hsp70-mediated immunomodulation includes IL-6 influence on Th17/Treg and Th1/Th2, since expression of this inflammatory cytokine is enhanced by in vitro Hsp70 treatment. These results are nevertheless preliminary and require further investigation to validate the above model.

*The role of AP-1, PPAR-gamma1 and PPAR-gamma2 transcription factors in lysosomal storage diseases of the group mucopolysaccharidoses*

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Mucopolysaccharidoses are a group of rare genetic disorders, classified as lysosomal storage diseases. Due to mutations in genes coding for specific hydrolases, the amount of lysosomal enzymes responsible for glycosaminoglycan (GAG) degradation is decreased. GAGs are gathering in lysosomes, and are causing a number of disorders in functioning of the cellular metabolism, which results in appearance of impairments of the functions of whole tissues and organs. Recent studies on pathogenesis of MPS indicated that the course of the disease can be influenced by various disorders of cellular processes such as apoptosis, autophagy, ubiquitination or disturbances in the cellular cycle. Currently, there is no therapy allowing to stop or slow down all of the MPS symptoms, and the employed methods are pointed to treat single and the most severe symptoms. Thus, another therapeutical method in treating MPS could be the usage of transcriptional factors AP-1, PPAR-gamma1 and PPAR-gamma2 to regulate the expression of genes responsible for the appearance of the disease by activating or inhibiting the expression of these genes. The goal of my work was to investigate the activities and levels of transcriptional factors AP-1, PPAR-gamma1, PPAR-gamma2 and their location in cells. This aspect has never been tested in the context of MPS, and it could be a base for further works on a new potential therapeutical method.

## *Characterization of novel antibacterial peptide Intestinalin*

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In recent years, the public has successfully used antibiotics to combat disease-causing bacteria. Unfortunately, due to their extensive abuse, people are facing the problem of increased resistance of bacteria to antimicrobials. An alternative to antibiotic therapy are antimicrobial peptides that are naturally found in most organisms' immune system. Some peptides are also fragments of bigger proteins. In this project, we characterized novel synthetic, highly positively-charged antimicrobial peptide, Intestinalin, which is a part of the LysC lytic enzyme derived from Gram-positive bacteria *Clostridium intestinale* URNW. We investigated the antibacterial properties of Intestinalin against both Gram-positive and Gram-negative pathogenic bacteria. For example we found that the addition of the peptide to *S. aureus* ATCC 25923 cells caused  $6.69 \pm 0.09$  log reduction of viable bacteria and disrupted the biofilm formation ability of this strain. Fluorescence microscopy and transmission electron microscopy were used to visualize the antibacterial activity of Intestinalin. We used the NMR spectroscopy and molecular dynamics simulations to propose the mechanism of action of Intestinalin (KNLLRRIRRK; 10 aa). By strong salt bridge interactions the peptide is docked to the bacterial membrane. Next, hydrophobic residues (L3, L4 and I7) start to interact with hydrophobic chains of phospholipids separating them from each other what leads to bacterial membrane disruption and bacterial cell death.

## *Recalibration of mercury fractionation method using thermodesorption technique: problems and solutions*

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Analysis of mercury speciation, however, is time-consuming and involves high risk of contamination. The mercury thermodesorption method offers many new possibilities. The methodical works were prepared for the DMA 80 model heater SO0376. In the meantime, the manufacturer (Milestone, Italy) introduced a modified heater DMA0840, coated with insulation material. Although the results of THg concentration still reached accurate and precise values (Soil – NCS DC 87103, Tea leaves – INCT-TL-1; Recovery>95%, RSD>85%), fractionation results in environmental samples considerably varied from the values obtained for the previous heater model. Due to this, the developed Hg thermodesorption method after changing the heater and published in earlier papers had to be developed again based on reference material and Hg standards. The key element of the Hg thermodesorption method was the determination and application of appropriate heating time: (t1) time to reach target temperature, and (t2) time of heating the sample at each analysed temperature. Optimising the settings of the PID controller (proportional-integral-derivative controller) for the purpose of maintaining the output value at a specified level, called the setpoint value, and change of the mode of work of the ventilation system to continuous was also important. The advantage of the modification of the 5-stage Hg thermodesorption method is reduced time of sample analysis caused by thermal isolation of the new heater.

## *Differences in gene expression patterns between Sanfilippo disease subtypes*

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Mucopolysaccharidoses (MPS) are a group of genetically determined metabolic disorders in which the basic problem is a partial or a complete loss of the activity of specific lysosomal enzymes responsible for the degradation of glycosaminoglycans (GAG). Undegraded GAG are accumulated in cells, leading to disruption of their proper functioning, which further impairs the functioning of tissues and organs. Taking into account the type of accumulated GAGs, there are 7 main types of MPS. Moreover, MPS III and IV are divided into subtypes (four subtypes of MPS III and two subtypes of MPS IV). Each subtype corresponds to a lack of the different enzyme, each one responsible for a different step of breaking down heparan sulphate. While the course of MPS IV A and B is similar, the variability between MPS III A, B, C and D is high. Therefore, it can be assumed that there are factors influencing the diversified development and course of the disease within the MPS III subtypes. Therefore, the aim of this study was to determine differences of patterns of gene expression between all MPS III subtypes. Transcriptomic studies, carried out with dermal fibroblasts from patients with all MPS III subtypes, showed a significant variation in the gene expression pattern between them. The results presented in this study indicate a significant role of genetic factors in the diversified course of MPS III subtypes.

## *The level and impact of molecular chaperones on GPER receptor aggregation in mucopolysaccharidosis*

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Mucopolysaccharidosis (MPS) is a rare metabolic disease belonging to the group of lysosomal storage diseases. It is caused by the accumulation of glycosaminoglycans (GAGs), which are not properly degraded because of mutations in individual genes encoding lysosomal enzymes. GAG storage in cells leads to their malfunctions. The accumulation of undegraded compounds destroy cells, tissues and, as a result, entire organs. MPS is a severe and rapidly progressing disease. To date, no therapy that effectively removes all symptoms of the disease has been found. Therefore, an important task is to improve the quality and comfort of life of patients and their families by minimizing symptoms, delaying them or preventing. It is worth mentioning that malfunctions of the nervous system are also complex and severe, which is crucial therapeutic challenge in order to be able to develop effective therapy. Experiments were performed using skin fibroblast to assess the level of GPER. The level of cluster formed by GPER correlates with the accumulation of GAGs in the cells. The purpose of my research was to investigate if it might be an effect of the lack of the chaperones. One of the major functions of molecular chaperones is to facilitate protein folding, to adopt the native conformation and to prevent protein aggregation. If the chaperones are deficient, then an increase in their level might be an way to restrain aggregation of GAG, and it might serve as an important therapeutic option.

## *Machine Learning Categorization of Stars: Binary Classification Based on Predicted Habitability of Exoplanets*

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There's significant interest to find extraterrestrial life in the field of exoplanet research. Recently, machine learning has given valuable insight about previously unknown stellar objects, such as uncovering exoplanets and building atmospheric models of planets. In this study, a binary classification algorithm is built to filter host stars based on the habitability of possible exoplanets. Developed from Scikit Learn, the algorithm determines the stars' ability to host habitable exoplanets by comparing temperature, luminosity, and metallicity, labelling stars capable of hosting habitable exoplanets as 'good stars' and other non-viable entries as 'bad stars'. To establish a pattern between habitable exoplanets and the parameters of their host stars, both exoplanet and star entries from the NASA Exoplanet Catalogue were used to train the machine. After machine-generated labels of 'good stars' matched the actual categorizations by 92%, the algorithm was used to classify stars from the SDSS APOGEE All-Star dataset. The predicted classifications show that only about 7% of stars could host such planets; mostly K stars, with a small number of M and G stars. Calculating the means of parameters of the 'good' stars', habitable exoplanets seem to favor stars which are lower in temperature and smaller in radius compared to the Sun, suggesting that Earth's existence in the solar system is as much of an anomaly as the abundance of life it holds.



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