

PROCEEDINGS OF THE INTERNATIONAL
SOPOT YOUTH CONFERENCE 2018



THE
WORLD
IS
HEADING

25 MAY 2018
SOPOT, POLAND

<http://stn.edu.pl/SFM2018>

Proceedings of the International Sopot Youth Conference 2018: Where the World is Heading

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ISBN

978-83-946541-2-2

Published by

Sopot Science Association

Powstancow Warszawy 55

81-712 Sopot

www.stn.edu.pl

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Jozefa Kraszewskiego 25/31

81-815 Sopot

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PATRONAGE



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FOREWORD

In September 2015, a historic UN Summit took place, during which the nations of the world agreed on the 17 Sustainable Development Goals of the 2030 Agenda for Sustainable Development, which officially came into effect on 1 January 2016. These universal Goals aim at mobilizing all efforts in order to end poverty, inequalities, and to challenge the issues involving climate change. In order to reach these Goals, we all have to contribute, not only governments but also society, i.e. people like us.

Having this in mind, we are happy to present you with the outcome of the XI International Sopot Youth Conference entitled Where the World is Heading. Since 2008 the Sopot Science Association has created a platform for over 500 scientists from all over Europe.

As always, we gathered young scientists and science enthusiasts and gave them the opportunity to present their work, visions, opinions, and thoughts. Traditionally, the Sopot Youth Conference is divided into two categories: humanities and social sciences, and natural sciences. Due to the multidisciplinary character of the Sopot Youth Conference, the abstracts and presentations are intended for the general audience.



Tymon Zielinski

Chairman of the Sopot Science Association

AGENDA

8:15 – 9:00	Registration
9:00 – 9:10	Welcome by Jan Marcin Weslawski, IO PAN Director and Tymon Zielinski, IO PAN, Sopot Science Association Chairman
9:10 – 9:35	<i>The growth of EMI and implications for lecturers/teachers.</i> Colin Campbell, University of Reading
9:35 - 10:50	Session I: Natural Sciences and Polar Studies Session Chairs: Anna Makarewicz, Anna Pouch
9:35 – 9:50	<i>Spatial and temporal variability of High Arctic glacier's ablation based on example of the Waldemarbreen and Irenebreen, Svalbard.</i> Marta Majerska, et. al., Nicolaus Copernicus University
9:50 – 10:05	<i>Mesoscale variability of zooplankton in Isfjorden (high Arctic fjord).</i> Weronika Patuła, Marta Ronowicz, Agata Weydmann, University of Gdansk, IO PAN
10:05 – 10:20	<i>Earth sciences in forensic investigations – topic full of contradictions.</i> Joanna Michalak, Nicolaus Copernicus University
10:20 – 10:35	<i>Sea Spray Aerosol as the Climate Factor in the Modern Society Awareness.</i> Katarzyna Dziembor, Piotr Markuszewski, University of Gdansk, IO PAN
10:35 – 10:50	<i>Manifestations of shallow gas in acoustic imaging for sediments of the Gdańsk Basin and changes of their occurrence in years 2011-2017.</i> Damian Jaśniewicz, et.al., IO PAN, University of Gdansk
10:50 – 11:00	Coffee break

11:00 – 12:30	<p>Session II: Social Sciences</p> <p>Session Chairs: Dominika Janus</p>
11:00 – 11:15	<p><i>The Second Life: a Gift or a Curse?</i></p> <p>Anna Bury, University of Gdansk</p>
11:15 – 11:30	<p><i>Where does depression lead the humanity?</i></p> <p>Justyna Piątek, Małgorzata Łyczakowska, Natalia Głowacka, University of Gdansk</p>
11:30 – 11:45	<p><i>The Gender-Benders Are Here.</i></p> <p>Kinga Erzepki, University of Gdansk</p>
11:45 – 12:00	<p><i>Jobs of the future.</i></p> <p>Kinga Wasilewska, Zofia Falkowska, University of Gdansk</p>
12:00 – 12:15	<p><i>Where the World is Heading. About the forgotten world of reality.</i></p> <p>Kinga Wodzińska, University of Gdansk</p>
12:15 – 12:30	<p><i>The Complexity of Racial Issues Based on Implicit Bias and Social Justice Warriors.</i></p> <p>Zuzanna Czubacka, Anita Pogorzelska, Marta Kot, University of Gdansk</p>
12:30 – 13:15	<p>Session III: 1 minute poster presentations</p> <p>Session Chairs: Magdalena Krajewska, Paulina Pakszys</p>
13:15 – 14:00	<p>Lunch</p>

14:00 – 15:15	Session IV: Natural Sciences I
	Session Chairs: Marta Konik
14:00 – 14:15	<i>The tune of your heartbeat – the secret of 432 Hz.</i> Klaudia Szmidt, Neofilologye Artistic Institution Management
14:15 – 14:30	<i>Monitoring of Infrastructure in the era of big data.</i> Rohan Soman, Wiesław Ostachowicz, Institute of Fluid Flow Machinery, PAN
14:30 – 14:45	<i>Various health measurement techniques in structural engineering.</i> Kaleeswaran Balasubramaniam, et.al., Institute of Fluid Flow Machinery, PAN
14:45 – 15:00	<i>Space microbiology.</i> Emilia Prochwicz, University of Warsaw
15:00 – 15:15	Coffee break
15:15 – 16:15	Session V: Natural Sciences II
	Session Chairs: Marta Skowron Volponi, Agnieszka Necel
15:15 – 15:30	<i>Bacterial multipartite genomes - going towards the light?</i> Aleksandra Pawłot, Dariusz Bartosik, University of Warsaw
15:30 – 15:45	<i>Investigating the molecular mechanism of Hsp70-J-domain interaction.</i> Igor Grochowina, et.al., Intercollegiate Faculty of Biotechnology UG&MUG, Gdansk University of Technology
15:45 – 16:00	<i>Potential antimicrobial effects of lip secretions in genus Maxillaria sensu lato (Orchidaceae, Maxillariinae)</i> Monika Lipińska, Łukasz Haliński, Dariusz Szlachetko, University of Gdansk
16:00 – 16:15	<i>Quo vaditis antibiotics - can murein hydrolases replace you?</i> Rafał Ostrowski, Magdalena Popowska, University of Warsaw
16:15 – 16:30	Coffee break

16:30 – 17:30	Session VI: Natural Sciences III
	Session Chairs: Karolina Pierzynowska i Estera Rintz
16:30 – 16:45	<i>Antibiotic resistance – where this uneven fight heading?</i> Katarzyna Ścibek, University of Warsaw
16:45 – 17:00	<i>Phage cocktail against Salmonella enterica: isolation and characterisation of bacteriophages, cocktail creation and obstacles along the way.</i> Katarzyna Kosznik-Kwaśnicka, et. al., University of Gdansk, Alexandru Ioan Cuza University
17:00 – 17:15	<i>A 130-Year-Old Specimen Brought Back to Life: A Lost Species of Bee-Mimicking Clearwing Moth, Heterosphecia tawonoides (Lepidoptera: Sesiidae: Osminiini), Rediscovered in Peninsular Malaysia’s Primary Rainforest.</i> Marta A. Skowron Volponi, Paolo Volponi, University of Gdansk
17:15 – 17:30	<i>The effectiveness of phage cocktail in eradication of various Salmonella enterica serovars under laboratory conditions.</i> Łukasz Grabowski, et. al., University of Gdansk
17:30 – 18:20	Session VII: Poster presentations
18:20 – 18:50	Jury proceedings
18:50	Announcement of the results of the best presentation contest and the awards ceremony.
20:00	Afterparty in Club Atelier (Sopot, ul. Mamuszki 1, near Hotel Grand) All participants are welcome!

ORAL PRESENTATION ABSTRACTS

Various health measurement techniques in structural engineering

Kaleeswaran Balasubramaniam, Shishir Singh, Rohan Soman, Pawel H. Malinowski

Institute of Fluid Flow Machinery PAN, Gdansk, Poland

The Aerospace Industry is a multi-trillion dollar industry with purposes ranging from travelling, military, and cargo etc. But, due to various flight hours and heavy payloads their parts like skin, stiffeners, beams etc. are prone to structural damage. Air crash investigations reveals that the skin part bears heavy loads from the atmospheric pressure conditions. Thus, the damage monitoring of these structural components is a much need in saving the precious lives and valuable cargoes.

The health measurement of the structures is classified into physical inspection, complete overhauling of the structures, nondestructive evaluation, monitoring etc. This paper speaks about various measurement and monitoring techniques used in the automotive and aerospace industry to identify defects and to identify remaining lifetime. Nondestructive evaluation (NDE) is a technique that helps to identify the damages in the structures before they lead to structural breakdown. NDE helps in evaluating the structures at a reduced cost when compared to complete overhaul of the structures.

The NDE measurements mainly help to identify delamination, cracks, debonding, BVID (barely visible impact damage) etc. The main idea behind the technique is comparing the models without disturbing the intact structure and with the use of sensors, thermo mechanical instruments available. NDE mainly differs from SHM (structural health monitoring) methods in which the former is mainly into detection and evaluation of flaw geometry but the later also helps in lifetime evaluation. Thus, this paper basically focuses on understanding of techniques like eddy current, various methods of SHM, acoustic emission, ultrasonic inspection, strain sensing etc. and its overall pros and cons.

The Second Life: a Gift or a Curse?

Anna Bury

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An outbreak of new religions, social trends, and most importantly, the technological progress have inevitably changed our perspective; what used to be unacceptable in the past, is perfectly approved nowadays. In the era of computers and smartphones most of the people have a so-called "second" life: a combination of the real and the virtual world. The concept itself is not new; it has been present for more than a decade; however, it is still evolving. In the past, the "second" life was a way of spending free time, whereas now the Internet users are spending substantial amounts of money in the virtual world. Games, websites, and social media all offer paid memberships, microtransactions and even loot boxes. Goods that used to be "free to use" a few years ago, now require money, and people are actually buying it. To get the full experience—unlock all of the features, upgrade to a "pro" account, gain a one day earlier access to offered expansions—they are not going to hesitate to get the wallet out of the pocket and insert the card number where needed. Game publishers and creators have grasped an opportunity and started to raise prices, with no resistance from the users. In my presentation I will show hypothetical changes in the lives of ordinary people, if they continue to invest more of their time and money in the virtual world.

The Complexity of Racial Issues Based on Implicit Bias and Social Justice Warriors

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The Internet phenomenon of trying to prove others wrong about social issues, often supported by facts, while seeming righteous to a vulnerable part of the audience, is relatively new. It is known as “Social Justice Warriors,” and consists of people who consider any opposing point of view as hate and/or discrimination. Thus, taking into consideration the people who over exaggerate discrimination and the “Social Justice Warriors,” it is difficult for the majority of Internet users, whose views are not extreme, to make a difference on the issue. Another recently raised controversy, both cultural and linguistic one, is, undeniably, implicit bias. According to Rachel Godsil, the director of research at the American Values Institute, “Implicit bias occurs when someone consciously rejects stereotypes and supports anti-discrimination efforts but also holds negative associations in his/her mind unconsciously.” In our presentation, we will consider the surprising coexistence of the above mentioned problems in the United States, provide examples and comparison of their results and how they affect the contemporary American society.

Sea Spray Aerosol as the Climate Factor in the Modern Society Awareness

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In time of global climate change, the society is divided for two main groups: the first one that understands and accepts the idea of global warming, and the second one that does not. The processes, which are responsible, for example, for weather changing or ice sheet melting, are complex. But the answer on the question “Where the world is heading?” could be simpler. Firstly, our goal is to explain natural phenomena occurring in the environment, secondly, represent this knowledge to non-science people, in understandable way.

During this presentation, the authors want to explain the climate role of sea spray aerosol (SSA), its emission processes which are taking place between the sea and the air, and describe some examples of research methods, leading to the determination of aerosols fluxes. The necessity of continuous development in this domain will be mention as well. In conclusions, examples of activity aimed at popularizing the acquired knowledge will be presented.

The Gender-Benders Are Here

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Until the year 2017, the visibility of gender non-binary people in American popular media was non-existent. Even though the community thrived online, none of the mainstream tv shows featured a character who would represent the group. It was Showtime's Wall Street drama *Billions* that introduced the first gender non-binary character in the North American television.

Following the commercial success of the series, others have also begun to feature gender non-conforming characters. They have appeared in shows such as: *A Series of Unfortunate Events*, *Here and Now*, and *Heathers*.

The recognition of gender non-binary people in the mainstream media provides the opportunity to familiarize and educate the public on the topic of the gender spectrum. The rising visibility and acceptance of gender non-conforming people begins process of the evolution in the understanding of sex and gender.

The effectiveness of phage cocktail in eradication of various Salmonella enterica serovars under laboratory conditions

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Salmonella enterica is a Gram-negative bacterium, pathogenic to human. Each year, various serovars of *S. enterica* cause salmonellosis, a disease which is common throughout the world. Vast majority of cases of salmonellosis is caused by consumption of contaminated eggs or poultry meat. The most popular method of prevention against the development of *Salmonella* rods in poultry is the use of antibiotics added to chicken feed. However, due to the development of bacterial resistance to antibiotics, alternative methods of treatment are considered. Phage therapy, a therapeutic use of bacteriophages, may be one of such methods.

In this work, we have tested effectiveness of experimental phage cocktail in eradication of various *S. enterica* serovars under laboratory conditions. We have conducted a series of experiments, using phage cocktail containing phages isolated from sewage and poultry feces. Preliminary results indicated that effectiveness of phage cocktail depended on used *S. enterica* serovars.

We have also tested if the type of phage solvent affect the effectiveness of the cocktail. We have suspended phage lysates in TM buffer and 0.9% sodium chloride. We have observed, that effectiveness of phage cocktail depended on used solvents.

As phage therapy gains more and more attention around the world, it is important to properly understand its mechanisms of action and application. We hope that our work can provide useful information to evaluate this method of fighting bacterial infection.

Investigating the molecular mechanism of Hsp70-J-domain interaction

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Hsp70 molecular chaperones have critical roles in multiple cellular processes, including protein folding, cellular stress response and Fe/S cluster biosynthesis, each function dependent on a single mechanism of substrate binding and subsequent ATP hydrolysis. To function, Hsp70s require a J-protein co-chaperone that mediates the substrate binding and stimulates the ATPase activity of Hsp70, but the mechanism of recognition and binding of the co-chaperone remains unclear.

We present a structural model of a mitochondrial Hsp70 from *S. cerevisiae* (Ssq1) in complex with its specific J-protein co-chaperone Jac1, created with use of molecular dynamics (MD) simulations. Using equilibrium MD simulations, we have identified the key charged residues on Ssq1-Jac1 interface and verified their importance in specific binding of Jac1 with a combination of biochemical techniques and bioinformatics. We also investigated the effect of J-protein binding on Hsp70 - Jac1 facilitates Ssq1 domain undocking and dissociation of the lid, enabling the substrate trapping.

Based on our results, we suggest that the mechanism of Hsp70-J-protein interaction is bipartite: the variable Hsp70:J-domain interface is responsible for Hsp70 docking to Hsp70, and the evolutionarily conserved HPD motif on the J-domain stimulates the ATP hydrolysis. Further investigation of Hsp70-J-protein interaction might lead to development of potent inhibitors of Hsp70 activity with therapeutic applications.

Manifestations of shallow gas in acoustic imaging for sediments of the Gdańsk Basin and changes of their occurrence in years 2011-2017

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The Gdańsk Basin is known for its favorable conditions for biogenic methane production in the surface sediments. When dissolved methane concentration exceeds the saturation limit, its excess goes into the gas form, which due to distinctive acoustic properties can be detected by acoustic methods.

Presented results are based on acoustic profiles obtained in the years 2011-2017 by low frequency single-beam echosounder (12 kHz), in central and western part of the Gulf of Gdańsk. The acoustic data are supported by results of geochemical analyses of surface sediments, carried out based on the cores collected at two locations within the designated research areas, in 2011, 2014 and 2017.

Acoustic echograms indicated geomorphological differences in gas structures between sediments of central and western part of the Gulf of Gdańsk. The occurrence of shallow methane was observed in the surface sediments (upper 1 m) of both investigated areas (4-8 mmol·dm⁻³) and the methanogenesis zone was found to be present already below 10-20 cm bsf. Acoustic profiles from the western part of the Gulf of Gdańsk showed significant spatial changes in gas saturated sediments in the period of 2011–2017, based on echograms. Geochemical measurements revealed considerable changes in the methane profile over the study period (concentrations decreased with time).

The study was supported by the Polish National Science Center project no. UMO-2011/03/N/ST10/05633 and no. UMO-2016/21/B/ST10/02369.

Phage cocktail against Salmonella enterica: isolation and characterisation of bacteriophages, cocktail creation and obstacles along the way

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Nowadays, phage therapy is seen as an alternative to antibiotics in fighting bacterial infections. It is used in Poland as a last resort method of treatment severe infections caused by drug-resistant bacteria. In this method a “phage cocktail” – a mixture of phages is used in order to destroy the pathogen. However, before the cocktail is used phages must be isolated, characterized and tested in laboratory in order to ensure the cocktail is effective and safe to use.

In this work we would like to present our attempts to create a phage cocktail intended to be used against *Salmonella enterica* serotypes commonly found in poultry. We would like to present different phage isolation procedures from sewage water and bird’s stool samples and how they affected obtained results. We would like to present phages we have isolated and characterized, experimental phage cocktail we have created, problems we have encountered along the way and how we have managed to solve them. We hope that our experiences will prove useful to other young scientists if they ever intend to work with bacteriophages isolated from environmental samples.

Potential antimicrobial effects of lip secretions in genus Maxillaria sensu lato (Orchidaceae, Maxillariinae)

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In the representatives of genus *Maxillaria* Ruiz & Pav., waxes and lipid secretions are usually produced on the lip surface by floral papillae and trichomes.

The main aim of our study was to investigate floral fragrances and secretions in three taxa from distinctive alliances of broadly defined genus *Maxillaria*. Surface waxes and fragrance compounds were analyzed in dichloromethane extracts from whole flowers using gas chromatography-mass spectrometry (GC-MS) in native form and as respective trimethylsilyl derivatives (TMSi). Volatiles detected included several standard monoterpenes, with the most abundant limonene in all plant species. Their most probable role is attracting pollinating insects. Surface waxes were composed of saturated and unsaturated hydrocarbons and fatty acids (including atypical long-chain monounsaturated fatty acids in the range of 18-28 carbon atoms), monoacylglycerols and smaller amounts of other organic compounds. Their composition depended on the plant species studied. Establishing their possible functions requires further analysis, but it is supposed that they can act as protective substances against microbial infestation.

Spatial and temporal variability of High Arctic glacier's ablation based on example of the Waldemarbreen and Irenebreen, Svalbard

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The changes of glaciers are one of the most important subjects of research of the current glaciology. It is essential to look at those processes in terms of global warming. The ablation is the main factor influencing the glacier's loss of mass loss. The research on the Waldemarbreen and Irenebreen were conducted in summer 2017. They are located on the north-west Spitsbergen, in the area of the coastal plain called Kaffiøyra. The research methodology was based on the network of ablation stakes installed on the glacier at the depth of 10m using a steam drill. The measurements were taken in summer every 5-10 days. During the period considered, some dependences were found in the spatial diversity of ablation. Both on the Waldemarbreen and Irenebreen, a strong influence on the spatial distribution of melting had a local exposure and the shape of the surface of the glacier, which favored depositing snow and water-snow mush. The ablation of Waldemarbreen was especially dependent on the occurrence of moraine. Time spatial distribution was strongly dependent on weather conditions and topography of the area.

Nicolaus Copernicus University, Faculty of Earth Sciences, Nicolaus Copernicus University Polar Station on Spitsbergen, Centre for Polar Research.

Earth sciences in forensic investigations – topic full of contradictions

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Idea of using earth materials in forensic sciences existed as soon as in the XIXth century, but in past two decades it really flourished, therefore it is at the same time old and novel. As a conjunction of two types of sciences it leads to numerous contradictions because it creates great opportunities, but also leads to numerous problems. Opportunities are connected mainly to new possibilities, like new study techniques that earth sciences are offering to forensic practice. Contradictions are exposed in the approaches. Geographers for centuries are concentrating their efforts on generalizing and categorizing data whereas forensic scientists are constantly focused on details to discriminate the details. This duality is reflected in how this exceptional combination of disciplines is perceived. Vivid optimism perpetuating by popular portrayal of forensic science is mixed with objections and questions about sensitivity of used techniques and heterogeneity of environment. Contemporary scientists who want to practice this discipline have to take into consideration both opportunities and dangers because for insightful observers there are still some topics to cover.

Quo vaditis antibiotics - can murein hydrolases replace you?

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The most important component of bacterial cell wall is murein. It consists of long repeating sugars subunits. Every second sugar is joined with five amino acids peptide. Composition of this pentapeptide is variable depending on bacterial species. Murein can be digested by class of enzyme called murein hydrolases. These enzymes are widespread in nature, from bacteria, through eukaryotic organisms to viruses. In bacterial cell murein hydrolases are involved in several crucial processes including: cell growth, turnover of cell wall components, cell division and other. In animals, murein hydrolases are part of innate immune system (e.g. lysozyme is present in tears, saliva, human milk). Bacteriophages (viruses which infect bacteria) use them to break the host cell in the last stage of infection.

Facing the increasing level of antibiotic resistance in pathogenic bacteria, murein hydrolases can be used as antibacterial agents. We show the most interesting ideas described so far. Murein hydrolases can be used as bio preservatives to protect food from spoilage, as a medicine for bacterial diseases, antimicrobial agent for sterilization of surfaces, to create transgenic animals which will be more resistant to pathogens or to obtain milk from these animals (with high concentration of transgenic enzymes) which can be excellent medicine.

Murein hydrolases may become a new, effective class of antibacterial compounds and they can be interesting alternative to antibiotics in the future.

Mesoscale variability of zooplankton in Isfjorden (high Arctic fjord)

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The plankton community structure is important for marine environments, due to its role in bio-geochemical cycles and in trophic chains as the main food for many fishes and seabirds. The arctic ecosystems are very vulnerable to temperature increase and inflow of boreal species, because that can lead to remodeling in their short trophic networks. The trend of rising temperature of Atlantic waters, carried along with the West Spitsbergen Current to the Arctic, is observed recently. The goal of our study was to characterize mesoscale zooplankton community structure in the high Arctic fjord, Isfjorden, which is strongly influenced by the inflow of a relatively warm Atlantic Water transported northward along west Spitsbergen and to describe the impact of temperature and salinity on the taxonomic structure and abundance of zooplankton. The samples were collected from three different water layers determined based on environmental factors. Significant participation of holoplankton, and a minimal of meroplankton was present in each of the layers. In holoplankton ubiquitous (e.g. *Oithona similis*), boreal (e.g. *Calanus finmarchicus*) and boreo-arctic species (e.g. *Limacina helicina*) dominated, while in meroplankton Bivalvia veligers prevailed. Domination of small, less fat-rich species indicate the presence of warmer Atlantic waters in Isfjorden and if this trend continues, it may cause changes in food webs, leading to the reorganization of the Arctic marine ecosystems.

Bacterial multipartite genomes - going towards the light?

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The development and accessibility of modern technologies such as DNA sequencing bring more and more information on bacterial genomes. The number of genomic sequences in the databases grows rapidly. Today we know that many bacteria have multipartite genomes, meaning that their genetic information is divided between several autonomous DNA molecules - replicons. Most studies focus on bioinformatic analyses of bacterial genomes; very few include experimental approach, which could help to explain at least some of the complex interactions between the replicons residing within the same cell.

What information does the increase in completely sequenced genomes bring? Does the knowledge increase with the progress? What are the dark sides of filling up the databases at such a rate? Are there still things to be discovered that may surprise us? Here we will present some of our thoughts on this topic, supported with the results of our project on bacterial genomes.

Where does depression lead the humanity?

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Depression is a common mental disorder, which may go unnoticed by both friends and family members. Worse still, the symptoms and effects of a depression still remain underestimated within a society. Throughout the years, depression has become the leading cause of disability worldwide; globally, more than 300 million people of all ages suffer from the quiet disease, and the number is steadily growing.

The presentation will focus on social impacts of depression, such as influence on a family, relationships and one's career. The authors are going to broaden the topic relying on true stories of those who struggle with depression, and additionally, on recent data and statistics with regard to the issue. Moreover, the presentation debates about whether the mental health care is accessible and available for everyone, taken the examples of the United States and Poland.

Finally, it will consider the question if it is our mutual duty to prevent and cure the condition of the society we live in? Does the tremendous spread of depression lead to self-destruction of the whole humanity or the affected individuals only?

Space microbiology

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Mankind always looked up in the sky and dreamed about interstellar travels. Advances in space exploration are making it more and more possible. However, such improvement have led to series of questions about human safety in space, especially when it comes to potential microbial contaminations and infections. Another concern is the impact of the harsh and extreme space environmental conditions (e.g. cosmic radiation or vacuum) on organisms.

Having this in mind, since first space flights were launched, multiple researches were conducted. Among others, survival of microorganisms in outer space and impact of reduced gravity (microgravity) were examined, showing a variety of changes in microorganisms remaining and cultured in space in comparison to Earth's controls, including differences in drug resistance and virulence of some pathogenic microorganisms.

One of the biggest potential issues is constant microbial monitoring of spacecraft or space station environment. It is necessary and in the same time crucial for the sole purpose of control and prevention of potential microbial contamination and infection outbreaks. On the other hand we should also be concern about the changes in the crew microflora which may also be affected during space missions

Last but not least interesting topic is performing biotechnological processes using microorganisms e.g. antibiotic production in space environment, in order to build self-sustaining space stations in the future.

*A 130-Year-Old Specimen Brought Back to Life: A Lost Species of Bee-Mimicking Clearwing Moth, *Heterosphecia tawonoides* (Lepidoptera: Sesiidae: Osminiini), Rediscovered in Peninsular Malaysia's Primary Rainforest*

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Heterosphecia tawonoides Kallies, a species of bee-mimicking clearwing moth known until now only from a single specimen from 1887, the holotype (which is missing important morphological features), has been observed and filmed for the first time in its natural habitat. It belongs to the family Sesiidae, diurnal moths known for their resemblance to bees and wasps, and has a strongly light-reflecting, blue body, as well as characteristic tufts of elongated, hair-like scales on its legs. Our studies have shown that it is associated with Malaysian primary rainforests, ecosystems which are vanishing rapidly due to extensive human activity. Determining locations where the clearwing moth occurs regularly allowed us to document previously unknown behaviours. Remarkably, the moth mud-puddled (the process of sucking up fluids from moist substrate) among bees and never among butterflies which displayed similar behaviour nearby. The species has also been recorded buzzing in a similar way to bees, which might be a case of acoustic mimicry. Due to its rarity, striking colouration, as well as association with vulnerable habitats, *H. tawonoides* has become a symbol for the need of conservation efforts to be undertaken in Malaysia and has been listed by Global Wildlife Conservation as one of 2017's top rediscovered lost species. The published research gained significant media attention (The Guardian, Science, Mongabay, The Dodo, Dzień Dobry TVN, Radio Eska, among others).

Monitoring of Infrastructure in the era of big data

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The dependence of humans on the built infrastructure has been growing. The failure of infrastructure costs large amounts of money and in extreme cases life. The monitoring of structures in aerospace sector, transport sector, as well as energy sector has been a focus for the last few decades. More and more structures are being built in the so-called smart configuration and are instrumented with sensors.

But the processing of this data is still carried out in a traditional way. In the era of Internet of Things (IoT), this traditional approach is the limiting factor and is the sub-optimal use of the information and resources. Thus, this work focuses on the presentation of novel methods which need to be adopted in the maintenance of the structural systems to ensure safety and reliability for the users while keeping the operating costs low. The presentation will showcase the systems of the future, the tools that might be used in the future as well as some disruptive technologies. The work presents the future of monitoring of the structure and how a common citizen in the future may contribute to the safety and reliability of the built environment.

The tune of your heartbeat – the secret of 432 Hz

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Contemporary music is tuned to A=440 Hz, as such standard has been informally changed from 432 Hz, which is proven as natural for humans, and is also considered as saint in most of the main temples around the world. The new standard, however, was adopted by the music industry in 1926 and was approved as the worldwide reference frequency. It is said that 8Hz is the fundamental “beat” of the planet. The earth vibrates at 7.82 (close to 8Hz), which is called the Schumann resonance. The human body, being made up of elements of the earth, resonate with the harmonies of the planets and the heavens, which govern the rotation and rhythms of the earth and the waters upon it. Most importantly, the human nervous system can be tuned like a musical instrument. 8Hz is also the frequency of the double helix in DNA replication. On the musical scale, the note A has a frequency of 440Hz, while the note C is at about 261.656 Hz. Having taken the natural 8Hz as our starting point and work upwards by five octaves, we reach a frequency of 256Hz (it is natural C) in whose scale the note A has a frequency of 432Hz.

The research carried out with the help of the Rockefeller Foundation has proven that 440 Hz affects for left cerebral hemisphere, which allows people to work harder, stifle creative thought and invalidate emotions. It may also explain why modern music, which has changed to the 440 Hz standard in 1939, and had such a negative impact on today's culture. In my presentation, I will aim at explaining why the world associated with 432 Hz has unexpectedly changed our natural frequencies and provide examples for the alteration.

Antibiotic resistance – where this uneven fight heading?

Katarzyna Ścibek

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Since the discovery in 1928 Penicillin by Alexander Fleming, antibiotics have been the subject of intense research in the field of microbiology and allowed effective treatment. Antibiotics are secondary products of microorganisms that affect the functioning and distribution of others microbes. To this day, antibiotics are used not only in medicine. Despite the prohibitions they are commonly used as additives to animal feed. Excessive and too often incorrectly ordered by doctors or lack of basic knowledge of patients about the use of antibiotics in therapy, lead to a growing antibiotic resistance. Through such irresponsible actions, we can go back to the times when people died because of trivial bacterial diseases. At present, there is a very well-known group of antibiotics and their synthetic derivatives, but despite this, more and more bacteria are becoming multidrug resistant.

Bacteria have developed numerous resistance mechanisms such as active drug removal from the cell through pumps, enzymes that break down the antibiotic molecule, or change the permeability of the cell wall. Despite efforts, scientists are still losing this armament race with bacteria - the last effective antibiotic was invented in the 1980s. Most of today's known effective antibiotics come from production by soil bacteria and fungi. In the soil there is antibiotic potential but most of them fail to grow under laboratory conditions. Where is antibiotic therapy going and how not to lose this uneven fight?

Jobs of the future

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In the 21st century, the development of technology makes our lives more automated, and thus easier. The automation makes it less and less necessary for humans to do manual work, which is related to the fact that plenty of professions are disappearing, and new ones are created in their place. In our presentation we will focus on predictions regarding employment prospects in the 21st century, on the jobs that will be the most desirable and the ones that will be lost over the next several decades. The emphasis will be put on young people (18-24) who find it difficult to choose their future job. We will, therefore, aim at showing a variety of employment options that are compatible with the changes on the contemporary and flexible job market.

Where the World is Heading. About the forgotten world of reality

Kinga Wodzińska

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I would like to present my thoughts on where the world is heading. In my opinion, the world is gradually degrading, which can be easily seen in everyday life. I would like to describe what life on the Internet means. People stop talking to each other and lose themselves in the world of abstraction, in the world of the Internet. Interpersonal relationships are slowly disappearing. They have been transferred to the world on the web. People lose contact with reality and transform into smartphone zombies. This addiction to the phone, computer or Internet has become fashionable. Why? It is because if you do not have a Facebook account, you do not exist. Something that does not exist on the Internet, does not exist at all. It is worth to raise the issue of information, which we put on the Internet. Sometimes from the Internet you can learn everything about a man of – starting from marital status through education, work, ending on past holidays. Currently, a whole lot of applications have access to our data such as location or gallery. Is it definitely necessary? Is this problem our own fault?

POSTER PRESENTATION ABSTRACTS

High-resolution atmospheric modeling in two high-latitude fjords, Hornsund and Porsanger

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In this research we have focused on weather modeling in two Arctic fjords: Porsanger, which is located in the northern part of Norway, in the coastal waters of the Barents Sea, and Hornsund, located in the western part of the Svalbard archipelago. The atmospheric downscaling was based on The Weather Research and Forecasting Model (WRF, www.wrf-model.org) with polar stereographic projection.

We have tested what is the impact of the spatial resolution of the model on derived meteorological quantities. The simulations were done using parent domain ($dx_1=20$ km) with nested subdomains ($dx_2=4$ km, $dx_3=0.8$ km) for both fjords. Note that child domains had 5 times higher resolution than parent domains. In this part, we used planetary boundary layer (PBL) scheme with simple turbulence and mixing. PBL is used to distribute surface fluxes through the boundary layer and to use vertical diffusion.

To validate the results we have used meteorological data from the Norwegian Meteorological Institute. We estimated coefficients of determination, statistical errors and systematic errors between measured and modeled air temperature and wind speed at each station. We have also compared wind speed and direction in the fjords, to check if the orographic effects are visible in the output model data.

The project has been financed from the funds of the Leading National Research Centre (KNOW) received by the Centre for Polar Studies for the period 2014-2018.

The variability in iron (III) oxide-hydroxides content in sediments of the Gdańsk Deep

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The reduced frequency and volume of inflows of highly saline surface water from the North Sea in the second half of the twentieth century and the increased organic matter respiration due to eutrophication have caused deterioration of oxygen conditions in the deep Baltic water. Declining oxygenation is accompanied by a change in cycles of many elements, including iron. In the present study, the content of iron (III) oxide-hydroxides in sediments of the Gdańsk Deep was investigated. The availability of iron (III) oxide-hydroxides, so called reactive iron, is considered as a major factor in controlling the amount of pyrite formed.

The aim of the study was to determine the impact of worsening oxygen conditions on reactive iron accumulation in sediments of the Gdańsk Deep. The obtained results demonstrate that concentration of this form of iron in sediment decreased within long-term periods of stagnation. With limited oxygen resources, iron (III) oxide-hydroxides is consumed in oxidation of organic matter. In addition, in the anaerobic conditions there was no oxidation of Fe²⁺, which is a source of iron (III) oxide-hydroxides.

This study was financed by the Polish National Science Centre (Project no. UMO-2013/11/B/ST10/00322).

Anatomical structure of the succulent leaves

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Environmental conditions occurring on the earth are very diverse, what has also a significant impact on the living organisms. The climate as well as associated with them temperature, the availability of light, water and nutrients (soil conditions) makes that some structural features of plants have an adaptive value, enabling survival. Plants growing in some area can have structural features that distinguish them from others plants and make them more adapted to life in a specified environmental conditions. Various ecological forms of vascular plants have been described including this, which grow in different water conditions: hydrophytes, hygrophytes, xerophytes, mesophytes. Water is one of the factors that has a significant impact on processes occurring within the plant cells. Succulents next to sclerophytes are classified as xerophytes. Succulents are a group of plants which store water in vegetative organs like leaves, stems, roots or for example bulbs. The main aim of the work was to describe the leaf structure of succulent *Kalanchoe* species belonging to the family Crassulaceae. The succulent (juicy) leaves were analysed using light and scanning electron microscopy. The single-layered epidermis covered with the cuticle, uniform mesophyll cells formed water tissue, small vesicle bundles and hydathodes were observed on the leaf cross-sections. Features observed during research enables the plant to conduct a frugal water economy and survive in arid places.

Phenotypic and genotypic methods in the identification of selected members of Enterobacteriaceae

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The purpose of this study was the identification of 12 different species belonging to *Enterobacteriaceae* by means of phenotypic and genotypic methods. Phenotypic identification involved Gram-staining followed by light microscopy, the analysis of bacterial colony morphology and the shortened biochemical profile which tested lactose and glucose fermentation, production of hydrogen sulfide, urease and tryptophan. Genotypic identification was performed by PCR amplification of the gene coding for small subunit ribosomal RNA (16S rRNA). The purified PCR products were sequenced and the obtained results were compared with sequences in NCBI database. The received results suggest that the accurate identification of all tested bacterial species was possible only with the use of genotypic approach, which confirms that 16S rRNA is a good molecular marker in bacteria. However, the genotypic method appeared to be more time consuming and more expensive than the phenotypic method. The proper phenotypic identification was possible for 8 out of 12 tested bacterial species. Perhaps extending the spectrum of tested features would increase the effectiveness of the method. In conclusion, both approaches of bacterial identification have their limitations. Therefore, it is advisable to use them as complementary methods in routine diagnostics.

Phytoplankton-driven pH changes in the Baltic Sea area

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This work is divided in two cores, whereas one represents results from laboratory and the other one from numerical experiments. Phytoplankton-driven changes in the Baltic Sea were studied by Omstedt with the aid of numerical model. These results pointed to increase of seasonal variability of pH as a consequence of eutrophication and phytoplankton blooms in the Baltic surface water (Omstedt et al., 2009). Laboratory experiments on Baltic filamentous cyanobacteria (FCY) and picocyanobacteria (PCY) conducted in the present study showed pH increase along with time in ambient synthetically generated environment. This was the case for both fractions (FCY and PCY) but with the greatest increase in pH values in PCY cultures. However, the highest correlation between the cells abundance and the pH change was calculated for FCY. After implementing the pico-bioalgorithms (algorithms derived for PCY life cycle model representation, see the sequent abstract) into the 3D numerical model Ecological Ocean ReGional Model (www.ergom.net) hosted in Modular Ocean Model, the acid-base balance was analyzed. This was done in order to check whether the PCY implementation into the modelled ecosystem would change the extent of phytoplankton-driven contribution to pH changes in the Baltic Sea area. Conducting numerical analysis on acid-base balance was motivated by the laboratory results.

This work has been funded by the Polish National Science Centre project (contract number: 2012/07/N/ST10/03485) entitled: "Improved understanding of phytoplankton blooms in the Baltic Sea based on numerical models and existing data sets". The Author (AC) received funding from the Polish National Science Centre in doctoral scholarship program (contract number: 2016/20/T/ST10/00214).

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On the picocyanobacteria modelling in the Baltic Sea – pico-bioalgorithms development

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This study presents the new numerical approach development and implementation for the Baltic Sea ecosystem modelling studies. Three algorithms representing Baltic picocyanobacteria (PCY) life cycles (pico-bioalgorithms) were developed on the basis of laboratory experiments on three strains of PCY *Synechococcus* sp. cultures. The pico-bioalgorithms provide for the PCY abundance temporal change depending on growth, respiration, mortality and zooplankton grazing pressure. This is a typical representation commonly used in Nutrient-Phytoplankton-Zooplankton-Detritus (NPZD) type models. The growth is represented by a growth function R_n with a growth sub-function $F_n(S, T, I_0)$, where the 'n' index indicates the functional group of phytoplankton, S states for salinity, T is temperature and I_0 is the Photosynthetically Active Radiation (PAR) reaching the sea surface. The response of PCY to changing environmental conditions is provided within F_n sub-functions. The nutrient limitation is applied with the aid of Michaelis-Menten kinetics and Liebig's law of minimum. The algorithms were adjusted to the modelled ecosystem by tuning the half-saturation nutrient uptake constants, respiration losses, mortality rates and maximum grazing pressure factors. Different parameterizations (adjustments) were created and examined in test runs as a part of this study. The pico-bioalgorithms were implemented into Ecological ReGional Ocean Model (ERGOM, www.ergom.net).

This work has been funded by the Polish National Science Centre project (contract number: 2012/07/N/ST10/03485) entitled: "Improved understanding of phytoplankton blooms in the Baltic Sea based on numerical models and existing data sets". The Author (AC) received funding from the Polish National Science Centre in doctoral scholarship program (contract number: 2016/20/T/ST10/00214).

Analysis of wave and storm climate of the Gulf of Gdańsk over years 1958–2001

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The information required for modern coastal management and engineering design needs a statistical characterisation of the impact of storms on the shoreline or coastal structure. The impact is related to the combined influence of waves and surges, which are the hydraulic parameter inputs into functional relationships that describe the loading and response of the structure. Changes in global weather climate will naturally influence storm climate, which will induce consequential changes in the severity and frequency of regional coastal extremes. Due to complex geometry of both coastline and bathymetry of the Baltic Sea, variability in wind wave characteristics is very high, especially in gulfs, that are at least partially sheltered from wind.

The long-term stochastic properties of wind wave field over the Gulf of Gdańsk, are being analysed based on modelled data spanning almost half a century. Those properties cover basic statistics of integral parameters: significant wave height H_S , including its maximum value and 95th and 99th percentiles, as well as the mean and peak periods, T_z and T_p , respectively, and mean direction of wave propagation θ_0 , associated with extreme H_S . As expected, the highest values of H_S were modelled for the open part of the Gulf, and, in most extreme cases reached over 8 m. Mean value of this parameter was close to 1 m and mean value of T_p was in range of 3–4 s. For both parameters those values are in accordance with literature data for the Baltic Sea (see Soomere & Räämet, 2014). Analysis of changes registered in corresponding months was performed as well.

The spatiotemporal distribution of storminess was looked at as well. Data analysis seems to suggest general increase in storminess, measured in number of events classified as storms, in the North Sea (see Weisse et al, 2005). We investigated whether this is also true for Gulf of Gdańsk, even though it is much smaller body of water and quite sheltered from the influence of dominant winds. Especially interesting is analysis of spatial variability of the highest values of H_S in time and its relation to probable change in storms' paths.

In addition, the analysis of spatiotemporal distribution of significant steepness is performed. We also examine whether it remains, with changing wind patterns, in an interval between 1/16 and 1/20 that is typical for stormy waves (see Tucker & Pitt 2001). Also included in this work is analysis of relation of H_s , storminess and steepness to wind direction and presence of trends visible in analysed period 1958–2001. Those trends are analysed against the atmospheric indices, such as NAO, since there is a possibility of a positive correlation (see Cieřlikiewicz et al, 2005).

The modelled data, used in this study, is the result of an EU-funded project HIPOCAS (Cieřlikiewicz et al. 2005, Cieřlikiewicz & Paplińska-Swerpel 2008), which generated long-term statistical information about, among others, wind waves over the Baltic Sea for years 1958–2001. As mentioned before, an important aim of this study is to determine the most characteristic features of extreme storms that had significant impact on the Gulf of Gdańsk during the last half-century.

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The role of orf61 and orf60a in the development of phage λ and phage Φ 24B, a representative of Shiga toxin-converting bacteriophages

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Shiga toxin-producing *E. coli* strains may cause some infections. The most dangerous of them are enterohemorrhagic *E. coli* (EHEC). High pathogenicity of EHEC depends on production of Shiga toxins, encoded by *stx* genes, located in genomes of Stx phages. These genes are silent in lysogenic bacteria and prophage induction is necessary for toxin production. This process is provoked by inductors like H₂O₂. Our previous results present the evidence for the relation between the *exo-xis* region of the phage genome and lambdaoid phage development. We also indicate that *orf63* from *exo-xis* region may have specific functions in the regulation of lambdaoid phages development, especially at the stage of the lysis vs. lysogenization decision. Molecular mechanisms of activities of other genes products are still unknown.

In view of this, I decided to determine the influence of the uncharacterized open reading frame *orf61* and *orf60a* from the *exo-xis* region on lambdaoid phages development using recombinant prophages, λ and Stx phage- Φ 24B.

I can conclude that analyzed *orf*'s has a special role in the control of phage development. The removal of these elements may change the phage titer during the prophage induction with use H₂O₂, influence on survival of *E. coli* bacteria during this process and after infection of phage mutants. I also demonstrated the interesting effects on lysogenization of *E. coli* bacteria, intracellular lambdaoid phage lytic development and phage adsorption on bacterial cells.

Response of the rats immune system with different locomotory activity to single administration of amphetamine

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Although the amount of data on the effects of amphetamine (AMPH) on the immune system is still growing, so far little is known about the basis of individual variation in response to this substance. The aim of this study is to assess the possible correlation between behavioral and the immune system response to AMPH.

The experiment was carried out on 15 rats which were randomly divided into two groups: rats receiving a single injection of AMPH and rats receiving a single saline injection. After 20 minutes of injection, the animals were placed for 15 minutes in the actometer to test locomotor reactivity induced by AMPH. Blood was collected 1 hour after injection by cardiac puncture. The total number of leukocytes and the number of lymphocytes, granulocytes and monocytes, the number of T lymphocytes, B lymphocytes and NK cells was determined in each sample.

In the peripheral blood of rats receiving AMPH was observed a statistically significant reduction in the total number of leukocytes and lymphocytes as well as a reduction in the number of T lymphocytes. On the other hand, a significant increase in the number of monocytes was observed. Rats receiving AMPH were also characterized by a strong motor excitation. The correlation analysis revealed a strong correlation between the number of movements and many parameters of the immune system in rats with AMPH injection.

The increased response of the immune system to AMPH depends on the amount of motor agitation after its administration.

Seoul's creative spaces in the light of the analysis of tourist geoportals

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The increasing demand on spatial information as well as the concept of the universal access to such data has contributed to the creation of not only national and regional geoportals, but also thematic ones in the last decade. The tourist geoportals are the ones which develop the more intense. The development was observed in terms of the quantitative plane (the increase in content) and the qualitative one (the increase in functionality). These are mainly Asian cities that play a leading role in the development of tourist geoportals. An example of such city is Seoul (South Korea) because of the fact that it leads in innovations and TRL (Technology Readiness Level). The specificity of the development of access to spatial information presented above implies the need to analyze creative spaces in cities in terms of tourism based on geoportals.

The aim of this work is to discuss the resources used in maps located in the user's interface of the analyzed geoportals. The number of 25 districts called *gu* was used to perform the study. The study was based on the geoportals provided by the official Seoul's government website (<http://english.seoul.go.kr/>) and the official tourist website of North Korea (<http://www.imagineyourkorea.com/>).

As a result of the analysis, it was found that in the tourist geoportals of Seoul, the gastronomic content and related to accommodation are predominant. The distribution of tourist facilities in the urban space of Seoul shows their main concentrations in the districts of Gangnam-gu, Jongno-gu, Jung-gu and Yongsan-gu. It is also essential to highlight that, in Seoul's case, primarily the distance and financial barriers generate the need to get to know the city through the analyzed tourist geoportals.

Characterisation of novel Shiga toxin-converting bacteriophages.

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Escherichia coli is an ubiquitous, symbiotic bacterium. However, some strains of it can pose a threat to human health. One such group are the enterohemorrhagic *E. coli* (EHEC). The major virulence factor of these bacteria are Shiga toxins, which genes are located in the genomes of Shiga toxin-converting bacteriophages (Stx phages), integrated in the bacterial chromosome.

Contemporary knowledge of the Stx phages, can not keep up to the number of new isolates discovered annually. The aim of this work was to characterise three novel Stx phages' (P22, P27 and P32) stability in various environmental conditions, their genomic sequence and compare them with known lambdoid phages: λ , 933W and Φ 24_B.

The genomic sequences were obtained using next-generation sequencing (NGS), and corrected and analyzed. All genomic annotations were created using myRAST software and manually corrected using various computer programs (e.g. ClustalW, HMMER). The stability of the phage particles was measured in 4°C, with the change of other environmental conditions.

Despite high global similarity in genomic sequence, some regions participating in the phages' development show sequences' differences. Special attention was also paid to highly conserved genomic fragments of still unknown function. The protein and genomic sequences of other lambdoid phages were also used to determine open reading frames that could encode potential structural virion proteins.

Ectomycorrhizal fungi of acidic beech forest during transformation from mature to natural regenerated forest

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Habitat loss and decrease of biodiversity are one of the most important problems in nature conservation. Forest management may negatively affecting both, ecosystem functioning and biodiversity. Fungal biodiversity can be closely related to the total biodiversity because it expresses the heterogeneity of a habitat and can potentially give an indication of ecosystem change. Hence, monitoring the composition and the fungal community dynamics may represent a useful tool to evaluate the health status of forests and to establish management strategies. The aim of this study was to determine the diversity of ectomycorrhizal fungi in the acidic beech forest (Gdańsk Pomerania, Poland) during transformation from mature to natural regenerated forest.

Research was carried out in autumn 2017 in Sopieszyno Forestry. We used standard morphotyping of mycorrhizas and molecular tools to describe ectomycorrhizal assemblages of European beech forests.

Altogether 27 ectomycorrhizal taxa were identified in Sopieszyno site. Most common taxa were: *Cenococcum geophilum*, *Clavulina coralloides* and telephoroid fungi. Particularly important is the finding of a new localities of fungi very rare in Poland, for example *Cortinarius anomalus* and *Russula silvestris*, including taxa new for Poland, such as *Cortinarius subturibulosus* or *Sistotrema citrifforme*.

Our study shows, that fungal communities in managed forests can be rich and diverse, even during forest transformation and timber harvesting carried out.

The role of the 3' -> 5' exoribonuclease in stability of sRNA in Escherichia coli

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RNA degradation dynamics plays a key role in regulation of gene expression in bacterial cells. Adaptation to ever-changing environmental conditions depends on rapid shifts in levels of bacterial RNAs. This mechanism rely upon RNA sequence susceptibility to degradation mediated by RNases. Divided into two classes, according to location of action on RNA strand RNases consists of endonucleases, that cleave molecules internally, and exoribonucleases, digesting RNA nucleotides from extremities. Involved in degradation, processing and maturation of different RNA substrates, 3' -> 5' exoribonucleases are crucial in the control of small noncoding RNAs (sRNAs) levels in cell.

sRNAs play the major role in post-transcriptional control of gene expression. Encoded on the opposite strand of coding sequences, antisense RNA (asRNA) have been found to influence mRNA stability, and translation rate. By binding to their target mRNA, asRNA can inhibit its translation, or promote its decay by RNases.

The aim of this project was to determine sRNA metabolism in the absence of 3' -> 5' exoribonucleases. For this purpose we used transcriptome sequences (RNA-seq) derived from Escherichia coli wild-type cells and three mutants for each of the main exoribonucleases involved in sRNA degradation (PNPase, RNase R, and RNase II). Our results indicated that deficiencies in activities of various exoribonucleases have different effects on sRNA degradation. Therefore, these enzymes play important functions in the regulation of sRNA levels in bacterial cells.

Research on autogamy in the world of orchids

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Orchids are unusual flowers that can adapt to different types of environments. The flowers are generally cross-pollinated by animals (insects, birds), but in dark forest, coasts, dunes, when pollinating animals are limited, one of the forms of adaptation to the environment is autogamy. Autogamy is a way of reproduction thanks to which the flower can be pollinated with its own pollen and could occur when the flower is aging and has not yet been pollinated by animals.

Planning the experiments with autogamy, the most important thing is to isolate flowers from potential pollinating animals. Then, the selected flowers are hand pollinated by pollen from the same flower (autogamy), from another flower from the same inflorescence (geitonogamy) or only isolate the flowers from pollinating animals (autogamy sensu stricto). The fruit set, formed as a result of pollinating the flower, it is a confirmation that the species is capable of reproducing as a result of autogamy.

The activity of three antimicrobial peptides: protegrin-1, aurein 1.2 and citropin1.1 against Staphylococcus pseudintermedius strains isolated from animal infections

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During the last decades bacterial resistance to the most clinically available antimicrobial agents has increased significantly. This situation requires to search for alternative chemotherapeutic compounds with new mechanisms of action.

The production of antimicrobial peptides (AMPs) is a primary mechanism in immunity of numerous organisms. AMPs have activity with wide spectrum (bacteria, fungi and viruses) and could be an alternative to conventional antibiotics in the treatment of infections. Sensitivity of staphylococci isolated from animal infections is poorly understood.

The aim of the study was to analyze the *in vitro* activity of few antimicrobial peptides against *S. pseudintermedius* strains isolated from animal infections.

The activity of antimicrobial peptides (aurein 1.2, protegrin-1, citropin 1.1) was tested using the broth dilution method in line with the Clinical Laboratory Standards Institute (CLSI) guidelines to designated MICs (Minimal inhibitory concentrations) values. The susceptibility of staphylococci strains to antibiotics was tested with the disk diffusion method in line with the EUCAST standards.

Investigated *S. pseudintermedius* isolates turned out to be susceptible to AMPs at the following concentrations: citropin 1.1 from 2 µg/mL to 8 µg/mL, aurein 1.2 from 32 µg/mL to 64 µg/mL and protegrin-1 from 2 µg/mL to 8 µg/mL.

All staphylococcal strains were susceptible to selected AMPs. Our findings point that examined AMPs might be promising antistaphylococcal agents.

Influence of shipping noise on underwater acoustic field in high intensity traffic regions in southern Baltic Sea

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For over last few decades gradual increase of underwater noise level is observed all around the world. Shipping activity is recognized as responsible for this phenomena due to continuously growing number of operating vessels and their engine power. Rising noise level and its gradual change from natural to more anthropogenic create potential negative impact on marine organisms.

Presented data have been collected by autonomous passive acoustic buoys in years 2014 – 2017 in two high intensity traffic regions: shipping lanes in Gulf of Gdańsk and Pomeranian Bight. Multi-parameter analyses was based on acoustic records, ship traffic (AIS), meteorological (wind and rainfall) and acoustic propagation data.

Results show short-term (hours) and long-term (days) variability of underwater noise, as a combination of ship activity and natural sources. Their differences and distinguishability are discussed. Highest observed noise levels were registered during ships passages and somehow connected with their operational status. Effect of multiple ships presence, in selected area (15 km radius), are presented including noise spectral characteristic changes as a function of time/distance to ship. Evaluation of potential noise impact range on fishes is presented based on modelling results.

Emotions and Visual Attention – on the waves or on the roads?

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In the field of cognitive psychology, one of the most interesting questions is whether and how emotions influence human visual attention. According to LeDoux's model (1996) cognitive processing uses a longer and slower thalamo-cortical path - the "high road", whereas affective (emotional) processing uses a shorter and faster thalamo-amygdala pathway – the "low road". Both processes share the same initial brain pathway up to the thalamus and might interact at a late level of processing. An alternative model - the multiple-waves model of Pessoa and Adolphs (2010) suggests that the affective processing is neither faster, nor more efficient than the cognitive one. Moreover, when a task requires a special attention, the processing resources would rather be allocated to this activity than to visual processing of emotions.

To test both models and study the relation between cognitive and emotional processing, we joined the dual-stream Rapid Serial Visual Presentation (RSVP) task (an alternative form of the well-established attentional blink paradigm), with the classical fear conditioning procedure. We measured skin conductance in the dual-stream RSVP task with some of the target letters being fear conditioned. We found a similar pattern of the left visual field advantage (LVFA) for both emotionally loaded and unloaded stimuli. A lack of significant difference between those two kinds of stimuli is interpreted in favour of the multiple-waves model (Pessoa and Adolphs 2010).

*Genetic diversity of *Trebouxia* photobionts in a gradient of altitude in Bolivia*

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A wide spectrum of ecosystems typical of a large part of the continent of South America occurring in Bolivia makes it one of the fifteen countries with the highest biodiversity in the world. Tropical lichens are poorly studied with respect to their photobionts, especially those from Bolivia. Many genera, or even families of lichen forming fungi, were found to be exclusively associated with terrestrial green alga *Trebouxia*.

Here we examined *Trebouxia* photobionts of diverse Bolivian lichen species. The samples were collected from various habitats, different localization and substrata in a gradient of altitude (i.e. 860 – 4650 m a.s.l.). Total genomic DNA was extracted. The internal transcribed spacer ITS1-5.8S-ITS2 rDNA region was amplified using the algal-specific primers. PCR-amplified DNA markers were sequenced and phylogenetic analyses were performed.

We detected a high level of variability in this group of *Trebouxia* photobionts. Some of them seem to be specific to the environment - they occur in a narrowly defined height range and substrata. In other cases they are divergent through different altitude with no significant pattern among locations and substrates. Moreover identical haplotypes of *Trebouxia* photobionts occurring in up to 6 specimens of lichens collected from different altitude and localities were also found, suggesting lack of relationship between environmental factors and photobionts. Research is funded by National Science Centre (no DEC-2015/17/B/NZ8/02441).

T7 RNA polymerase displays superior slippage properties

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In our study we investigate the transcriptional slippage phenomenon that is characteristic for RNA polymerases. This process usually result from inaccuracies in insertion of nucleotides during the process of transcription or translation present in all kingdoms of life. Short sequence repeats and homonucleotide repeats are prone to insertion/deletion (InDel) mutations that disrupt the reading frame and thus leading to loss of function of particular genes. In the light of our research, it appears that bacteria that contain single or double InDel gene mutations can produce wild-type protein. This is mainly due to the editing of mRNA by RNA polymerase, which during the transcriptional slippage on the A/T homopolymeric sequences can form different length variants of mRNA consequently leading to the creation of a mixture of different variants of proteins in a single cell, including the wild-type protein. In our study we present different efficiency of transcriptional type mRNA editing in the model *mbolIM2* gene and its derivatives containing InDel mutations, depending on the type of RNA polymerase (bacteriophage/ bacterial) and the structure of the homopolymeric region. Additionally by using a series of *gfp* reporter gene in fusion with set of various fragments consisting of A/T-rich homopolymeric sequences we determine the slippage ability of studied RNAPs regarding to the length and the type of nucleotide composition of a homopolymer run, but also in the context of the adjacent sequence.

*Modelling the potential geographic distribution and climatic factors limiting occurrence of expansive species - *Digitalis purpurea* L. in Europe*

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Modelling of potential geographic distributions of species is essential for different applications in ecology and conservation. One of the most commonly used methods for predicting taxa distributions and environmental tolerances from occurrence data is the maximum entropy method (MaxEnt).

The aim of the research was to determine potential geographic distribution and main bioclimatic factors limiting occurrence of *Digitalis purpurea* in Europe.

D. purpurea (common foxglove) is a subatlantic species whose natural geographical range covers south-western, western and central Europe, including mountainous areas. In central Europe it occurs more rarely and in western Germany, according to many researchers it reaches its eastern border of distribution. However, it is increasingly recorded from outside continuous range, especially from countries such as: Poland, Czech Republic, Slovak Republic, Lithuania and Finland. In addition in Poland, the Czech Republic and Finland foxglove is considered as locally invasive plant.

A list of localities of foxglove was obtained from the available databases and own field work. It was used to model potential climatic niches based on the maximum entropy method (MaxEnt version 3.3.2). The obtained results indicate that the most important climatic elements influencing the distribution of *D. purpurea* were temperature seasonality and annual precipitation.

Screening and characterisation of Pseudomonas spp. from domestic cattle

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Pseudomonas spp. are common opportunistic pathogens. They can cause acute infections in humans and animals, particularly in immunodeficient patients. In addition, these microorganisms exhibit different antibiotic resistance mechanisms and are able to produce biofilm that is extremely difficult to control and eradicate. These bacteria can be found in animals, thus cause serious economic losses in animal production. Moreover, according to the recent opinion issued by the WHO, carbapenem-resistant *Pseudomonas aeruginosa* is considered a critical threat in healthcare.

Risk assessment requires effective and quick diagnostics, therefore the aim of this research was to isolate *Pseudomonas* spp. strains from cattle, assess their drug resistance and verify the suitability of used research methods. In this work standard methods deriving from microbiological diagnostics were used including streaking, biochemical typing and PCR.

The isolates were successfully identified. All tested strains demonstrated growth on selective media, enabling the primary selection of ESBL (extended spectrum β -lactamase-producing) and KPC (carbapenemase-producing) strains, as well as on ceftrimide agar. Three strains demonstrated drug resistance in disk diffusion method. The results not only proved that both methods are useful for determination of bacterial drug resistance, but also underlined that obtained results should be verified each time with supplementary diagnostic tests to ensure the accurate outcome.

*14th protein coding gene in mitochondrial genome of *Mytilus edulis* mussels.*

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Contrary to strictly maternal inheritance (SMI) of mtDNA found in other animal species, male *Mytilus* spp. mussels have two different mitogenomes. One inherited from the father (M-type mtDNA) is located mainly in male germ line cells, and the second from the mother (F-type mtDNA) located in female germ line cells and in somatic cells of both sexes. This rare phenomenon is known as doubly uniparental inheritance (DUI) but for now, origin and mechanisms standing behind this unusual system remain unknown.

Recently, a novel short open reading frame (ORF) has been discovered in mitochondrial genome of *Mytilus edulis* mussels. The presence of this additional gene highly correlates with the occurrence of DUI in variety mussels species. Also, bioinformatical analysis indicates that this ORF should be functional and probably codes for actual protein.

In our research we try to prove if bioinformatic analysis was right and how distribution of this protein (expression in different tissues) correlates with current general DUI theorem. If we are right this could be a new milestone in research concerning DUI species.

The role of small regulatory RNAs in Listeria monocytogenes

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Listeria monocytogenes (Lm) is an intracellular, Gram-positive pathogen, which is responsible for a foodborne infections - listeriosis in humans and different animal species. *Lm* is able to survive exposure to highly stress conditions, including pH variations, cold temperature and high salt concentration. Regulation of transcription by small RNA (sRNA), was the subject of numerous studies in *Lm*. sRNAs are non-coding transcripts usually between 50-500 nucleotides that play important role in control of bacterial metabolism, stress responses and virulence. The mechanism of action includes the regulation of gene expression by hybridizing with target mRNA and blocking transcription or translation of the downstream open reading frame. Some sRNAs can bind to proteins with chaperone function. Bacterial most known RNA-binding protein is Hfq (HF-I protein), that facilitates the annealing of sRNAs with their target mRNAs, to build functional complexes and modulate their activity.

Thanks to advancements in bioinformatics, particularly in molecular biology and modern sequencing methods, it was possible to identify more than 250 sRNAs in *Lm*. Even though all types of sRNAs are negative postranscriptional regulators, the function of small transcripts in most cases is still unknown. The main goal of this poster is to summarise current level of knowledge of sRNA – based regulation in *Lm*, which is essential for many biotechnological applications.

*A sample preparation protocol for scanning electron microscope examination of *Staphylococcus aureus* biofilm*

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The majority of microorganisms in their natural habitats is attached to a variety of solid surfaces forming groups of bacterial cells which are embedded within an extracellular matrix rather than existing individually as planktonic organism. These communities of microorganisms are known as biofilms. Scanning electron microscope (SEM) is a valuable tool to study the cell morphology of bacterial populations in different biofilms. A variety of sample preparation methods are described in literature. The aim of this study was to find simple protocol for visualizing *Staphylococcus aureus* biofilm formed on polystyrene plates.

Biofilms of *S. aureus* were performed on 6-well polystyrene plates. Adherent bacterial cells were fixed with 3% buffered glutaraldehyde overnight at 4°C. The samples were dehydrated through a graded ethanol series at room temperature. The bottom of each well was cut out from the plate. After sputter coating with gold (LEICA EM SCD 500) the samples were examined with a scanning electron microscope (FEI QUANTA FEG 250) with secondary electron detector.

SEM micrographs of *S. aureus* biofilms revealed that there is no need to use additional chemical fixation such as osmium tetroxide or critical point drying. Imaging was performed in high-pressure mode at different acceleration voltages; 20 kV was found to give the best image quality.

The electron microscopy was provided by the Electron Microscopy Laboratory, Faculty of Applied Physics and Mathematics, Gdansk University of Technology.

*Influence of environmental factors on fitness components: effects of nutrition on reproductive traits in *Tribolium castaneum**

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Individual condition during organism development and in adult life is one of the most critical factors affecting diversity in animal fitness components. Understanding to what extent various components of fitness (such as life history and sexually selected traits) depend on condition is, therefore, one of the keys to explaining the evolution and diversity of life history and sexual strategies.

We used population of *Tribolium castaneum* to analyze how larval and adult diet affects key reproductive components: mating activity and fecundity. We found that larval but not adult malnutrition had strong effect of male mating activity, whereas female fecundity was influenced by both larval and adult diet. Interestingly effects were mostly independent on body mass, which suggests that adult body composition, not size influenced reproduction.

Angular unconformity for subsurface data, Cracow-Silesian Homocline, Poland

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In this presentation we will show a robust method for computing angular unconformity between two boundary surfaces from an ore-bearing clays deposits in Cracow-Silesian Homocline. Delaunay triangulation is used to compute plane-by-plane the angular distance between considered horizons. This method can be regarded as a development of determining the unconformity in outcrops. A distribution of this unconformity was obtained and certain statistical parameters. We discuss the obtained figures in terms of the geological structure of the investigated area.

Where the World is heading in the face of cardiovascular diseases?

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Despite positive changes of epidemiological trends, cardiovascular diseases still are one of major cause of deaths in highly developed societies. The main risk factors of cardiovascular diseases are hypertension, diabetes, smoking and hypercholesterolemia. The current guidelines and forecast of international scientific associations show the essence of prophylaxis and treatment in the fight against the disease. If ignored, the number of patients with cardiovascular diseases will increase dramatically. The aim of this work, according to current knowledge, we present where the world is heading in the face of cardiovascular diseases.

What if antibiotics can aggravate infection? Bacteriophage vB_Eco4M-7 against Enterohemorrhagic Escherichia coli (EHEC)

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Enterohemorrhagic Escherichia coli (EHEC) is a group of pathogens responsible for many outbreaks over the world. Infection with this bacteria cause food poisoning with several complications like i.a. haemolytic-uremic syndrome (HUS). The major source of these bacteria is cattle, and humans can get infected with EHEC mostly through consumption of i.a. undercooked meat or contaminated vegetables. The major virulence factors of EHEC are Shiga toxins, encoded by genes located on genomes of Stx phages. Effective production and release of toxins occurs only after prophage induction and start of a lytic life cycle.

There are groups of antibiotics that can cause escalation of the disease symptoms in EHEC infection. Also, the use of medications that slow down intestinal peristalsis is not recommended. At present, only symptomatic treatment is used and is important to search alternative methods. Moreover EHEC pathogens have an ability to form biofilm which is difficult to fight with.

In earlier biodiversity studies 83 bacteriophages were isolated from urban sewage. One of them i.e. vB_Eco4M-7 have an ability to lysis only E. coli O157:H7 strain and clinical strain E. coli O157:H7(ST2-8624). Our study shows that bacteriophage vB_Eco4M-7 is characterized by short life cycle, high multiplication rate and have ability to reduce the biofilm formed by EHEC strains. These results indicate vB_Eco4M-7 phage potential in the fight against Enterohemorrhagic Escherichia coli (EHEC).

Genistein-mediated elimination of behavioral and biochemical defects in the rat model of sporadic Alzheimer's disease

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Alzheimer's disease (AD) is a progressive neurodegenerative disorder. Its main reason is accumulation of beta-amyloid (β A) and hyperphosphorylated tau protein (P-tau). They impair functions of neurons what leads to neurodegeneration and specific symptoms, like progressive memory disorders. One of the most promising therapeutic strategies is the accelerated removal of aggregated proteins. However, compounds activating degradation processes have been considered dangerous due to possible adverse effects. In contrast, genistein, one of the flavonoids stimulating lysosomal degradation, is known to be a safe substance even in long-term use at high doses. The aim of this study was to determine effects of genistein on the rat streptozotocin AD model in two aspects: behavioral and biochemical. We found that administration of genistein for one month led to complete abolition of changes in locomotor activity of AD rats (novelty test and open field test) and improvement of cognitive disorders (Morris water maze and the elevated plus maze test). *Post-mortem* biochemical analyzes showed reduced levels of both P-tau, total β A, and its shortened forms β A40 and β A42 (Western blot and immunohistochemistry). Ultimately, the levels of inflammatory markers were reduced. In summary, genistein reduced the main cause of AD, leading to definite improvement in the biochemical and behavioral parameters of affected rats, and therefore, it has a potential to become a drug for AD.

The saxicolous species of the lichen genus Pertusaria s.l. in Poland

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Currently, about 360 species of *Pertusaria* DC s.l. (including *Lepra* Scop. and *Varicellaria* Nyl.) have been reported worldwide. So far, 40 taxa have been identified in Poland, but nearly all of them have not been confirmed by TLC investigation (except Oset & Kukwa 2010; Zduńczyk et al.2012). Taking into account, that the specimens were using morphological and anatomical characters only, detailed TLC data on the distribution and status *Pertusaria* species in Poland are still incomplete and uncertain.

The aims of present paper is to present results of studies on the morphology, chemistry, anatomy, distribution and habitat requirements of *Lepra aspergilla*, *L. corallina*, *L. ocellata*, *L. schaereri*, *P. flavicans* Lamy, *P. melanochlora* (DC.) Nyl., *P. pseudocorallina* (Lilj.) Arnold, and *Varicellaria lactea* (L.) Schmitt & Lumbsch in Poland, together with information of specimens from elsewhere. Due to the lack of materials three species have not been confirmed: *P. chiodectonoides*, *P. eitneriana* and *P. inopinata*. Lichen species usually were observed on sandstones, granite and andesite boulders. Almost all specimens were recorded in the southern part of the country.

Marigold (Calendula officinalis L.) as a model for studies concerning the role of triterpenoids in the plant response to environmental stress

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Triterpenoids are a large group of metabolites distinguished by their wide structural diversity and numerous biological and pharmacological activities. In plants, these natural products can exhibit a positive effect against stress factors, take part in defense responses against pathogens and herbivores, play an important role in the stabilization and regulation of permeability of the lipid membranes, and improve environmental stress tolerance. The aim of the study was the determination of triterpenoids in marigold *Calendula officinalis* plant and derived *in vitro* cultures with respect to investigation of changes in biosynthesis and accumulation of sterols and pentacyclic triterpenes in plant response to various abiotic and biotic stress factors (jasmonic and salicylic acids, chitosan, heavy metals, UV-radiation).

The triterpenoid profile of *C. officinalis* is composed of several sterols (e.g. campesterol, isofucosterol, sitosterol, stigmasterol) and numerous pentacyclic compounds (mono- and dihydroxyalcohols, acids, their esters and glycosides). Various stress factors applied to *C. officinalis* cell and tissue cultures differently influenced the triterpenoid metabolism. Particularly in the response to biotic stressors, the biosynthetic pathways of sterols and pentacyclic triterpenoids became competitive, and subsequent redirection of the carbon flow either favors the biosynthesis of pentacyclic defense compounds or sterols involved in basic metabolism and membrane regulation.

Influence of galactooligosaccharides and electrical stimulation of the amygdala on sociability index in the three-chamber social test in rats with different stress-related vulnerability

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Prebiotics like galactooligosaccharides (GOS) are defined as non-digestible polysaccharides that promote and stimulate the growth of probiotic commensal microorganisms, and which are known to have beneficial effects on the central nervous system. Microbiome also regulates the reactivity of the hypothalamic–pituitary–adrenal axis. The amygdala, especially its central nucleus (CeA) is one of the key structures regulating the stress response. It has been demonstrated that microbiota influences social behaviour and social cognition. The germ free (with no commensal microbiota) animals showed social avoidance and reduced preference for novel social situations.

Spontaneous locomotor activity in a new environment assessed in a novelty test allows to classify animals into high responders (HRs) or low responders (LRs). HRs, in which the neurohormonal HPA axis is more reactive than in LRs, are considered as stress-sensitive. HRs pronounced exploratory behaviour resembles sensation-seeking behaviour occurring in humans.

24 male Wistar rats categorized as HRs or LRs in the novelty test were subjected to 14-day electrical stimulation of the CeA and 21-day supplementation with GOS. Three chamber test was used to assess social behaviour.

We found that electrical stimulation of the CeA induced significant social avoidance in rats, especially in HRs. Stimulated animals with GOS supplementation showed more prosocial behaviour expressed by a higher sociability index in the three chamber test.

Transition of non-pathogenic bacterial strains into emerging pathogens

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Bacteria of the genus *Paracoccus* (*Alphaproteobacteria*) are classified into over 50 species, isolated from diverse environments. Interestingly, one of the species, *P. yeei*, was found to be associated with opportunistic human infections, which is a unique feature in the entire genus. It is suggested that the pathogenic behavior of these strains results from acquisition of exogenous genetic information originating from pathogenic bacteria of other species. Genomic comparative analyses allowed to identify putative virulence factors of *P. yeei* strains, comprising: (i) complete genetic unit for urease synthesis, (ii) type IV secretion systems, (iii) genes enabling hydrogen peroxide decomposition, which may play an exceptional role for the cell under oxidative stress and (iv) numerous systems possibly involved in antimicrobial resistance. Some of the genetic determinants are located within genomic islands or extrachromosomal replicons, which indicates the role mobile genetic elements in the evolution of pathogenicity in this species.

*Is the devil in the details? Scanning electron microscopy in botanical studies exemplified by *Goodyera repens* (L.) R. Br. (Orchidaceae Juss.)*

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In 1935, the first topographic image was obtained by using the scanning electron microscope (SEM). With the development of natural sciences, this revolutionary proceeding gave the opportunity to increased deployment of SEM and forced conducting researches in the micro scale.

The aim of this work is to present the scope of deployment of SEM in botanical researches. The object of study is *Goodyera repens* (Orchidaceae). It is the only Polish representative of the genus *Goodyera*. Due to its botanical value, *Goodyera* constitutes subject to rigorous species protection.

This studies embrace the deployment of SEM on the parts of *Goodyera repens* flowers for the verification of micromorphic structures presence and indicating their potential contribution in pollination. This studies have stated the presence of such microstructures on tepals and inflorescence shoot. In addition, we present the preliminary results of the comparison analysis of leaves and its taxonomic utility in the recognition of two plant varieties and carpological studies of the seeds shape and their interpopulation variation.

Antimicrobial Streptomyces strains from cave microbiota: a potential source for new drugs

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The rapid emergence of drug-resistant bacteria is a worldwide phenomenon, that forces scientists all around the world to search for new strategies and new drugs in order to manage this urgent issue. 2013 Global Risks Report warned about the growing risks associated with complacency towards antimicrobial resistance (AMR). Every year there are around 100,000 AMR-related deaths in US hospitals, 80,000 in China and 25,000 in the EU. The stakes are high - if resistance overtakes all our available antibiotics, it would spell the “the end of modern medicine”.

One of promising directions is isolation and characterization of antimicrobial compounds produced by bacterial strains isolated from cave habitats. Moonmilk speleothems host a rich microbiome, among which Actinobacteria represent exceedingly abundant phylum. It has been proven in Maciejewska et al. 2016 that the bacteria isolated from Belgium caves show antimicrobial activity.

In this study, we have evaluated 24 bacterial strains isolated from caves of the Tatra National Park. In order to evaluate their antimicrobial potential, we conducted a series of streak tests. Three of them, in particular, have shown a really promising antibacterial response to both Gram-positive and Gram-negative bacteria by inhibiting their growth. Overall, our work supports the previous research suggesting that natural compounds produced by strains isolated from moonmilk might effectively treat various infections.

Bactericidal activity of phage-impregnated cellulose membranes against chosen foodborne pathogens

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Despite using many advanced methods of food control, food industry still struggles with numerous threats related to contamination of foods by pathogens causing dangerous infections and food poisonings. In this case, searching for new methods of food control and protection of customers is needed. Bacteriophages could be a promising alternative, as safe, specific and natural antimicrobial agent.

The aim of this work was evaluation of bactericidal activity and operational parameters of cellulose membranes impregnated with bacteriophages. *Escherichia coli* O157:H7, *Salmonella* Enteritidis and *Salmonella* Typhimurium were used as bacterial hosts, representing common foodborne pathogens. Specific, lytic bacteriophage environmental isolates were selected against these bacteria. To determine the application potential of created surfaces, three different samples of experimentally contaminated meat were used. Raw chicken, pork and beef were chosen as natural, main paths of this pathogens transmission. The research has shown significant bactericidal activity, species-specific range of hosts and effective diffusion from membranes to media of used bacteriophages. Composing phage cocktail resulted in intensifying of lytic activity against each bacterial strain and wider infectious spectrum irrespectively of temperature conditions and form of media.

Bioremediation and bioaugmentation of soils contaminated with heavy metals and petroleum-like compounds by Antarctic bacterial strains

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The urgent problem of soil contamination with petroleum-like compounds and heavy metals is a serious challenge for biological remediation processes. Nowadays, bioremediation vaccines are based mainly on mesophilic bacteria, i.e. strains which are metabolically inactive at low temperatures. Therefore, bioaugmentation of contaminated soil with exogenous, cold-active bacterial consortia would be a promising solution to the problem of seasonal temperature changes especially in geographical zones with temperate climate. For such technologies bacteria producing: (i) biosurfactants (i.e. surface active compounds reducing surface and interfacial tension, thus increasing the solubility, bioavailability and biodegradation of the organic compounds, e.g. petroleum-derived contaminants) and (ii) siderophores (i.e. molecules that bind iron and other heavy metals with high affinity) can be applied.

In total, 427 cold-active, Antarctic bacterial strains isolated from three types of soil (petroleum and penguin feces-contaminated or iron-and copper-rich) and freshwater samples were tested for the ability to produce biosurfactants and siderophores.

Acknowledgements: The financial support by National Science Centre (Poland) OPUS project contract No. 2016/23/B/NZ9/02909 is greatly appreciated.

Plastic debris as a source of 4-tert-octylphenol and 4-nonylphenol for seabirds – preliminary results of experimental research

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Today plastic pollution is widely distributed in the marine environment. Ingestion of marine debris by wildlife, and especially that of plastics by seabirds, has been described very well. Plastic ingestion has a number of negative consequences. It can cause abrasions and ulcers, lead to clogging of the digestive tract and starvation. Moreover, plastic debris can be a source of hydrophobic organic pollutants and trace metals. These compounds are included in plastics or can be sorbed from the surrounding environment and subsequently released in the digestive tract, interfering with natural hormone functions, leading to e.g., mutations and cancer.

The aim of the experiment was determination of 4-tert-octylphenol (OP) and 4-nonylphenol (NP) leached from plastic debris in conditions stimulating digestion in seabirds' stomachs at different time intervals.

During 30 days of experiment OP leaching from plastic debris increased successively and reached maximum value of 1558,79 ng dm⁻³. NP leaching alternately increased or decreased with maximum value on the 4th day of the experiment (167,32 ng dm⁻³). This may suggest that desorption of leached NP on plastic debris and/or the vessel walls occurred. Obtained results indicate that due to plastic ingestion birds are permanently exposed to small, relatively to those in their natural diet, doses of the tested compounds.

Characterization and lytic activity of bacteriophage vB-EcoS-95 and use of this phage as means of destroying or controlling biofilms

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A *bacteriophage*, or *phage* for short, is a *virus* that infects bacteria. They played a significant role in the development of molecular biology, biotechnology or genetic engineering. In this part of the research we would like to present a virulent *Siphoviridae* phage, named vB-EcoS-95 that was isolated from sample of urban sewage. The aim of the study was determined on the morphological and biological characteristics of vB-EcoS-95. This phage was found to infect *Escherichia coli* bacteria giving clear plaques. Genome sequence analysis of vB-EcoS-95 revealed 74% similarity to genomic sequence of *Shigella* phage pSf-1. Compared to pSf-1, phage vB-EcoS-95 does not infect *Shigella* strains and has an efficient bacteriolytic activity against *E. coli* strains. One-step growth analysis revealed that this phage has a very short latent period (5 min) and a large burst size (115 PFU/cell) which points to its good infectivity of host cells and strong lytic activity. The bacteriolytic effect of vB-EcoS-95 was tested also on biofilm-producing strains. Based on the preliminary research we can notice that this bacteriophage can destroy the bacterial biofilm, which has been confirmed by several different experiments. In conclusion, the obtained results show that vB-EcoS-95 is a novel *E. coli* phage that may be used to *control the formation of biofilms*.

Restriction effectivity of the invasive DNA depends on the fragile balance between methylation and restriction

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The restriction-modification systems (R-M) function as one of the bacterial defense mechanism against invasion of the foreign DNA, such as the viruses. They consist of two enzymes with the opposite activity. First, the restriction endonuclease, which cuts double-stranded DNA and the second one –the methyltransferase, which protects DNA from being cut. Production's level of the R-M proteins determines resistance of a bacterial host to the viral infection, but there is a limitation of the maximum effectivity of the restriction. In my work I compared both – high and low –production's level of the enzymes on the model R-M system EcoRI from *Escherichia coli*. The restriction effectivity is higher, when production's levels of the endonuclease and the methyltransferase are low. Paradoxically, in the case of higher production, the bacteria are very sensitive and susceptible to the phage infection. These results show that the restriction effectivity depends on the general production's level of the endonuclease and the methyltransferase in fact even small changes in their concentrations results in the new phenotype. Moreover, the high amounts of these proteins are damaging to the bacteria: they induce SOS response, which is the last mechanism for cells used in order to survive. These research give insight into maintaining the R-M systems in the bacteria and how the conflict between them and the bacteria develops.

The use of computer software R to analyse the variability of PM_{2,5} concentrations in Polish coastal zone

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Air pollution constitutes a prominent issue in Poland, especially during the winter period. Aerosols with a diameter lower than 2.5 μm (PM_{2.5}) are a significant threat to our health, therefore their monitoring is needed. Even in the Tricity, commonly known as a place with good air quality, aerosol concentrations can be elevated above European limits. The study presents the scrutiny of PM_{2.5} concentrations in Gdynia and its sources during 2017's smog episodes. The analysis of obtained concentrations was conducted using of computer software R with the openair package. The presented tools are easy to use and make air pollution analysis more effective. Nevertheless, it can be used in other scientific research. By determining the variability of PM_{2.5} the study displays diverse ways to produce statistics computations and graphics. Basic statistics were presented on violin plot which is a compilation of boxplot and histogram. Calendar plot shows daily variability of PM_{2.5} concentrations, while pollution rose combines information about wind directions and PM_{2.5} concentration. GoogleMapPlot, as an alternative to GIS, displays spatial variability of PM_{2.5} in Gdynia in comparison with other parts of Poland. The presented tools shed new light on statistic and data presentation not only in the case of air pollution.

Micromorphological and ultrastructural analysis in studies of floral secretory tissue

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Electron microscopy is relatively young research method. Micromorphological studies using scanning electron microscopy (SEM) provide information about the surface of sample, cuticular striations and the presence of secretory material. In turn, ultrastructural studies with transmission electron microscopy (TEM) analyse anatomical features, especially structure of membranes, structure, size, number or location of organelles. TEM resolution is about an order of magnitude better than the SEM resolution. With magnifications up to 1 000 000 times we are able to easily resolve details of 0.2 nm. In studies of floral secretory tissue it enables to determine among others the way of secretion (stomata, reticulate cuticle forming microchannels or cracks of cuticle).

In *Bulbophyllum levanae* (Orchidaceae) the secretion is executed on the surface of the labellum by cuticular canals, whereas in related species- *B. nymphopolitanum* microchannels were not noted, the secretion is simply seeping through the cell wall and cuticle. Since these two species were previously sometimes considered conspecific, presence of microchannels observed in TEM were one of features that enables us to officially distinguish them as different species.

The changes in size structure of PRC cities over 1 mln inhabitants in 1950-2015 in terms of economic transformations

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Changes in the size structure of PRC cities over 1 million inhabitants in the years 1950 - 2015 are among the most dynamic ones in the world. In just over a dozen of years, the number of cities over 1 million inhabitants increased from 9 in 1950 to 103 in 2015. The size structure is very diverse, nowadays, apart from over a dozen or so million cities such as Quanzhou or Jilin, large urban agglomerations with over 20 million inhabitants (including Shanghai and Beijing) appear. Chinese cities tend to connect and create large population centers, so-called megalopolis, e.g. in the Pearl River delta or the Yangtze River delta. Both the number of over-million cities and the share of the urban population living there are growing. The main reasons for the increasing number of cities with a population above 1 million are economic transformations that have occurred in the Middle Kingdom since the second half of the twentieth century. The creation of special economic zones, the European achievement in former colonies, and the economic opening of the country (in particular cities for the inflow of foreign investments) have become the main urban-creating factors.

Is pollution in the Arctic getting worse? Sources, pathways and examples of aerosol pollution events in the Svalbard region

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For many generations, the Arctic has been considered to be a pristine environment with limited anthropogenic influence. Today, however, we know that the Arctic environment is being continuously contaminated by pollutants transported from sources at lower latitudes.

Pollution is the introduction of contaminants into the natural environment which causes adverse changes to it. Pollutants can be anthropogenic substances (e.g. some organic contaminants or radioactive isotopes) or naturally occurring substances e.g. nutrients. Their pathways include atmospheric transport, ocean current transport, riverine transport and sea ice transport.

Due to the lack of significant local anthropogenic pollution sources, the extremely sensitive ecosystem of the Arctic is mostly affected by aerosols and pollution transported through atmospheric circulation. However, the main local anthropogenic emissions within the Arctic are associated with NO_x (e.g. from shipping, oil and gas activities, transport) and SO₂ sources from limited industrial areas.

This work presents typical sources and pathways of pollution advection to the Arctic, with special emphasis on atmospheric advection. The discussion is related to the various types of pollution, namely microplastics, which are being introduced into the Svalbard area.

Anti-biofilm activity of drug-impregnated nanobiocellulose against wound pathogens

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The aim of this study was the preparation and evaluation of anti-biofilm activity of bacterial cellulose (BC) dressing impregnated with antibacterial substances against Gram-positive *Staphylococcus aureus* and Gram-negative *Pseudomonas aeruginosa*.

For the production of BC, the reference strain of *Komagataeibacter xylinus* was used. The antibacterial and anti-biofilm activity of impregnated BC was tested using A.D.A.M. test (Antibiofilmic Dressing's Activity Measurement), which allows to check in vitro a dressing's suitability against biofilm-related wound infections. For the impregnation 6 different substances were used: antiseptics (Oktanisept, Braunol), antibiotics (erythromycin - 25 mg/ml; chloramphenicol - 20mg/ml) and natural oils (thyme and clove leaf oil). The studies showed that BC pellicle can be easily impregnated with antiseptics, antibiotics and natural oils with antibacterial properties. BC pellicle was characterized by the high rate of absorption of substances used for impregnation. Results obtained with disc diffusion method confirmed that impregnated BC had antibacterial properties against *S. aureus* and *P. aeruginosa*. The performance of A.D.A.M. test allowed to estimate both efficacy and penetrability of substance released from a BC dressing. Various efficacy of antimicrobials released from the dressings was observed in dependence of biofilm's formation surface, type of biofilm-forming pathogens and antimicrobial substance type.



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Polish Academy of Sciences

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ISBN 978-83-946541-2-2



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