Training camp 2022

The Art of Giving a Popular Science Talk

May 19 - 20, 2022

Voore guesthouse

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The electronic version of this booklet can be found at:
https://kodu.ut.ee/~olli/dokonv2022.html

The open-source LaTeX template, AMCOS_booklet, used to generate this booklet is available at `https://github.com/maximelucas/AMCOS_booklet`

Contents

About

Why we do it?

Most of us burn a lot of tax-money to do our research. The society has a legitimate right to know what we do. They want to know — why is the world a better place to live in, once you accomplish your PhD project. Yet to explain the apparently simple thing to the society may not be a trivial task.

As scientists we are obliged to explain complicated phenomena with simple terms. What we commonly do is the opposite — explain even the simplest things through ridiculously complicated wording. Yet we can get better — by training, training, training ....

If we succeed to spread our word, ideas, the usefulness of our projects in the society — the society by large will become more willing to pay for our fun.

Why the rat-race?

Please try hard to improve your talk skills. Here, every talk will be evaluated by 3 equally weighted criteria:

1. It has to be interesting
2. It has to be comprehensible
3. Your artistic skills (e.g. your voice, pace, articulation, hand- and footwork, font and color selection on slides, keeping time)

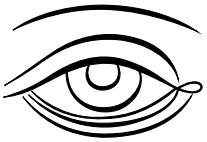
There are trade-offs between the criteria. If you discover that cold air is denser than warm air, it is easy to comprehend, but not particularly novel or interesting.

To qualify for a rat-race — the top 3 speakers will get new laptops as awards!

A few more hints

- Know and feel your audience — this is definitely not your working group seminar. We just mere mortals.
- Avoid specific terms. If you have to — use as few as possible.
- Beginning is important — if you loose listeners in the beginning — likely you will not get them back.
- If suitable, begin with something what touches everyone (or most) personally. E.g. every 2nd will wear glasses, every 3rd will die of cancer.
- A cheap trick is to have a bit of apocalypse at the start — e.g. if flooding is your topic, start with images of drowning people in south Asia.

No hard feelings



Chances are that some of you will learn nothing. Those win the laptops, but they learn nothing.

Yet the biggest winners are the loosers — we often learn through failures.

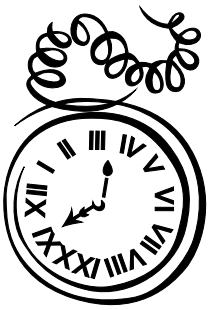
As stated in the novel "A good year" by Peter Mayle — "You'll come to see that a man learns nothing from winning. The act of losing, however, can elicit great wisdom"

Organizing committee

Kalle Olli et Co.
Estonian University of Life Sciences
Institute of agricultural and environmental sciences
Department of hydrobiology and fisheries

University of Tartu
Institute of ecology and earth sciences
Department of botany

Timetable



CS – Institute of Computer Science
GEN – Institute of Genomics
OMI – Institute of Ecology and Earth Sciences
MCB – Institute of Molecular and Cell Biology
PHYS – Institute of Physics
CHEM – Institute of Chemistry
OBS – Tartu Observatory
TECH – Institute of Technology

MATH – Institute of Mathematics and Statistics
PKI – Institute of Agricultural and Environmental Sciences
VET – Institute of Veterinary Medicine and Animal Sciences
FOR – Institute of Forestry and Engineering

IS – Invited Speaker

Thursday, 19 of May

9:00	**Ärasõit, Vanemuise 46, Tartu | Departure, Vanemuise 46**		
9:50	**Kondisirutus. Majutumine | Light refreshments, find you room**		
10:20	**Sissejuhatus, mängureeglid | Intro, housekeeping**		
10:40–11:20	IS	**Gleb Maltsev**	Case Training — the Anatomy of a Perfect Talk
11:20–11:40	CHEM	**Huy Qui Vinh Nguyen**	What If Your Electric Car Can Be Filled Up With Fuel?
11:40–12:00	OMI	**Sharvari Sunil Gadegaonkar**	Steps towards eradicating nitrogen pollution!
12:00–12:20	GEN	**Natàlia Pujol Gualdo**	The soundtrack of your life
12:20–12:40	MATH	**Shahid Mubasshar**	Natural Frequency of Stepped Nanoarches with Defects
12:40–13:00	PKI	**Jesamine Rikisahedew**	Mesophyll conductance: How does leaf anatomy affect plant physiology?
13:00–13:40	**Lunch**		

14:40–15:00	PKI	**Hongyuan Zhang**	Understanding the photosynthesis variations among a few sunflower species
15:00–15:20	FOR	**Sharib Khan**	SBSs — Sustainable Biorefinery Solutions — Electrochemical Valorization of Lignin
15:20–15:40	OMI	**Sanni Färkkilä**	Your molecular meal is being delivered — Shedding light to nutrient movement belowground
15:40–16:00	MATH	**Junming Ke**	A code construction from finite projective planes
16:00–16:20	PKI	**Kateryna Pantiukh**	To be specified
16:20–16:40	TECH	**Siim Laanesoo**	Biobased plastics: Can the Earth be saved?
16:40–17:00	**Water, coffee, stretching**		
17:00–17:20	TECH	**Kristel Alman**	Wood for food?
17:20–17:40	OBS	**Toni Tuominen**	The Large Scale Structure of the Universe
17:40–18:00	MCB	**Harleen Kaur**	Optimization of conditions for testing the efficacy of antimicrobial surfaces
18:00–18:20	CS	**Ida Maria Orula**	To be specified
18:20–19:20	**ÕHTUSÖÖK | DINNER**		
19:20–	**SOTSIALISEERUMINE | SOCIALIZING**		

Friday, 20 of May

08:30–09:20	**HOMMIKUSÖÖK | BREAKFAST**		
09:20–09:40	CHEM	**Jan-Michael Cayme**	I know what you ate last night! Food residues from archaeological pottery
09:40–10:00	OMI	**Fahad Kazmi**	To be specified
10:00–10:20	PKI	**Hassan Sulaiman**	Insect infestation increases plant heat stress tolerance
10:20–10:40	PKI	**Yusuph Olawale Abiola**	Foliage photosynthesis and water use efficiency responses to interacting heat stress and elevated CO_2 concentration in *Persea americana*
10:40–11:00	OBS	**Quazi Saimoon Islam**	Visual Methods for Planetary Surface Navigation
11:00–11:20	**Water, coffee, stretching**		
11:20–11:40	FOR	**Salini Chandrasekharan Nair**	Integrated processes to produce algal exopolysaccharides from biomass thermal conversion side streams
11:40–12:00	PKI	**Ricardo Martinez Prentice**	Image Upscaling Assesment From UAV To Sentinel-2 In Coastal Wetlands
12:00–12:20	OMI	**Farzad Aslani**	Global diversity and community assembly of soil eukaryotes
12:20–12:40	PHYS	**Arpan Chatterjee**	A modern shape for the non-local Nambu Jona-Lasinio model
12:40–13:00	MCB	**Vi Ngan Tran**	Interplanar Amida Network coordinates 3D organ shape and size of *Drosophila pupa*l wing epithelial morphogenesis
13:00–14:00	**Lunch**		
14:00–15:00	**Aftermath**		

List of talk abstracts

Thursday 19th

What If Your Electric Car Can Be Filled Up With Fuel?

H. Q. V. Nguyen

Tartu Ülikool, Keemia instituut; Tartu University, Institute of chemistry

The gasoline era is coming to its end in our lifetime. As the last barrel of oil on the Earth is expected to be pumped in 41 years, we are witnessing the shift of the car industry from the combustion engine to electric power. Since the battery has its limit in the long charging time and short lifetime, it provides a discontinuous experience for users. Do we have a device that can generate electricity unstoppably and regardless of the weather for the car? Yes, we have low-temperature fuel cells that can be filled up with many different types of fuels such as hydrogen and alcohol. Besides, this solution is the future because it decreases the carbon dioxide emission compared with the combustion engine.

Are we ready for this technology? Yes, we are. The ramp-up phase of hydrogen technology in Europe is completed in 2025. That means we have the general backbone for hydrogen gas stations in Europe. In Estonia, it is expected to have three hydrogen gas stations in big cities at that time. Besides, big players in the car industry such as Toyota and Honda have already manufactured their hydrogen cars and sold them in the European market.

How much does it cost for the device and traveling by hydrogen fuel? Yes, this is the problem that we are working on. At the moment, the price of hydrogen gas is still 62% higher than gasoline for the same amount of energy. The low-temperature fuel cells are expensive. However, we are working hard to improve the catalyst layer of low-temperature fuel cells and electrolyzer. This way will reduce the costs of the low-temperature fuel cell and the price of hydrogen gas.

Is this low-temperature fuel cell applied only for cars? Actually, this technology can be used for all mobile devices. Image that your laptop can work all day long after filling up the hydrogen gas for 30 seconds. This is the future and it may happen that way if many of you want it.

Steps towards eradicating nitrogen pollution!

S. S. Gadegaonkar

Tartu Ülikool, Ökoloogia ja maateaduste instituut; Tartu University, Institute ecology and earth sciences

Nitrate is a notorious pollutant; removal of nitrogen requires varying aerobic and anaerobic conditions. The ability of constructed wetlands and bio-electrochemical systems to provide these conditions, therefore can be exploited for complete removal of nitrogen. The study of dynamics of microbial communities in this conjugated system can help us in thorough understanding of the removal process. This work can eventually be explored to eradicate nitrate pollution, as nitrate being a necessary evil with the exponential rise in population.

The soundtrack of your life

N. Gualdo

Tartu Ülikool, Keemia instituut; Tartu University, Institute of chemistry*Tartu Ülikool, Genoomika instituut; Tartu University, Institute of genomics*

We are all born with a score of a song ready to be played for the rest of our life. This score is packed in our cells, builds us and keeps sounding until our last breath. How different is this from your grandfather's one, your best friend's, supervisor's or even Kaja Kalla's? How can we use this information to better understand our life ahead, how can this inform health and disease trajectories for every one of us? Are we performers or are we dancers?

Natural Frequency of Stepped Nanoarches with Defects

S. Mubasshar

Tartu Ülikool, Matemaatika ja statistika instituut; Tartu University, Institute mathematics and statistics

A numerical solution is developed for simply supported nanoarches based on the non- local theory of elasticity. The nanoarch under consideration has a step-wise variable cross-section and is weakened by crack-like defects. It is assumed that the cracks are stationary and the mechanical behaviour of the nanoarch can be modelled by Eringen's non-local theory of elasticity. The physical and thermal properties are sensitive with respect to changes of dimensions in the nano level. The non-local theory of elasticity is applied to study the vibration of nanostructures. In the non-local theory of elasticity, it is assumed that the stress state of the body at a given point depends on the stress state of each point of the structure. However, within the classical theory of elasticity, the stress state of the body depends only on the given point. The system of equations is solved by using the method of separation of variables. Consequently, the governing differential equations are converted into a system of algebraic equations whose solution exists if the determinant of the coefficients of the matrix vanishes. The influence of cracks and steps on the natural vibration of the nanoarches is prescribed with the aid of additional local compliance at the weakened cross-section.

SBSs — Sustainable Biorefinery Solutions — Electrochemical Valorization of Lignin

S. Khan

Eesti Maaülikool, Metsandus- ja inseneeria instituut; Estonian University of Life Sciences, Institute of Forestry and Engineering

Modern world heavily relies on material resources for almost all of society's activities. Therefore, it is essential to manage smartly and reuse the available resource and waste streams by keeping their value high and reducing the need to use virgin materials. Lignocellulosic biomass (LCB) refers to plant biomass which is abundant on Earth with an annual global production of about 181.5 billion tonnes. Traditional way of industrial LCB conversion is one-way subsequent pre-treatment, hydrolysis, fermentation, and subsequent product extraction. The approach is unsuitable if flexibility in product types becomes the driving force. Lignin, a complex amorphous heteropolymer, protects plants by providing mechanical strength, hydrophobicity and make plant cell walls indigestible. Lignin is the only natural polymer containing aromatic phenolpropanoid monomers, which makes it interesting for chemical industry. Depolymerization of lignin has huge potential to convert it into biofuels (e.g., phenolic oil, syngas etc.), many value-added materials (e.g., bioplastics, nanocomposites, nanoparticles, carbon fibre etc.), industrially important chemicals (e.g., benzene, toluene, xylene etc.), and macromolecules (e.g., dispersants, resins, surfactants etc.) as well as aromatic compounds such as vanillin. Primary and secondary conversion (lignin separation and depolymerization, biological hydrolysis of holocellulose) to produce fermentable carbohydrate intermediates will be the focus of the PhD project.

Mesophyll conductance: How does leaf anatomy affect plant physiology?

J. Rikisahedew

Eesti Maaülikool, Põllumajandus- ja keskkonnainstituut; Estonian University of Life Sciences, Institute agriculture and environmental sciences

Our understanding of the effects of impending climate change on the morphophysiological changes in plants are not yet fully realised. The global carbon cycle is driven by photosynthesis, suggesting that a thorough understanding of photosynthetic machinery in terrestrial plants is vital to produce reliable land surface models. Research has shown that mesophyll conductance (gm) remains a grossly underestimated parameter in existing models; and this project aims to compile a comprehensive database detailing gm and its underlying morphophysiological traits that cover all major plant clades. Advanced electron microscopical techniques will be applied to both globally underrepresented species in an effort to predict and model the ramifications of climate change on various plant functional types (PFT). A comparison of both 2D and 3D microscopies will be beneficial in our understanding of how CO_2 drawdown within leaves are affected by intercellular air spaces. The results generated from this project will serve as the catalyst for change in the way we consider traits affecting land surface modelling, adaptations of photosynthetic mechanisms in response to climate stressors, as well as a catalogued database that aids future research in the field of phytology.

Understanding the photosynthesis variations among a few sunflower species

H. Zhang

Eesti Maaülikool, Põllumajandus- ja keskkonnainstituut; Estonian University of Life Sciences, Institute agriculture and environmental sciences

The common sunflower, which operates a C3 pathway is an important crop. While facing global climate change, its yield and quality are not secured as C4 crops such as maize due to low water and nutrient use efficiency. However, the sunflower family naturally contains C3, C3-C4 intermediacy, and C4 pathways, which make it genetically possible to breed more efficient common sunflowers operating other pathways. We are examing the variations among a range of sunflowers, trying to find the key traits influencing their photosynthesis. By understanding the variations, we will be able to breed a new sunflower for future food security.

To be specified

I. M. Orula

Tartu Ülikool, Arvutiteaduse instituut; Tartu University, Institute of computer science

To be specified

To be specified

R. Kreevan

Tartu Ülikool, Genoomika instituut; Tartu University, Institute of genomics

To be specified

Your molecular meal is being delivered — Shedding light to nutrient movement belowground

S. Färkkilä

Tartu Ülikool, Ökoloogia ja maateaduste instituut; Tartu University, Institute ecology and earth sciences

What does a plant order for dinner, and how is the meal delivered? These are questions that have interested scientists for centuries. It has long been known that plants feed on nutrients, especially nitrogen and phosphorus, but the delivery process is less clear. These days we know, that while plants can access nearby nutrient sources themselves, the vast majority of them rely on food delivery through a network of "roads" built from fungi. However, we still don't have a clear understanding of how these networks operate, due to their small size and hard to reach location inside the soil. In my research, I put molecular meals in the spotlight, literally. By including a new secret ingredient: a tiny particle that acts like a miniature flashlight, we can visually follow the delivery of the meal. Information about the delivery process can help us better cater to our plants and even improve the delivery of our own meals.

A code construction from finite projective planes

J. Ke

Tartu Ülikool, Matemaatika ja statistika instituut; Tartu University, Institute mathematics and statistics

The size of datasets is dramatically increasing nowadays, to maintain the data reliability in the presence of node failures, the distributed systems adopt the erasure coding technique that takes the data as input and generates additional redundant symbols. When some of the storage nodes fail, the failed node is replaced by a newcomer, where the lost symbol is recovered and stored again. In this talk, we will introduce a construction of storage codes via finite projective planes, also having a short description and efficient local repair with availability. In general, we will introduce a code construction from the Fano plane (FG(2,2)).

To be specified

K. Pantiukh

Tartu Ülikool, Genoomika instituut; Tartu University, Institute of genomics

To be specified

How have start-ups benefited from hackathons?

M. A. Medina Angarita

Tartu Ülikool, Arvutiteaduse instituut; Tartu University, Institute of computer science

My article dives into the motivations and outcomes of hackathon participants, including startup founders who have attended hackathons to develop their startups further.v
Our findings suggest that the majority of participants do not attend hackathons in relation to the development of a startup. However, startups founders that have attended hackathons have been motivated to work on their startups, and have presented higher values of learning outcomes, project development satisfaction, and overall satisfaction with the hackathon.

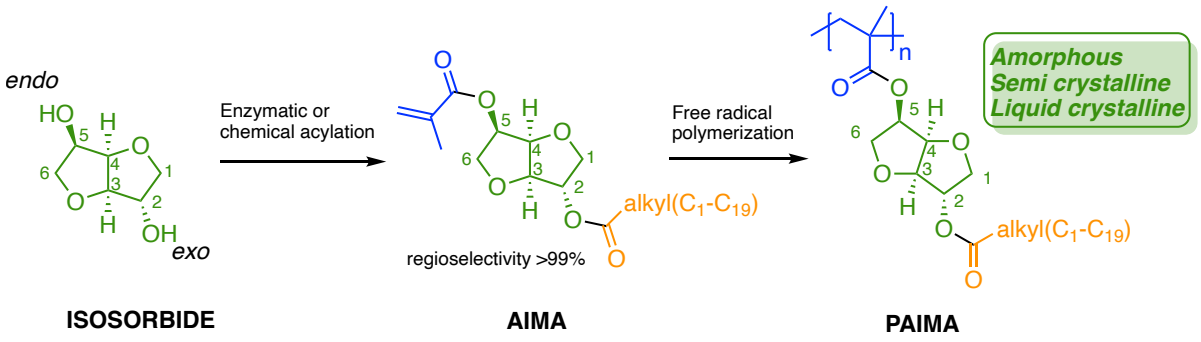
Biobased plastics: Can the Earth be saved?

S. Laanesoo[1], **O. Bonjour**[2], **J. Parve**[3], **L. Matt**[1], **O. Parve**[3], **L. Vares**[1], **P. Jannasch**[2]

[1] Institute of Technology, University of Tartu, Tartu 50411, Estonia
[2] Department of Chemistry, Lund University, Lund 221 00, Sweden
[3] Department of Chemistry and Biotechnology, Tallinn University of Technology, Tallinn 19086, Estonia *siim.laanesoo@ut.ee

The global demand for different plastics is rapidly growing. Depletion of the fossil fuels and environmental problems are forcing us to find greener alternatives from biomass. Isosorbide is a biobased and versatile polymer building block, derived from starch with few steps. It has a rigid and chiral structure with two [2] hydroxyl groups, which can be modified regioselectively .

In this work were synthesized Isosorbide monomethacrylate monomers (**AIMA**s) with different pendant linear alkanoyl chains (C2 to C20). **AIMA** monomers were polymerized by conventional free radical polymerization to obtain a series of 12 poly(alkanoyl Isosorbide methacrylate)s (**PAIMA**s). Polymers were investigated thoroughly by optic, rheological and thermal methods. As a result, we found that **PAIMA**s can compete with fossil-based plastics and could be used in many different applications.



References

[1] S. Laanesoo, O.Bonjour, J. Parve, O. Parve, L. Matt, L. Vares*, P. Jannasch*, Poly(alkanoyl isosorbide methacrylate)s: From Amorphous to Semicrystalline and Liquid Crystalline Biobased Materials. Biomacromolecules, 2021, 22, 640-649
[2] Matt, L.; Parve, J.; Parve, O.; Pehk, T.; Pham, T. H.; Liblikas, I.; Vares, L.; Jannasch, P. Enzymatic Synthesis and Polymerization of Isosorbide-Based Monomethacrylates for High- Tg Plastics. ACS Sustain. Chem. Eng. 2018, 6 (12), 17382–17390

Wood for food?

K. Alman

Tartu Ülikool, Tehnoloogiainstituut; Tartu University, Institute of technology

Estonia is well known for its vast forests. The increased deforestation, partly due to the burning of wood for energy purposes, is threatening the survival of our most treasured resources and leading to biodiversity loss and global warming. Therefore, there is a need for technologies that use wood biomass more sustainably and produce higher added-value products.

Biomass from wood processing consists of a large number of different forms of sugars. During the mechanical and enzymatic processing of this biomass, relatively pure sugars with different carbon chain lengths can be isolated. Such sugars can then be used as a carbon source for various organisms, such as baker's yeast. As one of the most studied model organisms, baker's yeast metabolism can be re-programmed through the addition of novel genes and gene pathways from other organisms, or ones designed by humans. This process often referred to as 'synthetic biology', allows us to construct biological factories within yeast cells and produce complex biological or chemical compounds that are of high commercial value.

As a proof of concept, I have used the above-described principles and introduced carotene production pathway genes to yeast cells. This modification allows the production of carotenoids within yeast cells and transforms simple sugars into complex high-value chemicals, carotenoids. Carotenoids are a class of orange-colored chemicals normally synthesized in plants, such as carrots, that are subsequently converted to vitamin A by human metabolism.

Apart from carotenoids, there are many proteins for different purposes that can be produced using similar pathways and systems. Therefore, we next aim to regulate other pathways similarly to amp up their production in yeast cell factories and obtain other desired proteins and chemicals. By applying such regulation, it is possible to produce high-value products in yeast from extremely low value starting materials, such as wood industry by-products. Therefore, by combining the surpluses of the wood industry and the production of high-value products in re-engineered yeast cells, the created system would be beneficial for both the economy and the environment.

The Large Scale Structure of the Universe

T. Tuominen

Tartu Ülikool, Matemaatika ja statistika instituut; Tartu University, Institute mathematics and statistics

I will take you on a journey from our solar system to the large scale structure of the Universe. It is an expedition through many orders of magnitude and overwhelmingly large (and small) numbers. At the end of the adventure lies the map of the Universe at a scale where galaxies are mere dots in space, a realm where time and distance blend inseparably together

Optimization of conditions for testing the efficacy of antimicrobial surfaces

H. Kaur

Tartu Ülikool, Molekulaar ja rakubioloogia instituut; Tartu University, Institute of molecular and cell biology

The growing interest towards the use of antimicrobials, especially non-antibiotic antimicrobials, for hygiene purposes has been evidenced by the increased level of research publications as well as by steady increase of their market share. There is also a growing trend towards including such antimicrobials to surface coatings. The two main key properties of antimicrobial surface coatings are activity towards the target microbes and safety against other, non-target species. Here, our goal is to clarify the differences in apparent efficiency of antimicrobial surfaces when analyzed using different test methods. Such a knowledge is essential for adequate assessment of the efficiency of antimicrobial coatings in conditions relevant to their final end-use. We varied three important test conditions during antibacterial analysis: air humidity, exposure media and drop-size. We selected 99.9% solid copper as the model antibacterial surface and *Escherichia coli* (ATCC 8739) as the model bacterium while glass and stainless-steel surfaces were used as non-antibacterial control surfaces. Air humidity in the test environment ranged from 20% till 90% RH, selected were organic rich exposure medium ("soil load") and oligotrophic 1:500 times diluted nutrient broth medium, and different drop-size was achieved using two bacterial drop sizes (1×50 µl and 5×2 µl). Initial results showed that all the varied parameters affected the antimicrobial efficiency of copper surfaces towards *E. coli*. The lowest efficiency was obtained with large drop size and organic rich medium in 90% RH and the highest efficiency was observed for smaller drop size in oligotrophic exposure medium.

Friday 20th

I know what you ate last night! Food residues from archaeological pottery

J. Cayme

Tartu Ülikool, Keemia instituut; Tartu University, Institute of chemistry

Various fragments of organic compounds are being extracted from archaeological pottery that are hundreds to thousands of years old. Based from these fragments, possible food residues that may have been cooked in the pot can be determined and can be connected to a particular diet during ancient times. The talk will give an idea on how these organic residues are retained in the pottery and its implication in understanding the past.

To be specified

F. Kazmi

Tartu Ülikool, Ökoloogia ja maateaduste instituut; Tartu University, Institute ecology and earth sciences

To be specified

Insect infestation increases plant heat stress tolerance

Hassan Sulaiman[1], **B. Liu**[1], **E. Kaurilind**[1], **Niinemets**[1,2]

[1] Institute of Agricultural and Environmental Sciences, Estonian University of Life Sciences, Tartu, Estonia
[2] Estonian Academy of Sciences, Tallinn, Estonia

Heatwaves are expected to become more frequent. High temperatures can stress plants and also increase the frequency of insect infestation. However, how insect infestation affects heat resistance is unclear. We studied how temperature extreme (45 °C for 5 min) affects foliage physiology, namely photosynthetic characteristic and stress volatile organic compound (VOC) emissions, in oregano plants infested with whiteflies right after exposure through 48 h recovery. Heat stress applied alone decreased photosynthesis persistently, but increased stomatal conductance indicating the activation of leaf cooling processes, and induced sustained volatile emissions indicating irreversible damages. In infested plants, heat stress also decreased photosynthesis and increased stomatal conductance but these physiological characteristics recovered to pre-stress level at the end of the experiment. Heat stress resulted in a much lower enhancement of VOC emissions in infested plants, which recovered to pre-stress level at the end of the experiment. Our results suggest that under insect infestation, thermal tolerance is improved in plants.

Foliage photosynthesis and water use efficiency responses to interacting heat stress and elevated CO_2 concentration in Persea americana

Y. O. Abiola[1], **E. Kaurilind**[1], **Niinemets**[1,3]

[1] Chair of Crop Science and Plant Biology, Estonian University of Life Sciences, Kreutzwaldi 5, 51006, Tartu, Estonia
[2] Estonian Academy of Sciences, Kohtu 6, 10130, Tallinn, Estonia

Climate change is expected to result in atmospheric carbon dioxide accumulation and temperature extremes, especially in the tropics. Warmer temperatures exert stress on plants, whereas elevated carbon dioxide can increase photosynthesis rates and water use efficiency, however, how the interaction of heat stress and increased-CO_2 concentration affect foliage physiological activities at different stages of plant growth remains poorly understood. We studied the impact of heat stress (48°C) at ambient (400 ppm) and elevated (800 ppm) CO_2 concentration on photosynthesis rates and water use efficiency in young and mature foliages of the tropical species *Persea americana* through 48 h recovery period. The rates of photosynthesis (A) generally decreased after heat stress treatment. A recovered to pre-stress level, but in young plants grown under ambient CO_2, A remained lower than in control plants. Heat stress generally reduced water use efficiency across the foliage ages with only elevated CO_2 young foliages recovered to control condition after the heat treatment. Our results show that heat stress exerts a significant effect on the foliage photosynthesis and water use efficiency of tropical plants, however, leaf ontogeny and increased CO_2 availability can enhance heat stress tolerance.

Visual Methods for Planetary Surface Navigation

Q. S. Islam

Tartu Ülikool, Tartu observatiorium; Tartu University, Tartu observatory

Planetary surface rovers play a key role in understanding the scientific history of an extra-terrestrial environment. In recent years, camera-based navigation systems have become popular in the field of mobile robotics owing to their versatility towards real-time pose estimation. This presentation gives a brief overview of current methods employed in visual navigation and deployment of visual navigation in past rover missions is discussed (based on publicly available data) focusing on the technology employed mostly in NASA's planetary surface rovers. The current research focus at UT Tartu Observatory in the field and applications of visual navigation is also discussed; describing key challenges, exciting solutions in the field involving machine learning based approaches to support and streamline classical methods, the research scope and goals of the PhD Study.

Integrated processes to produce algal exopolysaccharides from biomass thermal conversion side streams

S. Chandrasekharan Nair

Eesti Maaülikool, Metsandus- ja inseneeria instituut; Estonian University of Life Sciences, Institute of Forestry and Engineering

Efficient valorisation of low value side streams of biomass thermal conversion processes to produce high value microalgal products and study the possibilities of circular bioeconomy. For these two thermochemical conversion processes such as torrefaction and hydrothermal liquefaction (HTL) are selected.

Torrefaction condensate is a low value product with few applications such as pesticide and washing liquid in pre-treatment of biomass. The high concentration of acids and phenol reduces its applications. Here, microalgae are cultivating using torrefaction condensate and production of exopolysaccharides is evaluating. Torrefaction of wood biomass in different temperatures such as 225,250,275 and 300°C are done for an hour and torrefaction condensate collected.

Screening of microalgal strains which can grow on torrefaction condensate is done. *Chlamydomonas reinhardtii, Chlorella vulgaris*, and *Scenedesmus obliquus* can grow in 0.1g/l of torrefaction condensate. Preliminary study results shows that exopolysaccharide production from *Chlamydomonas reinharditii* is 0.308g/l. Single parameter optimization and statistical optimization of microalgal growth and EPS production will be carried out and compared with standard medium. Identification of best microalgal strain for EPS production and utilization of torrefaction condensate. Establishing and optimizing the downstream processing of algae biomass to extract and concentrate exopolysaccharides. Similar studies will be done with HTL aqueous fraction. Then, comparison of microalgal growth and EPS production in torrefaction condensate and HTL aqueous fraction. And establishing the overall feasibility of producing exopolysaccharides from biomass thermal conversion side streams.


Torrefaction
Hydrothermal liquefaction(HTL)
Temperature, time
Analysis of different operating conditions
Analysis of different operating conditions
Temperature, pressure, time
Torrefaction condensate
Composition analysis of the desired products
Composition analysis of the desired products
HTL aqueous fraction
Cultivation of microalgae on torrefaction condensate
Micro algal cultivation on aqueous phase of HTL
Optimization of micro algal growth and EPS production
Analysis of the EPS

Image Upscaling Assesment From UAV To Sentinel-2 In Coastal Wetlands

R. Martinez Prentice

Eesti Maaülikool, Põllumajandus- ja keskkonnainstituut; Estonian University of Life Sciences, Institute agriculture and environmental sciences

Coastal wetlands provide a range of ecosystem services and can support quite high biodiversity as a result of their high productivity. There are a range of techniques applied to monitoring and assessing ecological status and ecosystem service provision, however, traditional techniques can be quite time consuming and costly. In recent years, there has been a strong push to use remotely sensed data to evaluate ecological condition as well as estimate a range of ecosystem services within coastal wetlands. Unmanned Aerial Vehicles (UAV) platforms have increasingly been used in the field of remote sensing of coastal wetlands because they provide detailed radiometric data to carry out the classification of the high-resolution images. Classifications using supervised Machine Learning algorithms can be performed on those images, providing robust datasets for a range of variables.
However, in spite of the flexibility of performing flight plans to monitor coastal wetlands with high accuracy, it is often not feasible to capture large areas using UAV systems. Satellite imagery can be used to undertake evaluations of a wide range of environmental variables in coastal wetlands over much larger areas. Finding synergies between images taken from UAVs and satellite could provide the possibility to extend local observations of plant functional diversity or ecosystem service provision in coastal wetlands to larger areas or to regions. Using validation techniques based on ground-truth data, high-resolution UAV derived images can be used to characterize terrain and ecological features, such as plant communities and then upscale them to satellite resolutions.
The present study presents a methodology to compare images taken from a UAV multispectral camera and the freely available Multispectral Instrument (MSI) sensor images from the Sentinel-2 satellite because their spectral bands overlap with those commonly used for plant community assessments in coastal wetlands using drones. First, each pixel of Sentinel-2 image is characterized by the most frequent category of plant communities obtained from a ML supervised classification of high-resolution UAV image. Then, the results of classifying the study areas with the Sentinel-2 image are compared with the previous process by analyzing the differences and similarities of categories in each pixel. By this way, synergies between the UAV and Sentinel-2 images can be found in order to have a reliable upscaling of UAV-based data.
Keywords: Remote Sensing, UAV, Machine Learning, Upscaling.

Global diversity and community assembly of soil eukaryotes

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Soil fungi, protists, and animals (i.e., the eukaryome) play a critical role in key ecosystem functions in terrestrial ecosystems. Yet, we lack a holistic understanding of the processes shaping the global distribution of the eukaryome. We conducted a molecular analysis of 193 composite soil samples spanning the world's major biomes. Our analysis showed that the importance of selection processes was higher in the community assemblage of smaller-bodied and wider niche breadth organisms. Soil pH and mean annual precipitation were the primary determinants of the community structure of eukaryotic microbes and animals, respectively. We further found contrasting latitudinal diversity patterns and strengths for soil eukaryotic microbes and animals. Our results point to a potential link between body size and niche breadth of soil eukaryotes and the relative effect of ecological processes and environmental factors in driving their biogeographic patterns

A modern shape for the non-local Nambu Jona-Lasinio model

Arpan Chatterjee

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The Standard Model of Particle Physics, which classifies all the known elementary particles in nature, is based on two fundamental theories: the Electroweak theory of Glashow, Weinberg and Salam dealing with the Electromagnetic and the Weak interactions, and Quantumchromodynamics (QCD) developed by Gross, Wilczek and Politzer which deals with the Strong Force. Of these, QCD has two features, not common to the other interactions: Asymptotic Freedom, i.e. within a hadron at a high enough energy scale, quarks behave as though they are nearly free and Quark Confinement which does not allow us to "see" quarks as individual particles. The necessity to describe particles which have not and will never be "seen" as free particles led to the development of Effective Field Theories (EFTs). One of these EFT approaches is the one developed by Nambu and Jona-Lasinio in 1961. While the original approach is non-renormalisable, which in theoretical physics translates to something not very useful; in our project, we consider a non-local version of the NJL model which has been shown to be both renormalisable and confining and hence much more appropriate to be used in elementary particle physics. The main aim of our project is to present a modern and non-local version of the NJL model, applied to particle physics phenomenology, in particular as an EFT approach for QCD.

Interplanar Amida Network coordinates 3D organ shape and size of Drosophila pupal wing epithelial morphogenesis

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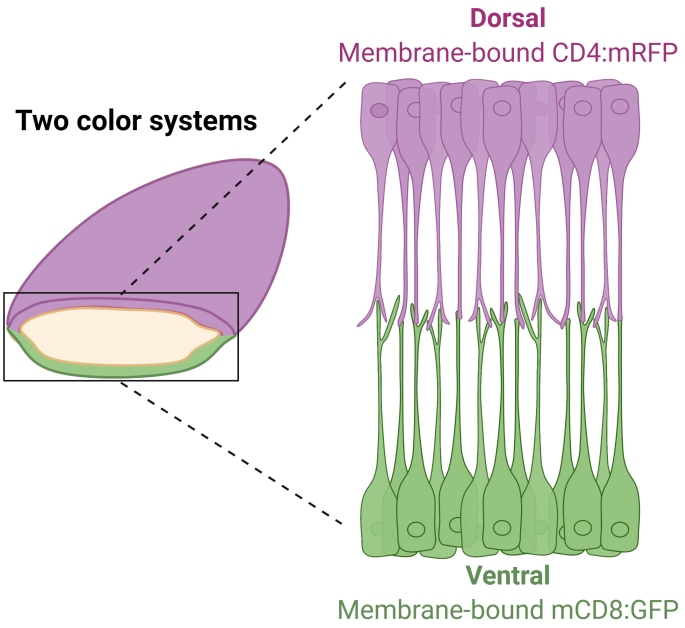
Comprehensive analysis of cellular dynamics during the process of morphogenesis is fundamental to animal development. Although advanced light microscopy enables us to observe cellular structures during development, how successive cell shape changes lead to 3D morphogenesis largely remains to address. Using in vivo live imaging of *Drosophila* wing development, we study novel cellular structures comprising a membrane protrusion network: the Interplanar Amida Network (IPAN). The IPAN initially sustains cell-cell contacts between two epithelia through basal protrusions. Subsequent programmed disassembly of the IPAN involves loss of these contacts, with concomitant degeneration of aligned microtubules. These processes are required for mitosis both autonomously and non-autonomously, leading to coordinated growth between two epithelia. Our findings further reveal that microtubule organization switches from non-centrosomal to centrosomal microtubule-organizing centers (MTOCs). The IPAN provides a unique framework in that cell shape change-mediated loss of contact results in 3D morphogenesis.



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Useful Information

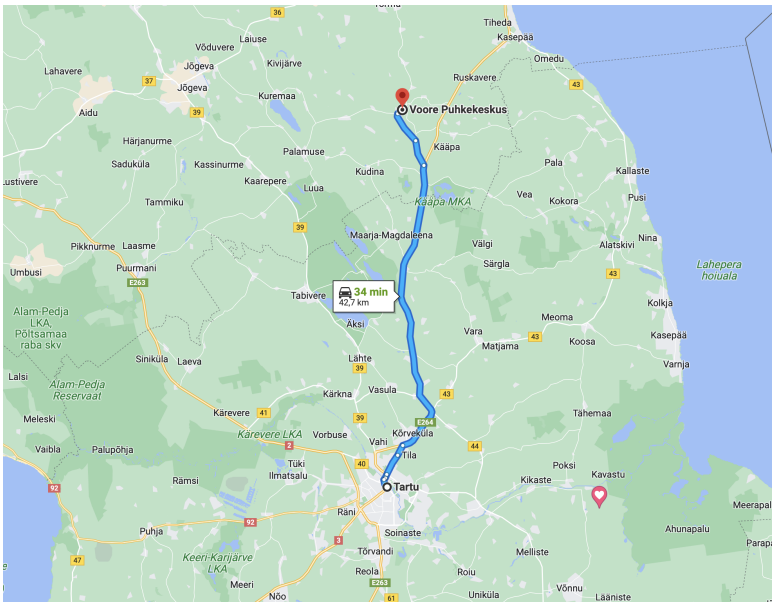
Talks will be held at the **Conference Hall-Auditorium** of Voore guesthouse, situated on the first floor. There will be a standard slide projector. You may be able to plug on your own laptop, or use usb-stick to get your talk to the presentation laptop. Presentations which require heavy bandwidth (slides are on the web) are probably possible, but discouraged.

Coffee breaks and lunches will be served in the in the conference hall.

Wi-Fi was OK a few years ago, hopefully also now. After the dinner our main duty is to get to know each other, socialise and discuss the talks.

How to get to the Voore Guest House?

Voore Guest house is conveniently close to Tartu, but far enough so that you can't escape by foot in the evening. **By car from Tartu** — follow Narva highway for 36 km until the sign indicates Voore Guest House 6 km. Then drive to Voore, over the bridge and you will see the sign Voore Guest House 0.6 km.



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