



UNIVERSITY OF TARTU

# Change the world with us

Explore our research



# Change the world with us!

The University of Tartu is one of the leading institutions for innovative education and excellent research in the Nordic region, driving inclusive and sustainable growth and innovation in Estonia, Europe and globally.

It's easy to make big changes happen if you are small.



## Quick facts

### The leading university in Estonia:

- › Founded in **1632** by the Swedish King Gustavus II Adolphus
- › THE (Times Higher Education) rankings: **201-250**
- › Around **14,000 students**, including around **1,800** international students from **90 countries**
- › **More than 100 PhD** theses defended annually
- › **About 3,000 employees**, 50% of them employed in academic positions
- › **Regional units** in Pärnu, Narva, Viljandi and Tallinn
- › The total volume of research funding from Horizon 2020 (since 2014) is **€69m** for **174** project participations
- › The **1909 Nobel Prize in Chemistry** was awarded to UT alumnus Wilhelm Ostwald, founder of physical chemistry

### Accelerator of smart economy:

### Influential research centre:

- › **More than 70 UT** scientists are among the top 1% of the most highly cited researchers in the world
- › Seven of the **39 ERA** Chair grants issued in Europe went to the University of Tartu
- › **10 ERC** grants since 2009
- › The University of Tartu has **61 spin-off companies**. In 2022 we provided **R&D services worth €14.9m** to public and private sector
- › At the end of 2022, the UT had **84 patents and patent applications** in **29** countries
- › Estonia is a unicorn nation. We have seven unicorn startups for a population of only about 1.3 million. **The most Baltic startup founders** come from the University of Tartu



# Good health and well-being

**The humankind lives in a world of constant change. Nowadays it is not such a challenge any more to live long, but to live an active and healthy life. In the University of Tartu we address this challenge by focusing on the person, and on one's genetic background, in addition to social and environmental effects. In case there are no technologies, we will make them.**

## We develop personalised medicine

“Everywhere in the world, people start taking care of their health only after they get sick. However, in a car, we are used to fastening the seatbelt before starting our journey, not when we are already in a ditch. The same principle should apply to health care.” – Andres Metspalu

Personalised medicine has the prospect to cut healthcare costs and improve the overall health of the population. By taking into account an individual’s molecular characteristics complemented by environmental and lifestyle factors, more precise and improved disease prevention and treatment programmes can be developed compared to conventional methods.

The Estonian Biobank in the Institute of Genomics includes the gene samples of more than 20% of the adult population of Estonia (more than 200,000 specimens). Gene-based medical feedback has been given since 2017.



**Andres Metspalu**

*Head of the Estonian Biobank*

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**The University of Tartu computer scientists have developed data infrastructure** that would allow genetic information to be made a daily tool for healthcare professionals to treat and advise patients.

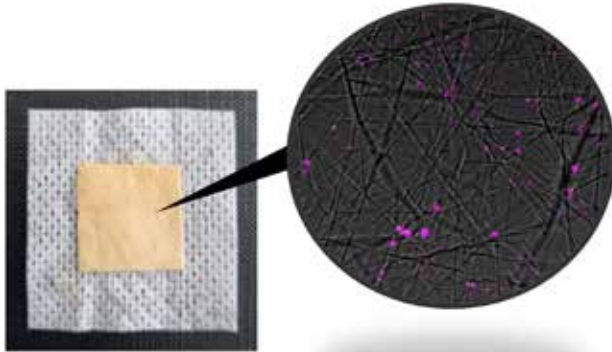
**The University of Tartu and Tartu University Hospital have established a personalised medicine research and development centre of international excellence.** This allows studying all stages of implementing personalised medicine. In addition to conducting clinical trials, the researchers develop scientific methods and new data tools to assess the impact of personalised medicine services on society, the economy and public health.



**Mait Metspalu**

*Professor of Evolutionary Genomics, Director of the Institute of Genomics*

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> **We create new technologies in medicine and pharmacology**

We design and develop antibacterial nanofibrous dressings for advanced wound care, 3D-printed personalised medicines intended for paediatric and geriatric drug therapy, and new nano-material drug products.



**Karin Kogermann**  
*Professor in Physical Pharmacy*  
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> **We discovered and introduced probiotic fermenting bacteria *Lactobacillus fermentum* ME-3**

The University of Tartu scientists discovered the *Lactobacillus fermentum* ME-3 already in 1995. It is the most widely studied bacterium in the world that has an antioxidant and antimicrobial effect on the human organism. Since 2003 the bacterium has been used in the dairy industry. In 2020 it found its way into ME-3 cheese, ice cream and chocolate.



**Marika Mikelsaar**  
*Professor emerita of Microbiology*  
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### > Smart drugs attack cancer cells

Smart drugs attack cancer cells in such a manner that the accompanying side effects are minimal. Our researchers at the Laboratory of Precision and Nanomedicine are developing a novel cancer therapy based on tumour penetrating peptides that allow using nanoparticles to deliver cancer drugs directly to tumour cells, leaving healthy cells intact. This is one of the leading scientific teams in the world that concentrates its research on the use of courier peptides in cancer treatment. Two research grants from the European Research Council are the proof of it.



**Tambet Teesalu**  
*Professor of Nanomedicine*  
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### > We conquer dangerous viruses

The University of Tartu researchers are the state's partners in finding a solution to the coronavirus crisis. The university researchers conduct national coronavirus studies that help detect virus pockets in wastewater at an early stage, assess the spread of the virus and the emergence of antibodies against Covid-19 and detect new coronavirus strains. The Scientific Advisory Board that advises the Government of the Republic also consists mostly of University of Tartu scientists.



**Toivo Maimets**  
*Professor of Cell Biology*  
*Head of the Scientific*  
*Advisory Board*  
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# People and society

## Climate crisis requires rethinking the foundations of industrial societies

We are facing climate change, reaching the planetary boundaries, the depletion of natural resources, and the loss of biodiversity together with social inequality. These problems have been created by the 250-year Deep Transition – a coevolution of energy, mobility, food, housing, waste management and other systems underpinning industrial societies. We seek ways for redirecting the coevolution of Estonian energy, mobility and communication systems on to sustainable and just path of development.



**Margit Keller**

*Head of Centre for Sustainable Development, Associate Professor in Social Communication*

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## We study what today's people are like

The people of Estonia (and the rest of Europe) have undergone rapid social development over the last 25 years. How has it changed the perception of citizens of a multinational state and what kind of changes in values has it introduced?



**Veronika Kalmus**  
*Professor of Sociology*  
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One of the main conclusions of the sociological studies carried out by the University of Tartu is that the differentiation between societal groups in Estonia has deepened in the last few decades and society has become two-speed: for some groups of people time is speeding up, whilst for others it is slowing down.



**Triin Vihalemm**  
*Professor of Communication Studies*  
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› **Shaping policy expertise on Eastern Europe and Eurasia**

The Centre for Eurasian and Russian Studies (CEURUS) does research on a complex set of issues and relationships in the vast Eurasian space historically shaped by the Russian Empire and the Soviet system.

CEURUS contributes to the society by producing policy-relevant research, educating the next generation of experts, providing research-based professional training for Estonian and European civil servants and participating in public debates.  
[ceurus@ut.ee](mailto:ceurus@ut.ee)



› **We help to resist information attacks**

The goal of information war is to deepen the existing divisions in society, create new conflicts and influence the perceptions and minds of ordinary citizens. Our researchers study how strategic conspiracy theories are spread. Knowing these techniques, everyone can help curb the spread of malicious information and support national security.



**Andreas Ventsel**

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**Mari-Liis Madisson**

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› **What is the ideal urban working and living environment like?**

The University of Tartu social and medical scientists work with Ülemiste City business campus in order to develop such a concept. Health is understood not only as physical but also as mental and social phenomenon. The project focuses on changing unhealthy behavioural patterns with the help of small interventions or “nudging”. The objective is to empower individuals, employers and city developers to create healthier habits, organizations and environments.




**Andero Uusberg**  
*Associate Professor of  
Affective Psychology*  
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› **Neuromarketing is bridging marketing with science**

Every day thousands of advertising messages are used to influence people. The University of Tartu researchers search for possibilities to cope better with advertising pollution. The Neuromarketing Laboratory of the University of Tartu studied in cooperation with Coop how to tie the customer’s movement trajectory and location in the store, his/her purchase behaviour and earlier purchase history into a real-time recommendation system.



**Kristian Pentus**  
*Junior Lecturer in Marketing*  
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# Culture studies and development of language

**The *Homo sapiens* has a unique and highly developed language and culture. These largely determine who we are as people.**

In a digital society like Estonia, language studies at the University of Tartu are intertwined with information technology. If we want AI to communicate with us in an understandable language, we have to know how to teach it to the computer. The Estonian language with its 14 noun cases is one of the most complex linguistic systems. If we can teach Estonian to AI systems, we can also do that with other languages.

# Neural machine translation

Although machine translation has been developed in the world for over sixty years, we are still far from the perfect translation machine. People at the Chair of Natural Language Processing in the Institute of Computer Science are working on multilingual translation systems for low-resource languages, primarily Estonian. The solutions that are available today already enable to considerably save on translation expenses. Post-editing a machine-translated text takes less time than translating the entire text.

The University of Tartu language technologists help to make the Mozilla translation program Bergamot more flexible and high-quality.



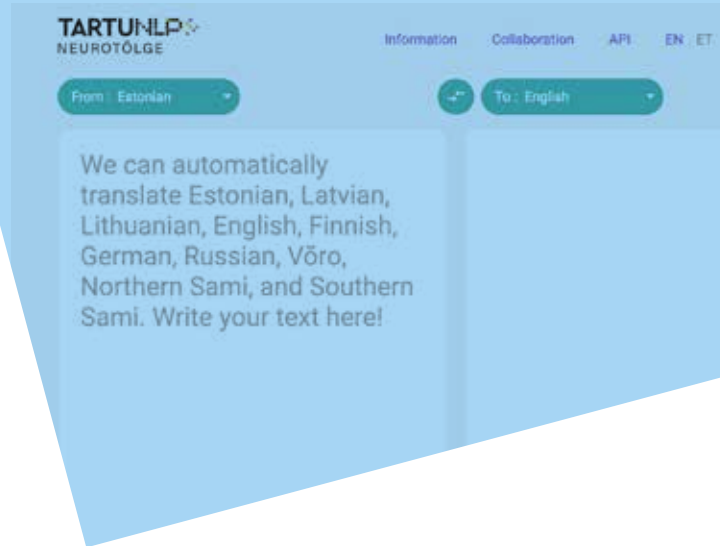
**Mark Fišel**  
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**Liina Lindström**  
*Professor of Modern Estonian Language*  
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## > ICT in the humanities

The general development model in research, including in the humanities, has shifted from the theory-driven approach to the data-driven one. Big data and big data mining, finding new information and searching for patterns and regularities are a part of modern humanities – opening up a whole new world of opportunities for humanities research at the University of Tartu.





› **We build bridges between Estonia, the Middle East, and Asia**

The University of Tartu Asia Centre supports understanding of Asian and Middle Eastern cultures and political trends in Estonia. The centre builds bridges by participating in international networks, supporting the development of study programmes, organising conferences, and working closely with the Estonian public sector, for instance, the Ministry of Foreign Affairs and the embassies in the relevant regions.

Our research projects raise awareness and provide new perspectives by forecasting scenarios of Estonia-Asia relations, analysing the dynamics between Southern and Eastern Asian countries, and finding cooperation opportunities between Northern and Eastern Europe and Singapore.





### › Sustaining cultural heritage

Intangible cultural heritage has become a highly topical field of research, alongside a growing need for professionals who understand its socio-economic context and entanglements. The UNESCO Chair on Applied Studies of Intangible Cultural Heritage is therefore a unique interdisciplinary institution that builds a bridge between the academic world, civil society, local communities, and policy-making while addressing current social, environmental and economic challenges. We are part of the wider network of UNESCO Chairs and actively uphold a broad international and domestic cooperation, in order to strengthen the research-training-policy-society nexus.

› **Creative industry** is a field of industry that has its origin in individual and collective creativity, skills and talent. Visit the UT Viljandi Culture Academy to explore our most exciting success stories in this area. The Culture Academy also offers the possibility to study unique crafts like native metalwork, construction or textile technologies.

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### **Kristin Kuutma**

*UNESCO Chairholder,  
Professor of Cultural Studies*  
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› **A wider view over informal culture**

Folklorists at the University of Tartu study traditional informal culture in its ever-changing social context, the relationship between environment and storytelling, the sense of belonging, non-belonging and the realm of the incomprehensible and irrational both as discourse and as lived experience. Our projects address the social aspects of informal culture, its variations and hybridity past and present, and meanings for individuals, groups and networks.



**Ülo Valk**

*Professor of Estonian and Comparative Folklore*  
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› **The Collegium for Transdisciplinary Studies in Archaeology, Genetics and Linguistics**

brings together researchers in the three fields. By applying novel methods and up-to-date theories, they reconstruct the cultural, linguistic and genetic history of the human population of Estonia and its closest surroundings.



**Valter Lang**

*Professor of Archaeology*  
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› **Archemy is the first archaeochemistry laboratory in the Baltic states** where archaeology meets chemistry, geology, biology, medicine, genetics and materials sciences etc. The study group concentrates on the biomolecular archaeology, by collecting information about ancient diet and health, but also about the environment and objects and the origin of people.



**Ester Oras**

*Associate Professor of Analytical  
Chemistry and Archaeology*

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# Quality education

Education — high-quality education in particular — plays an important role in improving the quality of life. Estonians have valued education for more than 200 years and founded their economic models and their state on educated people. The number of literate people in Estonia was 90% at the end of the 19th century. The results of the PISA test for recent years have shown that Estonia's education system is among the top 5 in the world.



# Children in Estonia learn in a physically active environment

**“In essence, we are trying to develop, evaluate and implement research-based intervention programmes of active movement in our laboratory.” – Merike Kull**

According to international and national recommendations, every child and youth should do at least 60 minute per day of moderate to vigorous-intensity physical activity, so that their breathing rate increases and they feel warmth and sweating (WHO, 2010). Physical activity has a positive effect on physical, mental and social health. Physical activity in subject lessons leads to better behaviour in class and has a direct positive effect on learning outcomes.

Researchers are developing an active movement programme for schools, which includes various means of keeping children physically active during the school day. The programme includes activity breaks during lessons, physically active teaching methods, planning a long physically active outdoor break, an increase in the number of physical education lessons, development of active school transportation, motivating parents to change their habits and much more.



**Merike Kull**  
*Associate Professor in Health Education*  
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UT Research Group of Physical Activity for Health has launched the project “**Schools in Motion**”. By 2021 40% of all students studying in general education schools were studying at the schools included in the programme.



## Better internet for children

“When used at home, sweet endearments like ‘pumpkin’, ‘my little princess’, or ‘my sunshine’ usually cheer kids up and help to maintain a good parent-child relationship. It’s a whole other story when parents’ cutesy behavior and sharenting practices go beyond the four walls of a home and reach the invisible audiences on social media.”

– Andra Siibak

There are consequences for the actions of parents who (over)post about their children on social media—not always with the child’s consent—and these consequences can have an effect on the parent-child relationship. Estonian research proves that our children would sometimes like to prevent family photos from being shared or ban posts where parents tell everyone about their ‘little sunshines’.



**Andra Siibak**

*Professor of Media Studies*

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The Estonian Safer Internet Centre exists to promote safer and better use of the internet and digital technologies amongst children and young people.

[www.targaltinternetis.ee](http://www.targaltinternetis.ee)







## Smart learning and entrepreneurial schoolchildren

› We have developed several assessment instruments and digital tools to systematically support students' self-regulation. This way it is possible to give recommendations for the personalised use of digital study tools both in the development of initial and ongoing learning. The aim is to make learning more efficient.



**Margus Pedaste**  
*Professor of  
Educational Technology*  
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› **We encourage Estonian schoolchildren to be entrepreneurial** from the first stage of school. Several student companies have achieved international success; for instance, bioplastic honey capsules created by UT students are marketed in Silicon Valley. No more dripping honey on the table!



**Lilian Ariva**

*General coordinator of the  
Edu ja Tegu programme at the  
University of Tartu.*

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# We introduce information technology into public service

Estonia is probably the only country in the world where 99% of the public services are available online 24 hours a day.

E-government services contribute to more reasonable use of resources and a paper-free management. Thanks to a safe, convenient and flexible digital ecosystem, Estonia has reached an unprecedented level of transparency in governance and built broad trust in its digital society. As a result, Estonia saves over 1,407 years of working time annually and has become a hassle-free (read: paper-free) environment for business and entrepreneurship.

The University of Tartu has everything to do with it!





## We make e-services safe and sound

The skillful employment of machine learning and artificial intellect solutions would enable Estonia to be the first one in the world to develop the next generation e-services. ERA Chair in e-Governance and Digital Public Services gives our scientists the capacity to take part in the discussions concerning the digital development of governance in Estonia as well as in Europe.



**Vincent Homburg**

*Professor of E-governance*

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The use of electronic services requires a secure digital environment. Our spin-off companies, such as Cybernetica AS, have built a basis to a secure digital environment. Moreover, Dominique Unruh, the Professor of Cryptography at the University of Tartu, has been awarded an ERC Consolidator Grant to protect e-services against the powerful quantum computers of the near future.



**Dominique Unruh**

*Professor of Cryptography*

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**Mihkel Solvak**

*Associate Professor of  
Technology Research*

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At the Center of IT Impact Studies (CITIS) researchers use the big data generated by various Estonian public e-services (like internet voting, mobile parking, e-health, digital ID, e-residency, etc.) to estimate the impact those services have economically, politically and socially.

# We develop AI to transform business processes

Professor in Information Systems Marlon Dumas was awarded a European Research Council (ERC) Advanced Grant to find out what artificial intelligence (AI) can do to improve business processes for companies. The open-source tool called Pix enables the regular monitoring of a company work flow and the finding of the most optimal solution.



**Marlon Dumas**

*Professor in Information Systems*

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## > Ethics of AI

In the new modern world also ethical issues must be analysed using a new paradigm – including issues concerning the ethics of artificial intelligence. What should the ethical and legal framework be like to ensure that artificial intelligence is reliable, to maximise benefit and minimise loss? The main fields of research at our Chair of Practical Philosophy are ethics, aesthetics and political philosophy.



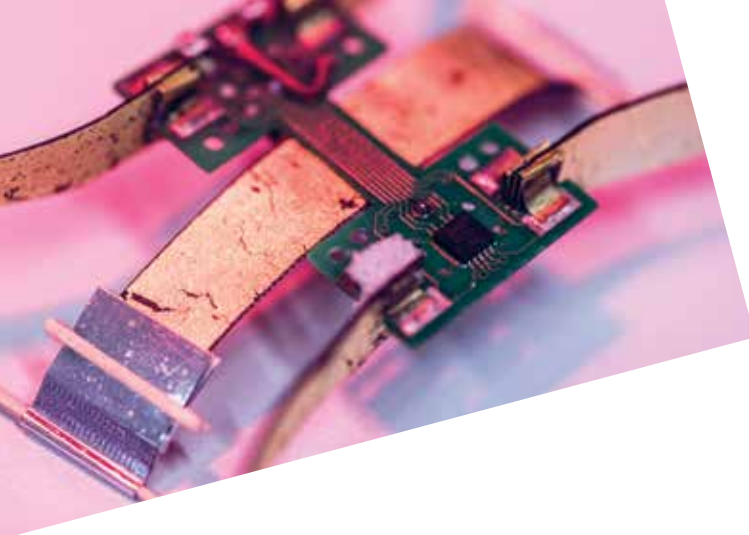
**Margit Sutrop**

*Professor of Practical Philosophy*

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**Industrial Master's Programme in IT** is a test-bed for companies before starting a voluminous R&D project. It is a collaboration programme between companies and the Institute of Computer Science where master's students carry out their internship, practical course assignments, and master's thesis at a partner company. Such collaboration strengthens the bond between academia and industry by providing necessary environment for experimentation.





## Intelligent materials and systems

› **Intelligent Materials and Systems Laboratory** works on the borderline of computational materials science, materials science, robotics, chemistry, computer science and electronics.

Soft robots are a field that opens up automation possibilities for humankind in the fields that until recently seemed completely to be a matter for the nature alone. Associate Professor of Soft Robotics, Indrek Must, develops a simulation learning tool for midwives. The artificial cervix solution helps to practice delivery in anatomically accurate conditions.



**Indrek Must**  
*Associate Professor of  
Soft Robotics*  
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**Gholamreza Anbarjafari  
(Shahab)**  
*Professor of Computer Vision*  
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› **iCV Research Lab** is a leading computer vision laboratory in Europe located at the Institute of Technology of the University of Tartu. In iCV, we conduct research for various applications of computer vision, human behaviour analysis and 3D modelling.





# Sustainable cities and communities

**Cities are complex communities in which both global changes and the needs of individual citizens need to be considered.**

**Over 3.5 billion people – more than half of the global population – live in cities. Cities consume nearly 80% of energy produced and urban environments account for 3/4 of the total carbon footprint of the world. Our researchers help to create more efficient urban environments.**

## Mobility Lab plans Tartu

The Mobility Lab of the University of Tartu focuses on various research topics such as activity spaces, travel behaviour, tourism, segregation, ICT use and environmental impacts to pursue a deeper understanding of spatial mobility. The Lab is also working in close cooperation with mobile big data analytics company Positium.

The Mobility Lab participates in several international projects, such as oPEN Lab (Open innovation living labs for Positive Energy Neighbourhoods). The project aims to identify replicable, commercially viable solution packages enabling the achievement of positive energy

neighbourhoods within existing urban contexts. These neighbourhoods are seamlessly integrated into the local energy system as an active micro-energy hub. The project tests these technologies and package as an integrated solution at neighbourhood scale.



**Siiri Silm**

*Associate Professor  
in Human Geography*  
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› **The scientists will help us cope better with crises in the future.** The University of Tartu, the Rescue Board and the company Positium developed a tool that helps find out where people are usually located and where they are moving to. Such information will help find people more easily and help them when an emergency occurs. The tool will help target rescue and social assistance better and thereby prevent crises or solve them more efficiently.



**Kati Orru**

*Associate Professor of Sociology  
of Sustainability*  
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› **We turn Tartu into test-bed for self-driving tech**

The Autonomous Driving Lab of the Institute of Computer Science helps the ride-hailing company Bolt to validate self-driving technologies. One of the priorities of the lab is to develop mapping technology that makes use of the Bolt fleet to construct high-definition maps for self-driving cars. The lab has aspirations in turning Tartu a regional test-bed for self-driving tech with the right environment and necessary infrastructure.



**Tambet Matiisen**

*Head of Technology*  
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## Sustainable cities combine quality living space for people and nature

› **A well-designed urban environment is a good place for both people as well as microbes.** Our scientists map the biodiversity found in the soil in Tartu. When we find out under which conditions the amount of good microbes is the highest, it is possible to take it into account in the future urban planning and when supporting the health of townspeople.



**Meelis Pärtel**  
*Professor of Botany*  
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› **Aerated concrete for zero-energy buildings**

The researchers at the Institute of Technology are developing a method for the preparation of novel aerated concrete construction elements. This will enable to construct cost-effective and high-quality buildings that conform to nearly zero-energy requirements.



**Tarmo Tamm**  
*Professor of Applied  
Materials Science*  
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# Affordable and clean energy

We live in the era of energy crisis. Physicists and chemists at the University of Tartu help to solve it, working on fuels as well as energy storage devices of the future. We do it as a valued partner for the world's largest research infrastructure projects like the ESS (European Spallation Source) accelerator, MAX-lab synchrotron, CERN accelerator, and the ITER fusion experiment. We have created electric self-driving cars, driving on fuel cells developed by our scientists.





## We make hydrogen cars more efficient

A fuel cell developed by the scientists of the University of Tartu powers the AuveTech autonomous hydrogen bus, which is the first of a kind in the world. The hydrogen created by the fuel cells functions as a power source in the vehicle. The only by-products are vaporised water and heat. The fast charging of the vehicle allows more working hours for the vehicle, increasing the efficiency and introducing a way to integrate autonomous transportation to our everyday lives.



**Jaak Nerut**

*Associate Professor in Physical and Electrochemistry*

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**Peeter Valk**

*Chemist of the Institute of Chemistry*

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# We build the energy storage devices for the future

› We have developed prototypes of **supercapacitors** based on microporous and mesoporous carbons with an increased amount of graphite microlayers. By means of new technology, it is possible to increase the number of charging cycles and push the limits of modern energy storage devices.

› We are developing a **solid oxide electrolyzer** together with H2Electro to make the production of hydrogen more affordable and renewable energy accessible in a more stable way.

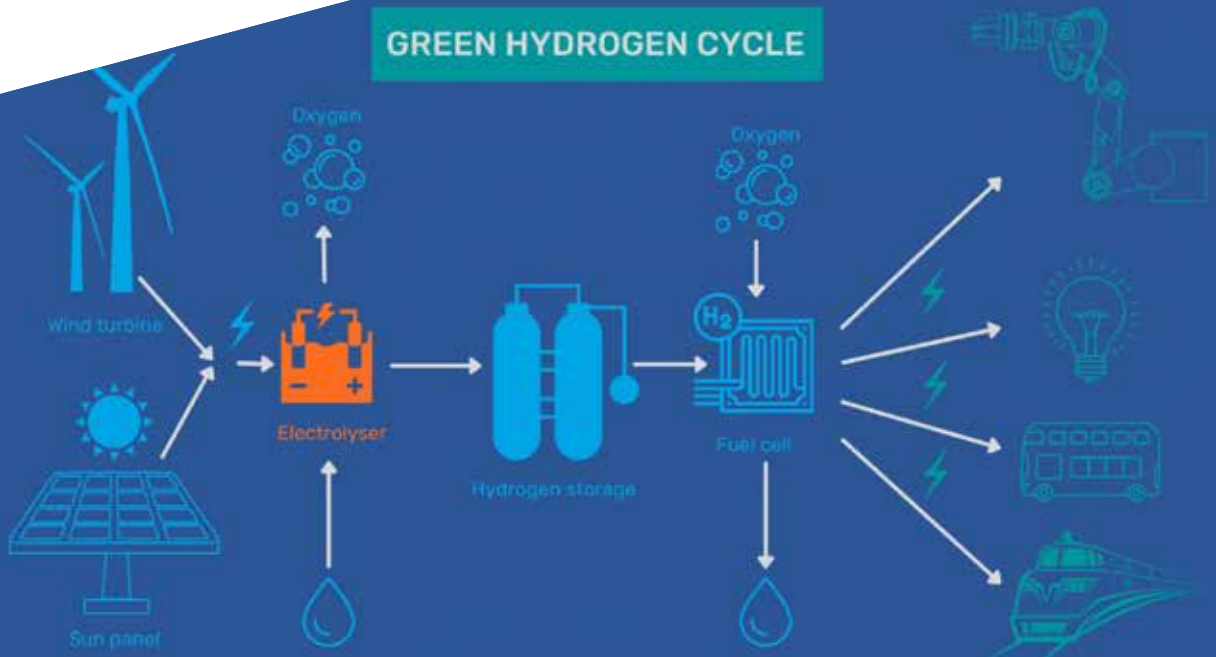


**Enn Lust**

*Professor of Physical Chemistry*

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## GREEN HYDROGEN CYCLE





### › New technology for batteries

Our scientists use carbon acquired from well decomposed mud peat in sodium-ion batteries. This results in a more environment and cost-friendly battery technology as compared to traditional lithium-ion batteries.



#### **Alar Jänes**

*Associate Professor of Physical and Electrochemistry*

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### › Carbon for energy storage devices can be caught from the air

The technology created by the spin-off of the University of Tartu, UP Catalyst enables to bind carbon found in the air for carbon material that can be used in accumulators and batteries.



#### **Ivar Kruusenberg**

*Co-founder of UP Catalyst*

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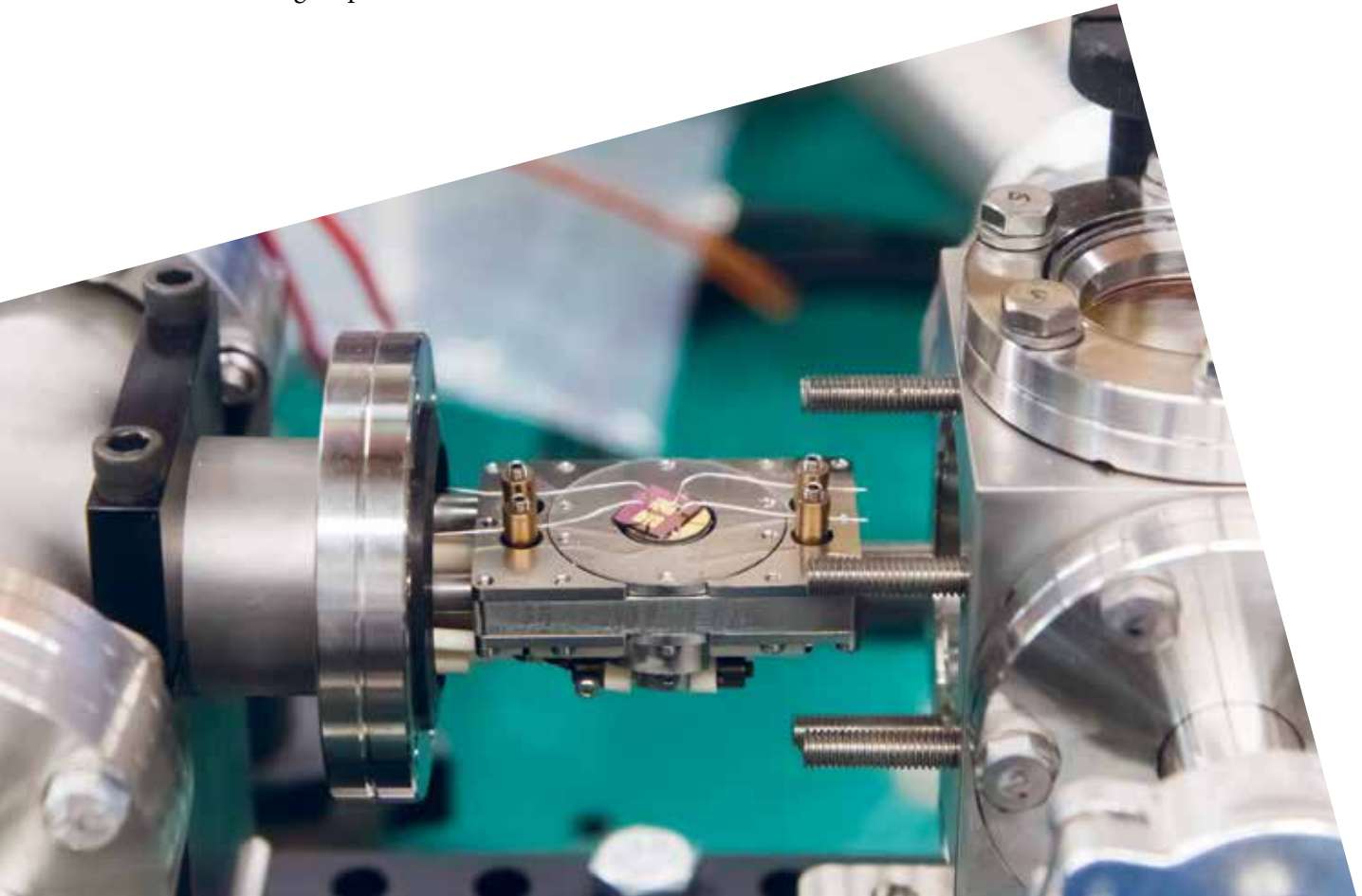
› **We contribute to the commissioning of the ITER nuclear fusion reactor**

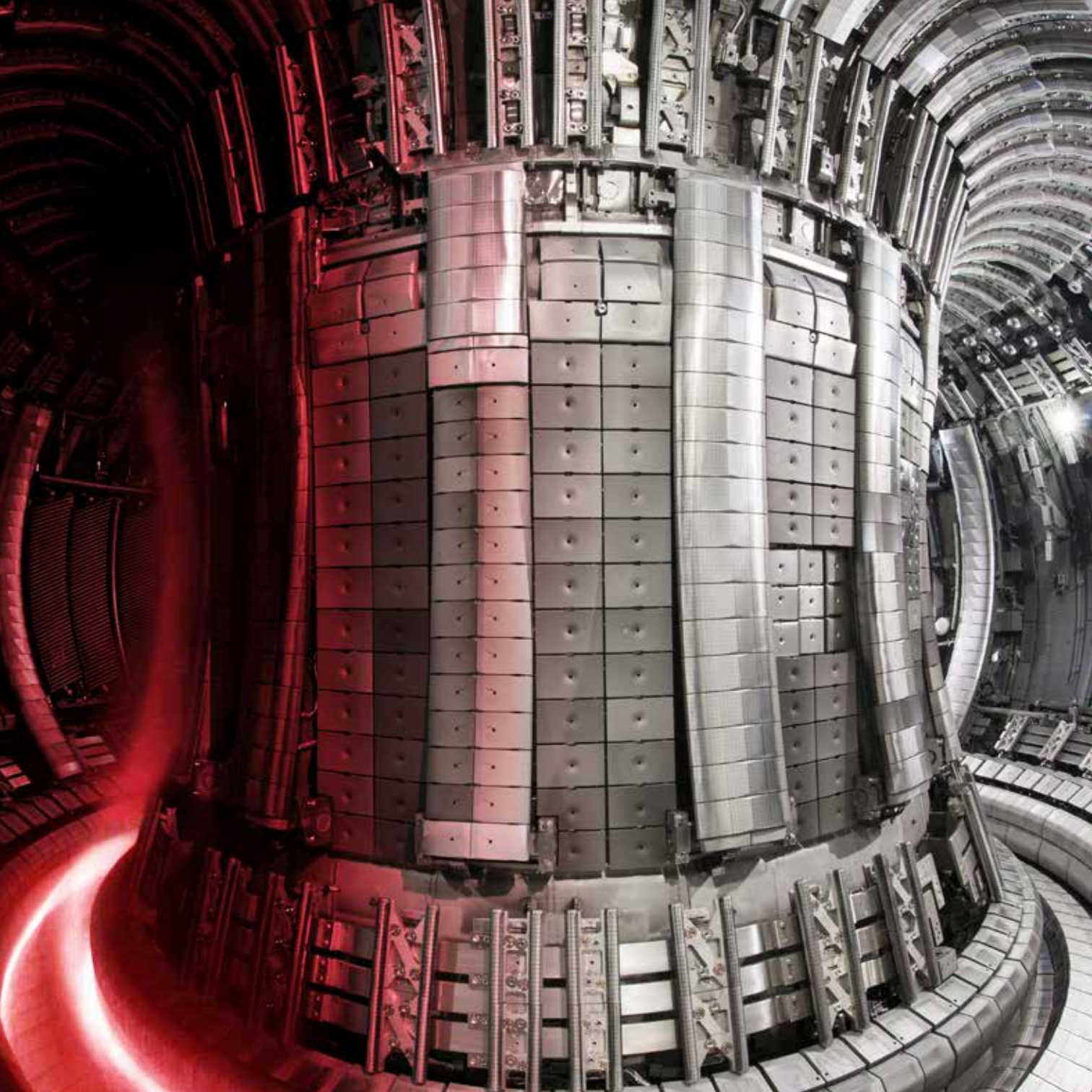
UT physicists help to develop new high radiation-tolerant materials for the international experimental nuclear fusion reactor ITER. In addition, laser-induced breakdown spectroscopy (LIBS) is developed at the Institute of Physics for monitoring the walls of the reactor to control the 150 million-degree plasma.



**Peeter Paris**

*Associate Professor in Optics  
and Gas Discharge Physics*  
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# Industry, innovation, infrastructure

**We believe that the development of technologies and innovation contributes to making the world a better place, and we do our best to achieve it. The robots we create do dangerous work to save lives, and the smart devices help to protect health. We involve students in technology development during their studies already and thus contribute to the emergence of UT spin-offs.**

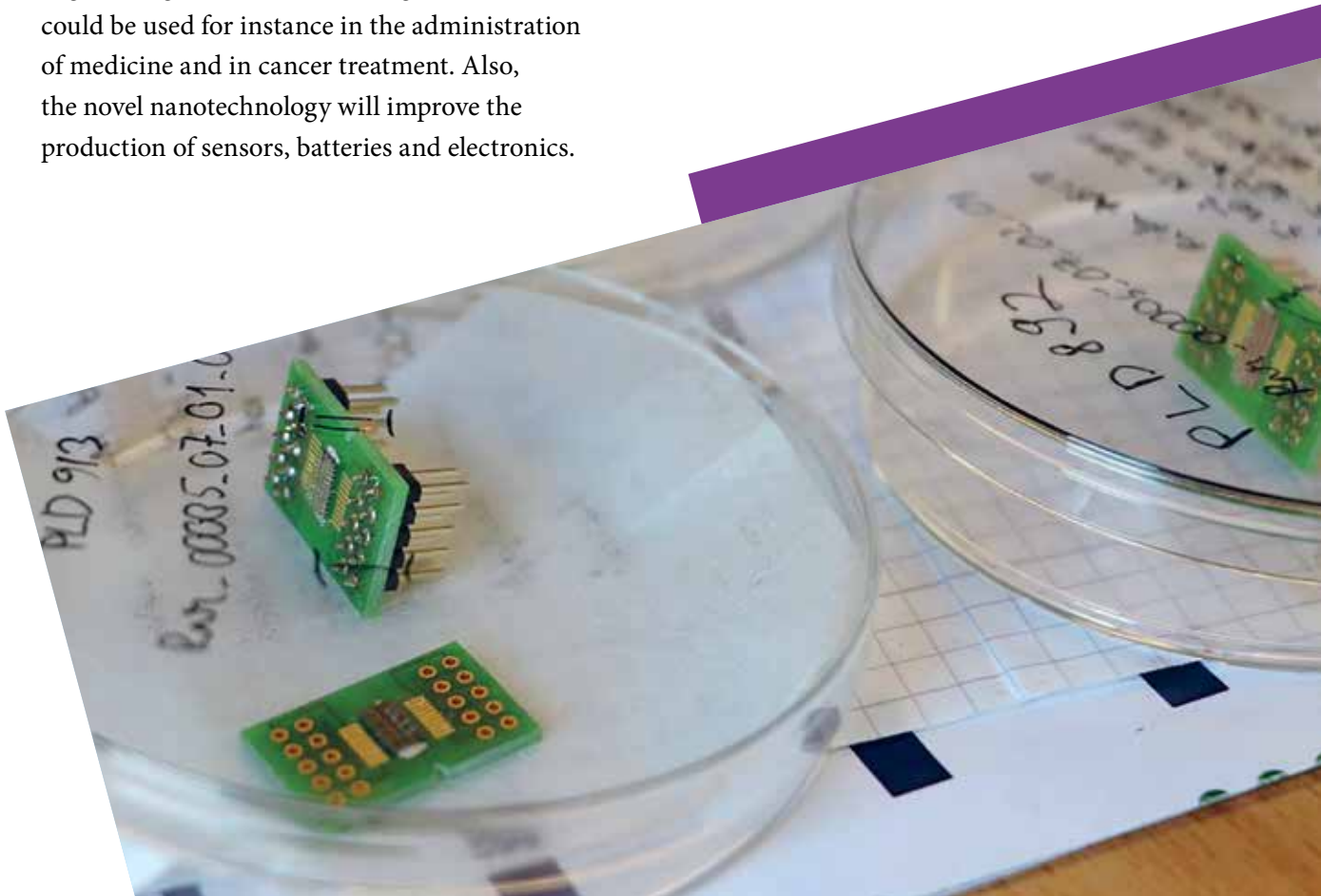
# Nanomaterials bring innovation to medicine and electronics

› We study the behaviour of nanomaterials in extreme environmental conditions in the project MATTER of the European Research Area (ERA) Chair. The research brings together physics, materials science, as well as computer engineering. New nanotechnological solutions could be used for instance in the administration of medicine and in cancer treatment. Also, the novel nanotechnology will improve the production of sensors, batteries and electronics.



**Andreas Kyritsakis**

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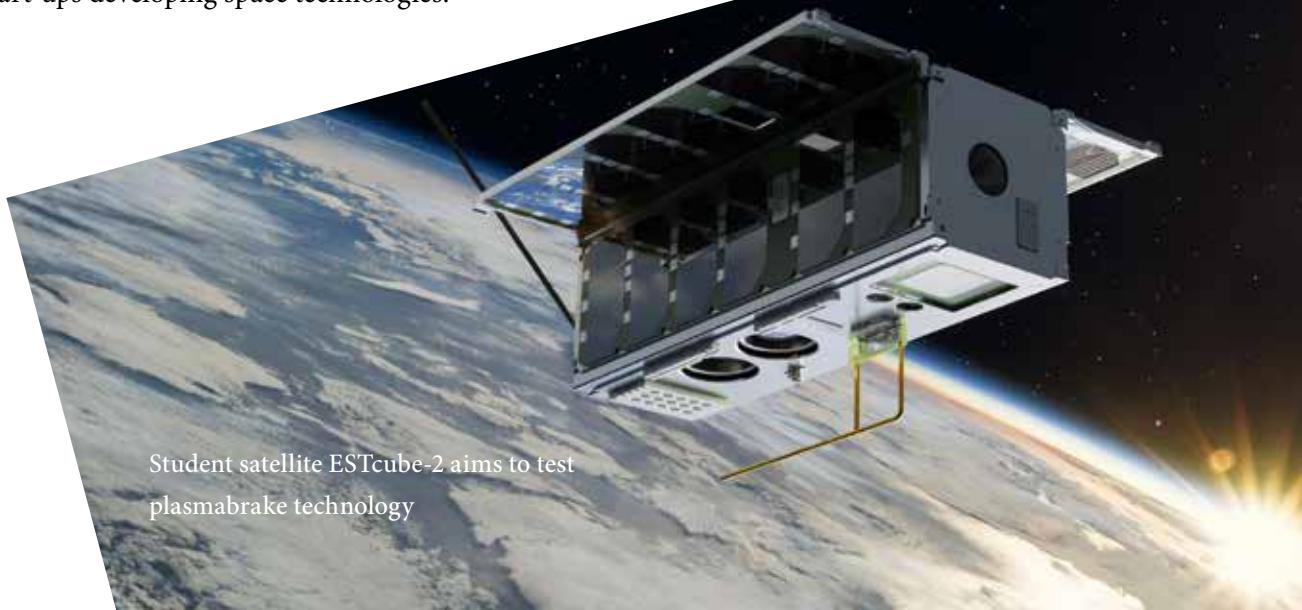




> **We have made Estonia a space-nation**

The Estonian Student Satellite Programme and the launch of the student-built cube satellite ESTCube-1 in Tartu Observatory in 2008 gave a strong push to a new generation of researchers and start-ups developing space technologies.

The University of Tartu spin-off Crystalspace is one of the many start-ups that have to date evolved from the ESTCube-1 team. Crystalspace builds stereocameras for the NASA Artemis programme. The final goal of the programme is to take men to the Moon in 2024 after a 50-year-long break. Crystalspace constructs cameras together with the University of Tartu Observatory and Krakul.



Student satellite ESTcube-2 aims to test  
plasmabrake technology



# Computational imaging enhances the vision quality of autonomous vehicles

## > We build robots to save humans

Milrem Robotics is an enterprise which effectively implements the R&D potential of the space technology researchers of the University of Tartu. Milrem's main focus is manufacturing unmanned ground vehicles for defence and security forces, commercial and industrial clients and rescue services. The cooperation of the University of Tartu and Milrem has helped to create the world's best autonomous (offroad) technology competence.



**Mihkel Pajusalu**  
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The joint application of photonics and computer-intensive data processing makes it possible to increase the image sharpness, depth and resolution in a manner that exceeds the technical-physical limit of the measuring system. Our researchers at the ERA Chair of Computational Imaging know how to test the limits.

The spin-off of the University of Tartu LightCode Photonics develops a compact and affordable software-based 3D camera for autonomous vehicles.



**Heli Valtna**  
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# A Teaming partnership with Novo Nordisk Foundation Centre for Biosustainability in Denmark

In 2023, a new EU-funded project DigiBio was started to establish an Estonian digital bioengineering platform. The project, engaging a partner centre from Denmark, the Novo Nordisk Foundation Centre for Biosustainability is a part of the EC Widening programme designed to alleviate the disparities in R&I performance in different EU countries.

The first step of the DigiBio project implementation was to establish a new Institute of Bioengineering. Our common aim is to understand the logic of genome engineering to create synthetic biology solutions for bio-based economy and biomedicine. One of the goals of the new institute is to recruit young group leaders recently trained abroad to establish their laboratories here.



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› **We digitalise bioengineering to help cope with global challenges**

The philosophy of the DigiBio project is based on the idea of digitalisation of bioengineering and applying computational methods and machine learning to analyse genetically engineered cells using an automated experimental biofoundry platform, based on the model of our Danish partners. The second step of the DigiBio

project – building the Estonian Biofoundry, a new member of the Global Biofoundry Alliance network, will be accomplished in the coming years. Engineering biology using such a high-throughput approach helps us to meet global challenges ranging from sustainable bioeconomy to fighting pandemics and diseases.

# Environment

The UN Sustainable Development Goals say that to preserve life on land, we must protect, restore and promote the sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss. This is what the University of Tartu researchers do both in Estonia and globally. The uniqueness of Estonia lies in seminatural habitats in which Estonians have lived side by side with the natural environment, for centuries. Science-based, sustainable management of natural environments helps us preserve biodiversity in our urbanising world.



## We protect environment in a science-based manner

The Institute of Ecology and Earth Sciences covers a vast spectrum of studies from plankton to mammal biodiversity. Based on the research of our scientists, thousands of hectares of highly species-diverse calcareous grasslands have been restored, and hundreds of mitigation pools have been constructed as reproduction sites for newts and frogs that are rare in Europe. Our scientists are leading broad knowledge-based debates on sustainable forest management at the governmental and societal levels and providing the needed information base through multidisciplinary research programmes.



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**Asko Lõhmus**

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› **We help to save water in agriculture**

In the last century the human water consumption saw an eightfold increase. 70% of the consumed water is used for the agricultural sector.

PlantInvent is a company that grew out of the University of Tartu plant signal research team and its objective is to decrease remarkably the use of water in agriculture with the help of more precise measuring instruments. The plant diagnostics instruments offered by them assess the gas cycles between plants and the surrounding environment. For example, how

much carbon dioxide plants can bind and how much water they can release. The acquired data will help regulate watering as appropriate and save water.



**Hannes Kollist**

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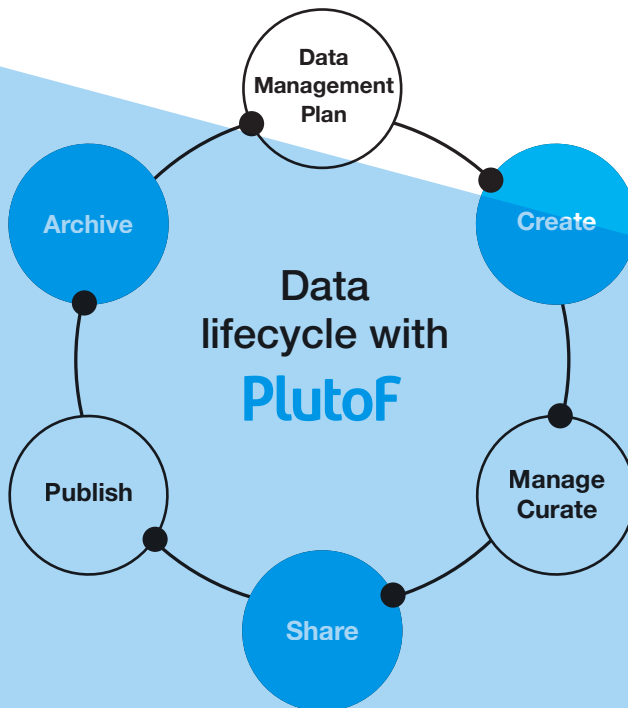
## Urmas Kõljalg

*Professor in Mycology,  
Director of the University of  
Tartu Natural History Museum*  
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### > We create unique modern wildlife databases

The University of Tartu Natural History Museum is a trailblazer in e-biodiversity systems and databases. Scientists have created a new method for communicating species – using the DOI code. The classification initiated by Carl von Linné, which has lasted for over 200 years, does not take into account current scientific methods, like eDNA and genotyping of soil samples. DOI codes do.

Moreover, a global database named UNITE was created. Gene sequences have been gathered together from all over the world, and on that basis DNA-based species are calculated.



> **We study soil biodiversity on a world-class level**

Small factors start great changes. Soil microbes and fungi, invisible to the eye, play an important role in shaping large ecosystems. Researchers of our Institute of Ecology and Earth Sciences have a global reach in researching soil microbes and fungi with molecular and bioinformatic methods. This allows us to find smart ways to protect and support soil biodiversity in the context of increasing human activity and climate change.



**Maarja Öpik**

*Professor in Molecular Ecology  
Director of the Institute of Ecology and Earth Sciences*  
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Marina Semchenko delivers with her ERC project better understanding of how plants regulate soil biota. It provides evidence-based knowledge, which will help to make wiser choices in habitat restoration or in crop breeding and improving soil health.



**Marina Semchenko**

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› **Smart tools for blue economy**

The innovative monitoring methods and web-based tools developed under the guidance of the University of Tartu marine scientists allow to make evidence-based decisions in the use of marine space both in Estonia and internationally.

PlanWise4Blue is a web-based decision support tool that combines novel modelling algorithms with existing knowledge about marine economy. The web model assesses both the cumulative environmental impact of human activity as well as the economic gain received from the use of marine resources.



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## Ülo Mander

*Professor of Physical Geography  
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- › **We study the evolution of atmospheric particles and their effect on climate change**

Under the guidance of the Laboratory of Environmental Physics, long-term regular measurements are in progress in Järvelja forest in order to study the evolution of atmospheric particles in the Estonian mixed forests. Studying the development of clouds on a molecular level, we find out among other things the answers to major questions, such as how the use of land influences global warming.



## Heikki Junninen

*Professor in Environmental  
Physics*

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- › **We study the formation, cycle and climate impact of laughing gas emitted from peat soil**

Nitrous oxide (N<sub>2</sub>O), commonly known as the laughing gas, is one of the most dangerous greenhouse gases produced by microbial life in the soils of agricultural areas and drained peatlands. Ülo Mander has been awarded an ERC Advanced Grant to study the cycle of N<sub>2</sub>O in fens and peatlands, its links to global climate change, and possible land-use practices that could help curb the production of this greenhouse gas in the future.



## We have brought all Estonian researchers to one database

UT leads the consortium named ADAPTER where all Estonian R&D institutions offer their services to public and private sector. It's the easiest and quickest way to find the right researcher for the job.

Find more information: [www.adapter.ee](http://www.adapter.ee)



2023

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