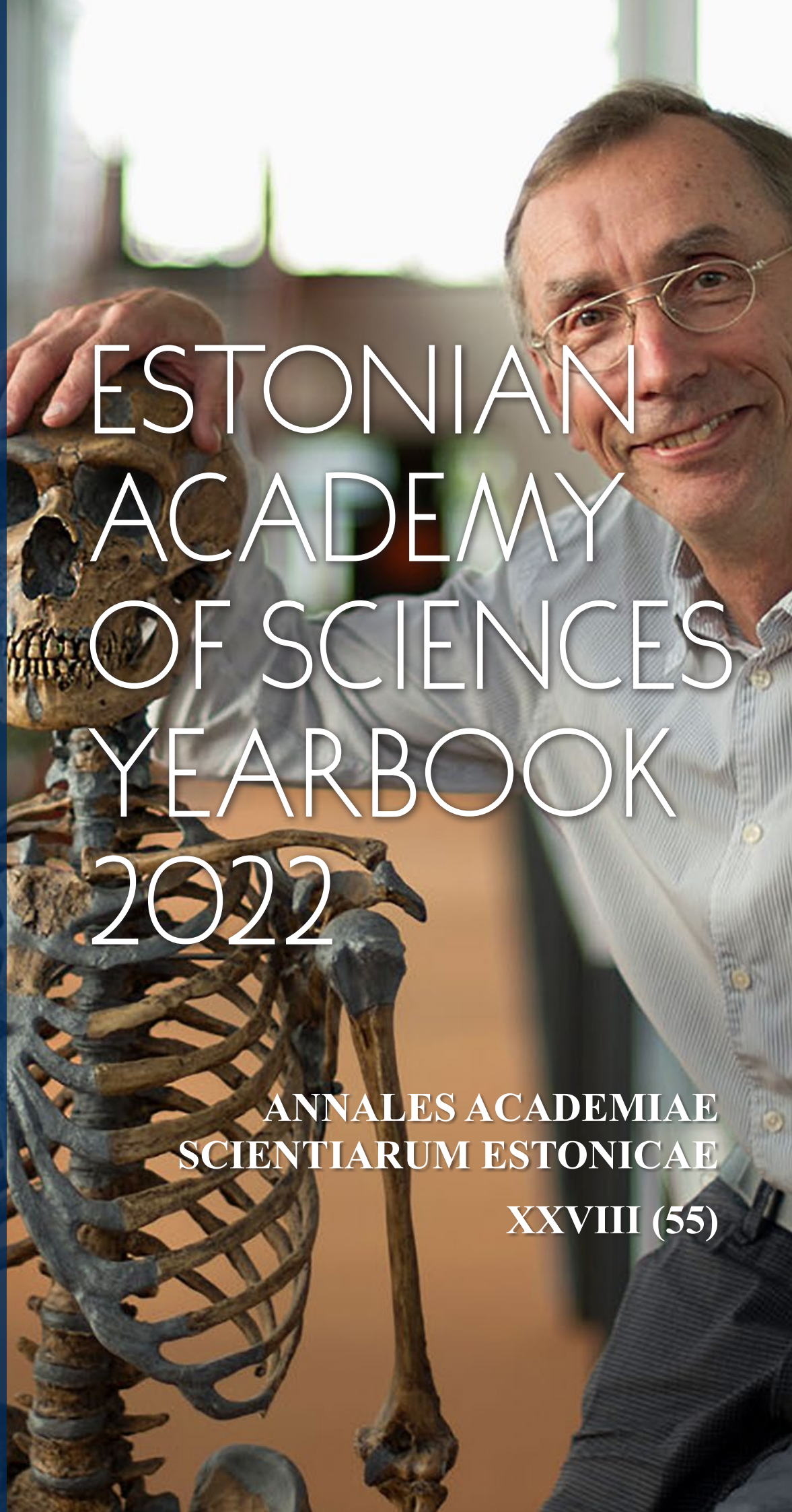


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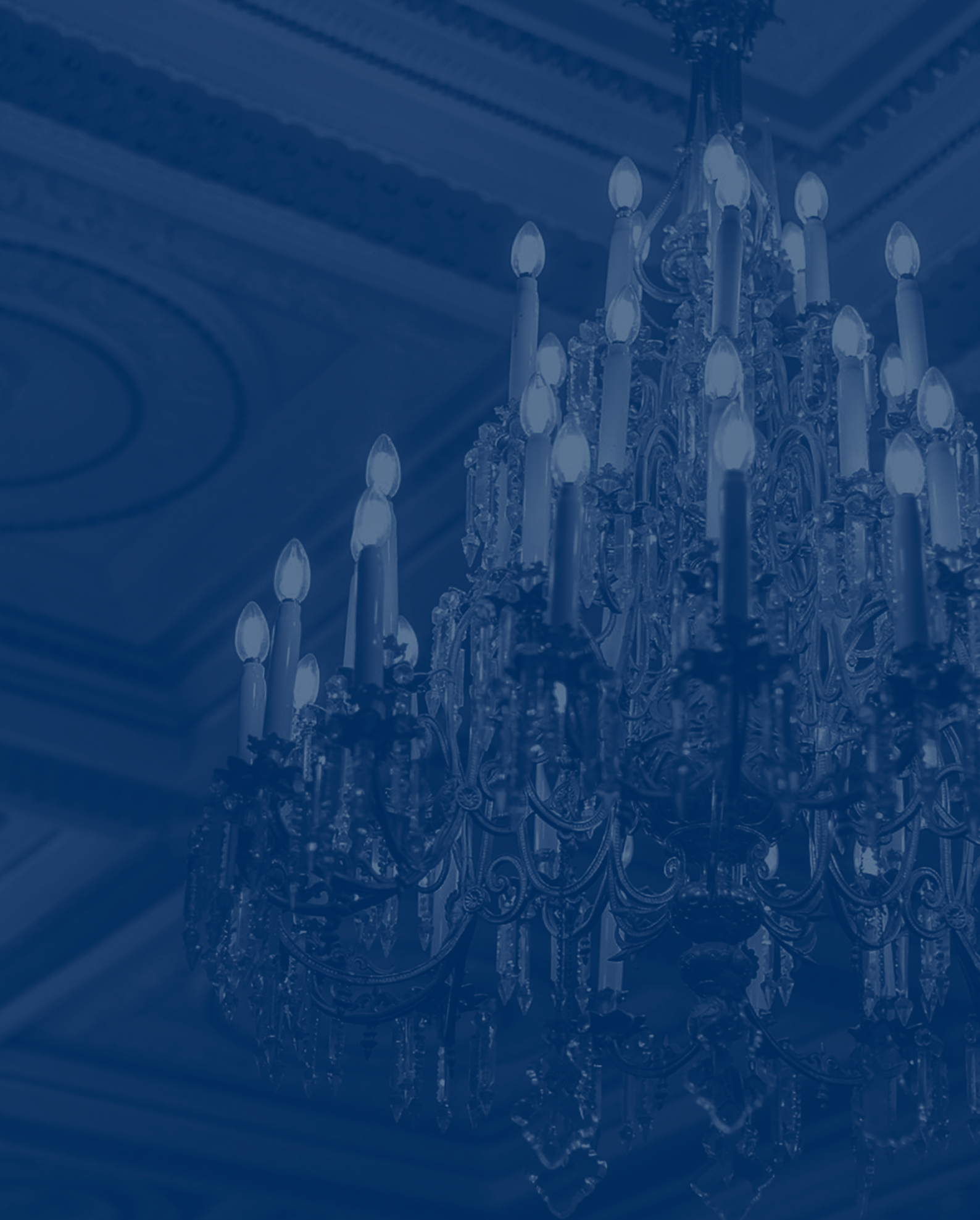
ESTONIAN  
ACADEMY  
OF SCIENCES  
YEARBOOK  
2022

ANNALES ACADEMIAE  
SCIENTIARUM ESTONICAE

XXVIII (55)







On the front cover: Svante Pääbo, Nobel Prize winner and geneticist with Estonian-Swedish roots, Foreign member of Estonian Academy of Sciences.  
Photo: Karsten Möbius

EESTI TEADUSTE AKADEEMIA

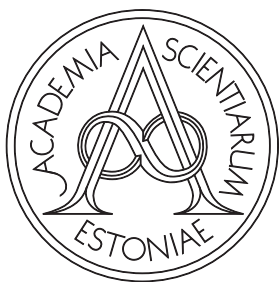
*Facta non solum verba*

ESTONIAN ACADEMY  
OF SCIENCES  
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TALLINN 2023



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# FOREWORD

2022 was a year of painful realisations. It was as if we were lurching from one ordeal to another. Through these ordeals, we have begun to realise how fragile our society is and how thin the layer of culture. It became clear that COVID-19 would not decimate humankind and even our civilisation, although it dragged us out of our comfort zone, forced us to make difficult decisions and brought discontent to the surface. Humans themselves, however, can do immense harm. Even our very own neighbour whose decisions can be so unexpected and yet, at the same time, entirely logical. We realised that we are continuously learning throughout life and that all the steps along the way, including higher education, must be maintained. We realised that electricity is not a simple given, but manifests through significant investment and the contribution of many of our fellow humans.

Last year was overshadowed by a war that virtually no one considered possible, even the best of experts in that field. As John Boright, Executive Director of International Affairs at US National Academy of Sciences, said in private: even the US specialists who should have access to the best information, including intelligence information, were convinced until the very last moment – the early morning of the 104th anniversary of the Republic of Estonia – that Russia would not launch a full-scale war in Ukraine.

This war is being waged not so much between countries or nations, but between value classes and cultural spaces. It has opened a new dimension in Europe and probably the whole world. Violence and terror no longer recognise any borders, and the once effective practice of respecting your enemy has turned into foul and systematic demonisation.

This course of events gave new substance to the Academy's mission formulated by law: as an association of researchers founded to help, independently and with expert academic professionalism, resolve issues relating to the development of Estonian research and the social and economic development of the Estonian state. Up until now, we could be forgiven for thinking that addressing domestic and/or socio-economic aspects is sufficient. Now, in this new reality, we cannot. Therefore, it is somewhat understandable that in 2022 the Academy faced considerably more significant cross-border tasks than usual.

Hopefully, we have learnt something from all of this. After all, we have had to accept that science can never decide what course of action the political environment takes with its conclusions. We also had to acknowledge the sage words of the Irish-born scholar and author, C. S. Lewis: you can't go back and change the beginning, but you can start where you are and change the ending.

Tarmo Soomere  
06.03.2023

# MESSAGES FROM THE ACADEMY

## PEACE WILL NOW UNFORTUNATELY COME ONLY AFTER THE WAR

*In 2022, the Academy of Sciences faced considerably more significant cross-border tasks than usual.*

*Tarmo Soomere*

**W**ar and eloquence  
The Estonian Academy of Sciences is currently responsible for two networks: the European Section of the International Science Council (ISC) and the European Science Advisors Forum (ESAF). A large part of last year's communication was conducted through them and for their needs.

The first days of the aggression of Russia against Ukraine were quite unusual. Hundreds of declarations were compiled, exchanged and posted on the internet. It was as if a contest had begun for who could condemn Russia the most eloquently – without actually saying anything substantive in the process.

However, the networks we are responsible for conveyed a concrete message: that peaceful countries must have the capability to defend themselves. We expressed that the scientific community as a whole had missed something very important. Something that stems from the difference in decision-making processes at work in seemingly similar cultural spaces. We said that academies now have to advise their countries in the area of foreign and defence policy. Between the lines, we also expressed that we must also be prepared to respond to military questions: ones of life and death. Not euphemistically, but directly, and with the force of all the knowledge we have. As the Russian proverb says: the good must have strong fists.

We recommended telling governments that we must now join forces to help Ukraine, to find and use any means possible to weaken the aggressor, and to contribute to understanding the processes that have led to this horrendous development.

The war also highlighted several aspects that are painful for scientists, such as the various extensive gaps in global science. It was obvious that all of us, including scientists, had entirely missed something fundamental. It is now clear that we need significantly more knowledge in order to identify, observe and forecast processes and decision-making chains in different cultures. We must learn to respond proactively in order to nip such terrible developments in the bud.

### **Emphasising the experience of small countries**

Academies cannot fight on the front lines, but they must give the best advice to their countries and governments. In 2022, the central message of our international efforts was clear: now is the time to listen to those small countries and their academies of sciences who live and operate beside a brutal and unpredictable neighbour and who witness the reality of what is happening across the border.

At several top-level forums, we presented this message along with the idea that governments must be given science-based expertise in the area of foreign policy and





Photo: Hendrik Osula

Academy President Tarmo Soomere giving a speech at the General Assembly of the Academy on 7 December 2022.

perhaps even in the area of warfare. This was also highlighted at the Annual Meeting of the European Members of ISC (see pp 86–87) held in London in October. A broader topic, which also included a call to consider how to help rebuild countries damaged by war or ravaged by other conflicts with both psychological support and structural aid, became the backbone of the Annual Meeting of the ESAF held in Vilnius at the end of November (see pp 87–90). The same topics reached more than one hundred academies even more acutely via the *Triennial Conference of the Inter-Academy Partnership (IAP)* and the *Worldwide Meeting of the Young Academies*. We stated there that now is not just a suitable window of time but, in fact, high time to start taking seriously the messages of the academies of the countries that see evil at work up close, right next to their home. The message was delivered thanks to the substantive and technically perfect solution organised by the Estonian Young Academy of Sciences, which was considered the flagship event of the entire congress (see pp 91–93).

### Science diplomacy in a complex world

The activities of the Estonian Academy of Sciences on the international arena can increasingly be classified as science diplomacy. As yet, it does not have a generally accepted definition, precise framework or clearly defined concept. Neither is it unambiguously clear who the participants are, what its instruments look like and which initiatives and actions it includes.

The definition of science diplomacy started taking root after the end of the Cold War as a further development of the ‘soft power’ concept formulated by Joseph Nye in 1990. It currently covers scientific support to foreign policy communication and diplomatic efforts to promote research cooperation as well as research cooperation as

a tool for alleviating international tensions and creating trust. The formulation, presentation and dissemination of Estonia’s message via sister academies and their networks therefore fits within the definition. One achievement of traditional science diplomacy is the formulation of the Sustainable Development Goals in 2015 in cooperation with two global associations of academies of sciences.

Our science diplomacy is represented in the European Commission’s scientific advisory efforts by Academy member Maarja Kruusmaa. Through this, Estonia’s voice, viewpoint, risk assessment and experience are integrated into recommendations issued at European level. This is a part of Estonia’s security architecture: our critical topics and experience are at the table and not merely on the menu.

Scientists are often only contacted when other options have been exhausted. For instance when countries no longer talk to each other at all. One thorny issue in Europe is the Białowieża primeval forest in the border region of Poland and Belarus. One party sent a flow of migrants through it, while the other built a border fence dissecting the forest. When the war in Ukraine is over and relations between Poland and Belarus are normalised, this unique ecosystem has to be managed cooperatively. The US Academy of Sciences is also seeking our assistance because we personally know the top scientists of both parties and (still) speak Russian.

At times, science diplomacy is like walking a tight-rope. The US Academy of Sciences is seeking ties with scientists even from pariah countries. The idea is simple: even if there are no relations between countries, contacts with smart living people must be maintained. Then, when the environment starts to change, there is someone to talk to – someone who is smart and constructive, not a tool of the old regime, not an oppositionist or a revolutionist, and not simply someone plucked from the street either.



Photo: Hendrik Osula x3



Those who are shaping and maintaining foreign policy have started to increasingly use the possibilities of science diplomacy. Estonia is currently applying for observer status at the Arctic Council. The backbone of the application is made up of an overview of the unique things that Estonian science is able to offer for the administration, protection and economic management of polar regions, as well as for the improvement of the quality of life of the people living there. In the same way, we have also offered support to the Estonian Climate Pact Ambassador in formulating what Estonian marine science is able to offer at global level. It is no wonder then that the parliamentary delegation of the Republic of Korea decided to take two hours out of their busy itinerary to visit the Estonian Academy of Sciences in early 2023.

### **Building momentum**

In Estonia, the Academy was considerably less active and visible than in the previous few years. That decision was intentional. With a war raging close by, the stage has to be given to those who have the skills, mandate and capability to guide the country through difficulties. The acutest domestic academic topic was the financing of higher education, which was advocated by Academy member Toomas Asser and barely reached a satisfactory solution.

During the year, our four esteemed colleagues passed on, but we also gained three dazzling scientists – Toomas Rõõm, Dan Bogdanov and Ellu Saar. The election of new Academy members has perhaps been made complex on purpose. The process has strict rules and as many as four thresholds. The decision, of course, is made by the General Assembly. It is not usually possible to involve all the Academy members in decision-making. In accordance with the rules, up to one fifth of the Academy members may be absent from the General Assembly due to either health reasons or being abroad. At least 2/3 of the attendants must take part in the voting. If more than one fifth is absent, at least 2/3 of those who are expected to attend must take part in the voting. In order to be elected, the candidate must secure 2/3 of the participating votes; as well as at least half of those expected to attend. Complex? Of course it is. Apparently, the legislator wishes for the Academy members to reach a near-consensus decision. And for many years running, we have succeeded in doing so.

### **Recognition of the best**

The future in which we ourselves would like to live is increasingly being decided by the skills of individual people, countries and the entire world to seek out and recognise those whose work has the potential to change the world. This is done systematically across the world via various recognitions, starting from young researcher contests to the Nobel prizes. One aspect of such recognitions is saying thank you to those who have contributed a great deal more than their employment contract prescribes. Another at least as important aspect is the need to identify breakthroughs, the giants on whose shoulders others can stand in the future, or those who will in all probability become giants in their own right.

It is also in every way logical that recognitions are linked to the names of those on whose shoulders we ourselves are standing. Last year, the Academy's medal list grew. This is in recognition of our own scientists who have made remarkable achievements in the field of science and a reminder of those through whose expertise we are now propelling forward. The Academy is now bestowing eight medals – each not more frequently than once in every four years (see pp 62–64). In 2022, Academy member Urmas Varblane earned the first Edgar Kant Medal and Academy member Martin Zobel earned the fourth Karl Ernst von Baer Medal.

In addition to the medals, there are now as many as four recognitions, which are partly or fully backed by private capital. The Estonian Academy of Sciences Foundation, established at the Estonian National Culture Foundation, has been supporting the research work of young Estonian researchers with doctoral degrees since 2006. Academy member Endel Lippmaa's lectures are held and the medal awarded fully from the donations of private persons. In 2022, the Academy member Mihhail Bronštein award and the Academy member Anto Raukas scholarship were added. The first of these was initiated and is being financed by the family of Mihhail Bronštein. The awards are bestowed in recognition of the theoretical developments of Estonian economists and their successful practical applications in Estonia and elsewhere in the world. This initiative is remarkable, as it emphasises Academy member Bronštein's significant contribution to the development of economics and the independence of Estonia. The Academy member





Images from the General Assembly of the Academy of Sciences on 7 December 2022.

Anto Raukas scholarship was initiated and is being financed by Fermi Energia. The goal is to promote the areas of specialisation of energy and physics and to support the development of local young people and their potential future contribution to the future of energy and nuclear energy in Estonia.

The ice also started moving in the area of thematic researcher professors and professorships. The Ministry of Foreign Affairs decided to create two professorships focused on Arctic research. The positions were filled at the beginning of the autumn semester. With financing from the Ministry of Education and Research, a decision was made to create a research professorship for future energy and another for studies into Estonian language and its teaching.

### **The development of solutions continues**

In spring, when it was the right time to raise the question of energy, we were shy. We feared that in the shadows of the war our message would remain weak. Perhaps it would have indeed. We now know that staying silent on the topic was a great oversight. The energy sector has become the driver of inflation. This should not be the case, as a high-quality energy supply is a prerequisite for the existence of today's society. One of the main problems is international: using an energy exchange in a situation where it actually should not be used. Systems and algorithms that have been developed for peace and prosperity cannot work in conditions of war and shortage.

The solutions proposed to date have been protectionist and take us a big step backwards towards a socialist way of thinking and the economic model stemming from that. The entire process has intensified economic polarisation, resulted in political chess and indirectly influenced the Academy's other choices. We must be grateful to the (now former) head of Eesti Energia, Hando Sutter, who outlined the big picture of the present situation and possible future directions of the Estonian energy sector in a fitting conclusion to the year at the Academy's winter General Assembly. The outlined picture was so impressive that the Board decided to take some time to consider selecting a future energy research professor and to specify the position more thoroughly.

The lesson learnt from these setbacks was actually formulated by Blaise Pascal four centuries ago: one-half of

the ills of life come because men are unwilling to sit down quietly for thirty minutes to think through all the possible consequences of their acts. We shall strive to find more time to contemplate urgent matters together. We shall try to take on board the words of US journalist Fareed Zakaria who said that the entire world has come to a realisation that should have come considerably sooner: people must be respected for the work they are doing, even if it does not necessarily yield significant financial revenue.

The war in Ukraine is a nightmare in the heart of Europe, a crime without any rational justification and a flagrant violation of international law and the core principles on which the international rules-based order is built.

Russia's military attack against Ukraine is a brutal wake-up call. It is a reincarnation of an ancient evil from the past, attacking a nation that is wishing to choose its own way of development.

It is an extremely dangerous situation that may bring chaos to the entire world. It demonstrates that those who have chosen a peaceful and democratic path must have sufficient resources to protect themselves.

It also tells us that we need much more knowledge to identify, monitor and predict processes and decision-making chains in different cultures, and we need to learn how to react preventively to avoid such dreadful occurrences.

There is strength in unity. Alone we are weak against such attacks, but together we are invincible. The Academies cannot fight on the front line but they have a duty to provide the very best advice to their nations and governments.

In recognition of this mission, we call on all Academies across Europe to consider in their advice to their nations and governments the need to join forces to help Ukrainians in their fight for their own future, to use every possible action to weaken the positions of the aggressor, and to further develop an understanding of processes that may lead to escalations of this type.

*The Estonian Academy of Sciences' appeal to the European academies of sciences on 26 February 2022. The English text of the appeal together with the declarations of the academies of sciences of other countries is available on the Academy's website.<sup>1</sup>*

<sup>1</sup> <https://www.akadeemia.ee/en/news/academies-of-sciences-in-support-of-ukraine/>



Photo: Cecilia Odland

## NOBEL PRIZE IN PHYSIOLOGY AND MEDICINE 2022 – A FOREIGN MEMBER OF THE ESTONIAN ACADEMY OF SCIENCES, SVANTE PÄÄBO

Announcement of Svante Pääbo's Nobel Prize.

*Maris Laan, Academy member, Professor of Human genetics at the University of Tartu*

An extraordinary event took place on 3 October 2022 – the Nobel Prize in physiology and medicine was bestowed on Svante Pääbo, a foreign member of the Estonian Academy of Sciences. The event was also special because Karin Pääbo, the mother of the new Nobel Laureate, is Estonian born and grew up in Rakvere.

Those occasions when scientists related to Estonia have received the Nobel Prize have been few and far between. In 1909, the Nobel Prize in chemistry was bestowed on Wilhelm Ostwald (1853–1932) who studied and defended his doctoral thesis at the University of Tartu and who is considered one of the founders of physical chemistry. It is an interesting coincidence that both Pääbo and Ostwald carried out most of their life work at Leipzig University in Germany. Both received the news of being awarded the Nobel Prize at their home in Leipzig. In 1991, the Nobel Prize in chemistry was bestowed on another foreign member of the Estonian Academy of Sciences, Richard R. Ernst (1933–2021) who worked in Switzerland. He was recognised for his contribution to the development of the nuclear magnetic resonance method, which is now widely used in medicine.

What has Svante Pääbo's journey to the Nobel Prize been like? On the one side, meandering and challenging,

but on the other side, moving stoutly towards a specific greater goal. As early as 1985, when he was still a doctoral student at Uppsala University, Svante was the first to consider studying genetic material from an Egyptian mummy. This opened the way to paleogenomics, which is aimed at unlocking the DNA codes of early humans and extinct species. Establishing an entirely new area of research, sequencing the DNA code of archaic humans (Neanderthal and Denisovan), and studying the evolution and demographic history of the modern human and sister species that lived in the same period have elevated Svante to the Nobel Prize pedestal 37 years on.

I had the privilege of working on Svante's team at the University of Munich for over two years, when in 1997 the first DNA segment was sequenced from the mitochondrial genome of a Neanderthal, an archaic human who became extinct nearly 40,000 years ago. That was preceded by more than ten years of methodical development work in order to extract 'old DNA' that had been preserved in small fragmented amounts in old bones and teeth in a form that was useful for scientific analysis. When I arrived in Munich in 1996, Svante's lab had been at the centre of attention in connection with the success story of studying the DNA of





Photo: Anna Schroll, Max Planck Society

Press conference at the Max Planck Society.

an ice man frozen in the Alps 5,000 years ago. The lab saw countless hours of work, experiments and brain-racking on ‘old DNA’ projects that never reached publication, such as failed attempts to isolate DNA from the biological material of over one hundred Egyptian mummies or extinct insects stuck in amber millions of years ago.

Back then, we moved forward in small steps, as if in a dark room, holding a torch, not even knowing the boundaries of the room. Svante Pääbo probably agreed to the bold attempt to study Neanderthal DNA out of his childlike curiosity in the genetic code of that archaic sister species. The desire to comprehend surpassed all methodical challenges at a time when the human genome had not yet even been sequenced.

The opportunity offered by the Max Planck Society at the end of the 1990s to establish an entirely new institute of evolutionary anthropology in Leipzig, which would focus on human evolution, gave a significant impetus to Svante Pääbo’s research. Doing something entirely new requires motivated scientists with an original way of thinking as well as time, money and the human resources to implement the ideas. In order to reach scientific innovation, top-level scientists need for their hands to be free enough to test and carry out their ideas. These are the very principles applied by the German Max Planck Society that finances nearly 90 institutes focused on different areas of research.

The results of Svante Pääbo’s research in the past 20 years represent advanced technological breakthroughs, combining archaeology, chemistry and the most modern methods of DNA research and bioinformatical analysis. At the same time, they are down-to-earth and concern all of us. In 2006, the first million base pairs of the Neanderthal genome sequence were published simultaneously in the top-level journals *Nature* and *Science*. These data showed that the paths of the predecessors of humans and Neanderthals split about 400,000 years ago.

In the subsequent years, DNA research gave us new knowledge: Neanderthals did not live only in Europe, but in the whole of Eurasia, they communicated with groups of modern humans and they even had common offspring as late as 40,000 years ago. Each of us carries about 2% of Neanderthal DNA.

The next impressive breakthrough came in 2010 when Svante Pääbo’s team identified an entirely new species of archaic humans on the basis of DNA data – the Denisovan hominin who lived in Siberia, Tibet and South Asia 15,000 to 200,000 years ago. Further studies proved that the Denisovan were in close communication with the Neanderthal and modern human populations of that time. The largest amount of traces of common offspring with the Denisovan humans has been found in the genome of the people of the



Photo: Frank Virken / Max Planck Uting

islands of Papua New Guinea – as much as 5%. The find, published in the journal *Science* in 2018, was sensational – the sequencing of the genome of a 13-year-old girl who had lived 90,000 years ago and whose mother had been Neanderthal and father Denisovan. Svante’s later research has been focused on the DNA segments of the human genome, which reflect the demographic history shared with Neanderthals as well as their connection to various biological conditions, such as a predisposition to suffering from a more severe form of the COVID-19 infection, pain sensitivity or the precision of the brain cell division process.

Besides his achievements, Svante is a great person who has always been fun to be around. His childlike curiosity, sincere and contagious excitement and fascination, sharp mind and the courage to think beyond the ordinary. His broad horizon and deep interest in world cultures. His friendliness and trust towards his colleagues and students. Politeness and modesty, respect for a healthy lifestyle and setting an example for others in this. All these qualities have supported him on his path from a medical student supported by a student loan to the world’s highest award in medicine.

When could a Nobel Prize be bestowed on an Estonian scientist for research carried out here? Most of the research that has led to a Nobel Prize has stemmed from an original idea of young scientists. The research has subsequently, through many ups and downs, lasted for years, step by step building a bridge towards important scientific breakthroughs. Testing and implementing innovative developments and new ideas take time, concentration and space to think. Consistent research funding is also important, as it allows for the possibility to take risks in research and continue even after failure. Through this process, the Nobel Prize will one day arrive at these shores!



Photo: private collection

Photo: Maris Laan and Svante Pääbo Maris Laan and Svante Pääbo in summer 1997 in Svante Pääbo’s office at the Institute of Zoology of the University of Munich.



# COVID-19 BROUGHT A PARADIGM SHIFT IN VENTILATION

Academy member Jarek Kurnitski

When the COVID-19 pandemic began, the importance of ventilation in preventing airborne viruses also emerged, and the need to modernise ventilation systems was identified by the Academy of Sciences in 2021 as one of the pillars of the triple challenge.<sup>2</sup> The Academy members identified three key components to defeat the coronavirus. Ventilation helps all users of shared indoor spaces, vaccination helps those who want to help themselves and responsibility means keeping others healthy by staying at home if sick.

A recently published study of Italian schools is a striking example of the impact of ventilation.<sup>3</sup> In ventilated school buildings with an air exchange rate of at least 10 litres per second per student, the risk of infection was 80% lower than in naturally ventilated school buildings. It has also become clear that masks should be worn for short periods of time, and that their use is justified in public transport and other crowded places. Air purifiers demonstrated their capabilities both in calculations and in tests. Unfortunately, however, the equipment has largely not been correctly installed in school buildings. When small air cleaners are used instead of large ones and placed in corners instead of in the middle of the classroom, the effect is negligible. Moreover, they give a false impression of an improvement in air quality because they do not replace ventilation, i.e. they only remove fine particles, not carbon dioxide. Therefore, there are no quick and easy solutions.

The private sector was the quickest to recognise the need for ventilation, with the Clean Air Label for shopping centres endorsed by the Consumer Protection and Technical Regulatory Authority and the Traders' Association. Ensuring safety in these buildings deserves a nomination for achievement of the year. Good work has also been done in Tallinn, Tartu and other cities, but with limited budgets and little support from the state. Gradually, however, school buildings and kindergartens are being renovated and installed with new ventilation systems with heat recovery and sufficient air exchange. At the same time, increased attention has revealed shortcomings in previously renovated schools, where a ventilation system is in place but cost



REHVA's proposal for post-COVID target ventilation levels.<sup>4</sup>

economy means inefficient air distribution in classrooms. There is still a lot of work to be done, but at least things are moving in the right direction.

In the three years since the start of the pandemic, sufficient knowledge has been gathered to develop a reliability in calculating the risk of infection in indoor environments. This also applies to the Omicron variant, for which measured and reliable median values are available. The demonstration of airborne virus transmission brought a paradigm shift in the design of ventilation systems. Previously, air distribution systems were designed to efficiently remove CO<sub>2</sub> and odours emitted by people who are evenly spaced in indoor premises. However, in the case of a virus, it is important to remove the virus particles emitted by one infected person. Since the location of the virus source is not known in advance, the ventilation system must be able to remove the source of contamination as effectively as possible from any location. The emergence of a new point source of contamination has upended the principles of air distribution design. Solving the problem requires, in tandem with more ventilation, significantly more efficient air distribution than before, with the right type and correct positioning of intake and exhaust elements. This helps to remove as many virus particles as possible with as little airflow as possible.

2 <https://www.akadeemia.ee/en/responsibility-vaccination-ventilation-from-virus-prevention-to-eradication/>

3 Buonanno, G., Ricolfi, L., Morawska, L., Stabile, L. 2022. Increasing ventilation reduces SARS-CoV-2 airborne transmission in schools: A retrospective cohort study in Italy's Marche region. *Frontiers in Public Health* 10, 1087087, doi: 10.3389/fpubh.2022.1087087.

4 [https://www.rehva.eu/fileadmin/user\\_upload/2022/Health\\_based\\_target\\_ventilation\\_09012023.pdf](https://www.rehva.eu/fileadmin/user_upload/2022/Health_based_target_ventilation_09012023.pdf)

In 2022, progress was made in both directions, in quantifying virus emission and in determining the efficiency of ventilation with a point source. These resulted in a new European post-COVID ventilation design method proposal in December,<sup>5</sup> in which the signatory also has a significant role. It will progressively start to influence building ventilation design, initially at the pace at which engineers understand the paradigm shift and acquire new skills.

5 <https://www.rehva.eu/activities/post-covid-ventilation>

Although it will still be several years before the proposal enters into force as a standard, the process is underway. Estonia, Finland and several other countries are already reviewing indoor climate regulations and standards. In any case, it is important that the new know-how reaches engineers and architects designing buildings, as well as clients. That will make it possible to provide more efficient and safer solutions which allow buildings to be utilised at controlled risk levels, even in pandemic conditions.

## Eesti kiire hinnakasvu peamistest põhjustest

Eelmisest sügisest sai hindade kiirest kasvust keskne kõneaine, kuid miks on Eesti hinnakasvu poolest Euroopa Liidu riikide hulgas esirinnas koos Leedu ja Lätiga?

Hinnakasvu välistest teguritest on olnud palju juttu: keskpankade rahatrükk, nõudluse tugev taastumine koroonakriisist väljumisel, ummistused tarneahelates ja sõda Ukrainas, mis on lõonud segamini energiaturu.

URMAS VARBLANE  
akadeemik, Tartu Ülikooli  
professor



### TEADLASE PILGUGA

2021. aasta viimases kvartalis 2019. aasta viimase kvartaliga kõigi Euroopa Liidu riikide lõikes, jäi Eesti teisele kohale. Seetõttu jäi meie tööpuuduse

The opinion piece 'About the Main Reasons of Estonia's Rapid Price Increase' by Academy member Urmas Varblane, published on 3 September, was the most read article of this column in 2022 (12,557 online views).

## FORTY OPINION PIECES WERE PUBLISHED IN THE ACADEMY MEMBERS' COLUMN 'THROUGH A SCIENTIST'S EYES'

*Krista Tamm, Head of Communication of the Academy of Sciences*

The Saturday *Postimees* column 'Through a Scientist's Eyes', which was launched on 28 August 2021, continued in 2022 thanks to the sharp pens of Academy members. Forty opinion pieces for the Estonian public were published, which ranged from dissecting various topical societal issues to simply sharing new knowledge.

**Maris Laan** wrote about what gave 2021 a place in the history of reproductive medicine – synthetic human embryos not made from either egg or sperm were successfully created in a dish.

When Svante Pääbo received the Nobel Prize at the beginning of October, Maris Laan – who had been on his research team at the University of Munich as a postdoctoral student in the second half of the 1990s – depicted Estonia's

links to the Nobel Prize. She also contemplated how people generally attain the Nobel Prize.

**Ülo Niinemets** discussed our choices between energy and food production in conditions of limited land resources. As our bread basket can only be filled with biomass in energy production, biomass has to be replaced by other carbon neutral sources of energy, such as solar, wind, hydro and geothermal energy.

In another opinion piece, Ülo Niinemets wrote that we have arrived at a crossroads in agriculture, from where we can no longer keep doing the same old things. We need renewable agriculture that 'fixes' food chains and cycles and allows us to again begin using habitats that have been exhausted due to unsuitable management and to decelerate climate change.



In a third article, Academy member Niinemets discussed the food security dilemma. Less food in the bin, informed consumption choices, a balanced diet – even the tiniest changes made by each of us can bring about great changes in our environment, he surmised.

In the fourth piece, he wrote that a very large part of once green ecosystems has been replaced by degraded areas as a consequence of unsustainable agriculture, mineral resource extraction and urbanisation. Before the UN biodiversity summit COP15, more than 600 scientists published a letter to world leaders urging them to stop burning biomass to produce electricity.

**Arvi Freiberg** wrote about the limits of knowledge and about the fact that at the current pace of information growth – 50 percent a year – the earth’s resources will be exhausted as soon as within 100 to 150 years.

In another article, Academy member Freiberg made a time journey to contemplate the role of natural sciences in the development of modern society, and the possible future directions.

Less than a month before the beginning of the war in Ukraine, **Lauri Mälksoo** discussed the international law framework of the Ukrainian conflict. He wrote that should Russia decide to launch a military attack against Ukraine, it would no longer constitute an attack against a single sovereign state, but against the entire world order as agreed in the UN Charter in 1945.

In another opinion piece, Academy member Mälksoo wrote about the meaning and importance of the new Commentaries on the Constitution by the Constitutional Law Endowment of the Academy of Sciences. According to him, the fact that we now have two different sets of scientific Commentaries on the Constitution shows the strength of Estonian law studies.

**Tarmo Soomere** wrote a total of seven opinion pieces, including thoughts about the possibilities of producing the energy necessary for generating electricity and heating our rooms with our own resources and about gradually increasing noise pollution in water and the effect it has on organisms that live in water.

After the war in Ukraine began, Tarmo Soomere wrote that if we wish to save Ukrainian lives, weaken the aggressor and achieve peace in Europe, we must do the same with strategic databases as we did with oil and gas. We must remove the avenues intended for peace to those who use them for waging war.

In the fourth piece, the President of the Academy wrote about the need to treat our language with the same degree of care with which we treat education or nature.

In the fifth opinion piece, he wrote about the importance of a large-scale change in the entire world of science. We must acknowledge that we also have to reduce the impact of research on climate.

The sixth article focused on energy. The more we want high-quality energy to be constantly available at a reasonable price, the bigger our capacity reserves must be – in local production, storage or production elsewhere. If there are shortages in the system, the price naturally increases.

In his last piece in the column in 2022, Tarmo Soomere contemplated the connections of light and science.

**Marek Tamm** invited people to open a broader public discussion on what the science-based missions of Estonian society could be. One of the preconditions to the success of a mission is its extensive reliance on the mission statement and its ability to engage people’s interest.

In another article, he wrote about the importance of valuing higher education. If we add up the direct and indirect benefits of higher education – as much as these can be translated into monetary terms – it turns out that investments in higher education are one of the most beneficial means for the use of money for both individuals and the state.

In an article published at the beginning of December, Marek Tamm discussed the main objective and proposals of the new report on the sustainability and quality of higher education.

**Krista Fischer** wrote about the dilemmas of causality during the pandemic. She admitted that we cannot compare the reality with a parallel world where everything else apart from COVID-19 would be the same as in the real world. Instead, scientists can do their best to get as close to the truth as possible.

In another article, Academy member Fischer gave recommendations to beginners on reading scientific literature. During the COVID-19 pandemic, many people tried to independently draw conclusions from scientific articles without waiting for their doctor’s recommendations. This unfortunately leads to the risk that we might be misled by seemingly rosy results.

**Veiko Uri** wrote that the forests of the northern hemisphere have an important role in capturing carbon from the atmosphere and thereby alleviating climate change. That is why forestry has become a part of the global climate policy.

In another contemplative article, he wrote that the disputes over felling volumes have overshadowed forest growing activities, which have a much greater effect on the development of forests and forestry. Our big task is to grow forests that would satisfy society’s needs as effectively as possible in the future and would be more productive and permanent in changing climatic conditions.

**Kalle Kirsimäe** wrote about the crumbling of the endless economic growth paradigm of the industrial sector. We are at a crossroads: either to continue with economic growth to the point of destruction or strive towards some kind of a balance.

**Anne Kahru** advocated that pursuant to a requirement that will soon enter into force, institutions must have a gender equality plan in order to secure research funding from the European Union. This will give our smart young women and men equal opportunities to build their career, help society and in turn raise a new generation not hindered by obsolete patterns.

**Urmas Varblane** commented on the years-long economic struggle between the United States and China for the role of leading country in the world.

In another opinion piece, he discussed the reasons for the rapid price increase in Estonia. In addition to the often mentioned external factors, the price increase has, for instance, been influenced by a process in the course of which our income level has been constantly creeping closer to the eurozone average, as well as by the small size of our economy and our preference for market-centred solutions, and the good coping ability of the Estonian business sector during the COVID-19 crisis. The future development of our country will be determined by the ability of the business sector to cope with the energy crisis and the preservation of competitiveness against the backdrop of a rapid salary rise.

**Valter Lang** was concerned about the risk of our history being lost. Although it seems that detectorists bring previously hidden ancient items directly to the desks of archaeologists, these do not contain the informative value that scientific excavations have. We urgently need to impose a moratorium on the use of metal detectors, until the discovered archaeological sites are placed under protection and a solution is found for processing finds.

**Jakob Kübarsepp** wrote about the car industry as the biggest driver of innovation in Europe. In 2020, the car industry's investments into research and development amounted to nearly €59 billion in Europe alone.

In another piece, he suggested that taking the environmental impact of technologies into account is one precondition for a sustainable economy. Every sector of the economy and even every company should acknowledge the inevitability of applying green technologies as well as green metallurgy, and act accordingly.

**Tiit Tammaru** wrote about the impact of Ukrainian refugees on the composition of the population of Estonia. Even if all the people who have come here from Ukraine

and applied for asylum in Estonia settle here, the share of Estonians in the whole population will still grow by almost two percent by 2050. However, it is highly likely that the share of Estonians in our population will decrease in the future, as people from other countries will also come to live, study and work here. It is therefore sensible for Estonian migration policy to keep to its fundamental principles, including the migration quota, in order to shape the permanent population of Estonia.

**Jarek Kurnitski** proposed a list of topics related to exiting the energy crisis, which will hopefully be raised in the election debates. One of the most important ones among these was the question of on what terms and at what pace we could make homes in 100,000 private houses and 14,000 apartment buildings energy efficient.

**Tõnu Tannberg** highlighted the origins of Russia's imperial aspirations. Russia has been a warring empire since the beginning of the 18th century. World War I did, indeed, throw the Russian empire into the wastebin of history, but the imperial notion still persisted in the Russian social consciousness both during the Soviet period and after the collapse of the USSR.

**Jüri Allik** wrote about disillusionment with liberalism and what a liberal society can do to defend itself. The main enemy of a liberal society is an authoritarian form of government. The preservation of a liberal world order is therefore in the hands of Ukraine in whose power it is to end Putin's terrorist state, which has failed in every other sense.

**Jaak Aaviksoo** illustrated that the power and justification of science stem, above all, from its objectivity and independence from any kinds of vested interests. Science is unambiguously aimed at understanding the real world. At the same time, many scientists in western universities have for years been complaining about the impossibility of the impartial study of certain topics.

**Margus Lopp** discussed whether oil shale is Estonia's fortune or misfortune. Oil shale in itself is neither good nor evil. The technologies that facilitate its use and the ways of using these technologies may be good or evil, he surmised.

**Andres Metspalu** looked at science communication through a scientist's eyes. Scientists do not dare to talk about their field in simply terms for ordinary people to understand – possibly for fear of their colleagues thinking they are stupid. Finding the line where simplification does not nullify the main thesis is, indeed, difficult.



**Maarja Kruusmaa** noted that our pain threshold of coping in crises has become lower. At the same time, crises have become more complex, just like human society on the whole. In order to manage a possible cascade of crises, we need a flexible cooperation model, the prompt engagement of all resources and resolute, local decision-making based on common values.

About ten days after publication in the paper edition of *Postimees*, all the articles are published on the Academy's website at [www.akadeemia.ee/paevik/teadlase-pilguga/](http://www.akadeemia.ee/paevik/teadlase-pilguga/).

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## ACADEMY COUNCILS AND COMMITTEES

### COMMITTEE ON METEORITICS

Founded in 1954

Chairman Dr Jüri Plado

The main tasks of the Committee on Meteoritics are the promotion, coordination and methodological guidance of research on meteorite craters and cosmic matter, the preservation and conservation of Estonian meteoritics objects, the promotion of meteoritics knowledge and the involvement of the general public in meteorite fall observation, meteorite prospecting and collecting meteorites for museum collections.

In 2022, the main focus was on summarising and publishing the results of previous fieldwork. A dozen Estonian and Latvian citizens were advised on meteorite-related issues (possible link between random finds and meteorites, possible link between round structures and meteorite craters).

### COMMITTEE ON NATURE CONSERVATION

Founded in 1995

Chairman Dr Urmas Tartes

The aim of the Committee on Nature Conservation is to highlight and discuss problems related to the protection and use of Estonian nature, especially natural monuments and unique natural objects and natural resources, and to make relevant proposals to the Academy of Sciences, the Ministry of the Environment and other competent bodies. It also contributes to promoting nature conservation ideas and shaping a nature-friendly public attitude.

The activities in 2022 continued to be affected by the emergency situation created by COVID-19 and the Committee did not hold any public meetings. Several members of the Committee acted individually. Urmas Tartes was a member of the Erik Kumar Prize Committee and continued to represent the Academy on the board of the non-profit organisation Loodusajakiri.

### ESTONIAN POLAR RESEARCH COMMITTEE

Founded in 1993

Chairman Professor Rein Vaikmäe

The Estonian Polar Research Committee is an independent body of experts that serves as Estonia's liaison body to the European Polar Board (EPB), keeps itself informed of developments in the field worldwide, shapes Estonia's development strategy for polar research, advises the country's governing structures when necessary and contributes at international level to enable Estonian polar researchers to use the international polar research infrastructure.

Chairman of the Polar Research Committee Rein Vaikmäe participated in the discussion of the European Polar Board's new strategy document for 2023–2027 from 13 to 17 June and the European Polar Board's autumn plenary meeting from 21 to 23 November in Luxembourg. The main activity of the Polar Research Committee in 2022 was to promote polar research in Estonia. At the invitation of the Ministry of Foreign Affairs, several members of the Committee participated in the preparation of the Estonian Arctic Action Plan, which was completed at the end of 2022.

### COMMITTEE ON ENERGY

Founded in 1998

Chairman Arvi Hamburg

The aim of the Committee on Energy is to be an impartial body of competent experts that provides recommendations and assessments for the development of a science-based, innovative and competitive national energy policy.

In 2022, the Committee's work focused on developing measures to mitigate the effects of the energy crisis and on testing the preconditions for the implementation of a long-term energy policy. The results have mainly been documented in the opinions formulated at the Energy Conference 'Estonian Energy Policy. Energy Trilemma-Balance' held on 30 May and the Energy Day Roundtable held on



The conference ‘Estonian Energy Policy. Energy Trilemma-Balance’ on 30 May 2022 at the Academy of Sciences. at the panel discussion on affordability of energy participated: (from left): Academy member Urmas Varblane, Professor at the University of Tartu Garri Raagmaa, businessman Indrek Neivelt, CFO of Estonian Cell Siiri Lahe, Nord Pool Baltic Market Manager Ingrid Arus and the Head of the Competition Board Märt Ots.

21 November. The opinions have been forwarded to the relevant ministries and published in the media and on the Academy’s website.

## COMMITTEE ON PHYLOGENY AND TAXONOMY

Founded in 2007

Chairman Academy member Urmas Kõljalg

The Committee on Phylogeny and Taxonomy represents Estonia in the work of the Consortium of European Taxonomic Facilities<sup>6</sup> (CETAF AISBL). CETAF coordinates the research and development activities of archives related to biodiversity and earth sciences in Europe. In Estonia, the Committee on Phylogeny and Taxonomy fulfils essentially the same role as CETAF in Europe, coordinating the work of natural science archives, including their digitisation.

Chairman of the Committee Urmas Kõljalg made an invited presentation about the PlutoF<sup>7</sup> data management platform of the Estonian research digital infrastructure at the 52nd CETAF annual meeting at the Hebrew University of Jerusalem on 23 to 24 November. As a result of the discussion, the representatives of European research collections decided to set up a PlutoF working group at CETAF. In 2022, under the leadership of the CETAF Earth Sciences Group, work started on the development of a mineralogy module to extend the DarwinCore data exchange standard. For this purpose, a separate TDWG Task Group<sup>8</sup> was set up, with Olle Hints as a member. The Committee actively participated in the organisation of the fourth interim General Assembly (iGA4) of the European scientific collections infrastructure DiSSCo<sup>9</sup> at Tallinn University from 24 to 25 March.

7 <https://plutof.ut.ee/>

8 <https://www.tdwg.org/community/esp/mineralogy/>

9 <https://www.dissco.eu>

6 <http://www.cetaf.org>



## **COMMITTEE ON MARINE SCIENCES**

Founded in 2007

Chairman Academy member Tarmo Soomere

The activities of the Committee on Marine Sciences are directed towards experts from all scientific disciplines related to the seas and other large bodies of water and their ecosystem processes (e.g. various branches of marine science and limnology, marine geology, coastal engineering and science, hydrology, scientific issues related to seabed and marine life resources and their exploitation, marine spatial planning). The concept of marine sciences is understood as a collection of disciplines thus defined.

The primary objectives of the Committee are to represent the Estonian marine sciences in the European Marine Board (EMB, [www.marineboard.eu](http://www.marineboard.eu)) and to act as a national advisory body.

Upon the invitation of the Ministry of Foreign Affairs, the Committee participated in activities related to the Arctic Council Observer status as well as in the preparation of the Arctic Action Plan and the document 'Estonia's Contribution to the World Sea Policy'. The Committee represented Estonia at the policy conference 'Arctic Circle Assembly 2022' in Reykjavik from 12 to 15 October 2022. During the Estonian visit of Science Director at the US Office of Naval Research Global (ONRG) Dr Patrick Rose, an extended session of the Committee was held in the format of the Academy's science afternoons, titled 'Sea and Power' (XXII) on 10 March 2022.

## **STANDING COMMITTEE ON MEDICAL SCIENCE AND HEALTH STRATEGY**

Founded in 2011

Chairman Academy member Eero Vasar

The role of the Standing Committee on Medical Science and Health Strategy is to analyse the situation of medical science and health care in Estonia, to shape development strategies in these fields, to coordinate research and development activities and to advise the decision-making bodies of the Republic of Estonia.

In cooperation with the area of medicine of the University of Tartu, the Committee has tried to advise the Ministry of Social Affairs in the area of research, development and innovation. Unfortunately, the COVID-19 pandemic put a temporary halt to that cooperation. Advice is provided by the Science Council chaired by Professor Toivo Maimets.

## **COUNCIL FOR ESTONIAN CENTRES OF EXCELLENCE IN RESEARCH**

Founded in 2012

Chairman Academy member Andres Metspalu

The aim of the Council for Estonian Centres of Excellence in Research is to develop and strengthen excellence in research and to communicate to the government and society the views and opinions of top-level scientists on the development of research in Estonia.

Chairman of the Council Andres Metspalu focused on the popularisation of centres of excellence and on the rules for new centres of excellence being drawn up at the Ministry of Education and Research, which were announced by the end of 2022. In regard to science communication, the Council decided to replace the usual science conference with science programmes on Estonian National Television (ETV). The first *TeadusEST (ScienceEST)* programme on centres of excellence was broadcast on ETV on 9 February 2023.

## **COMMITTEE ON EDUCATION**

Founded in 2022

Chairman Academy member Jakob Kübarsepp

The overall objective of the Committee is to be a broad-based and independent body of experts based on the best available expertise in the field of education, the role of which is to initiate discussions in matters concerning Estonian education policy and to provide assessments and recommendations to policymakers.

The Committee on Education was formed in March 2022 and held two meetings that mainly addressed three issues that are very topical in the field of education: natural sciences in basic schools and upper secondary schools, the language(s) of study at general education establishments, and the succession of teachers and lecturers and its bottlenecks.

# NEW ACADEMY MEMBERS

## THE ELECTION OF NEW ACADEMY MEMBERS

*Three new Academy members were elected in December 2022.*

*The conference of Academy member candidates was held on 25 October 2022.*

The election of new members is divided into three stages. First, the Board of the Academy considers which scientific fields require additional competence within the family of Academy members and whether it is time to make room for brilliant representatives within various fields of the creative arts. The titles of vacancies are worded in the divisions of the Academy in such a way that multiple top scientists or outstanding creative persons have a chance to apply. The Board may slightly adjust the titles based on the interests of the Academy as a whole.

Above all, the Academy determines the expected scope of new members on the basis of Estonia's needs and any gaps in the competence of the Academy that need to be filled. The aim is to be prepared to provide support to the state and its institutions at all times. Such a starting point presumes that there are multiple outstanding scientists in the announced areas of specialisation in Estonia.

The titles and number of vacancies are usually announced half a year before the elections. The fields of science to be covered are selected even earlier. The selection is usually made as a result of years of discussions, with an effort to maintain a balance between the natural and social sciences, engage all major players on the Estonian research landscape and improve gender balance of members. In 2022, the need to strengthen the Academy in the areas of exact sciences (particularly physics), engineering and computer sciences, and sociology was the most acute.

Candidates can be submitted by Estonian universities, research institutions and learned societies, as well as creative unions and associations. The Academy members may also nominate candidates, but this is rarely done. The idea is simple: the selection is primarily made from amongst those whom others consider to be at the level of Academy members.

To be elected an Academy member, the nominee must receive 2/3 of the votes of the Academy members participating in the General Assembly.

Elections are generally held once every two or three years. Four years ago (2018), the Academy attained seven new members: Marco Kirm, Jarek Kurnitski, Kalle Kirsimäe, Anne Kahru, Tiit Tammaru, Anu Realo and Tiina Randma-Liiv. In 2020, another three were added: Krista Fischer, Veiko Uri and Elmo Nüganen, and in 2021 another four: Maris Laan, Marek Tamm, Elmo Tempel and Dmitri Vinnikov.



Photo: Peeti Kõkk

## MEET NEW MEMBERS OF ACADEMY

*The overviews and interviews were published on Estonian Public Broadcasting's research portal Novaator before the elections.*

### **Academy member in computer and engineering sciences Dan Bogdanov**

Director of the Information Security Research Institute at Cybernetica Ltd. Dan Bogdanov defended his doctoral thesis at the University of Tartu in 2013, creating the privacy-preserving virtual machine Sharemind on the basis of his research. Since graduating, Bogdanov has been working at Cybernetica where he focuses on privacy-enhancing technologies and information security systems.

The main emphasis of Dan Bogdanov's research is on the development of technologies that facilitate secure data processing. The results of such research are applied in statistics, health studies, data-based decision-making and combating financial fraud. In the future, they may also be required in the joint processing of health, mobility and energy data in cross-border data environments in the European Union as well as for the creation of a wallet-based identity and certificate system.

According to Google Scholar, Dan Bogdanov has co-authored nearly 75 research publications. In total, his research has been cited more than 2,400 times, with 21 citations of at least 21 scientific articles.

Ten master's theses have been completed and one doctoral thesis has been defended under Dan Bogdanov's supervision. He is currently the supervisor of one doctoral student.

In 2016, Dan Bogdanov was the first to earn the Young IT Scientist Award of the Cultural Foundation of the President and in 2015 he received the Order of the White Star, Fourth Class.

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#### **What do you consider the most enjoyable experiences of your life to date, and to what extent do these coincide with the reasons for which the public know you?**

Bringing science from theory to practice has been the most enjoyable, as well as those times when research results become a real solution.

Before I became involved in science, I worked as a creator of software solutions for a few years. I built both small and big IT systems, including a timetable system for a hobby school, small accounting systems and computer games, and I also contributed to the creation of the medical trials system and the Estonian Genome Project system.



Photo: Reeti Kokk

Dan Bogdanov

Among many valuable lessons, I learnt that information technology is ultimately meant to make a person's life easier or happier. I also saw how much more difficult the lives of scientists and doctors are made by incomplete information security and data protection solutions.

So, when I got the chance to study secure computation systems for my master's thesis at university, I was by that time quite skilled in programming, while I also understood what problem I would ultimately have to solve. The subsequent years shaped the outline of the secure multiparty computation system Sharemind and my understanding of how future information systems must be designed and built.

As is often the case, when you're expectations have taken shape, their fulfilment is the most enjoyable moment. When our work group's first test systems that were built for the Estonian IT sector and the Tax and Customs Board on the basis of new research results started working, well, that was an extremely proud moment and one that was worth all the work.

The better the results worked, the more apparent it became to me that I had to implement the innovations myself and go teaching everywhere. This has become my public role – working to ensure that the development of



the Estonian e-state is not halted by incomplete data protection and information security solutions.

### **What are the main challenges in your area in Estonia and in the world as a whole?**

In various places, people are still trying to apply information security and data protection reactively – like a plaster on a fractured bone – and not proactively. To some extent, this analogy is an oversimplification, of course.

Breakthroughs in data science and software development have given states and companies so many ideas on what kinds of services to build. Computer programmes that can draw a Cubist swallow or write a summary of a book on a simple request. This development may create the impression that we can do anything with a computer as long as we give it sufficient data.

This is the point at which we encounter two problems – we do not yet know the limits of data science. And at the same time, the world is not yet able to securely concentrate data without impinging on the rights of people, creators or companies.

It is very appropriate to question whether we should worry at all. It turns out that people themselves have also not yet reached maturity in understanding data. As Veronika Kalmus said at the conference of Academy member candidates this year, studies show that older generations are more worried about the state's surveillance activities and younger generations about the surveillance activities of corporations.

At the same time, people tolerate both to a certain extent. We can conclude from this that the world is not yet ready and society has yet to figure out what its attitude to data is. Younger generations are now placing more value on the environment and the sustainable use of resources.

There may also come generations who begin to demand a more prudent use of data and wish to have more control over their data. We owe it to these future young people not to build states and business models that start using data uncontrollably.

Another important topic is that data equals power. We know from mythology that even knowing another person's name grants you power over that person – consider, for instance, the legends related to the building of Oleviste (Saint Olav's or Saint Olaf's – ed) Church in Tallinn.

Recent years have shown us how data gathered for one purpose have been put to use for a different purpose that was not initially foreseen or which people did not want to foresee. In Singapore, for example, the data gathered for identifying close COVID-19 contacts was in the end used for investigating crimes. After the change of government in Afghanistan, the Taliban gained access to the biometric databases of the security forces of the previous government. This meant that avoiding persecution became near impossible for its members.

Data protection may have more links with the preservation of democracy than we have considered to date.

### **How do you see the role of Academy members in 21st century society and how visible should they be in everyday life?**

The Academy can guide and support the discussions taking place over important changes in society.

Upon acquiring the knowledge, teaching it is the logical next step. This is how learning can spread. There are several ways to teach and in the long run we have to ensure the sustainability of knowledge through education. For some research results, the time for implementation is not yet right; in such cases, we have to ensure that future generations will carry the torch, step up at the right moment and support society. Scientists can take a more active role in this regard and help society bring about change based on knowledge.

This requires various skills that are not often required in academic work. Such skills may, however, come in useful in the work of the Academy, as this body is tasked with the application of research results for promoting the social and economic development of the Estonian state and improving the overall quality of life of people in Estonia.

This is work that never ends. When society has undergone and implemented changes and when things are good, we have to maintain our mental competence for things to remain good. Science fiction has depicted a society where technology had been so conveniently packed away and the importance of science had become so insignificant that people forget how their nuclear reactors work. In such scenarios, the pleasant and convenient arrangement of life did not proceed to last much longer.

### **What does the title of Academy member mean to you personally and how will it change your life?**

The title of Academy member would help me support the next developmental leap of the Estonian e-state towards better data processing.

The principles of security of X-Road<sup>10</sup> were once discussed in a master's thesis, and the security of internet elections have been debated by scientists for years, with hundreds of articles written on the topic. Now is the right time to focus on data protection and privacy in order to support their development in our country. We are at an active stage here – research results have to be brought into practice.

For the next developmental leap, technologies must be given a higher level of readiness, and this means the

<sup>10</sup> X-Road®, an open-source software and ecosystem solution that provides unified and secure data exchange between private and public sector organisations. As the backbone of e-Estonia, invisible yet crucial, it allows the nation's various public and private sector e-service information systems to link up and function in harmony – ed.

closer involvement of entrepreneurs and the state. I see that the Academy has several members with whom such innovations could be supported, and I find the thought of that cooperation exciting.

The process to become an Academy member is naturally very dignified and we do not know the results in advance. Work will continue regardless of the election results because we constantly keep hearing of new services, systems and Kratts.<sup>11</sup> Let's learn to be their smart masters!

### ***Academy member in physics Toomas Rõõm***

Research Professor at the Institute of Chemical Physics and Biophysics **Toomas Rõõm** defended his doctoral thesis at the University of Tartu in 1993, studying the impact of defects on the optical properties of calcium oxide crystals. Toomas Rõõm has worked at the Institute of Chemical Physics and Biophysics as both a senior researcher and a research Professor. In 2019–2021, he was a Research Professor at the Estonian Academy of Sciences. Toomas Rõõm's research is focused on the development of terahertz spectroscopy and its use in understanding various physical phenomena. Among other things, this frequency range allows us to obtain unique information about the quantum movement of molecules and better understand the properties of new materials.

According to Google Scholar, Toomas Rõõm has authored and co-authored nearly 90 published scientific articles. In total, his research has been cited almost 1,070 times, with 17 citations of at least 17 scientific articles. He is also a co-author of three patented inventions.

Toomas Rõõm has co-supervised three doctoral students and four master's students and is currently supervising two doctoral students. He has also supervised two post-doctoral students. In 2016, he received the Estonian National Research Award in Exact Sciences.

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#### **What do you consider the most enjoyable experiences of your life to date, and to what extent do these coincide with the reasons for which the public know you?**

The most enjoyable experience is hard to pinpoint. The dazzle of past moments is starting to fade and the threshold of enjoyment is shifting ever upwards. Reaching a solution for a physics problem still offers mental satisfaction, but primarily through putting an end to the annoyance of not knowing. At least until a new problem arises.

<sup>11</sup> A *kratt* is a mythological, Estonian creature, usually a treasure-bearer that comes to life to do its master's bidding when the devil is given three drops of blood. Today, it is also used as a metaphor for AI and its complexities. See also <https://en.wikipedia.org/wiki/Kratt> – ed.



Toomas Rõõm

#### **What are the main challenges in your area in Estonia and in the world as a whole?**

One of the challenges in my area – as in quite a few others – is the alleviation of energy deficiency. For this, we need to produce more energy, while reducing its consumption. The reduction of consumption does not mean that we leave our work undone; we simply have to aim to perform the same work using less energy.

Computer technology, including all the components of the Internet of Things, uses a large share of the produced energy and that share keeps growing. Chips that perform logical operations are based on silicon. The challenge is to find a material to make chips that use less energy than the silicon chip uses to perform logical operations. My work involves studying one such new type of material, which is a symbiosis of ferroelectric and magnetic.

#### **How do you see the role of Academy members in 21st century society and how visible should they be in everyday life?**

To convince people that the world is science-based and there is a rational explanation for every phenomenon.



**What does the title of Academy member mean to you personally and how will it change your life?**

I value it as recognition of my research and the fact that the Academy needs people with knowledge in my field of research. I think those closest to me would like it. As to changing my life – it will bring additional obligations and hopefully also new challenges.

***Academy member in sociology Ellu Saar***

Professor of Sociology at Tallinn University Ellu Saar defended her doctoral thesis at the National University of Belarus, Minsk, in 1983, where she studied the social mobility of young people with secondary education. During her career, Ellu Saar has worked as a junior and senior researcher at the Institute of History of the Academy of Sciences, a visiting researcher at the Max Planck Institute for Human Development and Education, a senior researcher at the Institute of Philosophy of the Academy of Sciences, and a senior researcher at the Institute of International and Social Studies of the Academy of Sciences. At Tallinn University, Ellu Saar has worked as a senior researcher and professor at the Institute of International Social Studies and the School of Governance, Law and Society.

In recent years, Ellu Saar's research has, among other things, focused on social stratification and mobility in Estonia and the factors that influence it, such as education. On a broader scale, her research focuses on highlighting the specifics of post-Socialist countries and the further development of the typologies of countries.

According to Google Scholar, Ellu Saar has authored and co-authored 150 scientific publications. In total, her research has been cited nearly 2,000 times, with 23 citations of at least 23 scientific articles.

Saar has supervised the completion of seven master's theses and the defence of seven doctoral theses. She is currently supervising five doctoral students, is a peer reviewer and a member of the editorial office of several international science journals, and is a member of professional associations.

Academy member Ellu Saar is also active in the social sphere – she has contributed to the preparation of censuses and the compilation of human development reports, and she has taken part in the preparation of a strategy related to lifelong learning and active ageing.

In 2014, Ellu Saar received the Estonian National Research Award in Social Sciences.

Photo: Reti Kokk



Ellu Saar

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**What do you consider the most enjoyable experiences of your life to date, and to what extent do these coincide with the reasons for which the public know you?**

There is career and life outside of career. For the latter, the birth of my daughter was definitely very important, as well as her subsequent achievements in education, including the defence of her doctoral thesis.

In terms of career, me rather randomly ending up in sociology after graduating from applied mathematics at the University of Tartu was decisive. My knowledge in statistics came in handy, of course (I would like to thank my then supervisor Ene-Margit Tiit for this), but I had to learn a great deal independently. Still, I made it to defending my candidate of sciences degree in sociology five years later.

Working at the Max Planck Institute for Human Development in Berlin in the early 1990s was very important, as it helped me establish international contacts and be included in international projects. Professor Hans-Peter Blossfeld played a big role in that.

The funding I received in 2005 from the 6th Framework Programme of the European Commission for a lifelong learning project which I led was of great importance. It was

the first social science project coordinated by someone from an Eastern European country. As it was a large-scale project that included 13 countries, my network extended even further. As a result, our research team has in the past decades taken part in more than ten large international projects financed by the European Commission or other European institutions. I am also currently leading a Horizon2020 project.

The Estonian National Research Award I received in 2014 was also a significant recognition. And the defences of all the doctoral theses I have supervised have been important. Several of those students now form the core of our research team or are active at the Institute of International Social Studies of the School of Governance, Law and Society of Tallinn University. My students have also gone on to work at other European research institutions or various Estonian state institutions and research companies.

### **What are the main challenges in your area in Estonia and in the world as a whole?**

My main areas of research include social stratification, education inequality and life path studies. In social stratification research, the issue of social reproduction through different generations has recently become very topical, as well as compensation and cumulation processes, i.e. people are examining whether there is a cumulation of advantages – such as highly educated parents – and adverse conditions both across generations and within one generation, or whether some kinds of additional resources compensate for earlier misfortune.

This kind of analysis is very demanding in terms of the data used, i.e., it necessitates the use of longitudinal data. We obtain longitudinal data when we interview the same people over a long period. Compared to, say, registers, longitudinal studies allow us to analyse the effect of attitudes, plans, self-esteem and other such factors on the life path. Unfortunately, conducting longitudinal studies requires a great deal of resources (money, time, etc.). In Estonia, extensive longitudinal studies were common in the 1980s and 1990s.

I was involved in those studies as a researcher. We are currently preparing a longitudinal study of young people in Estonia. Launching that study would give us an opportunity to compare Estonia's results with similar studies conducted in other countries, and – linked to various registers in Estonia – to identify the long-term effects of political decisions via the decisions and choices of individuals. We have engaged both external experts and the representatives of various Estonian ministries in the preparation of that study.

In the past decade, linking such longitudinal data to gene studies has increasingly been raised – this would allow us to determine to what extent people's options in

life (health, education, career, etc.) are influenced by genes and to what extent by environment, and to what degree, if at all, a favourable environment can modify the adverse effect of genes.

In terms of the future, the data of the planned longitudinal study in combination with the Biobank data would allow us to conduct such an analysis in Estonia.

### **How do you see the role of Academy members in 21st century society and how visible should they be in everyday life?**

Academy members are top-level scientists. They should therefore play an important role in society both as experts in their field of research and as opinion leaders who are contacted for science-based information as well as explanations that can be understandable to the general public. The cross-sectoral composition of the Academy should enable Estonian scientists to join international networks, particularly through the mutual ties between the academies of sciences of individual countries.

It is definitely important for different areas of science to be represented at the Academy. It is interdisciplinarity that allows us to give politicians and decision-makers better knowledge and data for making balanced decisions. I am glad to see that the Academy includes a growing number of representatives in the social sciences sphere. Academy member Tarmo Soomere has repeatedly said that the next decisive breakthrough should be in social sciences.

The Academy also has a significant role in preparing young scientists – via the Young Academy of Sciences, 'Science in Three Minutes', students' science seminars, etc.

### **What does the title of Academy member mean to you personally and how will it change your life?**

It would probably not change anything on the research side. I would continue my professional work: writing for scientific journals and monographies, taking part in research projects, etc. It would, however, help increase visibility and attention in Estonian society, and not just with regard to my person, but more widely for sociology and our research team. This would also be recognition of the research conducted by our research team.

I place great value in being able to communicate with the representatives of other areas of science within the framework of the Academy. Thanks to my mathematical background, I consider myself a sociologist and a representative of interdisciplinarity.

I have previously worked alongside scientists of other disciplines in various decision-making bodies and that has significantly expanded my general knowledge, contributed to my specialised research and sparked new ideas of how to use the approaches of other areas of sciences in my research.



# PLACE OF OPINION

## NEW KNOWLEDGE, DEVELOPING TECHNOLOGIES AND JURISPRUDENCE

*Prosecutor General Andres Parmas' speech at the General Assembly of the Estonian Academy of Sciences on 20 April 2022*

In the article 'Law – an unscientific science' published in the prestigious *Yale Law Journal* in 1934, Professor of Psychology Edward S. Robinson expressed the observation that 'modern man has learned that in his mastery of his physical surroundings and of his own body his success has been in direct proportion to his factual knowledge.'<sup>12</sup>

Robinson thought that by the fourth decade of the 20th century, humankind had employed the scientific method to transform the face of the earth and the physical conditions of life. Among other things, the scientific method had also been employed to suppress many infectious diseases at source and thereby promote human health. He was concerned, however, that only slight application of the scientific method had been made to the problems of social control.<sup>13</sup> In the spirit of the era, Robinson also highlighted an exciting parallel between engineers and lawyers. Namely – in our control of physical nature we are served by engineers, who are rigorously trained both in the practical tricks that can be used in the harnessing of physical forces and in the mathematical and experimental sciences. The conquests of our leading engineers have made more and more apparent the fact that we have little practical skill in adjusting our social arrangements to new circumstances and that we lack any social psychology in terms of which we can face the possibility of social change. In Robinson's opinion, it is

precisely this kind of bottleneck that requires lawyers who could be viewed as social engineers of a sort.<sup>14</sup>

Robinson then wistfully admits that it is often the role of lawyers to be content to justify social changes after they have taken place. He employed a rather colourful comparison to describe the lawyers' fear of social change: when a lawyer deals with an eight cylinder 'social machine' – which back then could have been the rather innovative ideas of the legal regulation of interlocking corporations or trial marriages – he typically considers it his primary duty and job to paint the 'engine' to look like a horse. In such an atmosphere, Robinson concludes, the legal science unfortunately imposes a constant drag upon the adventurous spirit of the times.<sup>15</sup>

Only a few years before the publication of Robinson's article referred to above, another author, sociologist and criminologist, Nathaniel Cantor, found in the article 'Law and the Social Sciences', published in the *American Bar Association Journal* in 1930, that the experimental methods of natural sciences applied in studying human behaviour have involved a noticeable development in social sciences in the 20th century – but legal institutions remain least affected by the striking transformations brought about by the rise of modern critical thought and methods.<sup>16</sup>

<sup>12</sup> Robinson, E. S. 1934. Law – an unscientific science. *Yale Law Journal*, 44(2), 235–267 (p 235), doi: 10.2307/790016.

<sup>13</sup> *Ibid.*, p 235.

<sup>14</sup> *Ibid.*, pp 236–237.

<sup>15</sup> *Ibid.*, p 238.

<sup>16</sup> Cantor, N. 1930. Law and the social sciences. *American Bar Association Journal*, 16(6), p 385.



Andres Parmas

You may be wondering why I'm spending the scarce time allocated to me here discussing the contemplations of two scientists (of whom neither is even a lawyer) from nearly a century ago. The thing is that the highlighted problems are still topical today. After nearly a century later, we unfortunately have to admit that there have been no principal changes in the observations presented above. Technological development and progress have not stopped. Engineers continue to come up with increasingly complex and technical engineering solutions. Psychologists, sociologists, criminologists and other behavioural scientists are conducting study after study that shake us loose from the imprinted prejudices and misguided beliefs about how the human mind and human society work, while the legal framework that standardises, regulates and, in places, shapes our social reality remains true to itself in trying to conservatively paint internal combustion engines to look like horses.

A few examples to that effect. In connection with new technologies, we now find ourselves facing novel (legal) problems and questions. Self-driving cars, buses and parcel robots that not long ago would have seemed like faraway visitors from a science fiction film are now driving around in our midst and all around us. Instead of a kite, you can order a real drone for your kid from the Amazon online store – and if you're lucky, in some places it would be flown to your door by an autonomous Amazon delivery drone. We also keep hearing more and more about various other machines that help humans in areas such as welfare

services, medicine, public administration, etc. But what are the rules by which self-driving vehicles participate in road traffic, who is responsible when a self-driving machine is involved in a traffic accident and by what mechanism does an autonomous machine reach a decision on whom to cause damage to when faced with a situation where causing damage to at least one fellow road user is technically unavoidable? Could a machine conduct a triage? Could a machine decide when to discontinue treatment that has become futile?

The face of today's warfare, that is currently perhaps even much too topical for us, is also unrecognisable from before. Beside humans and partly in place of humans, drones and UGVs (Unmanned Ground Vehicle – ed) as well as other remotely controlled or even autonomous weapon systems of various levels operate in this arena. Whom or what can an autonomous weapon system attack? How can it attack – launch a lethal attack or pursue to render the enemy otherwise incapable of combat? Does an autonomous weapon system also have to take prisoners? At some point, it will probably no longer be inappropriate to ask how to ensure that humans at least retain control over switching autonomous machines on and off. Yes, the legal system includes certain principles for integrating new technologies, but the number of questions in this area is considerably greater than the number of clear-cut answers.

A related, while still separate, aspect concerns legal decisions made by machines – for instance, road cameras or



*No exhaustive answer has been provided to the question about who is responsible for the mistakes made by machines and artificial intelligence, AI (the same programming or mechanical errors, as well as wrong decisions made on the basis of incorrect presumptions fed into a machine as input for making a decision).*

the so-called Kratts, which are tasked with automating the resolution of disputes or determining various consequences. Although a machine is free from human errors (apart from those made by a careless mechanic or those injected into them by a human entering a faulty programme), the question is if and, if so, to what extent humans are ready to accept a decision made by a machine instead of a human (better to have a humanely reasoned, albeit substantively incorrect decision – at least you have something to argue against – rather than a harsh machine truth that does not leave any room for interpretation). Furthermore, no exhaustive answer has been provided to the question about who is responsible for the mistakes made by machines and artificial intelligence, AI (the same programming or mechanical errors, as well as wrong decisions made on the basis of incorrect presumptions fed into a machine as input for making a decision).

We cannot deny, of course, that people are working on these matters. Attempts have even been made in our legal landscape to launch a discussion on regulating the field of AI. For instance, Tanel Kerikmäe, Mari Minn and Reet Pärnmäe found in an article published in the journal *Õiguskeel* in 2019 that the development and introduction of AI will, above all, depend on whether a relevant legal framework exists.<sup>17</sup> In an article published in the journal *Juridica* in the same year, Karmen Turk and Maarja Pild discussed in the context of civil law that perhaps proactive legislation is no longer a taboo in this situation, even more so because new technology cannot evolve in an environment of legal unclarity and uncertainty.<sup>18</sup> Whether AI solutions can influence court proceedings has been

analysed from various aspects in several articles in the 2019 Yearbook of Estonian Courts.<sup>19</sup>

In 2018, the Government Office and the Ministry of Economic Affairs and Communications launched a project for analysing and promoting the introduction of AI or Kratts in Estonia. In the course of this project, an expert group was formed to prepare proposals for legal acts in order to make the use of Kratts or fully autonomous information systems possible in all areas of life and to ensure the clarity of the legal environment and the necessary supervision.<sup>20</sup> The expert group reached the conclusion that in general no conceptual changes need to be made in the basic principles of the legal system, because Kratts are and will be humans' tools in the sense that they fulfil tasks assigned by humans and directly or indirectly express the will of humans – even in cases where humans have seemingly granted significant freedoms to Kratts. The theoretically possible artificial super-agent or super-Kratt that is capable of entirely independent action and has a will that is independent of the will of any human being is not feasible in the near future and therefore does not need to be regulated today. Today, humans are and will be the subject of legal regulation.<sup>21</sup>

It is clear that the formal question is whether the said framework should be regulated by a single 'law of Kratts' or whether changes made to various associated acts can be left for legislative drafters alone to decide.

The substantive part of the conclusions, however, raises the question of whether this does not again constitute lawyers stalling as usual, hindering changes in society – painting the internal combustion engine to look like a horse, to again borrow the metaphor used above. Even more so, as the expert group itself also left important questions unanswered: for instance, the need to review matters related to criminal liability where extension of the definition of the indirect commission of offences to also include Kratts was recommended as a solution to consider.<sup>22</sup> As a lawyer specialised in criminal law, I can confirm that this seemingly simple notion contains significantly more essential questions than merely supplementing the general part of the Penal Code with a few references to Kratts or artificial intelligence. Philosophers have at least since the beginning of the previous century been fascinated by the

17 Kerikmäe, T., Minn, M., Pärnmäe, R. 2019. How to live with Kratts? *Õiguskeel*, 2019/4.

18 Turk, K., Pild, M. 2019. With or without Kratts – that is the question. About robots and artificial intelligence in civil law context. *Juridica*, 2019/1, 43–55.

19 See, e.g.: <https://aastaraamat.riigikohus.ee/en/artificial-intelligence-a-substitute-or-supporter-of-judges/>; <https://aastaraamat.riigikohus.ee/en/a-kratt-as-an-administrative-body-algorithmic-decisions-and-principles-of-administrative-law/> (13 April 2022).

20 Vice Chancellor of information and communication technologies, Ministry of Economy and Communications: we will be using artificial intelligence in public services as soon as in two years. Available at: <https://mkm.ee/uudised/ikt-asekantsler-kasutame-tehisintellektiriigiteenustes-juba-ulejargmisesl-aastal> (13 April 2022).

21 Kerikmäe, T., Minn, M., Pärnmäe, R. 2019. How to live with Kratts? *Õiguskeel*, 2019/4.

22 *Ibid.*

thought experiment known as the ‘trolley problem’, which concerns a runaway trolley on the railway and liability for diverting or not diverting it in one or other direction depending on who, if anyone, is on the given track. There is no universal answer to that conundrum; it is always subjective and depends on the chosen value system, school of philosophy, etc. How could we claim with certainty that the existing legal framework has exhaustively foreseen and contemplated not only who is liable under penal law for the fatal errors caused by, say, a self-driving car, but also whether such activities were at all unlawful, or are there some circumstances that exclude unlawfulness?

From this, there is only a small step to the next aspect which has not yet been sufficiently resolved and applied and which I would also like to point out – the increasingly relevant data-based risk assessments. It is obvious that in light of technological development and the eternal and increasing lack of resources there is an ever-growing need for a risk-based approach and risk-based solutions. This means that we must use and develop automatic and semi-automatic solutions, some of which have actually technologically been available for a long time; however, there are currently no systemic and integral (legal) solutions in place for using these in the most optimal manner. We live in an era of immense quantities of data but do not know how or do not dare to use them or establish the rules necessary for using them. Examples of this include gathering, storing and using communication details for public purposes, which caused quite a stir in the media last year, or CCTV (closed circuit television or surveillance) cameras or sensors that measure the body’s temperature or other physiological indicators of passers-by, such as levels of intoxication or even anxiety. The potential possibilities of use of such technologies are essentially endless, from combating terrorism to medical solutions. All of these, however, require progressive and proactive legal and technical solutions with the help of which a machine, Kratt, information system, artificial intelligence – whatever we may call it – could on the basis of the data it has established independently make a decision or forward input to a human operator for intervention. So, what should our attitude be towards a smart machine measuring the body temperature of people entering a shopping centre and not opening the door to those whose body temperature is above the assigned level? The extent and form of human intervention should be well thought out and in accordance with the latest findings in social sciences, e.g. psychology, sociology, behavioural economics, etc.

This in turn brings me to another important aspect which I would like to touch upon today – the contradiction between our contemporary knowledge of human psychology and the commonly applied legal concept of human behaviour.

*We live in an era of immense quantities of data but do not know how or do not dare to use them or establish the rules necessary for using them.*

Although the question of psychology could with great probability be raised in quite a few places in law, the gap in my assessment is biggest with regard to the necessary elements of an offence and provision of evidence and, concerning the elements of an offence, with regard to intent as one element of an offence (as well as the objective assignment of guilt). Even today, in the 21st century, we are in a situation where many legal systems bundle intent together with guilt in the assignment of responsibility to a person, i.e. the substance of reprehensibility is that a person has a mental relationship to the committed offence – they know and wanted what they did. It is questionable whether this approach is adequate. But let that be. Things are unfortunately not much better even in more developed legal systems, which at least know how to distinguish between intent and the assignment of guilt. Namely, it is questionable whether one of the central prerequisites of liability – intent – is an appropriate criterion at all any more in its previous form. Is human behaviour characterised by free decision-making on which the elements of an offence are based or is it (in some situations) pre-determined and would require a different justification for its reprehensibility? It is clear that I cannot offer an exhaustive answer to that within today’s format. At the end of the day, the question of free will and its relationship with determinism has fascinated philosophers for significantly longer than the trolley problem mentioned above. However, the cognitive science aspect of the question based on recent findings is worth mentioning. Professor of Law at the Maastricht University Jaap Hage notes that human decision-making is often irrational (biased), and that the conscious will – whatever that may be – has less influence on human behaviour than the law seems to assume, and in some cases perhaps no influence at all. If law is to function optimally in guiding human behaviour, it should take these insights into account.<sup>23</sup>

From a somewhat different aspect, psychology scholars Tuomas K. Pernu and Nadine Elzein have in their article ‘From Neuroscience to Law: Bridging the Gap’ discussed the impact of neuroscientific evidence on assessing the level

<sup>23</sup> Hage, J. For the law, cognitive sciences should not change everything, but still a lot. Maastricht University Blog. Available at: <https://www.maastrichtuniversity.nl/blog/2017/12/law-cognitive-sciences-should-not-change-everything-still-lot>.

of legal responsibility of a defendant in criminal law in the context of free will. Their conclusion is thought-provoking: namely, they claim it is clear that external manipulation and coercion – the right sort of external forces – can rob us of our freedom and affect our assessment of culpability.<sup>24</sup>

It is therefore appropriate to review the current model of legal assignment and adjust it according to the knowledge gained to date about the mental mechanisms of human behaviour. E.g. it is possible that reprehensibility needs to be redefined, as well as a reproach that someone has voluntarily decided to act in contradiction with the established norm. But maybe it is possible that risk liability or the elimination of the dangerous agent is the right approach instead. There is much to discuss!

The above finally brings us to the question of how psychology relates to the system of legal proceedings. I understand a proceedings system to generally mean a mechanism for finding out the truth, or the provision of evidence, one part of which is obtaining evidence from the statements of witnesses. According to the current practice, this means interviewing witnesses in the course of preliminary proceedings (often repeatedly) and then cross-examining the witness at a court hearing. Unfortunately, the currently applied methods and the underlying legal regulation do not allow us to avoid mistakes that derive from human psychology. Memory is deceptive and can be manipulated, and the manner of presentation of evidence may be manipulating and coding for the perceiver and therefore influence the decision-making in a certain direction. This is a widely researched topic, but its applications in legal drafting or the courtroom are virtually non-existent. In a 2019 conference panel on scientific psychology and practical law, Andreas Kangur, Jaan Tulviste, Iiris Tuvi, Inga Karton and Talis Bachmann discussed truthful and deceitful communication mechanisms in the context of influencing and detecting lying; the perception of pixelated images of faces in the context of using security cameras (recognition) and assessing the reliability of a person's account; expectation-driven 'hallucinations' in normal people; brain mechanisms behind tricky decisions; and the process of providing evidence from a psychological point of view. In general, we can say that weighing the aforementioned questions led to the conclusion that in creating the rules of procedure there would be reason to more thoroughly consider what the parties to proceedings are cognitively capable of and in which conditions – and not only as a source of evidence, but also as an evaluator of evidence.<sup>25</sup>

24 Pernu, T. K., Elzein, N. 2020. From neuroscience to law: Bridging the gap. *Frontiers in Psychology*, 11, 1862, doi: 10.3389/fpsyg.2020.01862.

25 Kangur, A., Tulviste, J., Tuvi, I., Karton, I., Bachmann, T. 2020. Psychology and the Law: in the Footsteps of a Special Session of a Conference. *Juridica*, 2020/9, 748–765.

I am now getting to the most important thing – the thing I came here to tell you, my respected audience. How is all that I have said so far linked to you? You most probably have already joined the dots. I guess you have to come to the aid of your colleagues, the legal scientists, and more seriously raise the discussion of what we lose if we are unable to take into account the knowledge of human thinking processes in shaping legal mechanisms, as well as to keep up to date with technological development. It is also extremely important on a practical level that high-quality scientific analysis is an immanent part of changes in law both on paper and in reality (for example, the issues related to the latest change in the age limit of sexual self-determination or the Communicable Diseases Prevention and Control Act, which caused a big uproar).

Time is running short for discussing anything at any considerable length or depth in this hall today. I hope that even my brief thoughts have inspired you to discuss the relationships between new knowledge, developing technologies and jurisprudence. The eternal problem of jurisprudence has actually been written into its very essence – it is a system for regulating human behaviour agreed upon by humans. This means that it is in a way important for the system not to bend to the prevailing wind, but instead to be something that we can reasonably rely on. We cannot ignore that the principles of legal clarity and legal certainty are also of great value and the law should therefore not charge about like a calf that has just found its legs. At the same time, we cannot be happy with the extensive inertia of the established system, which has practically ignored new human knowledge and new technologies. To end with, I surprisingly found a quote from a clearly wise lawyer, former justice of the United States Supreme Court Oliver Wendell Holmes from 1895, in which he says: 'An ideal system of law should draw its postulates and legislative justification from science. As it is now, we rely upon tradition, or vague sentiment, or the fact that we never thought of any other way of doing things, as our only warrant for rules which we enforce with as much confidence as if they embodied revealed wisdom.'<sup>26</sup> So it may be that we, the lawyers, have not quite hopelessly disappeared into our hermeneutics and glossaries.

Thank you for your attention!

The text was prepared in cooperation with Kati Tee.

26 Lerner, M. (ed) 1988. *The Mind and Faith of Justice Holmes: His Speeches, Essays, Letters, and Judicial Opinions*. By Frederick D. Wilhelmson. Routledge, p 35.





## A SHORT HISTORY OF THE PLANET'S HEALTH ISSUES

*Opening speech by Tarmo Soomere to the 2022 annual congress of the Association of European Schools of Planning 'Space for Species: Redefining Spatial Justice', Tartu, 25 to 29 July 2022.*

For a long time virtually everything that happened in the world was considered and assessed from the viewpoint of people. Even major spheres such as climate were defined for people alone. The origin of the word 'climate' itself means the height of the sun over the horizon. Climate was understood for many centuries as a set of features under which people found it comfortable to live. It was only in the 19th century that it became detached from our comfort zone and veered towards detailing the statistics of various weather phenomena. Within a few decades, it had essentially become a part of mathematical statistics that spoke in the language of various distributions, quantiles, standard deviations or statistical significance of trends.

All these words carry almost no meaning for most mere mortals. Therefore, it is not surprising that discussions about climate took on two additional dimensions. One of them is almost religious. Just look at how frequently people talk about either believing or not believing in climate change.

The other even more important feature came gradually to the surface. From the onset of this dimension in climate discussions just a couple of decades ago the category of climate was something regarded as generic, predefined

and a reflection of the structure of the Universe on Earth. Something that affects our life. Something that we experience. Even if it changes. But something that is essentially beyond our control. It is not an easy perception because modern secular society and its members pretty much desire to be in control of everything – even climate.

And then came a disturbing realisation: mankind is able to impact climate. An old saying is that the largest punishment that God may give to a person is to fulfil his or her dreams. The next step was predefined: the category of climate became a political battlefield. Plus a driver of the economy. A great many areas and business fields benefit from climate warming. Be it access to natural resources in the Arctic, the potential use of the Arctic Ocean for intercontinental shipping or the greening of the northern hemisphere at high latitudes.

It is thus not unexpected why so many experts who really know what climate is try to avoid discussions about climate that contain a political dimension or promise lucrative business. They are happy to provide facts, interpretations and recommendations, but they prefer to leave when it's time to make decisions. This leaves the space open both for policymakers and various stakeholders; however, and

perhaps more importantly, it also gives licence to those experts who sign off on practical solutions for the future. Specialists who have the mandate to design solutions under which our children and grandchildren will live.

A change of a different kind but with some conceptual similarity has happened to our attitude of being sick. For millennia, it was only people who had the privilege of being sick. Much later, this privilege was expanded to include domestic animals and to our pets. This extension was probably pretty much a projection of our own zone of convenience to those who supported this zone. Or perhaps due to being aware about the many inconvenient features of our fellow citizens. As Blaise Pascal wrote 400 years ago: ‘The more I see of Mankind, the more I prefer my dog.’

A major shift happened 60 years ago, in 1962, when in *Silent Spring* Rachel Carson depicted the consequences of the extreme pressure that has been exerted in agriculture to achieve a more lucrative harvest. Since then, nature could also be seen to be sick.

There was still a long way to go until the ecosystem approach began to play a role. This development was further expanded exactly 50 years ago, in 1972, when the seminal book *The Limits to Growth* was published by the Club of Rome.

Remarkably, the Club of Rome was founded in 1968 at Accademia dei Lincei in Rome, Italy’s national academy of sciences. The name of this academy derives from the perception of the lynx. It is a symbol for alertness, observance and being sharp-sighted in Italy. From this time, the category of being sick was expanded to include all of Earth even though it was still formulated in quite a limited way, in terms of natural resources.

It is amazing how several seminal milestones in the development of the contemporary style of thinking about how the world functions have materialised in years that end with the number 2. This sequence is continuing, hopefully, with the current year, 2022.

It is debatable when and how exactly the systemic approach in terms of entire ecosystems was conceived. Technically, it was coined as part of the Convention on Biological Diversity. It is one of the three so-called Rio Conventions which directly emerged from the 1992 Earth Summit. Therefore, we can celebrate 30 years since this category was proposed for adoption worldwide. Of course, it was initially at the basic level of words or even buzzwords. However, now, after 30 years of a determined fight for existence, it is becoming clear that ecosystems may be sick as well.

We usually feel it when we are sick. The first indicator is body temperature. Let’s apply the same idea to the entire Earth in the context of climate change. If there were no greenhouse gases in the atmosphere, the average temperature would have been about  $-18^{\circ}\text{C}$ . Currently it

is about  $+15^{\circ}$ . The difference is about 33 degrees. This is just slightly less than our body temperature. An increase in this temperature by 1 degree from pre-industrial times is equivalent to a fever of 38 degrees for a human body. Not many would feel fine at this body temperature. Neither does Earth’s ecosystem.

It took two decades to recognise that several criteria need be met in order to be more or less sure that no part of the Earth’s ecosystem or section of society shall be affected disproportionately. This work was started in June 2012 at the United Nations Conference on Sustainable Development (Rio+20), held in Rio de Janeiro.

At this point, it became clear why the former Prime Minister of Israel Shimon Peres has stated that without science it wasn’t possible to eradicate poverty or achieve peace. Or, more convincingly, as formulated by Blaise Pascal: ‘One-half of the ills of life come because men are unwilling to sit down quietly for thirty minutes to think through all the possible consequences of their acts.’

The United Nations Department of Economic and Social Affairs (UN-DESA) invited two major worldwide consortia of academies of sciences to formulate the necessary criteria. The International Council for Science brought together the classic academies of natural sciences. The International Social Science Council provided competence in social sciences. This tri-lateral cooperation gradually led to the formulation of 17 Sustainable Development Goals. These goals were adopted by the United Nations in 2015 as a universal call to action to end poverty, protect the planet and ensure that by 2030 all people would enjoy peace and prosperity.

A specific feature of these goals is that they are interconnected and integrated. This means, *inter alia*, that everything and everybody has a place under the Sun. This place needs not only to be tolerated or accepted but also respected, and taken into account in our thinking and especially when planning the future.

The time when one could focus on simply one goal and ignore others is gone. Hopefully forever, even though Russia may try to turn back the wheel of time through its aggression in Ukraine. Those who are too focused on the future feel this probably better than anyone else: that action in one area will have repercussions for outcomes in others, and that development must balance social, economic and environmental sustainability as an ultimate goal.

This is a major challenge – as formulated by Blaise Pascal: ‘Nature has set us so well in the centre, that if we change one side of the balance, we change the other also.’ This is the point when science and evidence-based thinking again come into play. As formulated by Helmut Schwartz, foreign member of Estonian Academy of Sciences: ‘Without science, we won’t be able to build a future worth living in.’

*The greater the number of smart people who decide to stay silent for fear of otherwise being silenced by stigmatisation, the more strongly misconceptions take root and the smaller the hopes for the development of science – and, indeed, culture as a whole.*



## SCIENCE AND DEMOCRACY IN THE LIGHT OF THE CONSTITUTION

Ülle Madise

*Presentation of Chancellor of Justice Ülle Madise, ‘Science in the light of democratic constitution’,<sup>28</sup> at the research policy conference ‘Science as Estonia’s development engine. IX. Smartly in an open or closed polarised world’, 19 October 2022*

Honoured scientists and friends of science, members of the *Riigikogu!*

According to the words of the Constitution, everything is clear. Science is independent and free. The media and the development of public opinion are free. The word is free. Independent constitutional institutions, which are intended to protect people from possible abuses of power, ensure lawfulness and maintain the separation and balance of powers, exist and function.

Governance and elections must be honest in every sense. Democratically-elected leaders and appointed officials have the constitutional duty to abide by the Constitution, laws and Estonia’s interests in everything they do. The Constitution also sets a general goal for our country. Among other things: ‘to strengthen and develop the state, which is for the defence of internal and external peace, and is a pledge to present and future generations for their social progress and general welfare’. And how to strive towards that goal is also nicely written down in the Constitution. We have to respect everyone’s freedom and responsibility. Whether

you like it or not, there are no traces of collectivism in our Constitution. The freedom and responsibility of an individual must not be subjected to the community without justification based on deliberation and facts and logic.

Everyone’s freedom is the rule, and every restriction made in the public interest is an exception. We must always justify the inevitable necessity and proportionality of a restriction, not the absence of restrictions. We must weigh the conflicting interests and values and find a compromise that is in accordance with the Constitution. In no situation, even in the most critical one, does anyone have the right to push aside the rule of law – the unwavering reliance on previously agreed rules. It is written and must be so.

At the beginning of law studies, Professor Raul Narits taught us the difference between ‘is’ and ‘ought to be’. When we have described how things should be, we can move on to how things are. Perhaps the thing is that modern democracy and decision-shaping public opinion force scientists who are studying morally loaded topics into a spiral of silence and politicians into inevitable vicious competition?

27 [www.youtube.com/watch?v=p6a47UkIx\\_c&t=6604s](https://www.youtube.com/watch?v=p6a47UkIx_c&t=6604s)



The spiral of silence<sup>28</sup> is a public opinion theory established by Elisabeth Noelle-Neumann in the 1970s. It seems to me that it is a very apt term. It denotes a situation where the prevailing public opinion – often a deeply rooted ideologically and morally loaded misconception – forces scientists and officials to suppress facts, associations and logical conclusions and to refrain from honest reasoned discussion for fear of personal attacks.

Those who conduct science in practice, particularly on morally loaded matters, know that the choice of research questions is actually not free. The question is not whether an important topic is chosen, the results of which could enrich the world. No, sometimes an interesting and important topic cannot be chosen because there is a fear that either politicians or the public – and often both – may not like the results. The keywords here are ‘excessive political correctness’ and ‘considering your own people ignorant’. Not all scientific journals – I believe some of you will agree with me – continue to proudly and firmly uphold science ethics like they used to.

The dangerous situation of a spiral of silence emerges when scientists decide not to establish an important research question or not to honestly publish the results of research, not merely in fear of honest criticism or out of convenience, laziness, favouring a political force or wishing to abuse the title of a scientist – for instance, an algae researcher telling people how to fight an epidemic – all such things also occur. However, the danger arises when scientists do their professional work, study an important topic and reach important conclusions by using reliable methods, but then decide not to publish these for fear of losing their good reputation and then perhaps also their job, friends and peace of mind. Regardless of the fact that they were scientifically right and the conclusions are not subject to honest scientific criticism, but rather ideological condemnation. Things get this bad particularly when the prevalent misconception is morally loaded. And all those who cast doubt on it – regardless of how right they might be in terms of facts and conclusions – are labelled morally condemnable, someone who therefore cannot be right on anything, someone with whom no decent person should associate, someone who should be regarded with general suspicion at all times.

It is probably no news for anyone that polarisation and the spread of contagious ignorance is facilitated by social media, where everyone holds a loudspeaker, even those who are unable to read or write any texts that require deeper concentration and cannot control their emotions. It seems to me that journalism ethics and perhaps the overall way the media functions have also changed. All of this enhances the punitive impact on the search for truth.

28 *Schweigepirale* in German.

The polarisation of beliefs<sup>29</sup> is surely a phenomenon you are all aware of. On morally loaded matters, smart people convinced in their beliefs may be given very good facts, but they will not change their beliefs. At times, it is worth recalling the experiment carried out at Stanford University to determine whether firm proponents and opponents of the death penalty could be convinced otherwise or brought even a bit closer to the middle ground in their conviction using unbiased and comprehensive scientific results. It was not possible! Quite the contrary. From the unbiased scientific material, students who were otherwise very capable selected the bits that reinforced their earlier beliefs. They dug even deeper into their trenches. Those results were published in 1979. The polarisation of beliefs with regard to the COVID-19 pandemic has now also been studied in terms of machine learning.

Today, there are research groups focused on studying polarisation in quite a few places, particularly in America, and they naturally have rather weighty results to show. The polarisation of beliefs is a known phenomenon, but society gets really badly damaged when people no longer limit themselves to digging into their trenches, but instead start attacking scientists. They start attacking the scientists’ honour, life work and belief in the possibility of free ethical science.

The willingness of scientists to honestly and sincerely publish the results of their research may also be impaired by the possibility that the results of their mind’s labour are turned into entertainment or, even worse, into fuel for life-threatening conspiracy theories. Research into the adverse effect of COVID-19 vaccines is a recent example that should please those who have doubts about the vaccines. The topic is researched and the results are published – and nearly all the results are interpreted as supportive of anti-vaccine beliefs. When a research group reached the conclusion that after vaccination the menstrual cycle of women who correspond to certain characteristics lengthens by a few days over the course of a few months, it was twisted into the conclusion that vaccination has an adverse effect on fertility. What should scientists who had carried out honest and important work now feel?

Yes, it may be that the human mind has degenerated, for whatever reason. Perhaps people are truly no longer able to read scientific, unbiased, precise, nuanced and balanced text. I tend to suspect, however, that people are able, but choose not to.

The greater the number of smart people who decide to stay silent for fear of otherwise being silenced by stigma-

29 Lord, C. G., Ross, L., Lepper, M. R. 1979. Biased assimilation and attitude polarization: The effects of prior theories on subsequently considered evidence. *Journal of Personality and Social Psychology*, 37(11), 2098–2109, doi: 10.1037/0022-3514.37.11.2098.

tisation, the more strongly misconceptions take root and the smaller the hopes for the development of science – and, indeed, culture as a whole. Authoritarian countries do not tend to shine in the areas of science and culture. As far as I know, the Chinese do not yet even have a proper COVID-19 vaccine.

Science and scientists need freedom. I can say from my own experience that independent constitutional institutions and officials are in a very similar situation to that of scientists on morally loaded matters.

They must also be impartial. They must not choose a side on any issue, although everyone tells them it is a serious matter and they have to side with one or other opposing force. Even in the most acute crisis, we must defend the rule of law and dare to take into account the results of scientific research in assessing the constitutionality of all decisions. Even when public opinion seems to demand a violation of the Constitution because fear or hatred is so strong. You have all heard the mighty slogans: Something must be done! Perhaps a little will do! Other countries are also doing this!

The main purpose of sovereignty is to make the best decisions in the interest of your own people and not to tag along behind others or even get ahead of them on the path of ignorance.

In examining morally loaded topics in recent years, it seems that across the entire free world quite a few scientists and officials have let themselves be forced to choose a side because there is not much room for unbiased expertise in the field of public opinion. Trenches keep widening and a hail of bullets hits unbiased scientific thought from both sides.

Is it not also so that here in Estonia anyone who tries to discuss, say, forestry in an impartial and scientific manner seems to step on a proverbial minefield? Or anyone who dares to ask whether it is possible to use oil shale in a way that does not cause climate change. Or anyone who analyses COVID-19 restrictions and the mask and vaccination obligation with cold logic. Or the voting rights of non-citizens at local elections. You may have your facts and logic solidly in place, but the first question they ask you is ‘Whose side are you on?’ All of these are morally loaded topics where the public only demands to know your affiliation and is not interested in justified, science-based and nuanced claims of limited validity.

Even if you dare to present such a claim, it is quickly interpreted as side-choosing and you are given a fundamental moral assessment: you are either good or evil, depending on which trench you are viewed as being in. It may also happen that you are good when you support a misconception that has taken root among the public and violate your professional ethics, and you are evil when you are fearless and honest.

*If all science, including the science conducted on morally loaded matters, was ethical and honestly and completely published, could we hope for wiser statesmanlike political decisions?*

However, this is not a new phenomenon. People who proudly bear the title of scientist have had to suffer fire and brimstone for centuries. The main work of Nicolaus Copernicus, *On the Revolutions of the Heavenly Spheres*, was published in 1543, the year of his death, and 13 years after the completion of the work. In that book, he showed that the Sun does not revolve around the Earth, but vice versa. The heliocentric worldview was not exactly greeted with whoops of joy. Allegedly, Martin Luther even said in a speech that Copernicus was a great fool who knew nothing of things, as everything is clear and everyone can see how things are and the Bible also says that things are different. An overused example? Yes. Possibly a wrong one too, but therefore even more apt in this context! Researchers of church history have cleared Luther of the prescribed sin, so there is no evidence of such a speech.

Science ethics unfortunately demands that scientists say what they know and what they can prove with reliable methods. Facts, associations, conclusions. They say where the limits of knowledge are, where they have doubts and where they leave open the possibility that science will evolve further. New knowledge is generated and conclusions naturally change. There is nothing worse than a scientist getting stuck in professional dignity.

But when scientists assume an ideological position and hide their ideological message that is supposed to please the public or the forces in power in the guise of science, the trustworthiness of science will be lost in the long run. And I think this can already be seen.

For instance, the ethics of an official and judge dictate that if a person has a strong prior attitude, personal interest, personal fear or hatred in a particular matter, they must withdraw from making a decision in the matter. I think the same principle applies in scientific work. I have always told the students whom I supervise that if things are clear to them in advance, they should choose a new topic.

I think that the Constitution demands that all of us support ethical scientists and searching, honest, free and curious science in all matters, be it immigration or oil shale. Such science can be a basis for politics that creates a bright future. We have again come back to the Constitution telling us how we should act.

However, let us ask: if all science, including the science conducted on morally loaded matters, was ethical and honestly and completely published, could we hope for wiser statesmanlike political decisions? Or is the human mind largely unchangeable and the changes in the development and effect of public opinion also therefore inevitable, leading us to believe that there is nothing we can do about cut-throat competitiveness in politics? Will we receive even more over-spiced or over-sweetened useless and cheap fraudulent messages at every new elections?

We can see it both here and elsewhere that governments are tending to prefer appearance and current ratings to statesmanship. Because you are punished for statesmanship.

It is difficult to prevent cut-throat competitiveness in the politics of a free society, when the electorate is divided into hostile sides that refuse to share any common ground. Scientific research into polarisation is therefore beneficial. Perhaps it would help right away if we emphasised every voter's responsibility for their country. I understand that it is not popular with everyone, but I claim – and have claimed for years – that each adult citizen with active legal capacity who has the right to vote is an important state institution. A responsible choice cannot be indifferent random banging – it is a weighty decision. Choosing not to vote is also a decision. Vote this way or that or do not vote at all – it is clear that a citizen is responsible for his or her country. It seems unjust, but that's the way it is.

A statesmanlike politician should not make a citizen's responsible choice too hard. There is nothing noble in amplifying fear and anger, offering cheap and seemingly great, but substantively wrong solutions. It is noble to stand unwavering in defence of science-based decision-making that relies on facts and logic and looks several steps ahead in order to give citizens a fair part in decision-making.

I thought that I should end on a more optimistic note and then I remembered that in 2013 Toomas Paul wrote an excellent essay in *Maaleht* – 'Honest lie, false honesty'.<sup>30</sup> At the end of the essay, he asked whether an individual can stay honest when society has been built on lies. And then he impishly answered that there is hope, but there's no chance, and left a tiny door open to chance as well. He received The Enn Soosaar Ethical Essayists Award for that essay.

Thank you!

## THE CHALLENGE OF INCLUSION OF DIVERSITY INTO SCIENCE ADVICE

*Intervention of Tarmo Soomere as the delegate of EASAC (European Academies Science Advisory Council) at the discussion session 'Winning from greater inclusion: Relation between diversity and academic culture' at the InterAcademy Partnership (IAP) Triennial Conference and the Worldwide Meeting of the Young Academies, Biosphere 2, Arizona, 3 November 2022*

As a mathematician, I cannot avoid starting from definitions. Science has, in essence, two core pillars: obtaining new and essential knowledge and communicating that to others.

The first pillar is strong only if we include and test all possible ways of addressing the matter.

People of different ages, with backgrounds in education in different fields or from different cultural environments ask different questions, or ask questions differently. This intrinsic variety guarantees that we shall have the best possible information today organised in the best possible manner. This is what science offers today, not a final truth.

In particular, small countries like Estonia do not have the luxury of not including all talented people for this purpose. The entire world is now becoming too small for the same reason, and the integration of various ideas that branch across many boundaries of language, culture, gender, race – you name it – is becoming a must. To paraphrase Ester Oras from the Estonian Young Academy of Sciences: 'We never know whose question or viewpoint opens the way to the future that is worth living in.'

The other side of the coin is communication of this knowledge to others. This is the ultimate point of science for society: to constantly make the world a better place to live. Be it innovation – solving new challenges with new approaches, as Peter Drucker mentioned a long time ago – or shaping the legal system based on the best knowledge, as Helen Eenmaa from the Estonian Young Academy of Sciences recommended earlier today.

The competitiveness of countries, regions and even continents more and more depends on the ability of society to extract the best knowledge from the smartest people. This process involves the entire academic community and of course academies and young academies. On many occasions, their members have the very best and timely information. As Marju Raju from the Estonian Young Academy of Sciences stressed here, cooperation is the key.

<sup>30</sup> Paul, T. 2013. Honest lie, false honesty (Aus vale, vale ausus). *Maaleht*, 14.02.2013, 7(1323), 20.



*We can do much better in terms of science advice by being more inclusive and by giving adequate attention to the diversity of views.*

It is therefore natural that many academies and consortia of academies place a great deal of emphasis on presenting good advice for policy- and decision-making – like the European Academies Science Advisory Council whom I represent here.

Giving advice is a delicate matter because scientists and decision-makers speak different languages. They rely on different time scales. They often have quite different understandings of how the world functions.

Those who need advice usually have no time to listen to long explanations. Therefore, the given advice must be short, concise and contain almost no details. And of course it must be tuned to the level of the existing listening capacity of the partner. This feature (not a bug) normally means the need for severe simplification of the message (if your partner is not Dr Angela Merkel, that is).

The devil is usually hidden in the details, we often say. The original expression of this saying actually was completely different: God is in the details. Meaning: God is living or reveals itself in the details. This saying is far more than 100 years old. In the US, it was attributed to German-born architect Ludwig Mies van der Rohe. It was used in French by Gustave Flaubert much earlier, in the 1800s. The idea was that whatever one does should be done with great care and should not overlook any detail. The truth, if it exists, is in the details. In other words, it becomes evident if you are able to work out properly every single item and look into the details.

The work of the devil is therefore removing or hiding some of the essential details. This is what we have to do when giving the best advice. When condensing the information to the necessary level, we just have to remove some nuances, limit the diversity of opinions and leave aside the less probable options for solutions.

The side effect, sadly, is limited inclusiveness and often a bias towards a small set of the strongest arguments and conclusions.

The golden rules of science advice generally amplify this tendency. They are formulated by the chief science advisors to the European Commission as follows. First, the advice must be based on cutting edge science. Second, it should be made public. Third, it should come from a person or body with a clear mandate.

To put these rules critically into simple English: science advice is, by this definition, an extremely elitist action. These scientists who make most of research and provide diversity are usually out of the game. The message is often oversimplified to make sure that a large part of society could understand the point. Finally, it is provided by a kind of preselected aristocrats (even if they rotate). Is this really what we want?

There are more obstacles in this environment. The arguments and conclusions behind the given advice are estimated from the point of view of the advisor with a mandate – who

is often a middle-aged white man coming from natural or life sciences where scientometrics is almost equal to God.

There is nothing wrong in the Matthew effect. In this field, it works so that the one who has already provided good advice is invited to consult again and again.

But it is definitely wrong that the other side of the coin, the so-called Matilda effect, implicitly starts to work. It is not only about less frequently engaging female scientists and advisors. It is easy to overlook the opinions and warnings of less engaged members of the academic community, be they mothers who have to take children from the school or international researchers who are not fluent in the local language, as Ville Laukanen from the Young Academy Finland stressed. Even though the damage might not be crucial in single situations, the cumulative damage is substantial.

Research results are usually understood in the same manner in the entire academic landscape. The situation is different when we try to convert them into good advice on national level. The features that form our richness, such as cultural diversity, often start to play an impeding role.

Even seemingly identical words may have different nuances in different cities and regions. This often makes the transfer of operational advice across boundaries of language and cultural spaces virtually impossible.

This is what we saw during the first year of COVID pandemic: a cacophony of advice. This was one reason for the frequent shifts in policy goals.

We saw a fairly massive reaction within society in terms of the anti-vaccination movement. It has clear roots in this cacophony.

The explanation is almost trivial. In the formulation of Rainer Grundmann: as a gamut of social science research tells us, the rejection of official information is related to a lack of trust in public institutions.<sup>31</sup> This is at least partially a failure of the scientific community. A similar but much more massive failure was not being able to forecast the invasion of Ukraine by Russia.

We can do better by being more inclusive and by giving adequate attention to the views of fellow scientists who are not exactly in the centre of the distribution of all researchers but who work specifically on the problem or who can see the problem from a closer distance; for example, by taking more seriously the warnings coming from small countries who have a powerful and brutal big neighbour.

31 Grundmann, R. 2021. COVID and climate: Similarities and differences. WIRE's Climate Change, e737, doi: 10.1002/wcc.737.

# WAR IN UKRAINE

## GEOPOLITICAL IMPLICATIONS OF THE WAR IN UKRAINE

*Academy member Tiit Tammaru*

The war instigated by Russia on 24 February 2022 has led to a demographic catastrophe for Ukraine due to emigration, and we have seen the second largest flow of refugees since World War II. More than 8 million people have fled Ukraine since the outbreak of the war, meaning that every fifth Ukrainian has left the country. Here are some figures to illustrate the scale of the flow of refugees. Before the war broke out, the United Nations Refugee Agency estimated the total number of refugees living outside their home country to be 27 million worldwide. During the great refugee crisis of 2015, about 1.5 million people arrived in Europe from Syria. The war has displaced the largest numbers of refugees from Ukraine to Russia, Poland and Germany. In addition to the large number of refugees, the composition of the refugee population is not entirely typical, as women with underage children have been the main migrants from Ukraine.

For Ukraine, this is a demographic catastrophe, as the massive emigration and breakdown of families caused by the war took place in a situation where the birth rate had been one of the lowest in Europe for some time. Therefore, the integration and return of the refugees will be a key issue in the coming years for both Ukraine and the countries hosting refugees.

What is the right course of action for countries?

Creating the conditions for return migration after the end of the war is certainly a desirable option from Ukraine's point of view. But is this realistically possible in the next



Photo: Peet Kõkk

Tiit Tammaru

five years, given the continuing accumulation of destruction on an unspeakable scale? It is hard to give precise figures. The Kyiv School of Economics roughly estimates that considering the cost of reconstruction, around 150 billion euros worth of housing, schools, businesses, hospitals, roads, power plants and other infrastructure were destroyed as at the end of 2022. Rebuilding the destroyed homes alone will cost 50 billion euros. The destruction has been the



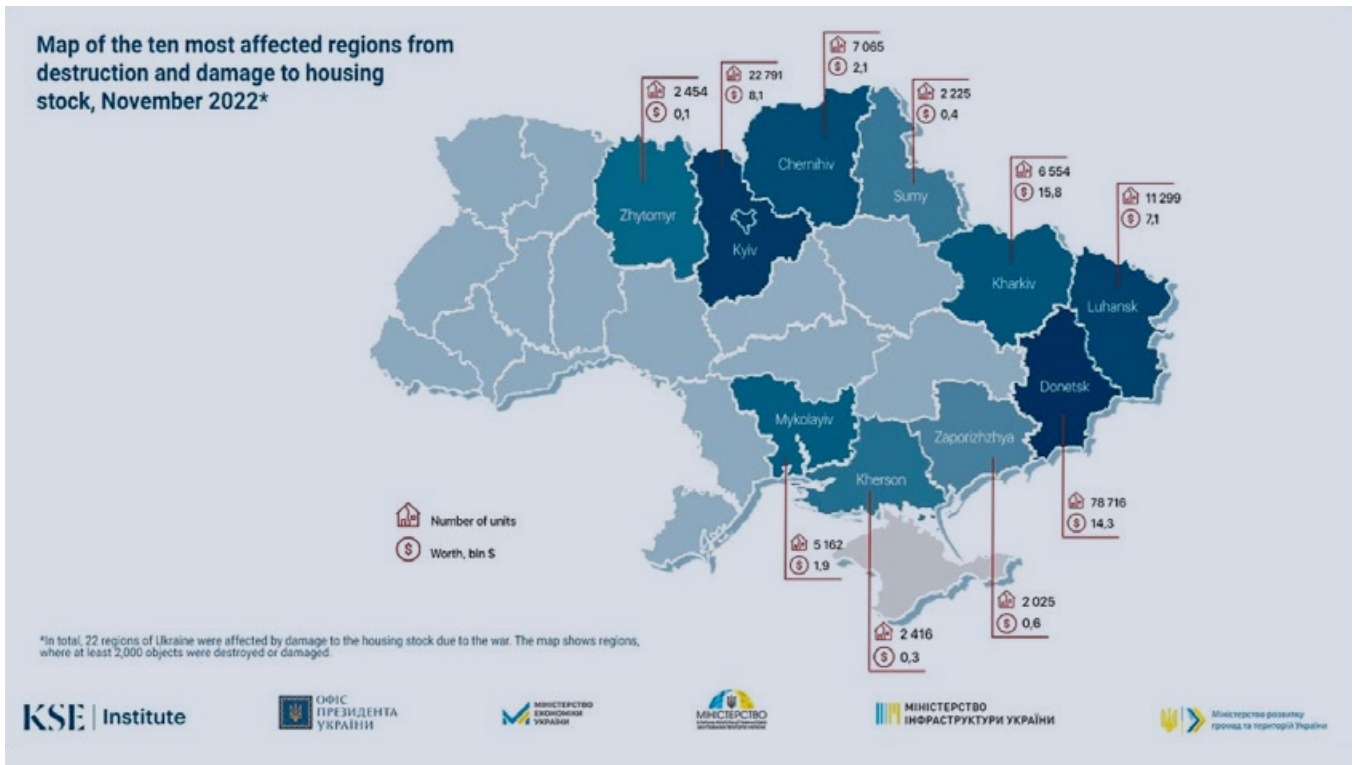


Figure 1. As at November 2022, the total amount of losses caused to the infrastructure of Ukraine amounted to almost 136 billion dollars – Kyiv School of Economics.<sup>32</sup>

most extensive in the Donetsk, Kyiv and Kharkiv regions. Naturally, returning home in the first place is dependent on the war ending. The message of return migration studies is quite clear here: if people have not returned to their home country within the first three to five years, it becomes more likely that they will settle in the new country

For countries hosting refugees, there is an important complement from the labour market perspective. For instance, the World Bank uses the term ‘refugee dividend’ when referring to Ukrainian refugees. All European countries are struggling with an ageing population and so Ukrainian refugees are an important addition to the labour market. The labour markets of the countries that benefit the most from refugees are those with the highest number of arrivals relative to their total population, i.e. Poland, Estonia and Czechia. In addition, previous experiences of accepting refugees in European countries show that it is important to facilitate their coping ability or integration in their new country from the first day of arrival.

Finding a home, learning the language of the host country, organising schooling for children and helping refugees into the labour market reduces the financial burden on the host country and helps refugees adjust to a new pace of life. All of this, however, works against large-scale return migration, even if the desire to return to the homeland is

<sup>32</sup> <https://kse.ua/about-the-school/news/as-of-november-2022-the-total-amount-of-losses-caused-to-the-infrastructure-of-ukraine-increased-to-almost-136-billion/>

Photo: Yevhen Sukhenko, Pexels

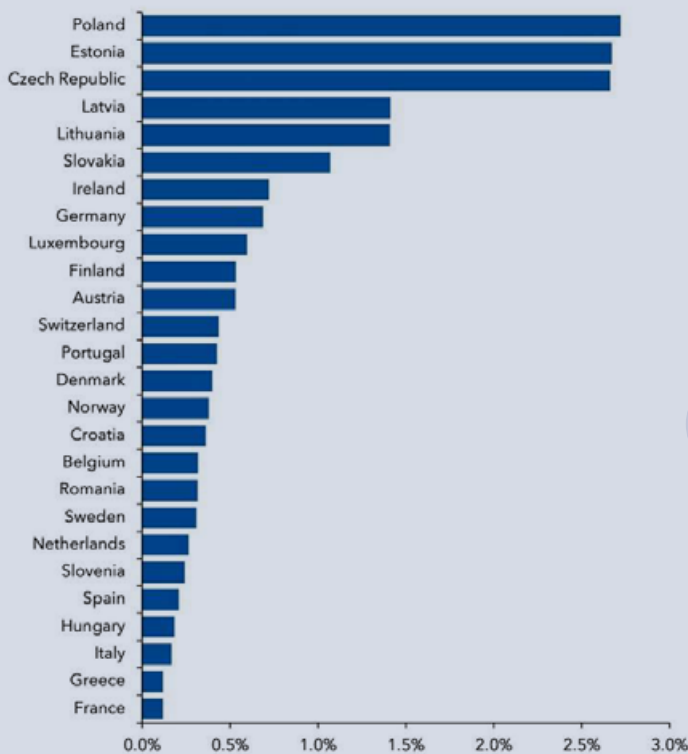


A destroyed residential building in Ukraine.



## Refugee dividend

Ukrainian refugees could raise the size of the labor force by 2.7 percent in the countries with the largest numbers of arrivals.  
(change in labor force size, 2022)



Source: OECD; Eurostat; UNHCR; IMF staff calculations.

Notes: Baseline estimates assume the participation rate of working-age refugees is two thirds that of non-EU native working-age women with a tertiary degree in the respective country.

IMF

Figure 2. Europe could do even more to support Ukrainian refugees.<sup>33</sup>

*If people have not returned to their home country within the first three to five years, it becomes more likely that they will settle in the new country.*

the only conceivable option at the moment of arrival. It is children, in particular, who adapt quickly and this begins to discourage return migration. The first year of the war is already over and the children's first school year is half-way through, but there is still no sign of an end to the war any time soon.

Ultimately, it is Ukraine's desire to get back its citizens who have been scattered across Europe by the war. This may not necessarily come true, and return migration can also vary greatly from country to country. Returning to Ukraine from Poland is more likely than from Germany. This is for the simple reason that the farther from the homeland a person lives, the weaker the ties with the homeland grow.

A recent in-depth survey conducted by the Centre for Applied Social Sciences of the University of Tartu gives an insight into the decision that the Ukrainians living in Estonia might take. According to the survey, two thirds of the Ukrainian war refugees hope to return to Ukraine in three years' time, and a quarter would rather settle in Estonia. It is safe to assume that each year of prolonged war and the accumulation of war damage means that the balance of responses will shift towards remaining in Estonia.

## HOW RUSSIA'S WAR IN UKRAINE AFFECTS THE GLOBAL ECONOMY

*Academy member Urmias Varblane*

Russia's attack on Ukraine came at a moment when the global economy was beginning to emerge from several years of crisis. The COVID-19 pandemic and the problems it caused in global supply chains had severely constrained growth in the world economy. The second half of 2021 had restored optimism in the economy and it seemed that things could only get better. Unfortunately, the war threw all forecasts into disarray. Economic growth slowed everywhere, but Europe was hit particularly hard by the war. The former development logic of the European economy, which had been based on maintaining competitiveness on the basis of cheap Russian energy, collapsed. The price of Russian natural gas multiplied, leading to a general increase in energy prices. This led to double-digit consumer price growth indexes in Europe.

<sup>33</sup> <https://www.imf.org/en/Blogs/Articles/2022/12/15/europe-could-do-even-more-to-support-ukrainian-refugees>



Photo: Reeti Kõkk

Urmas Varblane at the conference ‘Estonian Energy Policy. Energy Trilemma-Balance’ held at the Academy of Sciences on 30 May 2022, speaking about the impact of energy prices in macroeconomics.

The energy price surge caused by the war also led to much faster changes than expected. With incredible speed, Europe was able to reshape its supply chains for natural gas, oil and oil products. In just half a year, the EU member states reduced their dependence on Russian natural gas fivefold. This was done by increasing gas deliveries from existing partners such as Norway or Algeria and by building a whole range of new liquefied natural gas reception terminals. For instance, Germany, as Europe’s industrial engine, completed the first liquefied natural gas reception terminal in Wilhelmshaven in half a year. This was followed by the opening of terminals in Lubmin and Brunsbüttel in January 2023. The favourable winter weather also helped. All in all, the European Union’s storage facilities were 82% full in January 2023. This is much better than at the same time last year, when 53% of the storage facilities were full.<sup>34</sup>

All of this has calmed the markets and given entrepreneurs more optimism. For instance, the Germany Industrial Production Index has been rising steadily since September 2022 and is already close to its pre-war level. These developments come as a very bad surprise for Russia, which had hoped that in the winter of 2023 Europe would see business stoppages, a sharp rise in unemployment and populist victories at elections. In the longer term, however, the current situation has led to several participants in the global economy becoming increasingly interested in investing in various energy production technologies that will help accelerate the transition to renewable energy sources. In Estonia, we are also seeing energy projects that have long been disputed receiving the green light, which will

<sup>34</sup> European Council. 2023 Infographic – How much gas have the EU countries stored? <https://www.consilium.europa.eu/en/infographics/gas-storage-capacity/>.

in a few years’ time lead to a rapid increase in electricity production from renewable sources.

Russia’s place in the global economy is changing radically. Until now, the European Union has been Russia’s most important trading partner, but this position is now shifting to China. The extensive economic sanctions imposed by European and North American countries – the freezing of the Russian central bank’s foreign exchange reserves, the embargo on many technology-intensive goods, the price caps on natural gas and crude oil, and from February 2023, on oil products – were unexpectedly robust for Russia. Naturally, Russia is now looking for new trading partners to sell its energy goods to. In this sense, China is the biggest and most interesting partner for Russia. However, economic relations between China and Russia are not on an equal footing. Nearly a quarter of Russia’s exports now go to China, but only 2.1% of China’s exports go to Russia,<sup>35</sup> meaning China has a lot of power to bargain for favourable terms of trade. For instance, Russia is forced to sell its crude oil to the Chinese at around 35% below the world market price. As a large part of the Russian central bank’s reserves have been frozen, they are mainly left with reserves in Chinese yuan. This means that instead of dollars, Russia will increasingly start to trade in yuan and Russia’s economic future will become increasingly dependent on China.

What happens next? The predictions of many international organisations for 2023 are rather pessimistic. While even in autumn 2022 the global economy was forecast to grow by 3%, in January this year the estimate was downgraded to 1.7% and growth in Europe is expected to stall.

<sup>35</sup> <https://tradingeconomics.com/china/exports-by-country>

So far, however, Europe has managed to weather the Russian invasion of Ukraine better than forecast, so the actual situation may be different. Of course, the economic situation is the worst in Ukraine, where the economy shrank by as much as 35% last year. This was due to the destruction of production capacity, the damage to agricultural land and the reduction in labour, as more than 14 million people are estimated to have been relocated. Ukraine's economy can only survive thanks to large-scale foreign aid.<sup>36</sup> Therefore, the central question after the end of the war is how

36 Gorodnichenko, Y., Sologub, I., Weder di Mauro, B. (eds) 2022. *Rebuilding Ukraine: Principles and Policies*. CEPR PRESS, London.

## SOCIAL CONSEQUENCES OF THE WAR IN UKRAINE

*Academy member Anu Realo*

Russia's brutal military attack and invasion of Ukraine on 24 February 2022 put the whole democratic world at risk. It is being increasingly said that the world is on the verge of a turning point (*Zeitenwende*) – the tectonic plates of world order are shifting again, and we are facing the end of one era and the beginning of another. What this new era will look like depends on the outcome of the struggle between superpowers, the tragic spectacle of which we are currently witnessing in Ukraine.

The war in Ukraine caused not only a serious security crisis but also an extensive migration and food crisis, the likes of which Europe has not seen since the days of World War II. The social impact of the war is both local and global – while causing death, injury and suffering to the Ukrainian people every day, the war also affects millions of people around the world. Ukraine has often been called the world's breadbasket or granary, which is why the global food crisis and the resulting famine, poverty and premature mortality are a direct consequence of Russia's aggression. Before the war, many countries in the Middle East and North Africa received most of their grain, fertilisers and cooking oil from Ukraine and Russia, but the war has disrupted important supply chains, including the Black Sea shipping routes. The situation in these regions was already extremely difficult due to the COVID-19 pandemic and climate change even before the war in Ukraine, but direct food shortages and skyrocketing prices have aggravated the crisis. The UN World Food Programme estimates that 345 million people are already suffering or at risk of severe food shortages, which is twice as many as in 2019. Food shortages are also increasing in Ukraine, where agricultural infrastructure has been

to rebuild Ukraine. According to the World Bank's recent estimates,<sup>37</sup> the total rehabilitation and reconstruction needs in the social, production and infrastructure sectors amount to at least 349 billion dollars, which is more than 1.5 times the size of Ukraine's pre-war economy in 2021. The actual amount will certainly be much higher and will depend on the course of the war. Ukraine's reconstruction and integration into the European Union could provide a strong stimulus for the development of the Ukrainian economy, and of Europe's as a whole.

37 <https://www.worldbank.org/en/news/press-release/2022/09/09/ukraine-recovery-and-reconstruction-needs-estimated-349-billion>



Anu Realo at the 20th European Conference of Personality Psychology in Madrid in July 2022.

extensively damaged, and many farmers are fighting or have already died in the Ukrainian army.

The devastating impact of the war on the mental health and wellbeing of Ukrainians is more difficult to assess than the physical suffering, but it is estimated that nearly 10 million Ukrainians are at risk of various mental health problems such as acute stress, anxiety, depression, etc.



Post-traumatic stress disorder also affects war refugees, both the 6 million internally displaced persons and the 8 million who have fled abroad to escape the war.<sup>38</sup> A recent study conducted in Poland showed that one in ten Ukrainian refugees has some kind of mental health issue that hinders their daily lives. More than a half of these respondents said they need mental health support, which is often difficult to provide in the host country due to limited resources as well as language and cultural barriers. The mental health of war refugees is affected by the situation in Ukraine, concerns about family and home, and often also by the poor socio-economic conditions in their new host country.<sup>39</sup>

The impact of Russia's aggression on Ukrainian children is particularly tragic. Hundreds of children have been killed or injured in the war, many have disappeared, and tens if not hundreds of thousands have been deported to Russia. According to preliminary studies, the mental health of Ukrainian children has deteriorated significantly during the war, especially in areas of active warfare.<sup>40</sup> It has been well established that anxiety and trauma caused by violence and fear have a detrimental effect on children's psychological and physical health and development for many years afterwards.<sup>41</sup> Nearly 5 million children in Ukraine have had their education disrupted by the war, worsening the education shortfall caused by the COVID-19 pandemic and almost nine years of military conflict in eastern Ukraine. There is also a worrying situation among Ukraine's war refugees, where an estimated two out of three children are not enrolled in the school system of their new host country. In addition, there are many unaccompanied children among the refugees, who are exposed to the risk of human trafficking, exploitation and gender-based violence, even in situations where they are already under the care of the authorities of their new host country.

There are currently around 66,500 Ukrainian refugees registered in Estonia, which ranks first among the EU countries in terms of the share of refugees among the population (approximately 5%). The large number of war refugees has put the country's internal defence forces and the social security and education systems under severe pressure and raised questions about the state's ability to integrate the refugees into Estonian society and, more importantly, into the Estonian-speaking community. At the same time, statistics show that around 40% of adult Ukrainian refugees

38 Ben-Ezra, M., Goodwin, R., Leshem, E., Hamama-Raz, Y. 2023. PTSD symptoms among civilians being displaced inside and outside Ukraine during the 2022 Russian invasion. *Psychiatry Research*, 320, 115011, doi: 10.1016/j.psychres.2022.115011.

39 <https://www.who.int/europe/news/item/19-12-2022-new-research-reveals-how-war-related-distress-affects-mental-health-of-ukrainian-refugees-in-poland>

40 [https://gradus.app/documents/211/Children\\_Report\\_Gradus\\_28042022.pdf](https://gradus.app/documents/211/Children_Report_Gradus_28042022.pdf)

41 The Lancet (Editorial) 2019. The mental health imperative of children in conflict. *Lancet*, 394 (10203), 980, doi: 10.1016/S0140-6736(19)32143-9.

*Millions of shattered homes and destroyed lives are a direct consequence of Russia's military invasion of Ukraine, but the real impact of the war is global and extends far beyond Ukraine's borders.*

are already employed in the local labour market, which is one of the contributing factors to integration. Despite initial difficulties, the inclusion of Ukrainian children in education can also be considered relatively successful. From September 2022, Ukrainian school-age children living in Estonia are obligated to study in the Estonian school system. The majority of them (63%) are studying in Estonian, which is once again an important indicator of integration.

It has been argued that the war in Ukraine made Estonia's internal politics more Western and reduced the ethnic divide in Estonia. However, the latter claim needs more analysis, as support for both the acceptance of Ukrainian refugees and the increased presence of allied NATO forces in Estonia has been significantly lower among non-Estonians than among Estonians throughout the war. Furthermore, the sense of belonging to Estonian society among people of other ethnicities living in Estonia has decreased rather than increased over the past year and remains significantly lower than among Estonians. At least in part, the decline in the sense of belonging may be due to the government's decision to remove monuments bearing occupation symbols from Estonia's public spaces, including the much-discussed Narva tank, and the law amendments adopted by the *Riigikogu*, ensuring a full transition to Estonian-language education. Russia's aggression in Ukraine is directly or indirectly behind both decisions, giving the government the mandate to act decisively on sensitive and controversial issues that have festered for decades.

In conclusion, millions of shattered homes and destroyed lives are a direct consequence of Russia's military invasion of Ukraine, but the real impact of the war is global and extends far beyond Ukraine's borders. The war has shaken the foundations of the rule-based world order and set in motion a chain reaction of various social, political, economic and environmental processes, the true scale and scope of which we shall only be able to assess in the years to come.



## LEGAL EFFECTS OF RUSSIA'S AGGRESSION

*Academy member Lauri Mälksoo*

Russia's direct aggression against Ukraine, which began on 24 February 2022, has challenged the functioning of international law and drawn attention to certain weaknesses in international law. The biggest implications are not about specific issues, but rather about how to view the law and the challenge it faces in the context of a bigger picture.

International law does not operate in isolation, rather within the current environment of the international community. The post-Cold War world was characterised by a belief in steadfast progress and liberal values such as human rights, democracy and the rule of law, including, of course, the central role of international law in ensuring world order. In 1998, the International Criminal Court (ICC) was created to help end impunity and in 2001, the UN International Law Commission completed the codification of state responsibility.<sup>42</sup> Although the latter has not

(yet?) become a traditional multilateral treaty, the *de facto* codification of state responsibility in international law has led to a kind of logically completed system. Both states and individuals who commit a breach of international law are to be held responsible for it.

How are these principles being applied in practice? The Oxford legal positivist H. L. A. Hart once noted in his famous book *The Concept of Law*<sup>43</sup> that the Achilles' heel of international law is the so-called secondary norms concerning responsibility for the violation of primary norms and the procedures to be followed in the event of a breach of law. International law continues to be based on the principle of the sovereignty of states and as such may in relation to a violating state (particularly a major power) turn out to be a case of 'you can lead a horse to water, but you can't make it drink'.

On 4 March 2022, the legal foundations of war were discussed at the Science Afternoon 'War and Law' in the Hall of Mirrors of the Academy of Sciences. From left to right: member of the Academy of Sciences' Constitutional Law Endowment Council Uno Lõhmus, State Prosecutor General Andres Parmas, Academy member Lauri Mälksoo, and discussion moderator and *Postimees* journalist Ulla Länts.

<sup>42</sup> The substantive systematisation of rules of law within a specific field of law and their concentration into a comprehensive set of laws, or a code – ed.

<sup>43</sup> Hart, H. L. A. 1961. *The Concept of Law*. Oxford University Press, Oxford, 263 pp.



There have also been other reality check events in the international community over the past few decades. However, none of them have been comparable to the war Russia started in Ukraine. Many idealists are only now discovering that international law applies to Putin's Russia with reservations, that are far from ideal, and far from being just. Of course, a large majority of the UN General Assembly has adopted resolutions calling Russia's invasion an act of aggression and its attempts to annex Ukraine a violation of international law. In that sense, the instruments of law have been used, and an assessment has been given. But is that enough? What about actual individual and state responsibility for aggression and acts of war?

After WWII, international law was structured around the central role of the UN Security Council. Certain rules apply to permanent members of the Security Council to a limited extent. For instance, several major powers – including Russia, the US and China – have not formalised their membership of the ICC. It is currently difficult, if not near impossible, to hold their citizens (heads of state) personally responsible for starting a war of aggression. International law has sometimes overlooked the fact that, as such, the law is two-tiered – what is permitted of Jupiter is not permitted of a bull. But this is not good enough. Moreover, certain historically established institutions of common international law – e.g., the immunity of heads of state – protect heads of state from being tried internationally or abroad while in office.<sup>44</sup> Similarly, the principle of state immunity in common international law protects governments from state assets located abroad being even partially used for compensating for the damage caused by aggression. Compensation as an expression of state responsibility is

traditionally understood to involve some kind of formal agreement between states. But how can this be achieved when a major power with a lot of resources uses all its strength to cause as much destruction as possible and still militarily impose its will at all costs?

On 24 February 2022, quite a few masks that had been distorting the truth fell. International law may be a concept and practice historically developed by idealists, but today it has to prove itself in a very realistic world. As the perpetrator of the aggression is a permanent (and veto-wielding) member of the UN Security Council, it is impossible to ignore the fact that the perpetration of aggression is, in this case, a systemic problem of the world order. Much is at stake for the future of international law in this war. After all, there have been periods in history when 'international law' was, to a large extent, exerted as the will of the strongest states imposed on others. The UN Charter system has emphasised the sovereign equality of states and has therefore given a chance to small states and smaller countries. If Russia were now to succeed in imposing its will on Ukraine by force of arms, and in gaining some kind of (even mute) international acceptance for it, this would in fact signal a death blow to the UN system in the form in which many democratic countries have wished to see it. If, on the contrary, things go well, then aggression and the horrors of war may well contribute to the future reform and development of international law. It should not be the case that, on the one hand, the rules of international law are well established, but on the other, they only apply with great limitations to a great power that has a constitutional role in the UN Charter but has become aggressive. In this sense, Russia's aggression is also a wake-up call for diplomats and experts in international law. The end of history has not come. The lawmakers cannot rest on their laurels. Rather, Russia's aggression has highlighted the bottlenecks where international law needs further reform and development.

<sup>44</sup> See: Corten, O., Koutroulis, V. 2022. Tribunal for the Crime of Aggression Against Ukraine – A Legal Assessment. In-depth analysis requested by the DROI Subcommittee of the European Parliament, 09.12.2022, p 21 ff.



# ABOUT ACADEMIC PUBLISHING

## CHALLENGES OF OPEN ACCESS

### *Conference of the Estonian Academy Publishers*

*Piret Lukkanen, Director of Estonian Academy Publishers*

2021 marked 70 years since the beginning of the publication of scientific journals of the Estonian Academy of Sciences. The plan was to celebrate the respectable milestone with a conference, but unfortunately the event had to be postponed by a year due to the COVID-19 pandemic. The conference was held on 26 May 2022 in the historical building of the Academy of Sciences.

Besides aiming to draw attention to the journals of the Academy of Sciences, the conference focused on topics related to open access. In scientific circles, matters such as open science,<sup>45</sup> cOalitionS<sup>46</sup> and Plan S,<sup>47</sup> open data,<sup>48</sup> open access,<sup>49</sup> etc. have been topical for years. The conference touched briefly on all of those topics, but the main aim was to bring together presenters and listeners for whom open access concerns them in one way or another, starting from influencers and analysers of processes to authors who must make conscious choices as to whether to publish their research in an open access publication or not.

The conference was led by Jaak Järv, Academy member and the Chairman of the Publishing Council of the Estonian Academy of Sciences and Editor-in-Chief of the journal *Proceedings of the Estonian Academy of Sciences*.

45 Open Science. [https://en.wikipedia.org/wiki/Open\\_science](https://en.wikipedia.org/wiki/Open_science).

46 cOalition S. <https://www.coalition-s.org/about/>.

47 Plan S. <https://www.coalition-s.org/>.

48 Open data. [https://en.wikipedia.org/wiki/Open\\_data](https://en.wikipedia.org/wiki/Open_data).

49 Open Access. <https://www.scienceeurope.org/our-resources/principles-on-open-access-to-research-publications/>.

The day was divided into three parts. The first two sessions consisted of presentations. Pippa Smart, a consultant to research publishers and the editors of scientific journals, and President of the European Association of Science Editors (EASE) in 2018–2020, gave a substantive overview of the situation in the open access landscape in 2022. She talked about the source of pressure on both publishers and researchers to publish in open access publications and which business models have been developed to support free of charge and unrestricted access to research publications. Pippa also managed to talk about open data and the pre-publication versions of articles or open preprints,<sup>50</sup> as well as what open science entails, what its main components are and their effect is on research communication and scientific journals.

The presentation of the Academy President Tarmo Soomere examined if and how the attitude to open science has changed under the pressure of political tensions. The implementation of Plan S, the aim of which is to radically speed up bringing research results into use and making research results published with taxpayers' money accessible to everyone free of charge, has proven difficult against the backdrop of increasing geopolitical tension and the deteriorating global security situation. A question has also arisen as to whether unrestricted access should still be provided to the latest scientific knowledge, particularly when such information could also be used by perpetrators of genocide and instigators of brutal wars of conquest.

50 Open Preprints. <https://en.wikipedia.org/wiki/Preprint>.

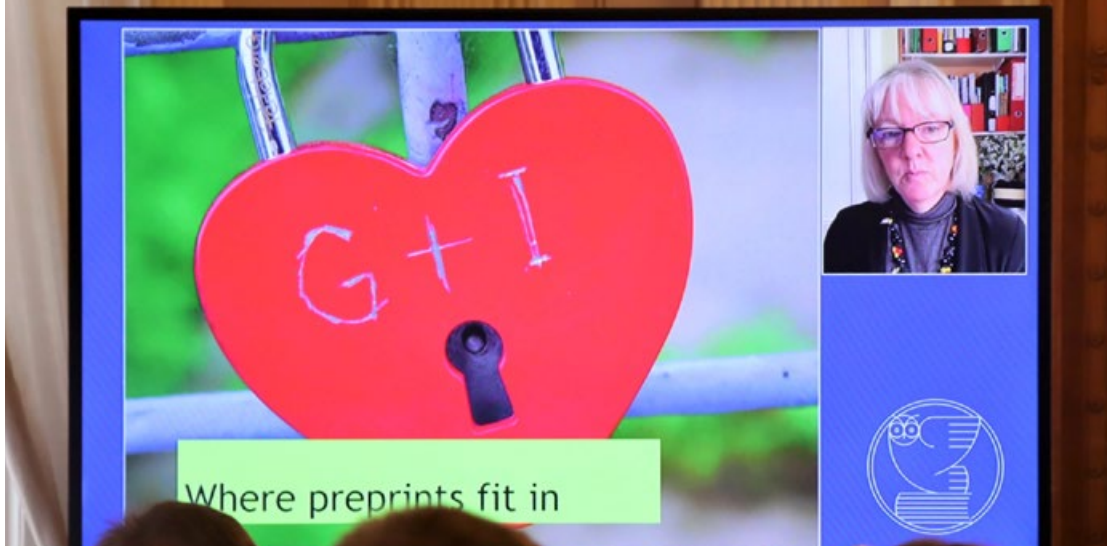


Photo: Krista Tamm

Pippa Smart

The presentation of the Director of Estonian Academy Publishers Piret Lukkanen provided an overview of the esteemed history of the journals of the Estonian Academy of Sciences, their evolution over time, the history, current standing and future plans of the Estonian Academy Publishers, and the Publishers' open access policy. The Academy Publishers supported the idea of open access before the initiation of Plan S. All the Academy Publishers' journals have been published in parallel as printed and electronic versions and have been available to be read online and downloaded free of charge since 2008. Matters related to copyrights have changed over time. The transition to Creative Commons licences was gradual. Since 2022, all articles are subject to Creative Commons licence CC BY 4.0, which corresponds the most to the principles of open access and restricts the possibilities of using the articles the least. The Academy Publishers aims to digitise all the journals of the Academy of Sciences that have previously been published only on paper, and to assign a unique digital identifier (digital object identifier, DOI) to every article and make them accessible and downloadable on the Academy Publishers' website free of charge.

Photo: Val Rajasaar



Kristi Viiding

The presentation of the Research Professor of the Under and Tuglas Literature Centre Kristi Viiding gave listeners a good opportunity to glance into the personal experience of a philologist working with historical materials. We were given an idea of a humanities scholar's need to access scientific literature and of the biggest challenges in accessing information in the European research landscape.

Marika Meltsas, the Head of the Estonian Research Information System department at the Estonian Research Council and the Estonian coordinator of the Electronic Information for Libraries network, provided an overview of the recent trends in the open access publications of the articles of Estonian researchers compared to international practices and talked about the possibilities of increasing the proportion of open access in the case of different economic models and strategies.

Photo: Krista Tamm



Marika Meltsas





Andres Kollist

Director of the Academic Library of Tallinn University Andres Kollist spoke at the conference as a representative of Estonian research libraries, where he discussed who is the owner, what is the value and what is the price of



Martin Eessalu

information. Buying research information and making it accessible is costly; furthermore, there is a big difference between the European and Anglo-American legal environment in disseminating electronically available information.



Photo: Vail Ratasaar x3

Panel discussion on how can we make Estonian scientific journals more visible. From left: Academy member Jüri Engelbrecht, Professor Reili Argus from Tallinn University, Editor-in-Chief of *Keel ja Kirjandus* Johanna Ross, Editor-in-Chief of University of Tartu Press Ivo Volt, Professor Timo Kikas from the Estonian University of Life Sciences, and Piret Lukkanen.





Foto: Vall Rajasaar

The heads of Estonian Academy Publishers and Editors-in-Chief at the conference: (from the left): Jaak Järv, Editor-in-Chief of the journal *Proceedings of the Estonian Academy of Sciences*, Chairman of the Publishing Council of the Academy of Sciences, Academy member; Urmas Sutrop, Editor-in-Chief of the journal *Trames*; Piret Lukkanen, Director of Estonian Academy Publishers; Ülo Niine, Director of Estonian Academy Publishers in 1994-2019; Marek Tamm, Academy member, Editor-in-Chief of the journal *Acta Historica Tallinnensia*; Olle Hints, Editor-in Chief of the journal *Estonian Journal of Earth Sciences*; Andres Siirde, Editor-in-Chief of the journal *Oil Shale*.

Martin Eessalu from the Ministry of Education and Research talked about the state’s view of open science and the open science framework.

The panel discussion held in the third session of the conference brought together the representatives of the major Estonian research publishers: Ivo Volt (University of Tartu Press), Reili Argus (Tallinn University Press), Johanna Ross (journal *Keel ja Kirjandus* (‘Language and Literature’)), Timo Kikas (the Estonian University of Life Sciences’ journal *Agronomy Research*) and Piret Lukkanen. Academy member Jüri Engelbrecht was the panel moderator. How can we make Estonian scientific journals more visible? How can we improve the quality of scientific journals? What challenges do small publishers face and how can they keep up to date with the newest technical solutions? Where do publishers find the latest information about new trends? Is international cooperation with other publishers important and, if so, why? How can we support the distribution of journals and how could authors themselves contribute to disseminating the articles? These were only a few of the questions the panellists sought answers to.

The conference is reviewable on the Estonian Academy of Sciences’ Facebook page and YouTube channel.<sup>51</sup>

## MESSAGES FROM 2022 JOURNALS OF ESTONIAN ACADEMY PUBLISHERS

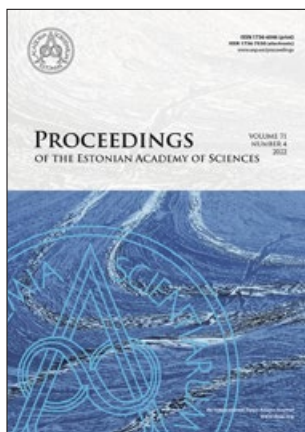
*A selection of the most exciting 2022 articles and thematic editions. All the journals are accessible in full on the website of Estonian Academy Publishers.<sup>52</sup>*

**Thematic edition of *Proceedings of the Estonian Academy of Sciences* to celebrate Ülo Lepik on his anniversary**  
Special editions of *Proceedings of the Estonian Academy of Sciences* not only cover the materials of recent scientific consultations; they are often also dedicated to important dates in scientific life. The first edition of *Proceedings of* 2022 was of truly great importance – it was dedicated to the 100th anniversary of meritorious Academy member Ülo Lepik celebrated in 2021.

During his long career at University of Tartu, Ülo Lepik achieved excellent results in analysing and solving many mechanical problems. As we know, mechanics is an ‘old science’, which according to David H. Allen shaped the modern world but is time and again still generating new

51 <https://www.youtube.com/watch?v=xmAoaMXV9Ig>

52 <https://kirj.ee/journals-issues/>



knowledge. Sven Dimberg was teaching mechanics at University of Tartu as early as in 1690 – just a few years after the publication of Isaac Newton’s famous *Principia*.

Ülo Lepik oversaw the teaching of mechanics at University of Tartu for over half a century. For him, fruitful teaching and research were two sides of

the same coin. His areas of research covered the plasticity theory, the optimisation of structures and wavelets, among many others. The use of Pontryagin’s maximum principle in optimisation problems and the development of new solution methods based on the Haar wavelet idea are examples of his search for new knowledge. Linking theoretical solutions to practical possibilities was a characteristic trait of his research. Despite the fact that a lengthy portion of Ülo Lepik’s career as a scientist was served under the conditions of a totalitarian state, he was always a focused scientist whose activities were free of the then dictated political influences both in his hometown of Tartu and on long visits to colleagues in Moscow, Warsaw and Providence. He retained his ability to work until a very advanced age.

The Ülo Lepik special edition of *Proceedings* is an expression of the gratitude of his students and colleagues to the meritorious scientist. The articles cover solving inverse problems of mechanics, analyses of problems involving vibration and loss of stability, examples of the use of wavelets and other important mechanics problems related to Ülo Lepik’s research interests.

Ülo Lepik (11 July 1921 to 12 February 2022) was a giant among scientists and will remain as such both in the history of science and in the hearts of his colleagues.

Jüri Engelbrecht

Academy member, member of the Publishing Council of the Estonian Academy of Sciences

### The most outstanding article of *Linguistica Uralica* in 2022

In the 2022 June issue of *Linguistica Uralica*, two young scholars from Finland, Niko Partanen and Riku Erkkilä, addressed the old puzzle of Komi-Zyrian grammar, in particular the alleged synonymy of the *prolative* and *transitive* cases.<sup>53</sup> Among the 24 Komi-Zyrian cases, the prolative in *-öd* and the transitive in *-ti* are often treated by gram-

53 Partanen, N., Erkkilä, R. 2022. Cases denoting path in Komi: Semantic, dialectological and historical perspectives. *Linguistica Uralica*, LVIII(2), 81–111, doi: 10.3176/lu.2022.2.01.

marians as two different realisations of one and the same case.<sup>54</sup> In their article ‘Cases denoting path in Komi: semantic, dialectological and historical perspectives’, Partanen and Erkkilä examine the functions and use of these two case forms on the base of a written corpus. The corpus consists of 62 Komi books from the Fenno-Ugrica collection<sup>55</sup>.

The theoretical background of the examination is rooted in cognitive linguistics. The analysis shows that, apart from several dialectal and grammatical factors, the two cases do actually have different distributions and functions. The difference they found is that the transitive (to which they assign the new term *via-case*) is primarily chosen based on the movement-limiting characteristics of a landmark, e.g., *вӧр муӱми* *мостӧдз* ‘along the forest path up to the bridge’. The prolative, on the other hand, is used with elongated landmarks, for which the restriction and control of the movement are salient properties, e.g., *мунӧны вӧр муӱӧд* ‘they walk along the forest path’. Furthermore, they show that there are also parallels between the distribution of these forms in other Permic languages and dialects, aside from Komi-Zyrian. This is the first corpus linguistic investigation of its kind into this old riddle of Komi-Zyrian grammar, but as the researchers acknowledge themselves (p 108), their work essentially verifies earlier ideas by the Komi grammarian Galina Nekrasova (2019).<sup>56</sup> Therefore, the contribution by Partanen and Erkkilä is a nice example of how both modern linguistic methods and good intuition by older grammarians can be brought fruitfully together.



| Gerson Stefan Klumpp, Editor-in-Chief

### Estonian Journal of Earth Sciences in 2022

The *Estonian Journal of Earth Sciences* published a total of 15 scientific articles in 2022. Most of these focused on topics related to palaeontology and bedrock geology in the Baltic region as well as oceanography and marine geology in the Baltic Sea. All the published articles equally

54 Kuznetsov, N. 2022. Komi. In: Bakró-Nagy, M., Laakso, J., Skribnik, E. (eds). *The Oxford Guide to the Uralic Languages*. Oxford University Press, Oxford, 487–506.

55 <https://langdoc.github.io/written-komi-corpus-fennougrica/>

56 Nekrasova, G. A. 2019. Конкуренция пролативных суффиксов в коми языке: опыт корпусного исследования. In: А. Г. Мусанов (ed), *Актуальные вопросы коми и пермского языкознания*. Выпуск 77. Труды Института языка, литературы и истории Коми НЦ УрО РАН, 53–63.





deserve to be presented to broader audiences, but we will briefly highlight two here. Both are of a regional nature and focus on studying changes in our marine environment – the first in our recent past and the other hundreds of millions of years ago.

In their article, Henry Vallius, Tiiu Alliksaar and Sten Suuroja analysed the distribution of heavy metals in the topmost layer of sediment in the Gulf of Finland in the Baltic Sea.<sup>57</sup> A comparison of the data gathered in 1995 and 2014 showed that the concentration of the studied elements had noticeably decreased over the two decades. For instance, the content of quicksilver in the upper centimetres of the sediment layer had decreased by an average of 50%, and the concentration of cadmium was significantly reduced in the entire study area. In most cases, the 2014 data showed contents lower or slightly higher than the recommended threshold values of pollutants, which indicates an overall improvement of the Baltic Sea environment. The article is the product of close cooperation between state institutions and universities within the framework of the international SedGoF project (Assessment for ecosystem based management of marine environment on the basis of sea bottom and sediments of the Gulf of Finland). This is a fine example of the necessity for the monitoring and applied research of sea bottom sediments as well as the value of the gathered data following the completion of the particular project.

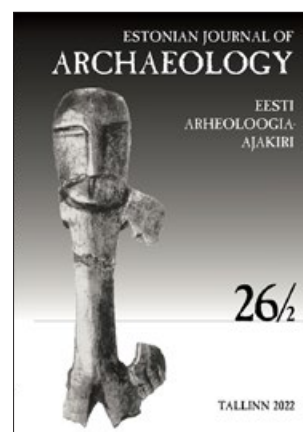
Stefi Guitor and Tõnu Meidla analysed the spread and ecology of ostracods in the Baltic Palaeobasin in the Late Ordovician era, about 450 million years ago.<sup>58</sup> The researchers showed that there are clear areal trends in the size and morphology of ostracod carapaces. For instance, the share of species with a large, round and ornamented carapace increases towards the depth of the Palaeobasin, while smoother, tuberculate and smaller taxa dominate the relatively shallow open-shelf environments. The article is based on an extensive micro-palaeontological collection and data set for which Estonia is well known worldwide. A comprehensive and thorough analysis of that material

helps find answers to general questions about the relationship between biota and the environment in geological time. It is also worth noting that the article forms part of the main researcher's doctoral project, which is focused on the reconstruction of Early Palaeozoic fauna communities.

| Olle Hints, Editor-in-Chief

### **Estonian Journal of Archaeology**

The 26th edition of the *Estonian Journal of Archaeology* (2022) was quite a fruitful one: 12 researchers from Estonia, Lithuania, Poland, Hungary and Ukraine provided seven articles of exciting reading material, covering the Stone Age, Bronze Age, Roman Iron Age, Late Middle Ages and the early modern period, i.e. from about the 4th millennium BCE to the more recent 16th and 17th centuries. The articles discuss settlement archaeology, the dating of graves at burial sites, burial customs in *tarand*-graves and various discovered artefacts.



Among others, it is worth noting Irina Khrustaleva and Aivar Kriiska's joint study of the Jägala Jõesuu V settlement site in northern Estonia, which turned out to be a multi-layered archaeological find: the cultural layer of a Stone Age settlement dating from the end of the 4th millennium/beginning of the 3rd millennium BCE at the bottom, on top of which were up to three layers of activity and separating dune sands, dated to the Bronze Age and the Early Iron Age.<sup>59</sup> The article focuses on the cultural layer of the Stone Age settlement and the spatial and contextual analysis of the finds gathered from there (more than 11,000). This was facilitated by the excavation techniques employed, which included the 3D documentation of findings, the fact that the settlement site was used for a relatively short period and that it was largely undisturbed by subsequent human activity. Therefore, it was possible to identify five concentration zones of findings in the excavation area, of which one was a pit-house recessed into the ground (5.3 × 2.8 m), while the second one was apparently an aboveground building (6 × 3 m). The exact purpose of the remaining three concentration zones was not identified in the analysis. The pit-house dwelling is to date the only

57 Vallius, H., Alliksaar, T., Suuroja, S. 2022. Changes in heavy metal concentrations in the sediments of the Gulf of Finland over two decades. *Estonian Journal of Earth Sciences*, 71(4), 177–188, doi: 10.3176/earth.2022.12.

58 Guitor, S., Meidla, T. 2022. Changes in the morphology of Late Ordovician ostracods along the shelf-to-basin transect of the Baltic Palaeobasin. *Estonian Journal of Earth Sciences*, 71(4), 157–175, doi: 10.3176/earth.2022.11.

59 Khrustaleva, I., Kriiska, A. 2022. Jägala Jõesuu V Stone Age settlement site in northern Estonia: Spatial and contextual analysis of finds. *Estonian Journal of Archaeology*, 26(2), 81–124, doi: 10.3176/arch.2022.2.01.



example in Estonia dating from the Late Comb Ware culture. Due to the large number and diversity of the finds as well as the location of the settlement near where the river flows into the sea and where various different resources could be used, the researchers believe it is likely that this was a permanent dwelling place at which a part or all of the community lived for most of the year.

| Valter Lang, Editor-in-Chief

### Special issue of *Acta Historica Tallinnensia* dedicated to centenary of recognition of Baltic states

The special issue of *Acta Historica Tallinnensia* (vol. 28(2), 2022), published in December 2022, marks the centenary of de jure recognition by the United States of the Baltic republics of Estonia, Latvia and Lithuania. Although the time-frame of this special issue encompasses the period of state formation in the Baltic region from 1917 to 1922, its specific focus does not only revolve around the idea of establishing sovereign states. It places Estonia, Latvia and Lithuania in the context of diplomatic relations, initially as de facto entities and subsequently as de jure subjects of international law.

The special issue, guest edited and introduced by Tallinn University junior research fellows James Montgomery Baxenfield and Kevin Rändi, endeavours to examine the actions and reactions related to attaining the political recognition of the Baltic states from the perspectives of four distinguishable communities in the region: Baltic Germans, Estonians, Latvians and Lithuanians. Heidi Rifk's (Tallinn University) contribution contends with the internal dynamics of the transnational Baltic German society and examines their varying responses to the recognition of Estonia and Latvia. Although citizens of the Russian Empire, Baltic Germans had retained their traditional positions as the political and professional elite of the Baltic provinces. Eero Medijainen (University of Tartu) examines the establishment of formal relations between Estonia and the US following de facto recognition. By bringing Wilson's perspectives and politics to the forefront, including the concept of self-determination, Medijainen investigates how Wilson's policies played out in the Estonian delegation's attempts to gain recognition. The article highlights Estonia's economic, political and diplomatic position, while the US focused mainly on issues related with Russia and Germany.



Eriks Jēkabsons (University of Latvia) analyses parallel events in respect to the pursuit of recognition of Latvia. While Wilson's principles themselves could not help Estonians and Latvians achieve what was hoped for, their position, politically, diplomatically and economically, was a crucial factor in determining the future of Europe. Side-by-side the articles by Medijainen and Jēkabsons provide a comparative element to the special issue, before Sandra Grigaravičiūtė (Genocide and Resistance Research Centre of Lithuania) presents a thorough analysis of the phenomenon of recognition from the perspective of Lithuanian historiography. Grigaravičiūtė appraises various recognitions extended by the US and other states to Lithuania between 1919 and 1924 and endeavours to identify de facto and de jure recognition within the meanings, valuations and contexts of international law. Finally, Eva Piirimäe (University of Tartu) brings the special issue to a conclusion with an afterword that combines findings from the various contributing authors. By developing a dialogue between recent studies of self-determination and its application in the Baltic context, Piirimäe interprets how current scholarship frames recognition practices in Baltic history.

The special issue is freely available on the website of the journal.<sup>60</sup>

| Marek Tamm, Editor-in-Chief

### Oil Shale

The oil shale industry was founded in Scotland where, in 1694, oil was produced by heating Shropshire oil shale. The use of oil shale has undergone many changes throughout its long history and can be used for several purposes: to obtain heat by direct combustion (such as the generation of electricity), to produce shale oil and as a source of other valuable chemicals.

Energy has quickly become one of the key global challenges in the 21st century, with both its core purpose and its real and potential side effects garnering considerable importance in today's political decision-making. In envisioning a global future, we cannot ignore the political, environmental and social issues related to energy production and consumption. Our decisions today will have a long-term impact on the environment and consequently on generations to come. Therefore, we must do our utmost to



<sup>60</sup> [https://kirj.ee/acta-publications/?filter\[issue\]=1267&v=a57b8491d1d8](https://kirj.ee/acta-publications/?filter[issue]=1267&v=a57b8491d1d8)

ensure a more efficient, available and competitive energy supply and demand. We simply cannot afford energy at any cost. It means that we must fully take on board environmental and socio-economic factors.

*Oil Shale* is the only journal in the world that primarily specialises in matters related to oil shale. The first issue was published in April 1984, and English became the medium of the journal in 1992. In 2022, *Oil Shale* published 19 articles with researchers from Estonia, China, Morocco, Saudi Arabia, Jordan, Mongolia and Kazakhstan.

All the published articles are engaging and contain new knowledge in the areas of oil shale thermal processing, mining technologies, environmental issues, new oil shale deposits and more.

As an example, we would like highlight the article entitled ‘Comparison of the ecotoxic properties of oil shale industry by-products to those of coal ash’, which was written by researchers from Tallinn University of Technology and was published<sup>61</sup> in the first issue of 2022. The article presents research that examines the hazardous properties of solid waste generated in the Estonian oil shale industry in light of the requirements of European directives. The properties of the resulting ash streams are analysed, and the results obtained are compared with those of coal in order to comply with common practice. As a result, the studied oil shale ash samples had a very similar composition and properties to coal and, as a result of a larger survey, oil shale ash and other oil shale heat treatment residues have not been classified as hazardous waste in Estonia since the beginning of 2020, thereby initiating policy changes that affect most economic sectors.

| Andres Siirde, Editor-in-Chief

### The most exceptional article in *Trames* in 2022

Selecting the most exceptional article from those published in *Trames* in 2022 was difficult. The study of Ukrainian Epiphany carols or *shchedrivka*-songs based on ancient magic and the discussion of Feng Zikai who lived and worked in socialist China and whose life and creations could be compared to those of Uku Masing were excellent. The article about the language policy of families of Ukrainian origin in the Estonian educational space as well as the legal analysis surrounding the Russian jet downed by Turkey on 24 November 2015 were both remarkable and educational.

After extensive consideration, I selected Academy member Jüri Engelbrecht and his Croatian colleague Ivo Šlaus’s discussion of the increasing role of academies

61 Lees, H., Järvik, O., Konist, A., Siirde, A., Maaten, B. 2022. Comparison of the ecotoxic properties of oil shale industry by-products to those of coal ash. *Oil Shale*, 39(1), 1–19, doi: 10.3176/oil.2022.1.01.

of sciences in the contemporary world as the most exceptional of all the articles published in *Trames* in 2022.<sup>62</sup> The authors claim that the members of both national and international academies are the best scientists and scholars and their responsibility is to promote knowledge. The basic principles of action in academies include independence of thought, excellence and authority. The complexity of the world requires cooperation that strengthens the production and dissemination of knowledge. The thesis of the article by Engelbrecht and Šlaus is Albert Einstein’s view that, ‘The temple of science is a multi-faceted building’. This expression contains a metaphorical comparison – science shines like a multi-faceted diamond, offering new insights when viewed from different angles.

| Urmas Sutrop, Editor-in-Chief



A poster from the conference held on 26 May 2022, depicting the covers of the first editions of the journals of the Estonian Academy of Sciences. Designed by Maria Muuk.

62 Engelbrecht, J., Šlaus, I. 2022. Academies of sciences in the contemporary world. *Trames*, 26(76/71), 131–139, doi: 10.3176/tr.2022.2.01.

# COOPERATION

## SCIENCE IN THREE MINUTES, OR THREE HUNDRED PRECISELY TARGETED WORDS FROM THE YOUNG, THE BRIGHT AND THE SMART

*Piret Suurväli, main organiser*

The Estonian Academy of Sciences has been staging contests of scientific presentations that last for 3 minutes since 2015. The final round of the sixth consecutive contest took place in 2022.

The main aim of the contest is to offer young scientists a professional training and practical experience in public speaking and presenting their research. Another important goal is to foster the development the Estonian language of science and science communication.

Young scientists have to talk about their research that has lasted for years in a relevant and understandable way within the allotted three minutes. As one of the initiators and leaders of ‘Science in Three Minutes’ and the President of the Estonian Academy of Sciences, Tarmo Soomere, said: it is increasingly important for students to learn to present their thoughts in a concise manner that is understandable to broad audiences, with substantive precision and technical perfection, even while they are still studying to become scientists. ‘Three minutes is a long time for listeners. This must include an explanation of why the research has been undertaken, a description of the progress made and how the results contribute to society.’

The contest is comprised of five parts:

- The internal contests of the participating institutions, where those who will go on to the finals held by the Estonian Academy of Sciences are determined;
- Professional presentation training for the finalists;

Photo: Aavo Kainne



- Contestants to write a popular science article about their research under the instruction of a journalist of Estonian National Broadcasting’s science website *Novaator*. This format helps young people hone their skill of expression and sharpen the focus. Last year’s articles were published on *Novaator* from 31 January to 10 February 2022;
- A gala where the polished three-minute presentations are delivered and the five winners are selected by the jury;
- TV-quality videos of the winners’ talks, to be aired on Estonian National Broadcasting.



The doctoral students and young scientists who took part in the finals represented the Institute of the Estonian Language, the Estonian Academy of Arts, the Estonian University of Life Sciences, the Estonian Academy of Music and Theatre, Estonian Business School, the National Institute of Chemical Physics and Biophysics, Tallinn University of Technology (TalTech), Tallinn University and the University of Tartu.

Estonian National Broadcasting is the cooperation partner of the contest. Various important components of the contest are financed by the European Regional Development Fund via the TeaMe+ programme.

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The Finalists of the 2022 edition of ‘Science in Three Minutes’ contest:

<b>ERIK ALALOOGA</b> Estonian Academy of Music and Theatre	Application of bricolage as a process method in post-dramatic theatre
<b>KARIN BACHMANN</b> Estonian Academy of Arts	Rich city, poor city
<b>TAAVET JANSEN</b> Estonian Academy of Arts	Virtual is also real
<b>MIRIAM KOPPEL</b> University of Tartu	Storing hydrogen – a key to a greener future
<b>ROBERT KRAUTMANN</b> TalTech	Solar batteries to power the components of Internet of Things
<b>PILLE-RIIN MEERITS</b> University of Tartu	How we could support children’s active recreation in free time
<b>KADRI METTIS</b> Tallinn University	Mobile outdoor studies in a dispersed learning environment
<b>RENEE PESOR</b> Estonian Business School	Large corporations losing millions
<b>MARI RASVA</b> Estonian University of Life Sciences	Concentration of land use
<b>LEENU REINSALU</b> Institute of Chemical Physics and Biophysics	Where does a tumour get its energy from?
<b>LYDIA RISBERG</b> Institute of the Estonian Language	Studying the meanings of words helps language planning keep up to date
<b>JASPER RISTKOK</b> University of Tartu	A new source of energy: nuclear fusion reactors
<b>ALINA ROŠTŠINSKAJA</b> University of Tartu	Artificial intelligence as a new helper in children’s neuro-rehabilitation
<b>LINDA HELENE SILLAT</b> Tallinn University	Focus on digital competence
<b>TIIA SÕMER</b> TalTech	Modelling cyber crime



The 'Science in Three Minutes' jury. From left: Elmo Nüganen, Anu Saagim, Karmen Joller, Annelly Akkermann, Tarmo Soomere, Andro Mänd ja Rein Veidemann.

The 2022 jury members: the President of the Estonian Academy of Sciences Tarmo Soomere, member of the *Riigikogu* Annelly Akkermann (Minister of Finances October 2022–April 2023), family physician Karmen Joller (member of the *Riigikogu* from April 2023), President of the Estonian Association of Architects Andro Mänd, actor, theatre and film director, Academy member Elmo Nüganen, *Õhtuleht* journalist Anu Saagim and literary scholar and Professor Emeritus Rein Veidemann.

The host of the gala evening was the Head of the Cultural Department of Estonian National Broadcasting Erle Loonurm.

The jury's job was difficult – choosing the best from amongst the best took a record amount of time.

ANNELLY AKKERMANN: It was very intense. We kept choosing and re-choosing. And then reverting back...

ANDRO MÄND: I can't say that we just made our choice and that was that, end of. As Annelly said – choosing and re-choosing. It wasn't the easiest of tasks.

REIN VEIDEMANN: All those fine details. We don't know how much of it is the skills of presentation and how much is something they themselves have done. Weighing these things up took time.

KARMEN JOLLER: Of course, it was difficult. They are all bright, smart people. One of my criteria was that

the presenter should be able to make a very complicated topic very simple. They were all able to do it in essence, but some of them stood out particularly clearly.

ANU SAAGIM: I had several favourites. I was able to make a valid contribution and I'm very happy about that. I never give in.

ELMO NÜGANEN: To those who didn't make it into the top 5 – don't feel discouraged! You are already streets ahead of ordinary Estonians. Congratulations! You were all very good!

TARMO SOOMERE felt that the jury stayed discussing the presentations at the table alone, knowing very well that Anu Saagim actually had fifteen favourites.

As the jury's spokesperson, he noted some general aspects that the jury highlighted. It was extremely pleasing to see that the technical level of the presentations has become increasingly consistent. In previous years, the first two or three or four could be picked out eyes closed, but that was no longer possible this time round. The structure of all the presentations was extremely professional. This is also due to Jaan-Juhan Oidermaa's contribution. It was very heart-warming to see that a link to the problems of society was established right at the beginning of all the presentations. In many cases, the presentations contained



even more hooks to keep the listeners and viewers engaged.

It seemed that what the young scientists themselves had done during the research tended to remain in the background at times, compared to the articles published on *Novaator*. It's a matter of choices. I would very much like to know exactly what you did with your own head or hands.

It is, of course, important to connect with the listener. But this should not take up half of the presentation. If you only have 180 seconds to use, the introduction should be 40 seconds at most. None of these things reduces the value of the presentations.



Following painstaking discussions, the jury's winners were:

Erle Loonurm and Jaan-Juhan Oidermaa

**Karin Bachmann** (Architecture and Urban Planning)

**Jasper Ristkok** (Physics)

**Robert Krautmann** (Materials Technology)

**Alina Roštšinskaja** (Paediatrics)

**Leenu Reinsalu** (Gene Technology)



Photo: Aavo Kaine x3

The best five of Science in Three Minutes. From left: Robert Krautmann, Jasper Ristkok, Leenu Reinsalu, Alina Roštšinskaja, Karin Bachmann.

Leenu Reinsalu was voted the people's favourite on Estonian TV and on the *Novaator* website.

In six years, 103 young scientists have taken part in the 'Science in Three Minutes' training and contest. We asked them what the experience gave them.



## Some feedback from participants: What did Science in Three Minutes give to you?

The experience of performing was the most important. Preparing the lecture, or the skill to present your research topic to others in as simple, compact and engaging a way as possible was also very useful.

I gained self-confidence from the training in particular. The finals did not necessarily benefit me other than giving me experience in front of the camera. The training and feedback from the whole process were very professional. I also highly value the cooperation involved in preparing a popular science article. I found the process enlightening and it gave me several valuable professional contacts.

The contest gave me the experience of giving the lecture in front of an audience different to an ordinary research audience.

A clear understanding of how to talk about my research in Estonian. I gained more confidence that the work I'm doing is an important area of research. I also learnt many interesting things from other finalists. My family also got more of an insight into what I'm researching, along with my colleagues.

A new performance experience in an entirely new environment. I listened to the presentations of the other finalists with great interest. To convey the essence of your work in three minutes is a lot more complicated than it may seem at first.

I overcame the anxiety of public speaking, and I learned to articulate more clearly and speak more expressively. My self-confidence and self-belief improved and I was more self-assured while defending my doctoral thesis. Some companies were even interested in introducing the research topic to the market and in the product.

I discovered that I am capable of speaking in an interesting manner about my research to a broader audience and

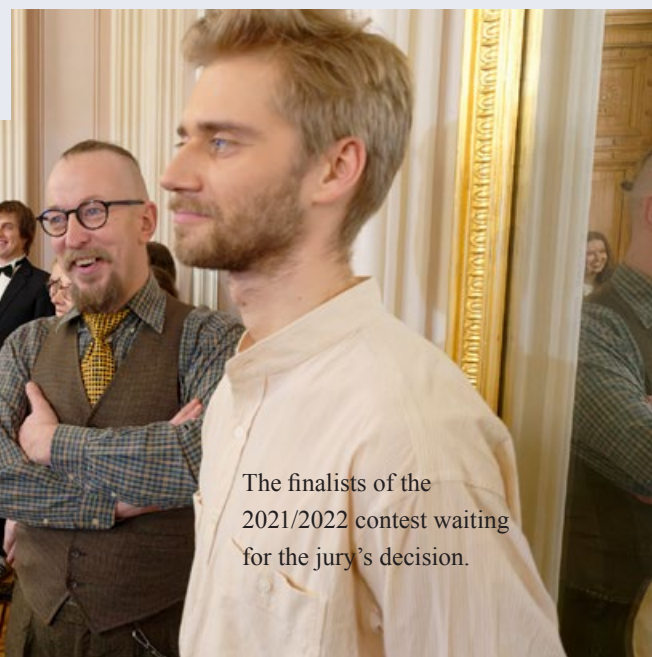
I obtained the skills to do it even better. Participating in this process also made me think of why we are involved in research in the first place and how it benefits society. I gained the reassurance that it is possible to talk about any research topic in an exciting manner. You just have to find the right level and the exciting angle.

Participating in the process really developed my performance skills and self-esteem. In the course of preparation, I was forced to think in an entirely new angle about why I'm focused on my topic and what the broader objective of my research is. It also helped me in giving meaning to my everyday work, as after years of working on the same thing you often fall into a routine and the initial enthusiasm fades. Before the contest, I completely avoided public speaking, but now I enjoy it. Since the contest, I've had an incredible number of opportunities and offers to talk about my work. All the positive feedback I received has been really motivating, and it has given me the sense that I'm doing the right thing. I want to achieve even more in the area.

The most significant challenge was to translate complicated research into a language that was understandable for ordinary people.

A great experience in performing on a live TV show. Honest and fair feedback on my public performance and great recommendations for improvement. Thanks to the contest, my research gained public interest despite the fact that I didn't win. I also met doctoral students working in other fields of research.

Performance skills, feedback on my presentation, good experience and recognition. I really liked the organisation side of the event, with its training and rehearsals. Tough in training, easy in battle. The organisers were very helpful and supportive.



The finalists of the 2021/2022 contest waiting for the jury's decision.

Photo: Aavo Kaine

# INTERNATIONAL YEAR OF BASIC SCIENCES 2022–2023

*Arvi Freiberg, Academy member, Estonia's representative on the IYBSSD2022 advisory committee*

At the initiative of Honduras, a Central American country far from Estonia, and with the support of many other countries, the UN declared 2022 as the International Year of Basic Sciences. The pandemic postponed the opening of the initiative by half a year and so the event is being celebrated until the end of 2023. I do not have a good explanation for why such an idea was proposed by the largely agrarian Honduras, where more than 10% of the population of 10 million is still illiterate. However, it certainly marks a breakthrough in their ordinary way of thinking. An act which by its inspiring effect could be compared to Jakob Hurt's (1839–1907) popular slogan 'If we can't be a great nation in population, we can be a great nation in spirit!'. It is also testament to the universal influence of basic sciences in today's society. Indeed, evidence-based knowledge has been considered one of the primary drivers of the global economy since the 1980s. According to the Estonian Science Barometer,<sup>63</sup> nearly 90% of respondents agree with that viewpoint. A subsequent Eurobarometer study raised that threshold further.<sup>64</sup> In this light, the proliferating promotion of horoscopes, witches and soothsayers in our media remains entirely unreasonable.

The Year of Basic Sciences is a title that has been made easily quotable, but it does not unfortunately reveal its extensive objective. The full name of the initiative – The International Year of Basic Sciences for Sustainable Development (IYBSSD2022) – clearly refers to an urgent problem that requires a solution. The title also reflects the conviction or at least the hope that basic sciences will be able to offer successful solutions to yet another problem faced by humankind.

Alas, this optimistic hope may not come to fruition so easily. In order to discuss it any further, the general definition of sustainable development must be outlined. The public largely became aware of the complex thought construct via the UN Agenda 2030 document signed in 2015. Before that, only specialised experts were acquainted with the term. In short, Agenda 2030 is a guideline of responsible conduct for countries in the areas of economy,



Photo: Hendrik Osula

Arvi Freiberg

social relations and environmental protection for the coming 15 years. The specific activities are outlined by the 17 Sustainable Development Goals formulated in the document. These also include quite a few that are close to us: controlling anthropogenic climate change, increasing energy security, clean water, air and land suitable for growing food, life-long high-quality education, accessible healthcare and reducing gender inequality. Fine and noble causes, each and every one, but upon closer inspection they all may seem unfortunately impossible to fulfil at once. Let us, for instance, take green energy, for which we could easily use quotations marks. The erection of electric wind turbines requires concrete and large quantities of various metals. Both the construction and the mining industry are

<sup>63</sup> Ainsaar, M., Himma-Kadakas, M., Themas, A., Kõuts, R., Espenberg, S. 2020. Estonian Science Barometer (ETb). Tartu, University of Tartu, Estonian Research Council, [https://www.etag.ee/wp-content/uploads/2020/11/Eesti\\_Teadusbaromeeter.pdf](https://www.etag.ee/wp-content/uploads/2020/11/Eesti_Teadusbaromeeter.pdf).

<sup>64</sup> European Union 2021. Special Eurobarometer 516. European citizens' knowledge and attitudes towards science and technology, <https://europa.eu/eurobarometer/surveys/detail/2237>.

some of the most carbon emission intensive activities. In order to transfer electricity, new transmission lines must be built. This removes valuable farmland from use, forces animals and birds to change their usual habitats, etc. The same is true of nuclear energy – in a word, a situation that reminds us of the law of action and reaction that we learnt in physics at school.

The substantive measurability of sustainable development as a cluster goal was also a concern. The problem is serious, as science has no place in a world without agreed measurement units, measurement and comparison. Luckily, this bottleneck has largely been overcome,<sup>65</sup> and therefore it would be interesting to know how the 193 UN Member States have managed to fulfilled their established goals. The latest data and their dynamics in 2000–2021 are available online.<sup>66</sup> We can see that the Nordic countries, particularly Finland (score 86.51), have come closest to achieving the goal of 100. That might have been expected, but at least for me Estonia's high placing of 10th with a solid result of 80.62 was a pleasant surprise. For comparison, the last place in the table is 39.05. Therefore, ours is a remarkable result, which has gone entirely unnoticed by both our officials and the media. It is also important that we are in a wholly sustainable region, for our other Baltic Sea neighbours have also scored highly, with Germany being 6th, Poland 12th, Latvia 14th, Lithuania 39th and Russia 45th.

In terms of achieving the goal, both the current level and the course of achieving it – or the dynamics – are important. It is namely the dynamics indicator that betrays the formerly well-kept secret. Should the observed pace of development continue, there is no way the established goal can be achieved! Instead of the required considerable acceleration, the pace of development of all countries at the top of the table will instead decrease. Experts have doubtlessly noticed this worrying trend, and hopefully also analysed it. Non-experts can only ask: have we at last reached the limit of growth defined by Earth's finite resources? And can we only talk in terms of a sustainable decrease in the future instead of sustainable development?

Yet, a scientific worldview brings with it the obligation to doubt and demand explanations. First of all, about the information on the basis of which fundamental conclusions are drawn. All data are inaccurate to a degree. We must be aware of such limitations and take these into account. Specific rules (of statistics) must therefore be adhered to in obtaining watertight information. The figures received

65 Xu, Z., Chau, S. N., Chen, X., Zhang, J., Li, Y., Dietz, T., Wang, J., Winkler, J. A., Fan, F., Huang, B., Li, S., Wu, S., Herzberger, A., Tang, Y., Hong, D., Li, Y., Liu, J. 2020. Assessing progress towards sustainable development over space and time. *Nature*, 577(7788), 74–78, doi: 10.1038/s41586-019-1846-3. Erratum: 2021. *Nature*, 592(7856), E28.

66 <https://dashboards.sdindex.org/rankings>



from individual countries must not only be mutually comparable; they must also be traceable to source data. Unfortunately, these elementary requirements of reliable data processing have not been fully applied in assessing sustainable development, starting from the submission of data being voluntary for countries to every country being free to use the data gathered and process it according to their own methods. Thus, the aforementioned table only contains 163 completed lines. The lines of as many as 30 countries are empty.

We should also point out that the reported data are full of holes, which can only be partly explained by innocent ignorance. These include the long-ignored impact of changes in the ground albedo caused by methane, aerosols and intensive construction activities on the climate. An unacceptable number of aspects depend on political choices and/or direct business interests. For instance, global statistics do not take into account the carbon footprint of armies. Either in peace-time or in times of war. In the assessment of M. A. Rajaeifar et al.,<sup>67</sup> even peace-time pollution is comparable to the pollution caused by aviation and shipping combined. The former US Vice President Al Gore has criticised the fact that as many as 52 UN Member States have not submitted any data about their emissions over the past decade, and the reported data and verified data differ nearly twofold.<sup>68</sup> It is not hard to guess which way.

The above examples are signs of the incomplete work of the most authoritative global organisation. The inherent readiness of that association to make all kinds of compromises forces us to make rushed and superficial decisions, which unfortunately may well become apparent someday in the future. Despite this, the efforts made must be assessed positively, as otherwise we would know even less about global processes. Unfortunately, arbitrary manipulations

67 Rajaeifar, M. A., Belcher, O., Parkinson, S., Neimark, B., Weir, D., Ashworth, K., Larbi, R., Heidrich, O. 2022. Decarbonize the military – mandate emissions reporting. *Nature*, 611(7934), 29–32, doi: 10.1038/d41586-022-03444-7.

68 Gore, A. 2022. Measure emissions to manage emissions. *Science*, 378(6619), 455, doi: 10.1126/science.adf5788.



can be found at all levels of power. It may seem utterly inconceivable, but in the Republic of Estonia data concerning state forests are classified, even for scientific research purposes.<sup>69</sup> Therefore, there must be something to hide, as good scientific practices include sharing and not hiding data.

A narrower objective of the Year of Basic Sciences is the sustainable development of humankind by way of promoting education and research and ensuring this by creating equal opportunities on the global north-south

69 Sims, A., Kiviste, A., Lang, M., Kangur, A., ed by Pajuste, M. 2021. Online edition of *Õhtuleht*, 31 March 2021, 12:50, <https://loodus.oh tuleht.ee/1030148/riikliku-avaliku-uuringu-salajasuse-vajalikkuse-paradoks-ehk-miks-on-meil-vaja-just-sellist-statistilist-metsainventuuri>.

axis. A significant amount of information about the Year of Basic Sciences is available on the central website.<sup>70</sup> You can read more about the events of the Year of Basic Sciences in which the Estonian Academy of Sciences has taken part on the Academy's website.<sup>71</sup> In order to support the achievement of the UN Sustainable Development Goals by 2030, the recent meeting of the IYBSSD2022 Advisory Committee discussed the possibility of declaring a Decade of Basic Sciences, similarly to the Decade of Ocean Science.<sup>72</sup>

70 <https://www.iybssd2022.org/en/home/>

71 <https://www.akadeemia.ee/en/events/alusteaduste-aasta/>

72 <https://oceandecade.org/>

## COMMITTEE ON EDUCATION OF THE ESTONIAN ACADEMY OF SCIENCES

*Academy member Jakob Kübarsepp,  
Chairman of the Committee*

In 2022, the Committee of Education of the Estonian Academy of Sciences started its work. The main aim of the Committee is to act as a broad-based, independent body of experts based on best practices in the area of education, to provide assessments and recommendations on challenging issues and to thereby participate in shaping Estonian education policy in cooperation with the Ministry of Education and Research and other stakeholders.

The area of activity of the Committee covers all levels and types of education, including primary, basic and secondary education (both general and vocational secondary education), all three levels of higher education, adult education and continuing education as well as lifelong learning as the focus of the Education Strategy 2021–2035.

The 17-member Committee includes members of the Academy of Sciences, researchers from Tallinn University and the University of Tartu, and heads of schools, including a representative of the Estonian School Heads Association. The first two meetings held in 2022 mainly addressed three very topical issues in the area of general education in Estonia today: STEM<sup>73</sup> education in basic school and secondary school, language(s) of the study at general education schools, the future supply of teachers and lecturers, and the related bottlenecks.

73 STEM – Science, Technology, Engineering and Mathematics – ed.

## THE MINISTRY OF FOREIGN AFFAIRS CONTINUES COOPERATION WITH THE ACADEMY OF SCIENCES IN THE AREA OF ARCTIC RESEARCH

*Erle Rikmann, scientific adviser at  
the Ministry of Foreign Affairs*

The Estonian Ministry of Foreign Affairs has applied for additional funding from the state budget for the development of important research topics pertaining to its field. Arctic research is one such topic. The Arctic will have an increasingly important role to fulfil in the future, against the backdrop of a changing world order. This makes it necessary to develop the study of the regions surrounding the North Pole and take part in international research cooperation in that field.

Estonia is interested in having a say in matters related to the Arctic in terms of both geographical location and geopolitical situation. This means there is a need to increase knowledge about the Arctic region in Estonia as well as the visibility of Estonian researchers and scientists with regard to topics pertaining to Arctic research. At the end of 2021, Estonia did not have any research groups that were primarily focused on the Arctic. A number of scientists worked in this area in different disciplines and universities, and bringing them together to work on common topics required separate financial support.

The interest of Estonian scientists in Arctic and polar research has for years been reflected in the work of the Polar Research Committee of the Academy of Sciences. The capability of our scientists to contribute to this field was vividly demonstrated in the preparation of Estonia's application for Observer status on the Arctic Council. As several universities that are engaged in Arctic research are interested in cooperating with Estonian researchers, the

Ministry of Foreign Affairs and the Academy of Sciences decided to announce a contest for creating two thematic researcher professorships focused on Arctic-related matters in the spring of 2022. The aim was to bring together research groups focused on Arctic studies. On the basis of the experience obtained, the Ministry of Foreign Affairs finds that partnership with the Academy of Sciences has worked well and the work undertaken to date must be continued.

In June 2022, Professor **Lauri Laanisto** from the Estonian University of Life Sciences and Associate Professor of Ethnology at the University of Tartu **Aimar Ventsel** were elected as **heads of Arctic research professorships for the 2022–2023 period**.

The research group of **Lauri Laanisto** will study the connections between the diversity and productivity of plant communities in the course of a long-term permanent experiment within the framework of the extensive NutNet research project on Spitsbergen. Thanks to particularly rapid climate change, polar regions have become our best source of knowledge about the impact of these changes.



Photo: Reet Kõikk

Signing the contract with Lauri Laanisto on 21 June 2022. From the left: Academy President Tarmo Soomere, Lauri Laanisto, and the then Vice-rector for Research and now Rector of the Estonian University of Life Sciences Ülle Jaakma.

The research group of **Aimar Ventsel** will concentrate on the representative organisations of the indigenous people of the Arctic and their activities. The aim is to establish an adequate overview of the role of scientists in the activities of these organisations, the projects and cooperation formats of the organisations of indigenous Arctic peoples, and of Estonia's opportunities to cooperate with these organisations.



Photo: private collection

Aimar Ventsel

*Tarmo Soomere,  
President of the Estonian Academy of Sciences*

The positions of researcher professors at the Academy of Sciences were established in 2002 for scientists who are internationally recognised in their field and who would be available to focus temporarily on research and the supervision of young researchers. For more than 20 years, researcher professors have been individually selected from esteemed scientists. The Academy assessed the candidates' qualification and research programme, but it did not intervene in the selection of topics. This approach has allowed more than 20 scientists to intensively and fruitfully work on a set of problems of their own choosing for three years. Several cycles of works that have been completed in this way have been considered worthy of the National Science Award.

Nearly eight years ago, the Academy found that it would also make sense to apply such an efficient practice to topics and tasks that stem from the needs of the state. In this way, top-level scientists could be inspired to focus on tasks that are of strategic importance from the viewpoint of the development of science or a specific area, and for which financing from other sources is difficult. This would also allow us to fill gaps in the research landscape or encourage scientists to specialise in prospective areas that are still in a phase of development. This approach also has a more

general meaning: in order for us to realistically hope to gain a place among the richest countries in the world, we need to engage cutting edge science in solving tasks faced by the state and society in general. In other words, we must shorten the time from obtaining research results to their actual utilisation, i.e. innovation.

This idea was brought to life thanks to the additional funds allocated to ministries in the framework of the National Agreement on Research Funding concluded in 2018. Extending the corps of researcher professors for research required by different ministries offers a unique opportunity to engage the best academic competence in solving matters important for the Estonian state, direct the state's needs-based orders promptly to the research system, and bring top-level scientists closer to actually serving society.

The new statutes of researcher professors that entered into force in spring 2022 have established the option of selecting thematic researcher professors for the Academy. Professorships are created for at least one year. The circle of tasks is formulated in agreement between the Academy and the financing organisation. The Academy offers its experience in finding the best candidates for such research, motivating them and analysing the level of results.



# SCHOLARSHIPS AND RECOGNITIONS

## THE SIX ACADEMY MEDALS

The medals of the Estonian Academy of Sciences<sup>74</sup> are bestowed on individuals for either exceptional service in contributing to the development of Estonian science or a significant contribution to the fulfilment of the goals of the Estonian Academy of Sciences.

The original concept behind the recognitions is simple: it symbolises the highest honour to people who have achieved considerably more than prescribed in their employment contract or job description. Unlike the Academy's memorial medals which are awarded for excellent achievements in science, one's scientific qualification or the level of citation is not very important here.

At its General Assembly in April 2022, the Academy recognised the former chairman of the Management Board of the Estonian Research Council **Andres Koppel** who was awarded a medal for his persistent and fruitful work in concluding the Research Agreement.<sup>75</sup> Lengthy discussions over the reasonable level of state funding for research and development ended four years ago with the general acceptance that 1% of gross domestic product was appropriate. At that point, there was still a long way to go to achieve political agreement, however. Andres Koppel stood and acted at the front line. Thanks to his persistence, the Research Agreement was concluded in December 2018 with the participation of practically all the political stakeholders.

**The former head of the Academy Publishers Virve Kurnitski** was recognised for her tireless work in maintaining the quality of the Publishers' scientific journals.

<sup>74</sup> The Statutes of the Estonian Academy of Sciences medal and the full list of its recipients: <https://www.akadeemia.ee/en/academy/medals-prizes-scholarships/medal-of-the-estonian-academy-of-sciences-2/>.

<sup>75</sup> See p 78: [https://www.etag.ee/wp-content/uploads/2019/04/Estonian\\_Research\\_2019\\_veeb.pdf](https://www.etag.ee/wp-content/uploads/2019/04/Estonian_Research_2019_veeb.pdf)



Tarmo Soomere and Andres Koppel.

Pursuant to the Estonian Constitution, the state is not obligated to support the publication of research results. In particular, the state has no requirement to intervene in the work of peer reviewed scientific journals where the selection system is based on objectivity and quality. This places a special responsibility on those who are tasked with ensuring the quality of research publications.

Another four recipients of the Academy's medal were announced at the General Assembly in December.



Photo: Maris Krünvald

Virve Kurnitski



Photo: Hendrik Osula

Tarmo Soomere and Krista Aru.

The director of the University of Tartu Library **Krista Aru** received a medal for her long-standing efficient cooperation with the Academy of Sciences as well as for the development of a novel library network that supports education and the processing of the archives of Academy members at the University of Tartu Library.

**Mart-Olav Niklus** earned recognition for his translation of Charles Darwin's epochal *On the Origin of Species* (2012) and *The Descent of Man, and Selection in Relation to Sex* (2015) into Estonian. Mart-Olav Niklus has also made

a notable contribution to the development of the Estonian scientific vocabulary. The arrest and 16 year imprisonment of the biologist for demanding freedom for Estonia cut short his path as a scientist, which had barely just begun. However, he did not break and ultimately made a significant contribution to the world of science and Estonian culture despite his situation.

Tenured Full Professor at Tallinn University of Technology **Malle Krunk**s received a medal for her extensive efforts in increasing the visibility of female researchers,

Photo: Margus Ansu, Tartu Postimees, Scapix



Academy member Richard Villems (on the left) and Secretary General of the Academy Jaak Järv (in the middle) visited Mart-Olav Niklus (on the right) on 6 January 2023 to personally hand over the medal.

Photo: Reti Kokk



Tarmo Soomere handed the medal over to Malle Krunk at the Academy of Sciences on 13 December 2022.



inspiring young colleagues and her long-time contribution to the work of the L'Oréal-UNESCO scholarship assessment committee. Top-level science is still dominated by middle-aged white men. This is neither sensible nor sustainable. Small nations cannot afford to leave promising thinkers and creators in the background simply because they are of the wrong sex. This is one of the reasons why the Academy is contributing considerably to the screening of scholarships issued to talented female researchers, in particular, in a cooperation between the cosmetics company L'Oréal and UNESCO, which is ensuring a high quality threshold high and balancing the entire process.

A medal was also bestowed on scientific journalist and organisational manager of the Estonian Public Broadcasting's research portal *Novaator*, **Jaan-Juhan Oidermaa**. He was recognised for his contribution to the development of the portal and the organisation of the Academy's Science in Three Minutes lectures (see pp 52–56). He has built the portal and the work group behind it into a professional environment that covers research topics on a level comparable to the world's top popular science journals. A few

Photo: Hendrik Osula



Tarmo Soomere and Jaan-Juhan Oidermaa.

years ago, he brought an important new dimension to the Academy's Science in Three Minutes lectures by teaching the contest participants to write a popular science article based on their research.

## MEDALS OF EDGAR KANT AND KARL ERNST VON BAER

The memorial medals of the Estonian Academy of Sciences are bestowed on Estonian scientists who have achieved remarkable things in their area of research. There are eight such medals: the Nikolai Alumäe medal in informatics and engineering, the Paul Ariste medal in the humanities, the Karl Ernst von Baer medal in life and earth sciences, the Edgar Kant medal in social sciences, the Harald Keres medal in astronomy, physics and mathematics, the Wilhelm Ostwald medal in chemistry and related areas, the Karl Schlossmann medal in medicine and related areas, and from this year, the Alma Tomingas medal in the promotion of cross-sectoral synergy. These medals – the Academy's highest awards in the given areas – are bestowed seldom, and not more than once every four years.

At the Academy's General Assembly in spring 2022, the first Edgar Kant medal was announced and handed over to Academy member and Professor of International Business at the University of Tartu **Urmas Varblane** for his great work in the area of economics. The effect of his dazzling economic ideas and works extends beyond the teaching of students and contributing to the development of the faculty and University to decisions that have an impact on the future of the entire country.

Since 2007, the Karl Ernst von Baer medal has been bestowed on only three scientists: Loit Reintam in 2007,

Photo: Maris Krüvald



Urmas Varblane and Tarmo Soomere.



Ülo Mander in 2011 and Richard Villems in 2015. In December 2022, the Academy of Sciences bestowed the Karl Ernst von Baer medal on the Estonian biologist and ecologist, Academy member and Professor of the University of Tartu **Martin Zobel**. He has made a priceless contribution to biodiversity research, particularly through explaining the causes of that variability at both global and local levels. He has also invested an immense amount of his time and nerves into shaping and promoting the organisational aspects of science.

The Karl Ernst von Baer medal was handed over to Martin Zobel (on the right) by Academy member and Head of the Division of Biology, Geology and Chemistry Toomas Asser (on the left) at the Oecologicum House in Tartu on 27 February 2023.



Photo: Andrus Tennus

## THE MIHHAIL BRONŠTEIN AWARDS IN ECONOMICS WERE GRANTED FOR THE FIRST TIME

*Academy Member Urmas Varblane*

Academy member Mihhail Bronštein (23 January 1923 – 9 April 2022) was an outstanding economist, whose contribution to Estonia's development was wide ranging. After he passed away in spring of last year, his children expressed their wish to immortalise the memory of their father with an award for economists. In cooperation with the Academy of Sciences, a competition was announced in November last year for two awards in the area of economics with an award fund of 15,000 euros. This is an impressive motivator for economists and doubtlessly contributes to a broader introduction and appreciation of the activities of Estonian economists in our society.

The two awards, granted for the first time, drew 13 applications in total. A nine-member assessment committee was formed, chaired by Urmas Varblane. The submitted works were related to various areas of economics, such as macroeconomics and education economics, entrepreneurship, international entrepreneurship, culture economics, finance and other areas. Works were submitted from the University of Tartu, Tallinn University of Technology (TalTech) and the Bank of Estonia. The level of all the works was very good, which placed the committee in a difficult situation. After lengthy discussions, the committee

used the scope given to it by its statutes and granted two awards in equal amounts.

The two Mihhail Bronštein Awards in Economics were presented at a ceremony held in the Academy's hall on 23 January 2023, on the 100th anniversary of Mihhail Bronštein's birthday. The €7,500 awards went to Professor of Social and Cultural Studies in Economics at the University of Tartu Anneli Kaasa for the article cycle 'Cultural differences and the economy: steps towards a systemic understanding', and Professor of Macroeconomics at TalTech and Research Professor at the Bank of Estonia Karsten Staehr for the research cycle 'Macroeconomics of economic shocks in small open economies'.

Anneli Kaasa's research has helped systematise how we conceptually understand and measure cultural differences. This makes it easier to compare the results of different studies in the area of the impact of culture on various economic phenomena. Karsten Staehr's work concerns the main challenges that small open economies face.

In conclusion, it is quite remarkable that we now have a third award that the Academy grants partly or fully with the support of private capital. 'We are very grateful to the family of Mihhail Bronstein for financing this initiative,



Photo: Aavo Kaine

The awards were handed over on 23 January 2023, on the 100th anniversary of Mihhail Bronštein’s birthday. In the photo: member of the *Riigikogu* and Mihhail Bronštein’s postgraduate student Siim Kallas (the first on the left), President of the Academy of Sciences Tarmo Soomere (the third from the left), award winner Karsten Staehr (the fourth from the left), Mihhail Bronštein’s son Aleksandr Bronstein (the sixth from the left) and Urmas Varblane (the eighth from the left) with the members of the family of Mihhail Bronštein.

which emphasises his contribution to the development of economics and the independence of Estonia. It is quite assuring to know on whose shoulders the ones who see

farther than others currently stand,’ President of the Academy Tarmo Soomere commented on the establishment of the Award.

## ANTO RAUKAS SCHOLARSHIP

*Henri Ormus, Member of Board of Fermi Energia*

In cooperation between Fermi Energia and the Estonian Academy of Sciences, a scholarship named after Academy member Anto Raukas was established in 2022, with the goal of promoting the areas of specialisation of energy and physics and supporting the development of local young people and their potential future contribution to the future of energy and nuclear energy in Estonia.

Anto Raukas was one of the main founders of NGO Estonian Nuclear Plant and a firm advocate for Estonia to establish its own nuclear plant. He tirelessly explained to the society the need to diversify electricity production,

the importance of nuclear energy, and the environmental advantages and safety measures of a nuclear power plant.

The scholarship is intended for young Estonian people from the eastern region, as that area has historically been the pillar of the Estonian industry and energy sector. It is important for Fermi Energia to support the physics and energy studies of young people from the region because that is where there is strong potential to develop a small modern reactor and bring the Estonian energy sector into the 21st century.





Photo: Kristla Tamm

The scholarships of the first competition round were handed over at the meeting of the Academy's Committee on Energy on 21 February 2023. In the photo from the left: Member of Board of Fermi Energia Henri Ormus, scholarship recipient and student of mechanical engineering and energy processes control at TalTech Andrei Stepanov, and Academy member Martti Raidal.

The first competition round for the Academy member Anto Raukas scholarship was announced at the end of August 2022. In October, the committee chose three candidates from the Virumaa region, all of them first-year students at TalTech. The 1,600-euro scholarship was granted to:

- students of mechanical engineering and energy processes control, **Andrei Stepanov** and **Svetlana Ivanova**,

- student of electrical power engineering and mechatronics, **Aleksander Gamanko**.

The candidates' interest in studying science subjects and becoming engineers coupled with their willingness to contribute to the development of energy technology were the decisive factors in the selection of the scholarship recipients.

## NATIONAL RESEARCH AWARDS 2023

### LIFETIME ACHIEVEMENT AWARDS

**Mihkel Zilmer** – Professor of Medical Biochemistry at the University of Tartu

**Asta Õim** – linguist

### ANNUAL AWARDS

- *Award in the field of exact sciences for the research cycle 'The metageometrical basis of physics'*

**Tomi Sebastian Koivisto** – Associate Professor of Theoretical Physics at the University of Tartu Institute of Physics

**Luca Marzola** – Research Fellow at the National Institute of Chemical Physics and Biophysics

Photo: Birgit Püve



Asta Õim and Mihkel Zilmer at the national award ceremony on 20 February 2023.



- **Award in the field of chemistry and molecular biology** for the research cycle ‘Chemical energy production and regulation of mitochondrial energy transfer in pathologies’  
**Tuuli Käämbre** – Research Professor at the National Institute of Chemical Physics and Biophysics and Head of the Laboratory of Chemical Biology
- **Award in the field of engineering sciences** for the research cycle ‘Molecularly imprinted polymers: modern biomimetic sensing materials for medical diagnostics and environmental monitoring’  
**Vitali Sõritski** – Research Professor at the Department of Materials and Environmental Technology at the Tallinn University of Technology School of Engineering
- **Award in the field of medical science** for the research cycle ‘Interdisciplinary approach to neonatal sepsis’  
**Irja Lutsar** – Professor of Medical Microbiology at the University of Tartu Institute of Biomedicine and Translational Medicine  
**Tuuli Metsvaht** – Senior Physician and lecturer at the Department of Paediatric Intensive Care of the Clinic of Anaesthesiology and Intensive Care of Tartu University Hospital; Professor of Paediatric Intensive Care and Pharmacotherapy at the University of Tartu Institute of Clinical Medicine
- **Award in the field of geology and biology** for the research cycle ‘Anthropogenic environmental change and the health of wild animals’  
**Tuul Sepp** – Associate Professor of Animal Ecology at the University of Tartu Institute of Ecology and Earth Sciences
- **Award in the field of agricultural sciences** for the research cycle ‘The carbon dynamics in Estonian forest ecosystems affected by different management systems’  
**Veiko Uri** – Academy member, Professor at the Chair of Silviculture and Forest Ecology of the Institute of Forestry and Engineering of the Estonian University of Life Sciences
- **Award in the field of social sciences** for the research cycle ‘The impact of social changes and crises on health and health inequalities’  
**Mall Leinsalu** (leader of the research team) – Research Professor at the Department of Epidemiology and Biostatistics of the National Institute for Health Development; Associate Professor of Public Health Sciences at Södertörn University (Stockholm)  
**Rainer Reile** – Head of the Department of Epidemiology and Biostatistics of the National Institute for Health Development  
**Aleksei Baburin** – Researcher at the Department of Epidemiology and Biostatistics of the National Institute for Health Development
- **Award in the field of the humanities** for the research cycle ‘Political, military, legal and economic relations between the central authorities in Tallinn and Stockholm from the second half of the 16th century to the early 17th century’  
**Enn Küng** – Associate Professor of Estonian History (early Modern and Modern History) at the University of Tartu Institute of History and Archaeology

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## ESTONIAN SCIENCE COMMUNICATION AWARD

The Estonian Science Communication Award has been granted since 2006. The aim of the award is to recognise outstanding communicators of science and to inspire society to discuss and write more about science. The award is financed by the Ministry of Education and Research and bestowed jointly by the Estonian Academy of Sciences and the Estonian Research Council. The competition committee was led by Academy member Ene Ergma. This time, the winners were selected from 53 candidates.

The Tiiu Sild Memorial Lifetime Achievement Award for the long-standing systematic communication of science and technology was granted to Professor of Genomics and

Biobanking at the University of Tartu and the founder of the Estonian Biobank, Academy member **Andres Metspalu**. His name is directly linked to the inception and implementation of the Estonian population-based gene pool concept. Metspalu is also credited with the establishment of the area of specialisation of gene technology in Estonia. His long-standing contribution to the development of gene technology in Estonia and research communication has influenced society’s understanding of science and the importance of science. Metspalu’s work in research communication is, above all, related to explaining the importance of scientific results to politicians and increasing the knowledge of the wider public about genes and DNA.



The Science Communication Awards were handed over at the science communication conference ‘Science Communication Moves...’ organised by the Estonian Research Council on 11 November 2022. From the left: head of the award evaluation committee Academy member Ene Ergma, Andres Metspalu, and Minister of Education and Research Tõnis Lukas.

## *I was interested in humans*

*Andres Metspalu was interviewed by Marti Aavik, PR Adviser to President of Academy*

**2022 will be remembered as the year when Russia launched its full-scale war against Ukraine. You defended your doctoral thesis<sup>76</sup> at the Institute of Molecular Genetics of the Ukrainian Academy of Sciences in 1979. Why?** Mart Ustav (now Academy member – ed) and I wanted to defend in the area of molecular biology, but the University of Tartu only offered the option of defending in biochemistry. We were modern guys and wanted a new area of specialisation. The nearest places were Moscow and Kyiv. We did it in Kyiv in six months. I still have some acquaintances from that institute in Kyiv.

Some others moved west from Ukraine – to England, Switzerland, Sweden and elsewhere. We still work quite closely together with them too.

**What were the biggest differences between working in science behind the Iron Curtain and what you started seeing in the west?**

We did not have anything to work with in science; we had to build all our equipment ourselves. We had to isolate nucleic acids, ribosomes and different kinds of proteins. We did not have chemicals of sufficient purity.

We had Mart Ustav at our lab who had graduated from the chemistry department and he synthesised a few molecules for us. In 1975, Richard Villems (President of the Estonian Academy of Sciences 2004–2014 – ed) was already in Sweden, and he was able to bring us some reagents from there. We hired a man from an appliance factory who built equipment from our technical drawings. We had to do a great deal of preparatory work to be able to conduct an experiment.

<sup>76</sup> Andres Metspalu’s doctoral thesis ‘Interaction of 5S RNA, 5,8S RNA and tRNA with rat liver ribosomal proteins’. Supervisor Artur Lind.





Andres Metspalu was congratulated on receiving the Lifetime Achievement Award in Science Communication at the Academy of Sciences on 13 December 2022.

In 1984, Richard Villems finally heard that biocentres were being produced in the Soviet Union. He wrote a letter of application requesting one. It took some time, but we got it in 1985. There was loads of money, and we could buy anything we could think of. But all purchases were made through Moscow.

#### **From the west as well?**

It was all only western money. Ten million dollars over five years. We couldn't spend it all. Estonia became independent before that.

When I went to the US in 1981, there was more equipment in the labs, but the work was more or less the same. Of course, life here was not like it is now when I went in 1981. The US was like the dark side of the moon.

#### **During your first time in the US, did you have any teachers who influenced your later work?**

I was in two places, at Columbia University and then at Yale. One of my teachers, Joan Steitz, celebrated 50 years as a professor at Yale in August last year. They held a fancy conference for the occasion and invited me to speak as well. Joan Steitz herself had been a student of James Watson. She used to say that she was telling us what Jim had taught her. Her husband, Thomas Steitz, received a Nobel Prize for ribosome research in 2009.

For instance, the scholarship of the European Molecular Biology Organisation was rarely granted to anyone from the Soviet Union, but when Joan Steitz wrote a recommendation, I received that scholarship and quite a few others. I think that was the case, but I didn't actually see the letters myself. That helped a lot. We published research with her as well.

I don't think I was necessarily influenced by just that one person, but by the attitude in the US overall: the let's do it, let's get it done, no humming and hawing. I can't stand faffing about and discussing things for ages. I want to start doing things right away. That was a lesson I took from the US.

Things were the same with (Academy member – ed) Artur Lind. He was never on your back; he simply let you do things yourself, but you had to have results and get things done. In the US, I understood that 'let's do it, let's get it done' was the essence of the system. I still think that's the right way to do things. You must decide, do and get it done. Here, some people hesitate, thinking it may not work out. You have to focus more, then it works.

My first trip to the US was quite beneficial. Prior to that, I had been refused permission several times, but afterwards it meant a great deal to have post-doctoral studies at Columbia University and Yale University on my CV. In 1993–94, I spent nearly two years in the US,

*I was influenced by the attitude in the US: the let's do it, let's get it done, no humming and hawing. I can't stand faffing about and discussing things for ages. I want to start doing things right away.*

at the Baylor College of Medicine in Houston. That time, I went equipped with my own research idea.

In the 1980s in Tartu, we were not able to do much science, because we didn't have reagents and other necessary components. That decade was spent on studying what others did, and on building connections.

During the Singing Revolution, I spent most of my time in Germany. Things were at a standstill here; the old laws no longer applied and the new ones did not yet exist. In 1994, when I came back from the US, things started moving here. The Research Fund (Estonian Research Fund – ed) had been established and was beginning to offer grants. In 1995, it turned out that there was no screening of newborns in Estonia. Even East Germany had had it for quite a while by then. With the late Tiina Talvik we launched the screening of newborns for genetic diseases for which treatment existed. The first diseases were phenylketonuria and congenital hypothyroidism. Today, there is the equivalent of two classes full of kids going to school who would not be alive or would be severely disabled without that testing.

### **So a part of the Estonian miracle – a very steep decline in the number of newborn deaths – is partly thanks to you?**

Partly, yes, but there are many reasons for this miracle. These children do not die right away without treatment, but they have no brain activity; they are like bundles of living matter in a corner. All of them lived in orphanages and I remember that there was one employee for every child. Today, Estonia is testing for about twenty such diseases.

If we were to do DNA sequencing for newborns, we would identify a lot of many other diseases. About ten years ago, we started exome sequencing for the Health Insurance Fund here at the Biobank, but now it is done by Tartu University Hospital itself. The Biobank has, indeed, introduced new things in medicine.

It was very simple at first. All the knowledge came from the research lab. When we discovered something here, we were able to use it at the hospital on the very next day, as I was also the head of the hospital's molecular diagnostics centre. Now it is much more complex, what with all kinds of technology transfer agreements and other such.

As with children, we would all need information about our risks as adults. Then we could do something before we fall ill. All over the world, doctors are saying, 'we have enough sick people; don't bring us the healthy ones', but the thing is that you might be healthy today, but sick tomorrow and are halfway there today. We must place more emphasis on the prevention of diseases.

### **What prevents us from knowing our individual genetic risks and using these in medicine in Estonia?**

The biggest obstacle is the mindset. Treatment is great, a few lung or liver transplants a year, but this does not change public health. If we could do tests for 80 percent and then tell some to take pills to prevent diseases that would be a great change.

### **Is the technology ready for that?**

It is. Estonia needs a national strategy for personalised medicine. We need a plan until 2035; then we could also determine what investments are needed. But these are not very big investments at all. People are really interested in it. We have provided feedback to about 5,000 people in total. That has been a great success.

To date, 200,000 people have been genotyped. The rest of the people in Estonia should also be offered that and it should be done centrally. Doing it en masse is the cheapest.

The knowledge and technology is there; we simply now need the decision to start doing it en masse. We'll wait until after the elections and the new government can make long-term plans.

### **Your most cited articles are papers concerning blood pressure. Why is that?**

The research topics depend on who is paying. Cardiovascular diseases are the most common cause of death. Cancer is only in second place. Measuring a person's blood pressure is very easy, and then we can look for links in the genetic data. The most cited papers also concern the height of humans. Height is not a pathological phenomenon; it is easy to measure and we can study how genes influence a person's phenotype. To date, hundreds of genes have been identified, each of which has a small effect on height, and it seems that our studies have plateaued out – no more height genes are being found.

Coronary artery disease and other heart diseases are extremely fatal. Familial hypercholesterolemia, for instance, is not very common (about half a percent of the population has it), but it is quite an insidious disease. You don't feel anything until it is too late. Even the cholesterol and lipid values in the blood do not often show a major change; you only end up at the doctor's with it when it forces you to go to the Emergency Medicine Department, if you don't die first. With gene testing, we would learn of the risk early.



*Personalised medicine should extend one's healthy life years by at least ten years. We need to drive prevention more.*

**Now, after the COVID-19 pandemic, many countries have become concerned that the average lifespan is no longer growing. Could we get lifespan growth moving again with gene testing and personalised medicine?**

I don't think life length is the most important thing, but how many years you live without diseases. Many people are currently falling ill before they are even 60 years old and then live another twenty years with a disease. Those chronic diseases are very onerous on people and expensive for the state. As an indicator, the average lifespan depends more on children's mortality rate and epidemics. Personalised medicine should extend one's healthy life years by at least ten years.

We need to drive prevention more. When we look at the budget, not even two percent of the health insurance budget is spent on prevention in Estonia or in the US. We just put up posters telling people to smoke less and walk more, or carry out some screening projects. There has been no population-based mass screening; of course, this was not even possible in previous decades, as DNA-based methods have only recently become available.

**What does 'recently' mean here?**

In the past ten years. For the past three years, the European Union has run the Beyond One Million Genomes initiative,<sup>77</sup> funded by the EU. The aim is to introduce personalised medicine in all European countries. The Nordic countries and the Netherlands are moving slightly faster than southern Europe. Germany has a bit of a problem with personal data – people are afraid of data leaks. People want things in, say, Romania to be at the same level as in Finland. No one asks any longer whether we should do it, but how quickly it can be done. It is thought that the breakthrough will come within the EU funding period that lasts until 2027.

The Institute of Genomics has now received 30 million euros to establish a Personalised Medicine Centre together with partners. Half of that money is coming from the European Union.

I can see that what has been built is moving us forward in a positive way, and will see significant growth. The Estonian state actually provides very good support.

**Personalised medicine is only starting to reach ordinary people. At the same time, I have heard of links that at first seem unusual, such as a journey from Biobank to bioinformatics, and Wise, a company founded by a student of this field, that is worth billions.**

For it to work, we had to bring a man named Jaak Vilo (now Academy member – ed) back from England. He was working at the Wellcome Sanger Institute in the village of Hinxton near Cambridge, sitting in the same room as a Latvian. In 2000, I went to the Cancer Research Centre of Lyon as a visiting researcher. I was planning the Biobank at that time. Back then, the Lyon Centre had the largest gene bank in Europe, with more than 500,000 samples collected from 12 countries. It was clear even then that genetics would largely become mathematics. The only such specialist I knew was Jaak Vilo, who had defended his doctoral thesis in Helsinki.

I went to Cambridge to convince Jaak Vilo twice, before he agreed to return to Estonia. He built all the first information systems at the Biobank. True, the now well-known billionaire Kristo Käärman worked for him, developing some kind of new methods. Vilo had a very strong team.

*Genetics and informatics have grown in symbiosis. The advantages of a small university town come into play here. The atmosphere must be creative. People must communicate with each other, help each other and not build walls around them.*

It was important to find someone with a vision, but that on its own is not enough. There is a vision in every coffee room, but you must also have the capability to bring it to life. Jaak Vilo had both. He had a small room when he came back to Tartu compared with everything he has built since then, up to the Delta Centre.

Genetics and informatics have grown in symbiosis. The advantages of a small university town come into play here. In a big city, you maybe have to travel two stops on the underground to get to where the bioinformatics specialists are. Here, it was a ten minutes' walk. We all got along splendidly.

We had to find financing to bring him back, of course. Richard Villems was of great help in this regard. I invited another seven or eight people back from the west with the support of European grants. They are now all the heads of their groups and able to finance their activities by themselves.

<sup>77</sup> <https://b1mg-project.eu/ja> <https://digital-strategy.ec.europa.eu/en/policies/1-million-genomes>

*You also have to keep enlightening people about what they are doing and why. You have to open the eyes of the management of the faculty and the university, as well as the government. You won't get anything done on your own.*

Indeed, it is important to find people who want to achieve something and then let them act freely. You must create the conditions for it and that does not only mean money. You must have a vision towards which to work and in which everyone sees an opportunity to contribute. The atmosphere must be creative, and people have to communicate with each other, help each other and not build walls around them. The bigger a group grows, the more difficult it is to keep up to date. Sixty people is still easy, but with 160 the peripheries start to become distant from one another and find less in common.

Forming a creative team is decisive. You must have a common vector. I have always said that with the other 50% of the time you can go free-hunting – whatever you like. But the first 50% must be given to the common cause. People have developed all sorts of ideas. They may not necessarily be useful right away, but some ideas may change the entire world. Some people can't come up with any ideas. When you find those who can, you have to retain them.

You also have to keep enlightening people about what they are doing and why. You have to open the eyes of the management of the faculty and the university, as well as the government. You won't get anything done on your own.

In the early days of the Biobank, Jaanus Pikani had a very important role. As a doctor, he immediately realised what we wanted to do and what it would mean. Even when he still worked at the President's Office, he came here with Lennart Meri and saw that hard science was being done, but no one was applying it in medicine. He then invited a group of scientists to see President Meri in Kadriorg and asked what Estonia could do. All kinds of things were proposed.

We gathered at the hospital several times and held great discussions. I presented the Biobank idea. Many did not like the idea of a population-based gene bank. They wanted to focus solely on cancer patients, for instance. Now it is clear to everyone that a population-based gene bank is a very sensible thing to do. It was a difficult time and it took two years until we got our first sample.

Today, the situation is completely different and that kind of an idea would probably not be accepted at all in society.

### **Why? Are there more rules, bureaucracy?**

It actually started when Mart Laar's second government came to power in March 1999. He spread the word that he was awaiting ideas. Pikani came to me asking whether I had any. I wrote a page or page and a half for him. He took it to Isamaa or who knows where and came back saying that Laar had said that it was crazy enough; let's do it.

We then drafted a longer document and presented it to the government. Everyone was there. Only Jüri Mõis commented that at the bank they did things he understood, but this is some sort of ... As there were no other questions, it was all approved.

Then we needed to make a law. Dr Toomas Vilosius was the Chairman of the Social Committee of the *Riigikogu* and helped the venture along a lot. He ended up as Chairman of the Council of Biobank. Together, we went to Jüri Raidla who prepared the text of the Human Genes Research Act and said: 'You know, guys, I won't even charge you any money because this is such a cool thing.' Märt Rask was the Minister of Justice. He had a great pile of draft acts lined up in the *Riigikogu*, but he took our draft act and put it on the top of the pile. People came to help. This is still the case. Recently when we needed to collect 100,000 more samples, the team of the *Õnne 13* soap series included instructions in an episode as to how an elderly person could give a sample. They didn't charge anything for it. An advertisement was published on the front page of *Postimees*, for no charge.

People find that the idea is good and useful and are willing to help. Not everything is done for money. And this is great!

Now we're dealing with the medical sector, with contracts and more bureaucracy. I guess we should consider it natural that life can be quite conservative in ways. I don't remember those days, but older colleagues have told me how clinical chemistry came to be. Nowadays, it is natural that a blood test is done and the figures are automatically sent to the doctor.

I think that it will be the same with gene data. The doctor receives the data and sees that you have a risk of, say, glaucoma, and sends you to an eye doctor to measure your eye pressure. They prescribe drops or whatever is needed. If you have a risk of cancer, you're sent to the oncologist for a check-up. A family physician is quite familiar with his or her 2,000 patients, and can act as a guide, using gene data in making referrals.

With many things – the risk of diabetes, for instance – you need to change your habits. You can give a recommendation, but as nothing happens at once, the patient soon reverts to his or her old ways. We need support from family nurses in this matter. If the data show that the patient has not made more steps than from the sofa to the fridge for two weeks, the family nurse would remind them, saying:





‘For long-term storage, we keep tissue samples and white blood cells in containers filled with liquid nitrogen ( $-196^{\circ}\text{C}$ )’ says Academy member Metspalu.

‘Listen, Andres, are you sure you are seriously thinking about your diabetes – you could lose your leg this way?’ It wouldn’t take long for the patient’s lifestyle to change and in the end he or she wouldn’t get by without some physical exercise.

Some say that genes have been studied to such an extent that it is more interesting to focus on proteins. However, when your proteins are off, the disease is already so close that it is difficult to change anything. There are various -omics too, but they are all still at a research level. Genomics is something we can actually use.

Technologies are developing and new opportunities are arising, but if we are unable to explain their usefulness, people will not start using them. Now we have the problem that young educated people are not even vaccinating their children against measles. The internet is a double-edged sword. A small group of people can create a great racket against scientific information, and people no longer know whom to believe.

**When you are putting together a creative team, do you look for a weak spot and try to help it along, or do you always look for drivers, stars?**

I always want to hire personalities who have their own ideas. When I was still actively managing the whole thing,

I thought of myself as the conductor of an orchestra. We all have the same piece to perform. When the trumpets started to sound too loud and in the wrong place, I fired the trumpets.

**So gene science is a team game?**

I truly did fire some doctoral degree specialists. I told them they were not fit for this, that they did what they did very well, but they had to do it somewhere else. We have an ensemble and if you’re not yet the lead singer, you have to do what needs to be done. It doesn’t work that you are a trombone player and come complaining that the violinists can’t play properly. You have to focus on managing the trombone. I have had to fire people for the team to work.

You can start quickly on your own, but you make it much further with a team.

**The next layer is international consortiums. How complex is their management?**

If you have something to put on the table, people seek you out. In the old days, for instance, the Finns did not want to cooperate with us because we were too weak. They all came here and it was great. I proposed doing a joint project, but nothing came of it. When we had as many as 50,000 samples, and particularly now, when we have the data of 200,000 people, we’re being sought out for cooperation.

One of the reasons I started working on Biobank was, indeed, the fact that it was clear even before joining the European Union that we would have to compete with everyone. I thought then of our nation as being small, with a few scientists, a little money and not much to put on the table. In Iceland, Kari Stefansson created a biobank in 1996 and got several hundreds of millions from the Swiss pharmaceutical company Roche. I then thought about doing a public biobank in Estonia, not a corporate one. With this, we can compete for European research money.

I know many medical doctors. I started with one course and finished with another. I asked them to collect samples for me. They collected 30, and then ran out of steam. You can't do any research on the basis of that. A biobank with 200,000 samples is an entirely different matter. This is why we can publish as much as we do.

Unfortunately, I didn't think to collect microbe samples at that time. Luckily, a bright student, Elin Org, came back from the US and started doing that. And we managed to finance it. Microbes are an important part of what we do.

#### **Is microbiome genomics the new direction?**

Yes, Elin Org took it up. To date, two doctoral theses have been defended under her supervision and there will be more. A very talented scientist. She spent quite a long time at the University of California in Los Angeles.

New buds are opening here all the time.

In science, you have to somewhat foresee what is going to happen. When I got into human genetics, a four-year doctoral thesis was spent on one gene. I thought then that we would never put together a whole genome. We would need a method with which we could study many genes simultaneously. I then had an idea of how to do it. I wrote to a colleague of mine in Houston. He said, come here and let's do the tests. When I came back to Europe in 1994, there was a big conference in Paris. After my lecture, a queue built up; everyone wanted to talk to me. Everyone said that Andres introduced microarrays;<sup>78</sup> no one had heard of them before that. I can't even say why I had that idea.

#### **You received the Science Communication Award last year. Do you enjoy public speaking or is it a pragmatic activity?**

Pragmatic. Back in the 1990s, when we offered our chip technology to the Health Insurance Fund, a ministry official said: 'Andres, you have to explain to people what it is, because if they do not understand it they will never start using it.' So we had to start communicating.

Second, I saw in the US that funding depends on how well you are known. The committees that hand out money

*In 1981, I rode a bus in New York late one night. A lady on the front seat and the bus driver were discussing gene splicing. I wondered when we in Estonia would get to that point that ladies and bus drivers would know what 'gene' and 'splicing' meant.*

do not consist just of scientists, but also of ordinary smart people. It's an advantage if they have read something in the papers. One incident left a deep impression on me. In 1981, I rode a bus in New York late one night. A lady on the front seat and the bus driver were discussing gene splicing.<sup>79</sup> There had been an article about it on the science page of *The New York Times*. It was a new thing back then and I was working on it and that was why I wanted to go to Yale in the first place. I wondered when we in Estonia would get to that point that ladies and bus drivers would know what 'gene' and 'splicing' meant.

When we started screening children, we had to convince mothers to agree to us taking samples from the children. In the first year, we took less than 70%, but we had to reach 98%. We did that in the third year.

With simplification, you have to find a line that you still consider true, while people also understand what you're saying. I don't have an innate need to speak publicly and I don't go to places just for the sake of it. When we needed 100,000 new gene donors, there was no other option but to speak publicly.

#### **So the same rule applies to science communication: you have to start right away and get it done, no humming and hawing?**

What other option is there? Wait for someone to think of coming here to give a sample? Now, when he haven't advertised, we can see that nearly no one comes. Nothing happens by itself.

Women who have a high risk of breast cancer will soon be invited for mammography tests. With the current screening study, 30 to 40% do not bother turning up, but when the risk is individual, the majority will hopefully come.

People need to be educated and not just in the broadest sense. Doctors also need to be educated. In the old days, no one taught genetics.

<sup>78</sup> DNA microarray technology, see [https://en.wikipedia.org/wiki/DNA\\_microarray](https://en.wikipedia.org/wiki/DNA_microarray).

<sup>79</sup> Gene splicing, see [https://en.wikipedia.org/wiki/RNA\\_splicing](https://en.wikipedia.org/wiki/RNA_splicing).



I had a doctoral student who came to talk to me after one of my TV interviews and told me his grandma from Saaremaa had said: ‘Now I finally understand what you’re doing in Tartu.’ I was very happy to hear that I had spoken in such a manner that a grandma also understood. Colleagues think that I’m an idiot and don’t actually know more than I say on TV. That’s not true. You have to know a lot to speak plainly.

It is the same at international conferences where it’s impossible to ramble on. When you only have 15 minutes to talk, you must make an effort to make your point. I guess they like it, as they keep calling me back. When I organise

a conference, I always think whether a speaker is a good public speaker. Some do very good science, but cannot speak publicly. Some are very good speakers, but their science is only so-so. There are all sorts of combinations. Communication is an important part of science. In the old days, it was just writing articles – there weren’t many conferences. Today, we can communicate our message at conferences.

I recently noticed that the abbreviation ‘DNA’ and the word ‘gene’ are widely used in our media in all kinds of associations and as metaphors. This means that our ladies and bus drivers now also know what DNA is.

## L'ORÉAL-UNESCO BALTIC SCHOLARSHIP

**In 2022, the €6,000 scholarships of the L'Oréal-UNESCO Young Talents Baltic programme ‘For Women in Science’ went to Dr Ester Oras, who is studying ancient human dietary practices and their links to health, and Karolina Kudelina, who is creating an AI-based electrical equipment fault prevention system.**

Ester Oras, Associate Professor in Analytical Chemistry at the Institute of Chemistry of the University of Tartu and the head of the research team of the Archemy lab of the University, is using modern laboratory analysis methods to study the dietary practices and diseases of ancient humans. ‘As an arhaeochemist, I wish to demonstrate the impact of the historically developed dietary practices on our health and wellbeing in both the past and the present. I study clay pottery and human skeletons that are centuries and millennia old. Using archaeological material allows us to show how closely dietary habits and health are mutually intertwined, including, for instance, the impact of dietary practices on our physical appearance, the occurrence of metabolic diseases, changes in the microbiome or the development of long-term genetic mutations. Poetically speaking, we could say that I want to give the past a colour and flavour and bring history closer to all of us,’ she said.

Karolina Kudelina, a doctoral student/junior researcher at the Tallinn University of Technology Department of Electrical Power Engineering and Mechatronics and a member of the electrical



Ester Oras



Karolina Kudelina

Photo: Kaupo Kikkas x2

machinery research group, plans to use the scholarship to develop AI-based solutions to predict and prevent possible faults in electrical machinery that may cause financial damage and environmental problems and endanger human life. ‘Even the most modern electrical machines may sometimes break. In order to ensure the reliability of electrical machinery and avoid problems, constant monitoring and timely maintenance is required. Monitoring power systems is work intensive and requires considerable computing resources. It is reasonable to use AI-based novel diagnostic tools that are suitable for analysing big data. The research I am conducting integrates power systems with cloud data processing and proposes intelligent solutions for moving towards a digital, sustainable and climate neutral future,’ she explained.

The L’Oréal Baltic initiative ‘For Women in Science’<sup>80</sup> is the only support programme in the Baltic region that in cooperation with the UNESCO Estonian national committee<sup>81</sup> and the Estonian Academy of Sciences supports the professional development of female scientists and the achievement of goals that are important for them. The Baltic programme has evolved from the global ‘For Women in Science’ programme, which was created in cooperation between UNESCO and L’Oréal in 1998 with the aim of increasing the number of female scientists and promoting gender equality in the world of science.

80 Programme website [www.forwomeninscience.com](http://www.forwomeninscience.com).

81 Website of the UNESCO Estonian national committee <http://www.unesco.ee>.

## SPECIAL PRIZES OF THE PRESIDENT OF THE ACADEMY OF SCIENCES – THE $\pi$ -PRIZES – AT THE NATIONAL SCIENCE CONTESTS FOR HIGH SCHOOL AND UNIVERSITY STUDENTS

### *National science contest for school high students*

Since 2015, the Estonian Academy of Sciences has granted the Academy President’s special prizes for promising starts along the scientific path at the national science contest of school students. The winning research papers were selected by a committee that involved Academy members Jaak Järv, Kalle Kirsimäe, Valter Lang and Peeter Saari and members of the Estonian Young Academy of Sciences Karin Kogermann and Kerli Mõtus.

In 2022, the Academy prizes went to three upper secondary school students. Besides them, the Academy also recognised two papers by basic school students. The prizes were handed over by the Secretary General of the Academy Jaak Järv at the awards gala for the contest held at the Estonian National Museum on 13 April.

The 1st prize of  $\pi \times 200$  euros (628.32 euros): 12th grade student of Tartu Annelinna Upper Secondary School **Virginia Ždanova** for her ‘Statistical study of the cost of the international classic lottery Eurojackpot’ (supervisor Natalia Ivanova). In awarding the recognition, the Academy’s committee pointed out that the analysis of lottery results vividly demonstrates how statistics tidies up and explains a worldview blurred by random events and opens the links between the phenomena and processes related to such events.

Photo: Andres Teijs



Virginia Ždanova and Academy member Jaak Järv.



The 2nd prize of  $\pi \times 150$  euros (471.24 euros): 12th grade student of Tallinn French School **James Daniel Rock** for ‘Creating a book to prepare non-Estonian speaking children for kindergarten’ (supervisor Liis Reier). The evaluators noted that the paper contains a multi-faceted analysis of the language gap in the Estonian education system, which leads to significant conclusions and deserves attention and recognition. The author not only writes down the conclusions but takes a concrete step towards solving the highlighted problems by creating a book that helps prepare non-Estonian speaking children for kindergarten.

The 3rd prize of  $\pi \times 100$  euros (314.16 euros): 12th grade student of Miina Härma Upper Secondary School **Eetu Kalevi Heikkilä** for ‘Axis of rotation that minimises the volume of the rotating body’ (supervisor Hendrik Vija). The Academy’s evaluation committee highlighted that an interesting and clearly established problem had been resolved with the help of mathematical analysis. The author also explained the scope of use of the results obtained and proposed possible further developments.

The Academy also recognised two research papers by basic school students: 9th grade student of Tallinn Secondary School of Science **Liisa Grete Pürg** for ‘The language of the comments of articles on COVID-19 in *Delfi* and *Postimees*’ (supervisor Reet Varik) and 7th grade students of Aste Basic School **Karl Vapper** and **Siim Vatsfeld** for ‘Soil pants 2021’ (supervisors Ülle Soom and Inge Vahter).



James Daniel Rock and Academy member Jaak Järv.



Eetu Kalevi Heikkilä and Academy member Jaak Järv.





Photo: Andres Teiss x4

Liisa Grete Pürg, Karl Vapper, Siim Vatsfeld and Academy member Jaak Järv.

## National science contest for university students

From 1994 to 2015, the Estonian Academy of Sciences held a separate science contest for university students. Since 2016, the Academy has granted the President's special prizes at the national science contest for university students.

Academy members Marco Kirm and Lauri Mälksoo are members of the committee of the national science contest for university students, they are supported by various colleagues in selecting the best research papers.

In 2022, the Academy prizes went to three university students. The prizes were handed over by Academy member Krista Fischer at the awards ceremony held at the Ministry of Education and Research in Tartu on 13 December.

**The 1st special prize for research papers by doctoral and master's students for the most elegant student paper**  $\pi \times 1,000$  euros (3,141.59 euros): **Sille Remm** (University of Zurich) for the doctoral thesis 'Drug resistance mechanism characteristic of the *Mycobacterium tuberculosis* bacteria: a glance at the molecular mechanism of lipid export mediated by Rv1410 and LprG'.

The research paper provides a systematic, thorough and contemporary overview of the drug resistance mechanisms of the *Mycobacterium tuberculosis* bacteria that causes tuberculosis, with a focus on the structure of the cell membrane of the bacteria and the transport systems



Photo: Michèle Sorgentrai

Sille Remm

located in the cell membrane. The results obtained in this extremely work-intensive and high-quality study help us to understand antibiotic resistance mechanisms in the *Mycobacterium tuberculosis* pathogen that causes tuberculosis.

**The 2nd special prize for research papers by doctoral and master's students** for an unconventional student paper  $\pi \times 500$  euros (1,570.80 euros): **Juhan-Henrik Uppin** (Estonian Academy of Music and Theatre) for the doctoral thesis 'The formation of the traditional playing style of the Teppo type diatonic accordion in the 20th century and creating a traditionally informed performance practice'.

This doctoral thesis is the first of its kind in the history of Estonian ethnic musicology and sets the bar very high for future studies. The theoretical part of the creative study seeks answers to the question of how an individual performance style is shaped in folk or traditional music and how traditional playing techniques that have evolved over time in turn shape or help to shape the individual playing style of the instrumentalists of new generations. The main research methods included musical analysis and the self-analysis of the author as an instrumentalist. The author analyses the notation of audio recordings and tries to distinguish style elements stemming from the playing technique. The creative process and the performance practice were analysed using self-reflection.

The special prize for research papers by applied higher education and bachelor's students for auspicious scintillating sparks  $\pi \times 250$  euros (785.40 euros): **Mona K uuts** (University of Tartu) for the bachelor's thesis 'A leaf-inspired robot that combines an embroidered structure and the induced behaviour of ions'.

Wearable electronics is technology that is integrated into clothes, worn as an accessory or in direct contact with the human body, such as implants. It is a growing trend that is providing new solutions every year. The aim of the study was to develop soft fillers for wearable electronics, i.e. for a robe/textile robot. In her study, Mona K uuts solves the plant-inspired transpiration mechanism as a traditional embroidery. Instead of simply demonstrating embroidering as a robotic technique, she solves the biomechanical task by using fibres placed as an embroidery. The unique solution provides plenty of material for further technological development.

Photo: Henri-Kristian Kirsip x2



Academy member Krista Fischer and Juhan-Henrik Uppin.



Academy member Krista Fischer and Mona K uuts.



The monetary amount of the President's special prize is not a mere round figure. In our indicator-based world, figures often tend to dominate over substance – be it an impact factor of a magazine, a university's place in a ranking list or the number of citations. Although such figures also have their place, the Academy considers it important to preserve the ability to see beyond the figures, to notice something that is currently unmeasurable but may be a part of our future. It is as important to be able to think outside of the box, to do something that pokes the boundaries of our present existence.

That is where the criteria come from which the Academy intends to keep alive with the science contest for university students: elegance and unconventionality as aspects which unmeasurably add value even to very good science. As a combination of these concepts, two special prizes are awarded at doctoral and master's

degree level: one for the most elegant student paper and the other for an unconventional student paper. When speaking of obtaining new knowledge, we often use the metaphor of bringing something to light. This is why a special prize for auspicious scintillating sparks is awarded at the applied higher education and bachelor's degree level.

At the science contest for school students, the Academy highlights school students whose works shine with a promising beginning for a future path as a scientist.

The figure  $\pi$  (Pi), which is the basis of the prize amount, reflects a lot more than its basic definition or any near value. This kind of figure simultaneously expresses both the immense wealth of knowledge of the academic world and the unmeasurable amount of things we do not know.

## ESTONIAN ACADEMY OF SCIENCES FOUNDATION

The aim of the Estonian Academy of Sciences Foundation, established at the Estonian National Culture Foundation in 2006, is to support the research work of young Estonian researchers with doctoral degrees. Since 2009, the Tiit Talpsep scholarship<sup>82</sup> has supported the research of master's and doctoral students in the field of molecular microbiology and virology.

The new sub-foundation of the Estonian National Culture Foundation was established with the Academy's donation of 400,000 Estonian kroons (about €25,000) which came from the sale of the Academy's summer house on the island of Vormsi. Academy member Mart Ustav also contributed a notable amount. The Academy also invites other organisations, companies, institutions and individuals to cooperate, in order to contribute to Estonia's economic, social and cultural development now and into the future by supporting top-level knowledge, research and young scientists.

The scholarships are awarded by the Administrative Board, comprised of Academy members Mart Ustav, Leo Mõtus, Jaan Ross and Peeter Saari.

In 2022, scholarships were awarded to the following young researchers:

Senior Researcher at the National Institute of Chemical Physics and Biophysics **Hardi Veermäe** received the €4,000 Young Scientist Scholarship to support his research, which is focused on studying the processes of the primordial universe (e.g. phase transitions and cosmic inflation) and dark matter using gravitational waves.

PhD student at the Chair of Genetics of the University of Tartu Institute of Molecular and Cell Biology **Karl Jürgenstein** received the €1,500 Tiit Talpsep Graduate Student Scholarship to support his studies, which are focused on exploring the molecular mechanisms of how the precision of light synthesis and mutation frequency in bacteria are interrelated.

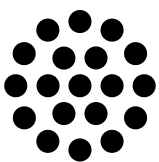
PhD student at the University of Tartu Institute of Pharmacy **Kairi Lorenz** also received a €1,500 scholarship for dedicating herself to the successful completion of her doctoral studies. She studies wound infections caused by bacteria and tries to find ways of preventing and treating infections.

<sup>82</sup> Tiit Talpsep (22 January 1954 to 26 February 2008) was an Estonian biologist who was engaged in applied molecular biology. The Tiit Talpsep memorial scholarship fund was founded thanks to a monetary donation by Academy member Mart Ustav.

# INTERNATIONAL COOPERATION

## INTERNATIONAL ORGANISATIONS AND NETWORKS

In the academic world, scientists are often like ambassadors of their country. The organisations that bring them together help enable a close exchange of information and ideas, a prompt transfer of competences and the shaping of good practices. The Estonian Academy of Sciences represents Estonian science and scientists in the main Europe-wide and global scientific organisations. The relevant membership fees are paid from the funds allocated to the Academy for that purpose from the state budget.



### **International Science Council**

The Estonian Academy of Sciences is a founding member of the **International Science Council** (ISC<sup>83</sup>), which was initiated in 2018. The ISC was formed as a result of the merger of an organisation of the same name that was established in 1931 and had been focused on traditional natural sciences. A sister organisation uniting academies of social sciences and humanities, the International Social Science Council (ISSC), was established in 1952.

Until 1998, the ISC was known as the International Council of Scientific Unions (ICSU), and the Estonian Academy of Sciences had been a member since 1992. The ICSU was one of the initiators of the concept of sustainable

development, which today has gathered global momentum. In Estonia, the Commission for Sustainable Development<sup>84</sup> established by the Government in 1996 is responsible for monitoring the 17 Sustainable Development Goals. The Academy of Sciences was a member of the Commission until 30 June 2022 when the composition and work format of the Commission were changed.

The International Science Council has two types of members. According to a territorial principle, the ISC includes one academy or science council of natural sciences and one academy of social sciences and/or humanities from each country. The ISC members may also include leading global science societies, regional associations of scientists and national research agencies as well as foundations that support or organise research for which the introduction and development of a science-based worldview is an important area of work. The central goal of the ISC is to make the global voice of science heard and to identify and manage the key global problems of society in cooperation with scientists from across the globe and in all areas of specialisation.

One of the important work formats of the ISC is regional sections. While in Europe a regional group of academies (the European group of the ISC) has been operating for years, the creation of regional sections in South America and South-east Asia is one of the programme objectives of the current ISC President Sir Peter Gluckman. These networks allow academies to coordinate their positions, consolidate their

83 <https://council.science>

84 <https://www.riigikantselei.ee/en/supporting-government-and-prime-minister/organisation-and-planning-work-government/global>



voices for the expression of the needs of entire regions and empower the academies of smaller countries to promptly respond to unexpected problems.

The Estonian Academy of Sciences holds the presidency of the European ISC Members for the 2022–2024 period. The group includes 48 research organisations from European countries. The 2022 annual meeting<sup>85</sup> of the group was held in London and included an overview of the activities of the member organisations in recent years, discussions of the role of science in the changed post COVID-19 world and new challenges. The presentations of the subsequent science day focused on the role of scientific advice in solving various problems. The participants discussed the possible future directions of scientific advice in Europe and the ways in which scientific advice could best be used for responding to crises. The annual meeting and the science day were organised by the Estonian Academy of Sciences in cooperation with the Royal Society and the British Academy (see pp 86–87).



The **InterAcademy Partnership** (IAP<sup>86</sup>) was founded in 1993 as a global network of academies. It currently unites more than 130 national and regional academies. The purpose of this organisation is to advise the general public and to offer support to various decision-making bodies concerning the scientific aspects of global problems.

Several ISC and IAP member academies share the viewpoint of the Estonian Academy of Sciences that these organisations should merge or cooperate much more closely. At a panel discussion held under the leadership of the Estonian Young Academy of Sciences at the IAP conference in Arizona (in November 2022), ‘Winning from Greater Inclusion: Relation between Diversity and Academic Culture’, the Estonian Academy of Sciences was represented by President Tarmo Soomere and Academy member Anu Realo (see pp 91–93).

The **European Federation of National Academies of Sciences and Humanities ‘All European Academies’** (ALLEA<sup>87</sup>) was founded in 1994 and brings together both traditional academies of natural sciences and academies of humanities and social sciences. The Estonian Academy of



Sciences is a founding member of ALLEA. The purpose of ALLEA is to exchange experience and information in order to attain the highest level of science and high ethical standards, and to ensure the independent handling of matters related to science strategy and policies on a European level. Academy member Jüri Engelbrecht was the president of ALLEA from 2006 to 2011. Academy member Raivo Uibo is a member of the ALLEA Permanent Working Group on Science and Ethics.



The **European Academies’ Science Advisory Council** (EASAC, founded in 2001) consists of individual members appointed by the academies of sciences of the Member States of the European Union. This membership is extended to Norway and the United Kingdom. Estonia joined this organisation in 2004. The central purpose of the Council is to direct the combined competence of the academies into advising top-level European bodies and politicians in making decisions that require scientific expertise. In other words, EASAC fulfils the role of an independent academic advisor in Europe by combining the top-level competence and experience of European academies.

Expert networks have been established in the three main areas of work (biosciences, energy and the environment). These deal with socially important matters, analyse arising problems and forecast development directions and side effects. Through its members, EASAC is in constant dialogue with policy-makers and in striving to contribute to the science-based making of political decisions in Europe.

The Estonian Academy of Sciences is represented on the EASAC Council by Academy member Jaak Järv. Academy member Tarmo Soomere is on the EASAC Environment Steering Panel and Academy member Enn Lust is on the Energy Steering Panel. Academy member Jarek Kurnitski represented the Estonian Academy of Sciences in the EASAC expert group on the decarbonisation of construction and operation of buildings (Decarbonisation

85 <https://euro-isc.org/annual-meeting-2022/>

86 <http://www.interacademies.org/>

87 Read more at <http://www.allea.org>

of Buildings<sup>88</sup>), the results of which were published in June 2021. Academy member Ülo Niinemets participated in the working group ‘Towards More Sustainable, Flexible and Regenerative Agriculture in the European Union’ as an expert. The report ‘Regenerative Agriculture’<sup>89</sup> was published on 5 April 2022. Academy member Anne Kahru was an expert in the working group ‘Impact of Neonicotinoids on Ecosystem Services in the Light of the Most Recent Knowledge’. The report<sup>90</sup> was published on 28 February 2023. The Chairman of the Academy’s Committee on Energy, Arvi Hamburg, is an expert in EASAC’s Energy Programme project ‘The Future of Gas’.<sup>91</sup> The report will be published in May 2023.



The **International Union of Academies** (*Union Académique Internationale*, UAI<sup>92</sup>) was founded more than one hundred years ago (1919). It is a global organisation of academies in the fields of the humanities and social sciences with the aim of promoting joint research (including joint projects) and contributing to the broader dissemination of research results. The Estonian Academy of Sciences became a member of the UAI in 1998. Estonia is represented in this organisation by Academy member Jaan Undusk. On 5 March 2022, the UAI published a declaration in support of Ukraine.<sup>93</sup>



The foundation of the **European Science Advisors Forum** (ESAF<sup>94</sup>) was initiated in 2014 by Professor Anne Glover, who was then chief scientific advisor to Manuel Barroso,

88 Read more at <https://easac.eu/publications/details/decarbonisation-of-buildings-for-climate-health-and-jobs>

89 <https://easac.eu/publications/details/regenerative-agriculture-in-europe/>

90 <https://easac.eu/publications/details/neonicotinoids-and-their-substitutes-in-sustainable-pest-control>

91 <https://easac.eu/publications/details/future-of-gas>

92 <http://www.uai-iaa.org/>

93 <http://www.unionacademique.org/en/news/24/statement-of-the-uai-on-the-invasion-of-ukraine>

94 [esaforum.eu/](https://esaforum.eu/)

the President of the European Commission. The aim of the ESAF is to allow the scientific advisors of European countries to exchange ideas and information on matters of pan-European importance before providing advice to their governments or the European Commission, as well as to exchange experience and to promote a culture of making political decisions based on scientific understanding in the European Union.

The Forum is an informal network of individual experts and scientists who are responsible for providing scientific advice or organising the provision of scientific advice on a national level. A large number of its members are the leading scientists of their countries and the heads of academies of sciences and research councils. There are also some representatives of state governing bodies and university professors to whom the state has given the respective mandate. President of the Estonian Academy of Sciences Tarmo Soomere has been Chair of the Forum since 1 July 2020. See an overview of the ESAF in 2022 on pp 91–93.

The Estonian Academy of Sciences is a founding member of the **Union of European Academies for Science Applied to Agriculture, Food and Nature** (UEAA)<sup>95</sup>. This association of academies that also perform the analysis of the necessary natural resources was founded in October 2000. The UEAA focuses on joint studies and comparative analyses in the said areas on a European scale with the main aim to ensure the sustainable development of agriculture, food security and sensible land use. The Academy’s main form of cooperation is the exchange of information and maintaining contacts.

## INTERNATIONAL PROFESSIONAL ASSOCIATIONS

The Academy supports the participation of Estonian scientists in international professional science associations (prioritising the professional associations that have joined the ISC) and international science organisations. Estonian scientists are represented in these by area-specific national committees and science societies. Participation of Estonian scientists in the following international organisations is supported:

95 <https://ueaa.info/>



<b>International organisation</b>	<b>Estonian body of contact</b>
Consortium of European Taxonomic Facilities (CETAF)	Committee on Phylogeny and Taxonomy of the Estonian Academy of Sciences Contact: Urmas Kõljalg, urmas.koljalg@ut.ee
European Chemical Society (EuChemS)	Estonian Chemical Society Contact: Margus Lopp, Jaak Järv, info@keemiaselts.ee
European Marine Board	Committee on Marine Sciences of the Estonian Academy of Sciences Contact: Tarmo Soomere, tarmo.soomere@ttu.ee
European Physical Society (EPS)	Estonian Physical Society Contact: Kaido Reivelt, kaido.reivelt@ut.ee
European Polar Board (EPB)	Estonian Polar Research Committee Contact: Rein Vaikmäe, rein.vaikmae@taltech.ee
International Astronomical Union (IAU)	Estonian National Committee on Astronomy Contact: Laurits Leedjärv, leed@aai.ee
International Association of Geomorphologists (IAG)	Estonian National Committee of IAG Contact: Tiit Hang, tiit.hang@ut.ee
International Federation of Automatic Control (IFAC)	Estonian Association of Engineers / Estonian Society of System Engineers Contact: Sven Nõmm, sven.nomm@taltech.ee
International Geographical Union (IGU)	Estonian Geographical Society Contact: Hannes Palang, geograafiaselts@gmail.com
International Mathematical Union (IMU)	Estonian National Committee for Mathematics Contact: Mati Abel, mati.abel@ut.ee
International Union of Geodesy and Geophysics (IUGG)	Estonian Geophysical Committee Contact: Piia Post, piia.post@ut.ee
International Union of Geological Sciences (IUGS)	Estonian National Committee for Geology Contact: Kalle Kirsimäe, kalle.kirsimae@ut.ee
International Union of History and Philosophy of Science, Division of Logic, Methodology and Philosophy of Science (IUHPS/DLMPS)	Division of Methodology and Philosophy of Science of the Estonian Association for the History and Philosophy of Science Contact: Peeter Mürsepp, peeter.muursepp@taltech.ee
International Union of Pure and Applied Physics (IUPAP)	Estonian National Committee for IUPAP Contact: Marco Kirm, marco.kirm@ut.ee
International Union for Quaternary Research (INQUA)	Estonian National Committee for INQUA (ESTQUA) Contact: Tiit Hang, tiit.hang@ut.ee
Thesaurus Linguae Latinae (TLL)	Estonian Academy of Sciences Contact: Janika Päll, janika.pall@ut.ee
World Energy Council (WEC)	World Energy Council Estonia Contact: Andres Siirde, andres.siirde@taltech.ee

## BILATERAL EXCHANGE PROGRAMMES

The academic exchange of researchers is an important practical output under the cooperation agreements concluded with partner academies. Such agreements have a long history. In 2022, thirty-five years passed from the signing of the first such agreement with the Polish Academy of Sciences on 16 December 1987 in Tallinn.

The periodic updating of agreements creates a flexible framework for supporting cooperation between the scientists of individual countries, contributing to establishing contacts and increasing the international visibility and impact of Estonian research.

In 2022, the Estonian Academy of Sciences supported the research visits of 36 foreign researchers to Estonian universities and research institutions under 18 cooperation projects (224 days in total). Partner academies supported 44 visits of Estonian researchers (319 days in total). The opportunities offered by the international exchange programme were used the most by Hungary, Poland and Czechia, followed by Latvia, Lithuania, Bulgaria, Sweden and Slovenia to a lesser degree.

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## THE FIRST FULL YEAR OF THE ESTONIAN ACADEMY OF SCIENCES AS CHAIR OF THE EUROPEAN SECTION OF THE INTERNATIONAL SCIENCE COUNCIL

*Erle Rikmann, Secretary of the European ISC network*

The International Science Council (ISC) is a global science organisation that brings together research unions and associations, national academies and other representative research organisations. The main aim of the Science Council is to express and amplify the voice of scientists in matters concerning global public wellbeing. Supported by its members and numerous international partner organisations, the Council takes part in shaping international research policy and promotes the provision of scientific advice and knowledge-based policy-making. In 2021, the Estonian Academy of Sciences was elected as the chair of the European members of the ISC for three years (2022–2024).

During Estonia's presidency, the main activities of the network of the European ISC members are focused around three circles of topics. First, representation of the interests of European research institutions and researchers in the global ISC organisation. The activities of this science organisation have considerably expanded and the management of the organisation has also been replaced. Although the European members make up nearly a quarter of the member organisations of the global ISC, they are not proportionately represented in the new management of the ISC. One of the tasks of the European members' network and its Secretariat in Estonia, therefore, is to draw attention to the viewpoint and requirements of European research in the global ISC organisation.

The second important circle of topics is the promotion of science advice and knowledge-based policy-making in Europe, primarily by supporting the development of the structures necessary to enable this. The network of research organisations incorporates the best knowledge and helps find the best new practices for solving the challenges in the provision of scientific advice by sharing experience, holding public discussions and engaging in research cooperation. The need for more permanent scientific advice structures with a prompt response capability and interdisciplinary competences is also growing at European Union level.

The third area of activity in the work of the European ISC members is the development of research diplomacy and international research cooperation. This includes the improvement of the level of overall knowledge, as well as practical activities where the aim of research cooperation is to support relationships between countries or regions or to contribute to the development of research and innovation with the help of diplomacy.

All three topics were discussed at the Annual Meeting and science seminar held in London on 12 and 13 October together with the Royal Society. The improvement of scientific advice, crisis preparedness and international research cooperation were discussed by various top European scientists, scientific advisers to governments and representatives





Annual Meeting of the European ISC at the Royal Society in London.

of academies, including Paul Monks, Chief Scientific Adviser at the UK Department for Business, Energy and Industrial Strategy (BEIS); Marco Sacchi, Royal Society University Research Fellow in Computational Surface Science, Materials Modelling and Quantum Biology;

Robin Grimes, the UK Ministry of Defence Chief Scientific Adviser on nuclear science and technology matters and Professor of Materials Physics at the Imperial College London; and Tarmo Soomere, President of the Estonian Academy of Sciences and Chair of the European ISC.

## THE 8TH ANNUAL MEETING OF THE EUROPEAN SCIENCE ADVISORS FORUM (ESAF)

The Estonian Academy of Science organised the 8th Annual Meeting of the European Science Advisors Forum (ESAF) titled ‘The role of science advice in rebuilding society’<sup>96</sup> in Vilnius on 29 – 30 November 2022.

The members of ESAF and guests from the European Commission took part in the Annual Meeting. First, the ESAF Chair, President Tarmo Soomere gave the network an overview of what was done in 2022 under the auspices of ESAF. There has been a number of one-on-one discussions about the future of ESAF with various members of the network. For instance, meetings were held with Dr Istvan Szabo from Hungary, Professor Gerald Haug from Germany, Professor Anton Zeilinger from Austria and the former ESAF member, Professor Mark Ferguson from Ireland. ESAF’s cooperation with other networks was discussed with the new President of INGSA Rémi Quirion and Vice-President Claire Gregg. ESAF’s positions were also presented on the international arena: at the joint

conference of SAPEA and the Group of Chief Scientific Advisors to the European Commission, titled ‘Science advice under pressure’, at the IAP Annual Conference in Arizona, USA, and at several discussions held by the US Academy of Sciences.

### **An overview of the presentations made at the meeting**

The main topic of the meeting was most directly discussed by the head of the Scientific Committee of the National Council of Ukraine on Science and Technology Development **Dr Oleksiy Kolezhuk** and **Vaughan Turekian** as well as **Franklin Carrero-Martinez** from the US National Academies of Sciences.

**Dr Oleksiy Kolezhuk** gave an overview of the main problems in the Ukrainian research system before the beginning of the war as well as of those that have emerged in the course of the war, and he outlined the steps that would need to be taken to rebuild the Ukrainian research system. In a situation where 15% of Ukraine’s scientists have emigrated, 30% have relocated within Ukraine and nearly 15% of the

<sup>96</sup> <https://esaforum.eu/esaf-annual-meeting-2022-esaf-8-the-role-of-science-advice-in-rebuilding-the-society/>

research infrastructure has been destroyed, the combination of all the factors means that about 73% of Ukrainian scientists are currently unable to perform their primary work.

Dr Kolezhuk emphasised the imperative of any support to scientists being able to continue their work. Otherwise, Ukraine will no longer have any scientists with whom to rebuild the research system after the war ends. It is important to support young scientists, help research groups continue their joint work regardless of whether they are located in Ukraine or have emigrated and support Ukrainian scientists in joining international research networks.

**Vaughan Turekian** and **Franklin Carrero-Martinez** gave an overview of what the US Academies of Sciences have done to support Ukraine during the first year of the war. In cooperation with various academies and financiers, the programmes RESET Ukraine<sup>97</sup> (Rebuilding Engineering, Science, Education and Training in Ukraine) and SEED<sup>98</sup> (Scientists, Engineers in Exile and Displacement) have been launched. These programmes have helped find professional work for hundreds of scientists who have emigrated from Ukraine, and provided other support to them. In cooperation with the European Federation of Academies, ALLEA, a ten-step roadmap, was developed at the beginning of summer 2022 for rebuilding the Ukrainian research system.<sup>99,100</sup>

**Anne-Greet Keizer** from the Netherlands Scientific Council for Government Policy (WRR<sup>101</sup>) and member of Estonian Academy of Sciences **Maarja Kruusmaa**, who is one of the seven scientific advisors of the European Commission, talked about changes in the content of scientific advice.

**Anne-Greet Keizer** pointed out that one important piece of advice intended to be given to the government of the Netherlands is that the government should think through in what way the country's alliance relations have changed and in which areas the changed situation affects the country, aside from national security. She also stated that the international expertise and the diversity of viewpoints brought together in the EASF is inspiring and helps them to provide significantly better advice to their government. This has become particularly clear in today's situation where there are countries that are able to understand Ukraine's situation much more clearly thanks to their previous experience with the aggressor.

Academy member **Maarja Kruusmaa** gave an overview of a report published in November 2022, which provides recommendations to the European Commission on better crisis prediction and management and recovering from crises.<sup>102</sup> The main conclusion of the analysis is that strategic crisis management in Europe needs adjustment to the new situation and is in its current form fit only for the past when crises emerged one at a time.

The participants also discussed more general topics related to the provision of scientific advice.

**Dr Jaakko Kuosmanen** (Finnish Academy of Sciences) gave an overview of the latest developments in the Finnish system of scientific advice. He talked about the previously project-based scientific advice initiative SOFI<sup>103</sup> that has today become a permanent programme, about a cross-ministry science-based planning instrument, and the strategic research funding instrument established in 2015 that has funded a number of topics that are strategically important for the state and have significantly improved cooperation between scientists and politicians.

**Jacques Verraes** (European Commission, DG Research and Innovation) gave a brief introduction to the European Commission's scientific advice related activities planned for the near future. The provision of scientific advice will be in focus on several occasions during the next two European Council presidencies – for instance, a conference of the ministers of research is planned to be held on that topic on 10 to 11 October 2023. He also proposed that the ESAF take part in the organisation of the event.

**Kristian Krieger** (European Commission, Joint Research Centre (JRC<sup>104</sup>)) and **Jacques Verraes** gave an overview of the European Commission's working document,<sup>105</sup> which addresses the situation of the provision of scientific advice in the Member States of the European Union, the problems in that structure and possible solutions.

**Tarmo Soomere** reflected on this discussion by noting that a common platform of the EU and all Member States is that it is of paramount importance nowadays to consider the scientific perspective in the decision-making process.

However, there are several core differences in how science advice functions in the European Commission and in the national governance systems of Member States. Seven such differences have been identified in the ESAF discussions.

97 <https://www.nationalacademies.org/our-work/rebuilding-research-education-and-innovation-in-ukraine-a-workshop>

98 <https://www.nationalacademies.org/our-work/scientists-and-engineers-in-exile-or-displaced-seed-program>

99 <https://www.nationalacademies.org/news/2022/06/action-steps-for-rebuilding-ukraines-science-research-and-innovation>

100 <https://www.science.org/doi/10.1126/science.add4088>

101 <https://www.wrr.nl/>

102 [https://research-and-innovation.ec.europa.eu/document/bd11a590-70ee-4721-94b7-562c5e03e488\\_en](https://research-and-innovation.ec.europa.eu/document/bd11a590-70ee-4721-94b7-562c5e03e488_en)

103 Science Advice Initiative of Finland (SOFI), <https://acadsci.fi/sofi/nain-saat-yhteyden-sofin/>.

104 [https://commission.europa.eu/about-european-commission/departments-and-executive-agencies/joint-research-centre\\_en](https://commission.europa.eu/about-european-commission/departments-and-executive-agencies/joint-research-centre_en)

105 [https://knowledge4policy.ec.europa.eu/file/staff-working-document-supporting-connecting-policy-making-member-states-scientific-research\\_en](https://knowledge4policy.ec.europa.eu/file/staff-working-document-supporting-connecting-policy-making-member-states-scientific-research_en)



*Some participants of ESAF annual meeting*



Tarmo Soomere, Estonian Academy of Sciences.



Anne-Greet Keizer, Netherlands Scientific Council for Government Policy (WRR).



Marco Topic, University of Ljubljana, Slovenia.



Lucian Brujan, German National Academy of Sciences Leopoldina.



Amélia Maria Polónia da Silva, Portuguese Foundation for Science and Technology.



Frede Blaabjerg, Danish Council for Research and Innovation Policy.



Jacques Verraes, European Commission.



Jaakko Kuosmanen, Finnish Academy of Sciences.



While such advice at EU level is normally requested from the European Commission in accordance with the top-down approach and the evidence reports are then occasionally worked out by contributing academy networks, national academies largely provide advice on a proactive basis from bottom-up.

While the advice provided to the European Commission is always public and is usually widely discussed in the academic community all over Europe before it is formulated, the governance system of many Member States operates in a way that the government meetings are usually behind closed doors. For example, the Constitution of Estonia states that government meetings are private unless the government decides otherwise. Among other things, this means that the material submitted for decision-making and its supporting documentation are not necessarily accessible to the public.

While the science advice system of the European Commission follows a specific structure and has been centralised since 2012 when the first Chief Scientific Adviser to the President of the European Commission was nominated, national science advice systems are often of a varied nature and/or operate on ad hoc basis with convened or nominated experts or expert groups, or even based on personal contacts.

While the advice to the European Commission is provided in one of the working languages of the Commission, is homogenised in regard to terminology and is immediately accessible to virtually all EU members, advice on a national level is provided in the local language, with its own system of meanings and nuances. As it is based on the semiotic system driven by the local cultural background, including expectations of how society may react to it and the level of trust within society to the government institutions in the particular country, it is often untranslatable to even slightly different cultural environments.

Furthermore, while the European Commission almost entirely looks for strategic advice, operational advice is frequently requested from national advice systems. This kind of advice must take into account the capacity of the particular country and therefore is often not transferable.

The officials of the European Commission who decide how to implement the advice are permanent; this is in contrast to policy-makers at national level, who depend on the outcome of the next round of elections. This difference generates extensive variations in how the advice is used in decisions, which should be taken into account in preparing the advice.

Finally, while the officials of the European Commission are accountable to the Commission, the Commissioners and members of the European Parliament are effectively accountable to their nominators or electorates, that is, to the Member States. This feature implies that advice to the

European Commission needs to be at least to some extent synchronised with the positions of the Member States. This kind of synchronisation is much less necessary for advice at a national level.

At the end of the meeting, a discussion was held about the **future of the ESAF** as well as the membership and activity principles set forth in its underlying documents.<sup>106</sup>

The main topic was the ESAF's role in the provision of scientific advice in Europe – the question of whether the structure of the ESAF should be changed to strengthen that role and which changes need to be made to the underlying documents of the ESAF.

The discussion can be summarised as follows:

- The ESAF cannot handle and solve all the problems related to the provision of scientific advice in Europe; the ESAF's role and strengths lie elsewhere;
- The ESAF understands the European Commission's concern that there are countries where the system of provision of scientific advice is not functioning well, but it finds that influencing such systems from the outside is very difficult – the system of each country is based on local laws and customs;
- There is no need to change the ESAF internally for the purpose of solving problems, but a trilogue could be opened on these topics between the ESAF, the European Commission and the European Parliament (STOA<sup>107</sup>);
- Although the world has changed a great deal since the foundation of the ESAF in 2014, the network does not need any fundamental changes – just internal strengthening. The ESAF's strength is that it is aimed at Europe, while every member operates on the basis of their own national regulations – this brings diversity to the system. The ESAF's membership principles must be changed so that all the democratic European countries can be represented in the ESAF (including Switzerland, Norway, Ukraine and the United Kingdom).
- For the purpose of making these changes as well as other changes in the underlying documents, a work group will be formed, with representatives from Germany, the Netherlands and Slovenia. The changes will be approved at the next Annual Meeting.

<sup>106</sup> <https://esaforum.eu/about/>

<sup>107</sup> Panel for the Future of Science and Technology (STOA) <https://www.europarl.europa.eu/stoa/en/home/highlights>.



A screenshot from a video in which Helen Eenmaa raises the question of what we expect from science: achievements or the best knowledge? Whose success is supported by the academic environment, and who succeeds despite a hostile work environment? To what extent can and should these conditions be considered when evaluating results? The video is part of a series first presented at the InterAcademy Partnership conference.

## WINNING IN ACADEMIC ENVIRONMENT: VALUE-BASED ACADEMIC CULTURES FOR SCIENTIFIC EXCELLENCE

*Helen Eenmaa, Vice President of the Estonian Young Academy of Sciences*

Researchers around the world are increasingly talking about the need to move towards a more inclusive, diverse and sustainable academic ecosystem. This is more than simply a pragmatic stance, as it is motivated by scientific evidence which shows inclusive and diverse organisations achieve better scientific results. It is also a stance on values. While researchers stand up in society to promote the science-based approach to solving problems, they also stand up to elevate the status of science and the status of research organisations. One can only have such high status with continued excellence in science. Moreover, one can only have it through adherence to universally-accepted principles, unambiguous rules and high standards; it requires legitimacy that only a value-based and sustainable academic culture can provide.

'Winning from greater inclusion: Relation between diversity and academic culture' discussion session at the InterAcademy Partnership Triennial Conference and the Worldwide Meeting of the Young Academies (Biosphere 2, Arizona, 2022)

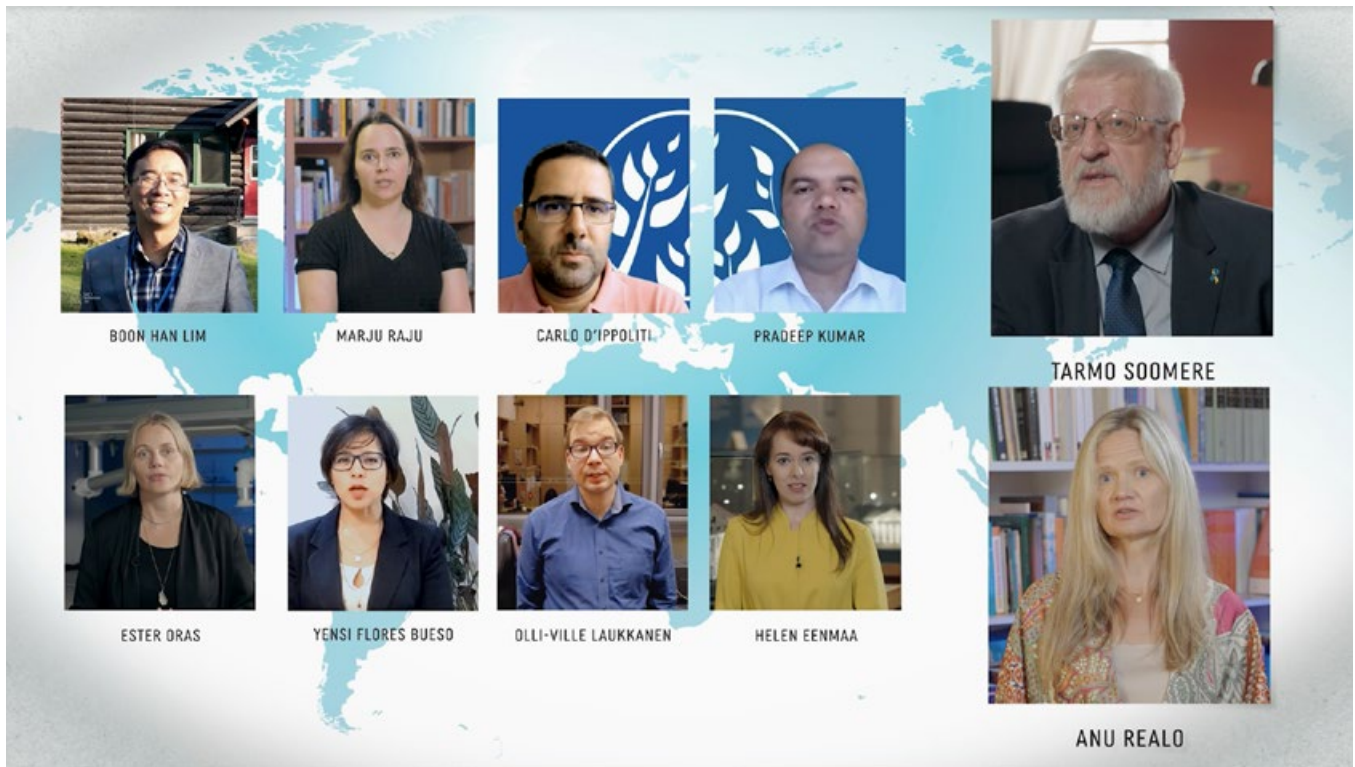
Organised and moderated by Vice President of the Estonian Young Academy of Sciences Helen Eenmaa.

### Participants

- Ester Oras and Marju Raju, Estonian Young Academy of Sciences
- Tarmo Soomere and Anu Realo, Estonian Academy of Sciences
- Olle-Ville Laukkanen (Finland and Germany), Young Academy Finland
- Yensi Flores Bueso (Ireland and Honduras), Carlo D'Ippoliti (Italy), Boon Han Lim (Malaysia), Pradeep Kumar (South Africa), Global Young Academy

Videos are available on the Estonian Young Academy of Sciences YouTube channel.





Panel participants

This is why the Estonian Young Academy of Sciences and the Estonian Academy of Sciences have joined forces to draw attention to the role of diversity, equal treatment and inclusion in society and academia, both in Estonia and beyond. Researchers from diverse backgrounds enrich the world of science. The variety of their knowledge and experience is necessary in solving the challenges facing society. At the same time, we need to acknowledge that we have yet to achieve equal treatment in academia.

As part of this collaboration, we organised a discussion session entitled ‘Winning from greater inclusion: Relation between diversity and academic culture, at the InterAcademy Partnership’s Triennial Conference and the Worldwide Meeting of the Young Academies in Arizona in November 2022. The event was attended by delegates from more than 100 national academies of science around the world, and our session was very warmly received.<sup>108</sup>

We wanted to know how diversity in science is understood and valued. Beyond that, we wanted to know how attitudes towards values relate to creating the best knowledge or developing academic environments. Are the researchers who have the appropriate expertise through specialising in a particular field of study involved in providing scientific advice on related matters, even when they operate, in some sense, at the margins of science (e.g., due to some features in their intersectional profiles, or distance from dominant

research hubs)? How do research evaluation practices consider the diversity of researchers and their research methods?

Attitudes and practices regarding these matters differ across disciplines, cultures, career stages and other factors. It was, therefore, essential to us that the content of the debate should go hand in hand with the form, bringing together leading researchers from both traditional and young academies of science worldwide. We were determined to listen to scholars from different cultural and historical backgrounds, both from the global North and South. We also sought to cut across scientific disciplines, including representatives from the humanities, social sciences, medicine, natural sciences and engineering. We wanted to find out where we think alike.

By drawing on her personal experience, Anu Realo explained how important it is to ensure the sustainability of science by considering how to promote a healthy work-life balance in higher education and other ways to encourage researchers to remain in academia. Efforts to foster a respectful and inclusive academic environment worldwide have mostly focused on correcting some inequalities (e.g., gender). While the gender gap is closing in most countries, progress in other (historically) marginalised groups is slower. Key imbalances such as age, ethnicity, race, disabilities, parenthood, resident status, social and economic status, and multidimensional discrimination have received less attention, though they also affect the quality of research and research-based policy advice, as Ester Oras discussed in her talk.

<sup>108</sup> [www.interacademies.org/event/triennial-conference-interacademy-partnership-iap-and-worldwide-meeting-young-academies](http://www.interacademies.org/event/triennial-conference-interacademy-partnership-iap-and-worldwide-meeting-young-academies)

Acknowledging the biases in academic cultures and initiatives is instrumental in solving the structural problems that are currently standing in the way of achieving effective and excellence-inspiring academic cultures. Why? Because as Tarmo Soomere said, ‘We never know whose question or research will open the way to the future we want to live in.’ Academic communities are selective, but excluding researchers in connection with the marginalising factors listed above affects the potential, reach and quality of both research and science-based policy. To quote Yensi Flores Bueso, ‘A vast body of evidence has found that diverse research environments increase creativity, innovation and problem-solving, ultimately, benefiting research,’ inviting the question of which societal attitudes and practices limit the diversity of academic environments and thus the capacity of research to deliver the best knowledge. The policies that drive such practices are a problem for individual researchers and also for the quality of science and science-based policymaking in society.

Ensuring a healthy global research ecosystem requires input and commitment from all stakeholders. The creation of a more inclusive research environment depends on decisions taken among research cooperation and funding mechanisms, scientific advice mechanisms, and those designing and implementing research assessment policies. We see principles regarding new research assessment policies on policymakers’ tables, but if they are only adopted as recommendations, the new norms will not solve structural problems. As Marju Raju pointed out in her talk, greater collaboration and coordination are central here.

Moreover, diverse research environments not only need diversity across researchers. Drawing on Carlo D’Ippoliti’s remarks: ‘[B]oth metrics and qualitative methods often ignore the diversity of researchers: both in their background and career paths and – I think we don’t discuss enough about it – diversity in their methods and ideas.’ The same was confirmed by the Global Young Academy’s worldwide survey of institutional promotion criteria presented by Boon Han Lim and Pradeep Kumar, which showed the prevalence of this practice in researcher assessment internationally.

Science advice mechanisms and research evaluation practices tend to amplify such biases, calling their underlying policies into question. Tarmo Soomere’s observations are striking here: while, on the one hand, scientific advice goes hand-in-hand with the Matthew effect – those who have already provided with good advice are invited to consult again and again. However, we see the simultaneous Matilda effect on the other side of the coin, which is problematic. It is easy to overlook the opinions and warnings of the less involved academic community members, be they mothers who have to drop their children off at school or, as Olli-Ville Laukkanen pointed out, researchers moving



A screenshot from a video in which Tarmo Soomere talks about researchers of wide-ranging backgrounds asking various questions or asking the same questions in a different way – all of which enriches scientific research and new knowledge. The video is part of a series first presented at the InterAcademy Partnership conference. See full text of his intervention on pp 34–35.

between countries who are not fluent in the local language. As Tarmo Soomere stressed: ‘Even though the damage might not be crucial in single situations, the cumulative damage can be substantial.’ As the discussion suggested, inclusion in the provision of scientific advice and academia more generally starts with illuminating the views of fellow researchers who may not be at the forefront of the distribution of all researchers but who work specifically on the problems that call for solutions or see these problems up close.

Fostering inclusivity provides a path towards both scientific excellence and sustainable academic culture. On the one hand, in searching for the best knowledge, it is important to include researchers working on a problem that needs a specific solution, even if they think a little differently, their voice has been quieter or they have been less in the limelight. It is in everyone’s interest to involve them as this allows us to achieve the best results in research.

On the other hand, inclusion is also a matter of equal treatment in any academic community. More broadly, it is a matter of values and academic culture. Without equal treatment, an academic community, however successful in other respects, has no legitimacy. This perception goes hand in hand with the best knowledge of legal systems. Even if some laws gave us the best means to achieve specific welfare goals, the means would not be legitimate unless they were also sufficiently just. Ensuring equal treatment is necessary to this end. Policies promoting inclusion, equal treatment and diversity thus pave the way for the best science and a legitimate academic ecosystem.



# BRIGHT MOMENTS

## UNDER AND TUGLAS LITERATURE CENTRE

Founded in 1993 (the Affiliate Museum, formerly known as Friedebert Tuglas House Museum, founded in 1971)  
Personnel: 16, including 13 researchers  
Webpage: <https://www.utkk.ee/en/>

The Under and Tuglas Literature Centre of the Estonian Academy of Sciences (henceforth referred to as the Literature Centre) is a research and development institution. The main task of the Centre is the complex investigation and theoretical modelling of Estonian-language written culture in its entirety and the multilingual Baltic-German culture from earlier eras, thereby making the historical Baltic and later Estonian realm of written culture visible, interesting and available for comparison with similar realms in international scholarship.

The main research areas of the Literature Centre are:

- The history of Estonian literature and culture in the 19th to 21st centuries, and the emergence and transformation of modern culture;
- The written Baltic German culture in the 13th to 19th centuries, and the role of the written German and Latin word in the development of modern Estonian culture;
- Literary culture as national, international and social identity formation;
- Rhetorical and discursive models for describing European and Estonian culture;
- Environmental humanities.

The Literature Centre publishes the results of its research, along with cultural history source materials, and it also organises conferences, exhibitions and other events.

The Literature Centre's Museum Department (henceforth referred to as the Museum) is the reserve of the heritage of writer and Academy member Friedebert Tuglas and of other collections.

In 2022, the Literature Centre started work on the 'Emergence of a Civilised Nation: Decadence and Transitionality in 1905–1940' research project (PRG1667), which is being funded by the Estonian Research Council.<sup>109</sup> The international team of scholars focuses on studying modern literature, visual art, philosophy and music in the cultures of the Baltic and Nordic countries at the beginning of the 20th century in comparison to decadent trends in Western European culture.

At the end of 2022, the Estonian Research Council also decided to finance the Literature centre's research project 'Connections, transition, change: *nobilitas haereditaria ac litteraria* in the emergence of early modern literature in Polish and Swedish Livonia' (PRG1926), which involves source-critical case studies of the literature created by the nobility of the Early Modern times.<sup>110</sup>

The implementation of the EU Research and Innovation Framework programme Horizon2020 project 'Citizen Science for Environmental Citizenship' (EnviroCitizen,<sup>111</sup> grant No. 872557) also continued.

In 2022, the researchers of the Literature Centre presented the results of their research in 20 Estonian and five foreign language academic articles, and they published book reviews, translations of works of fiction, popular science articles and other writings. The collection of articles 'Game

<sup>109</sup> <https://dekadents.utkk.ee/en/>

<sup>110</sup> <https://nobilitas.utkk.ee/en/>

<sup>111</sup> [www.envirocitizen.eu/](http://www.envirocitizen.eu/)





Three researchers of the Literature Centre were bestowed with the Estonian Cultural Endowment Annual Award for Literature in 2022: Research Professor Mirjam Hinrikus for the best article, Director Jaan Undusk for the best play and Research Professor Kristi Viiding for the best translation of contemplative literature.

and Melancholy. Friedebert Tuglas' novel *Felix Ormusson*' published in the Literature Centre's series Seminars on Modern Estonian Literature deserves a separate mention.

It is also worth highlighting the special issue of the journal *Methis. Studia humaniora Estonica*, which was published with the participation of the Literature Centre. The special issue focused on nature contemplation and environmentalism.

The Literature Centre's 2022 science events were related to decadence studies, the studies of the earlier German and Latin language culture in the Baltic region, and environmental humanities research.

The Museum continued to carry out development activities in 2022, during which it focused mainly on improving the availability of the Literature Centre's collection and digitising archival documents.

## A SELECTION OF ACTIVITIES OF SCIENTIFIC SOCIETIES AND INSTITUTIONS ASSOCIATED WITH THE ACADEMY

### **Institute of the Estonian Language**

On 10 November 2022, the Institute of the Estonian Language held the 6th Language Technology Conference 'From Testing into Use' at Tallinn Creative Hub. Together with language technology leaders and implementers, the conference looked for answers to the following questions: What is the current status of Estonian language technology? What are the latest trends in the area? What do language technology developers think and where are they going? What do users expect and dream of? @ the photo: Product Manager of the Institute of the Estonian Language Martin Luts spoke about the usefulness of language technologies in translating.



Photo: Marek Meislaid

### Estonian Literary Museum

On 19–22 September, the Estonian Literary Museum hosted the 5th edition of the international conference series ‘Balkan and Baltic States in United Europe: History, Religion and Culture’, titled ‘Nature and Culture in Rituals, Narratives and Beliefs’, which was also the 14th annual conference of the Centre of Excellence in Estonian Studies. Over 90 scientists from 17 countries attended. @ the photo: Tõnno Jonuks speaks about the relationships between nature, nationality and religion, as well as of the emergence of nature religion in Estonia.



Photo: Alar Madisson

### Tartu Observatory

In spring 2022, we opened a testing laboratory for extra-terrestrial environments, or the Space Bunker. The new laboratory instantly found purposeful use in several projects and proved to be a popular guest attraction. @ the photo: President of Estonia Alar Karis and Director of the Tartu Observatory Antti Tamm on national lunar landscape.



Photo: Mari-Liisa Plats

lived on Rütli Street in Tartu (from left): Professor Jan N. Bremmer, a professor at the University of Groningen, Christoph Marksches, a professor at the University of Berlin and the President of Berlin-Brandenburg Academy of Sciences and Humanities, and Prit Rohtmets, an associate professor at the University of Tartu and a professor at the Institute of Theology of the Estonian Evangelical Lutheran Church.



Photo: Tarmo Toom

### Academic Theological Society

The event of the year for the Academic Theological Society was the international conference ‘Adolf von Harnack – Bridging the Gaps’, which was held in cooperation with the University of Tartu School of Theology and Religious Studies and the Berlin-Brandenburg Academy of Sciences and Humanities. @ the photo: the organisers of the conference in front of the house where Adolf von Harnack once





Photo: Mart Tsernijk

### Estonian Academic Oriental Society

The event of the year for the Estonian Academic Oriental Society was the 34th Orientalist Day conference ‘Humans and Humanity, Gods and Godliness’ dedicated to the 60th birthday of the President of the Society, Märt Läänemets, held in Tartu on 16 and 17 September. Over the two days, participants were able to attend fourteen academic presentations. @ the photo: Märt Läänemets, President of the Academic Oriental Society together with a portrait painting made for his birthday (painted by Kristina Viin).

### Estonian Society for the Study of Religions

The conference organised in cooperation with Tallinn Zoo was dedicated to the Animal of the Year – the brown bear. The conference was opened by the Director of the Zoo, Tiit Maran, and the President of the Society, Madis Arukask. The majority of the nine presentations focused on the bear as a mythological being or the bear’s symbols in various religions.

KONVERENTS  
**Karud looduses, mütoloogias ja usundis**

Käesolev aasta on kuulutatud pruunkaru aastaks. Et juhtida tähelepanu karude tähtsusele looduses ning erinevate rahvaste folklooris ja usundites, korraldavad Tallinna Loomaaed ja Eesti Akadeemiline Usundiloo Selts ühiskonverentsi.

KAVA

- Avasõnad ja tervitused
- Leif-August Kirs, Karud maailmas
- Peep Männil, Karu Eestis
- Kahvipaus
- Madis Arukask, Karu lõänemeresoome rahvaste usundis
- Tiina Vähli, Karu kannul lõänemeresoomlaste muistsetel ja nüüdsetel radadel
- Marju Kõrvupuu, Kas karune on karvane? Karu eestlaste elus ja folklooris
- Aasla Lintrop, Õhe looma mitu nägu. Karu manji rahvaluules
- Lüüna
- Vladimir Sazonov, Karu kui Venemaa sümbol: uskumused, müüdid, folkloor ja Kremli propaganda
- Elo-Mati Toomet, Karu Artemisega seotud kultuures ja müütides
- Jaan Luhe, „Tema jalad olid nagu karu jalad...“ Karudest ja karusümbolikaast Piiblis
- Martti Kalka, India karude kuningast Ramayanas
- Lüpetamine

Tallinn ZOO

6. SEPTEMBER  
10.00–19.00

Tallinna Loomaaia kesklinnahoovide aedituaariumis

Sissepääs tasuta

EAUS



Photo: Tõnis Org



### Estonian Geographical Society

The compilation of articles entitled ‘Landscape Units of Estonia’, published at the beginning of April, was compiled by Taavi Pae from articles by Professor of Geography of the University of Tartu, Johannes Gabriel Granö, which was originally published in 1922. His method of defining and classifying landscapes opened a new era in both Estonian geography and landscape sciences. The compilation, which includes three map pages, was published by the University of Tartu Department of Geography and the Estonian Geographical Society.

### Estonian Society of Human Genetics

The Society’s biggest event last year was the annual conference held in Pärnu on 29 and 30 September. The Society’s Lifetime Achievement Award was bestowed on Academy member Raivo Uibo.



### **Estonian Literary Society**

On 9 March 2022, the 150th anniversary of the Society of Estonian Literati was celebrated in Tartu under the auspices of the Estonian Literary Society and the Estonian Literary Museum and in cooperation with many others. @ the photo: Toomas Kiho speaking at the conference ‘Society of Estonian Literati 150’.

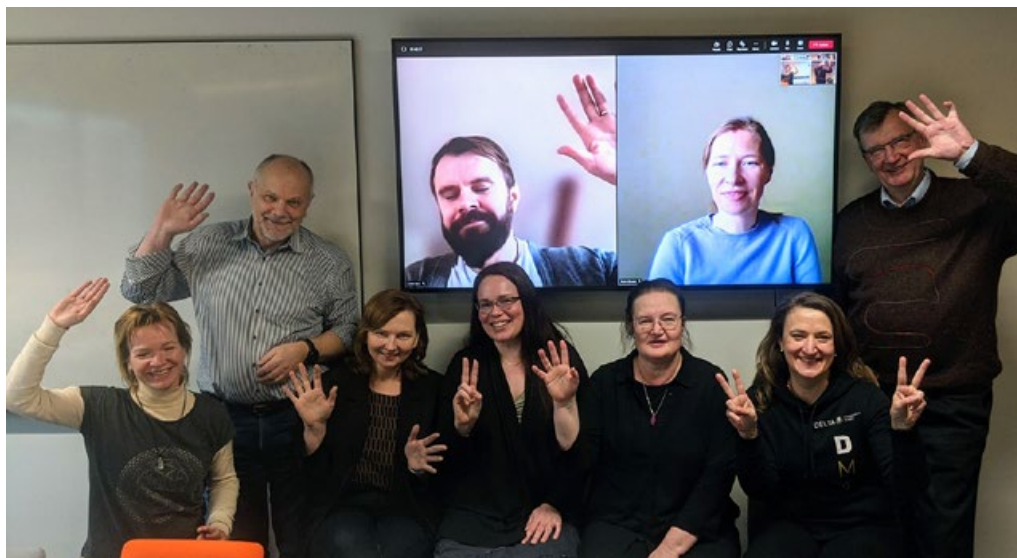
Foto: Alar Madisson



### **Estonian Economic Association**

On 11 February, the representatives of TalTech handed the leadership of the Estonian Economic Society over to the University of Tartu School of Economics and Business Administration. In the coming three years, the activities of the Society will be led by President Kadri Ukrainski. The management board also includes Anne Reino and Kertu Lääts. @ the photo: The leadership of the Associations being handed over to the University of Tartu School of Economics and Business Administration.

Photo: Andres Vaher



### **Estonian Musicology Society**

The traditional Tartu Day of the Estonian Musicology Society at the Estonian Literary Museum on 23 April was dedicated to the 65th birthday of Academy member Jaan Ross. @ the photo: Academy member Jaan Ross speaking at the meeting.

Foto: Kerri Kotta







Photo: Kristi Juurik x2

**Estonian Association of Sociologists**

On 14 April 2022, the Estonian Association of Sociologists celebrated a great achievement by the research team ‘Me. The World. The Media’, which is comprised of its members, and earned it the state science award in the area of social sciences. @ the photo on the left: (centre) Veronika Kalmus, Vice President of the Estonian Association of Sociologists; (from left) members of the Estonian Association of Sociologists Peeter Vihalemm and Marju Lauristin, Rein Taagepera, members of the Board of the Estonian Association of Sociologists Signe Opermann and Triin Vihalemm. @ the photo on the right member of the Board of the Estonian Association of Sociologists Anu Masso with Krista Uibu.

**Estonian Association of Engineers**

At the Christmas party of the Estonian Association of Engineers held at the TTK University of Applied Sciences on 9 December 2022, the President of the Association Igor Krupenski handed the title of Engineer of the Year 2022 over to Viljo Allik, the Chief Engineer of Tartu Observatory, and the title of Technology Student of the Year to Artur Lavrov, a student of electrical power engineering and mechatronics at Tallinn University of Technology. @ the photo from left: Igor Krupenski, Artur Lavrov, Viljo Allik and Vice President of the Estonian Association of Engineers Enn Kerner.



Photo: Aleksander Tall





### Estonian Naturalists' Society

On 24 November 2022, a roundtable of the academic societies associated with the Academy of Sciences was held in the hall of the Naturalists' Society in Tartu with the aim of introducing the representatives of the societies to each other and creating preconditions for cooperation between the societies. The event was attended by 26 representatives from 17 academic societies. @ the photo: The roundtable of academic societies began with an ice breaker game.

### Estonian Young Academy of Sciences

The event of the year for the Estonian Young Academy of Sciences in 2022 was the organisation of an international and cross-sectoral discussion session that brought together various academies at the conference of academies of sciences held in the United States, 'The Triennial Conference of the InterAcademy Partnership and the Worldwide Meeting of the Young Academies' (pp 91–93). The discussion received a very warm welcome at the conference, which was attended by delegates from the academies of more

than 100 countries, and saw the beginning of several new cooperation initiatives. @ the photo: Participants in the discussion session.



Photo: screenshot





Photo: Piret Viljo

### **Estonian Learned Society in Sweden**

It was a delight to see both new and familiar faces outside the lecture hall at the Society's visit to the Nobel Prize Museum in Stockholm.

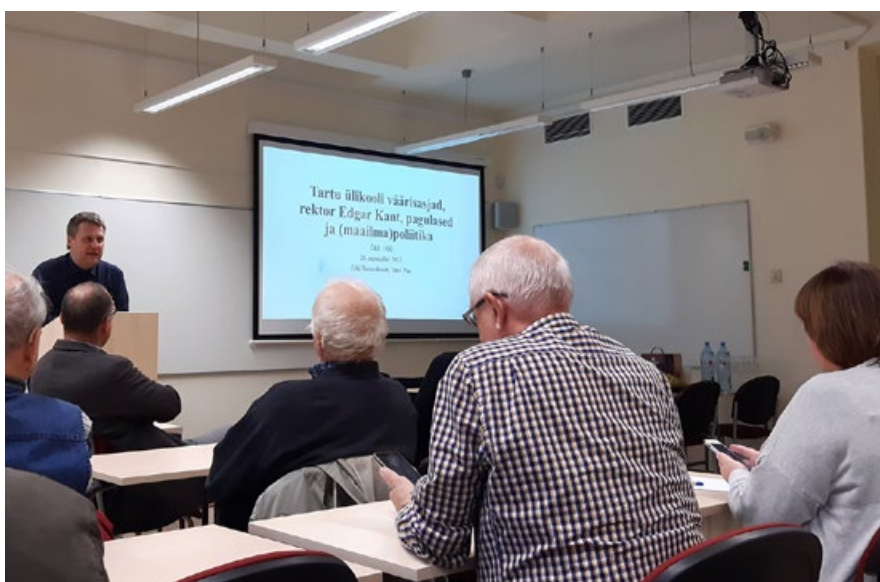


Photo: Madli-Johanna Maidla

### **Learned Estonian Society**

The Learned Estonian Society held nine presentation meetings in 2022, with the 1,500th presentation meeting of the Society held on 28 September being the most remarkable and attracting the largest number of participants. The meeting featured a presentation by Erki Tammiksaar and Taavi Pae, titled 'The Valuables of the University of Tartu, Rector Edgar Kant, Refugees and (World) Politics'.



Photo: Peeter Mürseppa private collection

### **Estonian Association of History and Philosophy of Science**

The most important event directly related to the Estonian Association of History and Philosophy of Science in 2022 was the 30th international conference of the Baltic history of science in Oulu. The next conference of the Baltic history of science is scheduled to be held in Tartu in 2024, with the main focus being on an analysis of the heritage of Friedrich Georg Wilhelm Struve. The presidency of the Baltic Association of History and Philosophy of Science was therefore also handed over to Estonia. @ the photo: The retiring President Ramūnas Kondratas and the newly appointed President Peeter Mürsepp.



# CONTACTS OF THE INSTITUTIONS AND ORGANISATIONS ASSOCIATED WITH THE ACADEMY

As specified in the Estonian Academy of Sciences Act, passed in 1997, research and development institutions and cultural establishments which are not part of the structure of the Academy, and academic societies or other organisations whose activities and

objectives are consistent with the activities and objectives of the Academy may associate with the Academy. The association is effected under bilateral agreements that state the aims of association and the tasks and commitments of the parties.

## Institutions associated with the Academy (in alphabetical order):

	Institution	Information and contacts
1.	Academic Library of Tallinn University Associated with EAS since 17 June 1998	Founded in 1946 Personnel: 86, including 2 researches Registered users: 35,382 Items in the circulating collection: 2,666,927 More information: <a href="mailto:tlulib@tlulib.ee">tlulib@tlulib.ee</a> <a href="http://www.tlu.ee/en/repositories/academic-library">www.tlu.ee/en/repositories/academic-library</a>
2.	Art Museum of Estonia Associated with EAS since 9 June 2015	Founded in 1919 Personnel: 154 More information: <a href="mailto:muuseum@ekm.ee">muuseum@ekm.ee</a> <a href="http://kunstimuuseum.ekm.ee/en/">kunstimuuseum.ekm.ee/en/</a>
3.	Centre of Estonian Rural Research and Knowledge (until 1 January 2023 Estonian Crop Research Institute) Associated with EAS since 23 September 2008	Founded in 1920 Personnel: 145, including 45 researchers More information: <a href="mailto:info@etki.ee">info@etki.ee</a> <a href="https://metk.agri.ee/en">https://metk.agri.ee/en</a>
4.	Estonian Literary Museum Associated with EAS since 11 May 1999	Founded in 1909 as the Archival Library of the Estonian National Museum Personnel: 101, including 32 academic staff More information: <a href="mailto:kirmus@kirmus.ee">kirmus@kirmus.ee</a> <a href="http://www.kirmus.ee/en">www.kirmus.ee/en</a>
5.	Estonian National Museum Associated with EAS since 21 December 2006	Founded in 1909 Personnel: 146, including 16 researchers More information: <a href="mailto:erm@erm.ee">erm@erm.ee</a> <a href="http://www.erm.ee/en">www.erm.ee/en</a>
6.	Institute of the Estonian Language Associated with EAS since 11 May 1999	Founded in 1947 Personnel: 82, including 57 academic staff More information: <a href="mailto:eki@eki.ee">eki@eki.ee</a> <a href="http://www.eki.ee/EN/">www.eki.ee/EN/</a>
7.	Tartu Observatory of the University of Tartu Associated with EAS since 8 May 1998	Founded in 1808, an institute of the University of Tartu since 1 January 2018 Personnel: 108, including 55 academic staff More information: <a href="mailto:kosmos@ut.ee">kosmos@ut.ee</a> <a href="http://kosmos.ut.ee/en">kosmos.ut.ee/en</a>

**Learned societies and other organisations associated with the Estonian Academy of Sciences  
(listed in an alphabetical order)**

	<b>Organisation</b>	<b>Information</b>
1.	Estonian Academic Agricultural Society Associated with EAS since 6 March 2018	Founded in 1920 207 active members, 31 honorary members, (incl. 3 honorary presidents) More information: <a href="http://aps.emu.ee/en/">aps.emu.ee/en/</a>
2.	Estonian Academic Oriental Society Associated with EAS since 12 June 2018	Founded in 1935, re-established in 1988 73 active members, 10 honorary members, 26 corresponding members More information: <a href="mailto:eao@eao.ee">eao@eao.ee</a> <a href="http://www.eao.ee">www.eao.ee</a>
3.	Estonian Academic Theological Society Associated with EAS since 15 October 2019	Founded in 1921 as an academic society of theologians, re-established in 1999 as an academic society of theology 65 members, 2 honorary members More information: <a href="http://usuteadus.ee/">usuteadus.ee/</a>
4.	Estonian Association of Engineers Associated with EAS since 23 September 2008	Founded in 1921 as the Estonian Society of Engineers Re-established on 10 December 1988 as the Estonian Association of Engineers Membership: 18 legal entities More information: <a href="mailto:inseneronlooja@hot.ee">inseneronlooja@hot.ee</a> <a href="http://www.insener.ee/">www.insener.ee/</a>
5.	Estonian Association of History and Philosophy of Science Associated with EAS since 4 February 1998	Founded in 1967 58 active members, 12 honorary members, 6 collective members More information: <a href="mailto:kaija.koovit@gmail.com">kaija.koovit@gmail.com</a> <a href="http://et.wikipedia.org/wiki/Teadusajaloo_ja_Teadusfilosoofia_Eesti_%C3%9Chendus">et.wikipedia.org/wiki/Teadusajaloo_ja_Teadusfilosoofia_Eesti_%C3%9Chendus</a>
6.	Estonian Association of Sociologists Associated with EAS since 18 June 2019	Founded in 1990 as the Academic Association of Estonian Sociologists, restructured in 1999 106 members More information: <a href="mailto:sotsioloogideliit@gmail.com">sotsioloogideliit@gmail.com</a> <a href="http://sotsioloogia.ee/in-english-2/">sotsioloogia.ee/in-english-2/</a>
7.	Estonian Biochemical Society Associated with EAS since 13 November 2009	Founded in 1959 112 members, incl. 84 active and 28 student members More information: <a href="mailto:katrina.laks@ttu.ee">katrina.laks@ttu.ee</a> <a href="http://biokeemiaselts.ee/en/">biokeemiaselts.ee/en/</a>
8.	Estonian Chemical Society Associated with EAS since 5 April 2011	Founded in 1919 71 active members More information: <a href="mailto:info@keemiaselts.ee">info@keemiaselts.ee</a> <a href="http://www.keemiaselts.ee/english">www.keemiaselts.ee/english</a>
9.	Estonian Economic Association Associated with EAS since 16 June 2011	Founded in 1930, re-established in 2002 Membership: 121 private persons and 4 legal entities More information: <a href="https://majandus.ut.ee/et/sisu/eesti-majandusteaduse-selts-ems">https://majandus.ut.ee/et/sisu/eesti-majandusteaduse-selts-ems</a>



	<b>Organisation</b>	<b>Information</b>
10.	Estonian Geographical Society Associated with EAS since 27 January 1998	Founded in 1955 180 members, 17 honorary members, 5 foreign members More information: <a href="mailto:egs@egs.ee">egs@egs.ee</a> , <a href="mailto:geograafiaselts@gmail.com">geograafiaselts@gmail.com</a> , <a href="http://www.egs.ee">www.egs.ee</a>
11.	Estonian Learned Society in Sweden Associated with EAS since 19 March 1999	Founded in 1945 Membership: 80 members, incl. 3 honorary members More information: <a href="mailto:teadusselts@gmail.com">teadusselts@gmail.com</a> <a href="http://www.etsr.se">www.etsr.se</a>
12.	Estonian Literary Society Associated with EAS since 23 January 2001	Founded in 1907 252 members (incl. 42 life-time members, 3 honorary members and 17 trusted members) More information: <a href="mailto:eks@kirjandus.ee">eks@kirjandus.ee</a> <a href="https://tartu.kirjandus.ee/en">https://tartu.kirjandus.ee/en</a>
13.	Estonian Mathematical Society Associated with EAS since 26 February 2019	Founded in 1926 as the Academic Mathematical Society, re-established on 17 September 1987 as the Estonian Mathematical Society 353 members More information: <a href="http://matemaatika.eu">matemaatika.eu</a>
14.	Estonian Mother Tongue Society Associated with EAS since 4 February 1998	Founded in 1920 375 active members and 17 honorary members More information: <a href="mailto:es@eki.ee">es@eki.ee</a> <a href="http://www.emakeeleselts.ee">www.emakeeleselts.ee</a>
15.	Estonian Musicological Society Associated with EAS since 21 June 2004	Founded in 1992 95 active members (4 from abroad), 1 honorary member More information: <a href="mailto:emts@hotmail.ee">emts@hotmail.ee</a> <a href="http://www.muusikateadus.ee">www.muusikateadus.ee</a>
16.	Estonian Naturalists' Society Associated with EAS since 23 January 1998	Founded in 1853 662 active members, 9 honorary members, 57 trustees Divisions: 23 More information: <a href="mailto:elus@elus.ee">elus@elus.ee</a> <a href="http://www.elus.ee/index.php/en/">www.elus.ee/index.php/en/</a>
17.	Estonian Physical Society Associated with EAS since 14 June 2005	Founded in 1989 163 active members More information: <a href="mailto:efs@fyysika.ee">efs@fyysika.ee</a> <a href="http://www.fyysika.ee/efs">www.fyysika.ee/efs</a>
18.	Estonian Semiotics Association Associated with EAS since 15 December 2009	Founded in 1998 73 members More information: <a href="mailto:info@semiootika.ee">info@semiootika.ee</a> <a href="http://www.semiootika.ee">www.semiootika.ee</a>
19.	Estonian Society for The Study of Religions Associated with EAS since 16 June 2011	Founded in 2006 56 active members, 2 honorary member More information: <a href="http://eaus.ee/en/welcome/">eaus.ee/en/welcome/</a>

	Organisation	Information
20.	Estonian Society of Human Genetics Associated with EAS since 5 April 2011	Founded in 2000 160 members More information: <a href="mailto:estshg@ebc.ee">estshg@ebc.ee</a> <a href="http://www.estshg.ut.ee">www.estshg.ut.ee</a>
21.	Estonian Society of Toxicology Associated with EAS since 31 May 2017	Founded in 1997 66 active members More information: <a href="mailto:ets@kbfi.ee">ets@kbfi.ee</a> <a href="http://ets.kbfi.ee/">ets.kbfi.ee/</a>
22.	Estonian Young Academy of Sciences Associated with EAS since 14 December 2021	Founded in 2017 33 active members More information: <a href="mailto:enta@akadeemia.ee">enta@akadeemia.ee</a> <a href="http://www.akadeemia.ee/en/eyas/">www.akadeemia.ee/en/eyas/</a>
23.	Learned Estonian Society Associated with EAS since 23 January 2001	Founded in 1838 111 active members and 14 honorary members More information: <a href="http://oes.ut.ee/english/">oes.ut.ee/english/</a>
24.	Society of Estonian Areal Studies Associated with EAS since 27 January 1998	Founded in 1939 175 members More information: <a href="mailto:ekus@ekus.ee">ekus@ekus.ee</a> <a href="http://www.ekus.ee/en/">www.ekus.ee/en/</a>



# ESTONIAN ACADEMY OF SCIENCES – FACTS AND FIGURES 2022

## FINANCIAL ACTIVITIES

TYPE	2022 budget	2022 budget implementation
<b>FOR THE ACADEMY FROM THE STATE BUDGET</b>	<b>1,974,370</b>	<b>1,974,370</b>
For the basic activities of the Academy, including remuneration to research professors	1,617,610	1,617,610
For remuneration to Academy members	293,090	293,090
For granting research awards	27,300	27,300
For the membership fees of international science organisations	36,370	36,370
<b>OTHER REVENUE</b>	<b>111,649</b>	<b>128,752</b>
Targeted allocations from the Ministry of Education and Research	61,649	61,649
<i>Including the balance of repairs and renovations</i>	61,649	61,649
Received from the lease of premises and the sales of services	10,000	33,791
From the sales of journals and commissioned works (Academy Publishers)	40,000	33,312
<b>Allocations to the Under and Tuglas Literature Centre</b>	<b>496,922</b>	<b>450,201</b>
<b>TOTAL INCOME</b>	<b>2,582,941</b>	<b>2,553,323</b>
Basic activities of the Academy (via the Office), including remuneration to research professors	1,357,610	1,296,656
Academy Publishers	310,000	296,663
Remuneration to Academy members	293,090	293,090
Activities of the National Research Awards Committee	27,300	28,236
Membership fees of international science organisations	36,370	36,370
Repairs and renovations of the Academy's buildings	61,649	63,493
<b>Expenses of the Under and Tuglas Literature Centre</b>	<b>496,922</b>	<b>424,852</b>
<b>TOTAL EXPENSES</b>	<b>2,582,941</b>	<b>2,439,360</b>
<b>Comment to the budget</b>		
The total amount allocated for the membership fees of international organisations decreased due to the part unused in 2021.		

# PEOPLE AND CONTACTS

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# ACADEMY MEMBERS

The names are highlighted to distinguish heads of divisions, female scientists, prominent creative individuals and the deceased. More information at [www.akadeemia.ee/en/membership](http://www.akadeemia.ee/en/membership)

## Division of Astronomy and Physics

**Jaan Aarik**, Exact Sciences, 2013\*

**Jaak Aaviksoo**, Exact Sciences, 1994

**Jaan Einasto**, Astrophysics, 1981

**Ene Ergma**, Exact Sciences, 1997

**Krista Fischer**, Mathematics and

Mathematical Statistics, 2020

**Arvi Freiberg**, Exact Sciences, 2009

**Vladimir Hižnjakov**, Physics, 1977

**Marco Kirm**, Exact Sciences, 2018

**Martti Raidal**, Exact Sciences, 2011

**Toomas Rõõm**, Physics, 2022

**Enn Saar**, Astronomy, 2010

**Peeter Saari**, Physics, 1986

**Mart Saarma**, Molecular Biology, 1990

**Elmo Tempel**, Astronomy and

Astrophysics, 2021

**Gennadi Vainikko**, Mathematics, 1986

**Richard Villems**, Biophysics, 1987\*\*

\* Here and hereafter the year of election as an Academy member.

\*\* President from 2004–2014

### Foreign members

**Jonathan (John) R. Ellis**, Theoretical Physics, 2015

**Charles Gabriel Kurland**, Biochemistry, 1991

**Jaan Laane**, Chemical Physics, 1995

**Alar Toomre**, Applied Mathematics, 2012

## Division of Informatics and Engineering

**Olav Aarna**, Informatics, 1990

**Hillar Aben**, Mechanics, 1977

**Dan Bogdanov**, Computer and

Engineering Science, 2022

**Jüri Engelbrecht**, Mechanics, 1990\*

**Ülo Jaaksoo**, Informatics, 1986

**Maarja Kruusmaa**, Engineering, 2016

**Jarek Kurnitski**, Engineering, 2018

**Jakob Kübarsepp**, Materials Engineering, 2011

**Rein Küttner**, Engineering, 1997

**Ülo Lepik**, Mechanics, 1993

† 12.02.2022

**Enn Lust**, Energy Technology, 2010

**Leo Mõtus**, Informatics, 1993

**Arvo Ots**, Energy Technology, 1983

† 09.01.2022

**Tarmo Soomere**, Engineering and

Informatics, 2007\*\*

**Raimund-Johannes Ubar**, Computer

Technology, 1993

**Tarmo Uustalu**, Computer Science, 2010

**Jaak Vilo**, Informatics, 2012

**Dmitri Vinnikov**, Engineering and

Computer Science, 2021

**Andres Õpik**, Engineering, 2013

† 28.01.2023

\* President from 1994–2004

\*\* President from 2014– ...

### Foreign members

**Steven R. Bishop**, Nonlinear Dynamics, 2012

**Michael Godfrey Rodd**, Process Control and

Information Technology, 1995

**Gábor Stépán**, Applied Mechanics, 2017

**Esko Ukkonen**, Computer Science, 2015

**Margus Veanes**, Software Science, 2019

## Division of Biology, Geology and Chemistry

**Toomas Asser**, Medical Science, 2011

**Jaan Eha**, Natural Sciences

and Medicine, 2016

**Jaak Järv**, Natural Sciences, 1997

**Ain-Elmar Kaasik**, Neurology, 1993

**Anne Kahru**, Ecotoxicology, 2018

**Dimitri Kaljo**, Geology, 1983

**Mati Karelson**, Natural Sciences

and Medicine, 2007

**Kalle Kirsimäe**, Geology, 2018

**Urmas Kõljalg**, Biosystematics

and Ecology, 2011

**Hans Kүүts**, Agricultural Sciences, 1994

† 06.10.2022

**Maris Laan**, Public Health, 2021

**Agu Laisk**, Natural Sciences, 1994

**Ülo Lille**, Biotechnology, 1983

† 02.01.2023

**Margus Lopp**, Chemistry, 2011

**Jüri Martin**, Ecology, 1990

**Andres Metspalu**, Biotechnology, 2010

**Ülo Niinemets**, Natural Sciences, 2013

**Valdur Saks**, Biochemistry, 1993

**Martin Zobel**, Ecology, 2010

**Raivo Uibo**, Medical Science, 2003

**Veiko Uri**, Forestry, 2020

**Mart Ustav**, Biomedicine, 2001

**Eero Vasar**, Medical Science, 2010

### Foreign members

**Ülo Langel**, Neurochemistry, 2015

**Pekka T. Männistö**, Pharmacology, 2012

**Svante Pääbo**, Genetics, 2019

**Matti Saarnisto**, Geology, 2008

**Helmut Schwarz**, Chemistry, 2002

## Division of Humanities and Social Sciences

Jüri Allik, Psychology, 2010

Mihhail Bronštein, Agricultural Economics, 1975; † 09.04.2022

Mart Kalm, Art History, 2010

Valter Lang, Historical Science, 2010

Lauri Mälksoo, Law, 2013

Elmo Nüganen, Dramatic Arts, 2020

Karl Pajusalu, Linguistics, 2011

Arvo Pärt, Music, 2011

Tiina Randma-Liiv, Social Sciences and Governance, 2018

Anu Raud, Art, 2016

Anu Realo, Cultural Studies, 2018

Jaan Ross, Humanities, 2003

Hando Runnel, Literature, 2012

Huno Rätsep, Estonian Language, 1981

Ellu Saar, Sociology, 2022

Marek Tamm, Cultural History, 2021

Tiit Tammaru, Human Geography, 2018

Tõnu-Andrus Tannberg, History, 2012

Jaan Undusk, Humanities, 2007

Urmas Varblane, Economics, 2009

Haldur Õim, Humanities and Social Sciences, 1994

### Foreign members

Juri E. Berezkin, Ethnography, 2012

Cornelius Theodor Hasselblatt, Literature and Culture, 2015

Raimo Raag, Linguistics, 2019

Päiviö Tommila, History, 1991  
† 18.11.2022

Endel Tulving, Psychology, 2002

Jaan Valsiner, Psychology, 2017



Photo: Maris Künvald

Group photo of the Academy members at the General Assembly on 20 April 2022.

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The war initiated by Russia on 24 February 2022 has led to a demographic catastrophe for Ukraine due to emigration, this means we are witnessing the second largest flow of refugees since World War II. (Academy member Tiit Tammaru, see pp 36–38).

According to the World Bank's recent estimates, the total rehabilitation and reconstruction needs in the social, production and infrastructure sectors amount to at least 349 billion dollars, which is more than 1.5 times the size of Ukraine's pre-war economy in 2021. (Academy member Urmas Varblane, see pp 38–40).

Millions of shattered homes and destroyed lives are a direct consequence of Russia's military invasion of Ukraine, but the real impact of the war is global and extends far beyond Ukraine's borders. (Academy member Anu Realo, see pp 40–41).

On 24 February 2022, quite a few masks that had been distorting the truth fell. International law may be a concept and practice historically developed by idealists, but today it has to prove itself in a very realistic world. (Academy member Lauri Mälksoo, see pp 42–43).