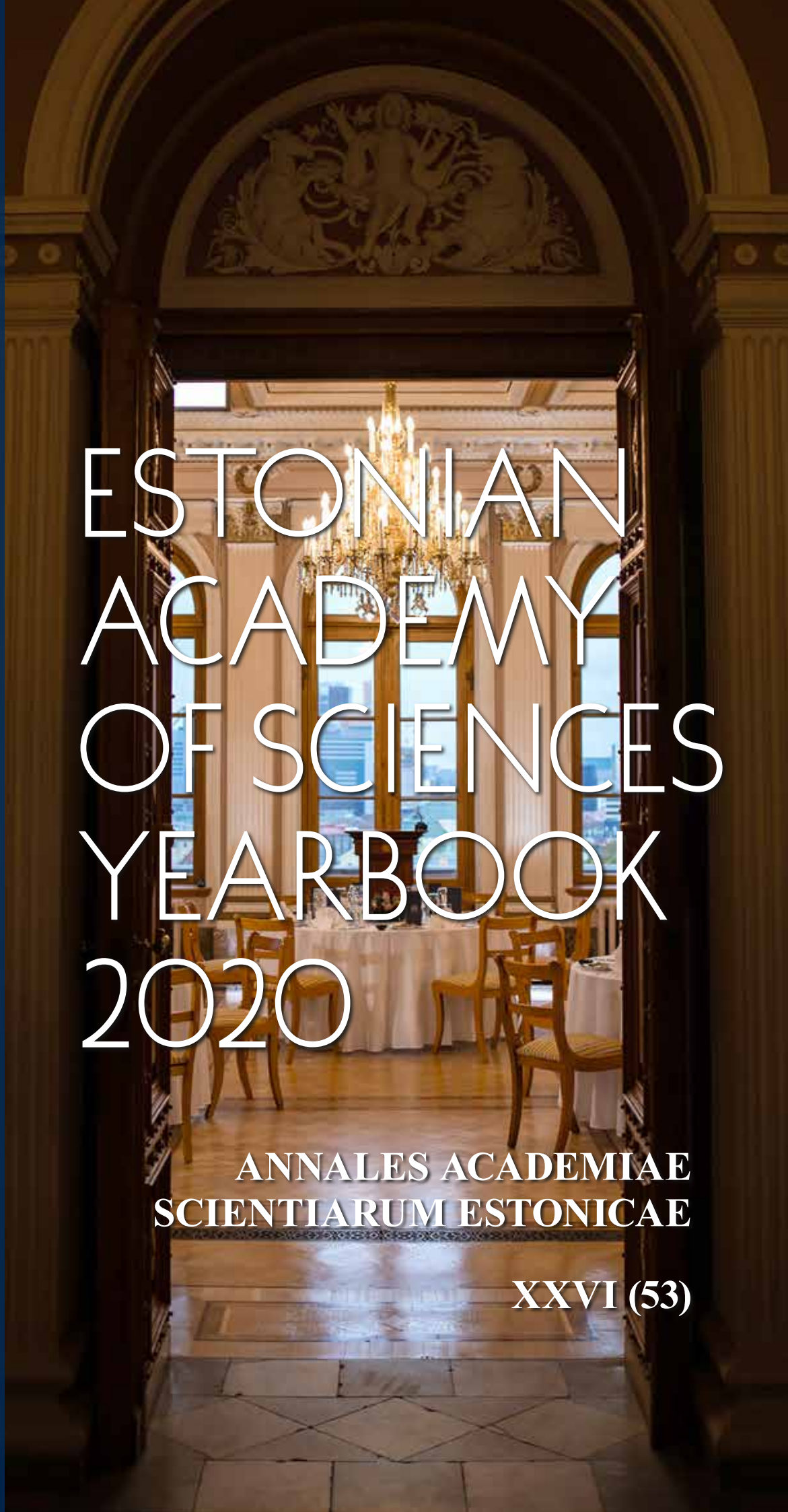
EESTI TEADUSTE AKADEEMIA



ESTONIAN ACADEMY OF SCIENCES YEARBOOK 2020

ANNALES ACADEMIAE SCIENTIARUM ESTONICAE

XXVI (53)

Front cover: The year of the COVID-19 can be characterized by the hope that it will all be over very soon and will be able to enter the hall again.
Photo: Reti Kokk

Facta non solum verba

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ESTONIAN ACADEMY OF SCIENCES YEARBOOK 2020

WORDS AND IMAGES

FACTS AND FIGURES

ANNALES
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FOREWORD

Such shocks across society as a whole, even kaleidoscopic change in exterior conditions, the fireworks of tightening and loosening restrictions, the round dance of attitudes and opinions which were born in 2020, but also the increasing strength of polarisation and a general growth of tension was something that no one could ever have anticipated. The Academy was involved in many ways. The government was in need of good advice. Most important was perhaps the work done to inform and calm society. The Academy's reaction was perhaps the most passive because we had adapted many of our meetings to be electronic.

We took our time to acknowledge and be grateful. Four Academy medals and the Paul Ariste and Karl Schlossman prizes were acknowledgements to those who have done much more than their employment contract would expect.

The activities of the Academy are cross-border by nature. The now three-year-old tradition of the Endel Lippmaa Memorial Lectures has evolved from a mere occasion in the scientific world to an event of diplomatic dimensions. The acceptance speech of the second Lippmaa Lecture and Memorial Medal laureate Uffe Ellemann-Jensen makes our small nation much larger.

In the middle of the summer, we were given the obligations of the chairman of the European Science Advisors Forum. In collaboration with the European Commission Joint Research Centre JRC, which is the in-house advisor to the European Commission, we have set specific goals to identify the *modus operandi* of science advice for policy in other countries, to share the best experiences in the field and attempt to avoid failures. After all, the speed and accuracy with which it is possible to acquire for economic and political decisions the competence that is accumulated in the scientific landscape is one of the pillars of competitiveness for nations and regions.

News, the importance of which we may perhaps be able to fully understand in a few years, is that Academy member Maarja Kruusmaa was nominated as one of seven advisors to the European Commission. This is one of the most remarkable achievements among Estonian scientific diplomacy. People are not elected into these positions randomly. Previous accomplishments of similar size were the work of Jüri Engelbrecht as the President of ALLEA and Mart Saarma's actions as the Vice-President of the European Research Council ERC.

The Academy is only as strong as its elected members. In 2020, we received an excellent addition to the family of Academy members. The many good qualities of the elected members are well-known. It is now all of our duty to allow them to manifest in the best possible way, for both the scientific field and for the common good.

There was also a breakthrough in realising the science agreement which was signed in December 2018. The government has decided to raise the funding of science to be one per cent of the gross domestic product GDP. Ideally, this is a decision, which will not be returned to and will not be disassembled. Even during the toughest of times. This allows for the solution of quite a few bottlenecks, but also poses a new challenge. Namely, 60 per cent of the additional funding will be distributed to different ministries. The reasonable implementation of this money is most certainly not a trivial task. In the case of failure, it may cause fear in other countries that would like to follow our example and may cause science to fall among underfunded fields. We may need to make audacious decisions and we must be willing to do our part. As Thomas Jefferson said: "If you want something you've never had, you must be willing to do something you've never done."

Tarmo Soomere
27 February 2021

THE ACADEMY DURING THE YEAR OF CORONAVIRUS

WITH OR WITHOUT A CROWN OR THE ACADEMY MEMBERS AT THE FOREFRONT OF THE CORONA CRISIS MITIGATION

Tarmo Soomere

In late winter of 2020, something began which seemed like a bad dream for a while. At one point, it seemed like it would pass. It has now (February 2021) returned with noticeably more force, as a better perceived hazard, which has become a part of our lives over time. Of course, we will defeat this disease eventually. The human race is a tough species, and a single virus will not be enough to take us down. Although it may hurt, and the medical bill will most likely be hefty.

It has been clear from the start that it is almost entirely up to us to determine how we arise from this pandemic nightmare. Primarily from understanding what the main threat in the given moment is, how to mitigate these threats, what will definitely change, and how to prepare for new circumstances.

Because what we know to expect or fear or adjust ourselves to is not as bad as it seems. Even if the predictions are raw, lack strict foundation, or include a great deal of uncertainty, then the roots which are needed for the future are already present. However, we simply do not know what they are. The more we try to observe the future through our current knowledge, logic, and the best possible models, the better prepared we are for adjusting to new conditions, and for disposing of the nightmare with minimal damage in the shortest possible time.

The Pandemic Arrived in Silence

Those that are more knowledgeable identified the problem when China decided to put Wuhan and its surrounding Hubei province under strict quarantine on 23 January 2020. It was not immediately evident how painful this new disease, which had risen its head on the other side of the world, actually is. Similar alarms occur across the globe once every decade. What takes place elsewhere is a foreign issue. However, those who were able to sense what is happening in the world began ordering protective masks.

Next were the troubled messages from Italy. This was not far at all. The location was connected through direct flights and other forms of communication. The wave kept approaching in a roar. Around 6 March, conferences and meetings were beginning to be postponed in the heart of Europe – Brussels, Hamburg, and so on. No one quite understood what this meant. Of course, there was also an excuse. Science in Estonia is arranged in such a way that a large portion of professionals have to apply for funding regularly. In 2020, the calls for funding were opened on 1 March and the deadline within universities was supposed to be 23 March. Many scientists turned their attention to that.

Nevertheless, many did not know to anticipate how urgent of a threat was on its way. One region in quarantine is not an issue. However, locking down entire nations showed that the situation was dire. So severe in fact that Islamic terrorists apparently said: don't go to Europe – it is too dangerous.

Photo: Shutterstock

Photo: Leemet Samel, ETAg

A Deafening Silence

The unity and co-operation of Europe fell apart in just a few weeks in March. Only words remained. Like the smile of the Cheshire Cat. It was the return of a time in which the only window to Germany, the heart of Europe, was by seaway. Travel by land was no longer available. Although a visa was not required.

Europe and the world as a whole are more than a billion people, supply and sales chains. It is a body which is multiple times larger than the sum of its parts. It is a living organism which can only function alongside its parts. It is our civilisation and therefore – to paraphrase Arnold Toynbee – is a movement by nature, not a condition. It is a voyage, not a harbor, even less a well balanced comfort zone.

The slogan of Estonia has been: "never alone again". We had to reaccustom ourselves in the middle of March. We often found ourselves alone. There was no need for a war, earthquake or the impact of an asteroid. All it took was a villain the size of a nanometre, who had us on its menu.

It quickly became clear that man is not at the top of the food chain after all. If we wish to be one with nature then we will become prey for somebody. Of course, we want this to be as delayed as possible, but natural selection may work differently.

The slogan of Estonia has been: "never alone again". We had to reaccustom ourselves in the middle of March. We often found ourselves alone.

The vulnerability of a thin planed nation became apparent. It seemed unbelievable that we did not have a good baggage of knowledge in the field of epidemiology. Perhaps the knowledge in the field moves faster than we can keep up.

Bull by the Horns

In retrospect, the nation made reasonable decisions. The Scientific Advisory Board for combatting COVID-19 was called together which comprised of top specialists. Their suggestions were followed for the most part. Many other nations had a worse time. At least for a period in time – as the saddening statistics of the beginning of March 2021 have shown (more than 1,500 infections per day). Professor Irja Lutsar took the lead and alongside her were Krista Fischer who was elected as an Academy member

in December and Academy Research Professor Andres Merits. Helping with model creation were Academy member Jaak Vilo and Mario Kadastik from the Estonian Young Academy of Sciences. Movement and gathering restrictions were put in place. Departments and necessary intensive care units were prepared to combat this highly infectious disease. Testing was commenced, mathematic modelling of the pandemic was organised, and much more.

All of this was also criticised, of course. Those who were more knowledgeable than others in leading national airlines became epidemiologists overnight or at least specialists in the field of public health. Social media kept running out of space. All of the nation's decisions were met with harsh criticism.

Something definitely went wrong. As it was later revealed in the European Science Advisors Forum's report, the created *ad hoc* (scientific) advisory boards, interestingly enough, often did a better job at providing advice for the specific problem than traditional systems of science advice.

The initial phases of these types of crises are complex by nature because relevant scientific information is uncertain and is expanding or updating rapidly, even daily.

Golden Rules of Good Advice

In situations such as this, it is common to attempt to convey complex advice as a simple message. This does not work too well when it is necessary to include complex and varied expertise. What then becomes determinative is whether society trusts those who make political decisions. One factor in this is trust in those whose advice is followed, or in other words scientists and methods in acquiring scientific knowledge.

The golden rule of scientific advice is especially important in a state of crisis: the decision makers must trust those who provide support. Trust can only be achieved when scientific advice a) comes from a expert with a clear mandate, b) is public and transparent and c) relies on the best knowledge. The latter two are classics, but the first became crystal clear during the corona pandemic.

The silver rule is more difficult to accept. Namely, whatever decisions are made, it is important to recognise that they are the best solution for their time and at that specific moment. We cannot replay history and must live on with the decisions we made. Hindsight has always been an exact science, but there is no point in criticising, especially in a time of crisis. We cannot maximise profits in these situations. The best strategy is to minimise damages in both maintaining lives, as well as restarting the economy.

A functional society is assured through hundreds of areas and thousands of linked enterprises. If an important sector were to collapse, such as transport, for example, then it would quickly damage the functionality of society as a whole. Rebuilding a damaged sector will take a long time. The regulations which assure quality in normal circumstances will quickly become brakes. If we want to move on at all, then difficult decisions must be made, and we must be bolder in our thinking while also avoiding the crash of society. This is an example of the case when "facts are uncertain, values in dispute, stakes high and decisions urgent". In other words, the classic post-normal science* tetralemma, described by Funtowitz and Ravetz, is realised.

In these situations, the new paradigm of counselling and good advice realisation becomes apparent. In the past, it was enough to convince decision-makers. Not anymore. Now it is also important to convince society while providing decision-makers with enough support by explaining the situation, as well as keeping all necessary facts at the ready.

Changing the World is More Important than explaining

In the middle of March, many were anxious to provide the government with advice and support. Common sense said that the Scientific Advisory Board would be able to receive advice from scientists on their own – what would be even better is if we knew how to channel it to the government. It became clear that advice from multiple voices would not work in this situation. For the most part, this would mean cacophony which no one wants to hear.

Common sense also reminded us that it would not be enough to keep good advice to ourselves or amongst friends. It needs to be taken to those who have the mandate to make decisions. A state of crisis is not the time to deal with festive letters. Those are read after the smoke has faded. The government's secretariat would most likely not have the leisure to analyse dozens of sets of advice to decide how to proceed.

Regardless, there was a need for an unconventional and powerful channel of communication. Communication only works when the target audience understands it. (Let us set aside the current most common shades of its meaning, such as promotion, advertising, lobbying, apologising, hiding mistakes and altering the truth.) This can only happen when the doers have the necessary knowledge which they are

* Silvio O. Funtowicz, Jeremy R. Ravetz, Science for the post-normal age. – *Futures* 1993, **25**(7), 739–755. doi: 10.1016/0016-3287(93)90022-L.

Only Business Class seats available - there were lot of empty chairs during all the events in 2020 to keep the distance.

able to apply to the current situation. Besides, crisis communication during a pandemic is incredibly difficult due to its volatility. It is important to rely on scientific fields with different philosophies, and use of language, where different types of assumptions are made, and conclusions are worded differently.

Journalism can change the world – if given a good enough input. Marti Aavik who had recently left his position as the Academy's Head of Communication and Director of the Academy Publishing House to become the Deputy Editor-in-Chief of *Postimees* proposed a solution: to call together an assembly of a wide range of intellectuals and gather their comments, advice, arguments, and their spirit or logic, and publish them in the daily paper's web publication, as well as through podcasts.

We thought that at least we would try and test if we could succeed in providing additional value to the COVID-19 Scientific Advisory Board and avoid informational cacophony at the same time. We would see what kind of new and/or less reverberated information, topics or visions from the world's informational space we could find. We would word, in an understandable manner, what the respective information means to scientists and experts, and what it means for society. We would search for reliable sources on which to rely and find additional facts. Most importantly, try to interpret the avalanche of information in a reasonable way that is relevant to our situation and do that systematically, and in a versatile way.

Experienced People from Different Fields

The initial phases of these types of crises are complex by nature because relevant scientific information is uncertain and is expanding or updating rapidly, even daily. Plus, the amount of hospital beds and breathing apparatuses needed is unknown, or what to do to make sure there is enough of both.

It is already incredibly difficult to mediate uncertainty and complexity to society, not to mention the fact that yesterday's information may already be false, and what is true today, along with state-of-the-art science, may be in the recycling bin of history the day after tomorrow. Such is the nature of science, and those who have chosen this path must accept it. Nonetheless, it must be clear to all what is definitely known, what is partially known, what is unknown, and what we do not know. Such is the structure of the universe, that despite our efforts, dreams, and feelings, there are things that we will not know, not even theoretically.

Putting complex information into adequate context usually only succeeds when it is poked and massaged by

Photo: Shutterstock

a lot of specialists from different fields. When talking about a pandemic then the participation of medical scientists is mandatory. If we want to peek into the future then a physicist and a mathematician with a thorough understanding of modelling has to be on board. The pandemic strikes both people and the economy. Entrepreneurs are the first to feel it. These considerations formed the core of the *Postimees* and the Academy's Scientific Board: medical scientist Eero Vasar, physicist Jaan Kalda, economist Urmas Varblane and human geographer Tiit Tammaru. They were soon joined by the CEO of the Estonian Employers' Confederation, Arto Aas.

Main and Repeating Topics

It was established already in the first round of discussions* that much of what had until now seemed to be self-evident needs, had changed drastically. It is good that time is no longer wasted on endless chains of meetings. Although doing things electronically is unfamiliar and things happen with a delay, but we will still manage.

Physical distancing (which for some reason was referred to as social distancing) is exciting for maybe a few weeks. When left alone, facing one's troubles and fears, rumours and conspiracy theories begin to spread rapidly. Civilization will probably not collapse from this pandemic, but we must consider a longer period in which life is different. Movement restrictions are an effective means of suppressing the spread of the virus, but where isolating and isolation may help us win the battle, we will most likely lose the war in the long term.

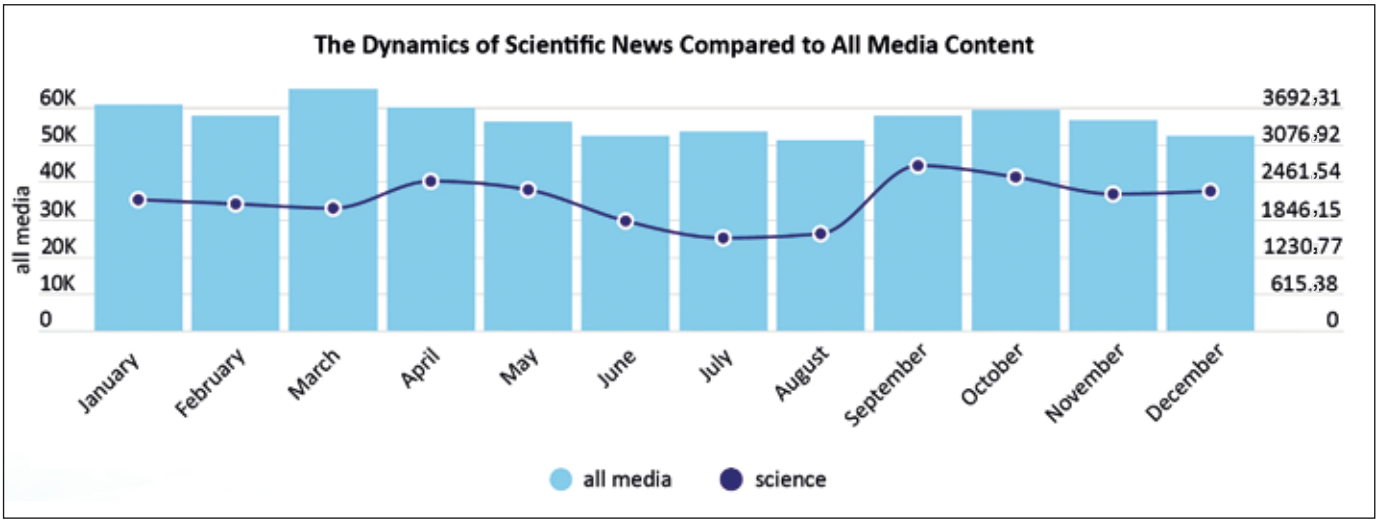
One of the burning questions, a creator of mass uncertainty, and the source of many speculations was that it was not known how many carriers of the virus there were. Mass testing was needed to understand the situation. Estonia was not capable of this. "Oh well," thought the participants of the discussions. We will live off of the data and forecasts of others for a while. Although the World Health Organisation (WHO) stressed that if you do not know who or what you are fighting, then it is similar to being a blind firefighter. Everyone thought that the billion-dollar question was to ask when a vaccine was going to be developed, or when people develop the necessary amount (at least 2/3) of immunity by some other means.

At that moment (and even now, March 2021), people were certain that an overburdening of the medical system must be avoided. Operating in this manner would possibly prolong the fight and would not guarantee a decrease in deaths caused by the virus. But if the medical system tears, then it will cause many deaths that could have been cured with ease under normal conditions. It is easy to understand what happens when it takes the ambulance several hours, rather than minutes, to come to the aid of someone who is having a stroke or a heart attack.

It seemed self-evident that attention had to be turned to already existing medicine. These may, at least partially, protect the body from an attack by the coronavirus or at least alleviate symptoms.

Admittedly, going to the countryside during the pandemic would have unexpected consequences. The percentage of elderly people is higher outside of Tallinn, medical aid is further away and interaction between people, e.g., in the village store, often denser.

* Marti Aavik, Postimehe ja teaduste akadeemia nõukoda: kuidas viiruse kahjud minimaalsed hoida? – *Postimees* 19.03.2020, https://arvamus.postimees.ee/6928191/postimehe-ja-teaduste-akadeemia-noukoda-kuidas-viiruse-kahjud-minimaalsed-hoida.



The waves of the pandemic correlate largely with the proportional change of scientific news in our media.
Source: Station.ee media audit to the Estonian Academy of Sciences, January 2021.

The unity of Europe before and after the pandemic is considered to be incredibly important and the precedent set by Poland (to close the borders even for transit) very dangerous. The economy and our way of life are heavily dependent on functioning trade. Components, spare parts, etc., disconnection of shipment chains immediately makes the economy very vulnerable. When goods are not moving then we cannot even buy tests for the virus or acquire vaccines, not to mention other necessities.

Even then, Academy member Urmas Varblane pointed out that global trade chains were likely to collapse. The coordination risks in a fragmenting world were simply too large. It was reasonable to take into account that shipment chains would go from global to regional. Estonian companies were, at this point, receiving orders which were primarily made by industries from foreign lands.

Estonia was not entirely alone. At least in words. It was evident that we had to manufacture a considerable amount of necessities ourselves or obtain them from neighbours. Nowadays, that is not so difficult. A small saving at the expense of the safety of shipment chains may not be reasonable in the future. It is likely that others may have the same idea, and so companies that export their goods to foreign countries must be careful.

It was nice to observe how the Chinese economy was exiting from the crisis, and movement was being restored. Japan, Singapore and Korea, who had done a better job of containing the virus, were at a better starting point with restoring trade.

It was clear that relieving restrictions, which were set in Europe to stop the spread of the virus, would prove difficult. The prediction that also came true was that the pandemic would give grounds to arguments of populist parties and that the field of tension between the illiberal and the democratic world would strengthen.

From Agriculture to Culture

The second round of discussion on 23 March 2020 included the viewpoints of Arto Aas and Academy member Maarja Kruusmaa. It later became clear that the central idea, which was how restrictions to people from moving freely would affect economy, was somewhat ahead of its time. The pandemic may strike a severe blow to some sectors if an entire year was to be skipped, as this would affect both entrepreneurs as well as food services. This is exactly what happened in the agricultural sector, where there is an abundance of foreign workforce.

Academy member Eero Vasar believed that monitoring how Africa deals with the pandemic could be beneficial. Namely, observations have shown a blood pressure lowering effect of the inhibitors in the core substance* ACE2 within the virus. If the virus in Africa performs differently from what has been observed elsewhere in the world, then it could provide valuable hints for creating medicine and developing a vaccine. Although Plaquenil, the medicine developed in many places, showed promise, it was believed to be too early to cheer. The tests at the time were definitely not perfect. There were already doubts that they are only 60–70 per cent correct. Specifying would have been possible through tests that were based on antibodies, which were not yet used in Europe.

It was stressed time and again that the free movement of goods was vital. Even e-commerce is the movement of

* Angiotensin conversion enzyme 2, which is a substance that acts as a lock for the cell membrane, which the coronavirus tries to delude on its way to the inside of the cell – ed.

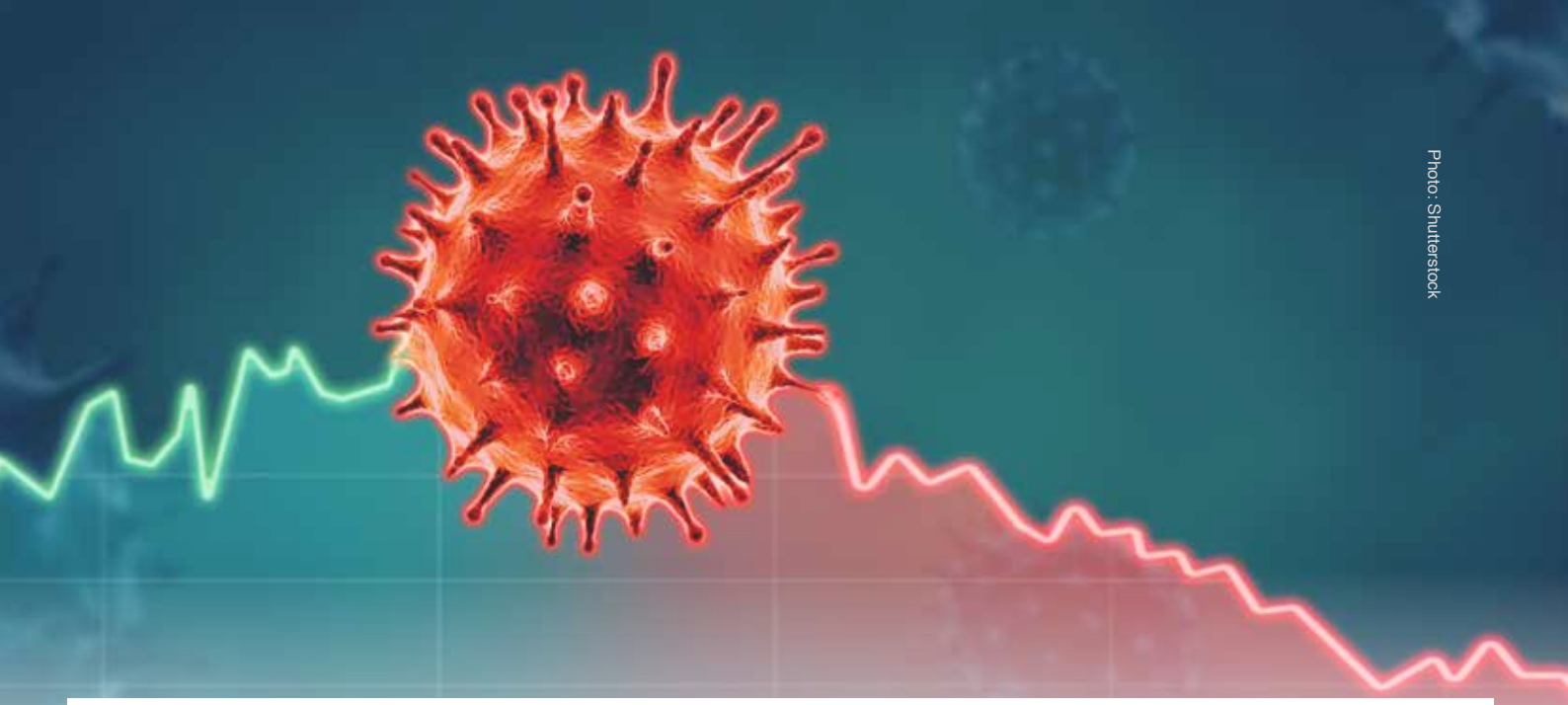


Photo: Shutterstock

Perhaps we will start living differently when the second wave of coronavirus eventually passes. We will not make unnecessary commutes or heat multiple offices.

physical goods after all. If we cannot maintain that, then we face serious difficulties. The initial shipping difficulties originating from the crisis in China were already over by this point, but now we faced difficulties arising from Europe. The economy can withstand a large-scale shipping crisis for two to three months. After that, the resources will be exhausted and could have ended in a difficult situation in the beginning of the summer.

Tiit Tammaru's message was also not cause for joy. Due to the change in national regulations, it was no longer possible to retrieve new data from mobile positioning. Even a direct statement did not help.* The stance that privacy is more important prevailed. (As a precaution, I will refrain from writing "than" and naming other aspects.) The existing (old) data did however provide a certain image. People's movement can be evaluated indirectly through the change in the usage of utility services (water and electricity) for example, or through satellite-based methods. Valuable information can also be obtained through the analysis of metadata which has been posted on social media. Peceiving and understanding the cultural and social consequences of the spread of the virus was deemed incredibly important. There was nothing good to gain from pushing blame onto someone.

Thorough Background, Adequate Interpretation and Meaning

What came after was a routine, but during our current, third wave (March 2021), definitely not yet history. There were 19 meetings in more than two months. Twice a week at first, and then once a week when the situation began to normalise. Ideas from a total of 13 members of the Academy of Sciences, as well as invited guests (Jaan Kalda, Arto Aas, and Krista Fischer, who was elected to the Academy in December) and of course journalists from *Postimees*, have been published. The topics developed further, and the participants varied. 17 discussions received quick coverage. Some remained as mere notes, some became podcasts.

The niche, which these discussions fell into, was less classical scientific advice and more discussions over the meaning of captivating and exciting topics. A signal was sent to society that calm and experienced people were exchanging ideas relating to the pandemic and its different aspects a couple times per week. Not trying to impose their knowledge onto others or trying to force their suggestions to the government, but attempting to create order in the avalanche of information. They brought forward aspects which were not yet noticed or simply not adequately covered, and made problems known that required solving. They acted as a filter to allow the prioritisation of ideas which were moving around, clarifying what lies behind the differences and where the border was between knowledge and value judgement, without hesitating to

* Tarmo Soomere, Andmete peitmine toob ohvreid. – Postimees 78(7089), 03.04.2020, 14. https://leht.postimees.ee/6940401/tarmo-soomere-andmete-peitmine-toob-inimohvreid.

muffle conspiracy theories and fake news. They considered how important were the current topics or topics which would arise in the near future. Conclusions from professionals were made in such a manner that ideas and information would be available for use by the public in a way that would not disturb the work of the Crisis Board.

Having this crisis pass with minimal damage to the nation as a whole, the economy, individual companies and communities as well as each companion on this road, was something that all participants considered an important cause to work towards. It is of course impossible to measure how many brain cells were left unharmed or how many disputes were avoided as a result of these calm explanations. These discussions and the comparisons of topics by *Postimees* provide an interesting conclusion in the language of indicators. Approximately a third of the topics which related to the coronavirus that were published within the first six weeks arose from these discussions, and almost half of all editorials focused on the central ideas of the discussions. Coverage of academic thought to the public at a rate such as this has not happened in the world before, as far as we know.

Strategy for Exiting the Crisis

The more these discussions became a routine, the more there were attempts to hypothesise what sort of new world we would find ourselves in after the pandemic. It was clear that something had changed. The explosive growth of remote work, the dissipation and stationarity of people, the decline in manufacturing and the halt of aerial transport had substantially reduced the emission of carbon dioxide and other greenhouse gases. The need to provide heating for offices and meeting rooms declined demonstrably. Just as evident was the quality of internet connections.

The ones that win the most from big changes are usually the ones who can turn them to their benefit. This leitmotif gave rise to the consideration of where to channel the Estonian economy after restarting it. Two ideas arose which have a chance to "take off" so to speak. Firstly, if many have already created the ability to work from home, then it should be supported through fast information exchange. Secondly, if transport and manufacturing have dried up, then the fields which should be prioritised are the ones that could also alleviate the climate crisis. Of course, in areasonable way and killing two birds with one stone. That is how the proposal* by the Academy of Sciences on how to exit the crisis became the most gleaming output of the discussions.

These proposals were soon repeated in the suggestions of the European Commission, but in a more contrast and insistent manner. Perhaps we will start living differently when the second wave of coronavirus eventually passes. We will not make unnecessary commutes or heat multiple offices. Instead, we will offer fast internet connections at a reasonable price, so that we can work from home. Renovate our homes and move to renewable energy sources in power generation and transport. Do all of this in a way in which the difficulties and burdens would be distributed equally, and that our more vulnerable companions would not have to pay the bills of the wealthy; not physically nor figuratively. Perhaps this would create a building block from the "hijacking" of daily newspapers perpetrated by scientists for the purpose of scientific communication, that is needed to build a future in which we all would like to live, although currently it is evident that this exercise must be repeated.

Sirp, 10(3832), 12.03.2021, 34–36.
https://sirp.ee/s1-artiklid/c21-teadus/krooniga-voi-koroonata-ehk-pargviirus-akadeemikute-hambus.

* Tarmo Soomere, Ülo Niinemets, Tiina Randma-Liiv, Jaak Järv, Sammud tuleviku poole. – *Postimees*, 121(7132), 26.05.2020, 15. https://leht.postimees.ee/6981409/akadeemikud-sammud-elamist-vaariva-tuleviku-poole.

THE ESTONIAN ACADEMY OF SCIENCES' STRATEGY FOR EXITING THE CORONAVIRUS PANDEMIC

26 May 2020

We are witnessing the birth of history. The world is suffering a crisis nobody could expect. At the same time climate issues have not disappeared anywhere. Consumption of fossil fuels, pressure on the ecosystem and overexploitation of the Earth's resources are continuing. Economic recession due to the Covid-19 outbreak has only mitigated climate concerns for a while through decreased production and consumption of energy and goods.

The coronavirus Covid-19 pandemic has hit hardest those who have been suffering most due to the climate crisis: low-income members of society and the young, who find it difficult to enter the job market. The price of the emissions of greenhouse gases and hazardous substances into the environment is often paid not by producers or consumers but other, often the weakest, members of society, who pay both in money and their health. We owe them not only well-paid jobs but also clean air, undamaged nature and good health.

It is up to us to choose how to move on. We may try to continue as previously and restore the collapsed businesses.

The standpoint of the Estonian Academy of Sciences is that now is the time to start structural changes through which with a longer perspective the state and society will become stronger and more sustainable.

We prioritise creation of jobs that are necessary for the future economy and require good education and much more sparing use of the environment. Let us build a future that is worth living in. Let us invest into jobs that support a cleaner environment and manage economic recovery so as to mitigate the climate crisis.

The reduced consumption of energy, especially of fossil fuels, coupled with large investments into transportation infrastructure is opening a unique window of opportunity in a way that is similar to crises in the past, that have motivated societies to give up out-of-date concepts and fostered introduction of innovative solutions and technologies.

The appearance of the future depends to a large extent on whether we will be able to replace the energy supply based on fossil fuels by renewable energy sources. Estonia has an opportunity and the capability to become the pathfinder for implementing Europe's new strategy of economic growth – Green Deal. Large-scale production of energy from biomass is a dead end. Wind farms on the land and in the sea and solar panel systems are rapid and affordable solutions under Estonian conditions.

Modern society is in continuous need of a high-quality energy supply. Energy security is an important cornerstone of the whole country. It is impossible to produce electricity into storehouses. However, by making smart investments it is possible to significantly decrease energy consumption.

To guarantee energy security we have to be able to produce and store suitable energy carriers. Pumped-storage hydropower facilities respond quickly to changing energy demands. The logical role of wind farms is to produce industrial quantities of hydrogen. Hydrogen is an ecologically clean, easy to transport and store energy carrier with a high content of energy, which can replace fossil fuels in the transportation sector.

The Estonian Academy of Sciences recommends that the economy be enlivened by investments into improving communication systems and radical restructuring of the energy sector. To this end the following activities are important:

1. Covering the whole of Estonia with a rapid data communication system, which will result in lower transportation needs and energy use, favours continuing telecommuting and will reduce regional inequality.
2. Deep renovation of existing buildings: reduction of energy consumption, improvement of indoor climate (incl. minimisation of danger of infection with improved ventilation systems) and on-site production of clean energy.
3. Removal of obstacles to the establishment of wind farms and making investments into energy storage systems (incl. pumped storage hydropower stations).
4. Large-scale production of hydrogen from difficult to manage renewable energy sources such as offshore wind farms that are difficult and expensive to integrate into the electric grid.
5. Change of public (especially rail) transport to use hydrogen, the creation of the required infrastructure and introduction of tax allowances for the use of hydrogen-based energy.

6. Tuning pollution taxes and emissions trading so as to influence consumer behaviour, proceeding from the effect of hazardous by-products of the generation and consumption of energy during their whole lifecycle, incl. effects on human health.

Environmentally friendly energy production and storage, use of efficiently produced and easy to store energy carriers in transportation and industry combined with reduced energy consumption through smarter building and offering rapid data communication will support our energy independence, will mitigate the pressure on our forests, and will enable us to safely give up the use of polluting energy sources.

Estonian Academy of Sciences on 26 May 20

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ROADMAP OF THE ESTONIAN ACADEMY OF SCIENCES

The general structure, way of operation, management scheme and distribution of tasks and competences of the Estonian Academy of Sciences mostly reflects the workflow of classical academies of sciences. A core feature is that the elected Members of the Academy have not only the right, but also real opportunities to participate in the decisions of the Academy. Therefore, the highest decision-making body of the Academy is a collegial body – the General Assembly including all the Members of the Academy. All elected leaders and managing bodies of the Academy are accountable to the General Assembly, and the resolutions of the General Assembly are final.

The General Assembly has the power to formulate the main lines and principles of action, and approve and amend the Statute and other source documents, but also the structure of the Academy and the statutes of the institutions of the Academy. The General Assembly elects the Members and Foreign Members of the Academy, also its President, Vice-President, Secretary General and part of the members of the Board. Only heads of divisions are elected by the divisions. The General Assembly is also the body that hears and approves the annual report, the budget and the report on its implementation, sets the principles and the procedure for paying remuneration to the Members of the Academy, and may naturally discuss and pass resolutions on any issues brought in front of the General Assembly by any of the Members of the Academy.

In addition to technical and organisational tasks, the General Assembly has the mandate and responsibility to advise the Estonian Government on various strategic aspects. This includes matters related to the academic landscape, e.g., discussing scientific achievements, assessing the situation of research priorities in Estonia and making proposals for their development, but also formulating positions and recommendations to the *Riigikogu* (the Parliament) and the Government of Estonia on issues related to the social, technological and economic development of Estonia. In this aspect, the Academy was relatively passive for a while, but has become more active in offering advice since 2019.

The General Assembly generally convenes twice a year and only in exceptional situations three times a year. In this sense, 2020 was an exceptional year. The traditional spring meeting was cancelled due to the pandemic, but for the future, it was definitely necessary to amend the Statute, so that all issues related to the operation of the Academy could be decided by electronic means. For this reason, an extraordinary meeting of the General Assembly had to be organised in summer.

Current matters are the responsibility of the Board, the other collegial governing body of the Academy. The number of Board members has changed over time. Until 2019, it had 16 members,

since 2020 the number of members is 12. The Board consists of the Academy's elected leaders (President, Vice-Presidents, Secretary General), heads of the divisions and the so-called free members who are elected by the General Assembly. Traditionally, the Board members are elected so that all divisions would have an equal representation.

The functions of the Board differ greatly from the role of a management board of a traditional business association. The mandate, responsibilities and obligations of the Board members of the Academy rather resemble that of the members of the senate of a university or councils of various institutions. The discretionary powers of the Board are quite extensive, but the members do not have any proprietary liability (which is assigned to the President and Secretary General). Therefore, the President of the Academy has the right not to accept the decisions of the Board and, if necessary, take the matter to the General Assembly. This right, however, has not been used for decades.

The Board prepares the questions to be discussed at the meetings of the General Assembly and ensures the implementation of the resolutions adopted by the General Assembly. The Board is responsible for announcing various research competitions and granting awards and scholarships. Naturally, the preparatory work is performed by relevant committees, but legally, the decision of the Board applies. It is interesting that the Board (and not the General Assembly) decides whether the Academy should submit an application for becoming a member of some international organisation or conclude agreements on association with some other institution or society.

The Board has the mandate to set up committees and appoint representatives of the Academy to decision-making bodies or expert groups. Although this does not apply to the bodies where researchers or Members of the Academy represent only themselves (e.g., the Evaluation Committee of the Estonian Research Council), the role of this function has greatly increased in recent years. It is good to know that the Academy is not only deemed as one of the many recruitment agencies, but that its mandate is seen as a quality mark. Just recently, the Board was given the mandate and obligation to express opinions on issues relevant to research policy, which used to be done only by the General Assembly.

Technical matters decided by the Board include the structure and positions filled in the Academy Office, but also the use of the assets of the Academy. The latter, however, is probably deliberately arranged so that the Board must share this mandate with the President, who is solely responsible for the legitimate and purposeful use of the assets and means of the Academy. This may also be one of the reasons why the Board cannot give orders to the President.

While the Members of the Academy have the obligation to participate in the sessions of the General Assembly, the participation in the Board meetings is their right, which has been exercised quite often and hopefully, becomes a tradition also in the era of electronic sessions. Related to this is the obligation of the Board to discuss the issues of research and its organisation that, in the opinion of the Members of the Academy, require consideration on the Board level.

The Board meetings take place about 10 times a year; during the current pandemic they are held online, of course. In 2020, the Board had seven work sessions, five of them as Zoom meetings. Also, decisions were made by electronic polls five times. Lively and sometimes rather heated discussions on how to organise the Academy's work more efficiently, or which advice to give on improving the research system, take a large part of the meetings.

In order to ensure the consistency of management, the procedure for substituting the President was established for cases where the President cannot perform his or her duties. This happened in December when the President was fighting the coronavirus.

The Academy is divided into four divisions of a more or less equal size. The divisions include the Members and Foreign Members of the Academy in the respective field

In 2020, the Board of the Estonian Academy of Sciences included the following members:

President	Tarmo Soomere
Vice-President	Mart Kalm
Vice-President	Arvi Freiberg
Secretary General	Jaak Järv
Head of the Division of Astronomy and Physics	Marco Kirm
Head of the Division of Informatics and Engineering	Jakob Kübarsepp
Head of the Division of Biology, Geology and Chemistry	Toomas Asser
Head of the Division of Humanities and Social Sciences	Valter Lang

Until 31 January 2020, the members of the Board were Jüri Engelbrecht, Karl Pajusalu, Peeter Saari, Andres *Öpik* and Eero Vasar. On 1 February 2020, they were replaced by Martti Raidal, Maarja Kruusmaa, *Ülo* Niinemets and Tiina Randma-Liiv.

of research. The divisions may arrange the activity of-respective institutions of the Academy and cooperate with other research and development institutions, societies and associations in the same field of research. In the context of institutions, the scope of this mandate has decreased as the consortium of the Academy includes only one research institution – the [Marie] Under and [Friedrich] Tuglas Literature Centre. On the other hand, the role of the divisions of the Academy is increasing in the work of permanent committees, especially in situations where some information or knowledge has to be consolidated for the government or the *Riigikogu* (Parliament). The divisions elect their head, who automatically becomes a member of the Board.

Operational management of the Academy is shared by the President and Secretary General. Their role and responsibilities greatly resemble the ones assumed by management board members in a commercial enterprise. The President is a general leader whose main role is to represent the Academy and who is responsible for the general development, for the activities specified in the Statute and for the use of assets and means of the Academy. The Secretary General has to ensure proper operation of the Office and deal with administrative matters. They both have to be Members of the Academy. As regards the President, this seems only logical, but most of the tasks of the Secretary General can also be performed by a good administrative specialist, and in many other academies, the respective tasks are performed by non-members. Since the membership is required by law, it is wiser to observe it. Vice-Presidents support the President in solving current issues, they lead respective fields and substitute for the President in unexpected situations if the President cannot perform the duties.

All elected leaders (President, Vice-Presidents, Secretary General, Heads of Divisions) act under employment contracts. The leaders usually perform large part of their duties outside the building of the Academy. In other words, and as understood from the above description, the Academy Office is the structural unit that operates in the Academy building and employs people working for the Academy. The safest way to contact any Member of the Academy is to call the Office. Necessary names and phone numbers have been listed at the end of this book.

The Academy has four divisions:

- Division of Astronomy and Physics
- Division of Informatics and Engineering
- Division of Biology, Geology and Chemistry
- Division of Humanities and Social Sciences

Since 2019, the divisions act under a common statute. Ideally, the divisions discuss the topics in which the General Assembly has to adopt a decision. The divisions are also the best level from which to view the scientific situation and development perspectives of separate research lines, and consequently, the right level for receiving the best expert advice.

On 16 November, for example, the Division of Informatics and Engineering arranged a discussion on the situation and perspectives of the Estonian forest and wood industries. The leader of the relevant professional association, Henrik Välja, introduced the state of the field. The forest and wood industry is the one of the largest and most significant sectors in Estonia that keeps the balance between export and import, and creates a lot of jobs in rural areas. The wood industry is properly automated and digitalised, but cooperation between businesses and research and development institutions is unfortunately not sufficient. Typically, research and development activities are undertaken by larger wood industry enterprises, mainly in the field of product development and applied research, but the sector is dominated by small and micro-enterprises. There is a clear need for research teams focusing on applied research. While the potential of research and development for mechanical value-adding is good, the situation is not encouraging in terms of chemical modification required for adding value to wood. We have researchers of the international level who carry out high-level base studies, but do not have those who would be able and motivated to provide practical input resulting from applied research.

The COVID-19 pandemic has greatly affected the activity of our divisions and a number of initiatives were not finished or were postponed. Despite everything, the lecture series "The Road to the (Poska) Academy" continued at Tartu Jaan Poska Gymnasium, also the participation in the think tanks of Academia Pernaviensis.

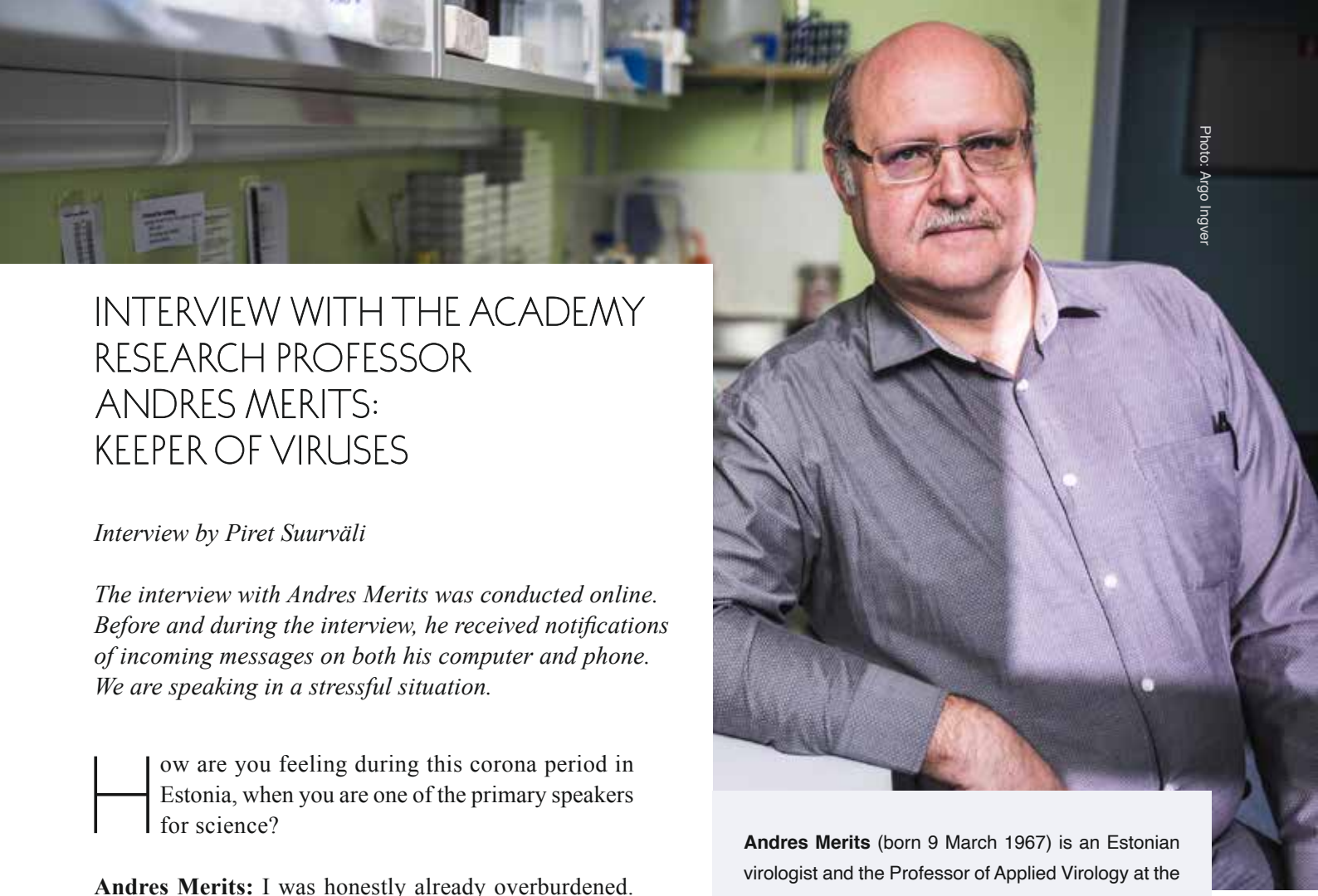

Photo: Argo Ingver

INTERVIEW WITH THE ACADEMY RESEARCH PROFESSOR ANDRES MERITS: KEEPER OF VIRUSES

Interview by Piret Suurväli

The interview with Andres Merits was conducted online. Before and during the interview, he received notifications of incoming messages on both his computer and phone. We are speaking in a stressful situation.

How are you feeling during this corona period in Estonia, when you are one of the primary speakers for science?

Andres Merits: I was honestly already overburdened. Until now, I have had 12 free days within the last 18 months. That is not a lot. The mind is beginning to fog. I do not mean that thoughts are escaping me, but motivation to work is lower than it should be. That is how it just is! This is not a dream job, but someone has to do it. I would be very glad if there was someone who could do it better. The problem lies more in the fact that you really cannot see who could do it better, and at the same time, understand that you yourself are not doing it in the best way either, or at least cannot convince people that it is important.

Why is there no one else sharing this burden? What is the current state of virology in Estonia?

Average, and it could be better. The fact that it is an important field of science should have reached more-or-less everyone by now. It seems that we have about a million and a half of hobby virologists – all right, a little less. Everyone has created some viruses in their head and is dealing with them. When it comes to science, then we have all of the hardships of typical experimental research. In my opinion, Estonian science is overall characterised by leaning too much towards observational science. Observations and their results are unarguably important – Charles Darwin was an observer after all – but results from observations must often be confirmed through experiments. That which can later be applied in practice is often also produced through research which is based on experiments.

Andres Merits (born 9 March 1967) is an Estonian virologist and the Professor of Applied Virology at the University of Tartu.

He received his doctorate degree (PhD) from Moscow State University in 1994. His thesis was titled “Chemical-enzymatic synthesis, cloning and functional analysis of DNA genome of plant nanovirus”.

In 2015, Andres Merits received the Estonian National Research Award in Chemistry and Molecular Biology. In 2020, he became the owner of a University of Tartu Grand Medal.

Since 2012, Professor Merits has been the representative of Estonia in the Global Virus Network, GVN. In 2019, Andres Merits was elected as a Research Professor of the Estonian Academy of Sciences.

There the attempt is not to try and research the connections between two things, but to show how something works.

Observation and experiment-based research should be in balance. The problem is that experiment-based research is often connected to more risk and is more time and work consuming. Therefore, the people in the field will most likely be caught between the cogs of the Estonian science financing system. For example, they are unable to go from the current start grant to a group grant fast enough. Four years is not enough time for experiment-based science.

When I returned to Estonia, it took me four years to get my work going, and that was with the help of two large foreign projects. Results started coming in about six or seven years later. I would almost definitely have failed if I had had a four-year project and a starting grant, I have no illusions in that. I applaud those that can [find success in the current system].

If the year has made everyone a self-appointed virologist, then what has changed in the life of a professional virologist?

For some reason, there is a notion that we know more than we do, that every virus is the same and we should be able to say something about each one. In my opinion, we have a regretful gap in people who have dealt with or should have dealt with respiratory viruses. In short, we lack experts. I research vector-borne viruses. I have been doing this for twenty years. Of course, I am more familiar with this field. Problems with the coronavirus are simple: I lack the right feeling. I understand that a virus is a virus and often behaves in the same way, but multiple things are still completely different.

Nothing has been done to research the coronavirus in Estonia. The problem has now [February 2021] been ignored for a year and four months and we are proudly continuing the same route. We do not have a single research project connected to the coronavirus that examines the virus or at least the viral disease. Definitely not the virus. We have something in the case of viral diseases, but those are indirect. Our understanding of this virus group has not moved too far forward and with reason, nothing has been done for it.

We have agreed with the virologists of Tallinn and Tartu, and in parallel with the Academy as well, that the University of Tartu or Tallinn University of Technology should participate, initiate true research on the coronavirus and create competence in the field with new experts and new groups. This is a challenge for not only the country, and no doubt a very important one, but also a good opportunity for younger people to find their strong work niche. Around the world, 90 per cent of the people who are working with this virus are actually amateurs, or people who have jumped over from other fields. There were just that few professionals. Estonia had none. We are not in a very unique state in that regard. No one is denying that something has been done. One hundred million has been put on diagnosing the virus, a good amount of money has been put on technologies that combat the virus, a good amount of millions have been put on solving and examining social problems which arise from the virus infections. But not a single project has been carried out with the goal of observing the main qualities of the coronavirus or the influenza virus as such, and it does not seem that anything will be done. The situation is too inert.

What does the Scientific Advisory Board, that has been formed next to the Government Commission, do?

On 20 March 2020, the Government Committee of the Emergency Situation formed a **Scientific Advisory Board** for combatting COVID-19, which collects and analyses information from experts for the Government Committee.

The Scientific Advisory Board

- assesses the epidemiological situation in Estonia and the world;
- keeps the government informed about the latest scientific studies;
- assesses the possible restrictions and reliefs through epidemiological and clinical aspects and provides suggestions to the government to make decisions;
- represents Estonia at the regular meetings of virologists of the European Union.

The role of the Advisory Board is to consult, and the government makes the decisions regarding restrictions.

Source: https://www.kriis.ee/et/node/50501

Alongside the government, there is also a Scientific Advisory Board which you are part of. You meet members of the government almost every week. You are heard, but do they not listen?

To be completely honest, my concerns lie elsewhere for the most part. It is something more long-term. Maybe I even understand the government, that it should be the business of universities and the Academy. Mostly, everything is stuck behind money. The government gave us one and a half million [euro] to set up a virology laboratory when it was needed. That work is now done, and the activation of the laboratory is only a question of weeks. So, I will not throw the government under the bus. They would have given more, but we relied on realistic estimations.

Who should and could be dealing with things? The Research Council? The Ministry of Education and Research? Universities? What is it actually stuck behind?

Priorities mostly. Like I said before, Estonian science does not seem to be dominated by a direction which deals with in-depth research, especially with experimental research. To differentiate a so-called inner and outer layer, then the outer layer is being dealt with, but not the core. Perhaps it comes from the understanding that Estonia is small, and

Why did you apply? – Mainly because the Research Professors are a very respectable group, to which it is an honour for a scientist to belong to.

we cannot do anything very important regardless. I do not think this is true. The need for local competence and expertise is also important. It is also very questionable, that successful applied research (even less industrial research) can be built on nothing, that means skipping the fundamental research step.

Considering how much scientists are being listened to, it would seem as if things are getting a little bit better?
I think so too, because a year ago it was at a very low point. Things have changed, but it is sad that something so inconvenient was needed for it to happen. All of this could have happened without the coronavirus.

You were elected the Academy Research Professor in 2019. Why did you apply? Why is the position of a research professor important or necessary?
Mainly because the research professors are a very respectable group, to which it is an honour for a scientist to belong to. It was also an opportune moment for writing. I was doing it while traveling (to Hong Kong, China, which includes the infamous Wuhan) and mainly on planes and in airports. Perhaps that is why the project ended up a little high-flown. I was also not aware that Estonia's most prestigious research grant, which is given to Estonian scientists is also the smallest one (meaning that it is lower than what is given to postdoctoral researchers). But if I had known, I would still have written. Academy member Ustav says that the most useful thing is the money that the spouse does not know about. Even a low amount of money, that can be used on what is needed, and not necessarily that which is strictly dictated, is valuable in this currently complicated situation.

After your first-year interim report, in which you were quite critical of the system, your reviewer (University of Tartu Vice-Rector for Research Kristjan Vassil) also provided the stance of the university. It was the following:
"The Research Professor's 2019 interim report shows that the substantial aims have been met in all of the mentioned fields, including education and research. From the report, it becomes clear that the support for the Research Professor's method is insufficient, which is amplified by the cyclical nature of research grants. Due to this, I support the continuation of the workplan proposed by Research Professor Andres Merits. I confirm that the deficit in the funding of the Research Professor's next period will be covered by the University of Tartu Institute of Technology. I will propose the Estonian Academy of Sciences to critically evaluate the overall sustainability of the Research Professor's methods while taking into account that the size of the grant will not enable concentrating on the scientific studies that were originally set as the goal."

How do you comment?
The status of a research professor has not stood the test of time. Even more in terms of funding. There have been almost no changes in funding since 2002. The size of the grant has been raised by five per cent, once. It is currently the year 2021. Nothing can be changed in our current stage. But next time, we should really consider if the system can continue in the same way, or face the fact that the Academy can only elect one research professor. And also say it clearly. You have to move with the times. Twenty years of festering does not help. Perhaps the other research professors would be less forthcoming. Not me.

What needs to change in the system and peoples' mentalities to get more money into science and virology, and for more young people to find application? Do we rely on Europe?
This is an old and painful subject for researchers, which usually boils down to words like European grants and other similar things. Local investments are needed to create competence. International projects are so-called top-up financing, which means they are not meant for starting from scratch. The starting position of our scientists is lacking, and people are overburdened with different tasks, which leads to many project opportunities missing our scientists completely.

I would not say that Estonia lacks the space or skills to start something. The question lies in the fact, that we cannot expect to change the world with only our own strengths to begin leading the field in the world, or even make the biggest discoveries. I am referring to our young scientists. They definitely have the potential to be among the one per cent of the world's most influential scientists, which is the minimum goal for almost all Estonian researchers. Of course, the goal in itself is not to belong to any specific affiliation, be that the one per cent of the most cited or the most influential in your field. But if you are going to do anything at all, then you might as well be at the top of the field. That should be doable and there are many Estonian researchers who have succeeded in that. Despite everything, there are multiple representatives of experimental sciences [I am not referring to experimental in the sense of academic landscape or as it is according to the Estonian Research

From the left: Toomas Asser, Rector of the University of Tartu, Andres Merits, Tarmo Soomere, President of the Estonian Academy of Sciences

Council (ETAg or EstRC), but specifically experiment-based science] who are already there.

Additional question: what is the difference between experimental and experiment-based science?
The EstRC considers all research which involves costs on experiments to be experimental. This may be – and often is – very limited, e.g., the materials for the extraction and sequencing of DNA. In that regard, we are dealing more with buying binoculars for birdwatchers. The achieved results and the resources which have been provided to achieve them usually correlate quite well, and projects have a relatively low risk of failure. There is nothing wrong with that, and like in all research, the importance is placed on the researchers' abilities, skills, and imagination.

Experiment-based science (as I see it) is research, in which the cause and result connection is observed through experiments. The first phase of this kind of research is building a unique experiment, multiple failures before any results are received. Sometimes, you are unable to prove your assumption because you cannot get your experiment to work. There is not a linear correlation between the tools that were used and the number of results that were received.

To return to the youth, a big question for me is whether they are given the chance to rise to the top of the world and whether they are motivated enough to do so. The risk of losing motivation is pretty high.

Well, let us assume that our youth is motivated...
I know they are, at least in virology.

... and let us assume that there is a political will for change. What is the dream package, what needs to be done within the next five years?
Let us stick to reality. I propose, to start, we should create a non-competitive, priority-based collaborative –universities, the Academy, the EstRC, the nation – base for a two- to three-year starting package. Natural selection will do the rest. Those that can put together a research group and create a working team are able to board the hopefully growing train of Estonian science funding, which is usually a group grant scheme. That will create a real opportunity to participate in European and international projects. This requires stable results and willpower from people.

In my field, and partially among my students, I can see that people have returned to Estonia after a successful post-doctorate. They ask the most questions about their future and perspectives. The central motive is simple: "I received a grant for two or four years, I know for certain that I cannot achieve anything with it alone in the scope of the world, therefore I understand that my chances of staying in the field are very low." That is not motivating.

This [forming a prospect for the future] has become a personal issue for people. If people do not have the opportunity to tackle things in a large way or at least in a reasonably large way, then they will not get anywhere.

Back in the day, when I returned to Estonia, I made my fair share of mistakes, albeit in a completely different situation. When I started, I had too much money and not enough experience to use it. I immediately received a

large grant from the Wellcome Trust*, which was two million kroons a year at the time. That was a large amount of money in 2003. I received an additional one hundred thousand euros from the European Union. So, an additional one and a half million kroons**. I did not know how to properly administer this. It all came with a bang and too suddenly. It goes against general logic, that an experimenter – as I was at the time – must put together a large and working laboratory fast and from practically nothing. It was of course important, but should not have happened so quickly. This was of course accompanied by inefficiency. Some avoidable foolishness and not the smartest decisions. Most of the mistakes that were possible were made in some shape or form.

It is much harder for those who are just starting now, if they are not lucky. They lack that kind of support. It is very reassuring to know that the Wellcome Trust is supporting you for five years. I will admit that 70 per cent of all that I wanted to do did not work out. But the remaining 30 per cent started off slow initially and later began to progress faster.

That is how life is. That opportunity to start is important and obviously applies to all scientific fields in Estonia. Virology and the virus are currently the hottest topics, so they should try that field. If you do not have enough money for everything, then you can at least do something.

How is your work as a research professor going? Corona came in at full force.

It came without warning. There were not many options. It was clear that, as a virologist in a massive virological crisis, whatever plans you had were going to go out of the window. And that is exactly how it went. I cannot say that I have not been able to finish things that I have started, but many things have had to be put on hold. I will say that the main goal of a research professor for me, which is to provide academic freedom, has definitely been destroyed by the coronavirus. But this is force majeure, which happens from time-to-time. In Estonian science, and in this case in virology and molecular medicine, there are perhaps only one or two people whose research the coronavirus has hit in the same way it has hit mine.

Still, I cannot say that my research results have been bad. The results are actually at the absolute top of my career. There are probably enough opportunities to raise it even further, but I most likely cannot continue like this, as it requires too much energy.

At some point, I should return to a calmer position, not give up my ambitions or work, but simply face the fact that carrying on at this speed will become more and more difficult. That is why I think we are very much in need of the youth coming up behind us. When we look at Estonian biomedical sciences, we see that the huge boost which was provided to us by the Wellcome Trust grant has created much of the top research in the field. Those grants were very specific and did not cover all of the fields. The grant was also given to Pärt Peterson, who leads our immunology; Tambet Teesalu, who is working in the field of biotechnologies; one of the leaders of human genetics, Maris Laan; Tanel Tenson from our institutes' microbiology group; Arnold Kristjuhan from the University of Tartu Institute of Molecular and Cell Biology; Marko Vendelin from the Tallinn University of Technology; Tõnis Timmusk, who is a significant figure in biology at the Tallinn University of Technology. And of course, Mart Loog, one of my closest colleagues, who is working on various things, including starting up wood chemistry in Estonia. By the way, he beat me in the field of coronavirus. The research [handling corona] conducted by his team was published in October of 2020. We reached the same point in winter of 2021.

All of those people represent an already older generation of scientists. The support was incredibly effective at the time! Nearly a one hundred per cent success rate. Estonia has invested nearly twice as much money into the schemes for top scientist grants. But the result is maybe five per cent. There is not a single leading professor, to my knowledge, who has come from this scheme. Although some associate professors have. This is a modest result in comparison to the seven or eight field leaders who received their wings through the Wellcome Trust grant. The Academy should follow the Wellcome Trust's example if it were able to pull even a couple such people into Estonia through its research professor or whatever other scheme! Maybe that is the logic behind a new scheme? Naturally, it has to work well. I do not know how Wellcome managed to achieve such a high level of efficiency.

Was it like this in all of the "Eastern Bloc" countries, was it an Estonian miracle or was it some sort of a mark of its time?

It was a collection of many different things: the right timing, the right action, and the right attitude. The way Wellcome handles things has been by far the easiest that I can remember: the least bureaucracy and the most accommodating.

Most likely it was also the pressuring of the right group of people. A smart choice. Before providing the grants, they invited many more applicants to interviews. That is perhaps very characteristic of the British approach. I have been to Wellcome Trust interviews multiple times; I have

* A foundation from the United Kingdom, named after Sir Henry Wellcome. Supports the development of top health research – ed.

** The exchange rate was 1 EUR = 15.6466 Estonian kroons – ed.

Photo: Marek Metslaid

From the left: Tiina Rahkama, Andres Merits, Jaak Järv, Tarmo Soomere.

failed and been successful twice. They are probably considering what is written on paper, personal motivation, reactions, and everything else. I do not know how they make their decision, but somehow, they always make the right one. In terms of Estonia at least.

As always, chance is also important. The entire scheme began when known Estonian scientist, Academy member Mati Karelson, at some point ran into an acquaintance, who had connections with the Wellcome Trust's external support department. About the same as how Academy member Richard Villems met up with Nils Otto Taube, who later financed the construction of the Estonian Biocentre. Many big things come from humble beginnings. Chance always finds a way. But there needs to be a goal behind it. I do not know how big the Academy's opportunities are. Something should be done in that regard. We do not have a private fund as powerful as the Wellcome Trust in Estonia, but it would be good to have something outside of the EstRC system. That would work where it is the most needed. Methods that would not bring anything besides the responsibility of conducting quality research. The Research Professor grant, even in its miserable state, from being chewed up by inflation, was important for the start of coronavirus research.

Maybe the research professor niche in its current form really has run its course or simply been stopped by a lack of funding. Let us be honest: when the programme was launched (2002), the professor, as it is, was a small link in terms of society, and funding. Today, the main issue of the self-made professor is not the wage. The main issue is that they cannot do what they have planned, wanted or have to do. Accepting additional tasks is especially punishing, because whatever you do, you are doing it at the expense of something else.

How do you manage to complete your tasks? What helps you?

To be honest, I do not know. Routine? But maybe the understanding that everything must end eventually and sometimes it ends in a better way. Nevertheless, I hope that we get somewhere with the pandemic by the summer. Maybe not the end, but at least close.

Many thanks for these words and for the entire conversation!

Stay healthy and safe!

The Estonian Academy of Sciences Research Professors

The position of Research Professor allows acclaimed scientists, who work in research and development institutions or lead research and doctorate students in universities, to focus on scientific research.

Anyone that has an Estonian doctorate degree or an academic degree of equal status from a foreign country, who has worked as a senior scientist or has worked as a university professor for at least ten years and has supervised a defended doctorate thesis, may apply to become a Research Professor. Continued research at an international level and successful fulfilment of research grants is expected from Research Professor applicants. The first Research Professors were elected in 2002.

The contest for the spots of Research Professor is held every three years and they are elected for three years.

RESEARCH PROFESSORS 2019–2021

- Professor of Applied Virology at the University of Tartu Institute of Technology **Andres Merits**
- Leading Research Fellow at the Tallinn University of Technology Department of Electrical Power Engineering and Mechatronics **Dmitri Vinnikov**
- Leading Research Fellow at the National Institute of Chemical Physics and Biophysics **Toomas Rõõm**

SPIRIT AND POWER DURING THE CORONAVIRUS PANDEMIC

Irja Lutsar's speech at the Estonian Academy of Sciences General Assembly on 2 December 2020

Dear President of the Academy of Sciences, Academy members, ladies and gentelmen,

It is very unusual for me to give a presentation without slides, but I will try. Perhaps it will make the listeners listen because they do not have to read slides constantly. Everyone has seen multiple slides of the coronavirus, of how the virus has taken over the entire world, the structure of the virus, and what individual elements of the virus do. The topic of today's presentation is more so concerned with how the collaboration between scientists and the government has been going during the coronavirus pandemic, what it has given to scientists, and what we can learn from it. One week ago, during a coronavirus conference* that was hosted by the University of Tartu, Minister [Tanel] Kiik said that from his perspective, the model has worked well, and that this kind of model should become the new norm in other crises as well. I am looking at this collaboration from the perspective of a scientist and will more so try to be critical of both myself and the government.

The question that I have been asked the most is whether the government listens to the scientists. My sincere answer: yes, and quite well in fact. That is why it is difficult for me to listen when now and again people say that the governments of other countries listen to scientists, but the Estonian government does not. That is not right.

This begs another question: are the suggestions given by scientists always worth listening to? In other words, do scientists have enough data and knowledge to provide science-based advice. Additionally, medical scientists may lack societal sense. In other words, methods that may be justified from a scientist's perspective may be intolerable for society. Then the sense of the politicians may be better than the scientific data.

The pandemic hit us all without warning, like any other crisis. What was a little misleading was that we had only read about the major flu pandemic of the previous century, and that the previous pandemic flu was much milder than was first expected. SARS-1 and MERS, the predecessors of the coronavirus, did not reach the level of a pandemic. This time we face a true health or healthcare crisis. On one hand, we cannot live without microbes, and on the other hand, these small creatures, who we cannot even always say, whether they are alive or not, can turn our world completely upside down.

* Online conference "Intelligent Adaptation to the Coronavirus" on 26 and 27 November 2020. https://www.ctm.ee/et/koroonakonverents/.

Photo: Leemet Samel, ETAg

Professor Irja Lutsar, Head of the Scientific Advisory Board for combatting COVID-19

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There have been times throughout history where microbes have had a devastating effect on humanity. We as humans had let our guard down. Due to antibiotics, vaccines and the overall improvement of living conditions, we had forgotten that micro-organisms had not disappeared. They existed in this world before us and will most likely stay longer than us. It is known to all second-year medical students, and probably every citizen who has observed their surroundings, that new viruses constantly enter mankind. HIV, HCV, SARS-1, MERS and the Zika virus are just a few that have shaken the world in the previous and current century. It is also known that the most devastating viruses are the ones that spread through the respiratory system, or through speaking, coughing, sneezing, yelling, etc.

What were our scientists and governments supposed to do with this information? How many scientists around the world foresaw the pandemic and its reach and could therefore have given preventive advice to the governments? If we look at what actually happened, then probably very few. Even when the infection was spreading in Wuhan, it was difficult to predict how it would spread in the developed world and developing countries. We believed that medicine was powerful enough to deal with severe pneumonia. At the same time, we underestimated what would happen if the virus were to reach a place where a large number of elderly people and/or severely ill people were located (nursing homes, retirement homes, palliative care hospitals etc.). We have known from the start that the virus was especially dangerous for the elderly. But still there is not a single European country that has managed to keep the virus away from care homes.

The SARS-CoV-2 pandemic is an entirely new situation in history. Pandemics have usually primarily damaged children. This time, the situation is completely different.

It is important to note that the average lifespan was significantly shorter 50 years ago and care homes for elderly were an exception rather than a rule. We knew that viral infections are usually the final illnesses for the elderly, but the aggressiveness of COVID-19 was still a surprise to us. In a situation such as this, it is not a miracle that governments had to make decisions based on their own knowledge and senses, and that the guidance from international organisations and experts came when the decisions had already been made.

Since the beginning of time, rulers have wanted to know what happens tomorrow. They have turned to prophets and foretellers time and again. In the modern era, foretelling has been replaced by mathematical models, thus replacing foretellers with mathematicians. I am quite confident, that it is easier to predict the future, especially the near future, through mathematics, rather than through Tarot cards, crystal balls, precious stones or whatever else.

The words that were said over one hundred years ago* by the British statistician George E. P. Box, that all models are wrong but some are useful, is true even today. It is not a question of whether the modellers are bad. Every model is only as good as the data that is inserted into it. The British saying "garbage in, garbage out" is very fitting here. What the modellers say based on the models and how the decision-makers or intermediaries interpret the models, is a question in itself.

The widely published models from a few weeks ago did not say for certain that Estonia would have a thousand patients in the hospital by Christmas. No model can do that. The models showed that if the current infection rate *R*0 changes slightly and remains at a relatively constant 1.2 or falls to 1.1, then by 1 January, the maximum amount of sick people in the hospital (the higher end of the confidence interval) would reach one thousand. However, if we can lower *R*0 to 0.9, then the lower confidence interval would be 350. Therefore, the model provided us with a direction of where the numbers were heading, but did not say what would necessarily happen. The models will most definitely become more exact as our knowledge grows, but this does not mean that the models will replace human thinking.

Additionally, rulers are also expecting scientists' interpretations of the [results of the] models. We should also not be swayed by the situation from spring, when many of the models at one point predicted a significantly worse situation and a significantly better one the other. This is further proof that models are only as good as the data they are based on. Improvements in the data are what make the models more precise, as we could see in autumn.

We can discuss whether closing the country (total lockdown) in spring was right or wrong. That decision was based primarily on the suggestions from scientists. Even in the 21st century, scientists, including those who are at the top of their field, still advise that closing down, and therefore pausing life, is the best way to fight the coronavirus. This is happening despite the immense development of medical science: we transplant organs, provide effective care against malignant tumours, manage babies with birth weight of five-hundred-grams, and have eradicated many infectious diseases through vaccination.

The initial euphoria [that it is enough] to close the country for a few weeks has, by this point, been replaced with the reality that it is simple to close down, but reopening a country is much harder. In addition, the long-term shutdown of the world is very difficult for people to bear, and destructive for the economy. This was already known during the plague pandemic more than 300 years ago. It is true that back then people were locked up for 30–40 days, just in case. Those who broke the quarantine were simply executed. The decisions were simple and understood by all. Exactly what is expected from scientists in the present day by society. Much like today, many people were not able to abide by those difficult-to-bear decisions and retaliated. It is nothing new under the sun.

It is good to know that scientists are very powerful when they combine their forces. Another example from the current pandemic. The genome of the new virus was [sequenced and] published a couple weeks after it was suspected to be a new virus. Multiple vaccines which are based on brand new technologies began entering the market only 11 months after the virus was identified. A process that would take 10–20 years in normal circumstances has been done in less than a year. Let us all hope that we did not miss any important details through this incredibly fast vaccine development process.

The paradox is that all scientists across the world are very good at developing vaccines (the so-called pharmacological method), but in the instance that a so-called non-pharmacological method must be developed, then the advice of scientists comes from the 16th century. Even though they were already difficult to accomplish then, as was mentioned above. I sincerely hope that this pandemic has motivated scientists to work more intensely with the aspect of so-called public health. The pandemic illustrated very well that ressuring the people the benefits of a method which is based purely on observations, belief, modelling, and is not backed by confirmatory data from clinical studies, is difficult for both governments and scientists. The number of debates that have been held in regard to the effectiveness of face masks, is something that I do not think any of us have seen, and final truth does not appear to be close.

Currently, it seems to be more rational to wear a face mask indoors, where it is impossible to keep distance.

* George E. P. Box (18 October 1919–28 March 2013) used the expression "Since all models are wrong ..." for the first time in the paper Box, G.E.P. 1976. Science and statistics. *Journal of the American Statistical Association,* **71**(356), 791–799, doi:10.1080/01621459.1976.10480949. It is a variation of a classic understanding among statistics specialists. George Box used the expression in the form that was presented during the lecture (All models are wrong but some are useful) for the first time as a subheading of a chapter Box, G.E.P. 1979. Robustness in the Strategy of Scientific Model Building in the book Launer, R. L., Wilkinson, G. N. (ed), Robustness in Statistics, Academic Press, pp. 201–236, doi:10.1016/B978-0-12-438150-6.50018-2 – ed.

However, this does not mean that research regarding the effectiveness of face masks should not be conducted between pandemic periods. There is no scientific proof behind the statement that masks save lives, nor is there proof that masks are useless. Let us hope that, for the next pandemic, our advice to the government and the nation is more science-based and therefore less confusing. Currently, however, we wear face masks indoors and remove them when we go outside. Microbes and the cool air should not be completely kept away from the mucosa.

To the credit of the government, it should be said that sometimes their sense has been better than that of scientists. Let us look at another much-debated topic in addition to face masks – testing. When the outbreak began, many scientists proposed that only those who are taken into hospital and show symptoms of the disease should be tested. This is entirely reasonable because it is how we act for every other infectious disease.

But then the stances changed. The new stance was that the infected, even those who did not show symptoms, should be isolated to reduce the spread of the disease. Data from around the world showed that in countries that carried out many tests and tested everyone, but isolated only the infected and did not close off the entire country (such as South Korea) were doing significantly better than those that could only test the seriously ill.

Politicians were perhaps even a step ahead at this time and began looking for avenues from where to buy tests, while international experts still advised to test only those who arrived at hospital. Now the stances have changed. Estonia is doing a lot of tests as of April [2020]. This was one of the possible reasons as to why we were able to get the first wave [of the pandemic] quickly under control. There has also been talks of antibody tests which entrepreneurs had decided to give to Estonia. Their sensitivity is low in comparison to the ELISA-tests, but the specificity is very good. At that time, it was thought (not known), that antibodies did not necessarily mean immunity. That is also a relatively uncommon situation in the field of infectious diseases. Now data show that antibodies are developed by nearly all of those that are infected, they last for at least six months, and are very likely to prevent another infection for at least some time.

The world is changing. The scientific papers that are read by scientists are also available to politicians, journalists, but also ordinary people like construction workers and farmers. Knowledge is no longer exclusive to elitist newspapers or groups. Scientific achievements are discussed in both Zoom science conferences and at the corner shop. Therefore, our discussion partners are far from those that would blindly believe scientists. As scientists, there may be fear that our advantage as holders and creators of knowledge may be disappearing. Through the current pandemic, I have come to realise that this fear is unwarranted. There have been many instances where someone has proposed a new idea or thought, but I can say that I have heard, seen, or learned it throughout a long career. Scientists always remain sceptical and do not necessarily follow every new idea. However, for a politician, grabbing a new idea may prove to be the base for a successful candidacy, and if the idea turns out to be false, then usually the voter has a short memory.

During this pandemic, many scientists have voluntarily taken on the role of explaining problems. Perhaps explaining the structure of the virus is sometimes better explained by robotics scientists or philologists, rather than virologists who have dealt with it their entire life and who may take the stance of "how is this not known already? It is taught in fifth grade of basic school." I believe that through the combined efforts of scientists, society and the government have come to understand the necessity of science and scientists.

The coronavirus pandemic has brought forward the question regarding death and the end of life because the virus is especially wicked towards the elderly. The reasons are not entirely clear. One possible reason may be the overly strong immune response that the elderly have towards the virus, but for some reason children's organisms do not have. In our ultra-liberal society, the topic of death has been swept under the rug. As if it does not exist and we are afraid to even begin discussing the topic. So, it is nothing to be surprised about when we hear a politician say that even one death is too much.

The COVID-19 pandemic made death a relevant topic once again, and not in the context of euthanasia or humane death. It is known to all that sometimes it may be more humane to let a person die than to try and keep them alive at all costs. As doctors, can we always think what we would want. The elderly people have died due to viral diseases in previous years as well, whether that be the flu or some other virus. However, what we have not done before is isolate the elderly for prolonged periods. I very much agree that we must protect our most vulnerable. Despite this, no elderly person would want to stay in a nursing home for months without seeing their loved ones. Skype, mobile phones, Zoom are sadly too much for many of the people that have lived on this earth for over 90 years. They have lived their lives in a time when you could visit a neighbour without needing to phone them first, and when potato salad was shared at a table during birthdays, and not on Zoom. Isolating the people that are the most vulnerable is completely justified when looking at it from a science perspective. However, from the humane perspective, it does not seem right. This is where scientists face a dilemma: evidence-based science or sense-based humanness.

The coronavirus has turned out to be a good social magnifying glass that has brought many societal problems out from under the rug. The situation in nursing homes, the lack of personnel or the incredibly low wages was not news to anyone. However, the solutions were easy to postpone. They cannot be postponed anymore. It is probably not news to the listeners that hospitals of Ida-Viru County are not the first choice among workplaces for the graduates of the University of Tartu Faculty of Medicine. So, it is

Photo: Maris Krünvald

The Karl Schlossmann medal and the reward ceremony at the General Assembly of Academy. From the left: Tarmo Soomere, Silja Kala, Irja Lutsar

not surprising that the hospitals of Ida-Viru have a shortage of both doctors and nurses. This is where the dilemma of the Scientific Advisory Board [for Combatting COVID-19] lies. On the one hand, we are expected to provide advice that is based on science. On the other hand: what science-based advice can you give when there are everyday problems that require quick solutions.

Having led the Scientific Advisory Board for over a year now, I see how the government (the power) expects clear, science-based statements in fields that allow us to understand human behaviour or knowledge, what sort of restrictions work in specific situations, and which do not, and if they work, then how. Schools are the best example. It is known to all that SARS-CoV-2 is a mild disease for children. Regardless, it is still possible for children to spread the disease. Currently, there are few scientific studies on how closing schools affects the epidemic. Therefore, we must give advice based on our own discretions, which are different for everyone. The advice of a scientist does not significantly differ from that of a politician and does not seem convincing to the decision-makers if there is no data.

In conclusion, even with our current knowledge, we cannot tell the government when or how the pandemic will arrive. We do not even know when the current coronavirus pandemic will end. Although now, with the vaccines on the horizon, we can predict that the year 2021 will bring some kind of relief. It also cannot be said where and in which field the next crisis will appear. Hopefully the coronavirus crisis has reassured the government that scientists can be of help in future crises and that it is worth turning to scientists. Scientists, as well as society must understand that they are giving advice and that the government, who the people have elected, and the civil services, govern the country and are responsible for it.

The Karl Schlossmann medal to Irja Lutsar

The Karl Schlossmann medal is one of the seven named medals of the Estonian Academy of Sciences, it is the highest reward that is given to Estonian scientists in medicine and related fields and is given out no more than once every four years. The Academy's statute for named medals also stipulates the Nikolai Alumäe medal for informatics and engineering, the Paul Ariste medal for the humanities, the Karl Ernst von Baer medal for life and earth sciences, The Harald Keres medal for astronomy, physics and mathematics, and the Wilhelm Ostwald medal for chemistry and related fields, and the Edgar Kant medal for achievements in social sciences.

The medal and its associated diploma are given to the recipient during the Academy's General Assembly meeting or during a representative science conference for the field. After receiving the award, the recipient holds a presentation during the General Assembly meeting or a public academic lecture within the next six months.

The COVID-19 pandemic showed society the importance of science and science-based knowledge. The latter would not have happened without informed, competent and ardent spokespersons. Multiple colleagues of ours have been on the frontlines and, figuratively speaking, thrown themselves into the embrasure.

The Academy wishes to thank and highlight the incredible medical researcher, Professor Irja Lutsar with the Karl Schlossmann medal and acknowledge her immeasurable contribution to alleviating the coronavirus crisis. Her competence has led to making the correct decisions, to giving competent advice to the government, and helped persuade society to implement scientifically justified rules of conduct.

THE ACADEMY EXPANDED

In 2020, the Estonian Academy of Sciences elected three new members.

ELECTING ACADEMY MEMBERS

Tarmo Soomere, President of the Estonian Academy of Sciences

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 creative arts. Vacancies are worded in such a way that multiple top scientists or outstanding creative persons have a chance to apply.

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

To become an Academy member, the nominee must receive 2/3 of the votes from the Academy members who are part of the General Assembly.

For the most part, elections are held once every two to three years. Two years ago (2018), seven new Academy members were elected: Marco Kirm, Jarek Kurnitski, Kalle Kirsimäe, Anne Kahru, Tiit Tammaru, Anu Realo and Tiina Randma-Liiv.

In 2020, it was decided that three vacancies would be opened. Forestry in Estonia is a field which is well known and highly praised*, but has been unrepresented in the Academy of Sciences and is inarguably important for the future of Estonia. Mathematics and mathematical statistics is the core field of modern science. The passing of exceptional mathematicians Ülo Lumiste (1929–2017) and Eve Oja (1948–2019) left a large gap in the competence of the Academy. Estonian theatre has broken into the world's absolute top and so it is natural that the leaders of the field have their viewpoints represented on the academic landscape.

> *The idea is simple: the selection is made primarily from amongst those who the others consider to be at the level of an Academy member.*

* Estonian University of Life Sciences is placed 48th in the field of Forestry and Agriculture in the 2020 sectoral standings by QS World University Rankings. This is the highest sectoral placement among Estonian universities.
See: https://www.topuniversities.com/university-rankings/university-subject-rankings/2020/agriculture-forestry – ed.


Photo: Reti Kokk

FRESH MEMBERS OF THE ACADEMY

Short interviews for Estonian Public Broadcasting (ERR Novaator), Jaan-Juhan Oidermaa

ACADEMY MEMBER KRISTA FISCHER

Academy member Krista Fischer (50) is the Professor of Mathematical Statistics at the University of Tartu, and her primary research topic is connected to applying biostatistics and statistical methods to epidemiology and clinical research. For example, her work helps to provide a more precise prediction of the infection risks within larger crowds.

Krista Fischer's work is closely connected to genetics. The Professor and her colleagues are creating a risk score which helps predict a person's risk of contracting various diseases based on their gene variants. Based on this, it is better to plan preventive measures and screening procedures. Fischer's research also helps better understand how biomarkers, which are connected to genetics and metabolism, affect overall mortality.

Her larger ongoing projects are related to applying computer learning to the field of exact medical science and finding out genetic and epidemiological risk factors that are connected to the untimely deaths among the Estonian people.

18 master's students and four doctoral students have defended their work under the Professor's supervision.

Krista Fischer is a member of the Executive Board of the International Biometric Society as well as a member of the Estonian Mathematical Society and the Estonian Statistical Society. Krista Fischer attracted much attention during the coronavirus outbreak in the spring of 2020. Currently, she is an expert in the Scientific Advisory Board for Combatting COVID-19, which even now is advising the government. As a member of the research team, she was awarded the Estonian National Research Award in the field of chemistry and molecular biology in 2019.

What do you consider the most enjoyable moments in your life and career until this point, and how big of a role do you think they played in the reason that you were nominated to become a member of the Academy?

Krista Fischer.

It is difficult to isolate specific moments. In the life of a researcher, it is often the process that leads to a new result, which is the most enjoyable. I am very glad that I even found biological statistics in the first place. It was an excellent solution to a dilemma which I had had since I was a child: should I tie my future with mathematics or biology?

Quite a few exciting discoveries have happened within the last ten years, in which my scientific work has been connected to the University of Tartu Estonian Biobank. Where the influence of individual gene variants turned out to have boringly small effects on health, then combining the effects of hundreds or thousands of variants into a risk-score, provided results which allowed us to realistically move on towards personal medicine. But how does this combining provide the best result – this will sometimes require exciting mathematics.

The other range of topics is connected to research which enables us to explain the difference in peoples' lifespans. Why is it that more than 40 per cent of Estonian men will not get to see their 70th birthday, and what is it that helps some of us celebrate our one hundredth birthday? Is it genetics or lifestyle? Do biomarkers found in blood help us predict the length of the lifespan? The times when I feel that me and my team of doctorates have managed to overcome an obstacle and are able to share this knowledge with the world are all very enjoyable.

Very motivating are of course the international collaborations and coordinating work with the network of biostatistics experts across the world as part of the International Biometric Society Executive Board.

What do you consider the main challenge in your field in Estonia and the entire world?
The biggest challenge currently is of course the COVID-19 pandemic. How could we get an even better idea of the situation with the use of smart analysis solutions? How do we decide which methods work best, and what are better to leave behind? How do we predict the future for health-care establishments, as well as society?

In a broader sense, however, I can see that the biggest challenges arise from collaborations. Here, we face a dilemma. The more science develops, the more narrowly specialised individual scientists are. It is impossible to be an expert on all topics, even within a single field. At the same time, results which are important for society and often breakthroughs, can only be achieved through collaborations between multiple fields. But how do you create opportunities for collaborations and interdisciplinary research teams when specialists from different fields often speak a "scientific language" that is quite different? I believe this is definitely a challenge, but not an insurmountable one.

One of the challenges in statistics is the fissure that appears between theory and practice from time-to-time. The narrow specialisation of statistics experts lies in focusing on just theory, or primarily on practical applications. It is very often the case that theorists may struggle with practical data-analysis and practitioners with complex theoretical derivations. At the same time, practice needs theory that provides the correct direction and the tasks set by theorists should be motivated by practical problems, how to build better "bridges" between theory and practice.

In the 21st century, what is the role of the Academy members in society and how much should they be visible in day-to-day life?
The good reputation of academic science has seemed to become more complicated in the 21st century when compared to the previous. In the current flood of information, it is incredibly difficult to distinguish between pseudoscience and real science. Furthermore, there is also a lot of misleading information in the field of "real science" which derives from debatable quality research.

Alas it is so, that as opposed to "pseudo- or semi-science", honest academical science does not provide easily understandable or black and white answers. That is why the popularisation of scientific communication and science is often a much larger task than it seems.

It seems to me that the role of an Academy member is to be a sort of ambassador of honest science; to help society, from the government to the ordinary person, and to distinguish between reliable knowledge in the informational noise and make decisions that are based on the knowledge available. Academy members are also the representatives and spokesmen for the entire scientific community and help stand for the development of science and education within the country. Therefore, it can be said that I consider "being visible" a direct task of the Academy members.

What would receiving the title of an Academy member mean to you personally, and how would it affect your life?
When I agreed to apply for the position of professor, I was already aware that there are no other professors of mathematical statistics in Estonia. Therefore, I must take on the responsibility of developing the field in the country, and in addition to educational work and research, also popularise the field.

As an Academy member, I represent mathematicians as well as statistics experts in a broader way. Therefore, the amount of responsibility is increased. I hope that I can direct more attention to the importance of mathematics and mathematical thinking in all walks of life. Without mathematics, other branches of formal sciences or sciences in the field of informational technology would not exist in the form that they do today. Therefore, the integral role of mathematics in the development of science should not be forgotten.

ACADEMY MEMBER VEIKO URI

Academy member Veiko Uri (52) is the Professor of Forest Ecosystems at the Estonian University of Life Sciences. He has concentrated on researching the carbon cycle and production within forest ecosystems. Furthermore, he explains the effects that various forestry methods have on the carbon sequestration of forest stands. Forestry is often considered as an applied science field; therefore, applicable results play an important role in most of his research, which helps make Estonian forest management become more science based. The results of the current projects will hopefully help us better understand how different methods of woodcutting affect the amount of carbon which is stored by the forest. Alongside his team, Veiko Uri has also developed regional biomass and litter models for Estonian forests.

Four doctoral theses and 28 master's degrees have been defended under his supervision. Among other things, Uri is also a member of the Estonian University of Life Science Council of the Institute of Forestry and Rural Engineering. Additionally, he is a member of the Examination Committee of PhD Theses in Forestry at his university and a member of the Estonian Naturalists' Society. In 2016, he was awarded the Order of the Estonian Red Cross, Fifth Class, and in 2013, he received the Estonian National Research Award in the field of agricultural sciences.

Photo: Reti Kokk

Veiko Uri.

What do you consider the most enjoyable moments in your life and career up to now, and how big of a role do you think they played in the reason for your nomination to become a member of the Academy?
Success is what brings the most joy in academic life but receiving the national research award has been my biggest accolade.

What do you consider the main challenge of your field in Estonia and the entire world?
It can be said that the problems deriving from climate change are very important challenges in Estonian forestry and in the world as a whole.

What is the role of the Academy members in society during the 21st century and how much should they be visible in day-to-day life?
I believe that the role of the Academy members is still the development of scientific excellence within their field, and the scientific counselling of society and the government.

What would receiving the title of an Academy member mean to you personally, and how would it affect your life?

Acknowledgement and more responsibility.

Photo: Reti Kokk

Elmo Nüganen.

ACADEMY MEMBER ELMO NÜGANEN

Elmo Nüganen (58) is the Professor of Dramatic Art at the Estonian Academy of Music and Theatre and has been the Artistic Director of the Tallinn City Theatre for a long time. Throughout his career, he has been an actor, brought tens of plays to the stage and worked as a film director.

Nüganen's plays are known for their professional ensemble work by actors and their richness in nuance and details, which has also earned him awards from Russia and Latvia, for example. His roles in both film and theatre have received acknowledgement in Estonia and around the world. One of his most renowned works is the Estonian-Georgian collaboration *Tangerines*, which was a candidate for both the Oscar and the Golden Globe.

As a director, Nüganen has disserted topics related to Estonian history and the self-searching of the modern man.

Other prizes include the Order of Merit of the White Star, Second Class, and he has also received the Russian Federation National Art Prize. Nüganen has received five Director's Prizes of the Estonian Theatre Awards and three Cultural Awards of the Republic of Estonia.

FROM THE HALL OF MIRRORS TO SOCIETY

ENDEL LIPPMAA MEMORIAL MEDAL AND LECTURE. UFFE ELLEMANN-JENSEN

Academy member, Endel Lippmaa (15.09.1930 to 30.07.2015), was one of the greats of Estonian science and politics, and is still one of the most well-known Estonian scientists in the world. As a talented personality with exceptionally sharp mind and wide grasp, he made a significant contribution to restoring the independence of Estonia and rebuilding a free society, influencing and shaping the development of our country for a long time.

By establishing the tradition of the Endel Lippmaa Memorial Medal and the related Memorial Lectures, the Estonian Academy of Sciences wishes to promote the spread of scientific excellence and innovation, but also recognise and value the mission of outstanding personalities in the history of Estonia. Therefore, the Endel Lippmaa Memorial Medal is awarded to an outstanding scientist or public figure who has significantly influenced the development of their field, and combined top-level science with serving society.

The recipient of the Memorial Medal is selected by the committee composed of Ene Ergma, Mart Kalm, Jaak Lippmaa, Urmas Nagel and Mart Saarma. The first Endel Lippmaa Memorial Medal was awarded to Nobel Prize Laureate in Chemistry, Kurt Wüthrich, who delivered the Memorial Lecture in 2017.

On 15 September 2020, the 90th anniversary of the birth of Endel Lippmaa, the second laureate of his Memorial Medal was announced – the outstanding Danish politician, a good friend of Estonia and an ardent supporter of our aspirations for freedom Uffe Ellemann-Jensen.

As the Minister of Foreign Affairs of Denmark (1982–1993), Uffe Ellemann-Jensen was instrumental in the process of recognising the Baltic States at the time of the restoration of independence of the Republic of Estonia. Thanks to his efforts, Denmark became the first state to restore diplomatic relations with all three Baltic countries. Together with his German colleague Hans-Dietrich Genscher, he convened the Council of the Baltic Sea States in 1992, the central objective of which was to ensure a balanced development within the Baltic Sea region after the end of the Cold War. For twenty years (1998–2018), Ellemann-Jensen contributed vigorously to the activity of the Baltic Development Forum, which brought together top performers in the domains of business, politics, media, and science within our region.

Due to the extraordinary year, the lecture by Uffe Ellemann-Jensen was presented via a video recording in the hall of the Estonian Academy of Sciences on 29 September 2020. The lecture focused on the challenges facing small nations. The medal was presented to Mr Ellemann-Jensen in his family circle at the Estonian Embassy in Copenhagen on 19 October 2020.

Photo: Maris Krünvald

Endel Lippmaa Memorial Medal. The author of the Medal is Risto Tali.

Photo: Reti Kokk

The President Kersti Kaljulaid.

WELCOME ADDRESS BY THE PRESIDENT OF ESTONIA KERSTI KALJULAID BEFORE THE LECTURE BY UFFE ELLEMANN-JENSEN

Dear Uffe,

Greetings from Tallinn, from the Estonian Academy of Sciences, one of my favourite rooms in this country to speak from.

I vividly remember President Frank Walter Steinmeier * when he became President of Germany, facing this room, and apologising for the Molotov-Ribbentrop Pact here in Estonia in clear words. What a statement, for counterparts like us today. I think we all learned from you and others this courage to face up to history, to stand up to it. You have taught us never to drive away closing the doors of the bus to feel safe ourselves– and this room is also linked to your teaching.

In March 2004, you wrote that during the midnight of 30th April, Europe will finally become one and the Baltic Sea can be considered the sea of peace for the first time in 300 years.

I believe that was the day when one journey ended also for you, which you had maybe undertaken even before we realised you had undertaken this journey. You had a vision to make the Baltic Sea region one of the most dynamic, innovative and competitive regions long before that. owever, of course, that dream could also not come true unless all the countries by the Baltic Sea were part of the free world, therefore also ready to develop their economies. You were one of those people who always realised that without a strong economy, without strong interactions between businesses of the free world and the newly free world, there cannot be long-term success. Because after all, building a state, particularly a small state, is an expensive business. We all know that. So, all of the countries on the Baltic Sea rim, which had suddenly become responsible for their own future also urgently needed to develop their economies.

Actually here, I think your road and mine crossed for the first time, and it must have been in the context of the Baltic Development Forum.

Because this was the forum, which started to bring together actors from the West and the East in order to promote and support the common economic development. You founded the Development Forum in 1998. And this is true indeed, that already in the mid-90s, Scandinavian companies were actively coming to the Baltic states and hiring Estonian people to work with the technology, which was not competitive enough anymore, in order to be used in their own country. So, we have been the solution for many businesses' cost problem. However, through the Baltic Development Forum, you took a wider position, a far wider position. Moreover, the position you took was that we need to have a grand scale business cooperation, development and operations considering all these countries. Why? Because otherwise we cannot harness private capital for the development needs. You carried through many, many years, working with the Baltic Development Forum, all the challenges, all the dreams starting to come true slowly but surely.

When you felt that we were there, we had an occasion in Tallinn to discuss what next.

Moreover, I made a promise to you and indeed, to a certain extent thanks to the Baltic Development Forum, our journey back among the nations who had developed their economy and heightened their sense of responsibility for this world had ended.

However, I promised you, I would take this forward for those to the right of us when looking at the map facing north.

I have been thinking how to do this and I can now report that we have managed to grab the tool and initiative, which was already there. However, it was floating in the air – it

* President of Germany Frank-Walter Steinmeier spoke at the Estonian Academy of Sciences on 23 August, 2017.

was called the Three Seas Summit. It was something, which was simply floating, and it was not concrete. But you know, and I know that in order to build something, you need a lot of concrete, as was also kindly reminded during the Baltic Development Forum in St. Petersburg to the then Finnish Prime minister Paavo Lipponen, when Russians were saying that we need something concrete for this Baltic Development Forum. Then Lipponen said, and I think you remember that as well, "Well, I think we gave you a lot of concrete, as we just finished building the sewage plant of St. Petersburg."

So, remembering that we need concrete, we are complementing the Three Seas Initiative from this year with a privately run investment fund, where the Three Seas countries themselves are paying in. The United States has promised to match every euro with dollar, which we can raise from the market and from the public purses of the Three Seas countries. And now we have stretched this idea, so the Three Seas Fund can invest into neighbouring countries, provided that one of the projects is in a Three Seas country, which by the way will involve Ukraine and the Balkan countries. This is very important. You told us we cannot leave them alone, and I promised you this idea will go ahead. And this is just the first fund. This is the fund, which will prove and kind of reinvigorate again the thinking that private money works for development. The idea you have strongly believed in, but which is completely forgotten in Europe nowadays because you know, money is everywhere, and it is very cheap. We still believe in it. We still believe that private allocation works for development, we still believe in good old return on investment in this region.

So, we brought together all the 102 million people in the Three Seas countries, and gathered the money into the fund we hope will reach 3 to 5 billion in two years' time. Then we will invest in this region to make sure we catch up with the West, but also towards Ukraine and Western Balkans. IMF and Kristalina Georgieva, whom I believe you know very well, are supporters of our drive to make private public cooperation again a tool for development, particularly in Eastern Europe. So, I'm now reporting to you, that I have kept my promise, and I am working on it. It is work in progress. We will have the Three Seas Summit in Tallinn in October. The first fund will work already for two of the projects, which will be outside of the strictly Three Seas countries towards the east. In addition, if the concept is proven, I will promise you we can continue working on the next funds, which will be already more centred on Ukraine, Western Balkans, and I hope this will be the case for Moldova and Belarus one day.

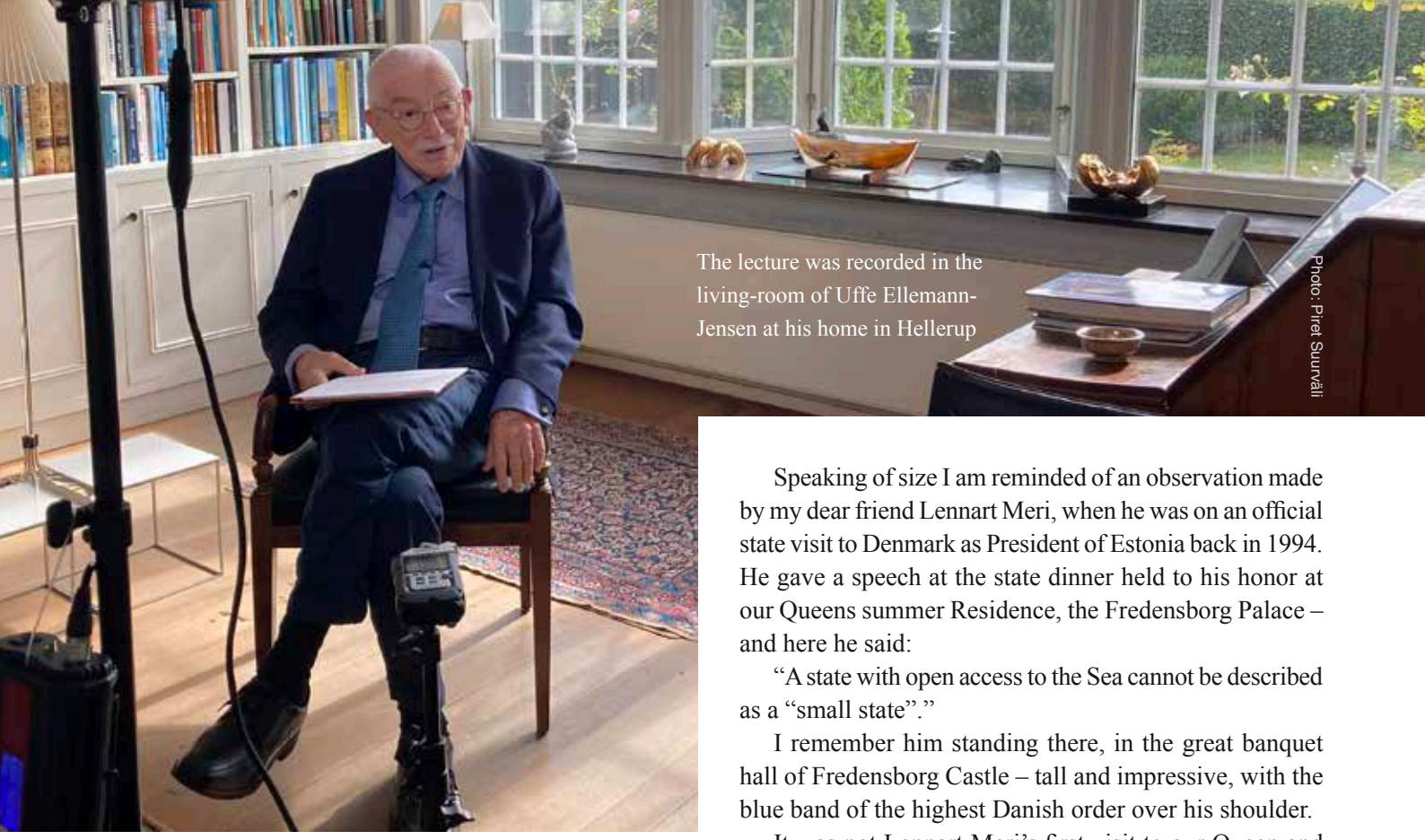
Also, Uffe, when you have to stand up and say that, you know, Hague is relatively close to Minsk, even maybe closer than Moscow sometimes, we think of you and Carl Bildt and others, others who stood up for us. Never mind that this was maybe considered reckless. Never mind that nobody understood how you could keep your promises. Never mind that it appears to be taking time.

Yes, we in the Baltic States realise that for those countries for whom we are now standing – Ukraine, Moldova, Belarus, Georgia, and all others a window of opportunity is not there right now. However, we are not giving up, and we have actually the very good excuse of not giving up and that is our history of occupation for 50 years. You did not give up. So strategic patience is something we learned from you, and we are now applying to the situations in our region. This is also something, which you taught us.

Uffe, I have met you many times and you have always insisted that if you had not been on a plane at that right moment, you would have been the first to recognise the independence of Estonia. However, since you were on the plane, well, that square in front of our Ministry of Foreign Affairs is called the Iceland Square. However, it does not really matter, Uffe. You were with us. They were with us. The whole Nordic region was with us and for us. We will remember this forever, and we still keep coming to Denmark to talk to you about defence issues, about the progress, which has been made there.

Moreover, many people tell us, I heard this from Uffe, Uffe made this proposal, and he mentioned this to me. It still comes up, and not only in the foreign policy features, but also military and defence policy areas. You know, we are now closer than ever, in this sense. eFP, our eFP works with your participation, but not only that, as the division situated in Division headquarters, situated in Ādaži in Latvia, is also chaired by a Dane, and he shares our ambition to work together for the common defence of the northeast corner of NATO, Latvia and Estonia. We need your participation to make sure that we will pull ahead and prove the value of this development to Jens Stoltenberg and all others. What we are creating there is a ready-made nest for troops if necessary to come into this country in the quantities, which you hope will never be necessary. Nevertheless, we know it will not happen unless we prepare. Moreover, you are with us on this way as well.

Thank you, Uffe, Thank you, and congratulations on the award tonight.



The lecture was recorded in the living-room of Uffe Ellemann-Jensen at his home in Hellerup

Photo: Piret Suurväli

Uffe Ellemann-Jensen. CHALLENGES FACING SMALL NATIONS IN THE WORLD OF TODAY

Madame President, Excellences, distinguished members of the Estonian Academy of Sciences I want to thank you for offering me the honor to give this year's Endel Lippmaa Lecture to this prominent audience. I am honored and humbled – and excuse myself for not being with you directly, but hiding behind a screen...

Endel Lippmaa was a towering figure in modern Estonian history. He was an accomplished scientist as well as a politician with an impressive career both in Estonia and on the European scene. He certainly left his mark on history.

I believe it will be in the spirit of Endel Lippmaa when I choose as my theme the challenges facing small nations in the world of today, in particular how to defend our democratic values.

Both Estonia and Denmark are small countries, if you compare our size to so many other countries. And we share a lot: Geography – though you call it the West Sea and we call it the Easr Sea – we also share beliefs and we have for some time now belonged to the same families, the Northern as well as the European and the Atlantic. So we might also share some experiences as how to deal with the challenges I am speaking about.

Speaking of size I am reminded of an observation made by my dear friend Lennart Meri, when he was on an official state visit to Denmark as President of Estonia back in 1994. He gave a speech at the state dinner held to his honor at our Queens summer Residence, the Fredensborg Palace – and here he said:

"A state with open access to the Sea cannot be described as a "small state"."

I remember him standing there, in the great banquet hall of Fredensborg Castle – tall and impressive, with the blue band of the highest Danish order over his shoulder.

It was not Lennart Meri's first visit to our Queen and Fredensborg Palace – and allow me to take you all on a tour down "memory lane":

It was in the year 1991. Many of you were probably very young at that time, or maybe not yet born. But those of us who are at age will never forget how 1991 became formative for Europe and the Baltic Sea Region.

After the OMON-attacks in January 1991 on the TV-tower in Vilnius and the Seimaa in Riga, Denmark signed three joint protocols of cooperation with each of the Baltic countries.

The joint protocol between Estonia and Denmark was signed on March 11th by Lennart Meri and me in our capacity as foreign ministers.

Here it was stated that the recognition by Denmark of Estonia as an independent state from 1921 was still valid. Denmark had never recognized the forcible inclusion of Estonia into the Soviet Union in 1940. And we intended to reestablish diplomatic relations as soon as the situation made it possible.

At that time not many of us believed this would happen soon – but I tell you, they got hopping mad in Moscow, calling our ambassador up for a verbal bashing while the soviet ambassador in Copenhagen showed up with a strong protest and thinly veiled threats to make life difficult for us in some areas where we were vulnerable.

They never materialized because in August that year things started to happen very quickly.

The "putsch" in Moscow started a Monday morning – but on Wednesday it became clear that the putsch had failed – and on Saturday August 24th we were in a position

to declare that we were reestablishing diplomatic relations with the three Baltic countries.

Two days later the three Baltic foreign ministers came to Copenhagen to sign a joint protocol confirming this. Our Queen was at that time in her summer palace in Fredensborg north of Copenhagen – but she had insisted to receive the foreign ministers Lennart Meri, Janis Jurkans and Algirdas Saudargas. So late in the evening we got into a minibus and went to Fredensborg. We arrived there around 11 in the evening, there was a full moon, and a company from the Royal Life Guard was standing in attention in full gala before the Palace with their music corps playing a ceremonial march. Jurkans said drily: Lennart don't cry. But I think we were all deeply moved by the moment. At the stairs into the palace we were received by the royal dog, a dachshund, and footmen in full gala – and in the hall the Queen received my three colleges with a glass of champagne and a short speech ending with a "Welcome to the free world!".

So yes, Lennart Meri had been there before. And in his speech 3 years later he referred to his first visit.

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What followed was a very busy time for all of us.

It was as if the world had opened up and a lot of dreams were coming true.

Francis Fukuyama wrote his famous book about "The end of history", and we were all deeply involved in the creation of the new World order and the new European structure.

What followed was NATO-enlargement and EU-enlargement. Optimism was in the driving seat.

That was then. Today we are facing a different world:

The ideals and values of European integration – as formulated in the so-called "Copenhagen Criteria" – are being attacked, both from abroad and from member-states.

Were we naïve at the time when Fukuyama's "end of history" was openly exaggerated and misunderstood?

To some extent, yes. But it was difficult not to be.

I remember warning at the time, that we had to remember, that the medal of freedom has two sides. And that the backside meant that freedom could be used and misused to settle old scores. That excessive nationalism, that had been kept under a lid during the oppressive years, could resurface. That this could lead to policies where national minorities or neighbors were targeted both in order to settle old scores and to cover for lack of results on the way to a better future.

That was what happened.

And the scourge of excessive nationalism is now found in all countries, old democracies as well as what still often is called "new democracies". And in small as well as bigger countries. We find it in my country – and we find it in your country.

Now, "nationalism" does not have to be a negative force. Being proud of your nation and your heritage can be a positive driver. But if it leads to rejection of international cooperation, we have a problem.

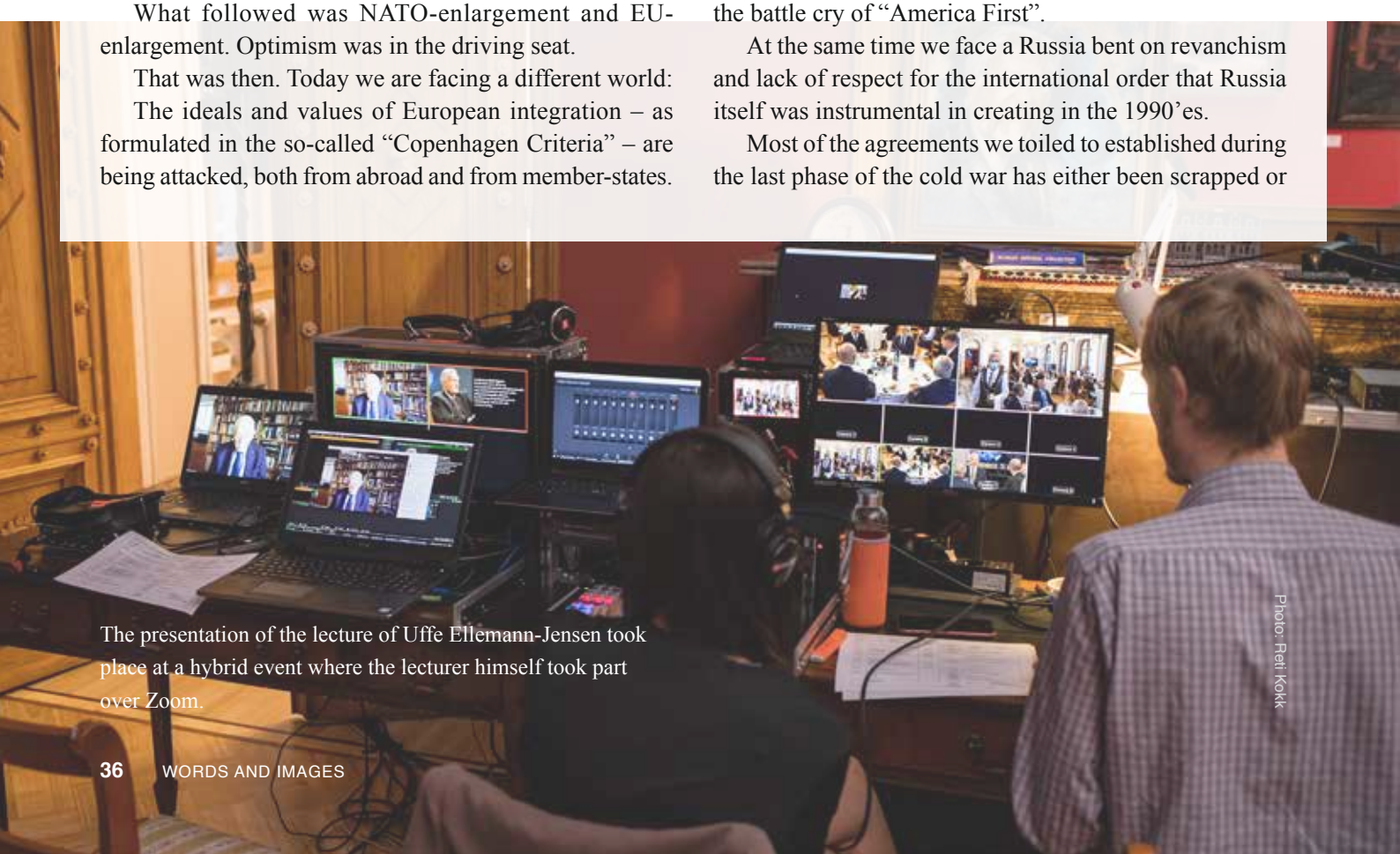
I am sure that had Endel Lippmaa been with us today he would have reacted strongly to the signs all over Europe that these forces are gaining strength.

Europe is facing some very existential challenges.

The traditional American leadership in the Atlantic Alliance has weakened. And traditional American leadership in the international organizations that the US were prime movers in creating after WW2 has been overshadowed by the battle cry of "America First".

At the same time we face a Russia bent on revanchism and lack of respect for the international order that Russia itself was instrumental in creating in the 1990'es.

Most of the agreements we toiled to established during the last phase of the cold war has either been scrapped or



The presentation of the lecture of Uffe Ellemann-Jensen took place at a hybrid event where the lecturer himself took part over Zoom.

Photo: Reti Kokk

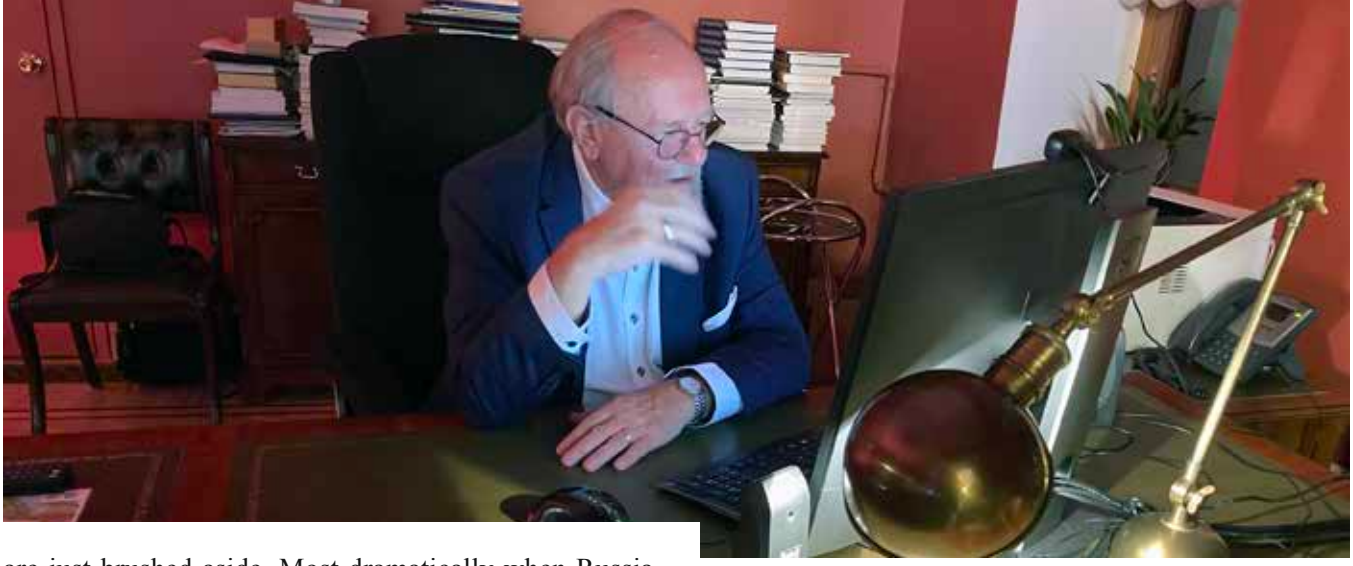


Photo: Piret Suurväli

Private conversations with Uffe Ellemann-Jensen over Zoom. On the picture – chat with Riivo Sinijärv.

are just brushed aside. Most dramatically when Russia seized Crimea and is fighting the war in eastern Ukraine.

But we have also witnessed how many of the confidence and security building measures that came out of the Helsinki-process have been thrown away.

We have also seen how some of the agreements dealing with the nuclear threat are either scrapped or will soon expire unless serious efforts are undertaken by both major nuclear powers.

All of this leaves Europe more vulnerable. In particular the smaller European nations that now are front line states.

Estonia is such a state together with the other Baltic states and Poland.

This is where the need for an active NATO-alliance becomes so important.

NATO has established a presence in these states – the so-called eFP, enhanced Forward Presence: A limited number of troops from other NATO-countries are stationed as what has been called a "trip-wire" or a "road bump", demonstrating alliance solidarity against possible aggression. If you mess with one country, you will be met with a response from all countries. One for all and all for one.

I still remember one ice-cold morning in Vilnius, the day after NATO-enlargement with the Baltic countries was decided at the Prague Summit. The American president at the time, George W. Bush, declared there that from now on, anyone who made himself an enemy of Lithuania would also become an enemy of the United States. The response from the thousands of freezing Lithuanians that stood and stamped their feet on the town hall square in Vilnius was deafening. And on the wall of the town hall you can see the quote on a plaque memorizing this event.

It is important that all European NATO-partners signal that this is not only an American undertaking. We are all part of it, big and small.

The first time I visited the base in Tapa east of Tallinn, I noted with pride the flags at the entrance to the base, showing who were there:

First of course the Estonian flag. Then the Union Jack, as the British were – and still are – in charge of the eFP in Estonia. Then the Tricolore, as the French were about to take over after the Brits. Then the Danish flag, we had some 200 troops on the base - as we have again today – and the Icelandic flag.

Er, the Icelandic flag? Iceland does not have a defense force... Right, but Iceland does have a coast guard, and there was a representative of the coast guard present in the eFP, so of course she should also have her flag there.

It is an impressive signal to send, that the NATO partners stand together, big and small. And in other countries you could find the flags of Luxembourg and Slovenia.

But this does not change the fact that the security of Europe depends on the American support of the alliance. And we have been reminded that this support cannot be taken for granted. It is important that we Europeans demonstrate our readiness to live up to the rules and agreements that binds the Alliance together. In other words: The days are over, when the disproportionate size of the American column in the alliance compared with the European column was just something you can brush aside...

And this example shows us what is the core of the challenges faced by the small countries in Europe: We have to make us worth defending – even though this might demand an extra effort on our side.

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The same goes for the cohesion of the EU.

We may have all kinds of worries and reservations with regard to the so-called "loss of sovereignty" that is part of belonging to such a union – like accepting a special set of rules where we can be overruled if we want to go our own ways. But at the end of the day it can only weaken the cohesion upon which we are much more depending than the bigger member states if we try to go our own ways.

Look what is happening with BREXIT. This is indeed an eye-opener for the smaller nations in Europe.

There is a price to pay if you want to go your own way, and the brits – or rather the English – have yet to find out

how big that price is. Not because some sinister countries on the continent wished to punish the English for voting Brexit – but because you cannot allow one member, and soon former member, to reap the benefits on the expense of those who choose to remain. Of course not. It is not Christmas, and Santa Claus has not moved his residence from Greenland to Bruxelles...

I am particularly worried about the way in which the EU has proved unable to tackle the challenge from those member states that wants to go their own way with regard to democratic rules – while remaining in and benefitting from membership of the EU.

Countries like Hungary and also Poland are doing exactly that – playing with democracy in a way that is not acceptable. From weakening freedom of the press to undermining the rule of law and using gerrymandering and other tricks to change the democratic structure.

If I should have some regrets with regard to the enlargement process that culminated with the EU-summit in Copenhagen 2003 it is that we did not create sufficient instruments to deal with member countries that forgot the basic rules once they were in. Well, there is the article that can take away voting rights from a member states – but that cannot be used, once more than one member state goes its own ways.

Instead we have to hope that there is sufficient political will to deal with such members in a way that takes money away from them. I cannot see other ways to go. I am only too aware of the havoc this will bring. But we cannot allow the disrespect for basic rules of democracy to spread.

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In this complicated picture the role of the small countries is a clear one:

It is in our own best interest to support the structures both in the EU and in other fora – and defend them from attacks from those who wish to turn the time back to a time where everybody believed they could make their own rules.

Some have compared the present situation with the cold war. I don't agree. After all we had certain safeguards established in order to avoid catastrophe. A price was payed for that, as you in Estonia are only too well aware.

No, I rather fear that we are moving back to what we saw in the 1930'es, where the lack of an international order – and international leadership – led to a situation where you tried to make your neighbor the looser. "Beggar Thy Neighbor", as it was called. And where this led to poverty and social disruption – and in the end the rise of un-democratic regimes and wars.

Democracy is under pressure, not just in Europe but globally.

The rise of China, democratic breakdowns in Latin America – plus the pressure from conflicts in Africa and the Middle East, explosive numbers of migrants and refugees and even the risk of a war between NATO-members Turkey and Greece – and the uncertainty of where the US is going. This all bears down heavily on Europe.

And being *small* means that you are first in line if the elephants starts to trample down the grass... That would be a pity indeed – because small nations carry a lot of value – if they manage to deal with excessive nationalism within their own borders.

*

Let me end by getting back to the question of being "small". I want to use a poem of our beloved Danish poet-philosopher Piet Hein – and make a few changes to his original text:

Estonia seen from foreign land
looks but like a grain of sand.
Estonia as Estonians see it
is so big you won't believe it.

Why not let us compromise
about Estonia's proper size.
Which will truly please us all,
since you're greater than you're small.

Photo: Kaja Laane

The President of Estonian Academy of Sciences Tarmo Soomere and Uffe Ellemann-Jensen at the Medal handing over ceremony in Estonian Embassy in Copenhagen.

Photo: Maris Grünvald

Jaak Kangilaski.

PAUL ARISTE MEDAL TO JAAK KANGILASKI

Academy member Mart Kalm's words when presenting the Paul Ariste medal to Professor Emeritus Jaak Kangilaski at the Academy's General Assembly meeting on 8 July 2020

The medal of Academy member Paul Ariste is a medal given out in the field of social sciences and humanities. It is especially important because it is the only medal in Estonia, which is given out in that field. Today, Professor Jaak Kangilaski will be the fourth recipient of this medal.

Jaak Kangilaski is not typical nor ordinary among Estonian humanitarians or art historians. He has been doing the ordinary and typical work of an art historian only since the turn of the century, when he began researching Estonian art. As his original creative work in science, he developed the concepts of artistic life in the Soviet Estonian post-war decades, which was a very difficult and very complex period in Estonian art history. Researching this artistic life was only possible with the diplomatic gloves of Jaak Kangilaski.

These diplomatic skills were polished to a masterful level in the previous century. Although he began researching classical modernism in the 60s and defended his dissertation regarding the Les Nabis group under the supervision of Vladimir Levinson-Lessing in Tartu in 1969, he continued to bring modern Western art to Estonia, in a way he continued what Voldemar Vaga's *Üldine kunstiajalugu* (*General Art History*) (1937) had started during the so-called bourgeois period in Estonia. With that, he was actually working completely against the socially devastative effects of the Iron Curtain. He was doing this while writing articles, but also when compiling books which were finally published with co-authors in the 1990s.

Even more so, he was doing this with his incredibly popular lectures. Orators that are as talented as Jaak Kangilaski are rare among Estonian scientists. Let us think about how art history in the University of Tartu was marginalised as a supportive science to history during the Soviet period. There was not even a chair or anything like what had been in the 1930s. All that remained was a small branch among a couple of specialised history scientists. So, let us imagine lecturer Jaan Kangilaski holding lectures where all of the people could not even fit into the large auditorium of the chemistry building on Vanemuise Street. This means that he had much to say to the Estonian intellectual space regarding the current, advancing Western arts.

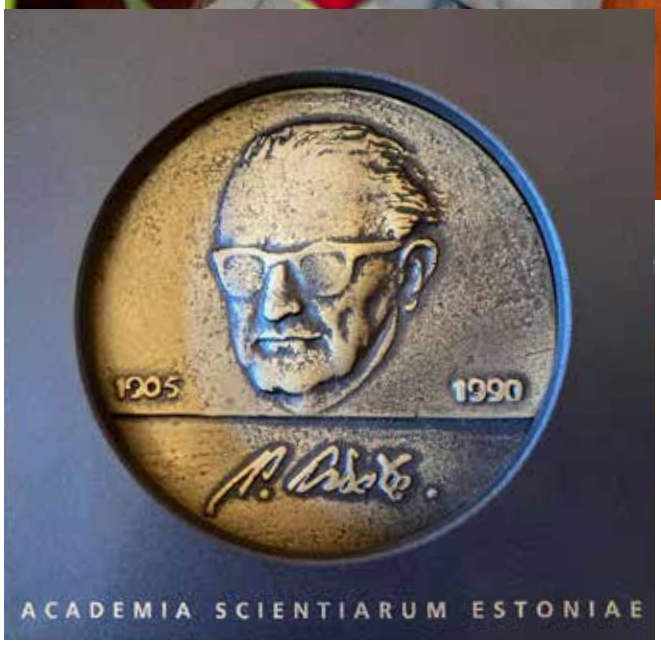


Photo: Archive of the Academy

Paul Ariste Medal.

Especially important were the before mentioned diplomatic gloves of Jaan Kangilaski. With those he has saved a great number of Estonian artists during the Soviet times. Not only Lembit Sarapuu or Maran: he has had to protect many from the ideological attacks of the party. Let us ponder how lucky Estonian art has been to have a man who is so well versed in Marxist theory that no one from the [communist] party's ideology department could object him. The artistic room of Estonian culture has been much broader thanks to Jaan Kangilaski. Therefore, we have a scientist, theorist, populariser, and colleague in one person, who has made Estonian art great.

1. Jackson Pollock
Autumn Rhythm (*Number 30*) 1950.

HOW TO BRING WESTERN CULTURE INTO THE SOVIET UNION

Jaak Kangilaski, *Professor Emeritus. Presentation at the Paul Ariste Medal ceremony.*

Respected Academy members, guests!

At my current age, I am no longer in the shape that was so beautifully described by our colleague [Mart Kalm], but I will try to schematically talk about how it was possible to dissert the art of the Western World during the time of the Soviet occupation.

My interest in modern Western art did not arise because my father or uncles were involved with art. I did not care for art as a boy. I was interested in the history of war, even more perhaps the theory of evolution. I dreamt of involving myself with it, to debate lysenkoism etc. It was only ten or so years later, when I began studying at the university that an episode I had experienced as a boy affected my actions as a handler of art history. This episode took place at my grandfather's farm near Viljandi. There, it was possible to enjoy an added bonus in addition to loved ones and the nature of Southern Estonia: you could listen to the Voice of America relatively freely, which was nearly impossible in Tallinn. When I was perhaps 14, I heard how an artist in America, whose name was Jackson Pollock, painted and created his work. He laid down a 4–6-metre-long canvas on the ground and then splattered it, dripped paint on it, all while running on top of it. Making such an image was without a doubt different to the painting that I had happened to come across here in Estonia. The emergence of this sort of art began to intrigue me when I became an art historian at the University of Tartu. (1)

How did such art achieve extraordinary fame? We need to remember the political situation in the West and for us during the Cold War. This was a big problem for the United States of America. Some years after the war, it was necessary to confront the soviet propaganda. One of the important shapers of the confrontation was the politician Nelson Rockefeller, a republican, but a representor of the liberal wing. Dwight Eisenhower, who was the [US] president in the 1950s, was smart enough to invite Rockefeller to instruct how art can be used to confront the Soviet system.

Some examples to remind us of soviet art were made some years before Pollock's painting. This was the socialist realism that the Soviet Union exclusively allowed, and what was advertised to the people of the western world as the only form of acceptable art. (2, 3) Not everyone in the West was supportive of Pollock right away. Even in America, there were people and politicians that were against it. For example, Congressman Dondero [republican

Aleksandr Gerassimov *Stalin and Vorošilov* 1938.

3. Elk Eber *This was the SA* (*So war die SA*) 1938 (SA = Sturmabteilung, National Brownshirts, a fascist paramilitary organisation from Hitler's Germany – ed).

George Anthony Dondero (16 December 1883–29 January 1968) – ed] said that soviet art attempts to control their people and mislead them with realistic art through domestic consumption, but favours modernistic art outside, to dismantle the sanity of the Western people.

Rockefeller and his peers worked hard to convince the conservative camp that America must accept that American art is represented by Pollock. My later work as an art historian revealed that what had happened in the artistic field of the Western World in the 1950s was actually a radical change. The new trends that had affected art in the Western World for a couple hundred years touched a very small proportion of the public during their inception. The number of scholars that were acquainted and interested in them was small. The majority of the people represented and supported traditional classicistic, academic, or realistic art. The public opinion, which was shaped by big press mostly ignored modernism until Pollock's time.

The big press of the Western World almost never covered innovative art until the 1950s. Only small publications with small readerships covered it. The national change – that Voice of America began supporting Pollock's art on a national basis and introducing it to those behind the Iron Curtain that heard from America – did not just affect politics, but cultural life as a whole. The big press grabbed on to it like a story, an exciting event. The very same Pollock was the cover photo of leading popular newspapers, as well as photos of how he dripped his paintings.

This change meant that innovative art became the official national art of the Western World which was also presented in Western Europe with state funds and where it was enthusiastically supported by innovative artists. The politically divided world that we all know – the Western World and the socialist camp behind the Iron Curtain – were very clearly visually different.

Pollock and social realism are different worlds. Eisenhower's support for modern art was definitely affected by the fact that he had led the armies of the Western World in the demolition of Germany. The Hitler-period in German art was interchangeably similar to socialist realism. Understandably, the political message was somewhat different, but there existed a reliance on realistic tradition in German art. This helped Eisenhower understand the intrinsic coherence between Hitler's and Stalin's regimes. There was of course specificity in Hitler's art. For example, socialist realism did not allow the depiction of naked figures, because it was immoral. Hitler's art was revered because the racist ideology favoured depicting people with beautiful bodies as examples to everyone else.

One unique difference between socialistic realism and Hitler's art was that Hitler distributed his art almost exclusively among Germans. For example, in the German occupied France, there was not even an attempt to teach about Hitler's art. Hitler told [Albert] Seer, who was also interested in why the French were allowed to display such horrendous Jewish and Bolshevik modernistic art, that they do not care for the spirit of the French, let them ruin it with their modern art. We, the Germans, need to have real art.

4. Pierre Bonnard *The Dining Room in the Country* 1913.

I will bring a random example to imagine what was done is Paris. Pierre Bonnard painted this kind of typical Parisian art between the two World Wars. It is [painted] based on nature, a simple random motif, and it is recognisable that it is some sort of a summer home and a landscape. The motif has a small, but still an important role in creating the message of the piece. The main attention is on visual pleasure from the colours and the method of painting. This was the art that was made in Paris, and that opposed the art of Hitler and Stalin. (4)

This, let us call it the Bonnard-style of art, was a direct example for most of the members of the Estonian Pallas school. They attempted to use such simple motifs to create visually interesting paintings, even when it was prohibited, that is to say at the end of the 1940s and in the 1950s, when only socialist realism was the right kind of art.

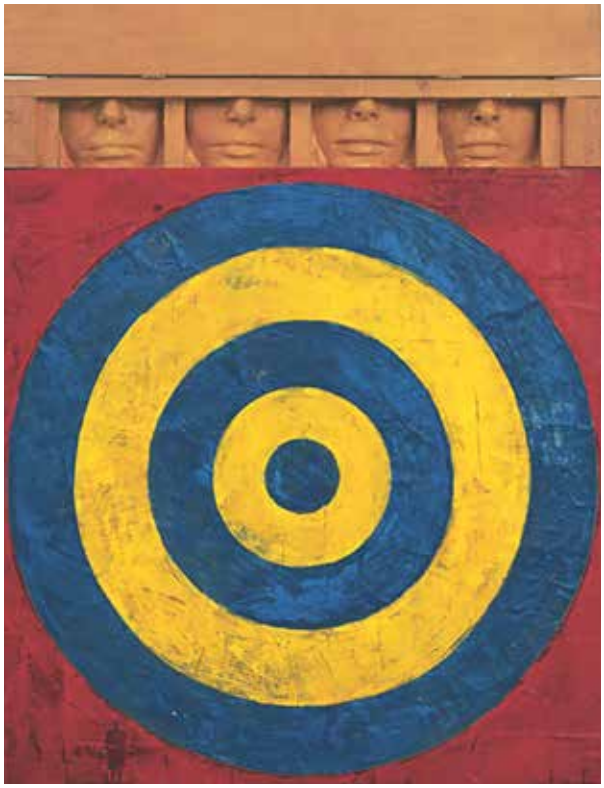
It should be stressed that the development of American modern art did not stop at Pollock. Pollock himself and his compatriots painted spontaneity and demonstrated the freedom of colours. The novelty of the dripped and splattered paintings was reduced when Pollock's descendants began to emerge in the hundreds in Western Europe. Big press awaited news and that of course was only one reason. The deeper reason was that the Western artists wanted to respond to their society. This road was a turn towards real life, and not in the sense of realism, but Neo-Dadaism. [Robert] Rauschenberg's "Bed" from the middle of the 1950s, for example. (5) This is five years after the creation of the Pollock's painting. The same aspect was reflected by Jasper Johns. (6)

In the beginning of the next decade, the 1960s, we see that the American government had also taken art which opposed Pollock under its protection. In other words, the kind of art that completely abandons paintings as the leading visual art type. This kind of art was favoured by the young John Kennedy.

One example of this is Jean Tinguely's "Méta Harmonie II", 1979 (7). In 1961, an event was held in the United States of America embassy building in Paris where Jean Tinguely and his wife were representing the Neo-Dadaist stream of Paris, but Rauschenberg and Johns are present from America. They host a joint event. New York and Paris combine in this kind of art creation, whichopposes not only social realism, but also abstract modernistic art. That is why Neo-Dadaism is more referred to as post-modernist art. Soon, the pop artists, such as Andy Warhol, become the users of mass art motifs (8, 9).

The second half of my talk may be more in line with the title because these are random, commonly known examples which I presented to you visually. When schematically recollecting the context of Soviet-era Estonia, I must talk about how I was even able to relate to Western art more deeply. Here the importance is on my doctoral studies, where I spent most of my time in the Hermitage in Leningrad. The Hermitage was a unique art museum at the time. They did not show newer Western art to the

5. Robert Rauschenberg *Bed* 1955.



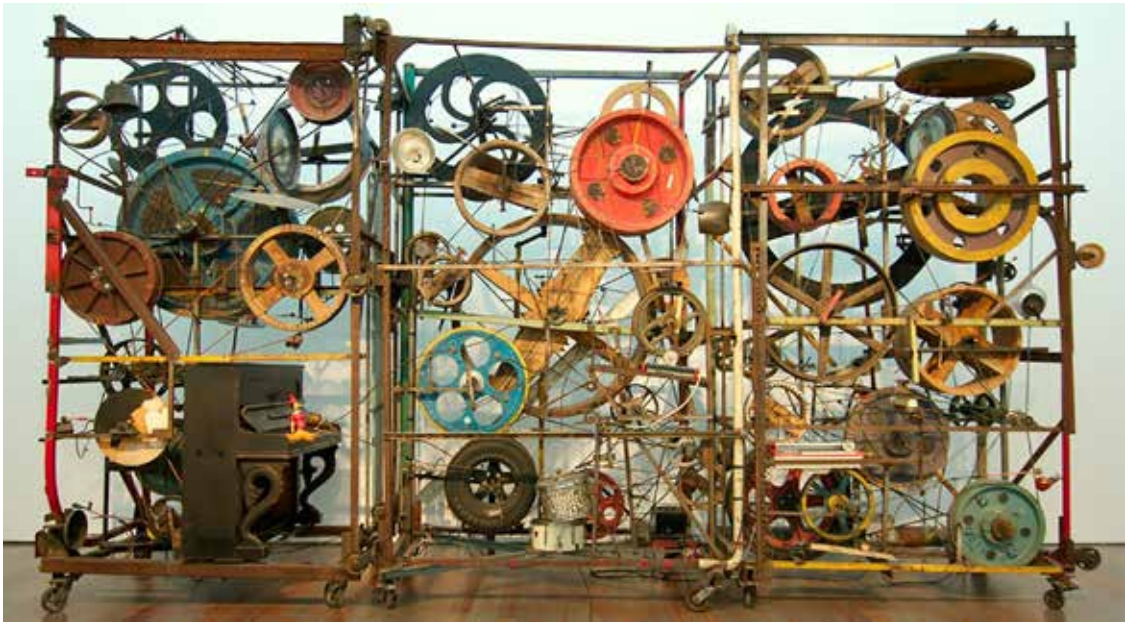
6. Jasper Johns *An Allegory of Painting* 1955–1965.

public, but they were present in the collections. This is true only until 1917 because the modern art collections of the Hermitage were based on the collections of the Tsarist period patron-collectors Štšukin [Shtchukin; also Shchukin] and Morozov. There were very few examples of new Western art in the Hermitage.

The Hermitage had an amazing library, which was a miracle in the Soviet period. Just one detail: not a single western art book was bought into the library of the State University of Tartu after the Second World War. The situation did not change until the 1980s. The situation made books that arrived from the West very rare. The library of the Hermitage had received many books as gifts from Western publishers which I was also able to use. As I said, these reached the early periods of modernism, not pop art, or Neo-Dada.

It was of course a serious wish for a young art researcher to see the phenomena of modern Western art. Naturally, a simple tourist visit would not be enough for that. It was natural to apply for a prolonged visit to the Western World. As you know, some young scientists were already able to go to the west for longer periods in the 1960s. I also made an application. It was perhaps in 1968 when I got past the Estonian SSR Ministry. Zonal committees functioned at the time. I travelled to Minsk, where I took an exam about the French language and French society. I had to elaborate my reason for wanting to go to France in front of the committee – to dissert the breakthrough in the development of modernist art in the beginning of the 20th century. I explained that this would of course be done through reliance on the Marxist aesthetic, etc. No one asked me anything. I was not allowed of course. The Chair of the committee was a small, older man, the representative of the Moscow Ministry. He came to me in a long hallway in Minsk, grabbed my hand with both of his hands and said that if I were a physicist or at least a doctor, I would be travelling immediately, but it is difficult with art researchers. I understood that with my field of study I could not claim a longer visit to the Western World.

Ten years passed. I was already working as a lecturer in Tallinn at the [Estonian State] Institute of Arts (ESIA). One of the reasons behind leaving Tartu was that it was incredibly difficult to get literature about Western art from there. However, some contacts with the Western World existed in Tallinn. Jaak Vares, the Rector of ESIA entered our office at this moment and turned to me and asked if I wanted to move to Norway for a longer period. He had



7. Jean Tinguely *Méta Harmonie II* 1979.

just come from the ministry where they had been dividing trainee spots at leading Western universities between Estonian universities. There had been a lot of competition between some German and American universities, but no one wanted to go to Norway. Not from the University of Tartu or the TPI [Tallinn Polytechnical Institute – ed] or EAA [Estonian Academy of Agriculture – ed]. The spot for Norway was left unfilled. In addition, it was also a spot for a scientist of the humanities. This came to light later.

When I received the spot for Norway, I was told by the [relevant] people from the Norwegian Ministry that they had grown tired of this practice, the so-called culture exchange. The way that it happened was that the specialists who left the Soviet Union were the ones who could be expected to bring economic or some other form of benefits to society. Humanitarian scientists were almost never sent. The Western universities – and not only universities, but also governments – began questioning this practice. They were always sending sociologists or economists and humanitarians here, but we were only sending people from practical fields. They threatened to stop this exchange. Moscow then sent out an order, saying that some humanitarians need to be sent. I was in the row who received the vacant spot in Norway from Estonia. In Vilnius, where the zonal committee had been at the time, I was let through with ease. Behold, I was in Norway, where I had my first opportunity to delve into the newer situations of Western art.

To conclude schematically: the second major breakthrough in Western art occurred at the end of the 1960s. Western art has been divided like political parties since then. Some artists have taken on a socially critical direction.

8. Niki de Saint Phalle *Bathers* (*Les Baigneurs*) 7/20, 1980–1981.

The main idea of the camp, which is sometimes referred to as the radical left, or simply socially critical, is that art which provides visual pleasure is considered bourgeois and therefore is condemnable. The correct kind of art is the kind that includes critical messaging. The messages themselves have changed over the decades. Feminism or ecological crises or messages against racism or any other message that criticises the current established order, for example, is the only correct camp of art according to those artists. It is important to stress that for the most part, socially critical art is endorsed by Western governments until this day.

Understandably, governments also acknowledge more conservative art. In my opinion, conservative art can be

9. Andy Warhol *Marilyn* 166/250, 1967.

divided into moderate and – as funny as the expression is – radical conservatism. Moderate conservatives can, in short, be described as those who believe good art provides visual pleasure and aesthetic delight. Moderate conservative art is the most popular. There is also radical conservatism, such as theorist Daniel Bell. He had already written a book in the middle of the 1970s, titled *The Cultural Contradictions of Capitalism*, in which its main message was that culture has become subversive to the economy and social life of America and the entire Western World, and is therefore almost calamitous.

According to the radical left, aesthetic pleasure is something that good art does not need to consider. Some members also say that the only art that can be good is anti-aesthetic art. The radical left also have their own theoretical sources. One of the most influential magazines that carries these ideas is *October*, which has taken its name from Russian, it began publishing in 1976 and is being published until this day. It is the leading art theory magazine where all the before mentioned socially critical directions are theoretically substantiated and analysed. These two camps oppose one-another. The radical left wants to critique Western culture and life, and the conservatives say that that is exactly what they, the fiends, are doing.

There is also the largest camp, which can be called the liberals. It is located between the two and allows and acknowledges all art. The liberals support pluralism which has room for the art of both the radical left and the extremely conservative. This kind of pluralistic art life obviously does not please the extreme camps. The radical left attacks the liberals because they support the art which supports the active order. Conservatives, on the other hand, say that the liberals are bad because they support art which denies traditional values. Liberals, however, primarily support creative freedom and invite the acceptance of art that provides all kinds of thrills. That is also something that I have been doing.

Questions

Agu Laisk: In his painting, Aleksandr Gerassimov placed Stalin and Vorošilov [Voroshilov] into a dangerous situation. The railing is missing where they are currently standing. Was it the hope of a poor artist, that they might fall?

Jaak Kangilaski. Sadly, I believe this is your so-called guilty interpretation. "Poor artist" is the wrong term for Aleksandr Gerassimov. He was someone who was gilded and coronated with all sorts of titles. Understandably, he simply tried to be realistic in details. The most important thing was the ceremonial exposition of these characters.

Agu Laisk: Hopefully he thought that if he had continued the fence, the uniform would not have been able to be differentiated anymore. This was actually a distortion of reality.

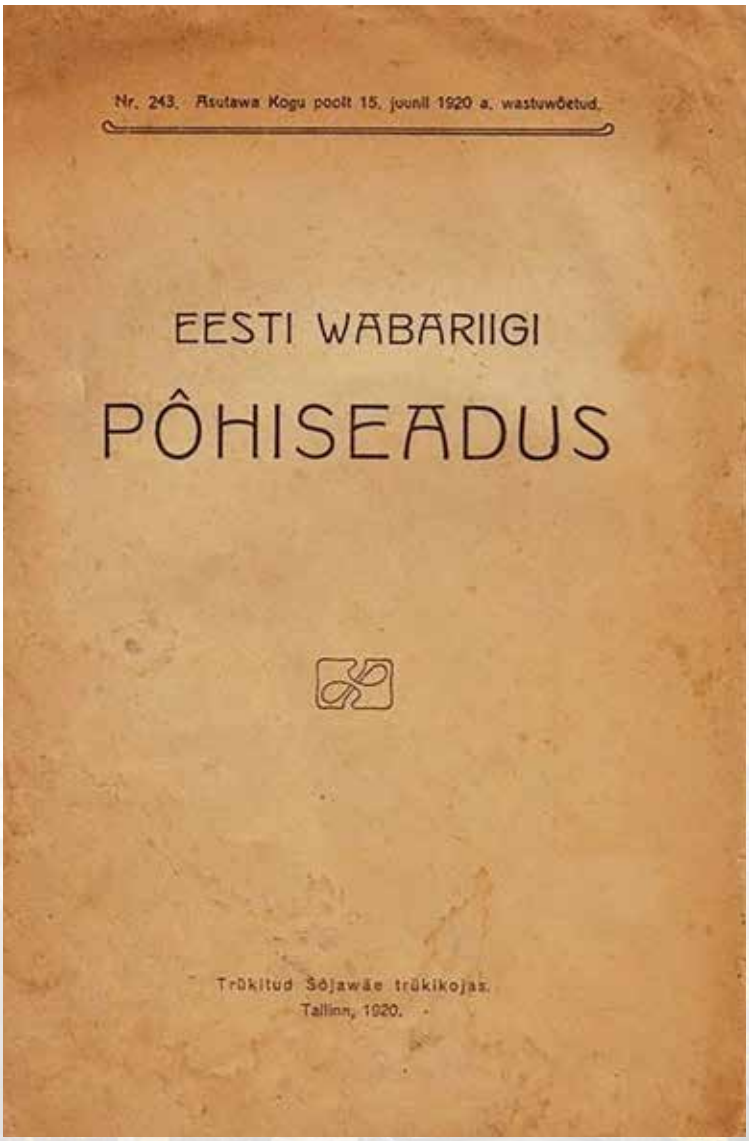
Jaak Kangilaski. Although the name – socialistic-realism – refers to realism, it is actually something different. When realism first appeared as an art direction in the 19th century, then the main idea was that the artist paints things the way that they see them. They do not add anything, do not idealise anything, do not lie about anything. That is also where impressionism comes from. This kind of realism naturally did not fit with the Soviet power. Socialistic realism is mainly still a propagandistic artform that had to show things not as they were seen, but idealised. Among artists, it was said that socialistic realism was praising of the party in a way that it would understand. That was the essence of the art. It was of course completely fake and distorted, ceremonially distorted. It did not deserve the title of realism. After the Second World War, [member of the SSSR Academy of Arts, Arkadi] Plastov's piece tries to be in accordance with 19th century realism. He does not idealise anymore, but shows a Russian village as it more-or-less would have looked visually. The extreme party propaganda was replaced by this kind of moderately realistic art after Stalin.

FIRST CONSTITUTION OF THE REPUBLIC OF ESTONIA 100

On 15 June 2020, the Constitutional Law Endowment of the Estonian Academy of Sciences organised the **webinar: "Constitution of the Republic of Estonia 100"**, wherein experts in the history of constitutional laws explained the context, peculiarities, and main features of the first constitution of the Republic of Estonia.

The presentations held at the webinar can be found by anyone interested at https://www.akadeemia.ee/sundmused/veebiseminar-eesti-vabariigi-pohiseadus-100/.

Rait Maruste's book titled *Eesti omariikluse põhidokumendid (Fundamental Documents of Estonia's Statehood)* was published and presented at the Academy of Sciences and the Estonian History and Civics Teachers Association joint seminars/science afternoons "The formation of the foundations of statehood" which were held in Tallinn on 21 September 2020 and in Tartu on 28 September 2020. The presentations of these events can also be listened to again at https://www.akadeemia.ee/sundmused/seminar-omariikluse-aluste-kujunemine-ja-raamatu-eesti-omariikluse-pohidokumendid-esitlus/.


Nr. 243. Asutawa Kogu poolt 15. juunil 1920 a. wastuwõetud.

EESTI WABARIIGI

PÕHISEADUS

Trükitud Sõjawäe trükikojas.
Tallinn, 1920.

The first Constitution of the Republic of Estonia was printed in 1920 in the Army printing house.

Photo: Screenshot of the Webinar

The speakers of the webinar "Constitution of the Republic of Estonia 100" in the Zoom.
From upper left: the Member of the Academy Lauri Mälksoo, Hannes Vallikivi; i the bottom row from the left: Hent-Raul Kalmo, Prof. Marju Luts-Sootak, Member of the Academy Tarmo Soomere

OPENING STATEMENTS OF THE WEBINAR

15. June 2020
Tarmo Soomere

We live in one certain space and a given period. The way we perceive and understand the world is inseparably linked to the experiences our senses provide us. In our everyday lives, we use the laws of nature that apply to our customary scope of time, space, and still, we know that these are only reasonable approaches to much more universal rules, be it quantum mechanics, the theory of relativity for physical events, or Murphy's law for processes happening in society. These universal laws define the framework in which it is reasonable to operate, and ignoring them (for example, that a body falls at an accelerated rate) can be life-threatening or even deadly.

The role of such universal rules in law-making is played by the constitution. For quite some time now, any new or re-emerging countries have been trying to set these types of rules for the game quickly. Just as the laws of physics and the possibilities of mathematics reflect the development of science at that very moment, the constitution also mirrors experiences, aspirations, and visions of a society at the time of its writing.

The constitution of a new country is not only setting the framework for other laws, but also a beam of light for the distant future. To a future in which its writers would want to live in for themselves and which they would like to pass on to their children and grandchildren. That is why a good constitution must go beyond the boundaries. Otherwise, there would be no point at all in writing or updating it. It also requires thinking outside of the box. In the words of Oren Harari: "Electric light did not come from the continuous improvement of candles."

Looking back at the different constitutions is a bit like archaeology. The difference being that we have an immense amount of information about, for example, the thoughts and passions that prevailed a hundred years ago. We know what happened next. We have a unique opportunity to look back on our first constitutions from where we are now. It is also an incredible learning opportunity: a chance to evaluate how big and ambitious our ancestor's thoughts were. Not only during their time, but also in the context of today. This is an experience that scientists always long for: to not only look at the big picture, but to also look back at the current world history, all of the development, not just from the distant future, but from the very end of the world. Only then can our thoughts, ventures, and actions get a final evaluation and be put into a context that can no longer be changed.

It is difficult to turn an experience like this into economic success or gross domestic product growth. Especially when the discussion is web-based, without driving to another city and sitting down to have coffee together. The values are entirely elsewhere in this instance. Not on the list of political or worldview values. In most cases, avoiding bad or even stupid decisions, and creating an encouraging framework at the same time, yields the most value. Like it is predominantly in nature conservation and environmental protection, it is also unexpectedly often in the organisation of a society. That is why good historical experience is the most important part of successfully organising and directing a country. We have that. Even though we obtained it through very painful trials. We hold this experience dear. Aldous Huxley has aptly worded the value of this: "Experience is not what happens to you; it's what you do with what happens to you."

THE INTERNATIONAL CONTEXT OF THE 1920 CONSTITUTION OF THE REPUBLIC OF ESTONIA

Speech by Lauri Mälksoo at the XIV science afternoon:
"The Formation of the Foundations of Statehood"
21 September 2020

Constitutions are an important material for studying history because they contain the political ideas and energy of their time. I believe that it is worth to take on these texts and compare them with later Estonian constitutions and other ideas that prevailed in Europe and around the world, even for people who are not lawyers and who are not interested in legal history.

The topic of constitutions, speaking in many ways for history teachers in the auditorium of the Academy of Sciences as well, reminds me of a memory from my high school days when I drove from Viljandi County to Tartu for the national History Olympiad. Kaido Jaanson's imposing form was there on the jury. There were two directions to write about: either the domestic or foreign policy of the Republic of Estonia. So, there I was, a seventeen-year-old student in about the year 1992, comparing Estonian interwar constitutions. It was an interesting learning experience, even though Kaido Jaanson himself was probably more interested in the foreign policies, for example, whether Estonian behaved correctly in the year 1939.

A hundred years ago, in 1920, the Republic of Estonia still sought after its legitimacy. In this sense, the constitution should not be seen just as a domestic political document. Certainly, the constitution's domestic policies were dominated by an idealized and, one might say, exaggerated understanding of democracy. The parliament dominated the government, but parliamentary power relations were often unstable. From the standpoint of international life, it was equally important that Estonia was still seeking recognition and legitimacy at the time. On 2 February 1920, the famous Tartu Peace Treaty was signed with Soviet Russia, and on 15 June 1920, the constitution was adopted. The Western European Union, which won the First World War, recognised the Republic of Estonia as de jure only in January 1921. Only later, in 1921, was Estonia accepted into the newly formed League of Nations.

Inevitably, one of the goals the drafters of the 1920 constitution faced was to create an image of Estonia as a civilized country part of the European Union. Although Juhan Liiv says in his 1905 poems that Estonia will someday become a country, it is not a self-evident matter internationally because the Europe that is lagging back in time is still a Europe of empires, where countries are expected to have weight. As a result of certain constellations, small countries are still formed, but even small countries in the European sense – in 19th century European history, Belgium and Switzerland, for example, are also called small countries – are still larger than Estonia, Latvia, and Lithuania.

The conditions for the emergence of small countries are always specific, related to some wars or conflicts. In that sense, it is interesting that the first United States president to travel to Europe for a longer time, Woodrow Wilson, did so to influence the Versailles Peace Treaty at the Paris Peace Conference. That is where it is stated that Eastern and Central Europe will be a new principle, under which the region is organised territorially, will be the right of self-determination for the people. In practice, there are still several problems with the interpretation and application of this principle.

The main problem with the right to self-determinate was, of course, that the nations never live in a way where they are hermetically separated from one another. Let us remember that this building here – the building of the Academy of Sciences in Tallinn – would not have been built in this form if it had not been for the Baltic Germans. In the European thought process, the right of small nations to self-determinate to the extent of becoming a country has not been the only conceivable solution. For example, Fyodor Fyodorovich or Friedrich Martens (1845–1909) from Pärnu, the most famous Estonian expert in international law, wrote in his Russian textbook of international law in 1882 that the right of peoples to self-determination "has begun to be seen as a panacea, but it could destroy many."

Estonia's answer to this, in 1920, is that Estonia is now independent, we are the Republic of Estonia, but we will not start to bully nor discriminate against any minority. From the point of view of the history of international law, Estonia's 1920 constitution should be viewed with whether there has ever been another such generous constitution for minorities in mind, as it states that you can address the country in your native language and even speak in your native language in the parliament without problems.

However, in the United States, although President Wilson himself promoted the idea of the right for peoples


Photo: Reti Kokk

Lauri Mälksoo, Member of the Academy and Professor of the University of Tartu.

to self-determination, it took even longer than that of the Western European Union to recognise the Baltic countries de jure because they still wanted to see what will happen with these things, and to see if these small countries being separated from Russia is sustainable or not.

The constitution seems to be a very country- and nation-centred thing. Just as if every nation chooses the way of life that suits it completely all on its own. Nevertheless, it is not quite that simple. Nowadays, we no longer talk about "civilised" (and accordingly also "uncivilised") nations. We talk about that at least in the Western world, there should be some respect for human rights and the principles of democracy. In 1882, the above-mentioned Martens defines [sic!] a "civilised country" as follows: civilised are those nations and countries that respect human rights, the rights of citizens.

Probably the best monograph written on the Paris Peace Conference is by Toronto professor Margaret MacMillan. It has also been translated into Estonian. There is an interesting aspect there, that when there are rumours in the world that things are now being redesigned worldwide on the basis of the principle of people's right to self-determinate, many colonies which have won wars, send their representatives to Paris, saying that they too want self-determination, as it is such a good idea. But they are be sent back from there, being told that we did not mean you!

At least de facto it is applied to the empires that lost the war in Eastern and Central Europe before all others. As far as the German-speaking minorities are concerned, there is clearly a slight tendency to say that Germany and the Germans should still be punished a little for the long First World War that took many victims.

An interesting thing also emerges from the study of international law: the right of peoples to self-determination has not always been applied generally or uniformly at all. It has had an important regional dimension. One can even say that the right of peoples to self-determination only became part of the general international law during the decolonisation process in the 1960s.

During the Cold War, in 1966, two human rights pacts were adopted at the United Nations (UN). Firstly, the Covenant on Civil and Political Rights and, secondly, the Covenant on Social, Cultural and Economic Rights. In both Covenants, Article 1 speaks of the right of peoples to self-determination. This shows the paramount importance of this concept during the time period. A nuance also becomes clear: the right of peoples to self-determination in Africa, for example, does not precisely match the meaning it held for Estonia in 1920 at all.

Africa's borders are usually not ethnic at all. The right of peoples to self-determination in Africa in the 1960s meant that they could get rid of European colonialism. This did not mean that there would be, for example, 150 tribal or linguistic national states in Nigeria.

Without a doubt, the most decisive choices in the 1920 constitution were the domestic ones. This is the case in every constitution. However, the Constitution of 1920 also sought to send a message to the outside world, to internationally announce: The Republic of Estonia is a civilised European country, where the rights of minorities are respected. The de jure recognition of the Republic of Estonia in 1921 and the accession to the League of Nations certainly also looked at the translation of the constitution.

PÕHISEADUS 100

SCIENCE AFTERNOONS AT THE ESTONIAN ACADEMY OF SCIENCES

SCIENCE AFTERNOON XIII: "CHALLENGES OF ENERGETICS"

25. August 2020

Conversation with Hando Sutter and Taavi Veskimägi, moderated by Tarmo Soomere

The spoken text is only lightly edited. The words in square brackets are added by the editor in places where the context of the conversation may not be automatically understood. The edited text is reviewed by persons concerned.

Tarmo Soomere: This summer marks five years since the Academy began its series of "Science and Society" meetings. Discussions about science and its challenges do not necessarily have to be boring or monotonous. On the contrary, especially when discussing matters that literally concern the society as a whole. Only few in our society do not have to pay for electricity, either directly or indirectly. The main concern consists in having guaranteed power in the wall socket tomorrow, and after then as well. We also need to know how much it costs.

Conversations in the academy have a certain nuance compared to some other discussions, especially the current mainstream, according to which the primary goal is to provoke someone or something. We are trying to do things differently, to distinguish ourselves positively. We are trying to formulate tasks in their most general scale, to build as complete picture as we can, to look for common ground with different actors, to create opportunities for cooperation, and to offer novel and elegant solutions. Our main goal consists, first of all, in putting arguments and facts on the table, not criticism. Most of our problems are complexed, whereas simple solutions are, in general, simply wrong.

At the initiative of the Estonian Academy of Sciences, four science afternoons took place in 2020.

On 25 August, the science afternoon XIII: "Challenges of Energetics" was held, where the Chair of the Management Board of Eesti Energia, Hando Sutter, and Chair of the Management Board of Elering, Taavi Veskimägi, discussed the central tripartite challenge of the energy landscape:

- what opportunities do we have to ensure the security of energy supply and energy security;
- how would energy production be environmentally friendly and sustainable;
- how to keep the cost of energy at a reasonable level.

(see the full discussion on pp 50–70)

On 21 September, the seminar/science afternoon XIV under the title of "The Formation of the Foundations of Statehood" was held and the presentation of Rait Maruste's book *Eesti omariikluse põhidokumendid (Fundamental Documents of Estonia's Statehood)* (see also Lauri Mälksoo's speech on pp 48–49)

On 2 November, the science afternoon XV: "The Sea Around the Wreck of MS Estonia" took place.

In November, at the science afternoon, eyes were turned towards the seafloor. The seabed may not be a smooth, quiet grave. Sediments can hide thousands of years of history of fine sediment as well as granite spikes and human-produced threats to the sea, whether they be thrown or abandoned. The water at the bottom of a sea can move at the speed of riffles or rapids. The topics of discussion were the following: what are the specifics of sediments on the seabed and seawater flow in the place where MS Estonia was lost, what should we learn more about it, what is meant by grave peace in the place, what are the skills and opportunities of Estonian scientists and specialists to find out the necessary information about this, and would we need to call backup from our neighbouring experts, etc. In addition, the role of researchers and experts in such extremely complex and sensitive situations was discussed, as well as how much and what information should be collected and shared with society. This was discussed by specialists from the Tallinn University of Technology, University of Tartu, Tallinn University and Geological Survey of Estonia Kristjan Tabri, Urmas Lips, Georg Martin, Hannes Tõnisson, Sten Suuroja and underwater work specialists Madis Madalik and Rait Kütt.

Photo: Piret Suurväli

Supply and energy security. This must be done in such a way that energy production is environmentally friendly and sustainable, and that the price of energy is what consumers can afford.

Science afternoon XIII)"Challenges of Energetics" speakers (from the left) Hando Sutter (Eesti Energia), Tarmo Soomere, Taavi Veskimägi (Elering).

Generally, we have been trying to apply the Chatham House rule on these kinds of conversations: everything that is said can be quoted but without revealing who said it. The classic Chatham House rule does not even allow disclosing the persons present at the event. At this moment, this is possible only partially because we were not able to accommodate all interested subjects due to the coronavirus crisis, and the conversation is broadcasted and can be followed on the web by all other interested parties. We therefore agree that nothing that has been said can used against those who have said it.

The Academy focuses on facts and does not attack messengers. The questions asked are what people really want to know. The questioner's wisdom or intelligence is not the point to demonstrate. No teasing nor accusative questions. All performers have much experience and asking such questions would be a waste of time.

The main topic is well known to everyone. Modern society can only exist if it is supported by a perfect energy supply. For now, it has mainly relied on the use of the fossil fuels, large-scale production in a single location or few locations, and powerful transmission lines. Global energy consumption tends to increase. This process will probably continue for some time. The higher requirements are for high-quality energy to be available at all times without interruption, the greater must be the reserve of capacity, whether produced on-site or off-site. This puts more and more pressure on power plants and networks, as well on the environment. We are perfectly aware that some peers just cannot stand a power line (some people are physically very sensitive), let alone a powerful power plant in their backyard or garden. But there is always that, the cleaner you produce and the more wires you hide underground, the more expensive the electricity will be.

Thus, my dear peers on my left and my right hand, whose salary includes responsibility for energy supply, have a permanent fight with the three-headed dragon. The named dragon is called, in the wording used by Taavi Veskimägi, the central triple challenge, or triangle, of the energy landscape. Thus, the interlocutors must guarantee the supply and energy security. This must be done in such a way that energy production is environmentally friendly and sustainable, and that the price of energy is what consumers can afford.

The main concern is not so much how to produce or transfer energy. The main limitation is that everything produced by the generator has to immediately go through the consumer's devices. The production of the electricity for stocking is not currently possible. That is why our guest-controlled systems always walk on the edge, and still have to be in perfect balance.

How is a balance kept between the security of supply, affordability and environmental friendliness?

Hence the first big question: how do Eesti Energia and Elering build and maintain this balance? There is another issue right behind this. Particularly, I would like to know even more about these elephants in a dark room, with whom you are constantly testing your strength, and of whom bystanders have little knowledge. In academic wordings: you must both fight the laws of physics and use them wisely.

On 10 November, there was the "Struve Arc and Estonia" research seminar celebrating the World Science Day. Presentations were followed by the **science afternoon XVI: "How to Value Struve's World Heritage in Estonia"** (see also article by Andres Adamson, pp 77–80).

Due to the special year, all science afternoons were also broadcast live. Links to see them can be found at https://www.akadeemia.ee/sundmused/ in the list of events of 2020 (in Estonian).

Elering's role is to ensure that the lights could always be lit and that households stay warm.

Taavi Veskimägi: Thank you to the Academy of Sciences for organizing this debate! Dear members of the Academy, dear guests, and everyone who is watching us at home or in the offices. There would be, without any doubt, many different ways to introduce the present debate, to give a sense of our position on the scale: security of supply, climate policy, and economic competitiveness.

First of all, as the title of this presentation introduces the topic [Taavi Veskimägi gives a presentation "Energy Policy is Not Without Values" – ed], the policy of energy is not without values. As in politics in general, there are a number of assumptions in energy policy that are reasonable to be taken as a basis so that further discussion would be consistent, and that it would be understandable on which assumptions the conclusions we draw are based on. Although, these assumptions are, in fact, very much based on the values on which we base our energy policy.

To begin, and based on the triple challenge that Tarmo Soomere mentioned above, I take a look at the role of Elering. In the public debate – and this is also part of the public debate here – the roles of one or other of the energy market players often tend to be confused. That is why it is important to define what Elering's role consists of in organizing energy management. Elering's role is to ensure that the lights could always be lit and that households stay warm. Our responsibility is the responsibility for security of supply. In other words, it means the perfect operability of the energy system as a whole, including both the electricity system and the gas system. That is how we define our responsibility. We perceive this responsibility and are working towards it and in such a way as to carry out this responsibility.

We have made it clear that our mission for the next five years is to synchronize the Baltic electricity system with the continental European electricity system. Why we are doing this? To mitigate the central security risk of supplying in Estonia: synchronous work with Russia. We are doing this because we understand that such a transition has always led to additional operational risks in the first approach. It is important that lights can always be lit, that households stay warm and that the electricity reaches the consumers. We are doing this in a way that supports the achievement of the climate policy goals of both the European Commission and the Government of the Republic, i.e., the decarbonisation of the energy sector. We also do this in a way that supports the competitiveness of the Estonian economy. This implies keeping the network fee low. In case of the, let's say thin network, the main cost consists in the cost of capital. A well-connected network with other countries is a factor, which determines the price of electricity. Be it the price of an electron or a gas molecule: Elering's goal is to provide interconnection capacities that would bring us the same energy price as elsewhere in the Baltic Sea region. Achieving this requires a functioning retail and wholesale market with sufficient competition.

Basically, the management of Elering's is both a daily and a strategic performance of balance between these three dimensions. Our key performance indicators (KPIs) are set in such a way that they balance each other. We are keeping in mind Estonia's competitiveness, and at the same time, we are looking to keep the lights lit and encouraging more renewable energy to enter into the electricity and gas systems. By doing this, we are keeping in mind the wellness of Elering's own employees.

To achieve these goals, there are certain assumptions to take into consideration. Let me define them. These are especially important in the public debate to understand why Elering is sometimes in one position, and Eesti Energia in another. Such a difference in positions is not tragic for me because our starting points and our roles in the energy market are different. In case of a hypothetical agreement on everything between us, there would be something fundamentally wrong and we would not be able to talk about an energy market in which all companies are treated equally regardless of their ownership. Elering is a system administrator that keeps the big picture in sight. Eesti Energia is one of the market players among others fighting for its economic profitability. If these roles are not understood, or if they are not defined, it is often incomprehensible why we are performing the way we do.

The primary assumption consists in that laws in general also apply to energy supply. No one doubts that the laws of physics are valid, such as Kirchhoff's law. The rules of a liberal market economy apply in our understanding of

Photo: Archive of Elering

The main task of the Control Center of Elering is the operational planning and 24/7 real-time management of the Estonian electricity system.


Photo: Archive of Elering

energetics exactly in the same way as in any other sector of the economy. We believe that the best way to ensure security of supply is a fully functioning energy market. This is far from being the only possible concept. When talking in continental Europe, for example, to the head of a French transmission system operator, he will tell you that we have the rules of physics here all right, but forget about the rules of the market economy!

We believe that the best for society, in other words, the most socio-economically efficient way is a fully functioning energy market. I am emphasizing the term energy market in particular, not the electricity or gas market. Different fuels, different energy carriers, different ways of producing energy must have the chance to compete effectively with each other. In our view, the electricity or gas market will not be separate in the future, but we will have an integrated energy market. For sure, our goal is to see the market with many players on market. We know that effective competition occurs when no player on the market has a market share of more than 40%. We want the market to be efficient and that the named market would be regional.

The retail market is clearly local, but the wholesale market is clearly regional or even a larger scale market. We have seen a situation where the so-called day-ahead electricity price is the same from Gibraltar to North Cape. In fact, this is an ideal situation. That is our vision. However, this means that there is no Estonian [local] wholesale electricity market. We have invested approximately one billion euros and we are investing in connections with other member states of the European Union in the firm belief that a generator in Latvia or a generator in Finland is, in terms of security of supply for Estonian consumers, just as good as a generator in Estonia.

Without this deep conviction, we would act in a completely different way, or we should do other things instead because it is obviously too expensive for a society to do two things at once: to invest massively in connections, and then, just in case, to invest in power plants that are not competitive at all on the market (in other words, subsidize them). That is where the abovementioned trinity comes in. As a society, we will not be able to pay for this (essentially) duplication without affecting the competitiveness of the Estonian economy. Namely that would be, on the one hand, and just in case, the power plants in our backyard and, on the other hand, the connections. While building these connections, we must also have confidence in the generators on the other side of the connections.

The third assumption is clearly linked to the logic of a market economy. I often see and perceive, even while preparing today's debate, the question: where do we build these power plants or what fuel will they use? We believe that this is not an administrative decision. An effective market code needs to be established. Then, each individual producer can decide, which is the most effective way because there are different markets. There are markets of fast reserves, and there is a day-ahead market, an intraday market and a flexibility market. Different markets differ in terms of production, consumption, management and storage. The most foolish thing to do would be to make administrative decisions like it was the case with Auvere power plant. I remember perfectly well the discussion with the Minister of Economic Affairs, Juhan Parts, at that period. Even if the Company said that the investment is not right, and Elering said that such an investment is not, in terms of the security of supply necessary, the named Minister still had a clear vision in that such a power plant should be built, no matter what, and for such a fuel. In the context of the current energy economics, such an administrative planning committee type of decision is not possible.

The next aspect involves the constituents of the security of supply. Very often it seems that the public debate lacks the understanding about the constituents of the security of supply. After all, the consumer is only interested in having the necessary power. The consumer does not care whether the lack of power is a result of no generator, if it is due to the transmission network not transmitting, or because there is a fault in the distribution network.

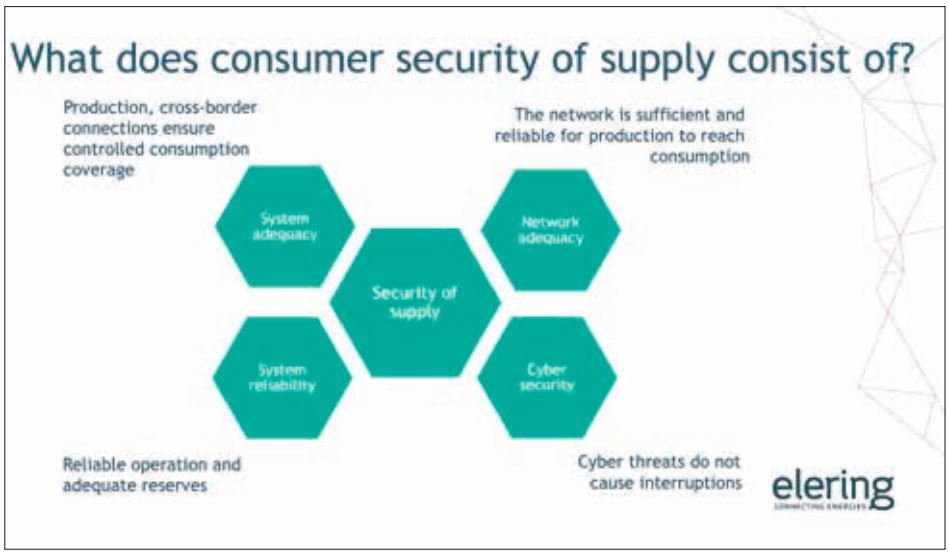


Figure 1. Security of supply.(From the presentation of Taavi Veskimägi at the Science Afternoon on 25 August 2020)

After all, the consumer is only interested in having the necessary power.

For the consumer, named security of supply consists of four components (Figure 1). Firstly, the adequacy of the system. That we would have sufficient production capacity and cross-border connections. For that purpose, I made a mention on this slide "to cover controlled consumption." The second component is system reliability. The operability of the system by us in real-time. To have sufficient reserves, and to have sufficient equipment for an operator to use. The third component is the network adequacy. That the wire is thick enough and the net is reliable enough because to be honest, Estonian consumers have experienced problems with the security of supply, mainly not because there is not enough production in Estonia, Finland, Latvia, Sweden, Norway or wherever from where the input of electricity for us is made based on market signals, but because the network failed. This has been a major concern in terms of the security of supply from the consumer's point of view to this day. Lastly, the fourth component concerns the growing cyberthreats causing disruptions. This is a new and growing issue to deal with. While decomposing security of supply, these are the four aspects emerging.

Next, there is one of the most interesting slides from today's presentation (Figure 2). This image has not been shown anywhere before. Coronavirus was not a reason to cease our active work. Pursuant to a European Union regulation, the government must set a standard for security of supply. This refers to the maximum (potential) number of hours per year during which production does not have to fully cover consumption. There is no difference whether the electricity is produced in Estonia or elsewhere.

In an eventual case of production not covering the consumption, it does not mean that there is a complete blackout or power outage. There is a possibility to implement consumption management or use Elering's own reserves. The named standards are referring to a situation when the production does not cover the consumption. This task consists basically in an assessment of a socio-economic impact. The system is built on the logic of maximizing socio-economic well-being. By this, we are talking about the situations, where the investment in a new capacity of generation is more expensive than the cost that the society would have to pay if production does not cover consumption for some hours.

Together with the consultant, we did a thorough job. An estimate was drawn, so that in Estonia, this number of hours is nine hours a year. In other words, for a maximum of nine hours a year, we could have a situation where the production with the interconnection capacities does not cover the consumption. In this case, the socio-economic damage is lower compared to the investment in a new generation capacity to cover these nine hours of unallocated power.

This is a standard that the government must establish. We are the ones to do the "dirty work", and those who make the appropriate proposal. It will be called the Standard on Security of Supply. Such a description is needed without doubt. It is also necessary for this standard to be in place in a completely different purpose. In the frame of public debates, it is asked whether Estonia should establish a kind of capacity mechanism consisting inherently in a state aid. The named standard for security of supply is a precondition for this type of state aid to be granted. In the absence of this standard, no state aid can be granted.

There is another work we are actually working on and which will be completed in the coming months, consisting in working with all the other Elering type of companies in

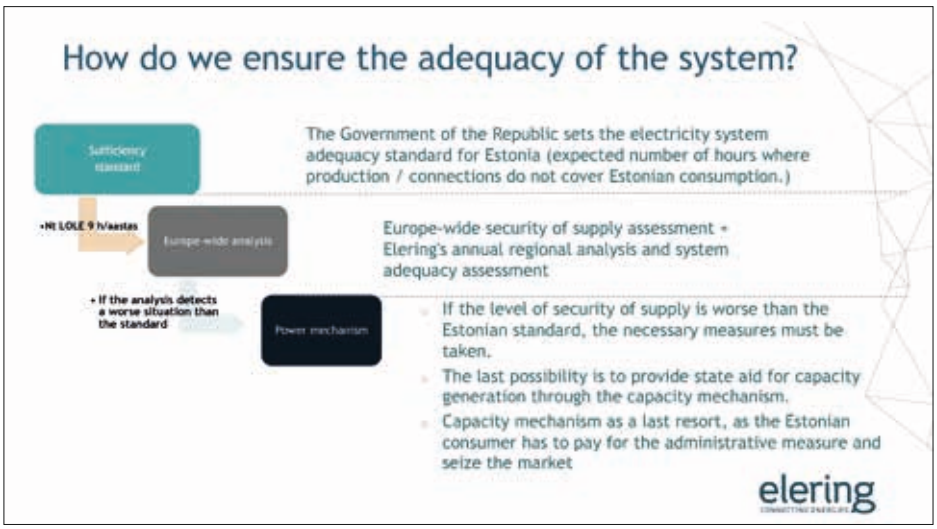


Figure 2. Sufficiency of the system. (From the presentation of Taavi Veskimägi at the Science Afternoon on 25 August 2020

Europe. We are preparing a medium-term assessment of probable security of supply until 2030. In case the number of lost load-expectation hours in Estonia raise higher than prescribed in the standard on security of supply, we apply the power mechanism. Whether this capacity mechanism will be a strategic reserve (i.e., we buy capacity in advance during these hours, but these power plants do not actually participate in the market) or is it the capacity market, where the named capacity then performs, is a matter for decision and public debate. Firstly, the standard on security of supply, and secondly, the European estimate for 2030. If the result does not meet our standard, namely the capacity mechanisms, then we proceed for buying capacity in advance.

The abovementioned subject may give the false impression that we are just beginning to study all these things and do not know anything yet. However, we have performed both probabilistic and deterministic analysis on an ongoing basis each year. In collaboration with the Ministry of Economic Affairs and Communications and the Ministry of the Interior, we have been working through four scenarios. There are two different scenarios for assessing the production adequacy of the market-based scenario. One of them consists in a baseline scenario. The second consists in a low-carbon emission scenario, in accordance with which we will close another twenty-three gigawatts of production capacity in Europe. The need to close them comes essentially from the basics of the European Emissions Trading System [ETS]. In both cases, the security of supply in Estonia is guaranteed until 2025. In addition, we have analysed a more stressful scenario, i.e., the so-called scenario of the Baltic synchronous areas, which is a simulation of the suddenly lost connections with Russia. We also analysed the Baltic Emergency Scenario, in which we excluded all DC links in addition to the connections with Russia. We have also made the so-called even worst case scenario, i.e., the scenario of Estonia's vital services. This scenario additionally excludes all connections between Estonia and Latvia. It is understood that, in this case, it may not be possible to cover all the consumption and the focus in this case will be concentrated on guaranteeing the supply of vital and general interest services. No matter the abovementioned scenarios, we are able to satisfy consumption needs in Estonia.

Energy production and consumption are changing

Hando Sutter: Thank you, Tarmo, and I am glad you took the trouble to convene such a respected company. The energetics is certainly not an easy matter, and if such wise heads think together, then things can only get better.

In a certain aspect, I am also occupied with WEC Estonia [the Estonian National Committee of the World Energy Council – ed], so it would be nice to put the trilemma, subject of today's brainstorm, in this context. The named trilemma is certainly not just a sporadic combination of something created somewhere. Each year, the World Energy Council compiles indices for this trilemma. These can be found on the WEC website [http://www.wec-estonia.ee/]. The index for this trilemma was last published at the end of last year. It essentially consists of finding a balance on three legs, just as it is already discussed above. According to the 2019 index, Estonia ranks 30th in the world. In my opinion, this is a great result. The result has improved year by year. And this is particularly true in the context of the environment, where we used to be in a relatively poor position. I think that the success may be due to the fact that we, as Estonians, are ambitious and never satisfied. This, in fact, is a powering force and a fertilizing medium for innovation.

In a certain manner, it is okay if we are not satisfied with something. In fact, we can say that things are not so bad. In terms of security of supply, our position is very good. So, in that sense, everything is just fine. But for now,

Photo: Archive of Eesti Energia

The Solar Park of Eesti Energia in Paldiski.

In August 2020, there have been about 400 solar power plant connection applications filed in a week.

I would suggest you take a look at the bigger picture and think about why the CO_2 issue became as big an issue in the whole world as it is today. Energy consumption has increased every year. It could be that this year will be the case over many, many years without the increase in global energy consumption. This is because of the coronavirus, which was in no way a part of people's plans, but was rather something unexpected. Last year (2019 compared to 2018), the energy consumption increased globally by 2.1 percent, including electricity consumption, by more than four percent. This is a really very, very big increase. This growth comes first and foremost because of the fact that the world's population is growing very fast. It is estimated that by 2040, there will already be ten billion people on Earth. Another reason consists in the fact that the average standard of living is rising. However, there are still more than 800 million people in the world today who have no electricity supply at all. They are all probably also dreaming of it as a basic need for them to have their lights lit and to be able to charge their phone. The corresponding options are becoming more and more affordable for them as well.

It is important to keep in mind that Europe is probably the only continent where progress has been made in reducing CO_2 emissions. In other words, a stability in CO_2 emission is achieved in the European Union with some slight decrease. This is because of a great effort, but also a very large financial contribution from consumers, industry, and from all of us. Unfortunately, the emissions from European Union account only for about eight percent of global emissions. Emission rates in Asia and many developing countries have increased. So, in fact, global emissions are constantly increasing, and this is happening pretty fast.

But for now, let's get back to the context in Estonia. While talking about the production of the electricity in Estonia, security of supply in Estonia, and the functionality of the Estonian system, then of course we would like to think that everything revolves around Estonia. Actually, the context is a bit different. Estonia's share of the Nordic-Baltic common electricity market is approximately eight terawatt-hours per year (TWh/y). The Baltics have a total of 25, and Finland, for example, almost 90 TWh/y. The Nordic countries, including the Baltic States, count four hundred terawatt-hours. In this respect, it is good to take some momentum. We cannot consider Estonia separately. We have to consider all regions as a whole, at least the Baltic States and Finland, or preferably more broadly, the Nordic countries and the Baltics. Although, in fact, we should look even more broadly.

Another subject of utmost importance to take care of is hydrogen, as already mentioned between us. It seems inevitable that all the stories about the energy of the future will collide with hydrogen in one way or another. Most probably, we will also touch this subject among others today. Why so? One thing is for sure, that all the discussions about the electricity as a separate matter will disappear. This will be the same for natural gas. Taavi [Veskimägi] already pointed to this matter by the way. This will be equally the same for biomass or oil shale. This will be the same for talking separately about hydrogen or some other energy source. The distinction between energy carriers and sources will gradually disappear simply because the boundaries between them are becoming increasingly blurred.

Actually, even the matter from which we produce electricity is no longer the strategic choice of Eesti Energia. In principle, any consumer or household can decide itself how to buy electricity. The consumer can choose what or how the electricity is produced, and the consumer even has their own options to produce the electricity. A fact is that, during the last weeks [in August 2020], there have been about 400 solar power plant connection applications filed in a week. We estimate that by the end of 2020, there will be approximately 6,000 solar power plants in Estonia with a total capacity of 350 to 400 megawatts.

I cannot figure it out, how was I not able to foresee that such a thing will happen in Estonia? There is no doubt that predicting the future is difficult, but I could not foresee such things happening even in my wildest dreams. Let's think about that soon we will have in order of 350 to 400 megawatts of the capacity sourced from solar power plants. Let's add the capacity of wind energy produced in Estonia, which makes a bit over 300 megawatts. This means that by the summer of 2021, for example in June, when there is a bit of wind and the sun is shining, it may happen that Estonian consumption is all covered by solar and wind energy produced in Estonia. And there will even be some electricity left to export then. This is very welcome. After all, we always wanted the renewable energy to be more and more important.

There is still another little thing that Taavi [Veskimägi] did not talk about. According to the standard of the security in supply currently being drafted, which Taavi [Veskimägi] reviewed, we have to accept that we might face up to nine hours a year without electricity. This may not be the case, but these are the calculations covering the worst-case scenario.

In fact, the technology is already so advanced that every consumer can decide by itself whether to accept it [that there is no electricity for nine hours a year – ed] or not. That is because of the accumulator becoming more and more affordable. Among other things, the solar energy produced on your own roof can be stored and used when these aforementioned nine hours come, as an element of your own security of supply, but it can also be used to keep your electricity bills as low as possible. In other words, if the price of electricity is at its highest, I can use electricity from my own storage. It can also be used to actively participate in the electricity market. This image is becoming more and more real. By today, this is already a technological reality, with quite good profitability by the way.

In fact, the segment of liquid fuels in Estonia's energy balance is currently twice as large as the electricity balance. There are also still changes waiting in the transport sector – it will be electrified. Almost a third of CO2 emissions in Estonia are produced in the transportation segment and in agriculture, and together, all these electric vehicles will, at some point, form a big accumulator in Estonia, when put altogether to work behind system services, for example.

This will be a great opportunity for all owners of electric vehicles – as owners of accumulators. Even if this market will not develop in Estonia (and unfortunately it does not yet exist), a micro-society or an energy association, for example, may emerge to exchange this kind of service. At some point, they will become independent. They simply do not need any network service in case it turns out to be too expensive. For them, it is a technology [based on local production and storage – ed] as an arbitrage against rising taxes and network charges. The network fee would clearly have its market-based ceiling then.

During the period when the whole energy system was regulated, we had to accept a regulated price. There were no alternatives. But for now, the technology – and not only in Estonia, but all over the world – offers more and more opportunities. We can choose whether we are part of a large system or we have the option to find a better solution for us. When adding new factors in this game, like the abovementioned hydrogen, which is likely to be discussed soon, there will be even more choices.

By today, I would rather not pretend to give any targeting prognostics on how the energy system will look like in ten years' time. There are quite a lot of choices. Some technologies have evolved much faster than we could have foreseen. In my opinion, it is the development of technology that gives raise to future trends.

One thing is certain in my opinion: the central energy system will be seriously challenged. Smaller electricity consumers will certainly be able to participate more actively in the electricity market, to produce and to store electricity themselves. There is no difference if the accumulators are stationary or electric vehicles. These are options which change the existing image a lot.

The development of solar energy, as well by definition as in real life, is seriously challenging the business model of network services in Estonia. In the case we have 350 megawatts of solar panel capacity next year, it will produce about 350 gigawatt-hours of electricity per year (GWh/y). This is the volume of electricity which disappears from Elering's environment. That is because much of it is transferred directly, either from the roof to immediate consumption or before the substation, for example, to be directed to someone else's consumption. It will no longer pass through the network. There are other challenges here, which are not at all a matter of regulated business.

We are investing very large sums in security of supply, system services, network development, and so on. If there will now be less of electricity flowing in this system, all these expenses will actually be distributed over the units moving in there. This puts a lot of pressure on the unit in the network. It has to get more expensive, and this is a pretty serious challenge.

All of these and other things are ahead of us and are waiting to be resolved or at least considered. It is a great opportunity for us to have an occasion for discussing several options and to see which ones are the best, but I do not think that there is a right or wrong answer here, and no option can be ruled out.

When could a local production become more reasonable than a large-scale production?

Tarmo Soomere: Last month's [July 2020] electricity bill revealed that the price of electricity was more or less the

same as the price of delivering it. A power charge or ampere charge was added. It is clear that a large-scale production is almost always cheaper than a small-scale production. A small-scale producer must take into account that the electricity it produces will eventually cost more. Powerlines, which actually work, are a challenge in itself. It still happens now and then that stronger winds knock over the masts or that snow and ice break the powerlines.

Let's remember, what Niels Bohr once said: predicting is a very difficult task, especially if it's about the future. But still, what if we would predict, when will the local production become more reasonable then the large-scale production? A question to Taavi Veskimägi: if you would think about a person putting up a solar panel and installing an alternator and a battery, when would this become reasonable on a large scale? We have enough forage land and forest land without a forest being accessible to everyone. There is another related question. According to my understanding, the mains transformers are largely symmetrical, but is the existing grid architecture suitable for tens or hundreds of thousands of small producers. Are these wires suitable, and will the transformers start to work the other way around?

Taavi Veskimägi: Thank you, there were a lot of questions here. I will try to answer them. Firstly, if we take a look at the electricity bill, we will see different sections, of which the price of electricity, indeed, makes about the first third, the second third is the excise duty, the renewable energy charge and value added tax (VAT), and the third is the network charge. Two thirds of the network charge are for the distribution network, one third is for the transmission network. Why is it like that? The fixed administrative component – compared to the cost of electricity we buy – is big. In fact, it is somewhat simply a consequence. We have made major investments in the main transmission network to ensure security of supply for the whole country. This is an important aspect today. As a result, we have been in very capital-intensive economic activities. In fact, external connections are those what provide most of our regulated current asset base and generate network charges.

In the electricity market, the price of electricity is somewhat different, the so-called variable cost of the last generator. But still, in case we do not have these connections, on which the network fee is based, and if we do not have Estlink [a set of high voltage direct current submarine power cables between Estonia and Finland – ed], the price of electricity would probably be something completely different. In other words, the price of an electron on the bill would be quite different from the actual one, with us being basically already part of the Finnish electricity market for years.

Hando [Sutter] is the one who is feeling this, in connection with Estonian power plants, most directly. We know there have been times when, and Einari [Kisel] perhaps remembers these times best, we basically had an administrative price of electricity based on the power plants of Narva city. For now, Eesti Energia puts the power plants of Narva city in operation when the price is 70 euros per megawatt-hour. Maybe even cheaper, Hando [Sutter] knows the exact threshold. All this spring we have been in a situation where the price of electricity has not been fixed by the power plants in Estonia. If there were no foreign connections, which as such have increased the component of network fee, the price of electricity would be defined by the power plants in Estonia or in the Baltic States.

Estonia's first high-voltage line mast with special design "Soorebane" ("Bog fox").

Hando Sutter: Let me just go through the facts. We just published our half-year results. In the first half of the year, Eesti Energia produced half of its electricity from renewable sources. That is a pretty big part and there is a variable cost of zero.

Taavi Veskimägi: I did not tell that you produce the electricity only from oil shale. Of course not. What I am saying is that, obviously some conventional power plant would have imposed its own, so-called variable cost electricity price on the [closed – ed] Baltic electricity market. There is no difference if it was a power plant of Narva city or some Lithuanian power plant, an oil shale or a gas power plant. But this price would obviously have been something other than the price of the electricity we have been supplied from the Nordic countries. The coin has two faces then. On the one hand, the network fee might seem to be relatively high. On the other hand, it can also

be said, that the price of electricity has been very low due to the fact that we have been investing in the grid.

It is understood that the role of the network is changing in terms of network configuration and network readiness. The role of the central network is changing. That's right: from the transmitter of the electricity to the security tool of supply. Indeed, most modern generation equipment is not connected to the main transmission network, but to the distribution network. This is to say that a lot of electricity does not upcome at all from the medium voltage side [to the high-voltage transmission network – ed], but is essentially produced and consumed on site.

This will obviously bring us to whole new tasks. Together with Elektrilevi [a distribution network operator owned by Eesti Energia – ed] and VKG [Viru Keemia Grupp – ed] networks, we have prepared a new joint development plan. Basically, we are trying to optimize this network. Hundreds of kilometres of network corridors can be made available for other uses. Tens of millions of [euros] of investments that should be made in the reconstruction of the current network can be excluded from the budget. Consumers will then also not have to pay for it.

In fact, it all follows the same logic. Particularly, the network can be significantly thinner in rural areas. What else does this entail? If there is currently only an energy-based network charge in the transmission network then, obviously, the only option in this aspect is (and is right) to move to a capacity-based network charge. This will, in this case, mean that we are not only transferring the energy, but we are above all ensuring that the energy supply is guaranteed for the customer also during these hours when your own production facility is not producing (whether it is connected to the line or not).

The result of this work belongs to society. Nor do we, Elektrilevi or VKG networks, have our own money. We are talking about consumer's money here. Joint network development provides an opportunity for us to invest in a lesser rate. After all, we are investing in ensuring the capacities specified in the network agreements of the connection points. If less power is needed there, and if consumers abandon their right on a certain number of megawatts or amps at a particular point of consumption, this provides an opportunity to invest in a lesser amount. It also gives Elektrilevi the possibility to invest in a lesser amount.

I believe then that the role of networks is changing. We have been considering two specific trends. Massive distributed production, the transition from central production to decentralized production on the one hand; and on the other hand, the transfer of energy in large amounts between countries in the belief that one market, one network across all the Europe, will emerge.

The role of networks is changing. Massive distributed production, the transition from central production to decentralized production on the one hand.

Complex future of oil shale electricity

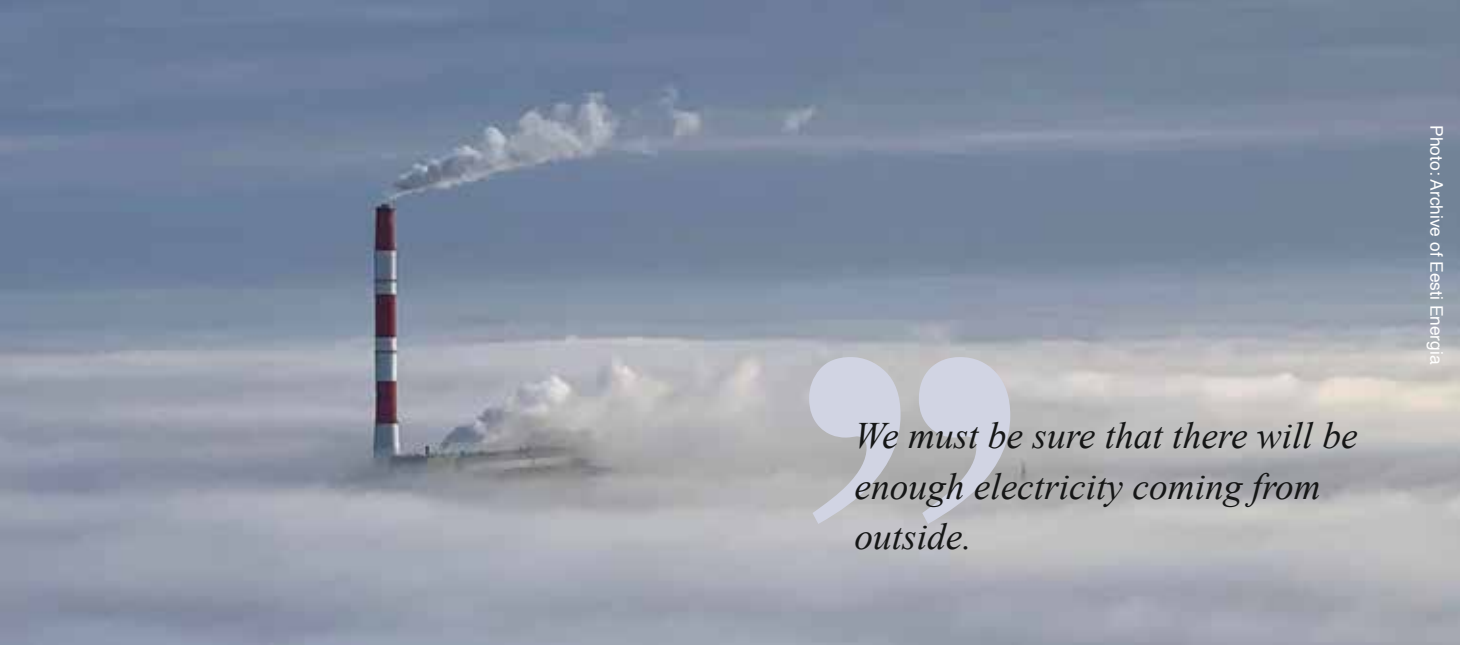
Tarmo Soomere: The society is becoming more and more cohesive. One measure of coherence consists in how our consumers are interconnected with the lines, along which the electricity travels. At present, the consumer does not even know who is the one having to ensure to the customer the availability of the electricity in their wall socket and that the lights will turn on when the switch is pressed. Much of electricity is currently imported. Estonia has become from a country that exports electricity to a country that imports electricity.

Taavi [Veskimägi] already pointed out that, for now, a probably already obsolete concept, postulating, yet not a long time ago, is that the country has to keep enough production capacities to cover, if necessary, all the consumption of the named country. It is probably not very relevant anymore, but to what extent is it still relevant? Added to that is the question, which probably many of those in the hall would like to ask much more sharply: Hando Sutter, under what conditions would it be conceivable to stop the production of oil shale electricity, which is still seriously polluting the environment, and at the same time to ensure the availability of electricity in Estonia with the electricity of its own producers or with imported electricity? What conditions have to be met for that?

Hando Sutter: I would take a look at this issue more broadly than only Estonia, said Taavi [Veskimägi], and he is right that we are all waiting the European Security of Supply Report with great interest. It has been under work for a long time and should be completed in the autumn. It will probably give us new information. We also hope that the assumptions used there are correct. For example, that it is not taking into account units which no longer exist or which will be closed very soon.

In fact, the current situation is still such that the electricity deficit is not only the concern for Estonia. The deficit concerns our entire region. Currently, only the Norwegians produce more electricity than is consumed in the country. Then, there is Russia, exporting the electricity to us. But still, all our closest neighbours are in deficit. Some of them more, some of them less.

The statement that the electricity, which comes through the cable, is just as good as the one produced on site, is, in my view, entirely reasonable. It is understood that, if our electricity is competitive, it should be on the market based on the same conditions. If the rules that we have to



Iru Power Plant.

follow here are also applying elsewhere, then it all makes sense, but there are also a number of disclaimers to be made here [in the present context: disclaimer or delegation excluding the responsibility – ed]. Firstly, we must be sure that there will be enough electricity coming from outside. Let's take a look at the indicators for the last few months. In the Baltics, for example, there was a significant incident in June. One Estlink connection was under repair. NordBalt [submarine cable between Lithuania and Sweden – ed] was out of order because of a breakdown. Next, the high-voltage breakdown in Latvia happened, which prevented one gas-fired power plant from entering the market. The prices of electricity were very high for some days. To ensure the security of supply, emergency power sources were turned on, and that was happening in the middle of the summer. This was the moment of truth for us to see that we are not ready for such situations. Half of Riga had a blackout. Fortunately, we did not have to be in the dark here.

Or, for example, a situation that has lasted for the last few weeks and will probably continue for the next week. Particularly, a relatively large number of nuclear power plant capacities in Finland and Sweden are under maintenance and emergency repairs. In addition, there has been little wind and therefore little electricity produced from wind. Many of the transmission capacities in the Nordic countries are underloaded [the amount of energy transmitted is limited by the operator – ed]. Due to a shortage in production capacities in Sweden, the system operator there has activated several production reserves – and that in the middle of the summer. On the basis of that, we still hope that the electricity will be supplied, if necessary, by the neighbours.

Some of facts stated by Taavi [Veskimägi] may need some more context. It is not possible for me to check elsewhere whether we receive free system services from Russia worth of around thirty million euros a year or not. It is possible, that the calculation is modified. These thirty million for free will certainly end by 2025, when we are desynchronising [our electricity system, that is, we disconnect the Baltic electricity system from the Russian and Belarusian systems – ed]. Unless Elering will start providing these services itself then, we will have to start buying these services from the market. Hopefully, we will get the best price then. No matter what, we are hoping that Elering seeks for these services on the market. Dividing thirty million euros by eight terawatt-hours gives roughly four euros per megawatt-hour. We must then tell the consumer that the bus services for free are definitely over – that we have to pay for by ourselves. Four euros per megawatt-hour means an increase of the electricity bill by about ten percent, and this seems to be quite inevitable.

I absolutely agree with what Taavi [Veskimägi] enthusiastically said about the market. Me too, I am the person who believes in the market. I like it, when the market is functioning on the basis of demand and consumption. As such, the market gives us the price reflecting the current situation in both categories, but our electricity market is a bit different. On the one hand, we do not have much experience with the electricity market here, and on the other hand, we are all used to the current market. In fact, it is a market of subsidies in Europe to a very large extent. Of course, it would be great if, as Taavi [Veskimägi] said, there would be one and only price applied from Gibraltar to North Cape. In reality, however, there is competition for subsidies. This is more like a beauty contest, not a market! Let's take a look on the schemes for subsidies. We do not have to go far for that. Let's take Finland or Estonia-Latvia-Lithuania-Poland and let's ask ourselves, for example, what kind of renewable energy subsidies are offered there. These are [by countries] fundamentally different, their rates are completely different. Even the principles of payments are different.

Photo: Archive of Eesti Energia

Eesti Energia Enefit oil plant in Auvere.

Just a question to keep an open mind, where does a major part of the energy wood from Estonia go to? Many of us know the answer. To the United Kingdom! Why the United Kingdom? That is because the United Kingdom pays about £90 a megawatt-hour for burning pellets at the same type of powerplant as the one in Auvere; dear fellows, it makes more than one hundred euros per megawatt-hour! If we call it a market, it is a very distorted market.

Let's add to this fact the interesting example we just had, which was the electricity seller who won the electricity procurement contract of our municipalities. Maybe some of you know it. I'll give you a hint. The first letter is I. Inter RAO. Do you know, who is representing this company? It is none other than the seller of electricity in Russia – the monopolitary one. I would compare the fact that the Estonian municipalities bought electricity from the enterprise Inter RAO to the alcohol policy. At the time, it was Jevgeni Ossinovski to order the alcohol policy in Estonia, in a very passionate way in fact. By his declarations, the excise duty is to preserve the health of the Estonian people. That is the reason the excise duty was raised. The direct purchase of electricity from a Russian producer is, in my opinion, as if the organizers of the reception of the President of Estonia would have brought alcohol from Latvia.

Taavi [Veskimägi] is talking, in a correct manner, about the value-based market, but what is really happening with all this is very different. Much of the electricity we consume comes from outside this value space, particularly from Russia, where there is no climate policy [according to our definition – ed] and no CO_2 taxation. We are ready to compete, no matter the provenance of the electricity, but the competition must be on an equal footing! If we are ever at a point where the market is really operating, all this will make sense, and that's what Taavi [Veskimägi] is talking about, but it seems to me that there is a very long way to go, and we are not even trying to get there at the moment.

In fact, the situation with the named market is quite different. Lithuania has made it very clear that they are implementing power capacity mechanisms, as this is urgently needed to ensure the security of supply. Finland is concluding the consultations with the European Union in a view to implementing power capacity mechanisms from the year following the consultations. Latvia is overpaying for its gas stations. They just don't call it a power capacity mechanism. Poland has just announced power capacity auctions.

When we are saying here in Estonia that we are all right and we are participants in the regional electricity market, then one of the parties is wrong. Is it all our neighbours who are wrong, or is it us. Is the first or the second of the claims correct? I am really not able to say. Hopefully the security of supply report will give us some understandings about what is going on, but it is still very difficult to call it a market. However, if the market is in need of the reserve of capacities, we could offer it to both Finns and Latvians. I hope that, in perfect cooperation with Elering, we will be able to connect the power plant in Auvere to the automatic frequency reserve in Finland, for example.

Taavi Veskimägi: From our part, everything is ready, and it has been ready for a long time.

Hando Sutter: From our part, everything is ready as well, and for a long time. This is great news. This would also be a good example of the role that the Auvere power plant could play in the future as one of the most modern managed power plants in the region.

About the security of supply in pandemic conditions

Tarmo Soomere: The energy system seems to be more complex than the climate system. With respect to the climate system, I have nothing to do but partially accept what Donald Trump has been saying. Even if the entire planet is warming, the eastern part of the North America is cooling. Especially the part of the ocean that borders with the eastern part of the North America. This is not an anomaly. In a climate system, different things may easily move in different locations and in different directions.

The opinion that the market and especially the big market is in general terms alright, is a modern opinion that was nicely expressed here by both interlocutors, but the coronavirus crisis has shown us that a large market is also very fragile. The crisis has shown how fragile our supply chains and cooperation between countries are, in case something really tends to go wrong. It's fine, just fine, that for moving the electricity, the people, who have installed the wires, do not have to move.

In a situation where countries and larger and smaller regions are separated in terms of the movement of people, a problem suddenly arises right at the moment something goes wrong. If this happens, there is a sudden need for people to move to fix the Võru substation, as maybe some big transformer, perhaps a transformer at the end of Estlink requires attention, to rectify a fallen powerline or to fix a broken turbine. Certainly, both Elering and Eesti Energia have a plan on how to cooperate with foreign specialists in the event of such failures, or then our specialists are available. Under current law, from 1 September [2020], there is a testing procedure [COVID-19] just after entry into the country which is then followed by isolation, so they do not come in contact with others until the result is known. What are the opportunities to bring specialists here to repair something? If you suddenly need workers or specialists for emergency repairs, can you get them to Estonia?

Hando Sutter: We have discussed all risk scenarios. I was also asking our risk management staff who had just attended a major risk conference two months before the coronavirus pandemic, about how much it was discussed. As the third point of one presentation, someone had mentioned the term "epidemic". Basically, it means that it was certainly not a topic out there.

We were looking for solutions on the go. In the second week of this, let's say a total lottery, we reached an agreement with the government's crisis committee. We had identified the necessary experts needed in Estonia to ensure the supplying of vital services. We also set up a system on how these people could arrive to Estonia. Fortunately, everything was fine, and the supplying of the vital services was guaranteed. For now, we got arrangements for it. If there is a second, third or fourth wave to come, then we are fine with this. The cooperation improved every week. It took about two weeks for everything to get in order. We are much better prepared now.

Taavi Veskimägi: Sure, there is two more comments to add here. Not in the context of the electrical system, but in the context of the gas system. We are building the first Estonian compressor stations. Pretty much all of those who are building it, are from outside of Estonia. I have to admit that the collaboration with the government was very good. All these people were present in the work area at all times. The work was going on alright and there were no problems.

On the other hand, the energy system as a whole functioned completely flawlessly during the COVID-19 epidemic. The cooperation of the system operators worked without any problems. The risk what we have seen here,

Illustration: Archive of Eesti Energia

concerning the physical movement of people – how the borders were closed, was nowhere in sight. I did not even notice such a vector of thought during this crisis.

Security of supply in small production conditions

Tarmo Soomere: It is good to know that the supply of vital services is guaranteed and that opportunities have been created for us to get experts here. However, I would still insist on asking Taavi Veskimägi, who just gave us a very clear overview on how the role and function of networks have begun to change.

Let's suppose that there will be a lot of small producers, then others will target these small producers as well, and that some region might sometimes give a few electrons. Is it possible, that if the proportion of small producers exceeds a certain threshold at some point, then it could reverse the security in the domain of electricity or energy? What if, suddenly, a group of small producers in a certain area decides that they will simply switch off their equipment? In principle, each and all small producers today have the right to switch off their equipment at any time. Is this situation open to changes? Is the actual situation, when around 300 to 400 megawatts of solar energy equipment and a total of seven hundred megawatts of renewable energy equipment have entered the market, changing the picture? Is there an eventual possibility to restrict in some measure their rights in the context of imposing them a duty to produce?

Taavi Veskimägi: No, nothing like this is certainly not in our plans. On the contrary, we would like to see more small producers and we are glad that there are more of them. This will for sure mean that the flexibility will increase and that the market will develop, like we already discussed. I am clearly sharing this concept, so that [with Eesti Energia] we do not have any difference of views here. The more there are these products on the market, the better. We will certainly start discussing in the autumn how to shape the market of emergency reserves. Elering is certainly of the opinion that the reserves of both maintenance and restoration of frequency must be obtained from the market and not be made by the system operators themselves. I hope that the participants on the Estonian market will actively participate in the public debate that is already taking place today, that they will come to the conclusion that the market is able to provide these services and that this is not for the system operators to do so. We are firmly supporting it. At the beginning of next year [2021], we will also try to get the flexibility market operational.

While coming back to the matter of the named nine hours [the possible power outage], I would like to add that these nine hours represent the situation without the storage option and equally without the active controlling of consumption. These offer many possibilities for buffering.

> *We are glad that there are more of them. This will for sure mean that the flexibility will increase and that the market will develop*

At this moment, when buying from Nord Pool Spot a day in advance, the price ceiling has been three thousand euros per megawatt-hour. Various European studies have shown that people do not consume energy when the price raises up to the level of 7,600 euros per megawatt-hour.

I am convinced that there are probably many consumers in Estonia who switch off their devices much earlier, and at a much lower price level. This means that the problem is actually smaller. It is more likely that the hypothetical situation where production does not cover consumption will not even reach these nine hours. The consumption is likely to be much more flexible and responsive to price changes. We are currently developing market products where such production equipment could provide its services. With regard to the outcome of energy security, I certainly think that the more production is decentralized (and production is not concentrated in one physical or geographical point), the better the situation is.

I also think that, as a system operator, we can even manage a system where most production equipment is inverter-based and based on the market. This also involves the future, where the whole energy sector is decarbonised. At the moment, we are performing a study on how to control the electrical system when all production equipment in the system is inverter-based. I believe that this will give us some limit values, which could result in some kind of issues for us according to our current knowledge.

How organic is organic energy?

Tarmo Soomere: It is also a very good remark that decisions are made on the basis of current knowledge. You probably remember that last week, the President of the Republic quoted* Hando Runnel's idea that scientific knowledge is aging the fastest.

The direction to the future is likely to be relatively clear. It has two pillars. One pillar consists in consuming in lesser amount. In this sense, the government's position that old apartment buildings will be industrially renovated, is very forward-looking. According to the calculations of our good colleague, Member of Academy Jarek Kurnitski, it is relatively easy to save a quarter to half of the energy consumed. The second pillar consists in a cleaner production. This is where we are moving towards the seriousness of climate change and its interpretation.

It is more and more often asked how long will nature continue to be our ally, and the need for environmental

* Speech by the President of the Republic at Kadriorg Rose Garden on 20.08.2020 – ed.

protection is being emphasized. The famous idea of "back to nature" may not always be possible. But it must mean much more than just organic potatoes, carrots or onions from your neighbour's field. It must just as well mean organic energy from your own garden, from behind your fence, or from a neighbour's yard. There is the question to the people of my generation: are the publicity and the reality two very different things? How organic actually is this energy, which is produced in the garden by yourself or by a neighbour? If not today, then in the foreseeable future, the question will for sure arise as to whether the world will have the resources to an alternator and a battery for each household.

Hando Sutter: Absolutely. Every production and industrial activity has an impact. There is no production nor industrial activity with no effect. Rather, the question is, on what scale do we have to measure the impact. Is it visual pollution, emissions to the air, or something else? For building wind farms, we are analysing the impact on birds, fish, seals, to whoever. It is years of work to characterize all the effects. Finally, a compromise must be found. We must take under the consideration what fish want, what seals want and the migration itinerary of birds. We also have to take into consideration amongst other things, what the residents of Kihnu and Hiiumaa want. This really is the art of finding compromises.

Three weeks ago, I was in Põlva County, at a summerfest of the Estonian Nature Conservation Society. Three hundred people and I were there, in the middle of the circle, as a cannon fodder. I was prepared for any kind of debates, but there were very interesting dilemmas emerging out there. For example, the first thing they asked was: where did you drive from? I said that I came from Northern Estonia. Very good. What did you see on the road? I thought it interesting where this question was aimed. All our fields are full of solar panels. Indeed, we get one megawatt of solar energy from about 1.8 hectares. I multiplied it with my fingers, I got almost eight hundred hectares. Is it still farming land now? Tarmo [Soomere] said, that it is a land with low value. Probably not all. There is also valuable farmland. If such a land is installed full of solar panels – and if this is just the beginning of a great journey – then, at some point, you really have to ask, what is this farmland worth? How much added value will it be able to create in Estonia? What are the consequences when this farmland no longer has photosynthesis nor air purification effect and is only producing solar energy? We have to think about the effect it will produce.

It is interesting that I was a target of such an attack to begin with. In my thoughts, I was ready to report that everything in Estonia is just fine, and that the wind and the sun are actually covering our summertime electricity consumption. It was not that easy either. The next dilemma we talked about was the closure of hydropower plants. Me, I was thinking again that we managed to do a good thing. After all, fish farmers said that in order to increase the fish population in the Gulf of Finland, Estonia's largest hydroelectric power plant must be liquidated. It turned out that there were completely different opinions and very interesting dilemmas on this and other issues. Finally, I said there that perhaps I can do more in my role now than they can. Nevertheless, there were a lot of interesting thoughts there and I got some valuable topics to think about. It was far from being the same thoughts coming from everyone. Afterwards, I heard that these debates had continued around the campfire in the evening.

Back to the solar panels. I just checked that the Energy Agency has published the conclusions, that by 2030, around eight million tonnes of solar panels will need to be disposed of worldwide. By 2050, that makes almost one hundred million tonnes. The content of it looked among other things at what solar panels actually consist of. The older ones are largely made of glass. There are also plastic components and about ten percent of aluminium. The newer ones have more glass, less plastic and less aluminium content. To be honest, there is also technology, which is still nascent, on how to process it, but still, the quantities are obviously very large. The parks installed today will have reached the end of their lifespan by then. Then, we will have one hundred million tonnes of materials that need to be recycled.

There is a need for a capacity to do it and it must be thought about. One day, we will surely come to the point where the respective responsibilities will be imposed on developers. That is exactly the same as for a nuclear power plant, which cannot be built without a clear vision for dealing with nuclear waste. It will already be imposed on the nuclear power plant operator as an obligation from day one. Accordingly, just as we are creating reserves for the recultivation of the abandoned oil shale mines already at the timepoint of their opening. At present, such an obligation does not form a part of obligations imposed on the producers of renewable energy. Let's imagine if, for example, a wind power producer goes bankrupt and the wind turbine stays up. Who will be those to eliminate it, and all possible pollution? These issues will arise as soon as more wind farms are built. Tarmo, this is the problem of the future and cannot be underestimated.

From WEEE to regulatory bottlenecks

Tarmo Soomere: Let's take some questions from the floor.

There are other concerns about this subject. An increasing number of issues are organically linked to uncertainty. It is well known how much it costs to extract oil shale, how much it costs to burn it, how much a turbine costs, and how much all those transformers, wires and inverters cost. There is relatively little uncertainty and it

Photo: Archive of Eesti Energia

Eesti Energia's brand new environmentally friendly bulldozer "Baruto"premiere in July 2020 in Narva quarry.

is more about whether there are enough resources in the world. Be it lithium batteries or copper wires, or is it expedient to replace them with some other material.

However, things will get out of hand when we have to look at the future in a new way. Extreme uncertainty arises when we have to calculate the cost of something in the distant future. At the time the nuclear power plants were built, no one knew exactly how much it would cost to dispose them. When the Nord Stream pipeline was laid in the sea, its policy of decommissioning was very simple: we leave it floating on the seabed, we never take it out.

With all these things installed in fields and the fragments of which may cause injuries and the decomposition products of which may poison us, we just cannot handle them that way. There is a huge uncertainty out there. This is where conspiracy theories and different opinions begin to emerge. Different opinions on what something what must be, also in this domain because if there are no differences of opinion, we will create a situation where no progress is possible. I would take up the idea expressed by Hando Sutter that we will have a large amount of material that needs to be restored or reused. Recycling a copper wire is easy, but what about the waste from electrical and electronic equipment (WEEE waste)? All these inverters and other such network component stuff are purely electronics. Has Elering thought about going into the WEEE business?

Taavi Veskimägi: We organized the recycling of such things in its simplest way. Most of these projects we perform as turnkey projects. Disposal of old equipment is the responsibility of the contractor, so we are not going nor thinking about entering into this business. This is by all means and purely the contractors business. If the contractor is invited to build a new substation, it's the contractor who will also have to demolish the old substation and dispose of the equipment from there. Our responsibility lays and remains in the security of supply. That's what we know and that's what we do.

> *By 2030, around eight million tonnes of solar panels will need to be disposed of worldwide. By 2050, that makes almost one hundred million tonnes.*

Hando Sutter: I would like to mention that, in my opinion, we have, here in Estonia, one of the competencies we have been developing over almost a hundred years now, and this is currently used by Eesti Energia and by several oil producers. This is a pyrolysis technology. There are several people present here who have been participants in this development and who have even been spiritual cornerstones of it. At the moment, we really are pyrolyzing oil shale. We are doing this about twice as efficiently as burning oil shale directly for electricity, and we are doing this with a significantly smaller environmental footprint.

In the context of waste recycling, Estonia is so small that we have no point at all in doing anything just by only keeping Estonian waste in mind. That's because the necessary investments are huge. Suitable raw materials for pyrolysis are those which contain a large amount of crude oil or petroleum. It also includes a tire chip with three times more oil there than in oil shale. Polymers, such as plastic waste, contain five times more oil than oil shale.

I believe that all the academic knowledge and practical experience we have on pyrolysis is worth applying. I have been asked whether it is theoretically possible that at some point our pyrolysis unit, now called the oil plant, could be a depolymerisation unit instead. It means a unit for depolymerizing polymers or their residues and produce an oil of them, or re-polymerize them. Technically, it really is possible. Such a research is going on in association with

the Tallinn University of Technology. In this sense, we have technologies in Estonia that can be successfully applied, and where we have our merits to show.

Tarmo Soomere: This is also energy, only the other way around. One relatively short question. Taavi [Veskimägi], you talked about security of supply, but not a word about energy security. Does such a thing even exist? Whose concern is that?

Taavi Veskimägi: Energy security is a much broader concept than security of supply. Security of supply is part of energy security. There is no doubt about the need for energy security. I believe that energy security is a purely value-based thing. This is common to those who are our allies in this domain. That is why we are talking here today about the European Union's single network and single market. We believe that we share the same values, and the same way of life with these countries. With them, we will also be able to control the energy system together. The key word here, as in any security, is trust, and whether it is trustworthy or not.

This is certainly a debate of the utmost importance. The trust, that is something cognitive. We have said that we trust [e.g., the European market], but there are certainly arguers who have said, for example, that one or another one cannot be trusted, or then, that here or there things have been done this way or that way. We do take into account all these aspects. There is no absolute truth here. It can always be argued that, for example, if Finns can be trusted; for example, if there is the energy deficit there, are they capable to turn off the Estlink. Knowing these people, I do not believe that Fingrid [the Finnish transmission system operator] will ever do that. I realize that this is our faith and trust in the Finnish state and Fingrid. Of course, the opposite may also be said, and that is part of the debate as well.

Tarmo Soomere: Isn't that part of the uncertainty on the decision-makers' table, isn't it? Question from Alvar Soesoo from the Estonian Club of Rome: "Does Eesti Energia think among other things about other potential energy sources? A nuclear power plant, we heard about it all right, but, what about, for example, geothermal energy and other possible sources?"

Hando Sutter: Of course, we think about it for sure. But the trouble concerning Eesti Energia is that we are a small company on a European scale, at the same time dealing with everything. We have worked hard to concentrate our focus. That's because the domain of what could be done is extremely broad. Eesti Energia has once already dealt with nuclear energy. Geothermal energy might be an eventual option in some areas. Even Finns are doing it in some places. Our focuses are, by the best of my understandings, pretty well concentrated. There is, of course, also room for dreams, but the real thing is always the main goal. In this sense, we've set our radars also on remote mode. We are constantly monitoring technologies, and every year we are revising our focuses.

Eesti Energia does not currently deal with nuclear energy officially, although we are still monitoring these technologies. Nor is it expressed, to deal with it, in the expectations of our owners. We have made some calculations in the field of geothermal energy. Right now, it's not on our radars because we are seeing better opportunities. However, our focus is on thermal power plants. What could be burned there, which could also support Estonia's 2050 ambitions, i.e., the ability to provide controlled power from a thermal power plant. We are working on how to capture carbon. Also, on how to produce hydrogen in an offshore wind farm. There are quite a lot of these issues. Namely storage technologies and everything in connection with that for example.

Tarmo Soomere: Question to Taavi Veskimägi from Member of Academy, Enn Lust: "Are the "Elerings" in Europe discussing amongst other things the construction of DC networks in Northern and Southern Europe and their connections?"

Taavi Veskimägi: Enn [Lust] is for sure waiting for a substantive answer. Yes, Elering has launched a project we are calling Baltic Offshore Network Initiative. This is particularly targeted on that kind of meshed grid, where it is combined together with the AC/DC network. It may even be that it is not just an AC/DC network, but a meshed grid in the view that, if large offshore wind farms will be installed at some timepoint, it will consider in what form the transfer and the storage of energy from there is reasonable, without limiting it to the shape of a cable or pipe.

Tarmo Soomere: Question to Hando Sutter: "Could Eesti Energia reveal how much it costs on average to generate one megawatt-hour of electricity in a wind farm? Or within which limits does it vary?"

Hando Sutter: That is an interesting question. At present, the market operates in such a way that the means of production are taken into account on the basis of variable costs. It is known that the variable cost of a wind farm is close to zero. Rather, sometimes even negative. In case if it makes an object of a subsidiary support – as most wind farms do –, it will be happy to produce even when the price is negative.

While considering the decision on investment in a wind farm, we are looking twenty-five years forward. To make this investment, we make everything to find signals from the electricity market Taavi Veskimägi talked to us about, but we will not find these signals. A month or two ago, Vattenfall [a Swedish state-owned international energy company – ed] lost two billion euros of the value of its offshore wind farms in Sweden and the Nordic countries. After that, the CEO was put in situation where he had to

Photo: Archive of Elering

start looking for a new job. I would really not like to be in that role.

In that view, our situation is right now somehow schizophrenic. We know exactly the price of a wind farm, as well as the price of megawatt-hour. This price depends on technology and wind conditions. However, the cost of electricity production in wind farms has fallen very fast. It is currently around forty euros, being as so very competitive. An onshore wind farm is cheaper, whereas an offshore wind farm is more expensive. The investment in the offshore wind farm is significantly higher. Both of them have to count with problems on the market we were just talking about. Politically, it consists in a consideration of particularly sensitive character, so it is not possible to make such investments against the market at the moment. Although, I am rather open to make investments – against the market – also in wind energy. So, in fact, the result depends very much on measures taken on a national level.

Tarmo Soomere: The idea of three similar questions consists in that, with the addition of renewable energy, we could be in a situation where the price of electricity is rising. This has been the case in several countries. The question is more like for Elering: will the price of electricity be tolerable for Estonian society in the future?

Taavi Veskimägi: There are several aspects here. My vision is that the basis of the energy system of the future is electricity. To the best of my understanding, there is rather too much energy than a lack of it. The main question will remain: is electricity available at the right time? In other words, this commodity, which will be expensive in the future, is it actually flexible? There is enough energy, but is it available at the right time? Above all, we lack flexibility. There is, for sure, great opportunities here for Estonia. This extends, for example, to the use of the wind. According to studies, the known wind potential of the Baltic Sea is approximately 325 Tera [watt-hours per year].

As Hando Sutter said, the annual consumption of the Nordic and Baltic countries is 425 Tera [watt-hours per year]. The wind energy is not only produced offshore. In fact, by 2022, 70 gigawatts of wind power generation capacity will be installed in the Nordic countries. Throughout this spring, we have seen what this means. In case of sufficient reserves of wind and hydrological capacities, the price of electricity has been very low. But, if those moments, hours, come when there is no wind energy, the price makes a jump up. In conclusion: this is the trend against which you can actually invest. [No big] investments have not yet been made in flexible energy production. That is where the one, who has the capability to offer flexibility to the market, will win. I am glad that there is a number of market participants in Estonia who are operating with different technologies. I think that this is correct way to do it.

Hando Sutter: Actually, this is a very good question. Me personally, I am thinking about it all the time – and in Elektrilevi, for example, we agreed about four years ago – that at some point the adjustment utility might not be of any help at all to cover those investments and increase the tariffs. It is simply because the competition breaks in the regulated business. Let's concentrate for a moment on a price of the extra solar energy. I made some simple calculations of how much will be added to the subsidies on renewable energy next year. The subsidies on additional solar energy will make about 15 to 20 million euros a year. That is the amount added to our electricity bills. This is, at least for the moment, provided by the rules. That makes roughly two added euros per megawatt-hour. I already mentioned about the calculations of the costs on system services. That will make an additional four euros. In addition, Elering is counting to make very large investments in desynchronization.

Taavi Veskimägi: This will not lead to any increase in network charges.

Photo: Archive of Eesti Energia

Eesti Energia solar park in Poland.

Consumers may vote, as one says, with their feet. The on-site generation of power and storage technology is coming cheaper and cheaper.

Hando Sutter: Elektrilevi is investing at least about 50 to 60 million a year in security of supply. All this will have inevitable consequences in the increase of electricity bills. The politicians did us a favour when lowering the excise duties on electricity during the coronavirus crisis. This compensates the increase in price somewhat, but this [high price of electricity] still remains a problem. At some point, consumers may vote, as one says, with their feet. They will set up a system of their own. This will be the case if it is worth doing so. The on-site generation of power and storage technology is coming cheaper and cheaper.

Tarmo Soomere: Alar Konist poses three questions, but the last of them is the sharpest: "What will be our opportunity to have a word about the types of production when the generator is not in Estonia? The question concerns mainly the relationship between organic electricity and so-called dirty electricity."

Taavi Veskimägi: The national climate energy plans of all the countries of the European Union are in fact available for public. The European Commission approves the named plans. In the countries of the European Union surrounding us, especially in the Nordic countries, the ambition for renewable energy is more ambiguous than we have. One great report I recommend reading is the document by Nordic Energy Research: "Flex for RES" [renewable energy sources] https://www.nordicenergy.org/flagship/flex4res/flex4res-publications/. It concludes that the Baltic Sea region has all the technologies in order to transform the energy sector into being carbon-free. That is why I would not really worry about that.

The other aspect Elering is dealing with consists in energy certificates of origin. We have a plan to put a nametag on all the kilowatt-hours of both electricity and gas. We want to know exactly from which source is every kilowatt-hour generated and from which fuel.

Of course, there remain the concerns about third countries. At least, what will happen to the Baltics from 2025, there will be no routes to there and therefore no trade. This is a process that is not feasible in one step. There are definitely intermediate stages there. Hopefully they will be disclosed to the participant on the market soon showing us how the import of electricity from third countries into the European Union market will be restricted.

Tarmo Soomere: Member of Academy Jaak Järv asks a question: "Which point in our legislation – but maybe in the laws of physics – hinders the development of energy the most?"

The interlocutors take a pause for reflection.

Hando Sutter: I still think that the best conception for the electricity market would be the one that Taavi Veskimägi presented at the beginning. I would be glad if it would be so. I am completely convinced that Eesti Energia would be perfectly at its ease in such a market, according to ideal conception. We have worked hard for that, but there is a very long way to go. As a matter of fact, it seems to me that this thing has gotten worse over time, not better.

It is not so much a question of regulation as of an elementary agreement. When looking to the future, the purpose of various subsidies in the single electricity market should, no doubt, be agreed at a high level. At the moment, we are seeing a solo performance in subsidies on the level of the state, and there is no sign indicating that one would try to do something about that from renewable energy subsidies and power mechanisms, plus a whole lot of other things.

Recently, I have seen system operators limit transmission capacity, for example, for completely incomprehensible reasons. The named electricity wanted from Gibraltar is in no way reaching us because [transmission] capacity is limited between Germany and Sweden. The colloquial languages simply say that the German is limiting it because there is not enough production capacity in Sweden and

they are not able to offer counter-trade. That was the reason given a week ago. Whatever that should mean.

I have been in the markets for a very long time. Honestly, I do not understand and I am tired of asking what is going on. Sometimes, we are still asking the regulatory authorities if they are really aware about what is going on and that this is a very bad trend. This market is far from being transparent and there is much of, let's say, folkloric approaches. This is not the way to the electricity market at its best. We rather get in this way to a point where we have to decide whether to return to the hyperregulated world, or will we still keep trying to move towards this ideal situation that Taavi Veskimägi was presenting. If this would be the way, I would no doubt be in the party of Taavi Veskimägi. Although I do not know how Taavi plans to get there, I am always ready to support moving in this direction.

Taavi Veskimägi: I have to admit that it is not easy. The subject matter we are arguing every day for concerning the abolishing of subsidies is still the same. The price of electricity should reflect the cost of producing electricity. The situation where most of the cost in generating electricity is covered by subsidies should not be allowed. We are also the agency of payments on renewable energy and our duty is the administering of subsidies on the named renewable energy. The volume of the Renewable Energy Fund is already one hundred million euros and it is obviously increasing. Solar energy production capacities are currently being installed. 120 megawatts of capacities are already connected to the network and 150 megawatts are under construction. We will probably have some more 100 megawatts, resulting in between 400 and 500 megawatts next year. This will obviously increase consumer spending. So, moving out of the world of subsidized energy is a real challenge. This can probably only be done through Brussels. Let's be honest, the more I have thought about this, the more I am of the opinion that a certain degree of centralization must be given in the management of the system. We have opposed us, for years now, to an idea on bringing the management of the system from the actual, national [Estonia] level to the regional or European level. There is nothing we can do; we are moving towards a single market and a single network in Europe probably in the interests of our economy, and also in the interests of market transparency, but then it must also be governed by common rules and the same logic.

Tarmo Soomere: The first Leninist question has already been answered, which is: "What to do?" The second question is still in the air: "From where to start?" It is indeed an extremely difficult question for both of interlocutors: "What would in your opinion be a reasonable way to reach a kind of carbon-neutral world, where the energy security would be guaranteed for an affordable price? From where do we have to start? How could all peers get involved in the way that everyone's contribution really counts?"

> *We are no longer determining all our discussions through a focus on oil shale plants.*

Hando Sutter: Me, I am a hardened optimist in this matter. At the moment, things in Estonia are relatively alright. I believe that we will meet the increased 2030 target of reducing CO_2 emissions by 70%. That will be a serious statement even in Brussels. A lot of major European countries are failing to meet their 2020 targets not even through the measures associated with the coronavirus pandemic. The named virus gave us a supplement of time. It let us set up and fine tune our tools. There is no need to abandon everything that is done. One does not interfere with the other. Let this reserve capacity remain in Narva city just in case. This does not prevent us from working actively on hydrogen.

Another aspect, in what I might have a little different profile than Taavi Veskimägi, is related to the fact that my grandfather was a farmer. There are some things I remember hearing from my grandfather. For example, that there are some tools you have to possess yourself, although some can also be borrowed. In fact, I would still like, especially given our location on the map, to possess much of our own capacity. The connection lines are a good thing for sure. They must be used in order for us to have more competition and also, for example, the opportunity to export the renewable energy produced here. It is not possible to make an offshore wind farm in any other way. They procure so much electricity that there is simply not enough consumption here. Or perhaps it is a nuclear power plant to envision, for example.

However, the keyword is stocking the energy. Here, we probably agree with Taavi Veskimägi, that a large-scale stocking capacity is the key to the future. The hydrogen is probably of greatest potential, especially when reading the European Union's hydrogen strategy, which is a document of great specifics. It has been a while that I've not received such a specific reading from there. Europe is most probably heading right now to a long-term storage of hydrogen. It pays to be at the forefront here. In order for something to get done in this domain, it is of utmost necessity that the people sitting in this room cooperate very well. This is a major scale project. A lot of effort is needed here, and also a little bit of luck. Then we will be able to get something done.

Taavi Veskimägi: In my opinion, we have made very significant progress in the last year. I remember well these debates in the spring of 2019. Then, there was a whole

Europe is most probably heading right now to a long-term storage of hydrogen. It pays to be at the forefront here.

discussion about what and how we need to do to keep in operation the oil shale power plants in Narva city. In a year, the focus of discussions has somewhat changed. We are talking openly now about possibilities in the future. We are no longer determining our further discussions by means of oil shale plants, and this will open up much more possibilities. There is no doubt that the oil shale may have a particular role in all this subject, but nevertheless, the scope of the debate has expanded significantly within that year. This is one of important preconditions to count with in the way to reasonable solutions, which will lead us not only in what happens now, but also in what will happen in the future.

We at Elering are also thinking that it would be great if all these connections we are building were not only for importing the electricity, but rather for exporting it. There is no doubt that, for this purpose, the production capacities we are building here must be competitive in other markets. We can enjoy the fact that the Finnish or Swedish consumers pay with their subsidies for the electricity that we can consume here at a low price. We are such a small part of this market that this does not bother them. However, given our own consumption volumes, we cannot subsidise producers who would sell the electricity to Finland or to Sweden on a subsidy basis. In other words, these power plants must be self-sufficient.

It is reasonable to bring the production of electricity offshore, but there we have to be wiser than we have been so far. We have to learn our lesson from the Hiiumaa island case, for example, where the Supreme Court cancelled the general plan. There is also a debate, I heard about a week ago, about what happened on Saaremaa [island]. Basically, on a national level, the discussion about the general plan was not prepared. With this level of readiness, we are not able to advance swiftly with offshore projects, promising in the view of eventual exportation of electricity from Estonia.

Tarmo Soomere: I would like to outline two keywords from that: wisdom and cooperation, even better, a smart cooperation. It seems that at the end of the conversation, an answer began to emerge giving us a hint for the best eventual energy pattern, or letting us know the most important bottleneck in forming the named pattern. There are three important aspects. Firstly, energy storage. Secondly, energy storage. And thirdly, energy storage. That is because, the high carbon emissions and pressures on the environment are not the result of inexperience in producing more energy. It is rather because the energy content (or energy density, if you like) of fossil fuels is very high, and the possibilities for storing that kind of fuel or just letting it wait underground are far greater than our ability of storing electricity.

From the point of view of the Academy: unless there is an unexpected breakthrough in the basic sciences, be it in the field of batteries or supercapacitors, at least now it seems that the core of carbon-neutral energy will consist in hydrogen-based energy. And added there is a wide range of different gizmos from rooftops construed of solar panels to small nuclear power plants, plus a powerline network of a very different kind.

HISTORY + PLACE OF OPINION

EXPRESSING OPINION IN A PUBLIC DEBATE

Madis Müller
President of Eesti Pank (Bank of Estonia)
Presentation at the Academy of Sciences General Assembly meeting on 2 December 2020

Eesti Pank and the Estonian Academy of Sciences are both participants in the public debate and must often express their opinions on different aspects of life in society. At Eesti Pank, we are used to dealing primarily with general questions about economic developments and macro-economics. The role of science from the perspective of both economics and public debate is definitely somewhat different.

The role of science in society has become more important, especially in recent times. In addition to the corona pandemic, there are a myriad of different challenges in society which require the contributions of science in order to be resolved. It is important for scientists to participate in discussions and provide their input. There are all kinds of topics which require input. The topics which arise when discussing the environment relate to sustainable economics, but also the Green Turn in society, maintaining biodiversity, and everything relating to achieving climate neutrality. Even today's pandemic is related to environmental change. Technological changes, including intense industrial innovation, the ever-increasing digital turn, the growth of social media, developing artificial intelligence, and the wider influence on society from this entire collective – all create a series of important questions. Demographic changes are equally as important, such as how we handle migration, or how do we manage the aging of the population.

From Climate Change to the Economy and Back

One year ago, the Tallinn centre of the Stockholm Environment Institute (SEI) evaluated how much Estonia and its society, including the public sector, would have to invest to achieve carbon neutrality by the year 2050. The numbers are colossal. We are talking about 17 billion euros, of which a majority, close to 13 billion, should come from the private sector and over 4 billion from the public sector.

It is clear that to make the smartest investments, which will help us achieve climate neutrality, we need the contributions of good scientists, science, and knowledge. At Eesti Pank, we have discussed how the climate goals could affect the actions of the central bank. There are multiple dimensions. On one hand, we evaluate how climate change and changes in climate policies could affect the financial sector. In the field, physical risks (such as extreme weather events and gradual changes in weather conditions) are combined with transition risks, which derive from climate policies, technological changes, as well as the preferences of the consumers. Transition risks are the most important from the perspective of the financial sector: starting from the energy sector, but also much broader, many companies will change their business models based on climate policies--. The preferences of consumers will change, which will also affect the economic results of some companies, the price of assets, and bring socio-economic change.

The influence on the real economy may appear in multiple ways. Supplementary costs (including one-time investments) may mean a decrease in profitability for companies. Increased costs and changes in the labour market will mean a decrease in income for households. The possible decrease in productivity can easily lead to the reappraisal of assets and that in return can lead to the locking of value behind projects which are not productive. Various socio-economic changes are added (for example, change in consumption preferences).

The result, for example, is that some loan clients may become risky for banks because they are unable to fill their current obligations. If we are unable to direct this process

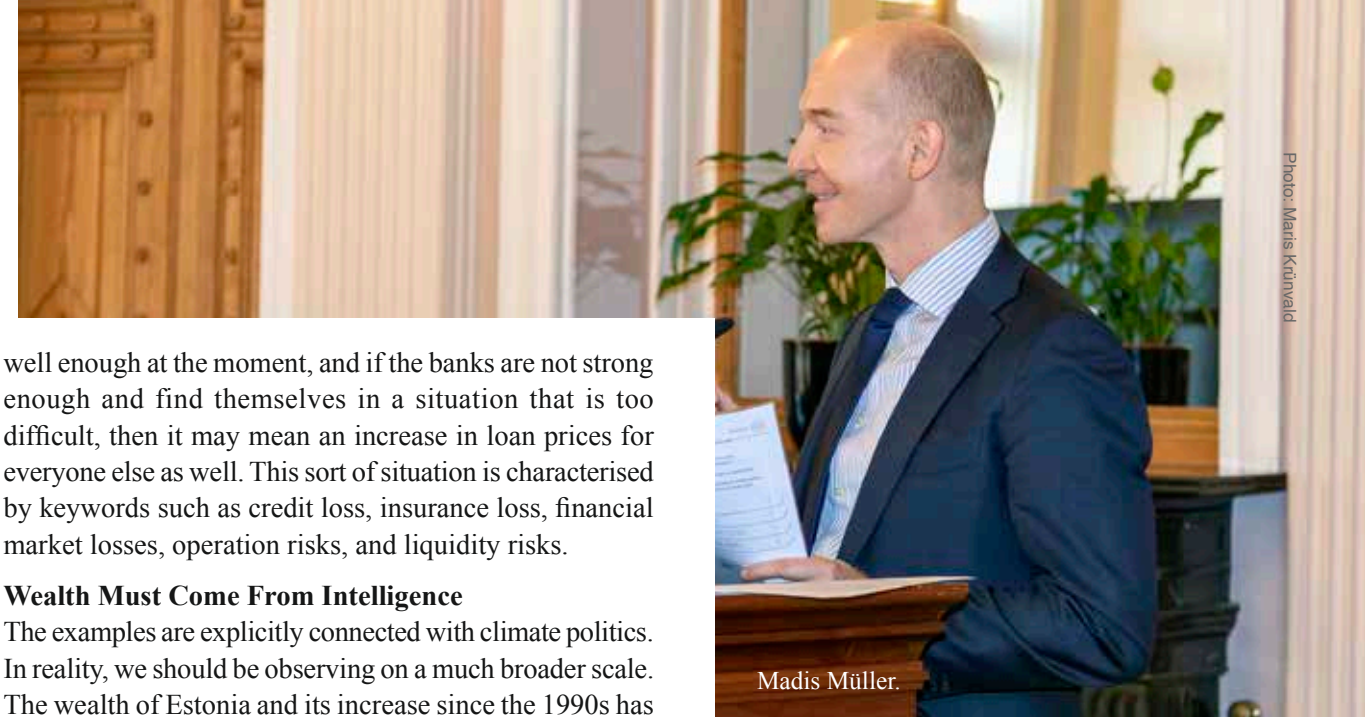


Photo: Maris Krūmvalds

Madis Müller.

well enough at the moment, and if the banks are not strong enough and find themselves in a situation that is too difficult, then it may mean an increase in loan prices for everyone else as well. This sort of situation is characterised by keywords such as credit loss, insurance loss, financial market losses, operation risks, and liquidity risks.

Wealth Must Come From Intelligence

The examples are explicitly connected with climate politics. In reality, we should be observing on a much broader scale. The wealth of Estonia and its increase since the 1990s has been impressive. In comparisons with different countries, our wealth as portrayed by the gross domestic product (GDP), and corrected prices has been approaching the average of European nations over the years. Our GDP increase has been quite stable when we do not consider the events from ten years ago, when all three Baltic states suffered quite a lot in the crisis. It should be noted that when looking at long-term patterns like this, it is easier to reach the average than it is to exceed it. It is necessary to have above average development speeds and investments into innovation in order to progress, as science and development activities are the prerequisites for the growth of productivity.

Our future progress becomes more complex as we reach higher levels in terms of income. That is why we need to invest more into innovations, science, and creative activities or other activities that produce additional value. The relative wealth of Finland and Denmark are above the European average, but it can be seen from their (especially Finland's) dynamics that when reaching a certain level, then there is extra effort which is required to maintain that level. Finland or Denmark are certainly not doing something fundamentally wrong in managing their economies, but neither is there any sign of an additional increase of relative wealth.

Now is the time to ask where Estonia's wealth and increase in income should originate from. We can separate the economic growth of the previous years into two components and observe how much of it has come from the contributions of the workforce, and how much from the increase of productivity. An increase in employment over the last decade has provided roughly half of the economic growth. There are two factors behind it. Firstly, in Estonia we have a very high rate of labour market

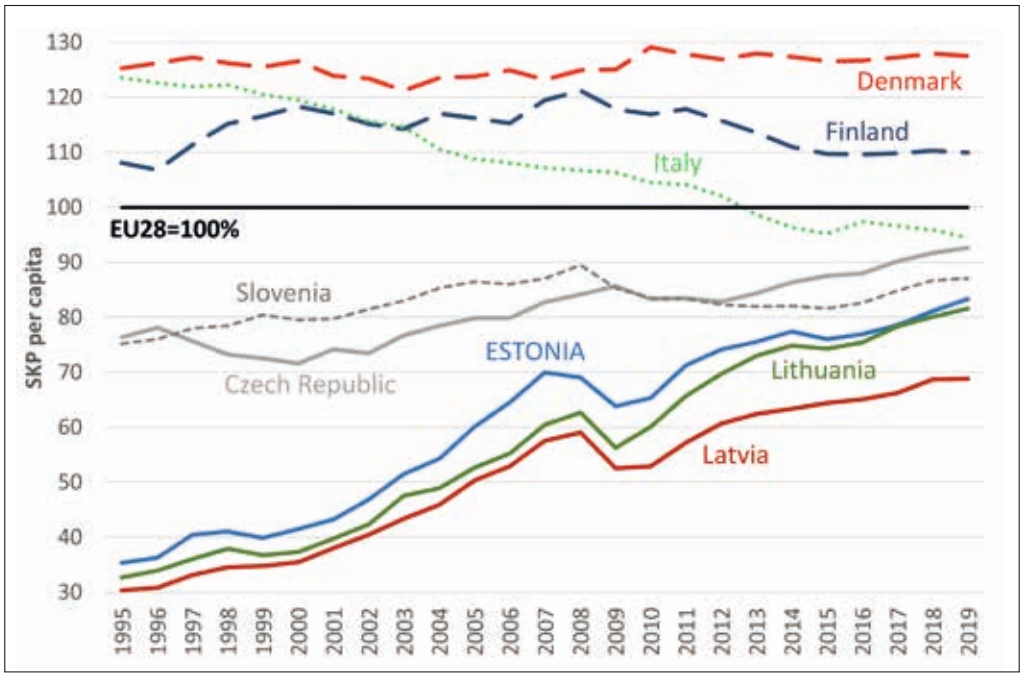


Figure 1. GDP per person with corrected prices, 1995–2019.

participation, which means that a very large number of Estonian adults participate in the labour market. This rate is clearly above the European average and unemployment has actually decreased in recent years. Increasing productivity will become important in the future because we do not have much additional resource to look forward to from increased participation in the labour market, nor from further decrease of unemployment. The contribution of development activities, science, and innovation is definitely important here.

Towards a Balance in Contributions Between the Country and the Private Sector

In the context of financing science and development activities, there has been much talk of how Estonia should contribute more to the funding of science. Naturally, it is important that the government carries out its part. When compared to other European states, primarily the wealthier

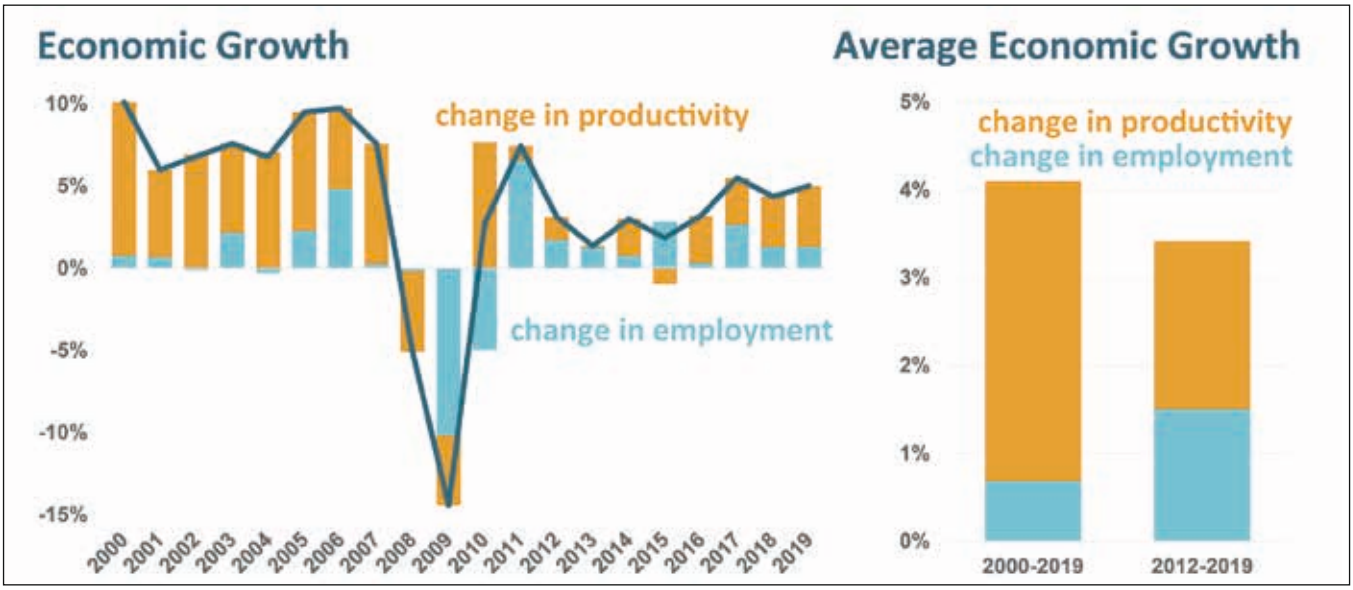


Figure 2. Economic growth and change in productivity and employment from 2000–2019.

Figure 3. The average economic growth and change in productivity and employment from 2000–2019 and 2012–2019.

and those who are more frontal in financing science and development activities, the primary bottleneck currently is the small contribution of the private sector. Estonia is quite in front in terms of the relative importance of the government sector in spending on science and development activities (on average over the past ten years), behind only Cyprus and Greece. This number has understandably been inflated by the denominator of the formula, which are the relatively small expenses of the entirety of science and development activities in the country.

The so-called innovation results chart, published by the European Commission, is very helpful when evaluating the innovation activities of Estonia, and their results. According to its unified index, we are not a bad example at all, as we are more so among the first half of the European states, between France and Portugal. From this survey, we can see that a large number of Estonian citizens participate in lifelong learning, the spending on innovation (not including direct investments into science and development activities) is relatively large, and Estonia is also rather innovative in the so-called "process innovation" with its small or mid-size enterprises (SME, up to 250 employees, according to the European standard – ed).

However, where we are lacking is innovation that creates completely new quality in how to make new things. It is immediately clear that our expenditure for science and development activities in the private sector is clearly below the European average. We also have a relatively small number of quickly growing innovative companies. Although our process innovation is quite strong, we have not put enough emphasis on marketing nor organisational innovation, and we are also not in a good state in terms of the export of hi-tech and medium-high technological industrial products. In those aspects, we are more so among the bottom five nations of the European Union.

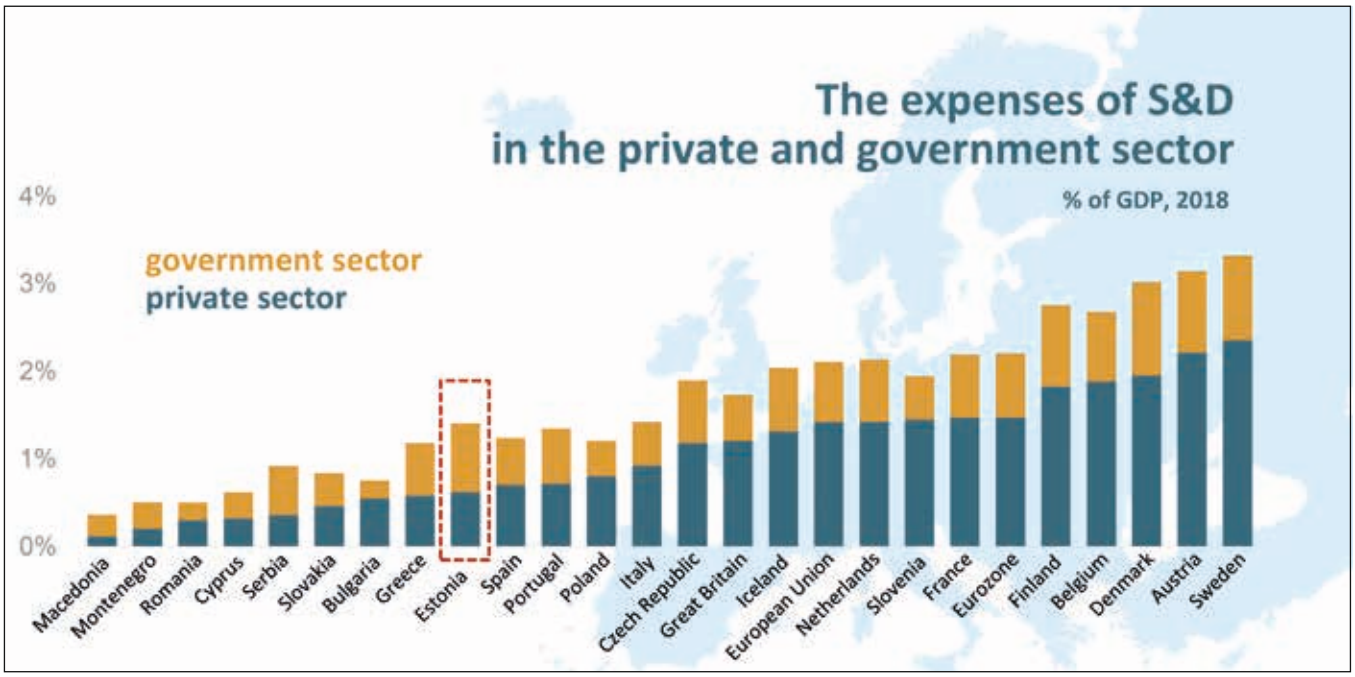


Figure 4. The expenses of science and development activities in the private and government sectors in 2018 (percentage of GDP).

Opportunities for Innovation

How can we increase the contribution to innovation in the private sector? We cannot offer a single magic wand or secret formula at Eesti Pank, but we do have some ideas floating around regarding the economy and science, as well as science and development activities. The field can be roughly progressed in four ways.

Firstly, we should ensure that new knowledge and ideas will reach the labour market through higher education. There are good examples that work, whether they be industrial doctorate programmes or government grants for companies to hire scientists with doctorate degrees.

Secondly, to create conditions in entrepreneurial environments which invite research-intensive companies, as this would favour their development and bring inward investment to Estonia.

Thirdly, through company business models. Companies should move towards more complex business models that alongside enhancing the efficiency of processes would have an increasing role in creating new goods, services and innovation. One good example here is Cleveron, which has developed its activities and moved towards real products and service innovation, including new fields of operation.

Fourthly, through tax incentives for science and development activities. We do not have many of these that have been implemented. This is related to the logic of taxing our companies. It is difficult to provide tax incentives to science and development activities specifically because companies receive income tax only when profits are distributed. Although many other countries have contributed to tax incentives. Perhaps we too have ways to move towards this, how to promote innovation and development activities through taxation laws.

Trust as Fixed Capital

It is important that society trusts the viewpoints of scientists. This would not only be beneficial in societal debates on different topics, but would also ensure our leaders in making difficult decisions in both the public and private sectors. The trust of the people is important for both scientists and us at Eesti Pank. We wish to be trustworthy in our economic analysis and suggestions regarding economic policies so that decision-makers of different levels would take them into account as much as possible.

The state of Estonian scientists is a very good starting-point. The Estonian people believe in science. The fresh Estonian science barometer confirms that a large majority (78 per cent) of Estonian citizens say that they believe in science. 66 per cent are interested in the viewpoints of scientists, and as many as 85 per cent of Estonian citizens share the sentiment that the development of science and technology have improved peoples' lives over the last 10–20 years.

It can be said that the corona crisis specifically, the communal fight against the virus, and the role of scientists in finding solutions has been recognised and has not gone unnoticed. Professor Tõnu Viik, in his recent opinion piece in the national broadcast service (Estonian Public Broadcasting, ERR*), brought out the parallel between scientists and economists. He wrote that the only

* The opinion piece of the Rector elect of Tallinn University, Professor Tõnu Viik, „Viirus, teadus ja poliitika" (Virus, Science and Politics), 23 April 2020. https://www.err.ee/1081091/tonu-viik-viirus-teadus-ja-poliitika – ed.

human-type who is listened to in addition to scientists in a time of crisis, are economic analysts who assess the effects of the economic downturn. At Eesti Pank, we all consider ourselves economic analysts and we are glad to hear that we are being listened to. However, Professor Viik was not very optimistic about that remaining to be the case after the coronavirus crisis. It is more likely that scientists will not participate in the meetings of the government cabinet, especially when politicians believe that they know what is good for the people. That is why we need to put in extra effort to hold the so-called confidence level high and constantly keep our opinions in the picture.

The Bank and the Science Within it

At Eesti Pank we routinely check the reliability index of institutions that we regularly work with. We are slightly above average in this comparison. According to the last survey, 69% of the population considered the viewpoints and the actions of Eesti Pank to be trustworthy. It is worth striving towards making sure that the trustworthiness of both the Academy, as well as the scientific community, would be measured in the same way. Perhaps this can be one of the future goals of the scientific barometer. Maintaining trustworthiness is definitely something that is worth striving for.

We have defined our role for ourselves at Eesti Pank. The broadest wording of this can be found in the vision of Eesti Pank. We want the viewpoints and actions of Eesti Pank to have weight in both Estonia and internationally. We wish to be an efficient and innovative organisation. We want to be the strongest competence centre in questions relating to micro-economics and finance. We participate also as an advisor in the life of the country. Providing science-based advice is one of the goals and the main purviews in the statute of the Academy of Sciences. In that field, we have made focusing on economic recovery from the crisis and supporting the sustainable development of the financial sector one of our goals for the coming years. We will attempt this by organising debates on economic policies. We want to make sure through research and publications that our messages are clear, purposeful, and understood by the people. We will regularly carry out analyses and publish the viewpoints and assessments of Eesti Pank in different questions. The general development of the economy will be observed in the economic publication that is published twice a year. More specifically disserted will be questions relating to the labour market, Estonia's competitiveness, the funding of the economy and the stability of the financial sector.

Eesti Pank is directly connected to scientific work. Six per cent of our employees have a scientific degree and 56% have a master's degree or a corresponding education. We have a separate unit which deals with in-depth economic research. To our guest researchers programme, we invite economists from outside of Eesti Pank, to work on specific projects. We award the Eesti Pank Research Award, organise international science conferences and participate in the activities of the Doctoral School of Economics. As a new direction, we try to conduct research and analyse relevant topics that would be beneficial for policymakers and provide suggestions based on economic analysis. We recently evaluated the effects of monetary policies on the Estonian economy and the financial sector, and organised a public seminar and presentation for the analysis of the pension reform. We definitely want to continue these activities.

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Just like the Academy of Sciences organises academic lectures, seminars, and discussions, we at Eesti Pank organise public debates and lectures on economic questions. We also invite renowned economists from outside of Estonia to perform.

According to the legislation of Eesti Pank, we are advisory subjects to the parliament. In addition, once a year at the grand hall of the parliament, when presenting the annual report, we strive to have a dialogue with the factions and commissions. We have also provided to the composition of the nation's general strategy documents by providing our viewpoints and feedback from the fresh *Eesti 2035* (*Estonia 2035*) strategy to field specific strategies.

Spokespersons of the Academic Landscape

Eesti Pank and the Academy have very different roles in the functioning of Estonia, but in some respects, our actions are quite similar. As an institution, we at Eesti Pank work hard in the role of advisor for the government and in a broader sense, for the society. It is visible how the Academy members of the Academy of Sciences naturally speak up in their field and are present in societal debates. It should be considered whether it is possible for the Academy to create their own institutional viewpoints on relevant topics and to attempt to actively present them in public debates. That should be more valuable and influential than the opinion of individual Academy members.

The scientific landscape is a very complicated ecosystem where concentrating opinions to a single viewpoint is understandably a big challenge. When discussing the focus

Photo: Maris Krūnvald

Tarmo Soomere (on the right) and Madis Müller at the General Assembly of Academy.

of this presentation with colleagues, it rang out that the scientific world of Estonia is fragmented, especially when looking in from the outside. Perhaps it should be asked whether the Academy should become the clear and strong lead organisation of the scientific world in Estonia, which would bring together the viewpoints of not only Academy members, but the viewpoints of all Estonian scientists, and would provide a balanced long-term viewpoint through active participation in societal debates. From the view of the bank, it seems that the Academy of Sciences has started taking on this role more and more and has become clearly visible in society.

The increased funding of science is now becoming a reality. The increase in the funding of science in the state budget is an opportunity to expand activities for both the Academy and its members, to more broadly fulfil the tasks set by the statute of the Academy and participate in discussions to have these resources distributed correctly. It is important to make sure that the resources are allocated reasonably and that they can be efficiently implemented.

The government's investment programme is connected to this. This is a much broader challenge than simply investments relating to climate neutrality. The new budget and recovery fund of the European Union hold potential for the growth of influence by helping us advise the allocation of additional resources for scientific goals and by motivating Estonia to set ambitious goals for science and innovation. It would be good to provide the maximum amount of science-based support to the government and other decision-makers in deciding where to primarily allocate government investments. These decisions must be based on objective analysis.

It is interesting to observe how the Academy words its identity as an organisation. Bystanders often ask whether the Academy is an umbrella organisation or a leading science establishment. Does it differ from other science-related organisations? What are the opportunities to consolidate and specialise in specific fields? Is the status of an Academy member an acknowledgement for their life's work? Or should it be a push for younger scientists towards reaching the top? The Estonian Young Academy of Sciences has also caught the eye. This seems incredibly gratifying. Some colleagues have asked whether thought should be given to a stronger connection or merging of the Young Academy and the "real" Academy to make the striking fist even stronger.

These are simply observations and questions for which we do not have answers, nor specific suggestions. From the perspective of development, it is important for the organisation to set a focus and select the main goals for its long list of activities, as well as changes in society which the Academy considers important to participate in and can contribute to. This may require the creation and strengthening of analytic capabilities. It would be interesting to evaluate the expectations of society for the Academy of Sciences and for those dealing with economic sciences.

It is definitely very interesting for Eesti Pank to hear your opinions on how the rolls of economic and social sciences would come forward in the work of the Academy. One point of discussion would be the importance of applied research. Choosing and balancing the target demographic is always a complex and periodically changing process. Among them there is both society as a whole, as well as future scientists and policymakers – and not as opponents, but as collaboration partners. Our common concern, which we have often racked our brains with at Eesti Pank, is how can we most effectively organise the counselling of policymakers, from the parliament, all the way to the government.

OF FOREIGNERS AND OUR OWN IN ESTONIAN SCIENCE THROUGH THE EXAMPLE OF FREIDRICH GEORG WILHELM STRUVE AND THE MERIDIAN ARC WHICH BEARS HIS NAME

Andres Adamson

The starting point of the example, which was worded in the title, is of course the circumstance that specifically Estonia's baggage of national science and scientific narratives is a little over a century old. However, Estonian science is much older and dates to the founding of the University of Tartu three centuries earlier.

Nowadays, we are generally already putting certain ethnocentric children's diseases behind us and consider multiple scientists that are not necessarily Estonian to be "our own", as well as numerous Baltic German scientists who are from here, and those from abroad who are continuously connected to the University of Tartu. The very high level of those who have come here from elsewhere, mainly in the 19th century, has definitely helped with this, which in turn came from the special role of the reopened University of Tartu in 1802 in Russia and its academic life. For decades, the University of Tartu was essentially the only scientific university which prepared specialists for others in the Russian empire thanks to the absence of a language barrier in the German cultural space and its scientific community.

Still, we determine the own-foreign question informally and through individual cases. We definitely do not consider every scientist or other creative person that has lived, worked here for a longer period, set their roots or been buried here to be so-called our own. For example, we do not consider the Polish writer, Jan Tadeusz Krzysztof Bułharyn (1789–1859), who was Struve's contemporary and who spent most of his time throughout 31 years here, who in 1828, bought the Karlova manor near Tartu, where four of his sons and his daughter were born, where he later died and was buried in Raadi cemetery to be an Estonian writer. No – although he wrote his pieces here, in which he also talked about Estonians multiple times, we still consider him to be the Russian writer, Faddei Venediktovitš Bulgarin. He himself would probably have said the same and Friedrich Georg Wilhelm Struve (1793–1864) would definitely not have called himself an Estonian scientist. Why do we now think of him – Wilhelm for us, Vassili Struve for the Russians – differently?

Wilhelm Struve was born a state German in the Duchy of Schleswig-Holstein from Altona near Hamburg. The latter was in a personal union with Denmark, but the life of the family was mainly connected to the neighbouring big city. Hamburg was added to France during the Napoleonic Wars and in 1808, the boy fled the violent enlistment into the French army, he escaped to Russia and more specifically Tartu because his brother Karl was working as a private teacher here. Later, the third brother, Ludwig, who later worked here as a Professor of Medicine, came to Tartu the same way.

So, Wilhelm came to Livonia as a teenager at the age of 15, and despite not having a gymnasium diploma, he was immediately accepted into the University of Tartu


Photo: Private collection

Andres Adamson.

Photo: en.wikipedia.org

Friedrich Georg Wilhelm Struve
(1793–1864)

Photo: Карл Иванович Теннер*

Carl Friedrich Tenner
(1783–1859)

thanks to his evident talent and the letters of recommendation that were acquired through his father, who was the headmaster of a gymnasium, can denote that the university was where he grew up. Or he grew up in the Berg noble family in Tartu and Sangaste because initially, alongside studying, he earned money for food and living by working as a private teacher for the family.

Being a teacher was still so-and-so because that would mean that his pupil would have been the later Field Marshal, Honorary Member of the Russian Geographical Society and Honorary President of the Nikolaev Academy of General Staff, Friedrich Wilhelm Rembert von Berg (1794–1874), who was only a few days younger than him and similarly talented in many ways, far ahead of his age, soon to be a university student and who would soon be the head of the family due to the death of his father. The two stepdaughters of the family were even older, but the remaining three sons were younger. In reality, it is known that the younger generation of the Bergs actually helped Wilhelm with his literature studies for example – despite him studying primarily philosophy in university at the time. Possibly not by following his heart, but by his father's wish.

The young man received a candidate degree – similar to the current bachelor's – in philosophy, and immediately in his time and situation, a proposal to become a history teacher in the Tartu Gymnasium, but decided to continue his studies in university and focus more on astronomy, mathematics, geodesy, and cartography. His first encounter with measuring land and creating maps was also in connection with the manors and activities of the Bergs.

Wilhelm Struve stayed in Tartu until 1839, until he became the Director of the Pulkovo Observatory. This means more than half of his conscious life and most of his scientific life. Throughout 31 years of which he was on the payroll of 25 universities as a Professor of Astronomy, the Director of the observatory, and he was also a Vice-Rector for a period. This is when most of his children from two marriages were born and some died. His primary scientific achievements are from this period. It was here where he was the first to measure the distance between the extrasolar star (Vega) and Earth, searched and determined the locations of thousands of binary stars, and was one of the two leading scientists in the trigonometric measuring of the Baltics, and the measuring of a gigantic meridian arc from the North Cape to the mouth of the Danube River. Some of his sons and grandsons studied in Tartu.

Later, the Struves settled elsewhere, initially primarily in Russia, and in the 20th century, also in France, Germany, USA, some branches of the family Russified and among them were not only astronomers – after all, people talk about the Struve dynasty of astronomers – but even foreign Russian Orthodox figures and religious philosophers.

The Struve arc is not a so-called Estonian thing merely because it passes through Estonia and was partially

Foto: Piret Suurväli x3

Research seminar “The Struve Arc and Estonia”.

measured during Wilhelm Struve’s Tartu period. The other lead and equally as important – or even more important as well as the initiator – of this endeavour was Carl Friedrich Tenner (1783–1859). Geodesist and astronomer who was born Estonian but culturally of course Germanised in his time. Self-taught, without a military base education despite his career as a General (he later took a course at the general staff which focused on staff work and cartography), but an Honorary Member of the St. Petersburg Academy of Sciences since 1832, or the same year that Wilhelm Struve became a member of the academy. But also, a senator who lived in Warsaw, a General (not Lieutenant General, as sometimes is written), and a father to three sons who also became Generals. With this list, I want to stress that he was influential enough for this initiative. The meridian arc from the Arctic Ocean to the Black Sea could probably have been measured even without Struve, but probably not without Tenner. As has been said many times, accurate maps in a military sense were worth gold – and this is not a figure of speech, when we consider that paper had to be perpended.

The militaristic dimension of the Struve Arc takes us back to Wilhelm Struve’s childhood companion and later background force, Field Marshal Berg. His later career was initially in Finland and then in Poland primarily connected to the geographical, or topographical-statistical, even geopolitical direction (although such a word, geopolitical, was not in use yet) of military intelligence. Later, over two decades, he led the cartography work in the empire’s European section as the leader of the general staff and military topographic corps, choosing methods, creating public and classified maps, and also indirectly measuring for the meridian arc, which was partially done through the Russian-Scandinavian collaboration. As an ex-spy and diplomat (such a double role was common even then), he mostly did not take the foreground and sometimes preferred using indirect methods. In fact, Berg also led exploration trips and initial mappings of the border and neighbouring areas of the empire.

Carl Tenner was sometimes, at least formally, his subordinate and perhaps the same can – indirectly! – be said about Wilhelm Struve, who throughout his life completed multiple special assignments abroad that were given by the Russian government which, if wanted, could be disserted as scientific or technological reconnaissance. And they should be disserted. All of this could of course be taken as a characteristic of the time, and that this was how the funding for the gigantic project of the Struve Arc was received.

The answer to the question of whether Wilhelm Struve should be considered our own or foreign is probably apparent – as well as the answer to if or when such questions should be, may be or are worth asking. But in the case of the Struve Arc, such questions never even arise.

The map of the Struve meridian is presented (from the left) by the Secretary General of the Academy Jaak Järv, main organizer of the Workshop Hillar Kala and Member of Academy Urmas Kõljalg

Andres Adamson speaking at the research seminar “The Struve Arc and Estonia”. The microphone is held by Urmas Kõljalg.

ACKNOWLEDGEMENTS TO ACADEMICIANS AND FROM THE ACADEMY

MEMORIAL STONE OF THE RESTORATION OF INDEPENDENCE FROM TO ESTONIAN RESEARCHERS

On 20 August, President Tarmo Soomere, together with Mario Kivistik, the President of the Estonian Young Academy of Sciences (EYAS), who represented the scientific community, welcomed the memorial stone celebrating the restoration of independence from the President of the Republic,
In his reply speech, the President of the Academy said:

Very respected President, good companions!

It is deeply true that this recognition, the stone in the wall of our independence, was not given to individuals, but to the scientific community as a whole. Very rarely do individuals change the history of the world. Change happens only when there is a broad consensus.

Good advice is very much needed in difficult times. In times of crisis for countries and nations alike. It is then, when a higher view is needed. In the words of Isaac Newton: "Standing on the shoulders of giants." You also need perseverance, and the understanding that some things in this world cannot be the subject of compromises. That laws describing both natural laws and social processes cannot be passed or amended by a majority vote.

When creating big things, it is not necessary for scientists to be smarter than others. It is enough for scientists to have wisdom just a bit earlier than their peers. Namely, before the problem even arises. Even the skill to use a small time shift often causes history to be born. Or helps solve some seemingly fatal concerns. In the words of John Locke, "The only defence against the world is a thorough knowledge of it." Even in the development of societies.

Estonian people believe in education. A very good education is needed to learn to use the best that science has to offer. Not all societies know how to do that.

Photo: Maris Krünvald

20 August memorial stone.

20 August memorial stone received by Tarmo Soomere and Mario Kadastik.

Bernard Beckett has written about it: "A society that is afraid of knowledge is a society that is afraid of itself."

Thus, one of the cornerstones of us gaining our re-independence were the broad horizons of our researchers, partly specialty skills, but above all, general knowledge and the persuasive skills and contacts based on it. Courage was born then as if on its own accord because according to Plato's golden words, courage is based on the ability to distinguish and know what to fear, and what not to fear.

During peaceful times, the role of scientists is somewhat different. The competitiveness of a country today is determined by how the knowledge and skills of wise people can be materialised. Scientists also have one specific task, in the paraphrased words of Francis Bacon – to avoid the most dangerous situation for a country from the very beginning, namely one where cunning people can appear as wise.

ESTONIAN SCIENCE COMMUNICATION AWARD

In 2020, Academy member Jüri Engelbrecht was merited the Tiiu Sild Memorial Lifetime Achievement Award for long-time systematic communication of science and technology.

Jüri Engelbrecht as a promoter and leader of science

Jüri Engelbrecht is someone who has not only made outstanding scientific achievements, but he is also a leader in research organisation and a successful promoter in both Estonia and Europe. His work spans a wide range of fields, from the popularisation of classical science to a huge contribution to shaping the current high-level science popularisation ecosystem.

Jüri Engelbrecht has provided detailed documentation for many aspects of the science of complex systems, including fundamental aspects of nonlinear worldview, and the strange phenomena related to single waves, both in engineering and technology, and inside the human body, from blood vessels to nerve cells. He has elegantly and

Jüri Engelbrecht.

convincingly shown to colleagues and society how uniquely and fantastically the parts that make up the whole world are connected, so that the whole is immeasurably greater than the simple sum of the separate parts.

These include articles in classic popular science publications, such as articles in the journal *Horisont* (a section on fractals and interviews with Rein Veskimäe), essays and travelogues in the cultural newspaper *Sirp*, articles in *Eesti Päevaleht* (incl. collaboration with Tiit Kändler), essays in the journal *Akadeemia*, in addition to many articles, accompanying words, and opinions in popular science books.

His classical style of popular scientific writings and discussions on the nature and meaning of things from the researcher's point of view, form a separate chapter in the landscape of popularising Estonian science, but are still just the tip of an iceberg compared to his actual contribution to popularising science.

His invisible, but at the same time enormous work as a representative and developer of Estonian science, an adviser to the research administrator and heads of state, has now been expressed in the fact that the best information of the moment, with the necessary context and explanations, reaches those who have the mandate to make strategic decisions. Although somewhat unusual, this form of popularising science is undoubtedly extremely important for the country as a whole. In this field, he has advised three Presidents of the Republic on their academic councils (1995–2011), been a member of the council of the Open Estonia Foundation, and a member of the EU committee of the Minister of Foreign Affairs, etc.

In the international arena, he has vigorously introduced the best of the popularisation of Estonian science and thus contributed to the development of meta-level popularisation. It is a known secret that, for example, Tiit Kändler's European Senior Science Writers Award 2012 was largely based on Jüri Engelbrecht's skills (more like exceptional art) to bring out the best Estonians into the world's spotlight.

The popularisation of science and the lobbying of the world of science are dependent on his successful efforts to transfer Estonian researchers to European and global think tanks and networks, such as the Young Academy of Europe, European Marine Board, European Research Council ERC, European Science Foundation ESF, the International Union of Theoretical and Applied Mechanics IUTAM, and the International Science Council ISC (formerly ICSU), etc.

Jüri Engelbrecht's enormous contribution to speaking and writing about the importance of research policy is somewhat more visible, but still rather underrated. Namely, due to his work, here in Estonia we can now enjoy an unusual sight of the rest of the world, research policy issues are available for the general public, the topics are familiar to the public and, for example, the cultural newspaper *Sirp* and the cultural magazine *Akadeemia* regularly publish in-depth articles about research policy. The indirect outcome of his work is also reflected in the growing courage of people not as familiar with science to use the results of research, including in discussions over issues of public interest, from the wood refinery to the development of distributed energy.

A small selection of Jüri Engelbrecht's hundreds of writings, speeches and statements in this field have appeared in several voluminous collections. The appearance of a selection of his writings in the series *Eesti mõttelugu* (*History of Estonian Thought*) *Akadeemilised mõtisklused* (*Academic Reflections*), Ilmamaa 2017, *Eesti mõttelugu* 133 proves the quality and merit of these ideas.

Perhaps even more important is the impact of Jüri Engelbrecht's approaches to popularise various aspects of research policy in English. Through the consortia of academies of science, they have spread to the research communities of many countries. There is reason to believe that they have significantly helped pave the way for Estonia's popularity in scientific communities, and among those who consider it their mission to bring the best knowledge to the table and consciousness of politicians and decision-makers because (government and parliamentary) scientific advice is essentially a form of popularising science.

A special emphasis should be put on Jüri Engelbrecht's contribution to the development of the current Estonian science popularisation ecosystem, which is unusually strong and influential on a global scale. During his twenty years as President and Vice-President of the Estonian Academy of Sciences, including the pivotal transformational years of the entire Estonian research system, he not only took every opportunity to inject the best knowledge into society, but also worked tirelessly to grow and strengthen the entire science and science popularisation ecosystem. A legendary example of this is his precise and elegant comments on the state research awards live.

Many of his colleagues say that, under the leadership of Jüri Engelbrecht, the Estonian Academy of Sciences reached a new quality from a formation that was almost on the verge of destruction, both through the representation and development of science and the popularisation of science. As President of the Academy, he launched several ground-breaking and pioneering events of his time, such as the seminar series "Science for Society", "New Directions in Science" and the Academy's public lectures. As an important activity aimed at the society, Jüri Engelbrecht launched the series of publications *Eesti Vabariigi teaduspreemiad (Research Awards of the Republic of*

Photo: Leemet Samel, ETAg

Jüri Engelbrecht was awarded the Lifetime Achievement Award by the head of the contest jury, Member of Academy Ene Ergma (on the left) and Minister of Education and Research Mailis Reps.

JRecent book "Complex Systems" published by Jüri Engelbrecht and Robert Kitt.

Estonia) and *Teadusmõte Eestis* (*Scientific Thought in Estonia*), and re-launched the periodical collection *Teaduste akadeemia aastaraamat* (*Estonian Academy of Sciences Yearbook*). The target group of these publications is the Estonian public and the scientific community, and their added value is the development of Estonian as a scientific language. On his initiative, the English *Research in Estonia. Present and Future* (2011) was also published.

Jüri Engelbrecht's low pain threshold, erudition and ability to see the big picture have been the basis for many writings that have brought the results of research closer to society and solved many of society's main problems. Ethical aspects are essential to the popularisation of science and, more generally, gaining the trust of society. On his initiative, the development of a code of ethics for Estonian researchers was started (adopted in 2002). All of Jüri Engelbrecht's activities are based on high ethical values and the ability to see the world in its complexity, which he has passed on to both students and colleagues alike. In this context, his edited book *Teaduskultuur Eestis* (*Research Culture in Estonia*) (2013) deserves a special mention on aspects of modern science culture in Estonia.

OTHER RECOGNITIONS FOR THE MEMBERS OF ACADEMY

Several unions and organisations have awarded numerous Academy members with awards or titles and honoured them by appointing them as members or honorary members in 2020.

- Toomas Asser was elected as the new Board member of The Guild of European Research-Intensive Universities.
- Jaan Eha received a medal from the University of Tartu Faculty of Medicine for his outstanding contribution and dedication for work in developing the cardiology field of study, as well as academic medicine.
- A memorial bench was opened in the courtyard of Tallinn Nõmme Upper Secondary School for Endel Lippmaa's 90th birthday.
- Andres Metspalu was awarded "Tartumaa Kuldne Tammeoks" which is the highest decoration of Tartu County.
- Arvo Pärt received Frontiers of Knowledge Award in the field of music, a prize from Spain's biggest bank BBVA for creating a new musical language. He is the world's second-most performed living composer.
- A memorial bench was installed in Haiba manor park, Saue County, in honour of Loit Reintam.
- This year's Cultural Endowment of Estonia's annual award in the field of music was received by Jaan Ross for his precise and thought-inducing scientific translation of Theodor W. Adorno's musicological writing *Philosophy of New Music*.
- Hando Runnel received a Cross of Merit of the Estonian Ministry of Foreign Affairs for an outstanding contribution in ensuring Estonian independence and advancements of Estonian interests in the world, and the Kultuurivedur award as the founder and long-standing Director of Ilmamaa publishing house.
- The Optical Society of America (OSA) has awarded Peeter Saari an honorary certificate for his diligent work in writing critical appraisals.
- The Union of Human Genetics in Estonia gave the Lifetime Achievement Award to Mart Saarma.
- The Association for Computing Machinery (ACM) chose Jaak Vilo as their Senior Member.
- The "100 Semesters in the University of Tartu" decoration was given to the following Academy members: Jüri Allik, Jaak Järv, Mati Karelson, Andres Metspalu, Raivo Uibo, Gennadi Vainikko and Haldur Õim.

Photo: Andres Tennus ((University of Tartu))

ACADEMY MEMBER JÜRI ALLIK: LIFELONG CONTRIBUTION INTO SCIENCE

Marti Aavik, Deputy Editor-in-Chief of Postimees, talked to Academy member Jüri Allik, winner of the 2020 Lifetime Achievement Award for Research, about the psychological impact of coronavirus, his life's work in science, and about why Estonian science is world-class.*

Jüri Allik.

* Riigi teaduspreemiad 2020 (National research awards 2020). Eesti Teaduste Akadeemia, Tallinn 2020, pp 26–35. See also pp 141–148 of this book.

Marti Aavik: We are talking in the last week of February 2021, when the number of people infected with coronavirus has jumped over a thousand per day. Watching the public debate, it seems that the first reaction is to ask who is to blame. What we should now do in the new circumstances will only come in third or fourth in the order of importance. Do psychologists have a good explanation for why "who is to blame?" comes first?

Jüri Allik: I do not think it is written deep into a person's genes or neural network. Rather, they are learned scenarios that people are used to performing.

When I started out as a psychologist, I read that there are two types of cultures: shame cultures and guilt cultures. Shame cultures are based on morality.

A mother asks her child, "Aren't you ashamed to act like this?" She is like a moral supervisor who embodies the ideal, and you are doing something in respect to the ideal.

In guilt culture, you are like a private who does not obey a command from the higher-ups. It does not matter if it is good or bad.

I have never separately researched how Latvians or Finns, for example, deal with the question of guilt, but for some reason I think Finns investigate much less who is to blame.

Your observation may be correct. I would say that perhaps culprits are being sought more in places where people are not responsible, not adult enough. This is the behaviour of a child or a dependant person.

Of course, the fear is big. Today, there were already 1,600 infected, which forecasts that in some time there will be more than 2,000. It is more like people cannot take

responsibility, whether it is wearing a mask or avoiding contact.

It is a very interesting time for psychologists. There is a great number of studies as to why some countries are doing better or worse than others.

I just remembered that the Finnish anthropologist Pertti J. Pelto once proposed a division into restrictive and permissive cultures. In some cultures, there is a lot of restrictions and everything is very strictly limited to the point of controlling whether you can blow your nose at a funeral, and whether it is polite to whistle while walking on the street, and so on. There are some very good studies comparing fifty cultures. By the way, Estonia is one of the countries with the most permissive culture. Anything can be done in Estonia.

Now, during corona, the corresponding research has also been done. Turns out that the virus is more prevalent in cultures where the general attitude towards all kinds of restrictions is very lax. You are told to wear a mask, but you do not want to wear it and that is all.

The Finns themselves have said throughout the time of corona, that they are the kind of people, that if *nimismies* says something, the Finns believe and listen. Are we very different from the Finns in this matter?
Almost certainly. We are more like Southern Europe in this matter.

But what are the strengths of Estonian culture that support us when it is necessary to act in the same way for some purpose?
One very good thing is the lack of conflict. Estonia is not an aggressive country.

The second thing is ultimately related to the current government. According to the dimensions of Geert [Gerard Hendrik] Hofstede (1928–2020), and his so-called music, psychology and anthropology have been dancing for half a century. We were walking with Hofstede in the Tartu Town Hall Square. One of us asked, now he has seen so much Estonia, where he would classify us according to his dimensions.

One of his dimensions is femininity-masculinity. Masculinity includes militancy, characteristics of competition and domination. The other side is leniency, softness, indulgence. Hofstede gestured towards the Kissing Students statue, and said that if you put a statue like that in the main square of your city, there is no doubt that Estonia is a very feminine culture. Now, after the last change of government, we are probably the only country in the world where both the Prime Minister and the President are women.

Turns out that the virus is more prevalent in cultures where the general attitude towards all kinds of restrictions is very lax. By the way, Estonia is one of the countries with the most permissive culture. Anything can be done in Estonia.

One of Estonia's hopes is that if the culture is based not on militancy but on reconciliation, then in tense circumstances it is probably easier to cope.

It is feared that as a result of the corona restrictions, the growing generation will be hit by ignorance and their fate will have changed forever. What does the wisdom of the psychologists say?
I have not specifically looked at research on these issues, and the exact effects will probably be seen over time.

However, I think there is a general rule. For those who are talented and have a good learning ability, it basically does not matter if the teacher is three metres away or somewhere *n* kilometres behind the computer.

As with all social benefits, the principle known from the Gospel of Matthew applies: whoever has will be given more, and whoever does not have, even what they have will be taken from them. If there are disabilities or learning difficulties [in play], the direct support of the teacher is definitely important.

There has also been a lot of research into if and how mental capacity can be improved. Many studies show that this is possible short-term, but these effects do not last long. It may be the same with disruptions in study, that the status quo will be restored after a while. So, it is not worth to draw very big and scary conclusions.

The message, then, is that neither universities nor technology companies have reason to worry that in five to ten years' time they will not find successors just because of coronavirus and somewhat different learning in schools?
Absolutely not! The general rule is that all social shocks increase inequality. Economically and socially disadvantaged people and their children certainly suffer more when something shakes society away from its normal course.

These successful companies, that are already gathering the intellectual elite of society to themselves, do not have to worry at all. A different condition than usual, be it

distance learning or something else, is more like a challenge for the intellectual elite, which trains them and makes them even stronger than the calm progress would have managed.

One of your most recent articles deals with the factors that predict the scientific wealth of countries. So, what makes a country scientifically rich?

There are works published in good magazines that say rich countries do better science, and indeed, if we take the total number of articles and also the number of citations to them, the United States is ahead of everyone. There are so many people there, and some average American cities have more researchers than there are researchers in the whole of Estonia combined. It is as if there is nothing to compare because the sizes are so different.

However, if we divide the number of articles by the number of citations, we get a general measure of the quality of science. It turns out that according to those conditions, America is by no means the strongest. For example, researchers in Switzerland, the Netherlands, and several other smaller countries, publish much more influential work.

It turned out that national wealth did not predict the quality of science at all, and it also became clear that the amount of money spent on research and development does not correlate with the quality of the science.

One of the best predictors was the Worldwide Governance Indicator (WGI) which was made by political scientists and economists. The most important feature of this is the lack of corruption, and also that the government has very clear programmes and reasonable rational measures in order to achieve something. Well, for example, the agreement that one percent of the gross domestic product goes to science.

Another important feature is the absence of conflicts. That there are no such things as there are in America, where racial unrest or some gang attacks on the Parliament occur.

If we combine a lack of corruption and violence with clear policies, we already get a good recipe. The lack of nepotism within science is important, and the fact that you can become a professor if you are from any village in Estonia, not only if your father and mother were already professors before you.

Is there more nepotism in science in big countries? The intuitive assumption would be the opposite, that in small countries "everyone knows everyone" and there could be more seeds of nepotism?

In Sweden and some other places, for example, there is concern and comparison as to whether the variability of surnames in research institutions is lower than in the general population. In reality, we know the Scandinavian countries quite well. The fact that they are worried about such a thing at all is a sign that they are very sensitive and try to avoid nepotism. In some other countries, that is no concern at all, but rather the normal course of life.

It is probably still bigger than just the field of science itself. Whether your success depends on your own knowledge and skills, or on your background and affiliations.

Having seen several other countries, I would say that Estonia is in a happy position. Rather, we have the opposite effect. If you are from a very famous dynasty of science, your academic progress is often much more difficult. Everyone knows that you are someone's son or spouse. To move forward, you need to be twice as good as you would have to be without your relations.

Do small countries have an advantage in science? If so, what is it and where does it come from?

Yes. We had difficulty publishing an article previously because one of the reviewers was very convinced that this could not be the case. We showed that the work of small countries is more effective.

We tried to find explanations. One well-known thing is that the larger the country, the greater the heterogeneity of the population ethnically and religiously. The greater the likelihood of conflict. Small countries have fewer conflicts. There is also more corruption in larger countries. Political scientists have asked why, and have come up with the answer that there are more officials who are tempted to take bribes in a large country.

All in all, small countries have a number of advantages in terms of both the quality of governance, and the conduct of science.

Is there anything in the structure of science itself in small and large countries that makes a difference? For example, differences in the choice of areas of study and topics.

One of our latest articles is dedicated to just this. It has long been thought that there are different paths to the excellence of science. Authoritarian countries place great emphasis on technology. Cultures with a European background put a lot of emphasis on medicine and biological research because human life is greatly valued. The rest deal a lot with social problems.

We looked at the sectoral profiles of 107 countries and territories. We also assumed that there were different paths, but surprisingly, it turned out that there were not. The only rule is that if you want to be big in science, it is not possible to climb to the top by developing only one field or a few. The only road is to develop all science more or less evenly. This is logical, since the fields of science are very interconnected.

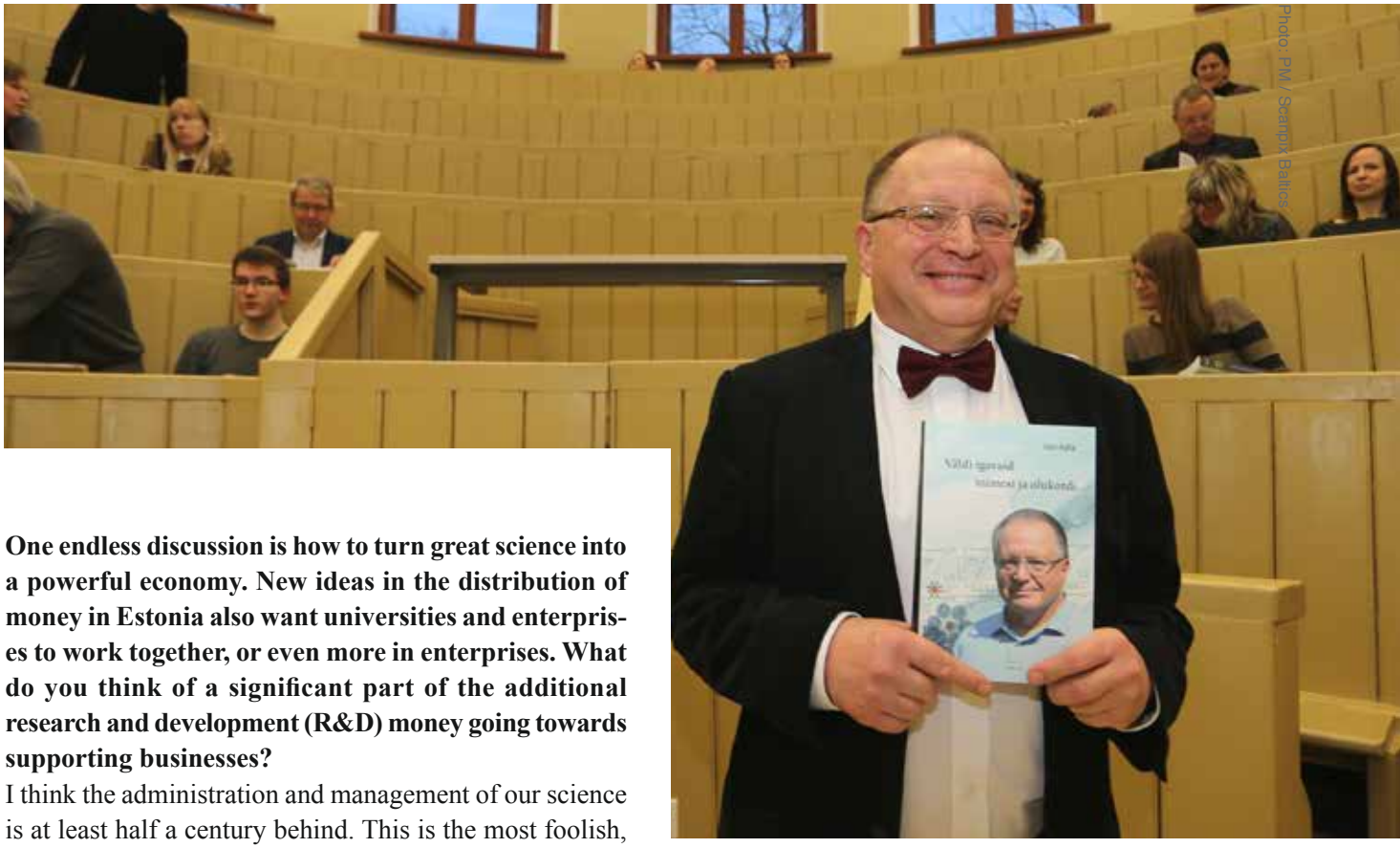

Photo: PM / Scanpix Baltics

Jüri Allik at the presentation of his book "Avoid boring people and situations".

One endless discussion is how to turn great science into a powerful economy. New ideas in the distribution of money in Estonia also want universities and enterprises to work together, or even more in enterprises. What do you think of a significant part of the additional research and development (R&D) money going towards supporting businesses?

I think the administration and management of our science is at least half a century behind. This is the most foolish, irresponsible, and pointless waste of money, not only for science, but also for the whole economy. It is based on a very short-sighted and misguided view of how science works.

If the Estonian economy could be compared to be cutting plywood and sewing a shirt, then to think that if science will come, the plywood will be cut a little better and the sleeve will be sewn onto the shirt a little more skilfully – this idea is so naive.

One day, I found floppy disks while cleaning a drawer. If you show the kids, they will have a hard time even imagining that we went around with some kind of discs onto which we had written about a megabyte of information.

All things that have emerged, even if it took place in a private company, have been scientific breakthroughs. Economic development is not cumulative. Joseph Schumpeter (1883–1950) already taught that the revolutionary development of the economy did not come from adding one workshop to the existing manufactory. Each new level of technology destroys an already existing one. Science does not just develop an existing industry; it replaces it with something else.

Where do these ground-breaking ideas come from? Not from industries that throw CO_2 into the sky somewhere, but from educated people who went to a university, or from people expelled from university at a good time, as we know from the example of Bill Gates.

But what if there is still a terrible concern that the average Estonian company does not even use IT tools as innovatively and as much as it could? What should be done then? Does the state not have to do anything?

It is like arguing over whether or not birds should be fed in the winter. Some say that when you do feed them, they get used to it and that way even the weaker ones survive.

I think it must be a terribly poor economy if the ones that do not even know how to use an Excel spreadsheet are still in operation. There is no point in supporting them with our taxpayers' money.

I think that we should accept more clever young people into the university, who will then start inventing and doing new things themselves. The old dinosaurs will die out. Wasting taxpayers' money on them is completely pointless.

From your non-memoir book *Väldi igavaid inimesi ja olukordi* (*Avoid Boring People and Situations*) (2018), I remember that after graduating from university, you and Aavo Luuk completed commissioned work for the Soviet military. What did these characters in the uniforms or leather coats ask you, and what did they do with the wisdom they received?

I hope that we significantly weakened the defence capabilities of the Soviet Union by doing completely

Jüri Allik at the opening of the Delta building of the University of Tartu.

pointless and unnecessary research. The situation was that the monetary figures of official statistics were insignificant. Much more important was the system that distributed money. It was called a military-industrial complex. They had their own budget among other things. Also, doing some lab or job at the university depended on you going there enough.

When Aavo Luuk and I graduated from university, no one offered us a position and we had to feed ourselves. Fortunately, my tutor was expelled from university, almost for ideological reasons. His friends employed him on the Soviet space programme and created a new field of science called technical aesthetics. Thanks to him, we got the first grants related to the psychological aspects of engineering equipment.

Later, we also established cooperation with the [S. I.] Vavilov State Optics Institute in Leningrad. One scientist there dealt with space measuring devices and collaborated with Tõravere. For the last ten years of the Soviet era, we lived at their expense. They designed optical devices for the satellites. I imagine that the main purpose of it was to monitor the locations of American tanks and missiles, but other things were also monitored. The main question was how to design optimal optical devices. For example, having a good resolution not only in the centre of the image but also in the periphery, requires a tremendous effort. Why to make such sharp optics if the human eye does not distinguish it anyway. In other words, the question was how poor optics could be made before the human eye could notice this lousiness.

Mostly, these problems had already been solved in English literature, but our Russian colleagues did not speak English well. So, this way, we mainly wrote reviews of ergonomic research. We also did separate research on how the human eye finds objects in aerial photographs. That is what we did to stay alive.

The reason for the interview is that, in 2020, you received the Lifetime Achievement Award for Research. What even is this life's work anyway?

Mathematicians have the Fields Medal, which is only given to those under 40 years of age. After that, is probably when the decline starts. I hope that my current age is not the beginning of any decline yet in the field I am in.

In science, awards are often given for a shorter period, such as the last four years of activity. The award given to me is for long-term scientific activity – it probably means it is for a period longer than four years then. My first scientific article in an international scientific journal was published in 1976.

So, I guess there is no better summary than life's work, as it is everything that a person has done up until receiving the award.

My biggest concern is that life's work almost references the end. Even at this advanced age, I would like to be optimistic that it will still be possible for me to do science for at least ten more years. My consolation and example is Academy member Jaan Einasto. Meeting up every once in a while, I ask what his life looks like. The answer is the same as always: every morning you sit at the table and start writing an article or come up with some theory. I hope that I will still be able to do what I am used to doing by following his example.

What are some big gaps in knowledge in psychology? What is something you would like to know about the most?

Sometimes I am asked to summarise the greatest achievements in psychology over the past year. If you look, for example, at the CRISPR (clustered regularly interspaced short palindromic repeats – ed) technology, for which Emmanuelle Charpentier and Jennifer Doudna won the Nobel Prize, there is a clear answer. But, if you ask whether there were such ground-breaking breakthroughs in psychology in the last year or even in the last five years, it is very difficult to say. Of course, there are nice and important works, but I do not see any revolutions.

Breakthroughs in psychology are not very common. Maybe because this science is not so clearly defined. Lists of major unsolved problems for mathematicians can be found on the internet. But when I say that the matter of

Photo: Val Rajasaar

Jüri Allik (right) at the summer seminar of the student scientific association with the main organizer Peeter Lorents.

consciousness is unresolved… Well, what does that even mean? Psychology is not advanced enough, so that the problems can even be worded clearly. It is too vague, indistinct to talk about major upheavals.

In that sense, it could be a bit troublesome as to whether the field I chose was the right one. Still, I have never regretted it because psychology is still extremely exciting.

You and your colleagues have distinguished between the stereotypical and popular perceptions that have truth behind them and the ones that do not. For example, that there are no national differences in the distribution of personality traits, but there are differences between genders. Three decades have been marked by political correctness and so-called cultural wars. What can be done about that?

We are on our way to figuring out what can and cannot be talked about. I hope that Estonia has enough intelligence that it stays in the zone of moderation. If *Uncle Tom's Cabin* and Mark Twain's books already have accusations of racism, then it's all very ridiculous.

A big reason why I stayed in Estonia as a researcher at all is that reaching the ridiculousness of political correctness in America and the United Kingdom quite definitely scares away any ideas of working there. Estonia seems like a nice and lovely place where there is no ridiculousness, but it is gradually growing.

There was a scandalous story when Google fired one of its analysts who had made an internal report on the differences between men and women. Unfortunately for us, he was referring to the work of me, Anu Realo, and some of our colleagues, on the differences between the personalities of men and women. A journalist of the *Guardian* wrote a long story about this and also interviewed me. As a researcher, I can say that we have research and data, the rest are interpretations.

However, when a journalist asks if Google did the right thing in laying off this man, I can only answer as a person and as a citizen, that it was unfair. When a journalist asks if science confirms his claims… I can say that there are facts that confirm that the differences between men and women do not decrease with equal opportunities for the development of society, but rather increase. However, what I cannot say as a researcher, is whether these facts support the conclusions of the Google Analyst's report.

Political correctness puts researchers in a difficult position. There is a huge difference between politics and knowledge.

I have many good friends who act as experts in court. It is very interesting how the judges have to start making a decision based on what an expert says. It is like a quantum leap. There is no single political conclusion from just the facts.

This is a very uncomfortable situation for the researcher, because you never know when the facts you present will be planted on an ideology and passed on to you; knowledge, that we are exploring sensitive fields. You may be accused of racism, gender discrimination, or something else

completely. As psychologists, we are well aware of this. Not very careful, but the feeling that you are in a minefield, where you can blow up, is always there.

So, what can we do to get back to a situation where village priest-level moralisers start to say what facts can be investigated and what can be talked about?
Academic institutions must remain very committed to academic freedom, even in the face of prolific political correctness.-

There is one very bad tendency that I do not like at all in university. One rector of the University of Tartu once said that there is not much difference between a boot factory and a university, in the sense that a university provides a service that the students buy.

In my opinion, a university should definitely not be just a customer-service relationship – that is more like a parody of a university. In other parts of the world, political correctness has often come from university students who apply the model of consumerism: the client decides what can be said at the university. If you are already smarter than a professor, why bother coming to university at all?

A professor's life's work is understanding what is worth teaching at the university and what is not. Someone comes to say, for example, that they do not want to know that women are, on average, a little behind men in terms of spatial imagination and mathematical abilities. Then someone comes and says it is politically incorrect because God created men and women equally. When an ideology begins to dictate, university loses all meaning.

In my opinion, a university is still a noble temple of science where pure knowledge and the right to new knowledge are protected, regardless of what the people or politicians consider to be right. The supremacy of knowledge over ideology is one of the core values of academia.

What is it that makes us optimistic about the future of Estonia and the University of Tartu?
For me, the biggest miracle is that Estonian science is ranked incredibly high. When I started with statistics about science, Finnish science seemed to be so high up that we would never get there. Certainly not in my lifetime.

Three or four years ago, we bypassed Finland and Sweden so quickly that they did not even notice how they were lagging behind.

I have many explanations, albeit not very good ones, as to why Estonian science is so good. Corona hit us pretty hard, but that is also a quality that makes Estonians so good in science. It's not just physics, ecology or genetics. You look at whichever field, and we are doing very well everywhere. There has to be a factor here that makes us move and makes us so successful.

This instils optimism. If only the government was also smart enough to understand that, considering the quality, there is nothing as good as Estonian science and education in the economy. Ten years ago, it should have already been said that out best export is university education, and any kind of education in general.

We know that we have smart children, but there is also something very good in the system that could also be used by others.

INTERNATIONAL COLLABORATION

INTERNATIONAL ORGANISATIONS AND STRUCTURES

In the academic world, scientists are often seen as the official representatives of their country. A dense exchange of information and ideas, quick competence brokering and formation of good practices is taking place through organisations connecting them. The Estonian Academy of Sciences represents Estonian science and scientists at the main science organisations throughout Europe and the world.

The Estonian Academy of Sciences is a founding member of the **International Science Council** (ISC) founded in 2018.

The ISC was formed when its namesake organisation, which was founded in 1931 and focused on classical life sciences, united with the International Social Science Council (ISSC) which was a sister organisation founded in 1952 with a focus on social and humanitarian sciences.

There are two types of International Science Council members. Following the territorial principle, the ISC has one life sciences academy or science council and one social and/or humanitarian sciences academy from each country. Leading international scientific professional associations are also members of the ISC. The main goal for the council is to collaborate with all the scientists of all professions to identify and handle the key problems of science and the globalised society. (See https://council.science/)

Until 1998, the ISC was called the International Council of Scientific Unions or ICSU. The Estonian Academy of Sciences has been a member of the ICSU since 1992. ICSU was one of the founders of a sustainable development programme which has now gained global support. The purpose of sustainable development is to further our lives, so we would not excessively exploit our natural resources that ensure the sustainability of our economy and society, and would not destroy the upkeep of our ecosystem that we rely on. In Estonia, the responsibility for this lays on the shoulders of the Commission for Sustainable Development (https://riigikantselei.ee/et/saastev-areng) created by the Strategy Unit of the Government Office in 1996. The commission was re-organised in 2017 and the Estonian Academy of Sciences is still an active participant in the commission's work.

The **Inter-Academy Panel** (IAP) was founded in 1993 as a global network of academies. Now there are more than 130 international and regional academies. The purpose of this academy is in collaboration with member organisations to advise the wider public, and offer support for various decision-making bodies in scientific aspects of global problems. (See http://www.interacademies.org/)

Several ISC and IAP member academies share the viewpoint of the Estonian Academy of Sciences that these organisations should join or collaborate more often.

The **European Federation of National Academies of Sciences and Humanities "All European Academies"** (ALLEA) was founded in 1994 and combines both classical academies of natural science, as well as academies of humanitarian and social sciences. The Estonian Academy of Sciences is one of the founders of ALLEA. The purpose of ALLEA is to accomplish the exchange of data and experiences to achieve the top level of high aesthetic standards and independent handling of questions regarding science strategy and politics on a European level. Academy member Jüri Engelbrecht was the President of the European Federation of National Academies of Sciences and Humanities in 2006–2011. Academy member Raivo Uibo is a member of the Permanent Working Group on Science and Ethics. (See http://www.allea.org)

The **European Academies' Science Advisory Council** (EASAC, founded in 2001) consists of individual members appointed by the academies of European countries. Estonia joined this organisation in 2004. The central purpose of this council is to direct the competency of these united academies in order to help counsel the EU top organisations and politicians that need to make necessary decisions, which require scientific expertise. In other words, EASAC fills the role of an independent counsel by uniting the top skills and experiences coming from the best academies in Europe.

They have formed networks of experts in three main fields of work (biosciences, energy problems and environment). They handle environmentally important questions, analyse the problems on the horizon and try to predict the scenarios of the problems and their side effects. Through their members, EASAC is consistently in dialogue with political influencers of the member nations trying to help make science-based political decisions in Europe.

The person standing for the the Estonian Academy of Sciences in EASAC is Academy member Jaan Järv. Academy member Tarmo Soomere is a part of EASAC's environmental committee and Academy member Enn Lust is in the energetics committee. Jarek Kurnitski represents the Academy regarding constructing dwellings and decarbonisation of buildings. The results of this research were published in 2021. (See http://www.easac.eu/)

The **International Union of Academies** (Union Académique Internationale, UAI) was founded more than hundred years ago (1919). The union unites all the academies of humanitarian and social sciences in the world to advance collaborative research (incl. joint projects) and help with the wider spread of the research findings. The Estonian Academy of Sciences became a member of UAI in 1998. The Estonian representative "to this union this union is the academician Jaan Undusk.

(See http://www.uai-iua.org/)

The academy has participated in the **European Science Foundation's** work for more than ten years (2000–2011). The organisation was founded in 1974 and was the uniting body for all of the European countries' science institutions (including the Estonian Science Foundation, the predecessor of the Estonian Research Council). There were several advisory bodies on science policy by ESF, such as the European Marine Board and European Polar Board.

By 2017, the ESF had undertaken re-organising the foundation. The advisory boards mentioned before are now fully independent non-profit organisations. The academy continues to advise the European Commission through those institutions.

Anne Glover, who was the science councellor of Manuel Barroso, the President of the European Commission, initiated the establishment of the **European Science Advisors Forum** (ESAF) in 2014. It has been developed into a non-formal network consisting of advisors, experts and scientists that hold advisory mandate from their Government and have a responsibility to provide scientific advice to their Government or help arranging it.

The main goals of ESAF are to:

- provide a forum for EU countries' main science advisors to exchange information and ideas to gain a broader perspective and be better equipped while advising their national governments or European Commission (EC),
- build sustainable capacity and capability across the range of different national science advisory organisations and systems in Europe,
- improve science based political decision-making culture in the EU.

ESAF was convened by the EC Group of Chief Scientific Advisors. A big part of the members of the Forum are the leading scientists, heads of science academies or research councils of the member states. There are also some representatives of Ministries and University professors whom their country has given the necessary mandate to.

ESAF provides a platform for organizations that may function in different systems but share a common ambition to provide the best science based strategic advice. An important task of ESAF is to facilitate sharing and exchange of information, expertise, practices and results. Such exchange does not come natural. It is done currently by means of i) suggestions for advisory topics, ii) feedback on recent advisory work also to other players, such as the SAM the European Commission, iii) by translation of national documents to other languages. ESAF itself has no formal advisory task; however, members of ESAF of course can join forces and provide joint advice.

The wider point in having ESAF or similar structures is that the ways of formulations, formats of messages and channels for communication of the condensed information from academics to the policy-making level are greatly different in different countries and regions. This is natural because of difference in how different countries have built the governance system. A corner stone of ESAF is that the variety of structures and institutions for such advice across different national governments is of great value.

From 1 July 2020, the chairman of ESAF is Tarmo Soomere, the President of the Estonian Academy of Sciences. (See https://esaforum.eu/.)

ESTONIA WILL BE LEADING THE EUROPEAN SCIENCE ADVISORS FORUM

Tarmo Soomere

It is good to think that in the past, science, economy (i.e., production) and leading the country ran hand in hand with each other and things worked like clockwork. The abundance was born when the inventor looked for refined ideas from the lab across the corridor. At the other wing of the building, the engineer thought of the ways how to make the invention work, and at the workshop across the street, the builder was already holding the hammer and the scientist was properly paid with the money from the sales of the product. This was how the well-being and more scientists were created. Until there were far too many scientists. We cannot be entirely certain that it was like this, but surely the sun was brighter, grass greener, native forests were honoured, winters were cold and summers were not half as hot as they are now.

Wisdom is an advantage in contemporary business competition

The matter of fact is that the ties of science and people's well-being have faded significantly. Perhaps the reason for this is partly because instead of that nostalgic hard-working "hamster wheel" type of crowd, there has been a surge in new types of scientists. There is a continuously growing research community that is gaining new knowledge and casting it in the air as publications. Administrators happily count the publications and grade the scientists, but only a few of the world's largest databases have a clue what actually may hide in the ocean of knowledge. Some try to paint the best finds to the public as thrilling. Inventors and entrepreneurs fish for ideas and solutions out of that valuable treasure chest, and on occasion, they may even convert an idea or two into new popular toys.

Wiser (and respectively wealthier) entrepreneurs have decided that that type of fishing will not give them any advantage against the competitors, and have established a more or less similar type of chain within their own company as I have nostalgically tried to describe above. This way of thinking has not yet become common in Estonia.

Smart countries have acted very similarly to successful companies upon the pool of knowledge that scientists have been gathering. They have created science advice systems The idea of this is simple – the scientific information the country requires needs to be gathered systematically and set in a suitable format for the country's governing body, so that it could be one component in the decision-making. Henry Thomas Buckle wrote more than one and a half centuries ago that, prior to his time, the countries where nature was abundant were considered rich, but already in his time the countries with more active people were wealthier. The times have changed to this extent that the wealth of the land is not merely measured by the strength of its science, but also by how well they can use the strength of its science for the wealth of their whole country.

Good advice for the country

In the last decade, providing science advice for policy has largely escalated in the whole world. The International Network for Government Science Advice (INGSA) connects around hundred organisations and hundreds of experts.

Scientific advice has been systematically built up in several Anglo-Saxon countries, such as the United Kingdom, Canada, Australia or New Zealand. These countries have national, state or regional (e.g., Wales) institutions of chief scientific advisors. The United States has organised scientific advice slightly differently – through the analyses and reports of the National Academy of Sciences (NAS). NAS was founded at the peak of the Civil War for pragmatic reasons as a consortium of the smartest people from all over the country, and it fills the role as the network of advisors to this day. The essential role of science academies is to be good advisors. The French Academy of Sciences has been quoted stating that "ever since it was created, the Academy has been resolutely committed to the advancement of science and has advised government authorities in those matters and issues deemed within its remit."

The European Commission is being advised by the Scientific Advice Mechanism (SAM), including the Group of Scientific Advisors consisting of seven leading scientists. There is also the Joint Research Center (JRC) that has a few offices in multiple countries and more scientists working there than there are scientists in Estonia.

Now, a former Commissioner for Research, Innovation and Science Carlos Moedas encouraged the member countries to think seriously about the necessity of science advice in single countries. He did it with the same agenda – the efficiency in gathering necessary information from the top scientists in the country is the pillar of a country's competitiveness. The COVID-19 pandemic has clearly shown its importance. If we in Europe are not able to put this ability in practice, other countries will surpass us.

Stronger together

In Europe, science advice been arranged differently. In the UK, the Government Office for Science is led by professors

and the Chief Scientific Advisor (they also teach the subject at universities). The Director General of Science Foundation Ireland is also the Chief Scientific Adviser to the Government of Ireland. Germany relies on the German National Academy of Sciences Leopoldina. The role of the Chief Scientific Advisor is filled by a government official in Bulgaria and Spain. Slovakia has appointed a government's special representative in the field of science. The Council of Finnish Academies is creating a new concept fit for Finland via the SOFI (Science Advice Initiative of Finland) initiative.

Carlos Moedas helped in setting up the European Science Advisors Forum (ESAF) since 2015. This informal network consists of experts and scientists who hold the national advisory mandate and the responsibility to advise or offer help in providing adequate science-related counsel. As there is no real practice in science advice for policy in some countries, the quick spread of the experience is important. The idea is that we would be stronger if we worked together and in a coordinated manner. We can measure how strong the concept is by looking at the European Union as a whole and admit the old saying, which says that a chain is as strong as its weakest link.

A big part of ESAF's members are the chief scientists of the member countries; the leaders of science academies and research councils, and people who represent state structures or authorised university professors. Wim van Saarloos, who is the President of the Royal Netherlands Academy of Arts and Sciences (KNAW), was the head of that forum. This honourable task has been given to the Estonian Academy of Sciences from 1 July 2020.

The coronavirus pandemic has shown that in some countries (including Estonia), ad hoc chambers of scientists and specialists called in for that occasion have been more successful than professional advising bodies, however, there is nothing amiss. Often the systems we have reflect the skill and strength that was important in the past. In the future, we may need a different kind of skill set and the opportunities to realise those. In this context, the variety of the mandate and the role of the chief scientist and its administration by country and region is a component of Europe's wealth. We do not know what the future brings or what is the best way to use the advice given. As a small country, we may not have as much wisdom at our disposal as bigger and more powerful countries may have. Therefore, the more significant it is to use what we have at the right time – before we find ourselves needing it.

Soomere, T. Eesti hakkab juhtima peateadurite foorumit. – *Postimees*, web publication, 30.06.2020, https://arvamus.postimees.ee/7007496/tarmo-soomere-eesti-hakkab-juhtima-peateadurite-foorumit.

SCIENTIFIC EXCHANGE PROGRAMMES AND SCIENCE DIPLOMACY

Many academies of sciences and humanities are vigorously supporting the international mobility of scientists. One of the results of the agreements between the Estonian Academy of Sciences and its foreign partners is the academic scientific exchange in which all Estonian scientists can participate in. The sums are not grand, but every little helps. The money from budget foreseen for academic exchange is used to finance the guest academics' welcome in Estonia. The expenses for our scientists abroad are covered by partner academies of those countries. The programme is being led by Academy member Jüri Engelbrecht.

Out of 42 collaboration agreements with other countries' national science academies, we have agreed on conditions for 20 cooperation agreements where scientists visits to and from Estonia have been agreed upon. There have been 14 scientific exchanges with partner academies between 2015–2019. In total, 286 foreign scientists visited Estonia and 295 Estonian scientists travelled abroad. We have had tight collaborative relations with Polish and Hungarian Science Academies where we have had fifteen to twenty visits both ways. We have also had numerous collaborations with Latvian, Lithuanian, Bulgarian, Czech Republic and Belarus academies.

As international travel was restricted due to coronavirus, there were only four visits in 2020 by visiting researchers to Estonian universities and science facilities for fifteen days in total. All previously planned collaboration projects between Estonia and Hungary, and Estonia and Bulgaria together with visits between Estonian and Polish scientists have been postponed to 2021.

Maarja Grossberg.

L'ORÉAL-UNESCO BALTIC SCHOLARSHIP

Female scientists with reputable recognitions are working towards a more sustainable environment.

Maarja Grossberg, a scientist from the Tallinn University of Technology and Lisandra Marina Da Rocha Meneses, Junior Research Fellow from the Estonian University of Life Sciences are laureates of the L'Oréal Baltic "Women in Science 2020" programme. They address new opportunities and means for applying and producing renewable energy using the €6,000 scholarship.

Professor Maarja Grossberg is Member and from 2021 President of the Estonian Young Academy of Sciences. She planning to use the scholarship to find and develop new environmentally friendly materials and technologies for solar panels. She claims that the premise for allowing rapid growth in the appliance of renewable energy sources is their diverse means of use. Grossberg has said that "roofs are just a fraction of the potential that facades and windows really offer as they could easily be used in the production of solar power. Our research team is studying and developing solar cell technology and materials that could be integrated into construction elements if used wisely. The new generation environmentally friendly solar cells that we are developing are light, half-transparent and flexible which makes them ideal for various means of use. Our current challenge is to magnify the efficiency of the solar cells. If we could overcome the obstacles, then it'd be a powerful feeling – like the feeling of finishing an unsolved science puzzle."

By using the L'Oréal scholarship, Lisandra Marina Da Rocha Meneses wishes to find more opportunities for producing second generation biomass in a sustainable circular economy and study the usage of various raw materials in the production of biofuels. She states that there is a lack of alternatives for renewable and carbon-neutral fuel that would be ready for industrial production in the Baltic countries' transport sector. "The alternative would be to use less valuable wood, straw or similar material in biofuel production. This would reduce the emission of greenhouse gasses in the transport sector and ensure safety

Photo: Kaupo Kikkas x2

Lisandra Marina Da Rocha Meneses.

of the Baltic States' energy source because it would come entirely from local materials. We are constantly looking for environmentally friendly technologies that would be competitively priced on the market and would enable us to move towards a wastage-free society. I'm certain that these current efforts will change our future remarkably," she said.

Tarmo Soomere, President of the Estonian Academy of Sciences said that the dedication of top female scientists in their field is significant, especially the dedication in developing environmentally sustainable technology and ensuring the safety of our energy source. "These are like beams of light to the future. They break out from conventional understandings and frames, similarly to how electricity did not break out from the continuous improvement of candles," added Soomere.

The L'Oreal Baltic "Women in Science" programme https://www.forwomeninscience.com is the only one in the Baltic States that in collaboration with the Estonian National Commission for UNESCO http://www.unesco.ee/ and the Estonian Academy of Sciences supports the professional development of female scientists and helps women in science to achieve their goals.

For Women in Science

FONDATION L'ORÉAL

INSTEAD OF LINDAU FORUM: ONLINE SCIENCE DAYS

Around 600 young scientists and several dozen Nobel Prize laureates have been getting together on Lindau Island in Germany to exchange knowledge, ideas and experiences since 1951. One cannot purchase a ticket because in order to participate in the Lindau forum https://www.lindau-nobel.org/, young scientists present multiple applications, which will be graded by a special committee each year. The second option is to win the Nobel Prize.

There were 660 young scientists picked out in the beginning of March 2020 to meet the laureates of the Nobel Prize on Lindau Island. Kristja Kalam and Urmeli Katus from Estonia were chosen to participate.

Kristjan Kalam (born 1989) is a doctoral student at the University of Tartu Physics Institute, Department of Material Sciences. He defended his master's thesis at the University of Tartu and continued his studies as a doctoral student on the subject of "Structural and Magnetoelectric Analysis of Multifunctional Nanolaminates and Solid Solutions Grown by Atomic Layer Deposition".

Urmeli Katus (born 1989) is a Methodological Advisor for a guideline development group. She received her master's degree at the University of Tartu in 2015 and followed her studies as a doctoral student on the subject of "Genetic, Behavioural and Environmental Factors in the Etiopathogenesis of Overweight, Obesity and Insulin Resistance". (foto)

Urmeli Katus's impressions

The Lindau interdisciplinary forum 2020 was supposed to take place from 28 June until 3 July. It was cancelled due to the pandemic, and was the first cancellation since the start of the forum in 1951. All the participants who were to attend received an invitation for the forum taking place in 2021. To keep up the spirit of the Lindau Nobel Laureate Meetings, the organisational committee decided to arrange a web-based event called Online Science Days between 28 June and 1 July 2020.

The schedule was busy which was pertinent to the Lindau Nobel Laureate Meetings. The day began at 7 AM and ended at 7 PM. The programme consisted of lectures and discussions where we discussed various topics, including international collaboration in science, the role of science in the COVID-19 crisis, COVID-19 and economy, innovation from evolution, climate change, reformations in teaching, women in science, starting a career in science and life of a scientist. After the lectures, there were

Photo: private collection

Kristjan Kalam.

Photo: private collection

Urmeli Katus.

Signatories of the declaration in Riga.

discussions with Nobelists and young scientists. The daily proceedings included Young Scientists' sessions where the best were given the chance to introduce their scientific work. In addition, the participants had the opportunity to debate between themselves in a virtual environment.

The thought that science and scientists have a significant role in society and especially during the pandemic was particularly substantial during the Online Science Days. We need more scientists who would speak out about finding solutions for problems that are essential to society. Nobel laureates noted that international communication and collaboration in the science community is vital in critical situations, but has reduced due to tough competition and information restrictions in home countries. It is hard to go into science as a young woman when you have to choose between starting a family and a career in science because the science structures in several countries are not yet flexible enough.

LINDAU NOBEL LAUREATE MEETINGS

THE RIGA DECLARATION

The Riga Declaration was signed at the Baltic Sea Science Academies' conference "Innovation – Power of the 21st Century" on 25 February 2020. The main objective of the Riga Declaration is to strengthen scientific cooperation and innovation for further implementation of available and prospective outcomes derived from studies of the Baltic Sea in the context of Horizon Europe.

The Riga Declaration was signed by Professor Ojārs Spārītis, President of the Latvian Academy of Sciences; Professor Arvi Freiberg, Vice-President of the Estonian Academy of Sciences; Professor Jūras Banys, President of the Lithuanian Academy of Sciences; Professor Risto Nieminen, President of the Finnish Academy of Science and Letters; Professor Indriķis Muižnieks, Rector of the University of Latvia; Professor Sergei Kilin, Vice-President of the National Academy of Sciences of Belarus; Aalto University Professor Taina Tukiainen, Leader of the Smart Up Project Consortium; Markku Markkula, Vice-President of the European Committee of the Regions; Kristin Bakken, Academia Europaea Bergen Knowledge Hub Manager on behalf of Professor Eystein Jansen; Academic Director of the Academia Europaea Bergen Knowledge Hub and Professor Eugene Eteris, Expert of the European Commission Smart Specialization Platform.

BRIGHT MOMENTS – A CHOICE OF ACTIVITIES OF SCIENTIFIC SOCIETIES AND INSTITUTIONS ASSOCIATED WITH THE ACADEMY

The Estonian Academy of Sciences may be associated with learned societies and research and professional associations whose activities and objectives are in accordance with the activities and objectives of the Academy.

The association is governed by a bilateral agreement which defines the objectives of the cooperation and the roles and responsibilities of both parties. As of 28 February 2021, 23 societies and professional associations, and 7 research and development or cultural institutions are associated with the Academy.

Bright moments:

The centenary of the founding of the **Academic Agricultural Society** was celebrated with a Vision Conference on 5 December 2020. This forward-looking conference focused on climate change, the green economy, food security, and environmentally friendly management. After the presentation by Marko Kass, President of the Society, on the role of agricultural sciences, Tarmo Soomere, President of the Academy of Sciences, Ülle Jaakma, Vice-Rector for Research at the University of Life Sciences, Sirli Pehme, Entrepreneur, Priit Tammeorg, a researcher at the University of Helsinki, and Liisa Parts, who holds a PhD from Oxford University got to have a word. The conference guided in the jubilee year of the society, during which a collection of the society's history will be completed and an exhibition on the diverse century will be opened.

The most important event of the year for the **Estonian Academic Oriental Society** were the XXXII Orientalist Days on 18 and 19 September in Tartu. The conference "Gods, People, Traditions, and Continuity in Eastern Cultures" was dedicated to the 70th birthday of the Society's Honorary President, Professor Tarmo Kulmar. The jubilee

Photo: Alo Tänavots

President of the Academy congratulates the President of the Academic Agricultural Society Marko Kass on the anniversary of the Society.

Photo: EAO Archive

At the festive reception of the XXXII Orientalist Days at the University of Tartu Art Museum. Opening speech by the President of the Society Märt Läänemets.

himself was among the 18 speakers, and several presentations were dedicated to Professor Kulmar's academic activities in the field of oriental studies and religious studies. The University of Tartu Art Museum also hosted a reception in honour of Professor Tarmo Kulmar.

Under the leadership of the **Estonian Society for the Study of Religion**, in cooperation with the Utopia bookstore and the Tartu Department of the Estonian Writers' Union, two academic discussion groups were held on the topics of anthropology classics published in Estonian this year. In March, a discussion group about Bronisław Malinowski's book *Magic, Science and Religion and Other Essays* took

Photo: Ivo Volt

Discussion on the Bronisław Malinowski's book *Magic, Science and Religion and Other Essays* on 3 March 2020 at Tartu Literature House. From the left: moderator Indrek Peedu, Ain Riistan and Aimar Ventsel.

Photo: Helle-Viivi Tolk

Discussion on the Arnold van Gennep's book *The Rites of Passage* on 11 August 2020, in the yard of Tartu Literature House.From the left: Moderator Indrek Peedu, Ülo Valk (over zoom), Toomas Gross.

Screenshot from application avastusrada.ee

place in the hall of the Tartu Literature House. Ain Riistan and Aimar Ventsel participated, and the discussion was led by Indrek Peedu. In August, a discussion group on the topic of Arnold van Gennep's book *The Rites of Passage* was held in the courtyard of the Tartu Literature House, where Toomas Gross took part, Ülo Valk participated via the web and the discussion was moderated by Indrek Peedu.

In co-operation with the **Estonian Geographical Society**, researchers of Tallinn University, and the Estonian Rescue Board, the Environmental Board created tracks "Outdoor Learning Week 2020" for the platform www.avastusrada.ee, which focus on being safe while in nature. Traditionally, the yearly spring outdoor study week is aimed at school classes, but in this year during the coronavirus pandemic, we invited families to explore the tracks during the outdoor study week (13–19 April) until the end of May.

The "Discovery Trail" is a map-based application which runs on a smartphone browser that allows you to create interactive learning, hiking, and adventure trails. The trails can be educational, adventurous, sporty, or all at once. Everyone can choose a suitable trail from the website, even from home. The trail guides families in nature and asks educational questions at checkpoints. All you need to play is a smartphone or tablet with an internet connection and sharing location enabled. The discovery trail is actively used in environmental education centres (keskkonnaharidus.avastusrada.ee) and schools (kool.avastusrada.ee), but can also be used in the tourism sector (seiklus.avastusrada.ee).

Despite a difficult year, during which most of the meetings had to be cancelled, we managed to organise an autumn seminar "Language – Regular and Disordered" at the **Institute of the Estonian Language** and the Graduate School of Linguistics, Philosophy and Semiotics in Vihula Manor on 15 and 16 October.

The theme of the event is based on the knowledge that language is a regular system, but there is also a certain amount of irregularity in it. There are exceptions to each rule, there are deviations in each pattern. This broad topic

Photo: Kristina Koppel

Participants of the autumn seminar.

Poster of the World Poetry Day.

intrigued researchers from all kinds of different language fields. There were more than 50 participants.

Plenary presentations were given by Kristiina Ross, Leading Researcher of the Institute of the Estonian Language (“On the Disorder of the Estonian Language and Attempts to Organise it in the 17th Century”), Anna Verschik, Professor of General Linguistics at Tallinn University (“Change Due to Language Contacts: Regular or Unpredictable”), and Helle Metslang, Professor Emeritus of the University of Tartu, winner of the F. J. Wiedemann Language Award 2020 (“This Complicated Estonian Language”).

On 21 March, the **Estonian Literary Society** celebrated World Poetry Day. For two years now, a full-day programme has taken place in Tartu, which includes performances by writers in Tartu cafes and bars. By the time the state of emergency was declared, all preparations had been made for World Poetry Day. Although the Poetry Day could not take place as planned, the organisers quickly reoriented, and organised it virtually. All interested parties were invited to post poetry videos recorded during the day, which were then shared on the Poetry Day Facebook page. This was the first major virtual literary event that took place in Estonia after the establishment of the state of emergency. Over the course of the day, more than 80 videos were uploaded, which received more than 5,000 views in total. Posts came from other parts of the world besides Estonia as well. Among the participants were also writers, musicians and actors of different ages.

The most exciting event of the **Art Museum of Estonia** in 2020 consisted of two interrelated exhibitions and discussions about the relationship between the science and art that developed from it. This theme is not new in the art world, but this time, a special ensemble was formed: an exhibition of Ancient Egypt was opened in the Kumu (the new building of the art museum) Great Hall, and an exhibition of artists and works inspired by the Center for Nuclear Research (CERN) on the fifth floor. The time difference between the creation of the different works was more than 40 centuries. On the one hand, it is an impressive display of time travel, but on the other hand, it gave rise

Photo: Museo Egizio / Kumu

Boat model. Middle Kingdom of Egypt 1980–1700 BC.

Activities of the Estonian Naturalists' Society (ELUS) in pictures

Photo: Oliver Kalda

1. Activities of the Estonian Theriological Society. Lecture before the bat trip to the Tallinn Zoo at night.

Photo: Vello Liiv

2. Activities of the Estonian Mycological Society. A group of participants of the 2020 autumn camp in Viljandi County.

Photo: Külli Kalamees

3. Activities of the Estonian Mycological Society. Cladonia stellaris was chosen as the mushroom of the year 2020.

Photo: Kai Vellak

4. Activities of the Botany section. Pincushion moss was selected as the moss of the year 2020 in the magazine *Samblasõber*.

to serious discussions on how to define and present non-aesthetic phenomena in the art museum.

Both the invaluable collection of Museo Egizio, which is studied as our historical and archaeological heritage, and the research of CERN as a basic material for artists are based on comparable principles and depend on the museum's context as an exhibition. The co-presentation of the exhibitions rendered meaningless the possible complaint that objects of ordinary Egyptian life are exhibited, and not art in the narrower sense because we did the same with our modern exhibition.

Photo: Sandra Saar, University of Tartu

Panel discussion in the white hall of the University of Tartu Museum. Panelists (from the left): moderator Signe Ivask, economist Erik Terk, professor of comparative sociology Marge Unt, social scientist Marju Lauristin, investigative journalist Holger Roonemaa, sociologist Mikko Lagerspetz.

The 15th annual conference of the **Estonian Economic Association** "Sustainable Estonia" took place in Laulasmaa on 23 and 24 January 2020. The main topic of the conference was the role of economics in supporting and achieving sustainable development. In his academic main presentation, Professor Matti Liski of Aalto University focused on theoretical and practical issues of climate policy implementation, introducing policy measures to curb climate warming and analysing their effectiveness and efficiency.

The presentation sparked a lively debate, as meeting Estonia's climate goals and the goals of the European Green Deal requires significant and far-reaching structural changes in the Estonian economy and resource use. For the first time, several panel discussions and sessions of the conference focused on the challenges of climate policy and meeting climate goals from an economical perspective.

The most important event of the **Estonian Association of Sociologists** in 2020 was the conference "How to Make Sense of Transition Periods?" which was organised on 15 October in cooperation with the Institute of Social Sciences of the University of Tartu. The coronavirus pandemic inadvertently placed presentations and discussions focusing on the relationship between society and science, and on understanding the changes taking place in society in a new light. One of the reasons for the event was the collective monograph *Researching Estonian Transformation: Morphogenetic Reflections*, which

Photos: EMS Archive

The 15th annual conference of the Estonian Economic Association "Sustainable Estonia."

analyses various aspects of the transformation of Estonian society, and this was reviewed at the conference by Professor Mikko Lagerspetz of the Åbo Academy.

The first half of the conference day was dedicated to the representative sociological study's "Me. The World. The Media" results and their interpretation through a new theoretical synthesis. This study was conducted over the last two decades. The conference was opened by Professor Veronika Kalmus with a presentation on the Estonian transition trip, followed by Professor Marju Lauristin's insight into the reasons for Estonia's successes and declines since 1988. Ragne Kõuts-Klemm and Professor Triin Vihalemm analysed the interactions between media and society, and Professor Triin Vihalemm introduced the possibilities of researching social agency by the method of cluster analysis. The day ended with a heated discussion "Can social scientists explain the past and predict the future?"

A collage of bright moments of the Estonian Crop Research Institute.

Photo: Terje Varul

Participants of the science camp flying blow missiles.

In 2020, the **Estonian Crop Research Institute** (Eesti Taimekasvatuse Instituut, ETKI) celebrated its 100th anniversary safely and with dignity. In January, the work of art "Tera" was opened in the yard of the new breeding centre and an author's evening took place, where the creators of the sculpture Fred Truus and Rainer Kaasik-Aaslav introduced their work to all interested parties. Exactly one hundred years after the beginning of plant breeding in Jõgeva (11 May 1920), a hundred candles were lit by the track, which leads from the first work building to the newest building of ETKI – the breeding centre.

The web conference "Estonian Crop Research Institute – 100 Years in the Service of a Farmer" took place on 29 October. During the conference, there was the film premiere of *Eesti Taimekasvatuse Instituut – 100 aastat sordiaretust Jõgeval* (*Estonian Crop Research Institute – 100 Years of Plant Breeding in Jõgeva*), coordinated by ETKI researcher Ilme Tupits.

The Estonian Mother Tongue Society celebrated the European Day of Languages with an annual student conference on 25 September at the University of Tartu. Those interested could also follow the presentations through the Internet. One of the aims of the society is to arouse public interest in the language, and to promote the academic communication of philologists. With the conference, we can fulfil another important aspect in our activities: to encourage young researchers to take up language issues, and to offer the opportunity to present their results in academic form.

Last year's conference stood out with the wide range of speakers, countries, and languages covered: Estonia, the Czech Republic, Bulgaria, Russia, Germany and Iraq. One presentation was given in sign language with a translation into Estonian. A total of 13 presentations were given in the general section, and in the two thematic blocks: "Language as a Mirror" and "Language Learning and Development" (see also https://www.emakeeleselts.ee/teated/emakeele-seltsi-uliopilaskonverents-25-09-2020-tartus/).

Photo: Raul Veede

Lea Leppik introducing the exhibition.

Good education is the basis of research and innovation. That is why popularisation and promotion of education have always played an important role in the **Tartu Observatory** of the University of Tartu. In the summer of 2020, for the first time ever, the observatory organised a science camp for primary and secondary school children. Through playful activities, the children of the camp were introduced to all the research directions of the observatory for three days.

It is only possible to tell and inspire such young children about science through age-appropriate hands-on activities. Satellite communications were clarified using an Arduino electronics kit, positioning with a compass and ruler, fieldwork for water remote sensing was carried out on the shores of a local pond, and the possibility of life outside planet Earth was introduced using a mural of the Andromeda galaxy. The members of the winning team of the *Vikerraadio* children's quiz "Mini Tournament" also took part in the camp.

After the regular annual meeting of the **Estonian Union of the History and Philosophy of Science**, the renewed exhibition of the University of Tartu Museum was inspected on the afternoon of 27 August under the guidance of Lea Leppik.

TALLINN UNIVERSITY

Due to the crisis, the **Academic Library of Tallinn University** had to design and offer contactless services because the readers' interest in borrowing printed materials was still high. Since February 2020, the e-catalogue ESTER provides the EPIK service for adding cover images, tables of contents and a short descriptions of the content to the entries of separate items.

Several events took place regardless the pandemics:

- The conference "Kotzebue-Gespräch IX" on 9 October in the Freie Volksbühne Berlin.
- On 17 February, the academic library hosted the XI Bibliography Day of Endel Annus. The focus was on local and personal bibliography and Endel Annus as the bibliographer and book historian on the occasion of the 105th anniversary of his birth.
- Within the year, several larger and smaller book and art exhibitions were organised, most of them dedicated to the anniversaries/birthdays of Estonian writers or other great figures.
- Four book fairs were organised at the library within the year, where anyone interested could purchase publications that the library collections had in surplus.

Estonian Literary Museum

The **Estonian Literary Museum** runs four departments: the Archival Library, Estonian Folklore Archives, Estonian Cultural History Archive and Department of Folklore. In 2020, the whole institution has dealt with different strategic themes – the role of the Literary Museum among the Estonian research and memory institutions, topics and areas that should be the niche of the museum.

Another activity in which the Estonian Literary Museum and actually all institutions of humanities research are involved is managing the Centre of Excellence in Estonian Studies. 2020 was a productive year for the Centre of Excellence. The reaction was constructive – in August, the first international COVID-19 conference of Estonian researchers of humanities took place. The research also addressed other important areas, such as migration and diaspora, health and environmental issues, or problems related to artificial intelligence (including ethical aspects and the trustworthiness of artificial intelligence). We also actively contributed into the action plan on digitisation of Estonian cultural heritage (2019–2023). The Archival Library is responsible for digitising printed materials, the Estonian Cultural History Archive and the Folklore Archives digitise collections of documents and photos.

EESTI RAHVA MUUSEUM
Estonian National Museum

In 2020 due to COVID-19 the **Estonian National Museum** was temporarily closed, all scheduled events, conferences and meetings of the international network were cancelled, held online or postponed until 2021. In 2020, the museum had over 100,000 visitors from more than 70 countries. The main attractions were permanent and temporary exhibitions (including the fairy tale exhibition "Elas kord" (Once Upon a Time) organised with the Estonian Literary Museum), cultural and educational events (over 300), educational programmes (almost 400) and tours (almost 300).

The research in the Estonian National Museum focused on Estonian and Finno-Ugric ethnology and museology. Two research conferences took place where the history of ethnology and the modern context of heritage were discussed:

- the 100th anniversary of the birth of the traditional costumes' researcher Aino Voolma,

- the 120th anniversary of the birth of the food culture researcher Aliise Moora was celebrated.

The researchers of the Estonian National Museum delivered presentations at almost 20 research conferences, published 15 scientific papers and 45 popular science articles.

The general meeting of the **Society of Estonian Areal Studies** took place at the end of the summer 28 August in Tallinn. New board members were elected. Kalju Idvand replaced Ene Luka in the Board. From the publications (co-)authored by the members in 2019, Märt Karmo's 2-volume substantial historical treatment of Tallinn Secondary School of Science (*Tallinna Reaalkool kannatuste aastast ikestatud aega. I ja II*), Milvi Hirvlaane (*Erastvere raamat. Kanepi*) Taivo Kirm (*Kastre vald ajajoonel. Aastad 1917–1920*) were noted as influential treatises.

A Museum Day took place on 10 September in Rapla County. Keila Parish Days were held on 19 September in Keila. The memorial day of Sergei Seeland in the community centre of Sulu took place on 21 November. On 3 October, a training session was organised for Jõgeva County enthusiasts (A. Ristkok). Vaike Hang, an enthusiastic researcher of Pärnu County villages and their histories arranged several exhibitions displaying the materials about Pärnu and Tartu counties.

In 2020, four lecture evenings took place at the **Estonian Learned Society in Sweden** and the festive events to celebrate the anniversary and the 101st anniversary of the Estonian-language university. The annual meeting of the ELSS on 06 March contained a viewing of the documentary: "Marju Lepajõe. Päevade sõnad" (2019, director: Vallo Toomla) and a conversation with Priit Rohtmets, Senior Research Fellow at the University of Tartu (moderated by Tiit Pädam). On 5 November, Mai Raud Pähn's 100th anniversary was celebrated. On 1 December, the traditional festive meeting to mark the 101st anniversary of the Estonian-language university was arranged online.

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In total, 10 presentation meetings were held by the **Estonian Learned Society.** At the annual meeting held on 29 January, the Chair of the Society Taavi Pae gave the presentation "Learned Estonian Society and the National Atlas". By the time of the annual meeting the *Yearbook of the Learned Estonian Society* based on the presentation meetings of 2018 was published. On 21 December, the Estonian Learned Society, the University of Tartu and the Academy of Sciences organised a conference "Who Does the First Constitution of Estonia Look Like?" to celebrate the 100th anniversary of the adoption of the first Constitution of Estonia.

EESTI MUUSIKATEADUSE SELTS

With the Department of Musicology at the Estonian Academy of Music and Theatre, preparations by the **Estonian Musicological Society** were made for the release of the 12th issue of the musicological yearbook *Res Musica*. The issue was published in November and focused on two areas, ethnomusicology and history of music. The articles discuss polymusic in different songs of lament and "embodiment" in learning and teaching vocal folk songs. The topics music history stem from selected papers delivered at the conference: "Urban and Court Culture in the Early Modern Baltic Sea Region," which was held at the Estonian Academy of Music and Theatre, Tallinn, on 2–3 May 2019.

The **Estonian Physical Society** organised 30–31 October 2020, the Autumn School in Natural and Exact Sciences, where 57 teachers and students discussed topical issues of teaching physics. In cooperation with the University of Tartu Youth Academy, the programme on physics, chemistry and biology workshops was continued and workshops were arranged in 42 Estonian schools. The development and publication of e-textbooks and Estonian-language study materials continued. The Science Bus activities were regularly carried out and another group of young science popularisers were trained, who started their work.

On 13–14 August, the Division of Teachers of Physics and the Estonian Craft Teachers Association (Chair: Andry Krikkul) organised a Summer School. The virtual day and the autumn seminar of Physics teachers took place. The EPS Society of Physics Students continued the programme: "A Student to the Physics Class," wherein students of physics and materials science teach physics in Estonian schools.

EESTI INSENERIDE LIIT
ESTONIAN ASSOCIATION OF ENGINEERS

In 2020, the focus of the **Estonian Association of Engineers** (EAE) was on promoting natural and exact sciences and technology for learners of all school levels. Two Engineers' Days took place – on 3 March in Tartu (within the Entrepreneurship Day at the Estonian University of Life Sciences) and on 12 March in Narva.

The EAE has initiated and for a long time prepared the Nobel project of the Estonian Science and Technology Centre, which aims at informing the general public of technological opportunities and the role and responsibilities of engineers in the dynamic system of developing technological culture. In 2020, the Riigikogu decided to approve the project and include it in the list of cultural objects of national importance.

A public competition was organised for electing the 2020 Engineer of the Year and the Technology Student of the Year. Arvi Hamburg, PhD in engineering and President of the Estonian Association of Engineers for 14 years, was named the 2020 Engineer of the Year. Erki Teder, year 5 student of the Tallinn University of Technology (Industrial and Civil Engineering), was elected the Student of the Year.

Eesti Biokeemia Selts
Estonian Biochemical Society

In 2020, the Spring School of the **Estonian Biochemical Society** did not take place due to the restrictions established because of the COVID-19 pandemic. The Board decided to use the unspent funds for awarding two first prizes for the best research papers by students. The first prizes were awarded to Anna Zadorožnaja (Tallinn University of Technology) for co-authoring the article: "Copper(II)-Binding Equilibria in Human Blood Published in the Scientific Reports" and Leenu Reinsalu (National Institute of Chemical Physics and Biophysics) for co-authoring the article: "Mitochondrial Respiration in KRAS and BRAF Mutated Colorectal Tumors and Polyps" published in the *Cancers* journal.

EESTI SEMIOOTIKA SELTS
ESTONIAN SEMIOTICS ASSOCIATION

In 2020, the **Estonian Semiotics Association** (ESA) started in cooperation with the University of Tartu Department of Semiotics, Tallinn University School of Humanities and the Juri Lotman Semiotics Repository, its most extensive project – organising the 100th anniversary since the birth of Juri Lotman in 2022. A dedicated website (www.juri-lotman.ee) was designed, a preliminary programme was drafted and preparations for the international congress "Juri Lotman's Semiosphere" taking place on 25–28 February 2022 in Tallinn and Tartu were started.

The traditional prize: "Semiootiline jälg" (Semiotic mark) was awarded to the PhD student at the University of Tartu Department of Semiotics Alexandra Milyakina.

ig Eesti InimeseGeneetika Ühing
ESTONIAN SOCIETY of HUMAN GENETICS

The 2020 Annual Conference of the **Estonian Society of Human Genetics** took place online on 19 November. The main topics were the history of pandemics and studies based on old DNA, modelling of epidemics, peculiarities of immune response to COVID-19 and possibilities of molecular diagnostics, applications of clinical genetics, links between psychology and genetics, and factors influencing the survival of neurons.

The Society's 2020 Lifetime Achievement Award was given to the Member of the Academy of Sciences, Professor Mart Saarma (Laboratory of Molecular Neuroscience at the Institute of Biotechnology, University of Helsinki).

In 2020, the discussions in the **Estonian Chemical Society** were held online and mainly focused on education and perspectives of chemistry, development of the nomenclature and terminology, and other similar issues. The Society supported the publication of the collection *Reliable Measurements in Chemistry* (TalTech Publishing).

The Ministry of the Environment and the Ministry of Social Affairs had asked an opinion of the **Estonian Society of Toxicology** on the new strategy on chemicals: "Chemical Strategy for Sustainability: Towards a Toxic-Free Environment". We stressed the importance of research in realising this ambitious strategy, especially in identifying toxicity and mechanisms of action of substances. We also suggested that in the implementation process of the strategy, the Society could represent Estonia's interests in exchanging information with the European Commission.

On 10–11 January, the traditional information days of the **Estonian Mathematical Society** (EMS) took place in Tallinn. On 17–19 August, the 17th Estonian Days of Mathematics took place in Võru County.

The open mathematical competition is held twice a year, this year on 26 September and 12 December (online).

The EMS also grants a student prize. It is awarded to bachelor's degree students for substantial achievements in mathematics and mathematical applications. The prize was awarded to Tähvend Uustalu for the B.A. thesis "Short Preexact Sequences in the Category of Preordered Ω-algebras" (University of Tartu, 2020, supervisor Prof. Valdis Laan).

The aim of the publication prize of the EMS is to recognise successful young researchers for theirpublications in an international journal on mathematics. The prize was awarded to Andre Ostrak and Kristo Väljako for the articles "Characterisation of the Weak-Star Symmetric Strong Diameter 2 Property in Lipschitz Spaces" (*Journal of Mathematical Analysis and Applications*) and "Monomorphisms in the Category of Firm Modules" (*Communications in Algebra*), respectively.

Due to the pandemic, the traditional general meeting of the **Estonian Academic Theological Society** took place later than usual, on 16 October. At first, the participants listened to the presentation delivered by Indrek Peedu, Lecturer in Religious Studies at the University of Tartu School of Theology and Religious Studies, "Evolutionary Thinking in the Comparative History and Theology in Estonia in the 1920–30s." The presentations and the relevant discussion revealed that the developments in Estonia have not been viewed in a wider background sufficiently, and the changes definitely need to be mapped.

ESTONIAN ACADEMY PUBLISHERS

Photo: Piret Lukkanen

Piret Lukkanen, the new Director of the Estonian Academy Publishers with the 2020 harvest.

The Estonian Academy Publishers in cooperation with Estonian universities publishes seven internationally peer-reviewed open access scientific journals reflected in the leading international databases, such as Web of Science and SCOPUS. In 2020, a total of 137 scientific articles were published in 23 issues. All magazines can be read in full at https://kirj.ee/.

Linguistica Uralica

In the first issue of 2020, the article "Die ostseefinnische Bezeichnung für den Zapfen bzw. Wirtel von Nadelbäumen **kerk(k)ä*" (The Finnic Word **kerk(k)ä for the Cone or Whorl of Coniferous Trees*) investigates the origin of Lembit Vaba Baltic Finnish words.

This word stem occurs in Estonian only in coastal dialects: *`kärgas* 'spruce or pine cones'. It is more common in other Baltic Finnish languages: Votic *kärkki ~ kärkkü* 'spruce and pine cone; catkin' (Ingrian or Finnish loan), Finnish *kerkkä ~ kärkkä* etc. 'top whorl of a conifer (especially pine), pine branches, the annual growth of the top or branches of a conifer, annual shoot; cone; ski pole ring basket, etc.', *kerkko* 'bulrush (*Typha*), spadix of Water Arum', Ingrian *kärkkä* 'cone; bunch (of berries), cluster', Karelian *kerkkä* 'annual shoot, annual growth; ski pole ring basket; *mütt* (plunger-like auxiliary tool for fishing), disk at the end of the *mütt*, etc.', Ludic *kerk* 'lower part of *mütt*'.

The presumed Baltic loan base is **kerk-*, which is followed by Lithuanian *kìrkužė*, *kérkužis*, etc. 'pine, spruce cone' and Latvian dialects *ķirkuôzis*, *cìrkuzis*, etc. 'cone'. The semantics of the Baltic Finnish vocabulary support the assumption that the Baltic **kerk*-family is related to Lithuanian *kerkulė* 'two or more trees growing from one

stump', *kerkutys* 'a branch with two or more forks' and *kérkūlė*, *kérkutė* 'mound, cluster'. The substitute for Baltic *e* in the Baltic loans of the Baltic Finnish languages is generally *e*, as in this case here. Language-wise, innovative phonetic developments have taken place in the analysed word family. An adaptation to different inflection types and derivation patterns can also be observed. The development in the meaning of the Finnish and Karelian *kerkkä* 'top whorl of a conifer' → 'ski pole ring basket' is supported by the description of an ancient type of ski poles from Rääkkylä, North Karelia, Finland: the ski poles were made of young spruce, where one whorl was left unclaimed, and was wrapped around the trunk and tied so that it formed a ring to prevent it from sinking into the snow. Metaphorical developments in the meaning include 'churning plunger; disk at the end of the fishing *mütt*; *mütt*; etc.

Väino Klaus, Editor

Vaba, L. 2020. Die ostseefinnische Bezeichnung für den Zapfen bzw. Wirtel von Nadelbäumen **kerk*(*k*)*ä* [The Finnic Word **kerk*(*k*)*ä* for the Cone or Whorl of Coniferous Trees]. *Linguistica Uralica*, LVI, 1–5. https://dx.doi.org/10.3176/lu.2020.1.01

The **Estonian Journal of Earth Sciences** (EJES) is an international open access publication where Estonian and foreign geologists, geographers, oceanographers, climatologists, soil scientists etc. publish the results of their work. In its current form, the EJES has been published since 2007, but the beginning of the magazine goes much further: in 1952, the first volume of *Proceedings of the Academy of Sciences* was published. If counting from there, the EJES has reached its 69th anniversary and a dignified jubilee is on the horizon.

In 2020, there was an important date for the Estonian geological education and science: in 1820, the Chair of Natural Sciences and Mineralogy was established at the University of Tartu, and the Office of Mineralogy was opened, where Professor Otto Moritz Ludwig von Engelhardt began his work. The EJES celebrated the 200th anniversary of our geological education with a special issue in December. It contains ten articles, most of which have been written by researchers at the University of Tartu, and the topics involve different directions of geological sciences ranging from the structure of Earth's deep interior and puzzling fossils to climate change after the ice age and the chemical composition of groundwater (Kirsimäe *et al*., 2020a).

Several research objects of Estonian geologists have remained in focus for well over a century, but the scientific hypotheses and methods used have changed a lot over time.

A good example of this is the article by academic Kalle Kirsimäe and co-authors on Cambrian blue clay (Kirsimäe *et al*., 2020b), which appeared in a special issue. This striking layer of clay and the fossils found in it were also well known to 19th century geologists. But they probably could not imagine the conclusions that geologists would draw in 2020 from an X-ray diffractometric study of the crystal lattice of blue clay minerals and modelling of the heat flux of the earth's crust.

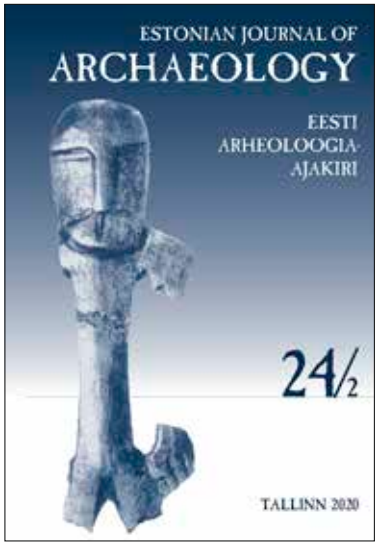
These findings may play an important role in understanding the processes of clay mineral change in general. We cannot predict future research methods either, but one thing is certain: the approximately 525-million-year-old blue clay will not disappear from the Estonian earth's crust, and it offers new information about the planet's development history and geological processes in centuries. Our pioneering discoveries are probably being used now and will be referred to in the future, just as we are quoting the great figures of Estonian geological science again and again from the 19th and 20th centuries.

Olle Hints, Editor-in-Chief

Kirsimäe, K., Hints, O., Meidla, T. 2020a. Two Hundred Years of Geology Education in Estonia. *Estonian Journal of Earth Sciences*, **69**, 175–176. https://doi.org/10.3176/earth.2020.22

Kirsimäe, K., Somelar, P., Jõeleht, A. 2020b. Illitization of the Lower Cambrian (Terreneuvian) Blue Clay in the Northern Baltic Palaeobasin. *Estonian Journal of Earth Sciences*, **69**, 200–213. https://doi.org/10.3176/earth.2020.14

The 24th anniversary of the **Estonian Journal of Archaeology** is remarkable with several articles from Estonian, Latvian, Finnish and Russian archaeology. Thus, Kaarel Sikk and co-authors present an overview of the site selection of Estonian Stone Age settlements and its connections with the former natural environment as a summary of long-term fieldwork. A team of authors, led by Heidi Luige, published a thorough study of the horn combs of Salme's burials. This is also the first article in our magazine about the extremely rich find of this unique



antique in Europe. Hopefully, new research will be added soon.

Alise Gunnarssone from Latvia, together with co-authors, analyse Raušas lipids found on the pottery of a 11th- to 13th-century settlement and cemetery, identifying the diet of ancient Livonians. Surprisingly, it was dominated by seawater fish, beef, and milk, and very few traces of plant-based food were found. However, Aija Ērkšķe, on the example of Latvia, focuses on the widespread problem of why the number of infertilities in Iron Age cemeteries is much lower than the high (child) mortality at that time would assume. An article by Jari-Matti Kuusela (*et al.*) is dedicated to the development of the trade network in Northern Fennoscandia in the first half of the second millennium, and Denis Jolshin presents recent achievements in the study of medieval brick production in Novgorod.

Valter Lang, Editor-in-Chief

Sikk, K., Kriiska, A., Johanson, K., Sander, K., Vindi, A. 2020. Environment and Settlement Location Choice in Stone Age Estonia. *Estonian Journal of Archaeology,* **24**(2), 89–140. https://doi.org/10.3176/arch.2020.2.01

Luik, H., Peets, J., Ljungkvist, J., Maldre, l., Maldre, R., Allmäe, R., Muñoz-Rodríguez, M., McGrath, K., Speller, C., Ashby, S. 2020. Antler Combs from the Salme Ship Burials: Find Context, Origin, Dating and Manufacture. *Estonian Journal of Archaeology,* **24(1),** 3–**44.** https://doi.org/10.3176/arch.2020.1.01

Gunnarssone, A., Oras, E., Talbot, H. M., Ilves, K., Legzdiņa, D. 2020. Cooking for the Living and the Dead: Lipid Analyses of Rauši Settlement and Cemetery Pottery from the 11th–13th Century. *Estonian Journal of Archaeology,* **24**(1), 45–69. https://doi.org/10.3176/arch.2020.1.02

Ērkšķe, A. 2020. The Children are Missing! Some thoughts on the Underrepresentation of Non-Adult Burials in Latvian Iron Age Cemeteries. *Estonian Journal of Archaeology,* **24**(2), 161–189. https://doi.org/10.3176/arch.2020.2.03

Kuusela, J.-M., Salmi, A.-K., Äikäs, T. 2020. Hunters, Fishers, Traders – An Archaeological and Zooarchaeological Perspective on the Development of the Late Iron Age and Medieval Northern Fennoscandian Trade Network. *Estonian Journal of Archaeology,* **24**(2), 141–160. https://doi.org/10.3176/arch.2020.2.02

Jolshin, D., 2020. Bricks for the Country of Wood: Brickmaking Practices in Mediaeval Novgorod (11th–13th centuries). *Estonian Journal of Archaeology,* **24**(1), 70–85. https://doi.org/10.3176/arch.2020.1.03

Acta Historica Tallinnensia

Estonian historical science in the 21st century

This article offers a quantitative overview of the development and organisation of Estonian historical science in the first two decades of the 21st century. Five topics are examined in more detail. An overview of the current state of Estonian historical science is given (how many historians there are in Estonia, what is the future of historians etc). The most important institutions of historical research (universities, research centres, archives, museums, libraries and societies) are described. An overview of the competitive financing of historical science is provided (how much the Estonian country has financed historical science, what are the main sources of funding and the most important funding trends). The publishing practices of historians and the most important communication channels (what, where, in what language, and how much Estonian historians publish) are introduced. And finally, some observations are made about the substantive development trends of Estonian historical writing in the last two decades.

The total number of professional historians in Estonia is about 400. The study of history is primarily concentrated in two centres: University of Tartu and Tallinn, in addition to larger museums and the National Archives. In the last twenty years, Estonia has invested 13,345,417 euros in competition-based grants in the field of history, archaeology and art history. In order to get the overall picture, basic funding must be added to this, as well as funding for higher education, but unfortunately it cannot be calculated separately in the field of history. Although the increase in funding for the historical field has been clear in numbers, the gap between applications submitted and funded has widened, i.e., competition has clearly intensified. For a long time, the success rate

of applications remained at around 20–30 per cent, but since 2015, it has been 6–14 per cent, which is very low in international comparison as well.

At the time of publication, the new century has marked a real explosion in Estonian historical science. About a dozen scientific journals or yearbooks in the field of history are currently published in Estonia per year, and in addition, almost thirty memory institutions publish a series of their proceedings. Several popular scientific history journals are published. Academic and private publishers publish at least half a hundred original history books every year.

Estonian historians, archaeologists, and art historians publish at least a few hundred scientific articles a year in both domestic and international scientific publications. Most research articles are published in English (46 articles by historians of Tartu and Tallinn University). In the case of scientific monographs, Estonian language still dominates (73 percent). Of the substantive trends, great attention is paid to the writing of review works (from the multi-volume *Eesti ajalugu* (*History of Estonia*) to specific approaches in *Eesti kunstiajalugu* (*History of Estonian Art*), *Eesti kooli ajalugu* (*History of Education in Estonia*), *Eesti linnaehituse ajalugu* (*History of Estonian Urban Development*) etc). There is also a growing interest in cultural and historical issues, while there has been a decline in interest in previously popular agricultural history. The fruits of the "digital revolution" of Estonian historical science can probably be seen first and foremost in the next few decades.

Marek Tamm, Editor-in-Chief

Tamm, M. 2020. Eesti ajalooteadus 21. sajandil: sissejuhatuseks (Introduction to Estonian historical science in the 21st century). *Acta Historica Tallinnensia*, **26**(1), 3–45.

An outstanding article of 2020 in the journal *Oil Shale*

The article "Major, Trace and Rare Earth Element Geochemistry of Coal and Oil Shale in the Yuqia Area, Middle Jurassic Shimengou Formation, Northern Qaidam Basin" by Yueyue Bai, Qingtian Lv, Zhaojun Liu, Pingchang Sun, Yinbo Xu, Jingyao Meng, Qingtao Meng, Wenquan Xie, Junxian Wang, and Kebing Wang, is a summary presentation of the research results of a large group of authors from different organisations.

These authors have also published the results of their research in our journal in previous years. Extensive citing their papers shows that there is interest in these works. The paper presents chemical-mineralogical studies of geologically intertwined oil shale and coal deposits with sedimentary properties of the Qaidami deposit in the Yuqia region. The article compares the coal and oil shale sedimentary rocks of the Yuqia region together, and analyses their inorganic geochemistry, such as the occurrence of trace elements and rare earth metals in the deposit, as well as the possible sources of origin of these. So far, oil shale and coal have been treated separately. The number of cited sources in the article (85) is also significant, as this convinces us that the authors are thoroughly aware of previous research in their field.

Andres Siirde, Editor-in-Chief

Bai, Y., Lv, Q., Liu, Z., Sun, P., Xu, Y., Meng, J., Meng, Q., Xie, W., Wang, J., Wang, K. 2020. Major, Trace and Rare Earth Element Geochemistry of Coal and Oil Shale in the Yuqia Area, Middle Jurassic Shimengou Formation, Northern Qaidam Basin. *Oil Shale*, **37**(1), 1–31. https://doi.org/10.3176/oil.2020.1.01

TRAMES. Sacred places and landscapes as monuments

Last year, Trames made a lot of interesting and important contributions. One of the closest to my heart is the article by Mare Kõiva, Tõnno Jonuks, Mare Kalda, Andres Kuperjanov, and Reet Hiiemäe (Estonian Literary Museum and Centre of Excellence in Estonian Studies): "Marking of Sacred Places". This study provides an overview of how the sacred space is created, and how all the monuments in it are used. For most religions, nature has been an important medium, and to a greater or lesser extent, all religions, whether Christians or Gentiles, use nature or its sanctity as a metaphor for religion. The emphasis is on the continuity of traditions and the fact that man and nature form a whole.

The Estonian country has taken, and is taking, natural sanctuaries under protection. Mare Kõiva and her research group show how the sacred space is constructed and what monuments and monuments

are part of it. It is also important how the citizens' initiative and the village movement, local governments, museums, researchers, but also just people, participate in the creation, protection, and celebration of natural sanctuaries with sculptures, for example. This way, the landscapes and their sanctuaries have been multidimensional and a strong connection with our past and folklore has been established.

The approach of Mare Kõiva, and her research group, is complemented by the approach of Lars Rhodin and Sun Jiuxia (Sun Yat-Sen University, Zhuhai, People's Republic of China) about the Sámi land as a monument. They emphasize that man-made artifacts are generally considered to be monuments, but for many indigenous peoples, such as the Sámi, landscapes are important and parts of them can have the function of monuments. Landscapes help them remember events and individuals, and recall the glory of the past. Today, an important dilemma is that on one hand, many Sámi value traditional values and landscapes, and on the other hand, some Sámi and enterprises, for whom landscapes are rather a usable resource, do not consider the value of landscapes as a monument.

A comparison of these two articles reveals that the Sámi, divided between several countries, have an example to take from Estonia in protecting their sacred landscape. Estonians must also be aware that our natural sanctuaries are subject to economic pressure, where instead of cultural and spiritual values, only resources are seen. The protection of sacred places only interferes with the management of these places.

Urmas Sutrop, Editor-in-Chief

Kõiva, M., Jonuks, T., Kalda, M., Kuperjanov, A., Hiiemäe, R. 2020. Marking of Sacred Places. *Trames*, **24**(2), 129–144. https//doi.org/10.3176/tr.2020.2.01
Rhodin, L., Jiuxia, S. 2020. Landscape as Monument: Sámiland and its Contested Patrimony. *Trames*, **24**(4), 487–504. https//doi.org/10.3176/tr.2020.4.01

Reflections on the Proceedings of the Estonian Academy of Sciences before the publication of its 70th volume

The first volume of the *Proceedings of the Estonian Academy of Sciences* was published in 1952. Some years later, the journal was split into a specialised series that covered the fields of science, natural and social sciences. In its present form, the journal exists from 2008, when the series of mathematics, physics and chemistry blended into one. In 2014–2015, also the journals on engineering and ecology were merged, which had existed as separate series for some time. Today, the *Proceedings of the Estonian Academy of Sciences* is the only scientific journal in the world reflecting the name of the Academy (https://kirj.ee/proceedings/).

The reform of 2008 did not only mean changing the name of the journal – in addition to its format and layout, several substantial changes were made. One of the most significant changes was the publication of the electronic version apart from its printed issue. This in turn provided an opportunity to follow the principle of providing open access to research publications (https://www.openaccess.nl/en/what-is-open-access), i.e., make full texts of papers freely available online. To all articles, the international open access licence CC BY-NC applies. As such, the journal is in compliance with the principles of open access to research publications and is included in the free access database of articles (DOAJ, Directory of Open Access Journals; https://doaj.org/).

Although the idea of providing open access to research articles had been spreading since October 2000, when well-known scientists H. Varmus, M. Eisen and P. Brown submitted a petition on open research signed by more than 30,000 researchers (incl. the undersigned), different opinions are expressed on the implementation of the idea even today. According to the initiative of the European Commission disclosed in 2018 (Plan S), research funding bodies should require that the scientists they fund make the resulting papers freely accessible immediately on publication since 2021
(https://www.coalition-s.org/why-plan-s/).

The *Proceedings of the Academy of Sciences* started to implement the idea of open access already in 2008, more than 10 years before the attempted reform acknowledged today. Besides, the authors can publish their research results free of charge if the studies were carried out at the Estonian taxpayers' expense. In the case of foreign authors, we only expect to cover direct publication costs.

Open access also applies to articles published in the *Proceedings* earlier. The earlier series have been digitised and the archive is available at: https://www.etera.ee/.

The *Proceedings of the Estonian Academy of Sciences* are published in close cooperation with Estonian universities, whose academic staff members are also topical editors of the journal and members of the Editorial Board. In 2020, 34 articles were published in four issues, incl. 23 research papers from Estonian authors, five of which resulted from the cooperation of authors from Estonian universities.

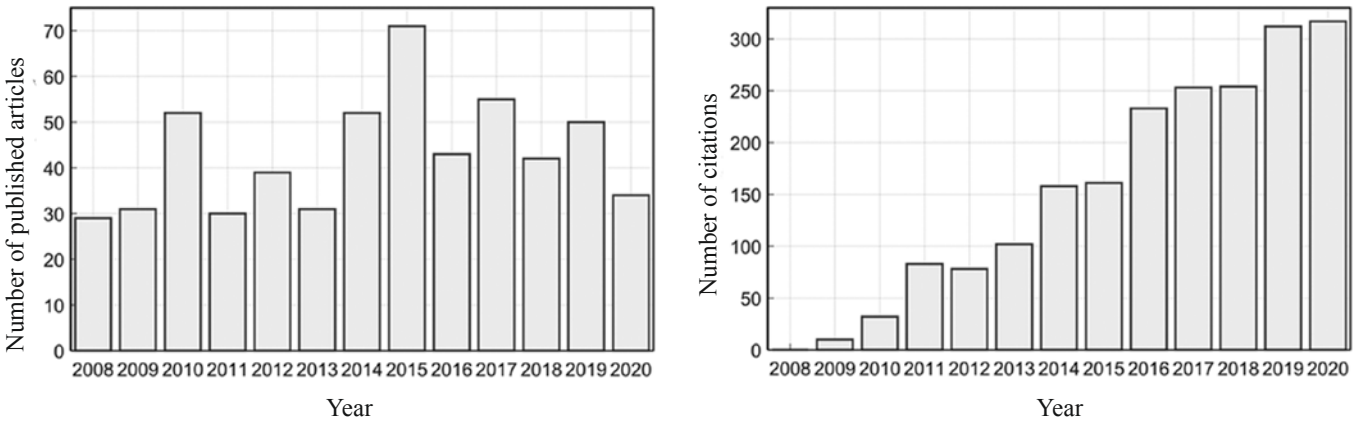
Strict peer review and careful work by our editors have developed the *Proceedings of the Estonian Academy of Sciences* into an internationally acknowledged scientific journal, which has been entered in the Thomson Reuters database Web of Science (Web of Science Master Journal

List) and reached the quartile Q2 in the database SCOPUS® managed by the publisher Elsevier. The journal is also indexed in many other international databases. With open access to the full texts of the articles, this has made the research papers published in the journal available to all researchers and those interested in sciences all over the world.

It is also interesting to note that 559 articles were published in the journal between 2008 and 2020, that according to the database Web of Science, have been cited 2003 times. This means that on average, each article has been cited 3.58 times, which shows the significance of the journal. The figures provided in the said database characterise the temporal dynamics of the publication of papers and citing them. Based on the same database, the *h*-index of the journal is 17 for the considered period.

Consequently, the reforms of 2008 were made at the right time. The *Proceedings of the Estonian Academy of Sciences* have become a multidisciplinary journal of international renown and may proudly celebrate the publication of its 70th volume in 2021. We strongly believe that the *Proceedings of the Estonian Academy of Sciences* makes Estonian science visible at the international level – maybe even more than just an address line of the research institution in the paper published in some other scientific journal.

Academy Member Jaak Järv
Editor-in-Chief
Proceedings of the Estonian Academy of Sciences



Number of articles published in the *Proceedings of the Estonian Academy of Sciences* journal and the dynamics of citing them between 2008 and 2020. The data has been obtained from the Web of Science database as of 10 April 2021.

TALKING ABOUT SCIENCE IN VÕRU COUNTY

Jaak Järv, Secretary General of Estonian Academy of Sciences

The names of county institutions and even schools have changed, but the co-operation started in 2014 at the initiative of the then educators of the Võru County Government has remained permanent.

Until then, the Academy used to hold one research day a year in several counties. The research day of 2014 had already taken place in the spring, when a request was received from Võru County to come and visit them, involving, as usual, presentations from the academy and introduction of business and cultural objects from the county government.

The then President of the Academy Richard Villems, could appreciate the proposal and gave permission to organise an unscheduled event. Võru's "real" or scheduled research day had taken place in 2003 in connection with the anniversary year of Fr. R. Kreutzwald. In the late autumn of 2014, the first event was held at Kääpa Primary School with people gathering from all over the county, as it later became customary in Võru County. Academy member Enn Tõugu spoke about online threats, Academy member Raivo Uibo about the immune system and academic Karl Pajusalu gave a presentation on the topic of language, which had also attracted people from the Võro Institute. After the school event, the company Estelaxe OÜ was introduced, which produces seats for boats, snowmobiles and trains, and has conquered the state railway network markets of the Nordic countries, especially Finland, and whose production is also valued by the Estonian Defence Forces. An exciting experience proved to be the renovated Lasva Water Tower with its exhibition, illuminated well and the only playing piano stairs in Estonia.

Photo: Andri Tallo

Prof. Anu Noorma, Director General of Estonian Research Council from 1 April 2021.

The first event was quite quickly followed by another one. A new app system, was introduced at Parksepa Secondary School by the Academy Research Professor, Rein Ahas, together with his students.

From there, attempts have been made to visit Võru schools twice a year. The lecture with the largest number of participants (224) took place at Võru Kreutzwald Secondary School, where Academy member Urmas Varblane, and Professors Maaja Vadi and Raul Eamets shared economic and career wisdom. Professor Urmas Varblane has given a presentation in Võru three times after this event, and also with political scientist Eiki Berg and the President of the Academy, Tarmo Soomere, whose lecture introduced the substantive activities and structure of the Academy as well as the problems of the Baltic Sea and climate change. After the completion of the Võru State Upper Secondary School, this beautiful, dignified building near the central square has become the venue for the events.

The choice of topics is based on the interests and wishes of the school students. The topic of Academy member Ülo Niinemets and his doctoral students at the event covering environmental issues was "The Language of Plants". One event was hosted by the Estonian Society for the Study of Religions, as religion and its various expressions were important issues among students at that moment.

One spring day in 2017, Academy member Mart Kalm spoke on the topic: "Is there beautiful architecture in Võru?", which caused a great joy of recognition and excitement among the audience. He was seconded by Academy member Anu Raud, who talked about her working life as a textile artist. In the autumn of the same year, it was the psychologists' turn. Academy member Jüri Allik had taken his doctoral students with him, with Karina Laas talking about drugs and Astra Schults touching on the intriguing question: "Does language make a person?".

Academy members Agu Laisk and Ene Ergma have visited Võru to talk about environmental physics and astronomy.Social media has been discussed by Andra Siibak, a founding member of the Estonian Young Academy of Sciences (EYAS), and for celebrating the year of Estonian language, Eva Saar from the University of Tartu spoke about the development of language. Attention has been drawn to the Estonian language, and also to the need to learn other languages several times. Thus, representatives from the University of Tartu Language Centre visited Võru. The event was led by Eri Miyano, a Japanese woman fluent in Estonian, who organised games and fun linguistic tasks to solve.

No place can function without medicine, so Academy member Toomas Asser, board member of Tartu University Hospital, Mart Einasto, and the chief doctor at Võru hospital, Arvi Vask, visited Võru State Upper Secondary School.

At the 2020 Võru day, presentations were given by the Secretary General of the Academy Jaak Järv, who spoke about the development trends of the Academy and his speciality – molecules, and Professor Anu Noorma, who spoke on the topic of Estonia as a space country.

In the early years of the co-operation, the school's representatives together with local government employees visited the Academy building in Tallinn.

It was a great pleasure for the school and its supporters to receive the title of School of the Year 2020.

The interests and concerns of the young people, which are reflected in their minds as reflections of the life in the county, are always the basis for the choice of topics, which ensures greater efficiency of the event. Võru does not keep their events to themselves, but usually also invites schools from all over its county and all those interested in science from the neighbouring county of Põlva.

Photo: Andri Tallo

Jaak Järv, Secretary General of Estonian Academy of Sciences.

LAST WORD

ADVISORY BOARD OF POSTIMEES AND THE ESTONIAN ACADEMY OF SCIENCES

Marti Aavik

When I was invited back to *Postimees* in February last year, one of my first messages was that we need to start preparing the society with knowledge of both the virus and quarantine.

If quarantine is possible in Italy, what miracle force should protect us from something similar? In March, we got confirmation that there was no such miracle force – on 12 March, the government decided to declare a state of emergency.

In my opinion, Jaak Vilo best summed up this breakthrough: "Last week, the state essentially moved from the earlier denial phase to shock therapy. But instead of panic, we now need a rapid raise in awareness and a common response." (*Postimees* 16.03.2020)

The beginning of the state of emergency was really quite disconsolate in terms of knowledge. We had heard from every channel that it was something like a seasonal flu, that the main thing is to avoid panic and buying toilet paper is very ridiculous.

I spoke to a lot of people about the idea of creating an interdisciplinary discussion group/advisory board that could propose ideas and help separate the wheat from the chaff in the international flood of information.

I heard that the top specialists in various fields did not have any smooth ways of communicating their message to decision-makers (there was no Scientific Advisory Board to the Government at the time – the announcement of its convening came on 20 March). Well, even if they had had an effective direct line to the government, thousands of entrepreneurs and other leaders across Estonia faced serious choices. How long could the restrictions last? What changes should be considered? After all, quite a lot depended on it, both in business enterprises and elsewhere – what plans to make, and who to send home. Perhaps to terminate all business altogether? When making decisions, knowledge from a reliable source does not hurt. It is the calmly presented knowledge, not the embellishment of the situation, that is the best defence against the feared panic, and the mediator of knowledge is the press of course.

It was immediately clear that medical explanations alone were not enough to answer all the questions that came with this crisis. We needed a very wide community of top experts that would be politically neutral and credible for readers as well. I quickly tried to start this activity in several ways, but in the end, it began gaining momentum when the Estonian Academy of Sciences came along with the idea.

Thus, together with Tarmo Soomere, we convened the advisory board of *Postimees* and Academy members, which started with Skype meetings a week after the state of emergency was declared on 19 March 2020. Within more than two months, about twenty gatherings were held. In total, some 15 members of the Academy of Sciences and many other experts expressed their thoughts. Many thanks to everyone!

The circle of topics expanded. However, in addition to the reports of 17 meetings [out of total 19] and podcasts on the *Postimees* website, dozens of more detailed stories were born, the ideas of which originated from these meetings. Moreover, topics and authors or interviewees from our meeting summaries were also picked up by other media houses besides *Postimees*.

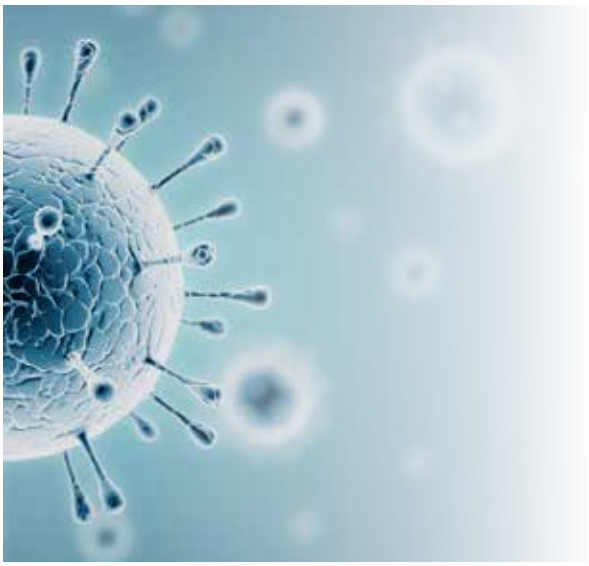


Photo: Shutterstock

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ACADEMY MEMBERS

Colored are names of **heads of departments**, **female scientists** and prominent **creative personalities**.

Department 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 Hiznjakov, Physics, 1977
Marco Kirm, Exact Sciences, 2018
Tšeslav Luštšik, Solid State Physics, 1964; † 08.08.2020
Martti Raidal, Exact Sciences, 2011
Enn Saar, Astronomy, 2010
Peeter Saari, Physics, 1986
Mart Saarma, Molecular Biology, 1990
Arved-Ervin Sapar, Astrophysics, 1990
Gennadi Vainikko, Mathematics, 1986
Richard Villems, Biophysics, 1987*

* President 2004–2014

Foreign members

Jonathan (John) R. Ellis, Theoretical Physics, 2015
Richard R. Ernst, Physical Chemistry, 2002
Charles Gabriel Kurland, Biochemistry, 1991
Jaan Laane, Chemical Physics, 1995
Alar Toomre, Applied Mathematics, 2012

Department of Informatics and Engineering

Olav Aarna, Informatics, 1990
Hillar Aben, Mechanics, 1977
Jüri Engelbrecht, Mechanics, 1990*
Ülo Jaaksoo, Informatics, 1986
Maarja Kruusmaa, Engineering, 2016
Valdek Kulbach, Mechanics, 1986; † 31.01.2020
Jarek Kurnitski, Engineering, 2018
Jakob Kübarsepp, Materials Engineering, 2011
Rein Küttner, Engineering, 1997
Ülo Lepik, Mechanics, 1993
Enn Lust, Energy technology, 2010
Leo Mõtus, Informatics, 1993
Arvo Ots, Power Engineering, 1983
Tarmo Soomere, Informatics and Engineering, 2007**
Enn Tõugu, Informatics, 1981; † 30.03.2020
Raimund-Johannes Ubar, Computer Science, 1993
Tarmo Uustalu, Computer Science, 2010
Jaak Vilo, Informatics, 2012
Andres Öpik, Engineering, 2013

* President 1994–2004
** President 2014– …

Foreign members

Steven R. Bishop, Nonlinear Dynamics, 2012
Gábor Stépán, Applied Mechanics, 2017
Michael Godfrey Rodd, Process Control and InformationTechnology, 1995
Esko Ukkonen, Computer Science, 2015
Margus Veanes, Software Science, 2019

Department 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
Ilmar Koppel, (Physical Chemistry), 1993; † 09.01.2020
Urmas Kõljalg, Biosystematics and Ecology 2011
Hans Küüts, Agricultural Sciences, 1994
Agu Laisk, Natural Sciences, 1994
Ülo Lille, Biotechnology, 1983
Margus Lopp, Chemistry, 2011
Jüri Martin, Ecology, 1990
Andres Metspalu, Biotechnology, 2010
Ülo Niinemets, Natural Sciences, 2013
Anto Raukas, Geology, 1977; † 19.04.2021
Valdur Saks, Biochemistry, 1993
Raivo Uibo, Medical Science, 2003
Veiko Uri, Forestry, 2020
Mart Ustav, Biomedicine, 2001
Eero Vasar, Medical Science, 2010
Martin Zobel, Ecology, 2010

Foreign members

Ülo Langel, Neurochemistry, 2015
Pekka T. Männistö, Pharmacology, 2012
Svante Pääbo, Genetics, 2019
Matti Saarnisto, Geology, 2008
Helmut Schwarz, Chemistry, 2002

Department of Humanities and Social Science

Jüri Allik, Psychology, 2010
Mihhail Bronštein, Agricultural Economics, 1975
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
Huno Rätsep, Estonian Language, 1981
Hando Runnel, Literature, 2012
Tiit Tammaru, Human Geography, 2018
Tõnu-Andrus Tannberg, History, 2012
Jaan Undusk, Humanities, 2007
Urmas Varblane, Economics, 2009
Haldur Õim, humanities and social science, 1994

Foreign members

Juri E. Berezkin, Cultural Anthropology, 2012
Cornelius Theodor Hasselblatt, Literature and Culture, 2015
Raimo Raag, Linguistics, 2019
Päiviö Tommila, History, 1991
Endel Tulving, Psychology, 2002
Jaan Valsiner, Psychology, 2017

More information: https://www.akadeemia.ee/liikmeskond/

Photo: Maris Krünvald

Group photo of Members of the Academy at the annual meeting of the General Assembly of the Academy on 8 July 2020.

FACTS AND FIGURES

INTRODUCTION

In several letters sent from Australia, the date and the year number 2020 are followed by a comma and the words "the year that did not exist". The same cannot be said about Estonia and especially about the Estonian research landscape. At least three processes mark the year. First, the heads of the state are no longer the most influential persons in our country. Secondly, the agreement to allocate 1% of gross domenstic product (GDP) to research became a reality. Thirdly, the COVID-19 pandemic made our society more aware of the significance of research and research-driven approaches, which was partly realised through a national memorial stone celebrating the role of scientists in the restoration and preservation of Estonian independence.

This third process made corrections in the plans of the Academy as well as the associated institutions and societies of the Academy. A large part of activities moved online. Some essential events were cancelled altogether. The annual General Assembly meeting of the Academy in spring had to be replaced by an online poll covering the issues which, according to law, must be resolved by the opinion of all Members of the Academy. The issues were relatively simple: approval of the annual report for the last year, approval of this year's budget and a decision on the remuneration to the Members of the Academy.

The management scheme of the Academy (more details on pp 15–17) is somewhat unusual. Under the applicable legislation, some of the decisions must be adopted by the General Assembly. The Statute allows us to resolve the issues mentioned in the previous paragraph by electronic polls, but not some strategic decisions, such as the election of Academy Members, removal of the Members of the Board, approval of the Statute and the structure of the Academy and any amendments to them. Until the summer of 2020, all these decisions required the physical presence of the Members of the Academy.

Before the spread of the COVID-19 virus in Estonia, our main concern was to find the time when work and travel would allow our colleagues to come together. This spring, however, we had to take account of the possibility that organising a physical meeting of the General Assembly with a few weeks' or even a few days' notice might become impossible or entail unreasonable risks. Even if we are conservative by nature, as an institution, we have to be able to react to changing circumstances. On the other hand, the government often needs operational advice. During the coronavirus crisis, in late-winter and spring, we were able to provide advice of strategic importance within a few days, sometimes even hours. There is no reason to believe that we could not do that at some other time, or in situations where we face a different problem.

The extraordinary meeting of the General Assembly that took place in summer introduced changes that allow the Academy to function fully via electronic channels. The concept of the Academy is to interact with each other so that together we would be greater than the simple sum of the parts. Our aim is not to hold General Assembly meetings while sitting at home, but sometimes the rule permitting it may prove necessary. The December General Assembly meeting was mainly held via electronic channels, with the voting procedure being completely electronic. As a result, we have three excellent new Members of the Academy.

Moving the events to the virtual environment and suspending all travel left us time for other important activities. The Endel Lippmaa Memorial Lecture organised as a hybrid-event and delivered by Uffe Ellemann-Jensen, an outstanding figure of Danish diplomacy and a good friend of Estonia, was mentioned by the President of Estonia in her Independence Day speech. The webpage of the Academy was redesigned so that it is more comprehensive and provides entirely different opportunities. Our time is the era of electronic documents. The electronic document management system is replacing the flow of information that was previously mainly printed on paper. Necessary information can now be found easily and very fast. Being in a common information space prevents some disputes at their root and allows us to focus on more significant issues.

Despite and partly even driven by the coronavirus crisis, life goes on. Charles de Lint said: "The world is always as it is. We just see it differently." One of the most important processes is drafting a new version of the Organisation of Research and Development Act, started in the summer of 2020. The act will govern our activities for the following couple of decades. Six of our colleagues and a member of the Estonian Young Academy of Sciences participate in the working groups set up for this process.

Battles are not won by generals and officers. An institution or its leaders can only succeed if they are supported by competent professionals. The Academy has received excellent support from its office also during this complicated year.

Tarmo Soomere
25 February 2021

ACTIVITIES OF THE ACADEMY AND ITS MEMBERS

GENERAL ASSEMBLIES

In 2020, the General Assembly of the Academy convened three times.

22 April: Extraordinary session of the General Assembly in the form of a poll
The spring session of the General Assembly, which was meant to be held as an annual meeting, was postponed due to the emergency situation. Under the Estonian Academy of Sciences Act, it is the General Assembly that forms opinions on the annual report on the activities of the Academy, and the report on the implementation of the budget, adopts the budget and financial plan and establishes the procedure for paying remunerations to the Members of the Academy, so the extraordinary electronic session of the General Assembly was organised.

In order to adopt resolutions on the above issues, the overview of 2019 prepared by President Tarmo Soomere (see pp 129–134), explanations of Secretary General Jaak Järv concerning the budget of the Academy, the consolidated table summarising the budgets of the Academy for 2019 and 2020, and the financial plan of the Estonian Academy of Sciences for 2020 were communicated to the Members of the Academy electronically. Detailed information on the activity of the Academy for the reporting year was made available in the *Estonian Academy of Sciences Yearbook XXV* (*52*). Before that, the links to the electronic yearbook and its coloured edition *In Words and Images* were sent to the Members of the Academy.

Based on the materials presented to the Members of the Academy, the General Assembly approved, in the form of an electronic poll, the activity report for 2019, the report on the implementation of the budget for 2019, and the budget and the financial plan for 2020. (See page 177). The General Assembly decided to divide the amount allocated for paying remuneration to the Members of the Academy for the period from 1 May 2020 to 30 April 2021 equally between all the Members.

8 July: Extraordinary session of the General Assembly
The main issue discussed at the extraordinary session of the General Assembly on 8 July was amending the Statute of the Academy, so that electronic polls would be allowed for passing resolutions necessary for the proper functioning of the Academy. At the beginning of the session, President Tarmo Soomere awarded the Academy Medal to Maaja Vadi, Professor at the University of Tartu, and the Paul Ariste Medal to Art Historian Jaak Kangilaski, Professor Emeritus of the Estonian Academy of Arts and the University of Tartu. Subsequently, Jaak Kangilaski delivered the presentation: "How to Bring Western Art to the Soviet Union?" (see pp 40–45).

President Tarmo Soomere introduced the proposal to amend the Statute in order to ensure the functioning of the Academy in the case of possible restrictions, keeping in mind the election of new Academy Members planned for the end of the year. The General Assembly supplemented the amendments and approved the new version of the Statute.

2 December: Session of the General Assembly
The third session of the General Assembly took place on 2 December as a hybrid session. The leaders of the Academy, heads of the divisions, presenters, laureates of the medals and a small number of the Members of the Academy were present at the Academy building. The other Members of the Academy participated via the Zoom environment.

President Tarmo Soomere awarded the Karl Schlossmann Medal to Irja Lutsar, Professor at the University of Tartu, the Academy Medals to Rait Maruste, compiler of the book *Eesti omariikluse põhidokumendid* (*Fundamental Documents of Estonia's Statehood*), and to Riivo Sinijärv, Chair of the committee for Academician Endel Lippmaa lectures, and announced that the medal is also awarded to Anne Pöitel, a long-time employee of the Academy's Office.

Invited guests presented two excellent ant intriguing speeches. Irja Lutsar delivered the speech: "Spirit and Power During the Coronavirus Pandemic" (see pp 24–27).

Madis Müller, Governor of the Bank of Estonia delivered the invited presentation "Expressing Opinions in Public Debates" delivered by (see p 72–77).

For three announced vacancies of new Members of the Academy, universities, Members of the Academy and the Estonian Theatre Union had submitted 11 proposals with 9 candidates. The secret electronic poll in the Election Runner environment resulted in electing Krista Fischer a Member of the Academy in the field of mathematics and mathematical statistics (candidates were Krista Fischer and Jaan Janno); Veiko Uri in the field of forestry (candidates Asko Lõhmus, Arne Sellin and Veiko Uri) and Elmo Nüganen in the field of dramatic arts (candidates Luule Epner, Merle Karusoo, Anu Lamp and Elmo Nüganen).

PRESIDENT'S SUMMARY OF THE ACADEMY ACTIVITY IN 2019

Dear colleagues,

Last year marked the end of the teenage age of the 21st century. The last adolescent-year was turbulent and only a few of us could relax in our comfort zone. If we try to summarise this in a single maxim, it could be: from a warm bath to a cold shower, more than once*. Considering some important aspects of scientific life, such as financing of research, the year was a complete failure, but for the Academy, it was a year of following the chosen course, but also a ground-breaking period as the mandate assigned to the Academy widened in Estonia as well as in the entire world.

The words reminding of President Lennart Meri expressed on 24 February [2020] in the Theatre Ugala by the President of the Republic Kersti Kaljulaid may have sounded prickly to many of us, but at the same time, she expressed a ruthless truth about the year. It really was a year that hurt us, and the scientific landscape as a whole. We failed to realise the national agreement on research funding. The concept of the agreement was not just to raise research funding in Estonia to the level that would be competitive on a global scale. The idea was much greater. The competitiveness of our state largely depends on our ability to extend excellent research to the areas where a new world is created through it. Scientific achievements themselves are silent. We achieve success when we manage to make them speak. The aim of the research agreement was to accomplish rapid development thanks to our ability to take the brightest minds from academic research to the positions where they could increase the competitiveness of the entire country.

In this context, the Academy showed courage after a long break, and prepared a political declaration which did not shock the world but proved that we – all together – have something important and valuable to say. Something that is not usual in Estonia, but almost trivial on a global scale: high-level research in the private sector is in the best interests of academic research.

Building on the same idea, we tried something infeasible – to accustom researchers and politicians to talking and listening to one another. The three days invested in it at the end of January and the beginning of February posed a classical dilemma of any employee: no matter how much you do, you never do enough, and the things you do not accomplish are always more important than those that you do. What some considered a pure waste of time, the others saw as enormous success which was worth to be presented in front of the European Parliament and the EuroScience Open Forum 2020 in Trieste. True, the pandemic made its corrections there, too.

The described exercise may also have been the reason why the newly formed government did something unparalleled in the world: they included the Academy of Sciences in the coalition agreement. Of course, "after that" is not the same as "because of that", but it still contributed to something – it may have been the reason why Estonia was elected the coordinating country of the European Science Advisors Forum (ESAF). Information about our achievements must have crossed borders.

The Academy building was not sufficiently spacious to accommodate the climate conference organised together with the Prime Minister's Office in September [2019] and had to be held in the Radisson Hotel. Despite everything, the conference was an unexpected anomaly. Who could have believed that the Prime Minister and a significant portion of Estonian high society would listen to what the scientists have to say for 4.5 hours? Moreover, that they would understand and make decisions based on the message of the scientists. The results were obvious at the site: Academy Member Jarek Kurnitski was at once invited to speak at the next Government meeting and the politicians spent most of the panel time discussing the three lines of action proposed by the Academy. This is unusual too, although this is how strategic choices should be made in a developed, science-based state. Some communication expert testing the limits of political correctness might even say that for a whole day, the Academy forced on the Government not only its own agenda, but also its mentality. Whether it is true, or only an illusion reminding us of an ideal landscape, it is difficult to say. One thing, however,

* As our good colleague Mart Kalm has remarked, doctors have recommended contrast showers as an effective enhancer of blood flow.

is clear: the Academy has to be cautious when voicing recommendations and consider what might happen if the recommendations are really put into practice.

* * *

Traditionally, for more than 10 years (i.e., as long as I have attended the Board meetings), the question of modifying the format of the spring meeting has been one of the issues discussed at the Board meetings while preparing for the spring meeting of the General Assembly. The detailed report on the action of the divisions and the Academy as a whole is always available for some time before the session either electronically or as a printed version. For the last three years, both versions have been made available. The new and improved format, though, has still not taken shape when the time set for the meeting comes closer. Fortunately, the heads of the divisions have every time and each in their own way managed to fill the classical format with real substance. Some of them have provided an intriguing vision – which is what we actually need even more – rather than a summary of the already published material.

This time, the Board made a firm decision to replace the classical reports by the heads of divisions with a longer overview provided by the President. Due to the coronavirus pandemic, it has been provided here in writing and not as a speech at the Assembly Meeting. As always, it is difficult to include every aspect of the work carried out in a text, even if it is made longer. The things carried out are so numerous that including everything might obliterate the whole picture. Therefore, at the end of the text, we have listed, in short and without comments or explanations, the achievements, drawbacks and events which would have deserved longer reflections.

As mentioned, the year 2019 reminded of alternating cold and hot showers. To sum up, the following events can be highlighted as significant in the context of the interaction between the Academy and society:

- Active communication between researchers and politicians started
- We issued a political declaration on organising the realisation of the research agreement
- Realising the research agreement failed
- Giving scientific advice gave some positive results: the Academy was included in the coalition agreement, and at the climate conference, the message of researchers received the attention of decision makers

* * *

The presence of the Academy is necessary in society and possible in more than one way. The logical role of the Academy is much more than just representing the scientific landscape. Organising and structuring the relations between academic circles and the state is the key here. Part of this work is consolidating the message that the researchers wish to convey and making the voice of researchers heard. The opinion of our top researchers is already heard on the level of society and the heads of the state. Universities, the Council of Centres of Excellence in Research, the Research Policy Committee, the Research and Development Council and the Estonian Research Council function as effective channels for giving out research funding. Consultations in the Academy before the sessions of the Research and Development Council have become a tradition. The opinions thoroughly debated in the back room of the Academy seem to be more suggestive at the sessions of the Research and Development Council than that of a single member of the Council.

On the other hand, some activities of the Academy have been fiercely criticised by close colleagues. One of these aspects was discussed in the General Assembly of 25 September [2019] in the context of perspectives of the Academy. "The Academy of Sciences, which in some countries is a vociferous champion of science, tries to sneak out of the door backward and to claim that the Academy has nothing to do with the crisis of higher education and research funding," wrote Andi Hektor in his opinion piece "Tädi Maali ja Pihtipudase memm Nokia jahil" (Aunt Maali and Pihtipudas Mum Hunting Nokia) published in the *Postimees* newspaper on 20 December 2019*.

It is true that in Finland, the growth in funding allocated to research and higher education was demanded not only by their analogue of our Council of Rectors, but also by the strong trade unions and, more importantly, the local business enterprises. Pressurising, however, is not the only method of persuasion. The scientific landscape has four important contact points with state administration. 1) Budget funding has to be allocated to research in some way. 2) The state needs advice also in other matters and not only on increasing the funding allocated to research and higher education. 3) Lobbying becomes more and more important. 4) If things seem to be going wrong, someone has to organise a protest.

Actually, these are not the only possible contact points, but to combine these four (channelling the funds, offering advice, lobbying and protest) in pairs is not an easy task. Because how can a minister, for example, take someone seriously who says they are only offering good advice, but is sometimes lobbying. The National Academy of Sciences of the USA is convinced that if they wish to offer advice to the state, they cannot even mention the issues of research funding. In this context, the academies of the (mostly)

* https://leht.postimees.ee/6855251/andi-hektor-tadi-maali-ja-pihtipudase-memm-nokia-jahil (in Estonian).

Anglo-Saxon countries, where offering scientific advice is organised as a separate state institution, have much more freedom.

The position taken by the Estonian Academy of Sciences is decided by the General Assembly. As we are required by law to offer advice to the state, the performance of other roles is somewhat incompatible, but not impossible. It is important that we already have the performers of these four roles in Estonia, partly as a result of the actions taken by the Academy. For some time now, research funding has been the task of the Estonian Research Council. Lobbying has been taken on, to a great extent, by the Estonian Young Academy of Sciences and the colleague Margus Lopp was awarded the Academy Medal [in December 2019] for initiating it. Protest marches are now often organised by the Estonian Chamber of Research.

As for the Academy, I would suggest that positioning itself as an advisor has helped to increase the trust of the state and society in the Academy. One of the direct results is the fact that the mandate granted to us by the state has expanded in several directions. For some time now, the Academy has appointed a member to the council of the University of Tartu and also to the council of the Tallinn University of Technology. The laws governing the other four public universities adopted last year follow this tradition. Thus, in 2019, we appointed one member to each of the councils of five universities. This was not an easy task and sparked off some debates in the Board, but we managed to do it.

The state decided to expand the mandate of the Academy even further, inviting us along with the Young Academy of Sciences to appoint a joint representative to the Appointment Committee of the Estonian Research Council Evaluation Committee. This task turned out to be rather complicated because these kinds of joint appointments have not been specified in the Estonian Academy of Sciences Act and the Statute of the Academy. But we met the challenge and Maarja Kruusmaa accepted this responsibility. The process showed us that we should certainly modify our legislative documents and make them more flexible. This year the Ministry of Education and Research asked us to find a distinguished candidate for the Board of the Estonian Research Council because the term of service of Mart Ustav ended. The position was accepted by Jakob Kübarsepp. It is highly likely that we will receive more similar invitations to act along with some other institution in the future.

As a remark, I would mention that establishing the Estonian Constitutional Law Endowment at the Academy on the last days of 2018 also indicates that the common core we share with the state and ministries is increasing. Its initiation was somewhat slower than intended, though. In 2019, only one public event took place, but a great amount of preparatory work was done, which is now (in spring 2020) being realised.

* * *

One of the functions of the Academy in our country – selecting the candidates for the national research awards – shows us that we need to take time for expressing gratitude. The highest award of the Academy is the medal of the Academy of Sciences. This is granted to individuals for their leading role in developing Estonian science or contributing to it, and also for performing the tasks assigned to the Academy.

At some point in the past, the value of the medals tended to decrease. The medals were awarded for too many. Of course, among others, almost all active Members of the Academy received one at some point. Ten years ago, the brakes were put on. Last time, in 2010, the medal was awarded to only one person – Laurits Leedjärv, the long-time Director of Tartu Observatory that is associated with the Academy.

It was high time to restore the tradition of awarding the medal, but to do so in a way that would restore the initial idea: the medal is a token of greatest gratitude. In the modern context, the medal is awarded to our fellow-travellers who have done more than expected. The person does not necessarily have to be a Member of the Academy because we need contribution on different levels. This time the laureates ranged from the elected head [Secretary General] of the Academy, thanks to whom the Estonian Young Academy of Sciences was launched, to the expert on the history of the Academy.

* * *

It was the year of electing the leaders of the Academy. The election of the President was almost reminiscent of a real election campaign, albeit without a competing candidate. I do not have much to say about it (as a person concerned), except that there was a lack of constructive dialogue and competition of visions, which gave a much better picture five years ago of what needs to be done and how. The mandate for the second term (or the number of votes) shows that almost half of the Members considered it reasonable for the President to continue for a second term, but a number of voters at the General Assembly meeting still would have wanted to see some changes. It probably pertained only to the President, because – to note in advance – the candidates proposed by him for the positions of the Vice-President, Secretary General and the free members of the Board were supported almost unanimously.

Two heads of the divisions were replaced. Our colleagues Jaak Aaviksoo (Division of Astronomy and

Physics) and Urmas Varblane (Division of Humanities and Social Sciences) had served the Academy in this position for 10 years or two terms. The Statute does not allow them to continue. The divisions decided to elect Marco Kirm and Valter Lang in their place, respectively.

The number of elected leaders (four) and the principles of their election (one from each division; Vice-Presidents residing in different towns) remained the same as five years ago. The idea is clear: to preserve a two-way connection in current activity with all divisions. At the General Assembly meeting held in December it was agreed that Arvi Freiberg from the Division of Astronomy and Physics and Mart Kalm from the Division of Humanities and Social Sciences, will continue as the Vice-Presidents, and Jaak Järv from the Division of Biology, Geology and Chemistry will remain the Secretary General. The elected leaders provide a balanced representation of Tallinn and Tartu, but also of all four divisions.

The General Assembly accepted the proposal to decrease the number of the Board members. Traditionally, the Board has had 8 so-called free members and 16 Academy Members in total. It is more than one fifth of all Academy Members and about one fourth of active Members. Sometimes, it is good to have a wide spectrum of different viewpoints around the Board table. The large number of Board members has some other advantages too, but today, a large collective governing body is somewhat unusual. Less Board members could be a step toward greater responsiveness, decrease the administrative load of the Members of the Academy, give a greater significance to the standpoints of the heads of the divisions, and provide a technical opportunity to test how it would work out if we asked or elected the heads of our strategic committees to be the Board members.

When electing free members, we tried to ensure that they represented a different field, university or city than the head of the division or the leader elected from the division (Vice-President, Secretary General). The average age of the Board members decreased and the Board is not entirely masculine any longer. In this aspect, however, there seems to be some scope for improvement. Just to remind you:

Martti Raidal (Division of Astronomy and Physics) resides in Tallinn and represents the viewpoints of independent research and development institutions. He is uncompromising, well informed in research policy and considers burning issues forcefully, which are all very valuable components.

Maarja Kruusmaa (Division of Informatics and Engineering) is a researcher with a sharp eye and excellent social skills. All three Members of the Board from the Division of Informatics and Engineering are from the Tallinn University of Technology, but there are only a few members of the division in Tartu and they are all known to be very busy.

Ülo Niinemets (Division of Biology, Geology and Chemistry) is one of the most active Board members. He never hesitates to express his opinion, but is always a constructive interlocutor and party in a debate. As regards his field of research, he complements the Head of the Division, Toomas Asser (medical sciences), and Secretary General Jaak Järv (chemistry), and represents the views of the Estonian University of Life Sciences in the Board.

Tiina Randma-Liiv (Division of Humanities and Social Sciences) is the first to bring the viewpoints of political science to the Academy and its Board. This competence becomes more and more important if we wish to have a greater role in providing advice to the state. With her field of research, she is a great addition to Mart Kalm (history of art/architecture) and Valter Lang (archaeology).

* * *

The foreign members of the Academy are our outposts and ambassadors of science at the international level and through this, they are a part of the strength and visibility of our country. The new foreign members elected in September 2019 include a relatively close fellow-traveller, computer scientist Margus Veanes (Microsoft Research), who started his career as a researcher in Estonia, also Raimo Raag, who has roots in Estonia, but comes from Scandinavian cultural space and has observed our developments very carefully, and Svante Pääbo, whose links to Estonia are not so close, but who is a researcher of international repute. Through them, we can make Estonia larger, but also support the country's development, by acting as members of the councils of our universities, for example. Ülo Langel was the first to take on this responsibility.

* * *

Last year, the activity of our divisions was slightly more intensive than usual. A number of elections took place, from the divisions to the leaders and foreign members of the Academy. In everyday work, the divisions contribute to the activity of different committees and events popularising science through their members. In cooperation, the lecture series "The Road to the (Poska) Academy" continued in Tartu, our members gave lectures in upper secondary schools and participated in the think tanks of the Academia Pernaviensis.

The Division of Astronomy and Physics selected and nominated a dignified candidate for the Harald Keres Medal, discussed the development of physics in Estonia in the next decade and participated in the debates on the

future of the Academy and presidential election. Marco Kirm was elected as the Head of the Division.

The Division of Informatics and Engineering proposed a nomination for the President of the Academy, consensually agreed that Jakob Kübarsepp should continue as the Head of the Division, selected the nominee for the Nikolai Alumäe Medal, discussed the possible foreign members and completed the collection *Teadusmõte Eestis* (*X*). *Tehnikateadused III* (*Scientific Thought in Estonia* (*X*). *Engineering III*). The division decided to support Margus Veanes, a computer scientist from Microsoft Research, as a foreign member of the Academy.

Serious discussions were held with the representatives of two professional associations – the Federation of Estonian Engineering Industry and Estonian Electronics Industries Association. Both associations are among the largest sectors of impressive export performance. Their burning issues are products of low added value, small investments in development, and a low level of digitalisation, resulting in a value chain that is too short. One of the possible solutions is a more forceful implementation of industrial PhD programmes. This would provide an opportunity to enhance cooperation between companies and universities, and to focus research funding through selecting PhD students and their supervisors. Research usually starts with raising a problem in a company or institution. The university then finds an appropriate supervisor and offers a suitable environment for conducting the research. There are about 30 industrial PhD students at the Tallinn University of Technology, which is less than 10% of all PhD students. Most of them are Estonian citizens.

The Division of Biology, Geology and Chemistry fully supported the mandate of Toomas Asser as the Head of the Division. The division discussed the issues of funding and the future of the Academy in connection with the election of the President. Svante Pääbo from the Max Planck Institute for Evolutionary Anthropology was proposed unanimously as a foreign member candidate.

The Division of Humanities and Social Sciences organised meetings with the representatives of the Estonian Association of Sociologists and the Estonian Academic Theological Society in relation to their association with the Academy of Sciences. Valter Lang was elected as the Head of the Division. Raimo Raag, Professor at Uppsala University, was nominated as a foreign member candidate.

* * *

The developments in international relations can be highlighted as a breakthrough. We expanded the geography of our relations. A relationship was established with the academies of sciences of Australia, Uruguay, Argentina, Chile, Hamburg and Sudan. (The latter is more like a learned society, but the roles of academies are different in different countries). Along with L'Oréal and UNESCO, we grant two scholarships to young female researches from 2019. Jaan Aarik is the Chair of the respective evaluation committee. We represented Estonia at the consultations concerning the United Nations (UN) Decade of Ocean Science for Sustainable Development, which were organised at the UN Headquarters in New York, organised the visit of our Prime Minister and the Minister of Education and Research to the U.S. National Academy of Sciences, and hosted the delegation of the Governor General of Canada at our academy. At the initiative of the Secretary General, discussions on the principles of cooperation between the Baltic Sea region academies were launched.

We seem to have been successful and effective in doing all that. This is proved by the fact that at the European Science Advisors Forum held in June [2019] in Dublin, our academy was nominated as the coordinator of the forum for the following three years.

An intriguing proposal was made at the end of the year. As known, the International Council for Science (under this name since 1998 and founded in 1931 as the International Council of Scientific Unions (ICSU)) and the International Social Science Council (ISSC), which was founded in 1952 and joined the academies of social studies and humanities, were consolidated in 2017. The organisation was named the International Science Council (ISC). Its European section has more than 50 members. We were offered to chair this organisation from 2022 to 2024. This is a unique opportunity for keeping ideas and topics important to Estonia in the agenda and at the core of discussions. It would probably be wise to share this task with the Ministry of Foreign Affairs. The feedback received from our Prime Minister, the Minister of Foreign Affairs and the Minister of Education and Research allows us to hope for the support of the state.

* * *

The year 2019 is also marked by heated disputes and criticism. Partly, this was definitely justified. If we wish to be a champion of a science-based world view, it is important to select the right partners for cooperation. One reason for this is the fact that we cannot work with all who wish this. We have to give serious consideration to the form of adequate scientific advice and think whether and how this should be institutionalised. If the necessity of the institution of the Research Professors and the Institute for Advanced Study is refuted, we have to be ready to make some difficult decisions.

I would still stress one difference: if the Academy has earlier been criticised primarily for what has not been

accomplished, now we are criticised for what we have done, but could have done differently or organised better. However, the proportion of proper things done properly also seems to have increased rapidly.

* * *

Finally, I would point out that battles are not won by generals and officers. They cannot succeed if they do not have capable and professional support. The Academy has received excellent support from the Office. The harder the work, the heavier is the load of the Office. I am extremely grateful to the Office staff because we would not have achieved the above-described advancements without them.

Wishing everyone good health

Tarmo Soomere
13 April 2020

EXPERT PANELS ACTING AT THE ACADEMY

COMMITTEE ON METEORITICS
Founded in 1954
Chair: Jüri Plado, PhD

In accordance with the decision of 14 March 2017 of the Board of the Academy, the Committee on Meteoritics is composed of Jüri Plado (Chair), Juho Kirs, Tõnu Pani, Ulla Preeden, Sten Suuroja, Reet Tiirmaa and Siim Veski.

At the end of 2020, studies of charcoal from the Ilumetsa craters related to the article published in the *Meteoritics & Planetary Science*[*] journal were completed. There are two round landforms (with a diameter of 75–80 m and 50 m, respectively) in the Ilumetsa crater field that are 725 m apart from each other. Although there is no evidence to prove the generally recognised origin of explosion (residues of meteoritic substance, chemical or mineralogical traces), these landforms are considered as meteorite craters. The sand in the crater walls contains small particles of charcoal. Geologically, these position in a way similar to the charcoal found in the Kaali and Morasko (Poland) craters that formed as a result of an explosion. Radiocarbon dating allows the researchers to believe that the charcoal is 7,170–7,000 years old and indicates that the craters were formed at the same time, excluding their glacial or anthropogenic origin. Land radar examinations of the bog (Põrguhavva) between the craters did not reveal any round landforms underneath the peat.

The results of the magnetic field studies of the Lonar (India) crater[**] with a depth of about 100 m and 1.88 km in diameter were published in the journal *Geosciences*. Strong negative magnetic anomaly (more than 1000 nT) relates to the crater pit, but positive anomaly is measurable in the crater walls. By means of modelling, the combination of strong magnetism between the relief and the Deccan basalts surrounding the crater was determined as the main reason of the anomalies, and it was concluded that the effect of explosion on the magnetism of the rocks is minimal. The studies invalidate the theory that some magnetic substance of cosmic origin is buried inside the crater.

* Losiak, A., Jõeleht, A., Plado, J., Szyszka, M., Kirsimäe, K., Wild, E. M., Steier, P., Belcher, C. M., Jazwa, A. M., Helde, R. 2020. Determining the age and possibility for an extraterrestrial impact formation mechanism of the Ilumetsa structures (Estonia). *Meteoritics & Planetary Science*, **55**, 274–293. doi:10.1111/maps.13431

** Kiik, K., Plado, J., Lingadevaru, M., Syed, H. J., Szyszka, M. 2020. Magnetic anomaly and model of the Lonar meteorite impact crater in Maharashtra, India. *Geosciences*, **10**, 417. doi:10.3390/geosciences10100417

In September 2020, Juulia-Gabrielle Moreau started a post-doctoral project in the University of Tartu Department of Geology. The aim of the project is to design an instrument that can be used to deliver molten metal into rocks of basic composition and examine the physical and chemical conditions of impacts in the asteroid belt. Namely, the presence of metal phases and iron sulphides has been observed on the surface of the fissures of some normal chondrites and siliceous minerals. Their presence in the rocks is the result of impacts between asteroids at high temperatures and impact pressure. For this reason, the number of S-group asteroids including normal choroids has been underestimated because as a result of this process, their spectrum becomes similar to that of the C-group asteroids.

For specifying the morphology of the inside of the crater, Argo Jõeleht and Kaidi Sarv continued with the interpretation of the seismographic data gathered on the Ries (Germany) crater that is 15 million years old and is 26 km in diameter. Jüri Plado, Herbert Henkel and Satu Hietala continued with the mineralogical studies of the Dellen (Sweden) crater and are compiling an overview. In March 2020, Jüri Plado and Satu Hietala participated in geophysical field studies (gravimetric and electromagnetometric) of the Summanen (Finland) crater.

During the year, employees from the University of Tartu Natural History Museum, the Department of Geology and Tallinn University of Technology Institute of Geology consulted about 10 people on the problems related to meteorites (possible links between accidental findings and meteorites, or between round structures and meteorite craters). No meteorites or craters were discovered.

COMMITTEE ON NATURE CONSERVATION

Founded in 1955

Chair of the Board: Urmas Tartes, PhD

The Board of the Committee on Nature Conservation of the Estonian Academy of Sciences continued with the following members in 2020: Urmas Tartes as the Chair, Vilju Lilleleht (Candidate of Biology, Associate Professor) and Heiki Tamm (Candidate of Biology) as Vice-Chairs and Vaike Hang as the Secretary. One of the Board members, Toomas Frey (Doctor of Biology), passed away.

The emergency situation caused by the COVID-19 pandemic significantly affected the activity of the committee in 2020. There were no public meetings. Negotiations were held in order to find new members for the committee.

Several exhibitions curated by Vaike Hang continued. To celebrate the 50th birthday of the geographer and historian of science Erki Tammiksaar, an exhibition introducing his publications was arranged in the Baer Building. On 8–9 August, during the days of Pärnu City Tõstamaa Rural Municipality District, an exhibition depicting the local villages in the middle of the rural municipality was arranged, and at the same time, the exhibition "Tõhela aeg ja inimesed" (Tõhela Time and People) was displayed at the library of Tõstamaa.

On 4 July, the 19th community day was held in Tõhela under the leadership of Vaike Hang. The participants talked about local wooded meadows and visited some of them around Männikuste village. Later, Vaike Hang also published a longer article in the local newspaper *Tõstamaa Tuuled*. On 20 August, as is customary, the life of Colonel K. J. Laurits was remembered at the memorial stone next to his farmstead. Vaike Hang also organised the new verification mapping of Kiraste village. She has also done this previously (1980−1982) and has published the materials gathered then (V. Hang. *Kiraste küla*. Pärnu, 2000).

Kiraste village is known as the birth place and home village of Mats Mõtslane (Mart Kiirats, 1884−1956), a writer and teacher to whom a memorial stone was placed in the village in 1986. From most of the old farmsteads, there are no traces left in the landscape. The state has ensured the maintenance of the former wooded meadows in Kiraste, Tamnemaa and Viruna. Vaike Hang proposed to arrange a guide-post on the side of the highway at the southern edge of Kiraste village that would lead the way to the birth place of Mart Kiirats. Vaike Hang reviewed all the exterior cellars (12) on the farms in Männikuste village in the region of Tõhela, and photographed and listed them by their size and wealth. She has published several articles in the local newspaper *Tõstamaa Tuuled*, the *Tartu Postimees* newspaper and the *Eesti Loodus* journal.

Aleksander Maastik developed the structure and content of the handbook of waste water treatment within the project: LIFE IP CleanEST, worked with compiling the terminology in Estonian, English and Russian, and edited the handbook. Astrid Saava wrote an overview of teaching medicine/hygiene at the University of Tartu through time (1962–1989/1991) (Tartu, 2020). Uudo Timm dealt with the topic of protecting mammals and published a number of articles on this in newspapers, journals and electronic media. Ingmar Ott co-authored the publication of a higher education textbook: Ott, I., Timm, H. (editors). *Siseveekogud*. Tartu, Eesti Loodusfoto, 2020. In a podcast interview (see https://podcast.ee/otsi/jarveteadlane/), he spoke about Estonian lakes, and he also carried out applied research with the aim of protecting lakes and compiled expert opinions for the rehabilitation of the lakes Neitsijärv (ordered by AS MAVES) and Kavadi (OÜ Veeprojekt). Kuulo Kalamees dealt with the problems of wild mushroom

protection: at the mushroom exhibition displayed on 10–12 September in the University of Tartu Natural History Museum, he explained how important it was to protect mushroom species entered in the Estonian Red Data Book and placed under protection, and also introduced the most significant endangered species in Estonia.

Urmas Tartes gave lectures on nature education to the participants of the study camp of Tõrva Gymnasium, during the insect study days organised by MTÜ Muinasjutt and Antsla Gymnasium, and also during the insect study days of Kilingi-Nõmme Gymnasium. Within the nature conservation conference in Kuressaare, he held a workshop on nocturnal insects and gave lectures in Albu School, the Kohila Environmental Education Centre and Saaremaa Ö-university. He also participated in the work of the panels in the photographic contest "Märka mind!" (Notice me!) organised by VVVS (the Vapramäe-Vellavere-Vitipalu Foundation), the contest "Looduse aasta foto" (Nature Photo of the Year) and the photo contest of the *Eesti Loodus* journal. He was a member of the Eerik Kumar Award committee, represented the Academy in the council of a non-profit organisation MTÜ Loodusajakiri, and consulted on the translations of nature films broadcast by Estonian Public Broadcasting. An important part of his activity was explaining nature conservation, forest ecology and Earth's substance and energy cycle on social media. This allowed him to obtain a better perception of the knowledge, values and determinants prevalent in society.

ESTONIAN POLAR RESEARCH COMMITTEE

Founded in 1993
Chair: Professor Rein Vaikmäe

In 2020, the Estonian Polar Research Committee (EPRC) was planning to celebrate the 25th anniversary of its activity. Due to the COVID-19 pandemic, the public events were rare and events were arranged via virtual platforms. The spring and autumn annual meetings of the European Polar Board (EPB) and the meetings of different committees took place online.

The main activity of the EPB was to contribute to the successful completion of the project "EU Polar Net – Connecting Science with Society" in the framework of the Horizon 2020 Initiative in the period 2015–2020. The aim was to develop an integrated European polar research strategy. All stakeholders were involved including government agencies, representatives of industry, polar inhabitants, academics, etc. Estonia was represented in the consortium by the Department of Geology in the Tallinn University of Technology. By the spring of 2020, the draft strategy had been compiled. It was subjected to a public online discussion carried out in the EPB member states. The discussion in Estonia was mediated by the EPRC. The final document approved by the European Commission in the summer of 2020 is intended to be used as an input for the development of R&D projects within the next European Union framework programme for environment and climate action. The European Commission has suggested submitting a follow-up proposal for a new project to draw up an action plan for the developed polar research strategy, in which the status of the EU institution implementing the plan should be defined. While finishing the final documents of the last project, the EPB prepared a new proposal for a project in spring 2020, which was approved in September.

The EPRC continued to promote polar research in Estonia. Regular committee meetings were not held and information on the activity of the EPB, in addition to relevant national information was communicated to the members electronically.

At the end of 2019, the EPRC decided to initiate the accession of Estonia to the (Madrid) Protocol on Environmental Protection to the Antarctic Treaty and submitted the proposal to the Ministry of the Environment. In 2020, the Ministry of the Environment relying on the competence of the members of the EPRC prepared relevant documents and sent them to the other ministries for approval at the end of 2020. The draft Act on the accession to the protocol should be on the agenda of the Government session in the near future. Hopefully, the process will be finished in the first half of 2021.

In the first half of 2020, discussions were held on the initiative of the Ministry of Foreign Affairs to submit the application for Estonia to obtain an Observer status at the International Arctic Council (IAC). By autumn, the necessary document was prepared. On 9 November, Estonia officially submitted the application for becoming the Observer at the Arctic Council. After submitting the application, the Ministry of Foreign Affairs also launched a media campaign to promote the candidacy of Estonia, which continues in the first half of 2021, and involves several members of the EPRC.

In 2019, the EPRC also participated in the preparation and execution of the closing events of the largest popular science expedition in modern Estonian naval history, Antarctica 200, organised to commemorate the historic journey of Fabian Gottlieb von Bellingshausen and the 200th anniversary of the discovery of Antarctica. In order to introduce the problems of the polar field to Estonian youth, the committee was also represented in preparing the polar quiz for school pupils, organised by the Estonian Polar Club and Estonian Maritime Museum for the second time already, and in planning a polar expedition for the

winners. The expedition was postponed until 2021 due to the COVID-19 pandemic.

Estonia's participation in the work of the EPB has allowed our researchers to contribute directly and effectively to compiling and designing research and development strategies and specific research programmes in the field of European polar research. We hope that this development will continue because several active and promising young researchers have joined the circle of scientists dealing with polar research, which is why we are optimistic about the future of the field.

COMMITTEE ON ENERGY

Founded in 1998
Chair: Arvi Hamburg, PhD

The goal of the Committee on Energy, as an independent body of competent experts, is to provide recommendations and evaluations for the state's science-based energy policy design.

In 2020, the members of the committee had contacts and developed opinions mainly through electronic channels. The central theme was a carbon-free economy, including energy production from non-fossil fuels, green transition and social-economic impacts related to it, especially in the Ida-Viru County, and the premises and predicted results of the implementation of the European Union strategies for hydrogen and energy system integration.

Online discussions revealed that achieving climate neutrality in the European Union depends on the current status of energy management, premises on which the changes in the region are based and the involvement of the rest of the world, while preserving the basis of the World Energy Council's Energy Trilemma.

The global consumption of primary energy has increased on average by 2.1% per year within the last 30 years and in 2019, the proportion of fossil fuels was 81.4%. The International Energy Agency expects that the consumption of primary energy achieves the pre-pandemic level by 2023, and thereafter, a continuous increase by less than 1% until 2040 is expected. In Estonia, primary energy consumption has decreased by 1.6 times in the period of 1990–2019, and the consumption of energy produced from fossil fuels has fallen by two times.

The increase in power consumption in the world in the same period was on average 4.6% per year. The proportion of fossil fuels in power production was 63.3% in 2019, which means an increase of 1.8 to 2% per year. In Estonia, power production decreased in 2019 compared to the average of the previous three years by 39.6%, while power production from oil shale fell by more than two times (from 9,608 GWh to 4,291 GWh in 2019). Estonia has become a country that imports electricity.

Estonia has achieved all targets set for increasing the share of renewable energy and reducing greenhouse gases, and by 2019, reduction of greenhouse gases in the CO_2 equivalents was 62% compared to 1990. The EU target is to reduce the CO_2 level by 55% before the year 2030.

The Committee on Energy had three sessions in 2020. On 30 August, the EU strategy for energy system integration and the options for implementing the EU hydrogen strategy in Estonia were discussed. Based on the strategy for energy system integration and the hydrogen strategy, the committee suggested to (i) analyse the opportunities for transporting hydrogen in gas pipes with the aim of defining the optimal and safe percentage of hydrogen by volume in the system; (ii) develop a concept of optimal positioning and configuration of local power production capacities, based on the load on the gas transmission network and the possibilities for transmitting different fuels; (iii) analyse the possibility of integrated use of all energy sources and fuels, based on the principle of the security of supply; (iv) prepare a national hydrogen strategy, a road map assessing the economic, environmental, technical and socio-political impacts of the exploitation of hydrogen; (v) draw up legislation for involving different parties in joint projects of the private and public sector and update regulations concerning safety technology for developing hydrogen technologies in Estonia; (vi) develop a legal framework for planning and involving local communities in building wind farms and solar stations and implementing integrated hydrogen electrolysis and storing technologies; (vii) develop a joint system of offshore wind farms and connections with the mainland power grids in cooperation with other states in the Baltic Sea region; (viii) develop an energy technology programme, using the competence of energy researchers; (ix) recommend the implementation of hydrogen technologies in several phases, which in the near future may mean obtaining experience, analysing the impact of implementing hydrogen technologies and carrying out projects for introducing hydrogen technology, in the medium term phase integrating the hydrogen industry with other technologies.

At the meeting on 10 September, the vision of electro-energetics and implementation of hydrogen technology in energetics were discussed. The Chair of the Management Board of Eesti Energia AS, Hando Sutter, participated as a guest. Two scenarios were defined on the ways the oil shale industry could achieve the EU target for 2050: the industry in the current form has become non-existent or an economically sustainable technology for capturing CO_2 exists and is in use. To achieve carbon neutrality and energy self-sufficiency is only possible if

the consumers are involved in ensuring the power system balance. The countries in the Baltic Sea region reduce their power production every year, but investments in introducing new capacities do not cover the increasing market demand. The decision of the owner of Eesti Energia AS to ensure the manageable power production capacity of at least 1,000 MW until 2023 in Estonia is reasonable. The need for and possibilities of extending the period require serious consideration. Indeed, it is pleasant to conclude that the strategic goals of the research and development measures of Eesti Energia involve the scientific potential and look forward.

At the meeting of 14 December, preparing a zero-pollution action plan was discussed. The members of the committee concluded that the "polluter pays" principle adopted in the EU climate and energy policy is actually a punishment or a sanction, and developing economy through sanctions may not be the most efficient way. Renewable energy subsidies are basically market distortions established on the political level. This may result in inhibiting the functioning of markets and giving competitive advantages to some countries. Pollution can be reduced in several ways. Real time systems have been developed for environmental monitoring which are effective. In addition, mobile equipment located in the so-called points of care should be implemented. Digital solutions are our future, i.e., gathering management information, establishing joint data warehouses, processing and feedback, and using integrated market mechanisms.

Ensuring the continuity of the power system was considered a great challenge by the Committee on Energy. An important issue is to contribute to the formation of a platform for the cooperation of businesses, research institutions and the public sector with the aim of ensuring the development of young engineers and the efficiency of research and development. It is a 4D-challenge. Reduction of carbon emissions or decarbonisation means the use of renewable energy which depends on uncontrollable weather conditions. In electrical systems, this requires integration of different energy sources in power production, using different energy storing possibilities, new technologies and business models, and flexible consumption so as to preserve the security of supply. Decentralisation means power production based on different local energy sources, which requires implementation of the smart grid principles in terms of managing the capacity and information flow, analysing and organising feedback. In the case of desynchronisation or a changed synchronous area, investments in ensuring electrical power balance and frequency reserves are needed. Digitisation or development of management systems, ensuring cyber security are the continuous challenges on that route.

COMMITTEE ON PHYLOGENY AND TAXONOMY
Founded in 2007
Chair: Urmas Kõljalg, Member of the Academy

The Committee on Phylogeny and Taxonomy represents Estonia in the work of the research organisation Consortium of European Taxonomic Facilities (CETAF AISBL, http://www.cetaf.org). CETAF coordinates research and development work of the archives related to biodiversity and earth sciences in Europe. The Committee's role in Estonia is similar to CETAF's role in Europe. It coordinates the work, including the digitisation, of natural sciences collections. The Academy pays a membership fee for Estonia to participate in CETAF's work.

The 47th annual meeting of CETAF AISBL on 14–15 October was held online due to the corona pandemic and was organised by the Muséum national d'Histoire naturelle based in Paris. Estonia was represented by the Chair of the Committee, Member of the Academy, Urmas Kõljalg, and the Vice-Chair, Professor Olle Hints. The only meeting where people actually met in person was held on 28 February in Helsinki within the general assembly of the DiSSCo (Distributed System of Scientific Collections); Estonia was represented by Urmas Kõljalg.

In 2020, Estonia was actively involved in the work of the CETAF Earth Sciences Group (ESG), which focuses on developing functional requirements for a new version of the European geological collection data network GeoCASe, and coordinating and testing the software. In the field of geology, the Committee is represented by Professor Olle Hints. The meetings of the ESG were held every month, sometimes even more frequently. Most of the developments of the GeoCASe new software were made in Estonia from September 2020 within the DiSSCo Estonian Research Infrastructures Roadmap project. The first stage of the development was finished by the end of the year and the result is accessible at https://new.geocase.eu. The new solution was introduced at the CETAF's annual meeting and a seminar on German Earth Science Collections.

In cooperation with the Estonian Research Infrastructure Roadmap object "Natural History archives and information network" (NATARC, http://natarc.ut.ee) and the Estonian Naturalists' Society, the committee organised the II Estonian taxonomy day "Taxonomy and Natural Education" on 12 November at Tallinn University. The leading organiser was Lembi Lõugas, an Associate Professor at Tallinn University. Presentations were made by the experts on taxonomy and natural education from Estonian universities and the Ministry of the Environment. There were more than 20 participants at the venue, plus over a hundred who joined online. The video recording of the conference is

available at https://www.youtube.com/watch?v=Wi9YlY-kIWHo.

The members of the committee actively participated in the work on the object of the Estonian Research Infrastructures Roadmap (NATARC). Its board includes the Member of the Academy Urmas Kõljalg (University of Tartu), Olle Hints (Tallinn University of Technology) and Agu Leivits (Environmental Board). The members of the Committee on Phylogeny and Taxonomy also take part in the work of the Ministry of Education and Research Expert Council on humanities and natural sciences collections. The Vice-Chair of the Council is Olle Hints. The goal of the expert council is to submit proposals to the state regarding the facilitation and funding of the work of natural sciences archives.

COMMITTEE ON MARINE SCIENCES

Founded in 2007

Chair: Tarmo Soomere, Member of the Academy

The main aim of the Committee on Marine Sciences (CMS) is to represent Estonia (its marine research) in the European Marine Board (EMB) and to act as an advisory body in Estonia.

The meetings, discussions and polls of the committee have been organised electronically for some years now. All bulletins of the EMB and other information pieces concerning the activity of the EMB were regularly communicated to the members of the committee, other relevant parties, and mass media.

The plenary sessions of the EMB took place online, the spring plenary was on 27–28 May and the autumn plenary on 4–5 November. The Chair of the CMS participated in both.

At the spring plenary, the Dutch institute for marine research DELTARES was accepted as a member of the EMB, Carlos García Soto (Spain) was elected as Vice-Chair again and Fiona Grant (Ireland), Alan Evans (United Kingdom) and Katrin Schroeder (Italy) new Vice-Chairs. Two EMB's Young Ambassadors were introduced – Alessandro Cresci (Norway) and Natalija Dunić (Croatia) (last year, Liam Lachs (Ireland) and Alba González Vega (Spain) were elected). Their mission is to communicate the activity of the EMB to the top marine sciences specialists and to the next generation of marine researchers.

No changes were made in terms of the membership or leaders of the EMB at the autumn plenary. As of 31 December 2020, the EMB includes 35 members from 18 countries. The membership of two of them (FNRS, Belgium, and TÜBITAK, Turkey) has not been formally ratified yet.

In 2020, the EMB published several overviews and policy documents. Materials are mainly targeted to the European Commission, where the policy documents prepared by the EMB are often taken as a basis for decisions made, or as an argument when allocating funds for proposed topics.

The success of the activities carried out by the CMS can be indirectly evaluated by the media attention received by marine sciences and related accomplishments. The frequent appearance of marine, lake and coastal sciences and sea-related phenomena at nearly all TV and radio stations and journals was still achieved, especially when the acute manifestations of climate change in seas and coastal areas were reflected.

The Chair of the CMS, Tarmo Soomere, is a founding member of the European Academies' Science Advisory Council's (EASAC) environmental panel. One of his responsibilities is to contribute to the communication of information between these organisations and coordination of their work.

Tarmo Soomere and Member of the Academy Maarja Kruusmaa visited the Chilean Academy of Sciences in Santiago. On 6 January, they discussed possible cooperation with President of the Chilean Academy of Sciences, Maria Cecilia Hidalgo, and marine researcher and Member of the Academy, Osvaldo Ulloa. As an indirect result of the meeting, the leaders of the Chilean Academy of Sciences were invited to the official reception of the President of Estonia.

Tarmo Soomere is an alternate member of the advisory council of the Geological Survey of Estonia. Professor Kalle Olli, Vice-Chair of the CMS, is one of Estonia's representatives in launching the Joint Programming Initiative [JPI] Oceans, Climate, Water.

Tarmo Soomere continues as a member of the Baltic Earth Science Steering Committee and participated in the 14th meeting of this committee (Norrköping, Sweden, 12 February 2020) and the 15th meeting of 4 June 2020 held online. Tarmo Soomere and Urmas Lips have been invited to co-author overview articles on the Baltic Sea marine sciences prepared in the framework of the initiative.

On 5 October, an intensive day on coastal research at the Tallinn University of Technology Department of Cybernetics was organised.

On 4 November, the CMS organised a science afternoon at the Academy Hall for the new information on the status of the wreck of MS Estonia where the hydrodynamic and geological conditions around the wreck and the possibilities of mapping it again were discussed. Several members of the committee explained or commented on the topic in the media.

The trust placed in the EMB is based on the balanced representation of research funding, research and higher education organisations. The EMB provides us possibilities for realising the position of Estonian marine sciences in research policy decisions that affect the entire Baltic Sea area and also the world, and to make Estonian researchers heard on the European level. The opinions of Estonia as a member of the EMB often carry a decisive influence on matters related to the Baltic Sea marine policy, as Latvia, Lithuania and Finland do not currently take part in the work of the board.

For over a decade, the CMS has been representing Estonian marine sciences at the European Marine Board and our top marine sciences competence in European academia. From 2012 on, the main focus has been on international aspects. This year, one of the targets was the hydrodynamic and geological condition at the site of the wreck of MS Estonia.

STANDING COMMITTEE ON MEDICAL SCIENCE AND HEALTH STRATEGY

Founded in 2011

Chair: Eero Vasar, Member of the Academy

In 2020, the Standing Committee on Medical Science and Health Strategy, jointly with the Faculty of Medicine of the University of Tartu, has attempted to advise the Ministry of Social Affairs in matters pertaining to research, development and innovation. Unfortunately, the COVID-19 pandemic significantly restricted this cooperation. Within the year, only one understandable change in the priorities of the activity of the Ministry of Social Affairs was made.

Members of the committee, Raivo Uibo and Eero Vasar, participated in the academic board of the *Postimees* newspaper and academicians. The views of the German National Academy of Sciences Leopoldina regarding the COVID-19 pandemic were covered. The vision document on the future perspectives of regenerative medicine drawn up by the European Academies' Science Advisory Council (EASAC) and the Federation of European Academies of Medicine (FEAM) was discussed*.

* Vasar, E., Soomere, T. Euroopa teaduste akadeemiate regeneratiivmeditsiini tulevikuvisioon. *Sirp*, 27 (3799), 10.07.2020, 22–23. https://www.sirp.ee/s1-artiklid/c21-teadus/euroopa-teaduste-akadeemiate-regeneratiivmeditsiini-tulevikuvisioon: (In Estonian).

COUNCIL FOR ESTONIAN CENTRES OF EXCELLENCE IN RESEARCH

Founded in 2012

Chair: Andres Metspalu, Member of the Academy

The annual working meeting of the Council for Estonian Centres of Excellence in Research took place on 26 May 2020 in the Zoom environment. On the proposal of Martti Raidal, amendments to the new version of the Organisation of Research and Development Act were discussed, in addition to organising a joint event with the centres of excellence in Tartu targeted to the wider public and an appeal to the Minister of Education and Research on the issue of the future of the centres of excellence, proposed during the meeting.

The Council found that implementing a new system outlined in the amended Organisation of Research and Development Act requires the use of different methods because institutions (public and private) and their funding models are diverse. Four main topics were highlighted that need further consideration:

- A tenure should be established for researchers and the institutions should have the right to decide on which grounds this is implemented
- Operating grants should be established
- The Centres of Excellence measure should be continued, in other words, the centres should still be funded within the framework of the measure, not through a specific institution
- Attention should be drawn to the need for additional funding, which might not be realistic, considering the current situation

The autumn event of the centres of excellence was decided to postpone until the epidemiological situation caused by COVID-19 normalises.

No reply has been received for the appeal sent to the Minister of Education and Research on 25 June 2020, which contained the proposals of the Council for the Estonian Centres of Excellence in Research that should be taken into consideration in the process of amending the Organisation of the Research and Development Act. The issue was raised again in the article by Maarja Merivoo-Parro published by the portal *Novaator* of Estonian Public Broadcasting ("Eesti teaduse tippkeskused ootavad selgust tuleviku rahastuse kohta" (Estonian Centres of Excellence still wait for clarity on funding issues), 11 December 2020, https://novaator.err.ee/1205302/eesti-teaduse-tippkeskused-ootavad-selgust-tuleviku-rahastuse-kohta). Subsequently, the matter was also covered in the news programme "Aktuaalne Kaamera" of the national TV service. The reporters interviewed Martti Raidal and Andres

Metspalu. In the same programme, the Deputy Secretary General of the Ministry of Education and Research, Indrek Reimand, promised that the centres of excellence will remain. If necessary, they will be funded from the state budget, even if the EU funds cannot be used for this.

The problem is that the Ministry of Education and Research is willing to support the centres of excellence, but they cannot be funded from the EU structural funds as it has been done so far. The European Commission (DG Regio) has taken a strict and reticent position on supporting research. For example, they do not plan to fund basic research or activities that are still far from the production process (the first of the so-called Technology Readiness Levels TRL 1–3). The message of the European Commission is that Estonia has developed high-level research infrastructures and research capacities and does not need support from structural funds. However, the discrepancy between the economy and the research system needs attention. Supporting commercialising and development of services is allowed, but only in the areas of smart specialisation, and on the basis of demand.

NATIONAL RESEARCH AWARDS

The tradition of national research awards has continued for 30 years already. It is older than our newly independent state. On 20 August 1990, Prime Minister Edgar Savisaar signed the regulation on founding the national research awards of the Republic of Estonia. Independence was regained a year later. The first awards were granted in 1991. From the very beginning, brilliant or extraordinary achievements have been in focus*.

The Estonian state has delegated the pre-selection of laureates of national research awards to the Academy of Sciences. This means helping to draft the rules, announcing the competition, reviewing and registering applications, then analysing them in depth and communicating the Academy's recommendations on awarding or non-awarding of prizes to the government. The award committee is set up by the Government of the Republic.

Traditionally, two national research awards for outstanding lifetime achievements in research and development, or lifetime achievement awards, are granted each year. Eight annual awards are given to acknowledge the best research work completed and published during the last four years in specific fields. Awards for outstanding scientific discoveries – so-called discovery awards – may be given for discoveries that change the paradigm and world-view in particular areas of research, that create a new field of research or lead to the creation of an innovative product which has a significant socio-economic impact. In the absence of research work at a sufficiently high level, the committee has the right to give a recommendation to the government to abstain from awarding a prize.

Traditionally, the awards received in the so-called reporting year have been published in the *Academy of Sciences Yearbook* (i.e., awards received in the year that precedes the publication of the yearbook). As the electronic preparation of the publication and its editing take less time than publishing a paper version, nothing prevents from announcing the awards received in the first months of the current year in the yearbook completed by the time of the spring meeting of the General Assembly. Therefore, the

* Eesti Vabariigi preemiad 2020 (Estonian National Awards 2020), Estonian Academy of Sciences, Tallinn, 2020, p 10 (in Estonian).

laureates of the national research award for 2020 and for 2021 have been provided in this publication.

NATIONAL RESEARCH AWARDS FOR 2020

The senates and councils of universities and research institutions made 51 proposals for 2020 national research awards. The national research award committee confirmed that all the proposals complied with requirements and registered them on 27 December 2019. On 28 January 2020, the committee proposed the government to grant two lifetime achievement awards, one discovery award and seven annual awards. No award was recommended to grant in agricultural sciences. The proposal was supplemented with a short remark on each nominee explaining why exactly this researcher or group deserves the award.

LIFETIME ACHIEVEMENT AWARDS (awards for long-term productive work in research and development according to subsection 2 (1) of the Statute for the National Research Awards):

Jüri Allik – born 1949, Member of the Academy (2010) and Academia Europaea (2014), Head of the Department of Experimental Psychology of the University of Tartu Institute of Psychology, Professor

Jüri Allik has made an incredible contribution to the development of psychological research, to promoting academic teaching of psychology and the development of psychology as a field of university studies. His research is remarkable in terms of the content as well as the metrics. Jüri Allik's work is characterised by novelty and he has participated in writing and publishing the first research papers by Estonian psychologists that became known outside the borders of the Soviet Union. He has added a number of exciting aspects to the area of personality psychology. He has authored several textbooks, popular science literature and publications targeted to the general public, which deal not only with his own field of study, but also the significance of research to society. He has guided both Estonian and European research funding mechanisms, advised the President of Estonia, edited international journals and contributed to research administration at the university.

- 1998 National annual research award in social sciences for research work published in 1997
- 2001 Order of Merit of the White Star, Fourth Class
- 2005 National annual research award in social sciences for research work in the field of experimental, social and personality psychology

Jüri Allik: "The best moments of academic life are definitely the instances when you discover something that contradicts the aspects everyone has believed to be true so far, or that seems to be inevitable in the view of basic logic ..."*.See the interview with Prof Allik on pp 86–92.

Richard Villems – born 1944, Member of the Academy (1987), Leading Research Fellow of Population Genetics at the University of Tartu Institute of Genomics; Head of the Chair of Evolutionary Biology at the Institute of Molecular and Cell Biology, Professor of Archaeogenetics

Richard Villems is one of the most brilliant, remarkable and influential Estonian researchers of all times. His extensive activity is focused on intensive scientific advances, strategic coordination of scientific work and appraisal of scientific thinking through teaching, supervising and communicating with society. After joining the molecular biology laboratory of Artur Lind, he soon became one of the leading figures of Estonian science. The doctoral students supervised by him have grown into leading researchers and opinion formers. In the last 25 years, he has established a school of Estonian population genetics and archaeogenetics, which he has taken to the absolute top of the international scientific landscape. His

* Eesti Vabariigi preemiad 2020 (Estonian National Awards 2020), Estonian Academy of Sciences, Tallinn, 2020, pp 26–35 (in Estonian).

uncompromising sense of consistency as a champion of high-quality research and an advocate of the fundamental values of new knowledge has greatly influenced the formation of Estonian research policies, and encouraged the synergy of different fields of research.

- 1980 State Prize of Soviet Estonia for a research cycle on the structure of protein biosynthesis system (as part of a group)
- 1998 Order of Merit of the White Star, Third Class
- 2006 Order of Merit of the White Star, Second Class
- 2017 National annual research award in chemistry and molecular biology (as part of a group): Nature and formation of genetic variety in humans

DISCOVERY AWARD (research award for an outstanding discovery: for scientific discoveries or research and development works that change the paradigm and world-view in particular areas of research, or that create a new field of research or lead to the creation of an innovative product which has a significant socio-economic impact according to subsection 2 (3) of the Statute for the National Research Awards):

Andres Metspalu – born 1951, Member of the Academy (2010), Head of the Estonian Biobank of the University of Tartu 2008–2018, Leading Research Fellow of Genomics and Biobanking at the Institute of Genomics, Professor of Biotechnology – award for research and development work that has led to the creation of an innovative product based on a scientific discovery and has a significant socio-economic impact − for founding and leading the Estonian Biobank and initiating the Estonian genome project.

From its early years, the concept of the Estonian Biobank developed by Andres Metspalu was a unique initiative in the entire world. About 20% of the adult population of Estonia has joined it, which allows the researchers to transfer from sample-based analysis to population-based studies. In these 20 years of action, Estonia has adopted the Human Genes Research Act, which is one of its kind in the world. Testing systems have also been developed for detecting rare diseases, genetic data have been included in the study of hereditary complex diseases and feedback on genetic health risks has been given to donors who requested that. Under the leadership of Andres Metspalu, the Biobank has become a breeding ground for personalised medicine based on gathered genetic information, which provides an opportunity to switch from reacting to illnesses, to preventing them, and to ensure more efficient medical assistance. All this has changed our society's perception of health risks and the influence of genes on our health.

- 1980 State Prize of Soviet Estonia for a research cycle on the structure of protein biosynthesis system (as part of a group)
- 2001 Order of Merit of the Estonian Red Cross, Third Class
- 2003 Estonian annual national research award in medical sciences for genome studies

Andres Metspalu: "Whether a scientific discovery leads to an innovative product that has a significant socio-economic impact is usually not known at the moment of making the discovery. It is rare that just one and only one discovery leads to that product. An innovative product of significant impact may result from the combined effect of several discoveries, a number of technologies and a brave vision for the future. For this to happen, there must be someone who has a thorough knowledge of all these aspects, who acts in this field and understands the logic of the developments. Then you need others who think along these lines, and supporters. This is the only way to realise promising ideas."*.

ANNUAL AWARDS (best research works completed and published in the last four years, i.e., from 2016 to 2019, according to subsection 2 (2) of the Statute for the National Research Awards):

Award in exact sciences for the cycle of studies "Extended Geometrical Theories of Gravity" to the following researchers at the University of Tartu Institute of Physics:

Laur Järv – born 1974, Assistant Director, Head of Laboratory of Theoretical Physics, Senior Research Fellow
Manuel Hohmann – born 1984, Senior Research Fellow
Margus Saal – born 1974, Senior Research Fellow

Understanding gravitation and describing it in mathematical terms is one of the main issues of modern fundamental physics, in which almost no progress has been made since Einstein. Other fundamental opposite forces (weak, strong, electromagnetic) are understood more thoroughly and also used every day. In the above cycle of works, some new parameters are suggested that, in principle, can be measured and used to confirm various theories on the essence of gravitation.

Award in chemistry and molecular biology for the cycle of studies "Mechanisms of Neuronal Activity-Regulated Gene Expression":

Tõnis Timmusk – born 1959, Professor of Molecular Biology at the Tallinn University of Technology Institute of Chemistry and Molecular Biology

More thorough understanding of molecular pathways that affect the maturation, number and interaction of neural cells and of the action of substances that mediate it, such as dopamine, is the key to treatment of several psychiatric diseases. The cycle of works analyses the action mechanisms of the genes BDNF and TCF4 that "direct" the functions of neural cells. The results provide new opportunities for developing new drugs and methods that can be used to treat diseases affecting the nervous system.

Award in engineering for the cycle of studies "Developing Advanced Oxidation Technologies to Solve Modern Environmental Problems: From Heavily Polluted Industrial Wastewater to Micro-pollutants in Air and Water" to the researchers of the Tallinn University of Technology Department of Materials and Environmental Technology:

Marina Trapido (team leader) – born 1952, Head of the laboratory, Professor
Niina Dulova – born 1981, Senior Research Fellow
Marina Kritševskaja – born 1974, Senior Lecturer
Sergei Preis – born 1959, Professor

The team developed new air, water and soil purification processes for the decomposition of widespread micropollutants with poor biodegradability, such as medicinal products, pesticides, or synthetic colourants, using advanced oxidation. A new nanocrystalline catalyst was synthesised. Some treatment processes were rendered waste-free and due to the reduction of the toxicity of wastewater, the biological treatment became more efficient.

Award in medical sciences for the research and development work "MicroRNAs in Chronic Immune System Diseases":

Ana Rebane – born 1966, Professor of Molecular Medicine at the University of Tartu Institute of Biomedicine and Translational Medicine

MicroRNA molecules have the ability to suppress the expression of genes in animal and plant cells. Ana Rebane shows how different microRNAs inhibit the emergence and development of various chronic diseases in skin and immune system cells through the effect of genes. Delivering these molecules in the lesions may reduce inflammation, suppress psoriasis, affect the development of vitiligo and even contribute to the reduction of the growth of cancer cells.

Award in geology and biology for the cycle of studies "New Paradigm for the Communication of the Taxons of Living Organisms: Development of Linné's System" to the researchers of the University of Tartu:

* Eesti Vabariigi preemiad 2020 (Estonian National Awards 2020), Estonian Academy of Sciences, Tallinn, 2020, pp 42–55 (in Estonian).

Urmas Kõljalg – born 1961, Member of the Academy (2011), Head of the University of Tartu Natural History Museum and Botanical Garden, Professor in Mycology at the Faculty of Science and Technology Institute of Ecology and Earth Sciences

- 1997 National research award in geology and biology: "Tomentella and Related Genera in Temperate Eurasia"
- 2001 Order of Merit of the White Star, Fifth Class

Kessy Abarenkov – born 1980, Senior Research Fellow in Biodiversity Informatics at the University of Tartu Natural History Museum and Botanical Garden

For more than 300 years, species have been distinguished and identified by external individual specimens on the basis of features that vary widely, but external features may not always reveal close relations and much of the biodiversity has remained unknown. As a fundamental innovation, a system for identifying species based on DNA sequencing and comparison has been developed. In addition to complex and discordant names of species, unique digital identifiers have been implemented which remain stable over time. Relevant methods have been included in global biodiversity databases.

Award in social sciences for the cycle of studies "Cross-Border Educational Innovation Through Technology-Enhanced Research" to the researchers at Tallinn University:

Tobias Ley – born 1973, Professor at the School of Educational Sciences
Mart Laanpere – born 1964, Senior Research Fellow at the School of Digital Technologies
Kairit Tammets – born 1983, Senior Research Fellow at the School of Digital Technologies
Terje Väljataga – born 1978, Senior Research Fellow at the School of Educational Sciences
Katrin Poom-Valickis – born 1969, Professor at the School of Educational Sciences
Luis Pablo Prieto Santos – born 1977, Senior Research Fellow at the School of Educational Sciences
Maria Jesús Rodriguez-Triana – born 1982, Senior Research Fellow at the School of Digital Technologies
Paul Seitlinger – born 1984, Senior Research Fellow at the School of Educational Sciences

The cycle analyses whether and how the use of new technologies and digital solutions enhances the performance of pupils at different educational levels at school or workplaces. A special focus is on making sciences more interesting for the pupils to learn. Their performance is viewed holistically and across different academic subjects, focusing on pupils, teachers and the development of innovative teaching methods and materials.

Award in humanities for the monograph "In Austrvegr: The Role of the Eastern Baltic in Viking Age Communication Across the Baltic Sea":

Marika Mägi – born 1968, Senior Research Fellow at Tallinn University School of Humanities Institute of History, Archaeology and Art History

Based on archaeological findings of the Viking Age, Marika Mägi has provided a comprehensive view which covers the west and east coast of the Baltic Sea. In her research, Mägi has highlighted the plurality of different cultures on the eastern coast of the Baltic Sea and the characteristics of the societies of the Baltic Finns. She has provided a thrilling account of the events in the areas between the Viking Age in Sweden and the developing Russian state, viewing the district as a space where local, social and political conditions had to be considered while passing through.

NATIONAL RESEARCH AWARDS 2021

The senates of four universities, 11 Members of the Academy of Sciences, the Estonian Literary Museum and the National Institute of Chemical Physics and Biophysics made 43 proposals for the 2021 national research awards. The national research award committee approved all the proposals and registered them on 29 December 2020. On 26 January 2021, the committee proposed to the government to grant two lifetime achievement awards and annual awards in seven fields. No award was recommended to grant in agricultural sciences. The awards were granted in the Academy Hall on 23 February 2021.

LIFETIME ACHIEVEMENT AWARDS

Toomas-Andres Sulling – born on 15 February 1940, North Estonia Medical Centre, Professor

One of the great Estonian figures of the 20th century, Toomas-Andres Sulling, is the founder of modern coronary surgery in Estonia. He was one of the first in the world to perform surgery on patients with systematically severe pre-infarction condition and acute myocardial infarction.

A tremendous leap forward was angiography, which he introduced in Estonian medicine, and which allows the surgeon to "see" the inside of coronary arteries and achieve the best treatment with little intervention. His 30 years of experience as a heart surgeon and researcher resulted in the aortocoronary bypass procedure that can be done without stopping the heart. This technique – removing a piece of a vein from the thigh and bypassing the blocked area of a coronary artery – provides an opportunity to remedy the most important blood vessels from the inside. Thanks to his work, the lives of thousands have been saved.

- 1985 State Prize of Soviet Estonia (as the leader of a group) for the diagnostics and surgical treatment of chronic coronary insufficiency
- 1988 State Prize of the Soviet Union for developing coronary surgery
- 1999 included in the list of 100 great Estonians of the 20th century
- 2001 Order of Merit of the Estonian Red Cross, First Class

Jüri Talvet – born 17 December 1945, Member of Academia Europaea (2016), Professor Emeritus of the University of Tartu; Professor of Comparative Literature at the Institute of Cultural Research of the University of Tartu Faculty of Arts and Humanities until 31 August 2020.

Jüri Talvet is one of the greatest Estonian humanities researchers, whose remarkable and versatile life work has an immense social significance and international scope. His fundamental contribution to Estonian science is laying the foundation for Spanish Studies and raising the study of Spanish-language literature and culture to the world level. As a lecturer, researcher of literature, developer of cultural contacts and creative person, he has been a mentor to a large number of Estonian humanities researchers, teachers, journalists, editors and diplomats. By analysing the links between the literatures of Estonia and other countries, he has transmitted our intellectual history to everywhere in the world. As a translator and introducer of Estonian literature he has been an ambassador of Estonian science and culture for decades.

- 1992 Order of Isabella the Catholic of the Kingdom of Spain
- 2001 Order of Merit of the White Star, Fourth Class

ANNUAL AWARDS

Award in exact sciences for the cycle of studies "Dark Matter Consisting of Black Holes" to the researchers of the National Institute of Chemical Physics and Biophysics:

Gert Hütsi, born 1975, Research Fellow
Martti Raidal, born 1968, Member of the Academy (2011), Leading Research Fellow

- 2005 National annual research award in exact sciences: "Unified Theory of Quarks and Leptons"

Hardi Veermäe – born 1985, Research Fellow

Understanding dark matter is one the greatest challenges in modern physics. The authors build on the idea that dark matter consists of macroscopic black holes which are practically invisible in observations. They have explained that massive black holes (30 times the mass of the Sun) may be just a small part of the dark matter, but may function as a seed for super-massive black holes in the centre of modern galaxies.

Award in chemistry and molecular biology for the cycle of studies "Development and Implementation of *Operando* Methods in the In-depth Studies of Electrodes of Porous Sodium-Ion Batteries and Other Porous Materials and Unit Cells" to researchers of the University of Tartu Institute of Chemistry:

Enn Lust – born 1956, Member of the Academy (2010), Director, Head of the Chair of Physical Chemistry, Professor of Physical Chemistry

- 2008 National annual research award in engineering: "Complex Studies of Processes in Solid Oxide Fuel Cells and Electric Double Layer Condensers and on the Interface Between Compact and Porous Electrodes and Electrolytes"
- 2020 Order of Merit of the White Star, Third Class

Alar Jänes – born 1964, Head of the Chair of Applied Electrochemistry, Associate Professor of Physical and Electrochemistry

The laureates seek substitutes for expensive components of Li-ion batteries by replacing Li-based electrodes with Na-based electrode materials. They have developed a unique technology for examining the functioning of electrodes, also tested electrodes synthesised from Estonian peat and measured their properties in battery charging and discharging. The capacity they achieved was equal to the capacity of Li-ion batteries.

Award in engineering for the cycle of studies "Optical Spectroscopy of Novel 2D and 3D Multinary Semiconductor Compounds" to the professors of Tallinn University of Technology:

Maarja Grossberg – born 1981, Charter Member of Estonian Young Academy of Sciences (2017), Head of the Laboratory of Optoelectronic Materials Physics at the School of Engineering Department of Materials and Environmental Technology
Jüri Krustok – born 1955, Tallinn University of Technology School of Science, Department of Cybernetics

- 1998 National research award – annual award in the field of engineering as a member of a group: "Semiconductor Materials for Solar Energy and Optoelectronics"

The laureates study the influence of micro additives on the ability of kesterite materials to convert light to electricity. They have developed monocrystal and monograin materials from a complex combination of copper, zinc/iron, antimony and sulphur, fine-modified them with other elements and measured the reaction of developed composites to light. In the future, the graphene-like superfine semiconductors grown by them may be at the core of optoelectronic solutions.

Award in medical science for the cycle of studies: "Translational Studies in Neuropsychiatry: From Genetically Modified Test Animals to Schizophrenia Spectrum Disorders in Humans" to four researchers of the University of Tartu Faculty of Medicine:

Eero Vasar (team leader) – born 1954, Member of the Academy (2010), Professor of Human Physiology at the Institute of Biomedicine and Translational Medicine

- 2001 Order of Merit of the Estonian Red Cross, Third Class
- 2004 National annual research award in medical science (team leader): "Psychopharmacological and Genetic Engineering Approach to Explaining Neurobiological Mechanisms of Negative Emotions"

Mario Plaas – born 1980, Institute of Biomedicine and Translational Medicine, Head of the Laboratory Animal Centre
Mari-Anne Philips – born 1979, Institute of Biomedicine and Translational Medicine, Associate Professor in Human Physiology
Liina Haring – born 1973, Institute of Clinical Medicine, Associate Professor in Psychiatry

The team has provided an in-depth explanation of the formation mechanisms of neuropsychiatric diseases, measured the effect of anti-psychotic treatment on inflammatory and metabolic markers, analysed the opportunities for preventing metabolic syndrome developing in patients with schizophrenia, and advanced the understanding of the mechanisms of, and possible treatment of, Wolfram syndrome: a rare and severe genetic condition.

Award in geology and biology for the cycle of studies: "Environmental Effects of Climate Change on Marine Ecosystems":

Jonne Kotta – born 1972, Professor of Marine Ecology at the Estonian Marine Institute, University of Tartu Faculty of Science and Technology

Jonne Kotta analyses the reaction of marine ecosystems to climate change and their possible enhancing or buffering effect on climate changes. He has compiled a wide view of interactions of different scales, ecosystems and habitats in the context of climate change, which encompasses benthic habitats and functioning of ecosystems with a focus on mapping the pressure on the coastal areas of the Baltic Sea.

Award in social sciences for the cycle of studies "Social Determinants of Mental Health and Well-Being, and Related Risk Behaviours (Especially Suicidal Behaviour)":

M e r i k e S i s a s k – born 1968, Professor of Social Health Care at Tallinn University School of Governance, Law and Society, and Senior Research Fellow at the Estonian Institute for Population Studies

Merike Sisask deals with acute modern issues related to mental health of various social groups, especially the youth. She demonstrates that mental health is affected by a number of factors, including sufficient sleep, smoking or bullying at school. At the centre of her study is the analysis of factors indicating suicide and the opportunities for reducing their effect, with a focus on the role of the media and the Internet on the emergence and prevention of suicidal thoughts.

- 2021 Order of Merit of the White Star, Fourth Class

Award in humanities for the cycle of studies "Developing a Philosophical/Theoretical Paradigm of Soviet Colonialism, Studies of Soviet Societies and Cultures":

E p p A n n u s – born 1969, Senior Research Fellow at Tallinn University School of Humanities

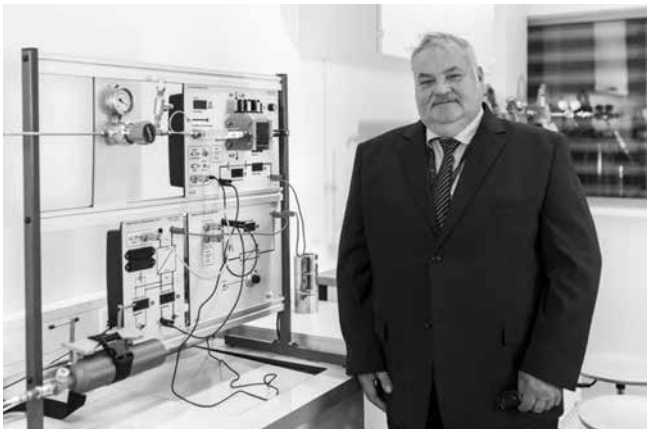
Epp Annus has created and developed a concept of Soviet colonialism and made it a part of academic research of culture, society and philosophy. Soviet colonialism means suppression of a sovereign country by a foreign power under the cloak of ideology and the colonists' attempt to transform the native population into "soviet citizens" convenient to the regime. With this concept, she develops a new paradigm of our recent history, emphasising colonialism instead of occupation, and tying it to sovietisation and extensive reconfiguring of peoples' mindset.

ACKNOWLEDGEMENTS TO ACADEMICIANS AND FROM THE ACADEMY

NATIONAL DECORATIONS TO ACADEMY MEMBERS

By decision No. 544 of the President of the Republic of Estonia, 27 January 2020:

ORDER OF MERIT OF THE WHITE STAR, THIRD CLASS,
to Member of the Academy E n n L u s t



By decision No. 702 of the President of the Republic of Estonia, 23 February 2021:

ORDER OF MERIT OF THE WHITE STAR, THIRD CLASS,
to Member of the Academy K a l l e K i r s i m ä e

MEMORIAL MEDALS OF THE ACADEMY

The Board of the Estonian Academy of Sciences decided to award

THE PAUL ARISTE MEDAL to
J a a k K a n g i l a s k i

The Medal was awarded at the General Assembly session of 8 July (see the lecture of Prof Kangilaski on pp 40–45)

THE KARL SCHLOSSMANN MEDAL
to Professor I r j a L u t s a r

The Medal was awarded at the General Assembly session of 2 December (see the lecture of Prof. Lutsar on pp 24–27).

THE ENDEL LIPPMAA MEMORIAL LECTURE AND MEDAL

On the 90th anniversary of Endel Lippmaa's birth, the Memorial Medal was awarded to

Uffe Ellemann-Jensen. (see pp 32–38)

MEDALS OF THE ESTONIAN ACADEMY OF SCIENCES

Medals of the Academy were awarded to:

Maaja Vadi – an excellent co-partner to the Academy

Rait Maruste – a tireless promoter and substantial implementor of constitutional law, whose writings have brought the fundamental documents of Estonia's statehood to life

Riivo Sinijärv – a remarkable advisor to the Academy, and the driving force and soul of the Endel Lippmaa Lectures

Anne Pöitel – a long time dedicated employee of the Academy's Office, and a pillar of strength of international relations of the Academy for decades

RESEARCH AWARDS FOR UNIVERSITY STUDENTS

Since 2016, the Academy's Student Research Paper Contest has been merged with the National Contest for University Students, organised by the Estonian Research Council. The representatives of the Estonian Academy of Sciences on the appraisal panel of the contest were Marco Kirm and Lauri Mälksoo. Three special prizes were awarded by the President of the Academy – the π-prizes. The laureates were announced on 18 December 2020.

Special Prize for the Most Elegant Student Research Paper (π × 1,000 euros = 3,141.59 euros) was awarded to

Kerda Keevend for the research paper "Inorganic Nanoparticles for Correlative Cathodoluminescence Electron Microscopy Bioimaging" (Swiss Federal Institute of Technology in Zürich, supervisor Dr Inge Katrin Herrmann).

Special Prize for an Unconventional Student Research Paper (π × 500 euros = 1,570.80 euros) was awarded to

Hare Unt for the research paper "The Possibility of Introducing the Military Grid Reference System Into a Single Landoperation Standard in Estonian Internal Security Institutions" (Estonian Academy of Security Sciences, supervisors Anne Valk and Tõnu Raid).

Special Prize for Auspicious Scintillating Sparks (π × 250 euros = 785.40 euros) was awarded to

Rahel Toomik for the research paper "The Most Elegant Oration of Pico della Mirandola: Analysis of Nine Keywords" (University of Tartu, supervisor Prof. Dr. Meelis Friedenthal).

Letters of Appreciation were also granted to supervisors of the prize-winning papers.

The Academy of Sciences also issued a constitutional law endowment special prize for the research paper of the

field to a student of bachelor's studies and studies in professional higher education (800 euros):

Liine Johannes for the research paper "Land Law Problems in the Practice of the Administrative Department of the Supreme Court in 1939–1941" (University of Tartu, supervisors Marju Luts-Sootak and Karin Visnapuu).

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 a doctoral degree. Since 2009, the Tiit Talpsep scholarship has also supported the research of master's and doctoral students in the field of molecular microbiology and virology. The scholarships are awarded by the Administrative Board, comprised of the Academy Members Mart Ustav, Leo Mõtus, Jaan Ross and Peeter Saari.

The 2020 scholarships were awarded as follows:

Mario Plaas (University of Tartu, Senior Research Fellow) Young Scientist Award (3,000 euros)

Laura Sandra Lello (University of Tartu, doctoral student) Tiit Talpsep Graduate Student Scholarship (1,000 euros)

ESTONIAN SCIENCE COMMUNICATION AWARD

The Estonian Science Communication Award has been granted since 2006. Its primary goal is to acknowledge remarkable members of the general public who have popularised science in Estonia, as well as encourage writing and increase the number of public speeches on research. Funded by the Ministry of Education and Research, the prizes are jointly awarded by the Estonian Academy of Sciences and the Estonian Research Council. The competition was held for the 15th time in 2020. The appraisal panel led by the Member of Academy, Ene Ergma, selected laureates from 50 candidates.

The Science Communication Awards of 2020 were granted as follows:

The Tiiu Sild Memorial Lifetime Achievement Award for long-time systematic communication of science and technology was granted to the Member of the Academy Jüri Engelbrecht as a long-time fender and populariser of research in Estonia and Europe. He has shaped the understanding of science and its importance in a broader sense (see pp 82–84).

The Grand Prize for the best communicator of science and technology was awarded to the instigator of the field of robotics Raivo Sell, who among other things, laid the foundation for the festival of robotics – Robotex. He is known to the general public as the creator of Iseauto – the first self-driving car in Estonia, and the manager of the respective project. He has contributed greatly to the development of the field and has been a competent motivator of the youth.

The Motivational Prize in the category was awarded to Katrin Tiidenberg, a researcher of digital culture and social media, member of the Estonian Young Academy of Sciences, and Jaana Ratas, a visualiser of archaeology and history.

The Grand Prize for activities/series of activities communicating science and technology was awarded to Laura Altin and Merili Ilves, who organised the project "Cool Geography Lesson". In these thematic lessons, which have already taken place for seven years, the career and future possibilities of geographers have been introduced to about 8,000 learners and teachers in more than 130 schools.

The Motivational Prize was awarded to the exhibition: "GEENIAALNE", organised by the University of Tartu Institute of Genomics team in Tallinn TV Tower and The Crazy Scientist's Science Conference organised by the University of Tartu Museum for primary school learners, which takes place for the 7th time this year.

The Grand Prize for science and technology communication via audiovisual and electronic media was awarded to the children's programme "Magus molekul" (Sweet Molecule), which aims at inspiring children and their parents to discover science and to cook together. The episodes of the first season had more than 250,000 viewers and the second season was just as popular. The Motivation Prize of the category was awarded to the series produced at Tallinn University "Ekspert eetris" (Expert on Air).

The Grand Prize for science and technology communication via printed media was awarded to Virgo Siil for his book *Teadlane miiniväljal: lähen ütlen tihastele, et teeme nüüd uuesti* (*Researcher on the Mine Field: I'll Go and Tell the Tomtits "Let's do it again"*). The book promotes the understanding of the hidden difficulties of research, problems with the system and mishaps that are not discussed very often in the world oriented on success. The Motivation Prize in the category was granted to Taavi Pae, the compiler of the National Atlas of Estonia.

Two Grand Prizes for the best new science and technology communication initiative were awarded to the science performance "KVARK show" organised in November of last year by OÜ Teadusteater and the "Young Engineer" festival organised since 2018 by the Estonian

Association of Technology Education.

The 2020 prize fund was 21,500 euros, including the Tiiu Sild lifetime achievement award grant of 6,500 euros, which is accompanied by the brass table sculpture "Möbius strip" by the sculptor Stanislav Netchvolodov. All laureates gain the right to use the "Nationally recognised science communicator" logo, a mark of quality and trust in communication.

The contest results were announced and prizes were presented on 13 November 2020 at the 13th science communication conference: "Science Communication: Lessons of Corona Crisis" held in the V Spa conference centre in Tartu.

L'ORÉAL–UNESCO BALTIC SCHOLARSHIP

The L'Oréal-UNESCO "For Women in Science" global partnership was founded in 1998 and since that year, L'Oréal and UNESCO have jointly contributed to research by increasing the number of female researchers and promoting gender equality in research through the programme. As a result of the programme, female scientists are recognised for their contributions, supported in reaching their goals and in publishing their achievements to a broad audience. (see also pp 97–98)

In Latvia, the stipend programme was created under the mentorship of the programme's patron Vaira Vīķe-Freiberga, President of the Republic of Latvia (1999–2007). The fellowship is currently jointly managed by the Estonian Academy of Sciences, Latvian Academy of Sciences, Lithuanian Academy of Sciences and the UNESCO Baltic states national committees and it is the only support programme which facilitates the professional development of female researchers and achieving goals significant to them.

One grant is awarded in each of the Baltic States to a female doctoral degree holder up to 40 years old for the purpose of carrying out research work in natural sciences, environmental sciences, physics or engineering. In addition, two grants are awarded in Latvia and one each in Estonia and Lithuania for female doctoral students up to 33 years old to complete their research in the same fields.

In 2020, the laureates of the L'Oréal Baltic programme "For Women in Science" grants (6,000 euros) are:

M a a r j a G r o s s b e r g, Professor at the Tallinn University of Technology, School of Engineering, Department of Materials and Environmental Technology, Member and from 2021 President of the Estonian Young Academy of Sciences

L i s a n d r a M a r i n a D a R o c h a M e n e s e s, Research Fellow at the Estonian University of Life Sciences, Institute of Technology, Laboratory of Biofuels.

The Estonian applications were evaluated by a committee composed of Members of the Academy Jaan Aarik (Chair), Jaan Eha, Anne Kahru, Professors Malle Krunks and Tiina Nõges, and Members of the Young Academy of Sciences, former laureates of the L'Oréal-UNESCO "For Women in Science" programme Els Heinsalu, Karin Kogermann and Tuul Sepp.

SPECIAL PRIZES FOR THE NATIONAL CONTEST OF YOUNG SCIENTISTS

The Academy's award committee awarded special prizes to the following works:

J o e l K o k l a (Tallinn French School, Grade 12) for the work: "Prantsuse arhitekti Hector Guimard'i 1899. aasta joonise põhjal juugendstiilis kanapee loomine" (Creation of an Art Nouveau Sofa Based on an 1899 Drawing by the French Architect Hector Guimard), supervisor Liis Reier

K a a r e l K i v i s a l u (Tallinn Secondary School of Science, Grade 12) for the paper: "Gravitatsiooni mõju erinevate kvantmehaaniliste süsteemide soojusmahtuvusele" (The Effect of Gravity on the Thermal Capacity of Different Quantum-Mechanical Systems), supervisor Jaan Kalda

K a r l - J o a n A l e s m a (Viljandi Gymnasium, Grade 12) for the paper: "Kunsti genereerimine teksti põhjal" (Text-Based Art Generation), supervisor Malle Eglit

A n n i H i p p V i s l a (Risti Elementary School, Grade 8) for the paper: "Läänemere reostuse muutused Nõva piirkonnas 13 aasta jooksul lestade (*Platichtys Flesus*) näitel" (Changes in the Pollution of the Baltic Sea in the Nõva Region Over 13 Years Based on the Example of Flatfish (*Platichtys Flesus*)), supervisors Tuul Sepp and Pille Pirk

I n d r e k T e n n u s (Tartu Herbert Masing School, Grade 11) for the paper: "A. H. Tammsaare „Tõe ja õiguse" I osa isikunimed ja nende kontekstuaalsed sünonüümid" (Names in Part I of *Truth and Justice* ("Tõde ja õigus") by A. H. Tammsaare and Their Contextual Synonyms), supervisor Andrus Org

Members of the Academy Jaak Järv (Chair), Kalle Kirsimäe, Agu Laisk, Valter Lang, Marco Kirm, and members of the Estonian Young Academy of Sciences Karin Kogermann and Kerli Mõtus contributed to the work of the committee.

PUBLICATIONS OF THE ACADEMY

In 2002, the following books were published by the Academy:

- *Eesti teaduste akadeemia aastaraamat XXV* (*52*) *2019*. Tallinn, 2020, 120 pages, in Estonian.
  The yearbook includes the facts and figures for the year.
- *Eesti teaduste akadeemia sõnas ja pildis, 2019*. Tallinn, 2020, 113 pages, in Estonian.
  The publication – Estonian Academy of Sciences In Words and Images – covers some aspects related to the Year of the Estonian Language, a failed research agreement, an interview with the laureate of the Discovery Award and fragments about international relations. Also, the conditions in which Estonian best researchers currently work are described and the history column reflects on "our" first academicians.
- *Estonian Academy of Sciences Yearbook XXV* (*52*) *2019*. Tallinn, 2020, 184 pages, in English.
  The publication incorporates the previous two publications in English into one book.
- The collection *Eesti Vabariigi preemiad 2020*, 358 pages, in Estonian.
  The book on laureates of national awards of Estonia includes the achievements of the laureates of the 2020 research, culture and sports awards and the F. J. Wiedemann language award. For the first time, the publication contains the overviews of the laureates of the national educational awards. These are granted for the year 2019, because they are traditionally awarded at the Teacher of the Year Gala, which takes place in autumn.

Electronic versions of all publications are available online at www.akadeemia.ee.

INTERNATIONAL COOPERATION

International cooperation through various organisations is an integral part of the Academy's work and networking activities. As provided for in clause 2 (2) 2) of the Estonian Academy of Sciences Act, the Academy is required to develop international academic cooperation in order to perform its functions. In keeping with tradition, the Academy represents Estonian research and researchers at numerous European and international academic organisations. See an overview of institutional transboundary activities of the Academy on pp 93–100.

In order to represent Estonia in international professional associations, national committees have been set up (this role is also performed by some scientific societies). As of 21 January 2021, membership fees in the following international organisations were covered from an allocation by the Ministry of Education and Research:

International organisation	Estonian contact point
Consortium of European Taxonomic Facilities (CETAF)	Estonian Academy of Sciences Committee on Phylogeny and Taxonomy Contact: Urmas Kõljalg urmas.koljalg@ut.ee
European Chemical Society (EuChemS)	Estonian Chemical Society Contact: Margus Lopp, Jaak Järv info@keemiaselts.ee https://www.keemiaselts.ee/
European Marine Board	Estonian Academy of Sciences Committee on Marine Sciences Contact: Tarmo Soomere tarmo.soomere@cs.ioc.ee
European Physical Society (EPS)	Estonian Physical Society Chair: Kaido Reivelt kaido.reivelt@ut.ee www.fyysika.ee/efs/
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 www.aai.ee/ERAK/ERAK.html
International Association of Geomorphologists (IAG)	Estonian National Committee of the International Association of Geomorphologists Contact: Tiit Hang tiit.hang@ut.ee
International Federation of Automatic Control (IFAC)	Estonian Association of Engineers/Estonian Systems Engineering Society Contact person: Sven Nõmm sven@cc.ioc.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 National Committee for Geophysics Chair: Rein Rõõm rein.room@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 Union for History and Philosophy of Science Contact: Peeter Müürsepp 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
International Union of Theoretical and Applied Mechanics (IUTAM)	Estonian National Committee for Mechanics Contact: Andrus Salupere salupere@ioc.ee
Thesaurus Linguae Latinae (TLL)	Estonian Academy of Sciences Contact: Anne Lill, (From 2020 Janika Päll) anne.lill@ut.ee (From 2020 janika.pall@ut.ee)

EURAXESS

The pan-European information resources network EURAXESS was established by the European Commission to advise researchers heading abroad for work and their families regarding administrative and practical problems. The Academy and the Estonian Research Council are the two national contact organisations appointed by the Ministry of Education and Research contributing to the planning and analysis of the network's activities in Europe and Estonia.

In 2020, the activities of the EURAXESS were influenced by the end of the Framework Programme for Research and Innovation (Horizon 2020) and the beginning of a new framework programme Horizon Europe, as well as the coronavirus pandemic. The pan-European study, the results of which the European Commission had intended to use as a basis for recommendations on the future of the EURAXESS network, was not completed by the end of the year, though. Even so, it became clear that the activity of the network is changing from just advising on geographic mobility of researchers to supporting the career of researches more widely. Consequently, we have started to enhance the competence of the Estonian network on topics related to supporting career progression. We encouraged Estonian research institutions to join the Human Resources Strategy for Researchers launched by the European Commission. In this context, we helped to prepare a topical study in Estonia. Due to the pandemic, major socialisation events of the ERAXESS were postponed, which have been highly valuable in introducing the society and culture of Estonia to the community.

International exchange programme

Due to the COVID-19 pandemic, the programme was implemented on a smaller scale than usual. In 2020, the Estonian Academy of Sciences supported the visits of four visiting researchers (15 days in total) to Estonian universities and research institutions. By way of comparison, in 2019 the Academy hosted 51 researchers for 331 days and partnering academies supported 43 visits for 340 days.

To the contest of Czech-Estonian science cooperation projects, 9 applications were submitted by the due date. After the negotiations between the academies, grants were allocated to the following joint research mobility projects of the Estonian Academy of Sciences and the Czech Academy of Sciences for 2021–2023:

- *Numerical and Experimental Study of Wave Propagation in Solids with Inner Structure*

Prof. Arkadi Berezovski, Tallinn University of Technology Department of Cybernetics

Prof. Radek Kolman, Czech Academy of Sciences Institute of Thermomechanics

- *Literary Representations of Early Modern Crisis in Central and North Eastern Europe*

Prof. Kristi Viiding, Estonian Academy of Sciences Underiand Tuglas Literature Centre

Prof. Lucie Storchová, Czech Academy of Sciences Institute of Philosophy

- *Gas Sensor Materials with Combines Photoluminescent, Electrical and Mass-sensitive readout*

Prof. Raivo Jaaniso, University of Tartu Institute of Physics

Prof. Michal Novotny, Czech Academy of Sciences Institute of Physics

UNDER AND TUGLAS LITERATURE CENTRE

Founded in 1993 (the Affiliate Museum, formerly called the Friedebert Tuglas House Museum, founded in 1971).
Personnel: 15, including 11 researchers
Address: Kohtu 6, 10130 Tallinn, utkk@utkk.ee
Museum Department: Väikese Illimari 12, 11623 Tallinn, muuseum@utkk.ee
www.utkk.ee
Director: Jaan Undusk, +372 644 3147, jaan@utkk.ee
Academic Secretary: Marin Jänes, +372 644 3147, marin@utkk.ee

The Under and Tuglas Literature Centre of the Estonian Academy of Sciences (the Literature Centre) is an institution of an international scope for research on literature and culture. Its task is the complex investigation and theoretical modelling of the Estonian-language written culture in its entirety and the multilingual Baltic-German culture from earlier eras, thereby making the historical Baltic and the later Estonian realm of written culture visible, interesting and open to comparison with similar realms in international scholarship.

The main research areas of the Literature Centre are:

- Estonian literature and culture in the 20th century;
- Earlier Estonian and Baltic German written culture in the 13th–19th centuries and the role of the Baltic states' German and Latin-speaking cultures in the development of modern Estonian culture;
- Mechanisms of identity formation of Estonian literary culture (spontaneous emergence, cultural transmission and entanglement);
- The Baltic literary space and literary relationships between Estonia, Latvia and Finland;
- Rhetoric and discursive basic research on describing European and Estonian cultures;
- Drama and theatre studies.

The Literature Centre publishes original research and source materials on Estonian national literature and humanities, curates a collection of historically valuable books and art, and organises conferences, exhibitions and other events. The Literature Centre's Museum Department (the Museum) is the holder of the property of the prolific writer, Member of the Academy Friedebert Tuglas, and of other collections, including the Tuglas Family library and art collection, Artur Adson's and Marie Under's library and art collection, the art collection of the Estonian Cultural Foundation in the USA and the Paul Reets library and art collection. In total, these bequests form a collection that bridges literature, cultural history and the history of thought, art history and art criticism, which due to their enduring scientific value and high level of systematisation have earned a place in the Estonian national collection in the field of the humanities.

In spring 2020, the institutional research topic "Entangled Literatures: Discursive History of Literary Culture in Estonia" (principal researcher: Jaan Undusk) was completed, which had started 6 years earlier and had involved most of the researchers at the Literature Centre. Within the programme, the emergence and development of literary culture on the Estonian territory was examined as an entangled process (*histoire croisée*), reflecting intertwined relationships between manifold ethnic, class-related, colonial, cultural and other impulses, involving crisscross patterns, resistances and inertias. In cooperation with scholars from Germany, Poland and the USA, political, legal, educational, linguistic-philosophical, and gender aspects of early multilingual Baltic literary cultures were investigated. With Scandinavian scholars, reciprocal influences of literature and national memory, as well as ideologies of history-writing were studied. The groundwork was laid for applying decadence as a concept of cultural typology in Northern Europe, including Estonia. The international dimension of literary urban studies intensified. Research continued on Estonian literary culture in the eastern exile before the Second World War and in the post-war political diaspora in the West, new sources were published. Further topics were the activity of future writers

during their years in prison camps and resettlement, and Russian literature in Estonia. In addition to literary studies, research progressed on mainstream Estonian drama in the Soviet era and the period of re-independence. The research team's publishing activity was remarkable: 300 scholarly texts were published in six years, many of which are also understandable to non-specialists; 25 books in Estonian, English, German, and Latvian were published or completed in manuscript (some of them in cooperation with the Baltic Historical Commission in Göttingen, the Jochmann Society in Heidelberg, the University of Helsinki and the Finnish Literary Society); 278 scientific presentations were given, and 156 of these at international events.

A special issue of the *Journal of Baltic Studies* titled "Entangled Cultures in the Baltic Region", published in 2020, gives an overview of the results of the work done within the research project. The special issue builds on conferences held in Tallinn in 2015 and 2017 by the Literature Centre (main organisers Eneken Laanes, Jaan Undusk, Rein Undusk), where researchers from Estonia and abroad discussed the interconnectedness of different cultures and the conceptual framework of studying them. The editor of the special issue is Eneken Laanes, and articles are also written by Martin Klöker, Ulrike Plath and Kristi Viiding who are researchers at the Literature Centre.

As a special publication, the Literature Centre published the collection of articles *Jalutuskäigud ja kohvijoomised* (*Walks and Chats over Coffee*) dedicated to Madis Kõiv in 2020 as the 26th volume in the series *Collegium Litterarum*. This was also preceded by two discussions held in Tallinn, namely, seminars arranged by the Literature Centre and the Association of Theatre Researchers and participated by people related to literature and theatre and philosophers of different schools (organisers from the Literature Centre Piret Kruuspere and Aare Pilv). The collection compiled and edited by Aare Pilv contains articles on the works of Madis Kõiv by 13 authors, who heavily rely on the presentations given on these seminars and try to provide a synergistic picture of the Madis Kõiv's spiritual world.

In 2020, the Literature Centre also published a single publication titled *Kirjad Sigridile. Sõjatandrilt ja vangilaagrist 1944–1949 (Letters to Sigrid. From the Continuation War and the Gulag 1944–1949)*, containing the letters of Raimond Kaugver, a popular writer of the Soviet era. A voluminous book with a thorough foreword and commentaries includes Kaugver's love letters to his future wife, Sigrid Kurvis, written during the Continuation War and in Vorkuta prison camp. The compiler of the book is Eneken Laanes, and commentaries are written by Krista Mits and Ülle Kurs. It was presented in the hall with the black ceiling in the Writers' House on 30 October. The book redefines the works of Kaugver and is a great addition to prison camp literature of Estonian writers.

As the third volume of the series *Johmann-Studien*, the Literature Centre along with the Jochmann Society in Heidelberg published a collection of studies on Carl Gustav Jochmann (1789–1830), a man of letters from Pärnu. Jochmann was a scholar with an exceptional fate, who was rediscovered in the 20th century and who discussed the effusiveness and openness of society, political aspects of language use, criticism against the nobility and religion, and homoeopathy. The collection *Carl Gustav Jochmann – Ein Kosmopolit aus Pernau* is compiled and edited by Ulrich Kronauer, Head of the Jochmann Society, and Jaan Undusk, Honorary Member of the Society, and was published by Universitätsverlag Winter in Heidelberg. The collection with its nine authors reflects the close long-time cooperation between the Literature Centre and the Jochmann Society. Due to the pandemic, Jaan Undusk sent a video presentation "Geheime Mission Öffentlichkeit" to Heidelberg.

The year was not only abundant in the compiled and published editions – significant publications were issued by the researchers of the Literature Centre in journals and collections of articles. In total, the researchers of the centre published 11 articles in Estonian and 13 in foreign languages, plus 10 scientific reviews, theses and other publications.

From articles in Estonian, Hegely Klaus' paper "Eesti varase tööliskirjanduse piirjooned ja tunnused" (The Outlines and Features of Early Estonian Working-Class Literature) in the *Keel ja Kirjandus* journal may be highlighted, which considers working-class literature neglected in modern literature research, and problems related to defining the concept; and Elle-Mari Talivee's "Ühistransport eesti kirjanduses" (Public Transport in Estonian Literature), which maps Tallinn through depicting public transport in Estonian fiction in the poeticized, physics-inspired framework suggested by Bart Keunen, a researcher of literary cities. Jaan Undusk published and commented on communication by letters between Jaan Kross and Villem Raam during the years they were in Siberia in 1951–1954 and in the article "Kaks kanget Krasnojarski kraist. Veidike Villem Raamist, seoses ka Jaan Krossiga" (Two Tough Guys from Krasnoyarsk Krai. A little About Villem Raam, also in Regard to Jaan Kross) reveals new information on the life of Villem Raam in the prison and deportation period, based on archive research.

Highlights among the foreign-language articles include Kristi Viiding's article "The Humanist Occasional Poetry in the Early Modern Estonia and Livonia" in the first voluminous multilanguage handbook *Att dikta för livet,*

döden och evigheten: Tillfällesdiktning under tidigmodern tid (Göteborg: Makadam) on early modern occasional poetry, which contains the first compact overview in modern English of occasional poetry in Latin, German, Estonian, Swedish, etc., in Estonia and Livonia. With the research team of the students of Tallinn University multilingualism in Baltic German literature was analysed, of which Marin Jänes wrote an article titled "Widerspiegelungen der gesellschaftlichen Mehrsprachigkeit in der deutschbaltischen Literatur am Beispiel von Georg Julius von Schultz-Bertram, Monika Hunnius und Edzard Schaper" published in the collection *Mehrsprachigkeit und das Politische. Interferenzen in zeitgenössischer deutschsprachiger und baltischer Literatur* (Tübingen: Narr Francke Attempto / A. Francke Verlag).

Several book reviews, overviews and essays were also published during the year. In the journal *Forschungen zur baltischen Geschichte*, Martin Klöker discussed the collection *Reformatio Baltica. Kulturwirkungen der Reformation in den Metropolen des Ostseeraums* dealing with the history of religion, and in the journal *Environment and History*, Ulrike Plath with Kati Lindström published an overview of the environmental history conference "Boundaries in/of Environmental History," held in Tallinn a year ago and organised with the participation of the Literature Centre. Piret Kruuspere contributed to the publication of the monography *Ado Vabbe. Wunderbar* by Tiiu Talvistu and participated in displaying an exhibition under the same title in KUMU, which included almost 50 art pieces and books from the collection of the Literature Centre.

In 2020, the employees of the Literature Centre also translated and edited fictional works and literature analyses. Along with Enn Siimer, Aare Pilv translated an influential analysis by Mihhail Bahtin, *Dostojevski poeetika probleemid* (*Problems of Dostoyevsky's Poetics*), and with Rein Raud, they translated Paul Celan's poetry (completed the collection *Tema seljas ratsutas* öö (*Night Rode on Him*), he also revised the A. H. Tammsaare's Estonian translation of Fjodor Dostoyevsky's novel *Crime and Punishment*, making it more easily accessible to today's readers, edited Jan Kaus' collection of essays *Homme tuntud avarus* (*The Spaciousness Known Tomorrow*) and Aija Sakova's poetry collection *Isa suudlus* (*Father's Kiss*). Jaan Undusk translated a selection of Johann Wolfgang Goethe's poems with Maarja Kangro and published for the first time an unfinished verse-novel titled *Tiit Pagu*, which appeared as the first book of 2020 in the *Loomingu Raamatukogu* book series. In his foreword, he describes the literary activity of Jaan Kross in Siberia, which had not been publicly known before, and sheds light on the events related to creating the verse-novel.

The Literature Centre was also involved in other events that were organised to commemorate the 100th anniversary of the birth of Jaan Kross. In January, the National Library launched an exhibition: "Discovering the World. Jaan Kross 100" and displayed Jaan Kross' works and their translations, a selection of illustrations of Kross' works from the national library's graphic art collection, as well as the private collection of his family. In February, an international conference: "Köielkõndija. Jaan Kross 100" (The Ropewalker: Jaan Kross 100) took place in the hall of the Estonian Writers' Union, where one of the organisers Jaan Undusk gave a presentation. He also gave a talk at the festive seminar in Helsinki Central Library Oodi arranged by the Friedebert Tuglas Society. In February, Jaan Undusk's play "The Great Land of Siberia" was premiered at the Estonian Drama Theatre (director Hendrik Toompere), based on the period in Jaan Kross` life when he was in mandatory resettlement in the Krasnoyarsk region after his imprisonment in the Gulag, and when he later returned to the Estonian SSR. The play was published in the February issue of *Looming*, and in March 2020 as the 33rd volume of the Estonian Drama Theatre's series *Playbook*.

Although a number of events planned for 2020 were cancelled due to the pandemic, the Literature Centre managed to organise a lot of interesting ones. At the beginning of the year, the centre participated in the joint project: "Staarese" (Star Object) of writers' museums, in the course of which unique museum objects from the museum collections were introduced. The Literature Centre Museum was represented with its true star object: Ants Laikmaa's pastel drawing of the young Tuglas, which represents the young revolutionary and refugee in 1905 on his secret visit to Estonia. The painting was introduced by Mait Vaik, a writer and musician, who has received the Friedebert Tuglas Short Story Award and written lyrics to the song "1905" by the band Sõpruse Puistee.

On 13 March, the scientific seminar "Jacob Böhme kujuteldavad jäljed Eesti 19. sajandi poliitmüstikas" (Jacob Böhme's Imaginary Traces in the 19th-century Political Mystics), led by Aira Võsa from Tallinn University Academic Library, and Mait Laas from the Estonian Academy of Arts. The seminar reflected on the possible effect of the ideas of Jacob Böhme, considered as the first German philosopher in Estonia during the Estonian Age of National Awakening. It was the opening event of the small seminar series in 2020, which was also the last in that year due to the pandemic.

On 10 June, a pandemic webinar inspired by the emergency situation "Love in the Time of Cholera" took place, which the Literature Centre (namely, Elle-Mai Talivee) organised with the University of Tartu Department

of Semiotics. In nine short presentations, reflection of infectious diseases in Estonian and world-wide fiction was examined, especially its epidemic and pandemic forms.

On 15 June, a virtual exhibition "Kodus" (At Home) was opened, which displayed paintings, photos and illustrations from the collection of the centre depicting homes and home places (curator Hegely Klaus). The exhibition construed the time of COVID-19 as a romantic break from social life, which allows us to have insights into ourselves and also our homes, discover things or emotions that would otherwise have remained hidden.

On 17–19 September, an international conference: "Baltische Erzähl- und Lebenswelten. Kultur-, literatur-, translations- und sprachwissenschaftliche Aspekte" organised by Tallinn University and the Literature Centre took place. At the interdisciplinary event, researchers of culture, literature and translation history, linguists and historians analysed biographic and cultural history narratives, facts and fiction in history writing, national identity as a narrative and its depiction, contacts with the cultural "Other", life in the Baltic region in visual arts, national and cultural narratives in translations, translators as mediators of cultures and different aspects of multilingualism.

On 29 September, a joint seminar by the Literature Centre and the Estonian Literary Museum "Elu mürtsuv orkester. Elulähedased esteedid Semper ja Barbarus" (Life's Thumping Orchestra: Down-To-Earth Aesthetes Semper and Barbarus) took place at the Adamson-Eric Museum, where also the book *Euroopa, esteedid ja elulähedus. Semperi ja Barbaruse kirjavahetus 1911–1940* (*Europe, Aesthetes and Viability. Correspondence Between Semper and Barbarus*) (EKM Teaduskirjastus, 2020) was presented (organiser from the Literature Centre Mirjam Hinrikus). The seminar, which intertwined literature, art and music, focused on the works of Johannes Semper and Johannes Vares-Barbarus from different perspectives, such as body politics, classicism and various stylistic layers. The participants also listened to the music that transmitted the spirit of modernism and was inspired by Johannes Semper's trip to Spain, as well as the art pieces related to the topic from the collection of Adamson-Eric Museum were enjoyed.

On 22 October, a joint seminar "Laps kirjanduses" (A child in literature) organised by the Literature Centre (Elle-Mari Talivee) and the Estonian Children's Literature Centre took place. It was already the eighth seminar with a sub-title "Mäng ja lastekirjandus" (Play and Children's Literature) where researchers of literature and linguists, writers and theatre figures discussed the importance of playfulness in works intended for children and the question whether adults are even able to play.

On 30 October, the presentation of the publication *Letters to Sigrid. From the Continuation War and the Gulag 1944–1949* containing letters from Raimond Kaugver, a popular writer of his time (compiler Eneken Laanes, commentaries by Krista Mits and Ülle Kurs) took place in the famous hall with a black ceiling of the Writers' House. Leena-Kurvet Käosaar, Aksel Tamm, Andres Tarand and the compiler Eneken Laanes spoke about life writing in literature, the life and works of Raimond Kaugver and his contemporaries, and Alden Mayfield, a student at the Drama School of Estonian Academy of Music and Theatre, recited some extracts from the letters.

On 9 December, the Literature Centre partnered at the conference "Igal tuulel oma tuju – tormid ja tormisus. Ekstreemne kliima ja selle ühiskondlik mõju Eesti näitel" (Every Breeze Has a Mood – Storms and Storminess: Climate Extremities and their Social Effect on the Example of Estonia), where historical storms were discussed, especially by historians and climatologists. In 2021, a follow-up is planned with a focus on studying literary storms.

On 19 December, a discussion "Kunsti ja kirjanduse koostööpraktikad Eestis 20. sajandi esimesel poolel" (Cooperation Practices Between Art and Literature in Estonia in the First Half of the 20th Century) in the context of Ado Vabbe's exhibition "Ado Vabbe. Wunderbar" took place in KUMU focusing on Ado Vabbe's cooperation with the writers belonging to the organisation Siuru, and on the formal and contextual links of his works to Estonian decadent and modern literature. There were also more general discussions on the tendency of European decadent and avant-garde groupings of the late 19th and early 20th century to invite representatives of different art types to join their organisations and on the synergy reflected in their works. The discussion panel included Tiina Abel from the Academy of Arts and Jaan Undusk, the event was moderated by Mirjam Hinrikus. An overview of the discussion was published in the January issue of the *Sirp* newspaper.

The researchers of the Literature Centre also presented their work at other Estonian and international conferences and seminars. Some examples: Hegely Klaus and Elle-Mari Talivee's presentation ""Raudsed käed" – kas (nais)tööliste-romaan või tööliskirjandus?" ("Iron Hands" – (Female) Working-Class Novel or Working-Class Literature?) at the conference "Seks ja linn. Vaateid Eduard Vilde loomingule" (Sex and the City: Opinions on Eduard Vilde's Works), Elle-Mari Talivee's presentations "Public Transport in Estonian Literature: From Horsecar to "Trophy" Tram Won in Battles with Poland" at the Åbo Akademi University's seminar "Public Transport as Public Space in European Cities: Narrating, Experiencing, Contesting", "Olga Pogodina-Kuzmina romaanist "Uraan" teiste Ida-Virumaa

tööstusmaastiku kirjanduslike kirjelduste taustal" (On the Olga Pogodina-Kuzmina's Novel "Uranium" in the Context of Other Literary Descriptions of Ida-Viru County Industrial Landscape) at the symposium organised by the Estonian Academy of Arts and Tallinn University, and "Tallinnast kõnelevas ilukirjanduses korduvad motiivid" (Leitmotifs in Fiction About Tallinn) in the lecture series "Tallinna lood ja legendid" (Stories and Legends of Tallinn) of Tallinn City Museum, also Aare Pilv's lectures "Sergei Zavjalovi "Kvartett Horatiuse teemal" ja mõnda selle kontekstist" (Sergei Zavjalov's "Quartet On the Theme of Horace" and on its context) at the Arvo Pärt Centre and "Jaak Jõerüüdi "Muutliku" poeetika" (Poetics of Jaak Jõerüüt's novel "Muutlik") at the X Summer School of the Estonian Literary Museum, and Piret Kruuspere's presentation "Teatrikoolipuu. Tagasi juurte juurde" (Tree of Drama School: Back to the Roots) at the conference "Eesti teatriharidus: teerajajatest nüüdisaegse lavastajaõppeni" (Estonian Drama Education: From Pioneers to Modern Directing Studies) of the Drama School of Estonian Academy of Music and Theatre and the Association of Theatre Researchers and Critics.

In addition to research-related events, the Literature Centre actively participated in other events targeted to the wider public. For example, the centre took part in the Literary Street Festival in Kadriorg. Also, the researchers of the centre were guests on several television and radio programmes: Jaan Undusk and Ulrike Plath in the "Plekktrumm" programme in February and March, respectively; in December, a lecture at the so-called Night University was recorded where Marek Tamm from Tallinn University and Jaan Undusk talked about changes that digital opportunities have introduced into everyday life and different cultural fields. Also, the play "Ümarlaud" (Round Table) premiered in October at the New Theatre in Tartu (playwright: Aare Pilv). It is a partly improvised drama or situation play where actors involve the audience and perform a continuously changing play.

A lot of interesting events also happened in the Literature Centre Museum, which for obvious reasons had about two times less visits in 2020 than a year before – about 500 visitors and 20 researchers. People came to the museum to participate in thematic tours and educational programmes, from which the short lecture "Kirjanike aed – kirjanduse ja looduse suhted" (Writers' Garden – Relations Between Literature and Nature) with a tour along the Museum's literary nature study trail was especially popular. As the only larger event at the museum, the laureates of the Friedebert Tuglas Short Story Award were announced for the 50th time on 2 March along with the Estonian Writers' Union. The jury, in which Marju Kõivupuu represented the Literature Centre, selected Livia Viitol for her short story Õpetaja*nna saabumine* (*Arrival of the Teacher*) and P. I. Filimonov for the short story *Sebastian Rüütli tõehetk* (*The Moment of Truth for Sebastian Rüütel*) as the laureates.

The collections of the museum were increasingly used from a distance, though – the files of the collections in the Literature Centre's information system MuIS were accessed 561,500 times. In 2020, the ASTRA project "Developing the Under and Tuglas Literature Centre Museum Department into a Contemporary International Research Centre" (project leader Elle-Mari Talivee) ended, which was funded from the Structural Funds and focused on the digitisation of the Literature Centre's collections, making them available from outside. Within the project, much work was done in order to develop the museum into an international research centre on cultural history where archival materials, most of which were on paper or out-of-date digital media, were digitised according to contemporary requirements and gathered together into a functional database connected with the homepage, where they could be accessed by local and foreign researchers and other participants in the research process. By the end of 2020, 35,000 archival documents had been entered in the MuIS information system, which is reflected on the homepage of the Literature Centre (Head of Digitisation: Kri Marie Vaik, Databases Administrator: Urve Sulg). All who are interested have access to information on 19,000 books, 6,000 photos, 4,000 post cards, 2,200 photo negatives, 2,200 art collection items, 500 objects, 400 audio files, 30 clipping folders, 240 correspondences, 160 documents, 100 small printed works and 90 manuscripts.

The Literature Centre has been in close cooperation with higher education institutions and has put a great effort in organising research activities. The Literature Centre continued to provide practical training opportunities to the students of the University of Tartu and Tallinn University, the researchers of the centre gave lecture courses and supervised seminars at Tallinn University, the Estonian Academy of Music and Theatre and Academia Artium Liberalium (Piret Kruuspere, Ulrike Plath, Jaan Undusk, Kristi Viiding), Ulrike Plath continued as Professor of German History and Culture in the Baltic Region at Tallinn University and Jaan Undusk as a Visiting Professor. The Literature Centre participates in the work of the research councils of Tallinn University Academic Library, the Estonian National Library and the Estonian Literary Museum, the doctoral council of the Estonian Academy of Music and Theatre (Jaan Undusk), in the board of the Estonian Writers' Union (Aare Pilv) and is related to many other organisations. Jaan Undusk was also a member of the jury of the Jaan Kross Literary Award, the committee of the *Rahvusmõtte auhind* ("National Identity" award) and the award committee of the national contest for

university students. Elle-Mari Talivee participated in the work of the jury of the Estonian-Latvian Language Award. At the end of 2020 she was elected a member of the board of the Tallinn University Institute of History, Archaeology and Art History and she represents the Literature Centre in the Horizon 2020 project "Envirocitizen – Citizen Science for Environmental Citizenship," launched in spring and coordinated by Stavanger University, Norway, in partnership with six European research institutions, including the Literature Centre. Kristi Viiding acts as the Secretary General of the International Association for Neo-Latin Studies and received a grant from the Polish National Agency for Academic Exchange (NAWA) for the project "Transcultural Knowledge Production in Renaissance Europe (1470–1620): Competition and Cooperation Between Poland and Livonia". Kristi Viiding also leads the international comparative literature research project "Literary Representations of Early Modern Crisis in Central and North Eastern Europe" launched by the Estonian Academy of Sciences Under and Tuglas Literature Centre and the Czech Academy of Sciences Institute of Philosophy in 2021, which the Members of the Estonian Academy of Sciences and Czech Academy of Sciences selected from the proposals submitted to the Estonian-Czech competition for academic research mobility projects (see page 97). The researchers of the Literature Centre also participate in the work of several other organisations and juries. They are also members of the boards of editors of several other research publications and contribute to journals as peer reviewers.

INSTITUTIONS AND ORGANISATIONS ASSOCIATED WITH 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 comply 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. Short information on the activities of associates institutions and organisations see pages 102–113.

Institutions associated with the Academy (in alphabetical order):

	Institution and time of association with Estonian Academy of Sciences (EAS)	Information and contacts
1.	Academic Library of Tallinn University Associated with EAS since 17.06.1998	Founded in 1946 Personnel: 103 * Number of registered users: 38,317 Number of copies in the circulating collection: 2,657,249 More information: tlulib@tlulib.ee https://www.tlu.ee/en/repositories/academic-library
2.	Art Museum of Estonia Associated with EAS since 9.06.2015	Founded in 1919 Personnel: 154 More information: kantselei@ekm.ee https://kunstimuuseum.ekm.ee/en/
3.	Estonian Crop Research Institute Associated with EAS since 23.09.2008	Founded in 1920 Personnel: 141, including 37 researchers More information: info@etki.ee https://etki.ee/
4.	Estonian Literary Museum Associated with EAS since 11.05.1999	Founded in 1909 as the Archival Library of the Estonian National Museum Personnel: 102, including 34 researchers, 18 librarians and bibliographers More information: krimus@kirmus.ee https://www.kirmus.ee/en
5.	Estonian National Museum Associated with EAS since 21.12.2006	Founded in 1909 Personnel: 130, including 17 researchers More information: erm@erm.ee https://www.erm.ee/en
6.	Institute of the Estonian Language Associated with EAS since 11.05.1999	Founded in 1947 Personnel: 82, including 68 academic staff members More information: eki@eki.ee https://www.eki.ee/EN/
7.	University of Tartu Tartu Observatory Associated with EAS since 8.05.1998	Founded in 1808, an institute of the University of Tartu since 1 January 2018 Personnel: 87, including 46 academic staff More information: kosmos@ut.ee https://kosmos.ut.ee/en

* All numerical data from December 2020

Organisations Associated with Estonian Academy of Sciences (EAS) (listed in alphabetical order)

	Organisation and time of association with Estonian Academy of Sciences	Information
1.	Estonian Academic Agricultural Society Associated with EAS since 6.03.2018	Founded in 1920 Membership: 212 active members, 31 honorary members, (incl. 3 honorary presidents)* More information: https://aps.emu.ee/en/
2.	Estonian Academic Oriental Society Associated with EAS since 12.06.2018	Founded in 1935, re-established in 1988 Membership: 72 active members, 7 honorary members, 28 correspondent members More information: eao@eao.ee https://www.eao.ee
3.	Estonian Academic Theological Society Associated with EAS since 15.10.2019	Founded in 1921 Membership: 66 members, 2 honorary members More information: https://usuteadus.ee/?page_id=785&lang=en
4.	Estonian Association of Engineers Associated with EAS since 23.09.2008	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: inseneronlooja@hot.ee https://www.insener.ee/
5.	Estonian Association of Sociologists Associated with EAS since 18.06.2019	Founded in 1990 as the Academic Association of Estonian Sociologists, restructured in 1999 Membership: 105 More information: sotsioloogideliit@gmail.com
6.	Estonian Biochemical Society Associated with EAS since 13.11.2009	Founded in 1959 Membership: 103 members, incl. 78 active and 25 student members More information: http://www.biokeemiaselts.ee/?mid=4&lang=en
7.	Estonian Chemical Society Associated with EAS since 8.03.2011	Founded in 1919 Membership: 72 active members More information: info@keemiaselts.ee https://www.keemiaselts.ee/english

* All membership data from December 2020

8.	Estonian Economic Association Associated with EAS since 16.06.2011	Founded in 1930, re-established in 2002 Membership: 121 private persons and 4 legal entities; Honorary Member More information: https://emsconference.org/
9.	Estonian Geographical Society Associated with EAS since 27.01.1998	Founded 1955 Membership: 180, 17 honorary members, 5 foreign members More information: egs@egs.ee geograafiaselt@gmail.com http://egs.ee/
10.	Estonian Learned Society in Sweden Associated with EAS since 19.03.1999	Founded 1945 Membership: 90 members, incl. three honorary members More information: teadusselts@gmail.com https://www.etsr.se
11.	Estonian Literary Society Associated with EAS since 23.01.2001	Founded 1907 Membership: 270 members (incl. 36 life-time members, 6 honorary members and 21 trusted members) More information: eks@kirjandus.ee https://tartu.kirjandus.ee/en
12.	Estonian Mathematical Society Associated with EAS since 26.02.2019	Founded 1926 as the Academic Mathematical Society, re-established on 17 September 1987 as the Estonian Mathematical Society Membership: 340 members More information: https://matemaatika.eu
13.	Estonian Mother Tongue Society Associated with EAS since 4.02.1998	Founded 1920 Membership: 382 active members and 17 honorary members More information: es@emakeeleselts.ee https://www.emakeeleselts.ee/kontakt/
14.	Estonian Musicological Society Associated with EAS since 21.06.2004	Founded 1992 Membership: 91 active members (4 from abroad), 1 honorary member emts@hot.ee https://www.muusikateadus.ee
15.	Estonian Naturalists' Society Associated with EAS since 23.01.1998	Founded 1853 Membership: 13 honorary members, 667 active members, 67 trustees Divisions: 23 More information: elus@elus.ee https://www.elus.ee/index.php/en/

16.	Estonian Physical Society Associated with EAS since14.06.2005	Founded 1989 Membership: 212 active members More information: efs@fyysika.ee https://www.fyysika.ee/efs
17.	Estonian Semiotics Association Associated with EAS since 15.12.2009	Founded 1998 Membership: 69 More information: info@semiootika.ee https://www.semiootika.ee
18.	Estonian Society for The Study of Religions Associated with EAS since 16.06.2011	Founded 2006 Membership: 57 active members, 1 honorary member, 3 correspondent members More information: http://eaus.ee/en/welcome/
19.	Estonian Society of Human Genetics Associated with EAS since 5.04.2011	Founded 2000 Membership: 173 active members, 1 legal entity (Asper Biogene) estshg@ebc.ee https://estshg.ut.ee/
20.	Estonian Society of Toxicology Associated with EAS since 31.05.2017	Founded 1997 Membership: 67 active members More information: ets@kbfi.ee https://kbfi.ee/ets/index_english.html
21.	Estonian Union of the History and Philosophy of Science Associated with EAS since 4.02.1998	Founded 1967 Membership: 60 active members, 7 honorary members, 6 collective members More information: Kaija.koovit@gmail.com https://et.wikipedia.org/wiki/Teadusajaloo_ja_ Teadusfilosoofia_Eesti_%C3%9Chendus
22.	Learned Estonian Society Associated with EAS since 23.01.2001	Founded 1838 Membership: 111 active members and 17 honorary members More information: http://oes.ut.ee/english/
23.	Society of Estonian Areal Studies Associated with EAS since 27.01.1998	Founded 1939 Membership: 185 Address: Kohtu 6, 10130 Tallinn More information: ekus@ekus.ee http://www.ekus.ee/en/

IN MEMORIAM

Member of the Academy Ilmar Koppel

16.01.1940 to 9.01.2020

Only a few days before his 80th birthday, the outstanding chemical scientist, Ilmar Koppel, passed away. In 1958, the future academician born in Võru graduated from Puurmani Secondary School, and in 1963, from the University of Tartu Faculty of Mathematics and Natural Science. Subsequently, he became an aspirant at the Chair of Organic Chemistry, and in 1969, he defended his Candidate of Sciences thesis (in modern terms, PhD). In the scientific world of his time, only a doctoral degree was considered a top-class result, which required decades of hard work. In 1986, Ilmar Koppel defended his Doctor of Sciences thesis in Moscow, at the A. Semjonov Institute of Chemical Physics of the Academy of Sciences of the USSR. In 1990, he received a professorship and in 1993 was elected a Member of the Estonian Academy of Sciences.

Ilmar Koppel's activity was mainly to the University of Tartu. For almost 40 years (1967–2005) he worked as a senior research fellow, led the work of the laboratory of chemical kinetics and catalysis, was the Head of the Chair of Analytical Chemistry, Head of the Institute of Chemical Physics, and Professor of Analytical Chemistry. In 2005 to 2008, Ilmar Koppel was a Research Professor at the Estonian Academy of Sciences. Even after he was granted the emeritus status (in 2008), Ilmar Koppel contributed to the development of his area of research, acted as the Vice-Director for Research at the Institute of Chemistry between 2008 and 2015, and until 2018, as a Research Professor of Physical and Analytical Chemistry.

His interests reached far beyond the frames of classical organic chemistry. The scientific community knows him as the designer and researcher of superacids and superbases. It is difficult to imagine substances that would be millions of times more acidic than hydrochloric acid, nitric acid or aqua regia, so that it is difficult to find proper vessels for preserving them. For him, these substances were everyday toys. His interests ranged from these substances to neutrino physics, from processes in solutions and their environmental or solvent effects to gas-phase reactions in high vacuums. The results and conclusions included profound generalisations and basic research into chemistry, but also achievements with a great potential for high tech applications.

Science is programmed to look forward, so the great achievements of the past may seem as simple facts. The high status of our science, however, is built on the selfless contribution of our colleagues in the times when Estonia's future was on a razor edge. After Estonia regained its independence, the efforts of Ilmar Koppel helped Estonian chemical research to blend in the international scientific life. He worked hard to bring Soros grants to Estonia. Supported by these funds, several researchers were able to cross the deep cleft in Estonian research funding in the 1990s.

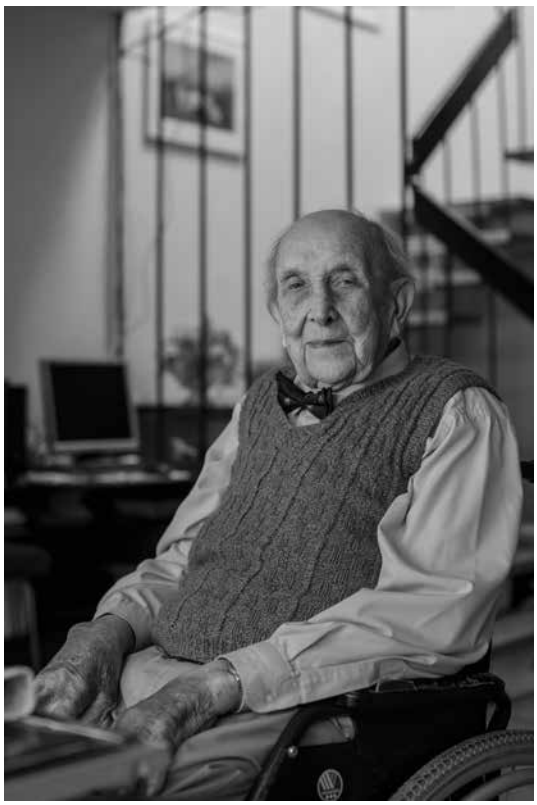
Since 1995, Ilmar Koppel was a member of the Higher Education and Science Reform (HESR) steering committee and the coordinator of the Tempus project. This support helped to advance science in the young state, also its internationalisation. Ilmar Koppel's personal relationship with top researchers served as a bridge between us and the wide world, including the universities of Uppsala, Barcelona, Madrid and the other leading research institutions, which opened the doors to top-class laboratories for his colleagues.

International success cannot be achieved without a solid foundation at home. Under the leadership of Ilmar Koppel, the Centre of Excellence in Chemistry and Materials Science functioned in the first round of Estonian centres of excellence in 1999–2006. The centre brought together researchers of chemistry, materials science and physicists from two main universities. Their symbiosis laid a foundation to the development of the Centres of Excellence focusing on high-technology materials (2011–2015) and equipment (2015–2023). The centres have contributed to the development of chemistry and materials science, and also to the advancement of energy production based on high performance hydrogen and fuel elements. In the context of climate change and carbon neutrality, these advancements may be a real engine for the future.

As other leading researchers, Ilmar Koppel often played a leading role in international conferences, represented Estonia in international organisations, and coordinated or was responsible for carrying out research projects. In 2004–2014, he was the Head of the Division on Biology, Geology and Chemistry of the Academy of Sciences. Having published more than 300 research works, including five monographs, he became one of the most cited Estonian researchers. He supervised more than 30 defended doctoral and master's thesis. His research work has been acknowledged with the national annual research award in 1998 and the lifetime achievement award in 2005. In 2006, Ilmar Koppel was awarded the Order of Merit of the White Star, Third Class. To acknowledge his role in building up relationships, he was appointed Honorary Doctor of Tallinn University of Technology in 2007 and in 2010, he became the second researcher to be awarded with the highest prize of the Estonian Academy of Sciences in chemistry and related subjects – the Wilhelm Ostwald Medal.

Estonian Academy of Sciences
University of Tartu
Sirp, 2(3774), 17 January 2020, 38

See also the obituary in the previous yearbook (*Academy of Sciences Yearbook. Facts and Figures XXV* (*52*). 2019, page 116).



Member of the Academy Valdek Kulbach

6.04.1927 to 31. 01.2020

Valdek Kulbach, Member of the Academy whose true name could be the Unifier, has left us forever. He is best known as the designer of the Saaremaa Bridge, who was also ready to provide a solution which would result in the longest suspension bridge in the world.

Similar to his great mentor Ottomar Maddison and his disciple Jüri Engelbrecht, a bridge was a symbol of connection for him. Be it a bridge built from metal, concrete, wood, or in a broader sense, it may create a spatial separation, but mentally, culturally and economically it unites communities and peoples. Valdek Kulbach built many bridges, in every size and shape. The bridge was a sign as well as a stamp for him, which may have been a flashback to his childhood near the Narva River. Anyway, he collected all the stamps depicting bridges. Even his name refers to a need for a bridge – born on Kulli farm owned by his grandparents, near a flowing stream (*Bach* in German).

Everyone who knew him also knew that he was not afraid of hard work or tiring mental effort. In many fields, he had to be a pioneer leading to pro-Estonian research and art of engineering. More than 50 years ago, his books on metal and wooden constructions opened a window to mastery in these subjects for our students. The books revealed his feeling for language and extensive experience as an engineer and a teacher.

He continued this work in the field of norms applying to building constructions. Continued, and never tired, or as he said himself: "When it comes to engineering, I have never distinguished between work and rest. I rest while engineering." It was obvious that he enjoyed teaching, especially teaching the subjects that were in the range of his research.

He did not care about old age, at least until he could move his fingers. It was only a year ago when he published an overview of his numerous ideas and solutions found by him. Only when it was difficult to move, at the age of about 80, he accepted that he could not go and show himself how real results would be achieved.

For our Eastern neighbours, derrick cranes invented, designed and built by Valdek Kulbach have become legendary. In the harsh conditions of Siberian winters, the cranes were used to lift devices that were about 100 metres high and weighed around 1,000 tonnes.

Inventing great things like that requires more than just knowing facts. You have to be able to perceive complicated constructions and functioning of systems. There is more than complex mathematics behind it – a creative bright mind that can invent unique solutions. In his opinion, learning mathematics at school is boring only because it is taught without relating it to fascinating real-life problems.

His primary force was the theory and practice of suspension constructions. Beside complicated equation, the functioning of a construction must be perceived and interaction of individual components. For a construction to remain intact, it cannot be too stiff. Some parts must be let loose.

The work he took the greatest pride in is the unique solution of the sound arc of the Song Festival arena in Tartu. No-one has dared to build a construction with

non-supported edges, as if the arc is suspended in the air. The trick is that the structure itself takes an optimal shape and has been designed so that it becomes more rigid if the load on it increases. Normally, strong crosswind causes problems with structures like that. To the components of the stage in Tartu, vertical load applies in these conditions.

The work of Valdek Kulbach was noticed and recognised with national awards four times – from the awards of the Soviet Estonia and the Council of Ministers of the Soviet Union (1970, 1985), to the national lifetime achievement award of the Republic of Estonia (2008). Despite all the glory and countless obligations in the University of Technology, work in Estonian and international professional associations, committees or God knows where else, he remained himself.

The horrors he experienced as a child and young man shaped him into a person who strongly supported the independence of Estonia, but were never manifest in human relations. Always calm and helpful, he never closed himself in his office or avoided complicated or obscure questions. The Academy will remember Valdek Kulbach as an extremely kind, level-headed, pleasant and warm person, who always took time for a friendly word, firm and supporting handshake.

Now he is probably building a bridge between the Earth and Sky, according to his own understanding. Whether it is the latest model of a cable-stayed bridge he loved so much or built from pure light as recommended by Uku Masing, we will find out when the time is right for us, everyone at their own time – when we follow him

Tarmo Soomere's eulogy at Kaarli Church in Tallinn on 10 February 2020.

Sirp, 6 (3778), 14 February 2020, 38

See also the obituary in the previous yearbook (*Academy of Sciences Yearbook. Facts and Figures XXV (52)*. 2019, page 117).

Member of the Academy Enn Tõugu

20.05.1935 to 30.03.2020

On 30 March 2020, Enn Tõugu, a founder of Estonian computer sciences, Member of the Estonian Academy of Sciences and Professor Emeritus at Tallinn University of Technology, passed away.

He was born on 20 May 1935 in Tallinn to the family of a well-known lawyer and lived a long, versatile life best characterised by the title of his biography: *Life as a Performance: Through Siberia and the Kremlin, to the Kingdom of Sweden*. In 1941, his family was deported to Russia to Kirov Oblast. He lost his parents there, lived in the orphanage and started his schooling at a Russian-speaking village school. After returning to his homeland, he grew up with his aunt's family near Tallinn in Haabersti.

As a member of a deported family, his options were often severely restricted. His greatness manifests itself in the way he described the period himself. Always with some touch of humour. Almost creating an urban legend, as if it had been by reason of a mistake that he had become a computer researcher. That he actually wanted to go to Westholm Gymnasium as his brother had done, but took the wrong door and applied to Tallinn 20th Secondary School. Maybe for this reason, he has become almost a symbol of infallibility in his profession.

His winding road to the sharp edge of computer science started with mechanics at the University of Technology. He started his career as an engineer at the Tallinn Excavator Factory. His work was just the opposite to the spick-and-span computer technology: he designed a mud pump and participated in the creation of a multi-bucket excavator, which made Estonia famous and is widely used in land improvement.

Enn Tõugu was one of the young Estonians sent to study computer sciences in Moscow and Leningrad at the end of the 1950s, and to become pioneers in this field at the beginning of the next decade.

The specialty turned out to be right for him, just as the timing was. With him, computer science reached Estonia already at the very start of its development. But nothing came too easily. Before using a computer for your own good, it often had to be built. For the first years after returning from Leningrad, Enn Tõugu worked at the so-called Pirita Road Institute (Tallinn Institute for Scientific Research of Electrotechnology), designing and building an original STEM minicomputer. *Nomen est omen*, people used to believe once. The name of the then computer is an acronym marking four fields of science (*science, technology, engineering, mathematics*), on which smart states build their future.

Enn Tõugu started as a programmer and in the 1970s and 1980s, he focused on system programming, declarative languages and artificial intellect in the meaning of that time. His research focused on describing knowledge as calculation models and taking them as a basis for the automated development of algorithms, using a method known as structural synthesis of programmes.

His career as a researcher advanced fast: he received the degree of Candidate of Sciences which equals the modern PhD degree in engineering in 1965 and a doctorate in engineering in 1973. He was awarded a professorship in 1978 by the USSR Higher Attestation Committee, as was customary at that time. He was elected a member of the Estonian Academy of Sciences in 1981 and as the 8th Estonian researcher, a member of *Academia Europaea* in 2010.

In parallel to his research at the Institute of Cybernetics, he began his teaching career at the University of Technology and continued as a professor at Stockholm Royal University of Technology (1992 to 2000) and then again in Estonia, at the Estonian Business School and the NATO Cooperative Cyber Defence Centre of Excellence in Tallinn.

Although some of his ground breaking works were first published in Russian, he is well-known throughout the world. His works on computer software, artificial intellect and cyber protection, in total seven scientific monographs and more than 200 scientific articles, have been published in Estonian, Russian, English and Polish. He has also published dozens of bright and sharp essays and popular science articles.

Enn Tõugu's main contribution to educating scientists and engineers has been 21 candidate and doctoral theses and dozens of master's theses defended under his supervision. Through this, he helped to establish a strong computer science school in Estonia, which in turn became the basis for the emerging IT industry. With his students, he laid a foundation to software development and cyber security that has made Estonia famous.

The strong legacy of the School of Computer Science, already established in pre-independence Estonia, made it possible for Estonian researchers to quickly reorient themselves. The foundation Enn Tõugu helped to create also stands indirectly behind the success of Estonian IT start-ups. His activities have influenced all software engineers and computer scientists educated in Estonia a few decades ago. In addition to his dissertation supervision, his teaching included the component of bringing up a scholar and decent human being with ethical beliefs that does not always guarantee success in the modern academic culture following the elbow law, but gives priority to persistent values. Maybe for this reason he was a good friend to the world's leading figures and always a welcomed guest. His personal relations became a springboard to great science for many of our researchers.

Enn Tõugu's activities were far from being limited to science. As a representative of scientific and technical societies, he became a deputy to the Congress of People's Deputies of the USSR from 1989 to 1991. In Moscow, he joined the Estonian fraction and contributed to the struggle for independence. In 1996, Enn Tõugu was a candidate in the Estonian presidential elections.

In 1965, Enn Tõugu was awarded the Estonian SSR State Prize and as one of the few Estonian scientists, he was awarded the State Prize of the USSR (1987). In 1985, he was awarded the Order of Honour, in 1995 the Medal of the Estonian Academy of Sciences and in 2001, the Order of Merit of the White Star, Third Class. In 2017, he was awarded the National Lifetime Achievement Award for his long-term productive research and development.

Enn Tõugu was a passionate offshore sailor and among other things, was a member of the Moscow Olympic Games Tallinn Sailing Regatta. He was intensely interested in everything happening in the world, especially in the development of information technology and information society, and this interest did not fade away even when his health started to deteriorate. For decades, he shared his knowledge and experience in his calm and enjoyable speeches and publications, sometimes humorous and a little sarcastic, but always influential. When asked how he managed all this, he would answer: "Actually, for doing something you have just as much time as you take for it." No-one can control time, but Enn Tõugu used the time given to him exceptionally well.

We commemorate our teacher, outstanding scientist and dear colleague, and extend our condolences to his loved ones.

Estonian Academy of Sciences
Tallinn University of Technology
Department of Software Science
Department of Cybernetics
Sirp, 15(3787), 17 April 2020, 37

Member of the Academy Tšeslav Luštšik

15.02.1928 to 8.8.2020

The community of physicists have suffered a severe loss. On 8 August, Member of the Academy Tšeslav Luštšik, the USSR Doctor of Sciences in physics and mathematics, the scholar who has contributed to the development of research in Estonia for the longest time (almost 56 years), has passed away.

He arrived in Estonia by a quirk of fate. His grandfather, a Polish nobleman fell out with Russia's imperial power, was deprived of his title and deported to Siberia. Finally, the family reached St. Petersburg. Tšeslav Luštšik was not only born there but was a third-generation resident of St. Petersburg. He went to school there and graduated from the university. During World War II, he survived the most terrible first year of the siege of Leningrad as a teenager.

After graduating from secondary school with a gold medal, completing his studies in physics at the State University of Leningrad *cum laude,* and defending the Candidate of Sciences (today's PhD) thesis, Tšeslav Luštšik moved to Tartu to start his career as a researcher. He had been invited to Tartu in 1954 by his supervisor Feodor Klement, the then Rector of the University of Tartu. Only 10 years later (1964), he already defended his doctoral dissertation and was elected a member of the Academy of Sciences, despite his uncommonly young age.

This was not an advance payment. Tšeslav Luštšik was one of the few researchers whose work has resulted in a distinct school of his own. His primary force was solid-state physics, especially the way various specific (with somewhat wider exclusion zone) crystals act in different types of light. He showed how interesting it might be to what happens within particles of a different size when exposed to radiation with different wave lengths at different temperatures and pressures – a world full of opportunities, almost as inexhaustible as nature itself.

More than 50 years ago, Tšeslav Luštšik with his exuberant mind perceived every possible application of short-wave radiation causing this richness of phenomena, all of which was novel then. The school of Tartu initiated by him and bearing somewhat cryptic name (vacuum ultraviolet spectroscopy of solid-state materials and isolator crystals radiation physics) prompted the advancement of this research line in the entire world. From this, also came the production of materials needed for safe luminescence lamps, the far-away predecessors of LED lamps still on the market, but also the development of certain dosimeters and finding experimental evidence to prove a theoretical prediction of the legendary physicist Lev Landau. Also, the newly developed space technology needed optical materials that would be resistant and sensitive to radiation. Research into this broad field became the cornerstones of Estonian radiation physics and attracted researchers from many countries.

The collection of Tšeslav Luštšik's works consists of more than 400 thorough and groundbreaking publications (including three monographs). With his students, he discovered and profoundly studied the multiplication of photons and the phenomena of decaying of electronic excitations into defect pairs, also finding interesting applications for them. On his initiative, the series of Baltic seminars on the physics of isolator crystals started, which lasted for 34 years (1969–1992). Although the seminars were held only in Estonia and Latvia twice a year, they promoted the advancement of radiation physics of materials in many other countries from where the researchers had come to the seminars of prominent substance.

The whole career of Tšeslav Luštšik as a researcher was related to the University of Tartu. He worked there for more than 60 years, supervised more than 50 candidates of sciences (doctors of sciences in modern sense) and was an informal advisor for large numbers of physicists. Many of his students have been elected members of academies of sciences in Estonia, Latvia and Russia. The school composed of Tšeslav Luštšik's academic children and grandchildren form a remarkable part of the University of Tartu *Physicum*. He always found time to share his profound knowledge with experienced and young researchers so as

to help them in their attempts to achieve the set objectives.

Tartu was not just a place of residence for Tšeslav Luštšik. The city offered almost ideal conditions for carrying out research. As he said himself: "Not just a work place, but the atmosphere prevailing in this city." His demand for a good environment also extended to himself. For a passionate researcher, physics was a demanding field, and food, for example, was first and foremost a necessary source of energy, but alcohol would have deterred novel and bright thoughts for several days, so it had to be avoided.

The dedicated work of academician Tšeslav Luštšik was recognised with an awe-inspiring number of titles and decorations of honour. At a very young age (in 1959), he belonged to a group which received the State Prize of Soviet Estonia. In 1968, he was awarded the Soviet Medal for Excellence in Work, in 1988 he was appointed a Distinguished Scientist of the Estonian Soviet Republic, awarded the Soviet Order of Friendship of Peoples and the Medal of the Estonian Academy of Sciences. The Republic of Estonia has recognised him with the National Lifetime Achievement Award and the Order of Merit of the White Star, Third Class. The decoration of honour of his life work is the E. F. Gross Medal Awarded by the D. S. Rozhdestvensky Optical Society, Russia, for excellent achievements in studying the solid-state excitons.

The colleagues at the Estonian Academy of Sciences and the University of Tartu Institute of Physics will remember Tšeslav Luštšik as an extremely correct, but always full of life and warm person, who was extremely fond of his family. We bow our heads in grief with his loved ones.

University of Tartu Institute of Physics
University of Tartu
Estonian Academy of Sciences
Sirp, 32(3804), 14 August 2020, 29

FINANCIAL ACTIVITIES

TYPE	BUDGET 2020	FUNDS SPENT 2020
FOR THE ACADEMY FROM STATE BUDGET	**1,584,000**	**1,584,000**
For basic activities of the Academy	1 162 948	1,162,948
For remuneration to Members of the Academy	293,090	293,090
For grants of Academy Research Professors	100,662	100,662
For granting research awards	27,300	27,300
OTHER REVENUE	**108,900**	**649,483**
Targeted allocations from the Ministry of Education and Research	43,400	593,400
incl. for membership fees to international organisations	43,400	43,400
incl. for renovation and repairs	0	550,000
Receipts from letting the premises and providing services	25,500	19,357
From the sale of printed materials and commissioned works (Academy Publishers)	40,000	36,726
Allocations to the Under and Tuglas Literature Centre	**388,122**	**375,625**
TOTAL INCOME	**2,081,022**	**2,609,108**
Basic activity of the Academy (through the Office)	911,950	933,060
Academy Publishers	310,000	262,108
Remunerations to Members of the Academy	293,090	293,090
Remunerations to Academy Research Professors	100,662	100,662
Prizes, medals	6,498	7,490
Membership fees to international research organisations	43,400	35,370
Activities of the National Research Awards Committee	27,300	27,300
Under and Tuglas Literature Centre	388,122	311,217
TOTAL EXPENDITURE	**2,081,022**	**1,970,297**

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