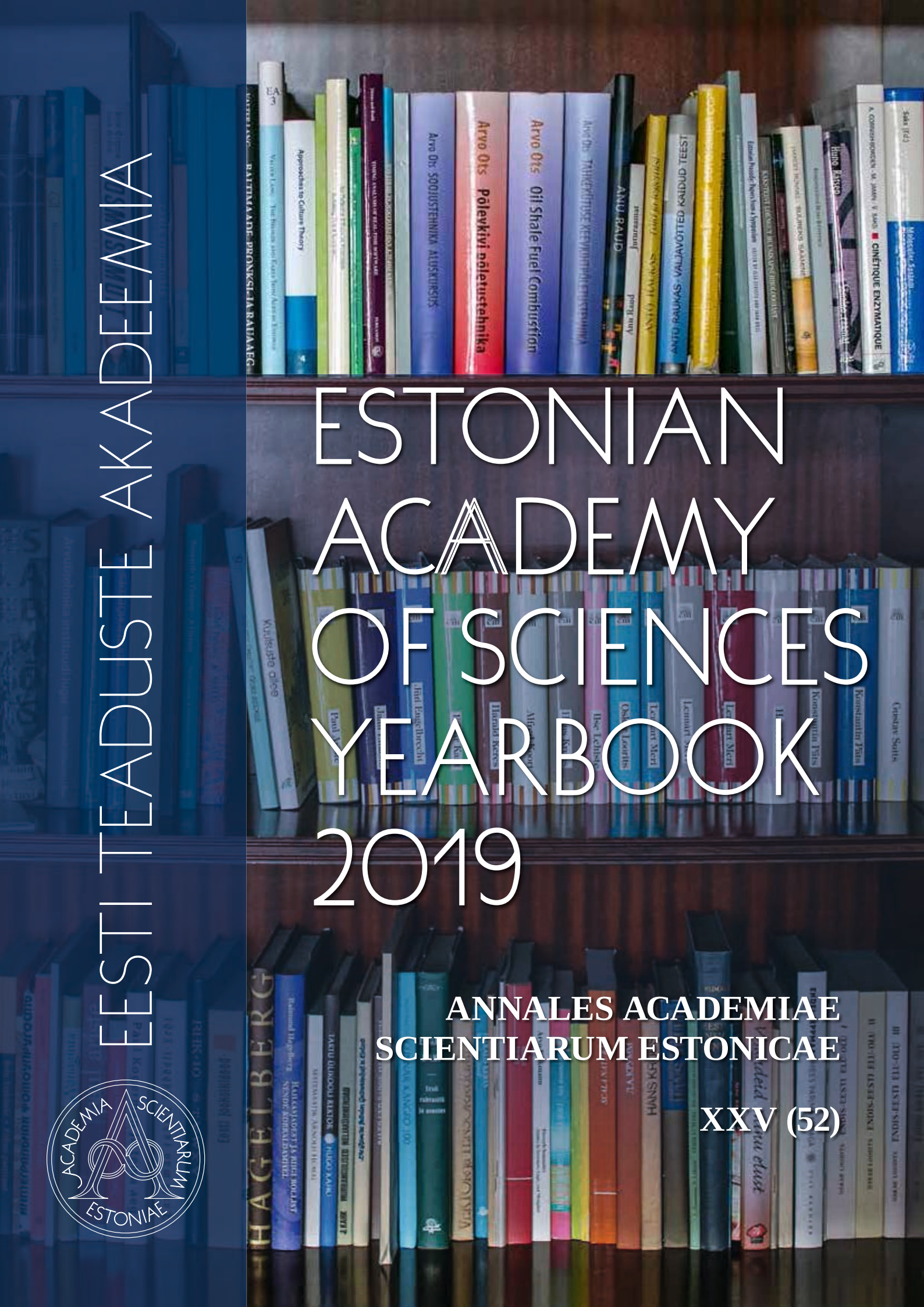
EESTI TEADUSTE AKADEEMIA



ESTONIAN ACADEMY OF SCIENCES YEARBOOK 2019

ANNALES ACADEMIAE SCIENTIARUM ESTONICAE

XXV (52)

Front cover: A selection of Academy Members' writings published in the "Eesti mõttelugu" (Story of Estonian Thought) series displayed on the Academy library shelf to celebrate the Year of the Estonian Language. The editor-in-chief of the book series is Member of the Academy Hando Runnel.
Photo: Reti Kokk

Facta non solum verba

EESTI TEADUSTE AKADEEMIA

ESTONIAN ACADEMY OF SCIENCES YEARBOOK 2019

WORDS AND IMAGES

FACTS AND FIGURES

ANNALES
ACADEMIAE SCIENTIARUM
ESTONICAE

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TALLINN 2020

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FOREWORD

The century has reached the age of majority. The final, turbulent year of adolescence forced us out of our comfort zones. The disconcerting words of the President of the Republic on 24 February 2020 at the Ugala Theatre illuminated the year 2019 in a harsh and unforgiving light.

It was a year of injury for the entire research landscape, among other areas. The realisation of the research agreement failed. Its goals would have gone beyond merely increasing Estonian research funding to a globally competitive level. The purpose was much greater. The competitiveness of a country depends to a significant extent on how and whether excellent science reaches those who would use it to improve the world. Scientific achievements do not speak for themselves. They have to be interpreted. Like a beaver dam on a stream, Estonia's advancement is hindered by the failure of research achievements to reach other sectors. Great leaps are possible only by redirecting our brightest minds from academic science to places where they can improve the entire country's competitiveness.

It is in this framework that the Academy found the courage to state something that is unusual in Estonia, yet almost obvious on the global scale: that a strong private sector research is in the best interests of academic science.

Continuing this train of thought, we attempted the reputedly impossible: to train scientists and politicians to communicate with each other. The three days invested in this initiative triggered the classic worker's dilemma: no matter how much you do, you'll never do enough, and what you don't do is always more important than what you do do. Some wrote the effort off as a waste of time, whereas others considered it significant enough to invite us to report on it at the European Parliament and the EuroScience Open Forum 2020. Perhaps the impact of this exercise impelled future government members to take the unprecedented action of including the Academy of Sciences in the coalition agreement. Of course, correlation does not imply causation. But perhaps it contributed to something, such as Estonia now holding the presidency of the European Science Advisers' Forum.

The climate conference in September was an anomalous event. It is, after all, far from normal to have the Prime Minister and a considerable proportion of the Estonian elite listen to scientists' messages for four and a half hours and, what's more, (apparently) base decisions on them. Nor is it normal to have politicians spend the majority of their time debating courses of action recommended by the Academy. Some communication experts might flirt with the limits of political correctness by suggesting that the Academy forced the political landscape not just to listen to its agenda, but to adopt its way of thinking for an entire day. Whether this is close to the truth or just wishful thinking is impossible to say. But one thing is clear: the Academy must consider its recommendations with care and think through all of the implications of their potential adoption.

Tarmo Soomere
March 1, 2020

THE MOTHER TONGUE OF SCIENCE

A NEW CENTURY OF THE ESTONIAN LANGUAGE

The Ministry of Education and Research proclaimed 2019 the year of the Estonian language. The celebrations began with the conference "A century of Estonian as the national language", which was organised jointly by the Estonian Academy of Sciences, the Mother Tongue Society and the language department of the Ministry of Education and Research, and took place on 24 January 2019 at the Academy of Sciences. The main takeaway of the conference is that the future of the Estonian language depends on us alone: if we don't cherish and maintain it, no one will.

The conference was introduced by the President of the Estonian Academy of Sciences Tarmo Soomere, who noted that for such small nations as Estonians, the importance of clear and precise expressions of thought goes beyond the simple act of speaking in their native language. "A small nation who would endure linguistically must speak with speakers of their own language and other languages," President Soomere stated. Speaking of Estonians' historical experience with foreign languages and cultures, he added: "Each language is a different vision of life. Let us safeguard the wealth we have accumulated. We have earned it."

The President of the Republic of Estonia Kersti Kaljulaid pointed out that the welfare of the Estonian language is in our own hands. She recalled the period of Soviet occupation in the last century when Estonian was not the national language. Kristjan Jaak Peterson's lofty cry "Cannot the tongue of this land, in the wind of incantation, rising up to the heavens, seek eternity?" offered us hope that our language would survive. This poem showed us how to love and appreciate our language. It was a lifeboat to cling to in the years of influx of people who cared nothing for our language and weren't shy about announcing the fact. The President noted that she understood the concern for the Estonian language, but emphasised that unlike in the 1970s, the rules and conditions surrounding the development and conservation of the Estonian language depend on ourselves, not strangers.

Minister of Education and Research Mailis Reps thanked linguists, language teachers, language managers and everybody else who had contributed to the survival and development of the Estonian language and pointed out that Estonian is among the fifty most developed languag-

Tarmo Soomere's opening remarks

An essential function of language is to help us think. John Dryden remarked that an idea well expressed sounds clever in all languages; small languages are no exception. For small nations, expressing their thoughts clearly and precisely is important in ways beyond simply speaking their language. A small nation who would endure linguistically must speak with speakers of their own language and other languages.

We are proud of our survival as a nation in a whirlwind of languages. We were long held in the embrace of the German language, and then of Russian. Alexey Tolstoy believed language was the soul of a nation. If so, the great powers who have swept over our land have granted us a rare opportunity to experience the world through various languages and the associated ways of thought. Ancient Arabs knew that the language of experience teaches the most truth. Federico Fellini added that a different language is a different vision of life. Let us safeguard the wealth we have accumulated. We have earned it.

To paraphrase Mati Unt, learning a language is not dissimilar to wandering through a forest of prohibition signs. Certainly, it teaches us to think. Perhaps that is why Martin Heidegger was inclined to believe that people learn to think (i.e. qualify as homo sapiens) only when they know at least two languages very well. Or, as Johann Wolfgang von Goethe remarked: "Those who know nothing of foreign languages know nothing of their own."

es of the thousands spoken around the world. "Every child, despite the English words on their shirts, speaks Estonian, plays games in Estonian and reads Estonian books. All students and researchers, even while reading English articles and contributing to international research groups, share their notions and knowledge with other Estonians in Estonian. Even our guests sense that this nation is proud of its language, and that these people are deserving of it," the Minister continued.

Martin Ehala, a professor at the University of Tartu, discussed the perspectives of Estonian as a language of education. He emphasised that the rumours of the death of Estonian as a language of education were premature. "Those who insist that the University of Tartu will inevitably descend into mediocrity unless teaching in English is extended are severely deluded. If a university has reached the absolute top of the world without English-language teaching, English cannot be a prerequisite for being at the top," Ehala stated. He described the depreciation of Estonian in certain circles and higher education curricula as "silent submission", while acknowledging the importance of English.

The Uppsala University professor Raimo Raag who was elected a Foreign Member of the Estonian Academy of Sciences later this year discussed Estonian as an international language and the way Estonian has been delivered to foreigners. "Estonian can rightly be called an international national language," Professor Raag said. Giving an overview of how Estonian has come to be taught outside the Estonian national borders, he remarked: "During the 41 years I have been teaching at Uppsala University, well over a thousand students have learned Estonian there and passed language exams. If we add those who learned Estonian in Uppsala before this time or learned the language elsewhere, we are sure to reach a very high number." He added that Estonian studies in foreign universities may seem a phenomenon of limited relevance, arising from scientific interest, but this is far from the truth: many people all over the world, from very different walks of life, have learned the Estonian language and act as ambassadors of the Estonian culture.

Urmas Varblane, Professor of International Business at the University of Tartu and a Member of the Academy, focused on Estonian as a specialised language in his presentation "The Estonian language and Estonian economy". The specialised language of economics is in constant flux: new economic systems require new vocabularies. Therefore, the past century brought rapid change whenever an old vocabulary was no longer sufficient. The use of Estonian as a language of economics has undergone significant changes in recent centuries. The same applies to Finnish and English. "There are rational explanations for teaching certain things in English in higher education. For a number of specialities, we cannot put together a single Estonian-speaking study group in the entire country," Varblane pointed out.

Chief Director of the Estonian Language Inspectorate

"There are rational explanations for teaching certain things in English in higher education. For a number of specialities, we cannot put together a single Estonian-speaking study group in the entire country."

Ilmar Tomusk summarised the Estonian language's century as a national language. "English has assumed the former role of Russian in many spheres of life. The only difference is that Russian was forced upon us from Moscow, by the Central Committee of the Communist Party. The image they attempted to create was that there was no pressure regarding the Russian language and that its use was expanding through the enthusiasm of the masses. As for English, however, we have adopted it quite voluntarily in many walks of life," Tomusk summarised.

Two books were presented at the conference: *A Century of the Estonian Language* ("Eesti keele sada aastat") by Karl Pajusalu, Professor of History and Dialects of the Estonian Language at the University of Tartu and a Member of the Academy, and *A Century of Estonians Abroad* ("Välis-Eesti sada aastat") by the Uppsala University professor Raimo Raag were both published in the book series *Estonia 100*. The books were introduced by the member of board of the series Tiit Pruuli. Pruuli commented that Professor Raag's work was not limited to the "classical" definition of Estonians abroad that his generation was used to: the history of those who escaped to the West in 1944. Significantly, it maps Estonians abroad during the pre-war Republic of Estonia – the Estonian colonies throughout the world between 1918–1940 – as well as the pattern of emigration after independence was regained.

Introducing the book by Karl Pajusalu, Tiit Pruuli noted: "This work explores and illustrates the constant changing of our language. Furthermore, it includes heart-warming chapters about the managers of the Estonian language, who in particular should be celebrated in the year of the Estonian language.

Estonian was first recognised as the state language in the temporary constitution passed by the Estonian Constituent Assembly on 4 June 1919;

The official status of Estonian as the national language was reaffirmed in the first constitution of the Republic of Estonia in 1920;

The Estonian Soviet Socialist Republic Language Act that reinstated Estonian as the national language in 1989 remained in force until 1 April 1995, when the first Language Act of the restored Republic of Estonia took effect.

KERSTI KALJULAID: WE MUST VALUE OUR LANGUAGE

The Estonian language and its instruction help us bridge the historical gap between our national groups and take newcomers settling here into our cultural space, President of the Republic of Estonia Kersti Kaljulaid emphasised in her opening speech.

Photo: Mattias Tammet

President Kersti Kaljulaid: “Without Estonian-language higher education, the Estonian language has no future.”

My dearest language friends!

This past century of the Estonian language has been fraught with twists and turns. On the one hand, it has been lofty: the establishment of a university teaching in the Estonian language and of Estonian as the national language were a couple of important beginnings among many. Before the Soviet occupation, we were free to argue over our language policy and to make our language decisions, and we re-instituted these freedoms with the restoration of independence.

Yet there were also critical times when we had to defend our language against intense external pressure over a very long period of time. These times brought us together around our language. Let’s consider, for example, the massive national undertaking of drafting the Language Act thirty years ago.

The last century has coloured our current attitudes; these experiences must be kept in mind, but they must not be allowed to restrict us.

Language plays a central role in our cultural space. The language of a small nation is its primary means of self-actualisation and self-identification. While the nation may be small, its language need not be, if there is the will and the ability to make sure the language is used generally and everywhere: to keep it big. The Estonian language is not a small language. Only we can make it small: through carelessness, through limiting its uses and, therefore, diminishing its value and dignity.

If we want to defend and promote our language and culture, we must think about ways to make learning Estonian as accessible and interesting as possible for children in a globalising world, where smart devices are a natural part of life. We must kindle and nourish their cheerful curiosity about the Estonian language. It may seem a tough challenge, but we must not overlook it.

Our children can access the entire world from the moment they learn to tap on a screen. Children already use the Internet a lot for studying, so let’s make it more exciting and varied for them. We have many wonderful means that could help children with online learning.

Falling behind in developing the digital capabilities of our language may well prove the biggest danger facing the Estonian language in the next hundred years. The Estonian language is not yet a major digital language: let’s make the leap!

In addition, it is important that Estonians explore the wide world, then return home. Ours is an era of journeys. We must offer Estonian schooling no matter where the child is located. This keeps Estonian children close to the Estonian language, our beautiful Estonian language. The World Wide Web should offer access to the entirety of school education, up to and including high school. Children should be able to freely acquire new knowledge and put it to the test. Let me refer to Peeter Põld’s words from 95 years ago: “Let every lesson be a language lesson.” That is, we must enable the survival of Estonian as a mother tongue everywhere in the wide world by offering a wide range of online subject lessons. The work of teachers in Estonia and abroad would be simpler with access to the necessary learning programs to help with teaching different subjects in Estonian to students in all corners of the world.

The Estonian language and its instruction help us bridge the historical gap between our national groups and take newcomers settling here into our cultural space. In modern Europe, millions of people live in countries whose language environments do not match their home language and where it is entirely natural that they make their first steps in the education system – kindergarten – in the local language. By the time they enter primary school, the children know and have adapted to the language and cultural space of the land. In school, and later in life, they will be on an equal footing with those whose home language is the same as their school language. They might even have a slight

advantage, since their knowledge of languages is bigger and their world view accordingly broader.

We need to help Estonia's children who speak another language at home to learn Estonian in kindergarten. It is not always necessary to spend ages preparing methodologies: let's simply start by using Estonian with children in kindergartens and it will continue from there, since children are clever and learn quickly. And please, let's drop the old misconception that Estonian is an awfully complicated language. This is not the case and proof to the contrary is readily available. I saw all this work out just fine in Sillamäe, home to fewer Estonians than in Luxembourg. None of the children at the Pääsupesa kindergarten speak Estonian at home, yet they all interact in Estonian and are well prepared to enter the local Estonian-language primary school.

Failure to take this route would waste a huge amount of children's time and Estonian society's public resources. Many would lose out, and the winners would not necessarily look out for Estonia's welfare: if anything, the opposite would occur. Naturally, the next thing to consider is a way to enable every school-aged child in Estonia to go to an Estonian school, so that they can move deep into the cultural space. The scarcity of teachers where they are needed the most is definitely a problem. But I would like to cite a bold example from Finland, where the six teachers at the Üleilmakool give lessons in twenty schools in Vantaa. Perhaps we could use this good example and leverage it at home with smart planning and reasonable pay.

The national language plays a crucial part in our interaction with the state and our understanding of the state. All of our legislation is in Estonian, and so is our public sector cultural space. A lack of understanding of this cultural space can lead to misunderstandings and unfortunate consequences. I talked about this while working in Ida-Viru County last autumn and, frankly, the people there got the point and I hope that it will soon prove unnecessary for local governments to translate documents back and forth. The willingness exists, and the people should be encouraged rather than chastised for every little mistake. But communicating with the state is a two-way street. The state should have the good sense to communicate with its citizens in clear and pure Estonian, without losing people in a labyrinth of legalese. Texts in the national language must be easily understandable and making this so is the duty of all legislators and officials. I am sure our linguists can help. For example, they can make sure the documents translated in Brussels are in clear and comfortable Estonian.

The Estonian language will survive if we are ready to contribute to its future as a cultured language. Without Estonian-language higher education, the Estonian language has no future. If we shy away from teaching even slightly more complex fields in Estonian, whether out of convenience or out of a profit motive, the language will begin to decline.

The Estonian language will survive if we are ready to contribute to its future as a cultured language. Without Estonian-language higher education, the Estonian language has no future.

Furthermore, local residents with other mother tongues will lose any motivation and interest in learning Estonian, since, after all, the public space can be navigated without it.

I would like to refer to the curator of the University of Tartu Peeter Põld's remarks at the opening assembly of the Estonian-language university in December 1919: "The university is a national plantation of culture: a participant in the worldwide shared scientific effort, it cannot tear itself away from its own surroundings, whose phenomena it must first illuminate, whose youth it must first and foremost motivate...." We must arrive at a reasonable balance where the position of the Estonian language is not diminished, but rather gains strength.

The development of our scientific terminology is directly involved, and taking part should be a matter of honour for every scientist. They know their subject area best and I am quite sure they would like to explain their work in a way that is accessible to their fellow Estonians Linguists could provide valuable support.

In summary, all of this is a matter of valuing our language. If we depreciate the relevance and capabilities of our own language, it won't be long until we reach the state poignantly described by Kristiina Ehin in the poem "Matiseis" ("Checkmate"). When students asked permission to write their creative writing papers in English, and she, the lecturer, wouldn't allow it:

The student agrees obediently
yet leaves with a resentful glare
as if I had forced her
into shoes she had grown out of.

Let us not treat Estonian as a shoe that doesn't fit and let us not undermine the position and attraction of our language.

THE YEAR OF THE ESTONIAN LANGUAGE AT THE ESTONIAN ACADEMY OF SCIENCES

By Karl Pajusalu

Apart from promoting high-level science and connecting top scientists, the Academy of Sciences is tasked with advancing the implementation of new scientific results in Estonian society. The science promotion activities of the Academy's members are supported by the broad-based activity of the scientific associations that have joined the Academy. The synergy thus created was evident in the celebrations of the year of the Estonian language.

In cooperation with the Mother Tongue Society and other partners, the Academy organised three events in 2019 focusing on the language year: the opening conference of the year of the Estonian language, "A century of Estonian as the national language", on 24 January, the terminology day of scientific associations on 16 May, and the seventh Estonian scientific language conference on 21–22 November.

The first conference of the language year was introduced by the President of the Republic of Estonia Kersti Kaljulaid. The conference focused on the development of the Estonian language as a national language and a protector of the continuity of the Estonian society, and discussed the challenges currently facing the language. Academy Member Urmas Varblane assessed the relationship between the Estonian language and Estonia's economy; Prof Raimo Raag from the University of Uppsala (pictured on the right), elected as a foreign member of the Academy in 2019, discussed Estonian as an international national language. Finally, Academy Member Karl Pajusalu's book *A Century of the Estonian Language* ("Eesti keele sada aastat") and Raimo Raag's *A Century of Estonians Abroad* ("Välis-Eesti sada aastat") were introduced. Both works were published in the framework of the *Estonia 100* book series.

The terminology day of scientific associations focused on challenges facing the development of technical terminology in various research areas. Academy Member Jakob Kübarsepp and the representative of the Estonian Association of Engineers Priit Kulu spoke of terminology development in engineering, and Toomas Kukk from the Estonian Naturalists' Society discussed how new plants were named in Estonian. The terminology day concluded with a round-table of scientific associations discussing the question "What is the push that Estonian specialised language currently needs?" The participants acknowledged that terminology committees active in scientific associations face certain common challenges that could be resolved by improving cooperation between associations. One such challenge is more effective promotion of new terms and their faster uptake into popular scientific and educational literature.

The scientific language conference "Estonian language and global science", organised in cooperation with the Tallinn University centre for academic Estonian, offered insights into the development of Estonian scientific terminology, the creation of Estonian high school textbooks, the development of specialised Estonian in institutions of the European Union and Estonian legal and legislative language. The keynote speakers were Academy Member Peeter Saari and Chancellor of Justice Ülle Madise.

In his opening speech, "Speaking scientifically about scientific terminology", Peeter Saari drew comparisons between linguistic and physical phenomena and argued, comparing linguistic conservation with natural conservation, that the Estonian language policy would do well to pay more heed to the actual state of the social environment. Academy Member Karl Pajusalu's presentation "How science became *science* in the Estonian language" explored

Photo: Liis Reiman / EV100 x3

Tiit Pruuli persuaded us all that writing a book is the greatest gift.

Member of the Academy Karl Pajusalu published the book “100 Years of the Estonian Language” as a present to us all Foreign Member of the Academy Raimo Raag on the left side.

the development of the connotations of the word “science” in older Estonian written language and the establishment of the names of scientific fields in Estonian. In her presentation “Beautiful language in law, legislation and management”, Ülle Madise emphasised that the jurist should seek to ensure not only that justice is just, but also guarantee the clarity that is so conducive to logical solutions.

In addition to the three conferences at the Academy, its members took part in local language days and other events celebrating the year of the Estonian language and the international year of indigenous languages. Scientific associations staged numerous diverse events to celebrate the language year. A central role was naturally played by the Mother Tongue Society, due to celebrate its hundredth anniversary in 2020, which organised language debates, a language hike from Riga to Tartu, language camps and seminars for school and university students and many other events.

OFF THE BEATEN PATH

The Academy of Sciences, along with the Foresight Centre, organised an international seminar-workshop within the framework of the European Commission Joint Research Centre (JRC) initiative "Science meets Parliaments. Science meets Regions" from 31 January to 2 February.

The event sought to map the best ways and formats for bringing scientists' advice to decision-makers.

The speakers sharing their expertise included Member of the Estonian Parliament and former government minister Marko Pomerants, Deputy Director General of the JRC Maive Rute, Chancellor Emeritus of the University of Helsinki Kari Raivio, Vice Rector of the University of Tartu Kristjan Vassil and top researchers from the European Union consortium for prospective technologies FuturICT2.0.

THE FEBRUARY TRAINING: A REQUEST FOR A DATE

Dozens, perhaps hundreds, of events aimed at improving (or fine-tuning) communication between researchers and (political) decision-makers take place annually around the world. Their efficiency is often so low that one of my esteemed colleagues has even suggested that the European Commission should be prohibited from funding such events as a clear waste of taxpayers' money. I tend to agree. The gloom of this senseless waste of time pervades the halls of many a research policy event. The best remedy? Choosing speakers and topics with care. To paraphrase the American actor Groucho Marx: we should find people who have something to say even before they take the stage, people who are more than mere intellectuals as defined by Dwight Eisenhower*, whose thoughts make a mark and offer clear returns even if the formal goals of the event are not met.

It may be surprising that the impact of communication is now the object of rigorous, exciting research. Technically, this field of research focuses on the theory and modelling of processes in society and large communities. A few years ago, the Academy had the good fortune to be invited to participate in the consortium of the European Commission's competition for prospective major IT technologies. The central goal of the competition was to attempt to model the functioning of large communities and, if possible, entire societies by the mathematical description of interpersonal relationships. The effort was spearheaded by ETH Zürich scientists, led by Dirk Helbing, a mainstay of the journals *Nature* and *Science*.

The two winners focused on graphene research and the modelling of the human brain. Our consortium came in third and received somewhat of a consolation prize in the simple statement: "make sure to keep this group working together." And so the "Large scale experiments and simulations for the second generation of FuturICT", or FuturICT 2.0, consortium was born.

Two of our colleagues in the consortium, Prof Mario Paolucci from Rome and Prof Tom Lenaerts from Brussels, demonstrated in an elegant and captivating manner how complex the "relationships" governing the functioning of

* "An intellectual is a man who uses more words than necessary to tell more than he knows" (Dwight Eisenhower).

Photo: Reti Kokk x2

Marko Pomerants offered recommendations.

Maive Rute: Scientific expertise 2.0.

even relatively simple systems are and how far-reaching the consequences of the tiniest changes in balance can be in systems similar to human communities. Such changes can often be made simply by accepting good advice.

RESEARCHERS' BEST ADVICE

This context made the future of Estonian research look particularly bright at the end of 2018. The research agreement signed under the President's watchful eye on 19 December 2018 engendered hope. It was approved by almost all major political forces, Universities Estonia, the Academy of Sciences, the Estonian Young Academy of Sciences, the Estonian Chamber of Commerce and Industry, and the Estonian Employers' Confederation. The purpose of the research agreement was to go beyond simply increasing the state funding of science to one percent of the gross domestic product: the goal was to ensure that the knowledge and discoveries of Estonia's brightest minds were harnessed for the benefit of society as quickly as possible.

This task is far from trivial. It is easy to boldly proclaim that rapid advances in knowledge must be used for the good of society. But nobody knows how to do this (nor dares to admit that they don't know). After all, we fall short on many far simpler tasks: for example, using awesome research results to reach the best possible political decisions. This involves how researchers can make their achievements usable by the parliament. Could this be done by classical semi-operative science advisory work? Estonia does not even have a decent base of experience in this field. How complicated, after all, is the interaction between scientists and politicians? Even if both sides speak Estonian, do they interpret words in the same way? After all, the format of a scientific article or even a popular science publication is hardly suitable for advisory work. How much, then, do research results need to be simplified? Perhaps achievements from separate fields need to be combined in different, more complex ways. How can we avoid misunderstandings? And if something goes (or has gone) awry, how can we rebuild trust? Furthermore, which scientists should speak up, or who should speak up on behalf of scientists? Can (or should) this process be institutionalised at all?

In the broader perspective, the national scientific advisory function needs to run more smoothly. In some countries, it works just fine, particularly those that have specialised institutions for scientific advice. In Anglo-Saxon countries, for example, the position of scientist-in-chief has existed for decades. It is generally held by specialists with impressive backgrounds in research.

Including academies of sciences in ongoing scientific advisory functions seems a possible solution. Some countries have implemented this. The three academies of the United States (the classical academies of sciences, engineering and medicine) form a powerful advisory system. A thousand specialists generate up to two hundred in-depth analyses or recommendations annually. Five hundred answer questions the academy has been set. The other half reflect on matters that the academies bring to the attention of society and decision-makers on their own initiative. Hopefully, having a president who disregards the advice of the academy will prove to be a temporary fluke.

In Europe, parallel developments have been fuelled by the academies themselves. The European Academies' Science Advisory Council (EASAC) was founded to address this particular gap. The analyses and (policy) recommendations it provides have become near-obligatory documents for the European Commission and several of its subordinate institutions.

A few years ago, the Science Advisory Mechanism was created at the European Commission. Its main pillars are a constantly working department of specialists and seven top researchers elected for set terms. An offspring of the mechanism is the SAPEA project (Science Advice for Policy by European Academies), whose goal is to ensure that the knowledge concentrated in academies of sciences reaches decision-makers in a form accessible to them.

Asking the right questions gets us half way to where we need to be. This area has many seemingly trivial, yet actually tricky questions. For instance: how quickly should the scientific community provide its answers and recommendations? Who should take responsibility: the scientist who makes the recommendation or the politician who accepts it as the basis for a decision? The scientific community tends to prefer having others shoulder the responsibility, which the "others" can generally sense, and others, left with this burden, are right to ask: was this solid advice or just lobbying?

The two – advice and lobbying – are contradictory, after all, at least in politics. Hopefully, if we succeed in keeping the two apart and dare to at least ask these questions, we will create a solid foundation for mutual trust.

BREAKING WITH TRENDS

The latter aspect is among the reasons the Academy of Sciences made a pact with the Estonian Parliament, the Foresight Centre and the European Commission Joint Research Centre (JRC). The amount of new and important information circulating in the scientific sphere is growing explosively, but the capacity of the pipelines of good advice is relatively limited. The obstacles are numerous, from the specificity of academic language to the cyclical nature of politics. And yet, many bottlenecks can be reduced or avoided altogether by using simple knowledge about what information, in which format, in which formulation and at what time politicians, and makers and implementers of decisions can use best.

Photo: Reti Kokk

Aare Kasemets explained how to ensure the use of the best existing information by decision-makers and lawmakers.

Science Meets Parliaments

The event was sponsored by the European Commission Joint Research Centre within the framework of the initiative "Science meets Parliaments".

This train of thought led the Academy, jointly with the Foresight Centre, to organise an event titled "Seminar and training workshop: Towards bridging science and decision-making", which ultimately took the shape of a three-day hybrid seminar and workshop (31.01–02.02.2019). The organisers are particularly grateful to the JRC, whose material support made it possible to invite several brilliant speakers and cover the participation costs of many interested Lithuanian and Latvian colleagues.

The organisers attempted to highlight scientific advice success stories, to convince representatives of the target group (i.e. politicians and top state officials) to speak up about what parts of scientists' messages they have been able to use in their work and how (in what format, language and timing) the advice is most useful, but also to include sobering reminders of how easily things can go wrong.

The organisers set the participants a single special condition: in the context of this event, it was not permitted to attack anyone for what they said or how they said it, nor for who they were, even if it was a generally unpopular top politician. Surprisingly, adhering to this requirement proved to be the greatest challenge of all. Attempts to mention problems with speakers or participants occurred after almost every presentation and in several of the workshops. Thankfully, the majority of the participants believed frank truths to be both rare and necessary. They felt that they were worth making an effort for, and, if necessary, getting a querulous neighbour to hold their tongue.

And of course, the organisers would like to think that this event, with its hundred-odd participants, constituted a significant step towards better communication between scientists and policy-makers. Two ideas that arose in the course of the "February training" went on to have a life of their own in the couloirs of Brussels.

One of them was born in Brussels as a reaction to the regular boring presentations at similar events. It is common (and almost expected) that official meetings are painfully boring. For passion and dedication, however, why not try asking your counterpart out for a date. The next round of

similar events may well be called “Science dates Parliaments”.

The other idea was proposed by members of the Estonian Young Academy of Sciences. It was sparked by friendly teasing of the passion for indicators: the success level of an event dedicated to creating or improving relations between scientists and politicians can be measured by how many new scientists’ phone numbers politicians add to their smartphones. And that is no longer a joke, because parameters such as that can adequately reflect the coherence of a shared community. Good advice should be no further than a couple of clicks or a phone call away; otherwise, we are doomed to play telephone tag forever.

> See the agenda and the recording of the plenary sessions: https://www.akadeemia.ee/en/events/seminar-and-training-workshop-towards-bridging-science-and-decision-making/

Photo: Reti Kokk

Urmas Vaino shared his experience on effective communication.

A STEP INTO THE POLITICAL FRAY

The 24 April General Assembly meeting and the political declaration

For the Academy, every fifth year is a “leap year”, hosting the elections of a new President, new Vice Presidents and a Secretary-General. Whereas each regular year is punctuated by two general assemblies, the leap year includes a third meeting for the express purpose of electing a president. 2019 was such a year. As is customary, the spring General Assembly meeting, held on 24 April, took stock of the past year and the future-oriented winter assembly was tasked with electing a new Board. The third meeting was called in September to elect a new President and new foreign members.

* * *

General Assembly meetings are perfect occasions for recognising outstanding achievements. The Academy medals are rarely awarded; some years, two are issued, but often, none are. This year, Academy Member Rein Küttner was awarded the Nikolai Alumäe Medal for his long-term productive activity in the field of engineering.

In the broadest terms, science consists of two components: discovering new, important information and communicating it to others. The major part of the communication takes place through peer-reviewed research articles. Therefore, a core task of the world’s academies of sciences is publishing scientific journals. This is financially viable only through researchers’ unpaid effort as reviewers and editors. The editor’s scientific qualifications, his or her desire to contribute to the journal, his or her contact network, reputation and even personal charm tend to be the keys to the success (or their absence to the failure) of the journal.

The two flagship journals of the Estonian Academy Publishers gained new editors-in-chief in early 2019. *Oil Shale* is a globally unique torch-bearer of oil shale studies and the *Estonian Journal of Earth Sciences*, which grew out of the earth sciences series of the proceedings of the Academy, is the channel for the achievements of Estonian earth sciences in general and geology in particular. This is a field of research for which we are entirely responsible: it is imperative for us to be the best specialists regarding our own nature and bedrock.

The Academy applauded the long-time editors-in-chief of these two journals, who were present when they were established, advanced them for decades, kept them on par with the world’s greatest and passed them on as orderly, smoothly running systems. Member of the Academy Anto Raukas received the Academy’s letter of appreciation for his work as the editor-in-chief of the journal *Oil Shale* and Member of the Academy Dimitri Kaljo for his work

as the editor-in-chief of the journal *Estonian Journal of Earth Sciences*.

* * *

No general assembly of the Academy is complete without research presentations. Traditional features of the spring assembly are keynote speeches by the annual national research award laureates. Peeter Saari, a laureate of the lifetime achievement award, took the assembly on a journey through equations, and Mart Ustav, a laureate of the discovery award, vividly described the complex relationships between research and enterprise.

The reports of division heads demonstrated that activity reports can be given in many different ways and that even traditional reports can offer exciting visions of the future. The Academy's financial activity report was in keeping with the tradition as well. Since it largely adhered to the budget and had been thoroughly analysed by a sworn auditor (who identified no significant errors), the general assembly had no further questions. The legally stipulated procedural point regarding the approval of Academy member stipends passed just as smoothly. As always, there was an equal split.

* * *

The meeting got substantially more interesting with the discussion of the Academy's potential recommendations for the implementation of the research agreement.

The President pointed out that the Academy had not been meeting one of its legal duties for at least a decade. Namely, an Estonian law (specifically, the Estonian Academy of Sciences Act) charges the Academy with presenting opinions on the organisation of Estonian science and on research and development funding. It is about time to start following this law.

Increasing public sector research funding to one percent of the gross domestic product has long been a subject of heated debate. This process seemed to really take off seven or eight years ago, but suffered a setback in the last three years after the previous European Union framework programme funding had run out. Science's share of the national budget had briefly dropped to an outright scandalous 0.51% of the GDP*. The number used by the government, which included many other sources of funding, was around 0.7%.

On the initiative of the Estonian Research Council, the document now known as the research agreement was signed on 19 December 2018. Public funding of research, development and innovation was to be increased to one percent of GDP and maintained or increased going forward. The agreement was also adopted by major national employers' and business associations.

After a brief Christmas break, arguments over the distribution of the additional money began. Some stakeholders thought the entire sum should be used to fund innovation by private businesses. The Academy had its own ideas. They were rooted in the thoughts of Peter Drucker: applying new knowledge to known goals increases the efficacy of the economy, but innovation happens when new knowledge is harnessed to solve new problems.

We managed to convince the Research and Development Council that the most sensible course of action was to channel 40% of the additional funds into the existing research funding system, 20% to the inherent costs of the research system, such as libraries, research literature, etc. (including funding for the Academy of Sciences), and the remaining 40% to the private sector. The goal was to boost the development of robust research and development activity to create a solid foundation for innovation as envisioned by Peter Drucker.

A sensible mechanism for the allotment of the additional funds flowing into the research system already exists. However, it is not clear how to manage the funds dedicated to promoting research activity in the private sector, as they bypass the public sector system. It would be best to give researchers a voice in their management. Since the new government is about to start developing the national budget strategy, the Academy's opinion is particularly important now.

The statement section of the opinion states that research funding is a key component in ensuring Estonia's competitiveness. So far, the state has mainly been funding research carried out in the public sector. Funnelling public money into the private sector constitutes a change in the prevailing research and innovation funding paradigm. It should be considered seed money to ensure the development of robust research and development activities in the private sector, which, in turn, would contribute much more to research and development in the future. Similar strategies have been attempted in several countries, mostly unsuccessfully. Success would make us global trailblazers. Being small, Estonia stands a solid chance of succeeding.

Of course, it is essential to have the research agreement immediately and fully reflected in the budgetary strategy. Otherwise, the probability of receiving the promised funds will decrease rapidly.

The document's claim that strong private sector research is in the interests of academic research in the long run may appear contentious, and partly for good reason. But let's consider the broader perspective. Young PhD and master's degree holders need jobs that suit their qualifications. Such positions are currently few and far between. We need to encourage movement between academia and industry. A strong pattern of competence transfer can develop only if a robust research capacity is created in the private sector. One of the goals of the research agreement is to earmark roughly 0.12% of the GDP as seed money. If this works as intended, it would ideally come to fruition in 5–10 years'

* Martin Ehala: miks teadlased ei mässa? ("Why aren't scientists revolting?"), Postimees, Meie Eesti 27.11.2018. https://meieeesti.postimees.ee/6462899/martin-ehala-miks-teadlased-ei-massa

Foto: Maris Krūmvald

The Academy recognises Dimitri Kaljo for his decades of work as the editor of the Estonian earth sciences journal.

time as a 1.3% GDP increase. That is how much the contribution of the private sector should grow for the target level of 2% to be reached. This might seem like a pyramid scheme, but the point is to obtain a strong return on the funds invested in research and development through improving private sector research capacity.

An influx of money into the private sector might easily lead to a migration of the best specialists from universities and research organisations into industry. Universities would then lack the necessary capacity to train the next generation of human resources. We must make sure to avoid bad moves when planning our actions. Our ideas should be backed by the necessary human resources, technical equipment, infrastructure and existing higher education options. For solid research to take root in the private sector, it must at all times be supported by robust public sector higher education and research.

The hardest aspect of the agreement is that this 40% of the additional funding will be committed to an area that lacks the competence, administrative and otherwise, to distribute this type of funding. The opinion conceals this fact behind the euphemism “support and enhance”. While delicate and diplomatically expressed, this message could well make the Academy enemies. However, leaving it unsaid would be even worse. After all, one of the Academy’s key functions is to prevent errors. The Academy does not have many opportunities to do so in the financial sphere. Many developed countries systematically appoint top researchers to the councils of national enterprises. This is not currently a common practice in Estonia. Neither the state nor the Academy can forcibly install top researchers in the councils of private corporations; however, in the councils of state enterprises, we can and we should.

The Nikolai Alumäe Medal

The laureate of the Nikolai Alumäe Medal was announced at the Spring Assembly. Academy Member Rein Küttner was nominated for the medal by the Division of Informatics and Engineering.

The laureate has been modelling and optimising technological processes at various levels for decades. He started developing computerised design software before software suites such as AutoCad had even been conceptualised. A strong and internationally recognised school of computer-aided design and drafting has developed in Estonia with his immediate participation and direction. He has invested a large part of his life and enormous effort in background work that, while largely invisible, has cemented the development of Estonian mechanical engineering.

The Academy issues six medals named after prominent scientists. Each of those is granted no more frequently than once every four years – provided a suitable candidate exists – to an Estonian scientist with outstanding achievements in his or her scientific area. Each medal is the Academy’s highest recognition in the respective field.

The Nikolai Alumäe Medal is granted for achievements in informatics and engineering, the Paul Ariste Medal in social sciences and humanities, the Karl Ernst von Baer Medal in life and earth sciences, the Harald Keres Medal in astronomy, physics and mathematics, the Wilhelm Ostwald Medal in chemistry and related areas, and the Karl Schlossmann Medal in medicine and related areas.

The Nikolai Alumäe Medal was awarded to Jüri Engelbrecht in 2005, Hillar Aben in 2009, and Raimund-Johannes Ubar in 2013.

Investments in Research, Development and Innovation in the Context of the Research Agreement

Annex III of Decision
No. 4 of the annual meeting of the General Assembly of the Estonian Academy of Sciences,
24 April 2019

The Opinion of the Academy of Sciences on Investments in Research, Development and Innovation in the Context of the Research Agreement

Adherence to the research funding agreement (research agreement) signed by leading politicians, universities and research organisations, as well as representative bodies of researchers, employers and industries, on 19 December 2018 is a key component in enhancing Estonia's competitiveness.
Implementing the agreement means altering the paradigm of research and innovation funding to foster strong, broad-based research, development and innovation (RD&I) activity in the private sector.

1. We consider the lack of a common understanding of the role of RD&I in the socio-economic development of the state in Estonia to be a serious problem. Implementing the research agreement in full in the national budget strategy for 2020–2023 is, therefore, crucial, as is reaching a stakeholder consensus regarding the goals of the research agreement and the measures for achieving them.

2. A robust private sector research capacity that prioritises the development of human resources is in the best long-term interests of both the state and academic research. The funding goal for this area is to increase private sector contributions to RD&I investments to two percent of the gross domestic product and to achieve healthy inter-sectoral mobility of experts and competence.

3. While enhancing private sector RD&I capacity, care must be taken to avoid exhausting the public sector research and higher education system and to ensure that the funding and target areas for RD&I development are adequately covered with human resources, technical capacity, higher education and high-level research.

4. Part of the additional funding from the implementation of the research agreement will be channelled through Enterprise Estonia and the relevant ministries. The main risk in this process is potentially insufficient administrative capacity. Supporting and enhancing the capacity to stimulate private sector RD&I in the administrative area of the Ministry of Economic Affairs and Communications should be prioritised.

5. A large proportion of the existing administrative capacity of this type is concentrated in the administration area of the Ministry of Education and Research. This capacity could be harnessed through the inclusion of the Academy of Sciences, top researchers and experienced research administrators in the entire research agreement implementation process and, following good practice common in developed countries, on the boards of state enterprises.

General Assembly of the Estonian Academy of Sciences
24 April 2019

The rest is best described using the quote by the former Russian Prime Minister Viktor Chernomyrdin: We wanted the best, but it turned out like always. It seems that the Academy's statement was read with considerable interest and some of its key points were widely discussed over several weeks. Then, however, harsh reality set in: there was no money to implement the research agreement. This is by no means the first time. In Laurence J. Peter's comforting words: The only problems money can solve are money problems. And Arthur Schopenhauer reminds those who would accuse the treasurers of cheating our research that "Money is never spent to so much advantage as when you have been cheated out of it; for at one stroke you have purchased prudence".

Comment: Plain text on regular paper can sometimes carry more weight than lofty addresses with letterheads and fancy seals.

Photo: Liis Reiman / EV100

A reminder that we only have one Planet Earth.

THE CLIMATE CONFERENCE FOCUSED ON SOLUTIONS

By Taavi Minnik

Climate was a key topic in Estonia last year. The conference "Climate neutrality: disaster or success?", jointly organised by the Government Office and the Academy of Sciences, became a highlight of Estonian public life in autumn 2019. In order to achieve carbon neutrality in the Estonian economy, the entire (energy) economy must change. At the climate neutrality conference aimed at politicians and entrepreneurs, our brightest scientists introduced the relevant technologies currently being developed at Estonian universities.

Climate was the hottest topic of 2019. The editors of the Oxford dictionary chose "climate emergency" as the word of the year. The publishers of another dictionary, the Collins English Dictionary, picked "climate strike". Language reflects reality. Philologists choose words and phrases of the year on an annual basis; and yet such a coincidence is rare.

During the last decade, politicians have affirmed and reaffirmed the need to combat climate change. Yet neither numerous summits nor the signing of the Paris climate agreement managed to prevent 2019 from becoming the hottest year in recorded history. Despite the many summits organised by the United Nations, not all countries are ready to take meaningful action. India refuses to reduce the use of coal, the officials of the United States refuse to speak at climate conferences, and the President of Brazil issues public denials of the existence of climate change. Furthermore, the participants in the summit held on 2 December – 13 December, in Madrid rather than in Chile as intended, reached no commitments or resolutions regarding the regulation of harmful atmospheric emissions.

On the other hand, global leaders' inaction caused a wave of protest among the world's youth. The protests shook many countries and filled the streets of major cities with angry children and adults. The youth were supported by 11,000 scientists globally. Researchers insist that we have reached a state of emergency. Without meaningful change, the bright future that the younger generation had been preparing for might never materialise.

Climate was also a major topic of discussion in Estonian public life. Our youth, too, protested. While our protests were calmer than those in major North American and Western European cities, climate became a top issue of 2019 in Estonia as well.

This was the context of the 13 September 2019 joint conference by the Prime Minister's Office and the Academy

Estonia's problem is a shrinking number of researchers competent at mathematical and statistical modelling.

of Sciences "Climate neutrality: disaster or success?". While climate change has become a heavily politicised, ideologised matter, the joint conference, rather than rehashing pessimistic scenarios, focused on the solutions Estonian researchers can bring to the table to help us adapt to climate change. Or, as the President of the Academy Tarmo Soomere concluded in his opening speech: "This is a unique opportunity to present solutions to the Prime Minister, the Prime Minister's think tank and our policy-makers."

On the morning of the conference, the participants were met at the hotel's main entrance by a couple dozen protesters. Unlike in protests elsewhere, which have sometimes taken an aggressive turn, the researchers, politicians, journalists, officials and entrepreneurs arriving for the conference were greeted by smiling young faces that held no hint of trouble. Rather, it was as if they had come to meet a visiting pop star.

The conference was introduced by the President of the Academy of Sciences. He emphasised that climate matters have outgrown science and turned political. "How to begin tackling climate change is a political decision. But it must be based on the best knowledge and facts," he added. Climate change is subject to a great deal of controversy. President Soomere highlighted the scarcity of relevant competence in Estonia. He noted that rather than climate change, Estonia's problem is a shrinking number of researchers competent at mathematical and statistical modelling. We cannot currently say for sure what is changing, how quickly it is changing and whether we humans have caused the changes.

In principle, two main lines of action are available to us. We should strive to produce cleaner and greener energy that is respectful of nature, relies to the greatest possible extent on renewable sources and avoids greenhouse gas pollution, the senseless waste of mineral resources and waste generation. Many are working in this direction. In addition, we ought to organise our life so as to consume less energy. More efficient transportation helps; however, renovating our buildings would be much more effective. This is a global and relatively neglected problem. For us, it means excessive heat loss in buildings; in the tropics, the opposite is true, but in both cases the root causes are inadequate thermal insulation and outdated ventilation systems.

Prime Minister Jüri Ratas asked which is more expensive: to do nothing or to lead the way in something. "We are a dynamic and rapidly changing society. This means we can make progress and safeguard our resources and environment," the Prime Minister added on an optimistic note when discussing social and economic problems. He emphasised the need to consider the use of various alternatives in energetics, including nuclear energy. "I doubt that the discussions on the use of the new generation of nuclear power are going to be easy, but even so they must occur."

Patrick Goodman, a professor at the Technological University Dublin, presented an overview of the EASAC report* on climate change and health and the challenges facing Europe. In addition he shared the Irish experience in adapting to climate change, comparing Estonia and Ireland, he said that Ireland has taken a lot more initiative in recent years, but a lot remains to be done. "We have an action plan for exceptional weather circumstances in the winter, but not for summer heat waves, which are becoming increasingly frequent and hazardous," he pointed out. Many of the aspects of climate change present unexpected side effects for our health and lifestyle. He also spoke on some of the unexpected consequences of climate change interventions (such as the European push for diesel vehicles in the early 2000s), and cautioned that any interventions need to be fully evaluated.

Professor Atte Korhola of the University of Helsinki discussed general aspects of climate change and the complexity of the problem. He emphasised that it affects social life and human security as well as the environment. Professor Korhola reminded us that greenhouse gas emissions are responsible for just one third of climate warming. He warned that the use of renewable energy is similarly fraught with problems. "It is time to cycle out the first generation of renewable energy production equipment. This process creates a lot of hazardous waste. Solar panels, for example, contain a lot of heavy metals." He emphasised that finding an alternative to coal is crucial.

Professor Kevin Parnell of the Tallinn University of Technology talked about the seemingly positive aspects of climate warning. At high latitudes, the impact of climate change can be positive for the economy. Navigation may improve, agricultural production may increase, and oil and gas reserves may become accessible. The melting of the Greenland glacial ice has released large quantities of water, which could be harnessed to produce hydroelectric power. "However, these positive aspects will be short-lived and they will not outweigh the damage caused by climate warming," Prof. Parnell stated.

Janika Laht, an expert at the Ministry of the Environment, reported on the amounts of greenhouse gases (primarily carbon dioxide) released into the atmosphere by the different sectors of our economy. Henri Ormus and Kalev Kallemets from Fermi Energia OÜ gave an inspiring

* EASAC 2019. The imperative of climate action to protect human health in Europe. EASAC policy report 38, https://easac.eu/fileadmin/PDF_s/reports_statements/Climate_Change_and_Health/EASAC_Report_No_38_Climate_Change_and_Health.pdf

Who is convincing whom? From the right: Prime Minister Jüri Ratas, Tarmo Soomere, and Strategy Director of the Government Office Henry Kattago.

speech on the possibilities of nuclear energy in the transition to carbon neutrality and attempted to convince the participants that next-generation small modular molten salt reactors are about to enter production.

Rein Drenkhan, of the University of Life Sciences, warned that new tree diseases and dangerous pests have reached our forests. European ash has already been entered on the vulnerable species list in Sweden. Professor Arne Sellin, of the University of Tartu, showed that climate warming and increasing humidity will slow the growth of broadleaf trees. Hence there is a need to bear in mind that the diversity of our forests and the rate of their renewal may be impacted.

Academy Member Jaak Aaviksoo gave a presentation on the use and removal of carbon dioxide. CO_2 is like a warm winter coat, which we thicken by 40 gigatonnes per year globally, 20 megatonnes of which in Estonia. A tonne of carbon weighs as much as a cubic metre of water. Limiting carbon dioxide emissions will not be enough. We need more cost-efficient technologies and carbon removal technologies, including in the oil shale industry.

The presentation of Academy Member Margus Lopp focused on the compatibility of oil shale production with combating climate change. There are many ways to use oil shale to manufacture complex chemical products with high added value. However, we need to exit the situation where our oil shale chemistry is focused on shale oil production and refining.

Ove Oll, of the University of Tartu, introduced the possibilities of hydrogen on behalf of the Academy Member Enn Lust. Hydrogen is the highest-perspective fuel produced using renewable energy sources, and its use in cars, buses and trains does not release any carbon dioxide at all. Therefore, hydrogen-based technologies help to decarbonise both industry and transport.

Academy Member Jarek Kurnitski emphasised that we in Estonia have already developed solutions for constructing passive houses and renovating existing buildings into nearly zero energy buildings, and the rest of Europe has a lot to learn from Estonia. If the state decides to contribute to the process, both the state and the private sector will gain a lot through reduced energy consumption and pollution created through energy production.

The conference concluded with a debate by the representatives of the parliamentary political parties. The participants were Erki Savisaar (Centre Party), Siim-Valmar Kiisler (Isamaa), Peeter Ernits (Conservative People's Party of Estonia), Yoko Alender (Reform Party) and Jevgeni Ossinovski (Social Democratic Party).

Tarmo Soomere: The Academy of Sciences and Politicians Bear the Burden of Responsibility

The President of the Academy of Sciences Tarmo Soomere emphasised in an interview with Taavi Minnik that the conference of 13 September 2019 was seminal on a global scale, since politicians rarely ask scientists for advice and solutions directly. President Soomere believes that if knowledge that could improve the world exists, it should be used.

What are your thoughts on the climate conference?
It was an anomalous event in many ways. It is unusual that a Prime Minister proposes to the Academy of Sciences to jointly organise a conference on a topic as delicate and sensitive as the fate of humanity and Estonia's part in it. Furthermore, the Academy was given complete freedom in deciding what to tell the leaders of the country and how to advise them. This kind of trust is rare.

It is also rare that the Prime Minister requests a direct recommendation from our own scientists on what Estonia should do, proceeding from our own competence, knowledge and development, which could improve the entire world.

Was the arrangement of this conference – with politicians listening and scientists speaking – the ideal of scientific advice?
It went beyond the ideal. In fact, politicians and scientists should be in dialogue. I remember from my childhood the legendary pastor Harri Haamer's sarcastic remark about chancel sermons: that teaching is when somebody talks and everybody else naps. In our days, teaching is when somebody talks and everybody else is on Facebook. The way it ought to be is to have both sides excited to learn and to do great things together.

We talk a lot about scientific advice. We emphasise its importance and organise conferences and seminars. In the past, academies of sciences were created to advise monarchs, and scientific advice is essentially coded into the word "academy". Isn't that natural? Or let me rephrase: how did Estonia get to the point that scientific advice is not seen as natural?
Many classical academies were created hundreds of years ago. Their core commitments are best summarised by the declaration of the French Academy of Sciences. It states that, since its inception, the academy has been committed to a double calling: to defend and advance science and to offer the best possible advice to those who need it, and the state in particular. The United States National Academy of Sciences was founded on a similar basis. It was established during the American Civil War. Even back then, the government wanted to be informed by the most knowledgeable people in the country. This is the whole point: the state needs the advice of the most knowledgeable.

We cannot say that the Academy gathers absolutely all of the most knowledgeable people of the country. But, statistically speaking, the people there are above average in knowledge and experience. The advice given by the Academy may not be perfect, since even Academy members are fallible, but statistically speaking, their errors are remarkably rare.

Back to the conference. The conference site attracted protesters. Similarly, the first Friday climate strike attracted schoolchildren and middle-aged politicians. Climate change has become an ideological matter; it has become controlled by the Greens and left-wing parties. Does this add an additional aspect to the pressure on scientists and decision-makers?
Scientists prefer to distance themselves from ideologies. The fact is that a significant proportion of society and many young people prioritise climate matters. Humanity has expanded so vastly that we are using more planetary resources than nature can replenish. People my age might figure that we won't run short, but future generations very well might. This is an existential matter.

Politicians will not be motivated to look for a solution until the electorate applies political pressure. The situation now is that younger voters are voicing their demands. This is a good thing.

The main current tendencies show economics, transportation and other spheres becoming increasingly ecological. Should we feel satisfied?
The universe is subject to certain universal rules. One such rule is Murphy's law: anything that can go wrong will go wrong. Our current experience with energy savings is that whenever a new device promising energy economy hits the market, it spreads so quickly that global energy consumption increases sharply. The effect continues until the global market is saturated. Since the global uptake of new technology is so rapid, the possibility of breaking with trends, particularly the trend of wasting energy, food and other resources, is within reach for the first time in the history of humanity.

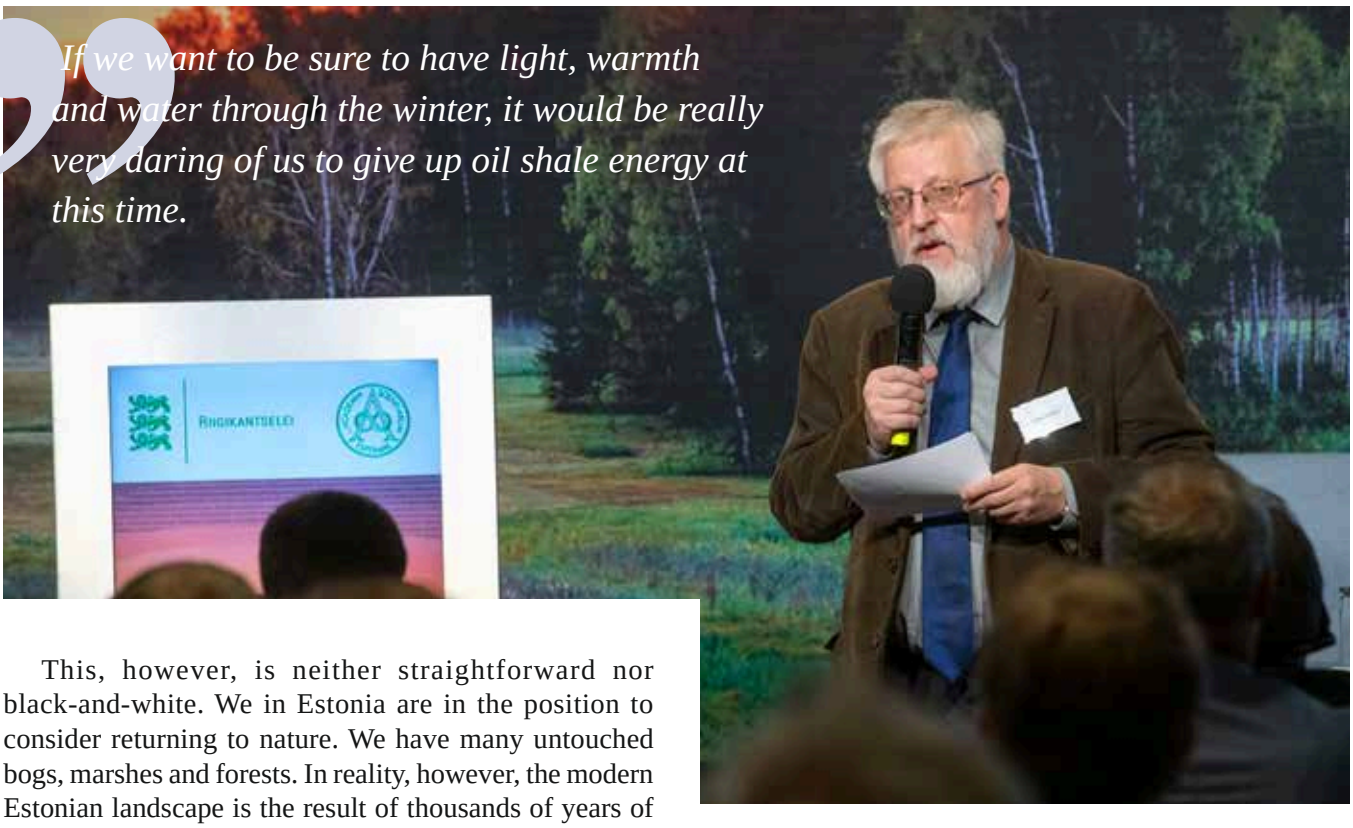


Photo: Raigo Pajula

Translating the message of scientists and experts for the general public was an almost back-breaking challenge at times.

This, however, is neither straightforward nor black-and-white. We in Estonia are in the position to consider returning to nature. We have many untouched bogs, marshes and forests. In reality, however, the modern Estonian landscape is the result of thousands of years of human activity. We owe a significant part of our wealth to the fact that humans have managed and harnessed nature. The current onslaught of human activity – whether harvesting timber, fertilising fields or using pesticides – harms our biodiversity. Even so, it is hard to imagine the harm to biological diversity when we stop mowing wooded meadows or making hay in flood-meadows. Our blind rush to return to untouched nature has significantly contributed to the decrease in biodiversity. The nature that develops without human interference may not necessarily be our ally.

The future of the oil shale industry was a recurrent theme in several presentations. Considering the general developments, does oil shale energy production have any future at all?

This is a complicated matter. We would like to transition to clean energy. Humanity's energy consumption, however, is always going up. After all, the source of all our energy is ultimately the sun. Collecting solar energy takes a lot of surface area. It is easier to capture energy created by the sun; in our country, this means wind.

The transition to new energy sources is a long and expensive process. Somebody has to pay for it. We can pay by purchasing wind generators or solar panels for our homes, or the expense can be borne by our collective wallet by building wind generators and reconstructing power systems. The process is expensive and slow. Its most expensive and challenging aspect is energy storage. The law of conservation of energy has been supplemented with another that describes the behaviour of power generation and consumption in power grids. The power produced in the turbines of power plants must be used immediately. It cannot simply circulate indefinitely in the grid.

The storage equipment to guarantee the functioning of Estonia through three cold winter days would cost roughly 100 billion euros. This is equivalent to seven or eight Estonian annual national budgets. If we want to be sure to have light, warmth and water through the winter, it would be really very daring of us to give up oil shale energy at this time.

Another aspect of concern are the problems in oil-producing countries. If the flow of oil from the Middle East to developed countries came to an end, Estonia would likely be among the first to run short of liquid fuel. The countries with the capacity to produce enough liquid fuel to cover their own transport needs would gain a vast competitive advantage in this situation. One of the current solutions, the production of shale oil, is a dead end in the global perspective, but it is a vital, organic component of our energy security. This is true even if we never end up needing the capacity to produce liquid fuel for our own needs.

Politicians and the academy of sciences must think ahead and account for many unlikely, but frightening scenarios.

THE NATIONAL MANDATE IS EXPANDING

NATIONAL RESEARCH AWARDS

Members of the Academy Saari and Ustav receive awards

This year's national research awards were announced in mid-February. Professor of Estonian University of Life Sciences Anne Luik and Academy Member Peeter Saari, Professor of the University of Tartu, received lifetime achievement awards for long-term productive work in research and innovation.

For the last fifteen years, the national research awards statute has allowed for issuing "discovery awards". These awards can be earned in two ways. One way is to make a scientific discovery that impacts a paradigm and world-view in a scientific area or establishes a new scientific area. The other way is related to the implementation of a scientific discovery through a solution that affects or benefits the entire society. The significance and exclusivity of this award are illustrated by the fact that only four discovery awards have been granted to date, including in 2018 to Ahto Buldas for developing the mathematical foundation for blockchain and timestamp technologies.

This year, the government decided to recognise the transformation of trailblazing basic scientific molecular biological research results into solutions that protect the health of millions. The award was given to Academy Member Mart Ustav for the research and development work "From research on the molecular mechanisms of the replication of DNA oncoviruses to the development of biological drug manufacture and development technologies".

The Estonian state has delegated the national research awards procedure to the Academy. This means helping to draft the rules, announcing the competition, reviewing and registering applications, analysing them in depth and making decisions concerning the awarding or non-awarding of prizes. The awards committee is formed by the government.

Traditionally, two national research awards for outstanding lifetime achievements, or lifetime awards, are granted every year. Eight "annual awards" are given to highlight the best research work completed and published during the previous four years in specific fields. Awards for outstanding scientific discoveries – "discovery awards" – can be given for scientific discoveries that change the paradigm of or 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. In the absence of suitably high-level research efforts, the committee has the right to abstain from awarding any prizes.

> T. Soomere, E. Pilt. Estonian Academy of Sciences in Words and Images 2017, Tallinn 2018, p. 22. https://www.akadeemia.ee/wp-content/uploads/2020/08/words_and_images_2017.pdf

Photo: Annika Haas

The national research awards were handed out by Prime Minister Jüri Ratas

Prime Minister's Welcome

Honourable President of the Academy of Sciences!
Dear Ministers! Dear Laureates!
Dear scientists, artists and athletes! Dear guests!

Last year's culture and education award ceremony took place in Haapsalu. Professor Reet Kasik, a laureate of the F. J. Wiedemann language award, introduced her speech with a beautiful statement that has stayed with me through the year: "It is a privilege to witness the hundredth anniversary of our state, to celebrate it in Estonian and experience the joy of it."

We speak this beautiful language every day, in countless situations. We think in it, too. That is why we don't notice every day how remarkable it really is. And that is why we need linguists to remind us. We need to appropriately celebrate the year of the Estonian language, thinking back to a century ago when Estonian became our national language.

Many long and difficult years later, we reconfirmed this with the language act we passed 30 years ago.

The beauty of the Estonian language is treasured far from home, too, in our communities and by people whom life has taken abroad, to Canada, the United States, Sweden and elsewhere. A few months ago, I enjoyed the opportunity to visit the originally Estonian village of Petrovka in Kazakhstan, where I met the 89-year-old Aliide Mägi.

In a foreign country, far from her roots and homeland, she spoke the very same and special Estonian language as her guests. Those moments highlight this joy.

Ladies and gentlemen!

It is an honour to be here at the great hall of the Academy of Sciences to offer my heartfelt congratulations to the laureates for their impressive contributions to Estonian art, culture and science.

It is a pleasure to see that we have so many people who have so much to give to Estonia and the world. Estonia's greatest achievements are without doubt also top achievements globally.

On the birthday of the Republic of Estonia, we also recognise that our intellectual wealth and our future in the centuries to come are determined by the vitality of our language, culture, research, sport and education. If we manage to maintain and develop what we have, our republic will, without doubt, have many dignified centuries ahead.

In conclusion, I would like to quote Jaan Tõnisson, a creator of the Estonian political national ideology, on the unbreakable bond between the state and its culture:

"The Estonian state will survive only if it is rooted in a solid national culture and economy. No military power, no nationalist ardour can support our statehood if we are not secured by good national wealth and if we do not grow as a culture."

My heartfelt congratulations and best wishes to the laureates in their great work. I wish us all a good 101st anniversary of the Republic of Estonia! Long live Estonia!

Jüri Ratas

Photo: Annika Haas

Photo: Annika Haas

Member of the Academy Peeter Saari

The outstanding lifetime achievement award was awarded to an eminent physicist, Head of Laboratory and Professor of Wave Optics at the University of Tartu Institute of Physics and an honorary citizen of the city of Tartu, Member of the Academy Peeter Saari.

This laureate of the lifetime achievement award is a scholar in the best sense of the word. As a lecturer and researcher, and promoter of science and scientific thought, he has always maintained that those with more knowledge bear a greater responsibility to inform society of the importance of the results of scientific studies.

This laureate considers himself to be a specialist in spectroscopy: how light or other radiation behaves differently at different wavelengths. Physics knows him as one of the discoverers of hot luminescence and a founder of the research direction of non-diffractive light pulses. (Non-physicists may, admittedly, not consider processes taking place at negative 270 degrees Celsius to be hot.)

His witty deliberations can take us from basic laws of physics all the way to energy-saving light bulbs or the conservation of the Estonian language. He has always enforced the distinction between numbers and digits. His opinions and undertakings have left a clear mark on Estonian society. His monumental work in science organisation (he essentially established the distribution of research grants in Estonia), unerringly gentlemanly and civil attitude, keen eye and weighty words have made him one of the most eminent Estonian researchers of all times.

> Awards of the Republic of Estonia 2019. Tallinn, 2019, p. 13

2000 National exact sciences annual award “Non-diffractive light pulses”
2002 Order of the White Star III Class

Photo: Annika Haas

Member of the Academy Mart Ustav

Member of the Academy Mart Ustav, Professor of Biomedical Technology at the Tartu University Institute of Technology, the founder and CEO of the Icosagen Group and an honorary citizen of the city of Tartu, was awarded a discovery award, granted for scientific discoveries that lead to the creation of innovative products with a significant socio-economic impact, for his R&D project "From research on the molecular mechanisms of the replication of DNA oncoviruses to the development of biological drug manufacture and development technologies".

His research focuses on papillomaviruses. These viruses can survive in the epithelium (including in our skin) for decades without any evident harm, be passed on to others, and ultimately cause cancer. They are related to over half a million cases of cervical cancer diagnosed in the world annually, claiming over a quarter million victims.

The laureate showed how the virus outsmarts the organism, how it replicates and how it causes cancer. Today, this knowledge has become a classic part of *Fields Virology*, the holy book of the field. No less importantly, the discovery has sparked the development of products that are important for the whole society, including an HIV vaccine.

Twenty years ago, the laureate decided that he must strive to make everything that he has learned as a researcher accessible to the public. And thus he has gone on to build on his discoveries to create an entirely novel technology for the manufacture of specific proteins. The technology is now used by many leading global pharmaceutical companies.

This laureate of the discovery award has achieved the ideal of innovative research: high-tech entrepreneurship that is based on fundamental research and helps to keep millions healthy.

> Awards of the Republic of Estonia 2019. Tallinn, 2019, p. 14.

1980 Research Prize of the Estonian Soviet Republic for research in the field of protein synthesis mechanisms (as part of a group)
1997 National chemistry and molecular biology annual award in the field "Research into the replication and oncogenes of the papillomavirus genome"
2001 Order of the White Star III Class

FIVE UNIVERSITIES HAVE NEW COUNCILS

The core of the updated management model of Estonian universities is a small council charged with strategic decision-making. At the Tallinn University of Technology, this body was called the advisory board until August 2019. The concept of a model that involves the Academy of Sciences was developed a long time ago and it was first considered at the University of Tartu. The recognition that the council should balance the strategic interests of the university and the state occurred quickly. The problem of eliminating the possibility of persistent stalemates in case of equal representation of the two "poles" was harder to solve. No one knows who first came up with the idea of having an odd number of members of the council, with one member appointed by the Academy of Sciences. But everybody remembers that it gained acceptance quickly.

The University of Tartu was the first to adopt this model nearly fifteen years ago. The Academy of Sciences' appointee was the former President of the Finnish Academy of Sciences, the former Rector of the University of Helsinki, the former vice president of the International Science Council (formerly the ICSU), etc., etc., Professor Kari Raivo. He served two five-year mandates and was universally respected. In January 2018, the Academy of Sciences appointed a new University of Tartu council member: President of the Estonian Young Academy of Sciences Els Heinsalu. In 2014, this management model was adopted in the Tallinn University of Technology. The Academy's appointee for 2014–2019 was Member of the Academy Mart Saarma.

In Spring 2019, the Estonian parliament adopted laws regulating the other four public universities. For each of the universities, one of the members of the council would be appointed by the Academy. This suggests that the model has proven itself and the previous Academy appointees have done good jobs. Since the laws entered into force on 1 September 2019 and the new management model was to be implemented at the beginning of the new year, the Academy spent a considerable amount of time discussing the matter in the autumn.

The board considered it sensible to appoint an Academy member or foreign member where possible. After all, the goal of the mandate is to ensure the inclusion of an independent top academic expert in strategic decision-making. However, if the Academy fell short of the necessary competence for a university or if the existing competence was otherwise occupied, the Young Academy of Sciences or universally recognised creative people were appointed.

The Academy appointed the following members of university councils:

Photo: Reti Kokk

Tallinn University: Foreign Member of the Estonian Academy of Sciences **Ülo Langel**, Professor of Neurochemistry and Molecular Neurobiology at Stockholm University, and Professor of Molecular Biotechnology at the University of Tartu.

Photo: Reti Kokk

Tallinn University of Technology: Member of the Academy **Mart Saarma**, Professor at the Institute of Biotechnology at the University of Helsinki.


Photo: Academy archive

Estonian University of Life Sciences: Member of the Academy **Anne Kahru**, National Institute of Chemical Physics and Biophysics, Head of the Laboratory of Environmental Toxicology.


Photo: Estonian Academy of Arts website

Estonian Academy of Arts: **Eva Näripea**, a founding member of the Estonian Young Academy of Sciences, and the director of the National Film Archives.


Photo: Ave Maria Mõistlik

Estonian Academy of Music and Theatre: **Erkki-Sven Tüür**, freelance composer and a member of the Estonian Composers Union.

MEMBERS OF THE BOARD AND APPOINTING COMMITTEE OF THE ESTONIAN RESEARCH COUNCIL

This year's scientific reforms involved the Estonian Research Council. The evaluation committee of the Research Council had long been appointed by the Council itself. Now, it was decided that decisions of this importance should be made higher up, at the ministerial level. The drafting of this decision was delegated to a brand new institution: a relatively small appointing committee. The Ministry requested that the Academy of Sciences and the Young Academy of Sciences nominate a joint representative.

Organisations have multiplied to the point that only very experienced research politicians still know their way around them. Another important institution is the Board of the Estonian Research Council, which, similarly to the boards of universities, manages strategic aspects. Member of the Academy Mart Ustav has been shouldering the responsibility of membership on this board for over five years. The Ministry of Education and Research requested that the Academy find a suitable successor.

Photo: Reti Kokk

Member of the Academy **Maarja Kruusmaa**, Professor of Biorobotics at the Tallinn University of Technology, was appointed as the joint representative of the Estonian Academy of Sciences and the Young Academy of Sciences to the Appointment Committee of the Estonian Research Council Evaluation Committee.

Photo: Reti Kokk

Member of the Academy **Jakob Kübarsepp**, Professor at the Mechanical and Industrial Engineering Institute of the Tallinn University of Technology, was proposed by the Academy as a prospective Member of the Board of the Estonian Research Council. FOTO

The Minister appointed Member of the Academy Kübarsepp as a Member of the Board of the Research Council. The term of office is five years.

ACADEMY SPECIAL PRIZES

The national student research paper competition awards were handed out on 12 December 2019 in Tartu, at the Ministry of Education and Research. The Academy has established special prizes for the competition.

The President of the Academy's special prize for the most elegant student research paper was awarded to Johannes Heinsoo for the doctoral thesis "Digital quantum computation with superconducting qubits" (supervisor: Andreas Wallraff). It stood out among other excellent papers in a number of ways that best express the elegance of a research paper. Exploring a trending topic using a still-developing methodology provided a solid foundation. Johannes Heinsoo addressed the subject with great clarity of insight, and provided an outstanding review of the existing body of knowledge and, crucially, an excellent analysis of the results.

The President of the Academy's special prize for auspicious scintillating research went to Karina Loid for her research paper "Do pop-up notifications regarding smartphone use decrease screen time, phone checking behaviour, and self-reported problematic smartphone use? Evidence from a two-month experimental study" (supervisors: Karin Täht and Dmitri Rozgonjuk).

Karina Loid (with two co-authors) disproved the widespread belief that the signals that smartphones send to their users impact the users' preferences or length of use. The problem is interesting and the results offer an intriguing reflection on the way our understanding of the world and our own behaviour can diverge from the factual measurements recorded by the devices that surround us.

The President of the Academy's special prize for an unconventional student research paper was awarded to Lehti Saag for the PhD thesis "The prehistory of Estonia from a genetic perspective: new insights from ancient DNA" (supervisors: Mait Metspalu, Toomas Kivisild and Kristiina Tambets). The President stated that Lehti Saag had executed an outstanding research work in a field where Estonian scientists are on the global leading edge.

The Academy of Sciences also issued its very first constitutional law endowment special prizes. The laureates were Karin Orgulas for the research paper "Rural law problems at the administrative department of the Supreme Court in 1930 through the example of the copy ERA.1356.2.102" (supervisors: Marju Luts-Sootak and Karin Visnapuu) and Sven Anton's research paper "The Concept of Estonian Culture and Estonian Nationality in the Constitution. The Use of the Concept of Culture in Legal and Political Documents" (supervisors: Tõnu Viik and Raul Narits).

Vice President Arvi Freiberg offers Johannes Heinsoo a firm congratulatory handshake.

Karina Loid's analysis of the use of phones disproves several common beliefs.

Photo: Hendrik Osula x3

Lehti Saag has offered interesting insights into our early history.

PERSONA

MART USTAV, LAUREATE OF THE DISCOVERY AWARD: THE GRASS IS NOT GREENER ABROAD

One of Estonia's most successful researchers, Mart Ustav, celebrated his 70th birthday last year. He and Taavi Minnik contemplated in retrospect his half century in science and his life in Siberia, Estonia and the west. Ustav emphasises that life is not fixed on a safe and secure path.

Mart Ustav's life began similarly to many in his generation: deported from Estonia, he lived in the town of Cherlak, Omsk Oblast. The twists and turns of his life took him far from home, and yet he has always returned to Estonia. Ustav himself says that something has always bound his grandparents, his parents and himself to Estonia. No matter what we would sometimes like to believe, the grass is not greener on the other side.

Your story reflects the story of an entire generation: you spent a part of your childhood in Siberia. What do you remember best from your childhood?
The first six years of my life were spent in the city of Cherlak, near the northern border of Kazakhstan, a major *sovkhoz** centre. I lived in an ordinary Estonian family. My mother and her sister Heljo were deported to Siberia on 25 March [1949] for life, labelled as enemies of the people. My mother was 26 at the time and my aunt 22. My mother had graduated from the Teacher's Seminary. She taught Estonian language and literature at the Lina Street school (the current Karlova school). When she arrived in Cherlak, five months pregnant, life was initially difficult because she had nothing.

She was simply abandoned in Siberia without shelter?
No. Cherlak was a fairly large town, 12,000 people in all. She and her sister rented a corner in a clay hut. They had a little money and some food. Then they started looking for a place of their own and a steady source of income. My aunt started working at a construction brigade at the *sovkhoz*, where she met her future husband, Kaupo Illak.

Do you have any memories from the Siberian period?
We returned to Estonia when I was seven. I remember the steppe, the infinite horizons, and the broad Irtysh River, with its steep banks. I remember floods, biting frost, clear skies, and roads that were muddy in the spring and autumn and smothered in dust clouds in the summer heat. The winters were cold and the summers hot. I was well taken care of, fed, clothed and sheltered. I cannot remember being hungry or having any major problems. I grew up bilingual. Our household language was Estonian, but the kids in the neighbourhood, my playmates, were mainly Russian and Kazakh. Cherlak had 28 Estonian families, as well as deported Latvians, Volga Germans, Jews and Russians.

The community had a lively social life: we have photos from parties attended by 50–60 people. To be frank, I cannot recall anything bad, nothing that haunts me. It was a natural economy, much like in Estonia during the same period: we had our own cow, a pig, a bullock that could be butchered, and a plot of land where we grew some basic vegetables. The shops were empty, and there was no money to buy anything, anyway. My grandmother, who managed to avoid

* Soviet-time state-owned collective farm. Another accepted way of agriculture was *kolkhoz*, formally created by peasants and operated on state-owned land. – ed.

Photo: Reti Kokk

Academy Member Mart Ustav's life has been fraught with twists and turns, but he has remained optimistic and keen on improving the world throughout.

Photo: private collection

The Ustav family in Siberia. This photo is captioned "Life went on in Siberia" in "Eesti ajalugu VI" (*Estonian History VI*).

being deported, remained in Estonia and sent her daughters some money. When I was four or five, she even visited us in Siberia. And I remember how we arrived in Tartu on 31 May 1956. My mother, who had been a teacher, was released first, and my aunt and her family followed us to Estonia in December.

How easy was it to get used to life in Estonia? Was it hard going to school after Siberia?

I had been brought up as an only child and all the noise and shouting during breaks bothered me greatly. First of all, I had to get used to being surrounded by large crowds. In Siberia, I had had an alphabet book, of course, and I could write a few sentences, but the neighbourhood wasn't entirely Estonian and I spoke Russian with the neighbourhood kids. When we arrived in Estonia, I spoke with a slight accent, which eventually disappeared in the Estonian-speaking environment.

On the upside, I had acquired Russian to the level that later in life, in the army and when lecturing in Russian, people couldn't tell I wasn't Russian. It came in handy, and language skills are never wasted.

Well-meaning adults often ask children what they want to be when they grow up. Do you remember what you wanted to be?

I never wanted to be a fire-fighter or an astronaut. I started reading books in fourth or fifth grade and soon realised that this offered me deep intellectual satisfaction. I mostly read fiction, but also serious history books. Reading always kept me engaged.

Estonia had an active natural economy back then. My grandmother's house and the land it stood on had been nationalised, as had many houses in the Tähtvere district. But my grandmother didn't give up. A week after her daughters had been deported to Siberia, she sent a petition to the Supreme Council, demanding the repatriation of her daughters and the return of her house and property. She wouldn't give up, and in 1957 the Tartu city court decided to return to Helene Rosalie Ustav her house and land and to compensate her for the assets she had noted down.

In our Jaama Street house, my grandmother used me as cheap labour. We grew all sorts of things: tulips, lilies, daffodils, peonies, apples, gooseberries etc. Anything and everything. My grandmother sold them at the local market.

Did this spark your future passion for gardening?

Definitely! This boy was put to use. To have tulips for 8 March, the tulips had to be planted in rows, the rows had to be filled with leaves and covered. I did the grunt work: I knew how to graft plants, grow all kinds of bushes and trees. It remains my hobby to this day and has developed into a broader interest in nature. Until 8th grade, I went to Tartu's 10th School. My class teacher was Rita Sermat and my biology teacher Tiiu Kutti. The director of studies was Valentin Marvet, whose daughter Ann and Jaan Eilart initiated the nature conservation movement in Estonia. I remember how they came to speak to the entire school and told us about nature conservation. At the same time, Holger Pukk's *Green Masks* ("Rohelised maskid"), a slightly naive book about protecting nature in accordance with some Robin Hood-like principles, was published.

The nature conservation movement was a significant force in my life, which led me to natural sciences. Every time I walk past the Vanemuise Theatre, downhill into town, I gaze at the two oaks we planted to celebrate nature conservation day. Since I was so terribly active in the nature conservation movement, I was always made to wield a shovel. The trees have grown well and tall.

The chemistry class of Tartu's 5th High School is an interesting phenomenon: it has bred five Members of the Academy. Why do you think that is?

Pure coincidence. This was not coordinated in any way, except that the opportunities were created. The year was 1964. The concept of communism had been redefined in 1961 in the Soviet Union. Lenin had said that communism was Soviet government plus electrification. Khrushchev added chemicalisation. As a result, chemistry teaching was

preferentially developed. Jüri Vene, the chemistry teacher at the [Tartu] 5th High School, established an advanced chemistry class where we were taught by university professors, among others. We went to the university chemistry building to listen to Professors Viktor Palm, Enn Kuus, Vello Past, Uno Palm and others, who taught us even as 10th and 11th grade "kids".

We received excellent chemistry training. Each of us proceeded according to his interests, using the knowledge base we all had developed. Jaak Järv and Mati Karelson stayed in chemistry. I went into chemistry as well, but later strayed into molecular biology. Mart Saarma initially went into biology. Mati, Mart, Jaak and I met again in the chemistry building, room no. 414. Working with Artur Lind and Aavo Aaviksaar, a new science was established in Estonia: molecular biology, which is now pursued in several institutes.

On the other side of the Iron Curtain, in the West, a vast cultural shift took place in the 1960s. What can you recall about the atmosphere at the University of Tartu and the Department of Chemistry and Physics at the time?

I can't rightly say that we were politically active, but we were intensely interested in doing research. We all headed into laboratories. The prevalent mentality back then was that if you wanted to get anywhere, you had to work very hard. It was not like now, when upon assuming the position of lecturer, your fate is decided and you are sure to have plenty of bread and butter for life and all the coffee you can drink. Back then, there were no guarantees. If you wanted to make it at a certain level, you had to work hard. Our moment coincided with a revolution in research. The recombinant DNA technology was developed, which made it possible to plan genes, determine genetic sequences and thereby to describe all life from the genetic code down to specific genotypes. We were incredibly lucky! We chanced across this just as it was discovered! It was just as lucky as when the five of us came to be in the same chemistry class!

Estonian research was at a very poor level back then and Moscow was not that much better, but they attempted to stay competitive with the ongoing developments in biology at the time. Russian and Soviet research at the time was moving away from Lysenkoism and denial of genes and genetics. This led many physicists into this scientific area, e.g. from the Kurchatov Institute*. As the makers of the atomic and hydrogen bomb, they were to a certain extent entitled to have and express their own opinions, unlike biologists, who were heavily repressed in the Soviet Union at the time.

You went from university into the Soviet army. Would it have been possible to avoid the army? After all, in the Soviet time, many were able to avoid military service through university: there were military study options and two months of training exercises, which culminated in graduating as a lieutenant?

The rank of second lieutenant was granted directly after the summer final exams and military training camp. Back then, I didn't understand the army recruitment principles. I remember how we stood in front of the committee, stripped to our underpants, and a senior officer announced: "*А у вас вопросы есть? Нет, хорошо, поедете в Калининград!*" ("Any questions? No. Very well, you're going to Kaliningrad!"). I graduated from university on 30 June and was commissioned as a lieutenant on 1 July. First, however, we received a month of vacation, and so on 1 August I arrived in the town of Gvardeysk** in Kaliningrad Oblast. I spent two years in Gvardeysk. I didn't have the connections for a medical release or to be released as insane. Life does not always take the ideal trajectory....

After the army, you spent a couple of years in Tallinn, but you returned to Tartu fairly soon. Why didn't you make Tallinn your home?

Aavo Aaviksaar, my university supervisor, had a biochemistry laboratory at the [former Estonian Academy of Sciences] Institute of Cybernetics under Endel Lippmaa, and he invited me to join. The main focus was research on enzyme genetics. By that time, I was married with two children. I didn't mind the research in Tallinn at all. It was interesting and intense. But we had nowhere to live. My wife stayed in Tartu with the children and I commuted to Tallinn every Monday morning and returned home on Friday evening after work. That wasn't much of a life.

And then came the very same Room 414 of the chemistry building, with Artur Lind's laboratory occupying three fourths of it. Richard Villems was there, Mart Saarma, Andres Metspalu, Artur himself, of course, Larissa Uusküla and Merike Kelve, all of them lovely people who came to be almost family because I worked right next to Aavo Aaviksaar's spectrophotometer, where we measured the genetics of somatic reactions.

We used to visit one another every now and then. Villems and I played chess, and occasionally had a drink or two. The customs and traditions were different back then. Villems and I knew each other well, and on that basis a mutual understanding and discussions about life developed. I dropped by the laboratory one Saturday after returning from Tallinn and told him, "you see, this is hardly any life at all, I don't get to be with my family, just like in the army days." Villems said, "no problem, join us here!"

* This legendary institute was established in Moscow in 1943 with the goal of producing an atomic weapon to win the war. It was initially code-named "Laboratory No. 2" of the USSR Academy of Sciences. The innocently-named Laboratory of Measurement Instruments of the Academy of Sciences, established on its basis after the war (in 1949), was renamed the Institute of Atomic Energy in 1956. In 1960, it was renamed after Member of the Academy Igor Kurchatov (1903–1960, "Father of the USSR Nuclear Bomb"). Since then, it has been known simply as the Kurchatov Institute. It gained the status of a national centre of excellence in 2010. – ed.

** Known prior to 1946 by its German name Tapiau. – ed.

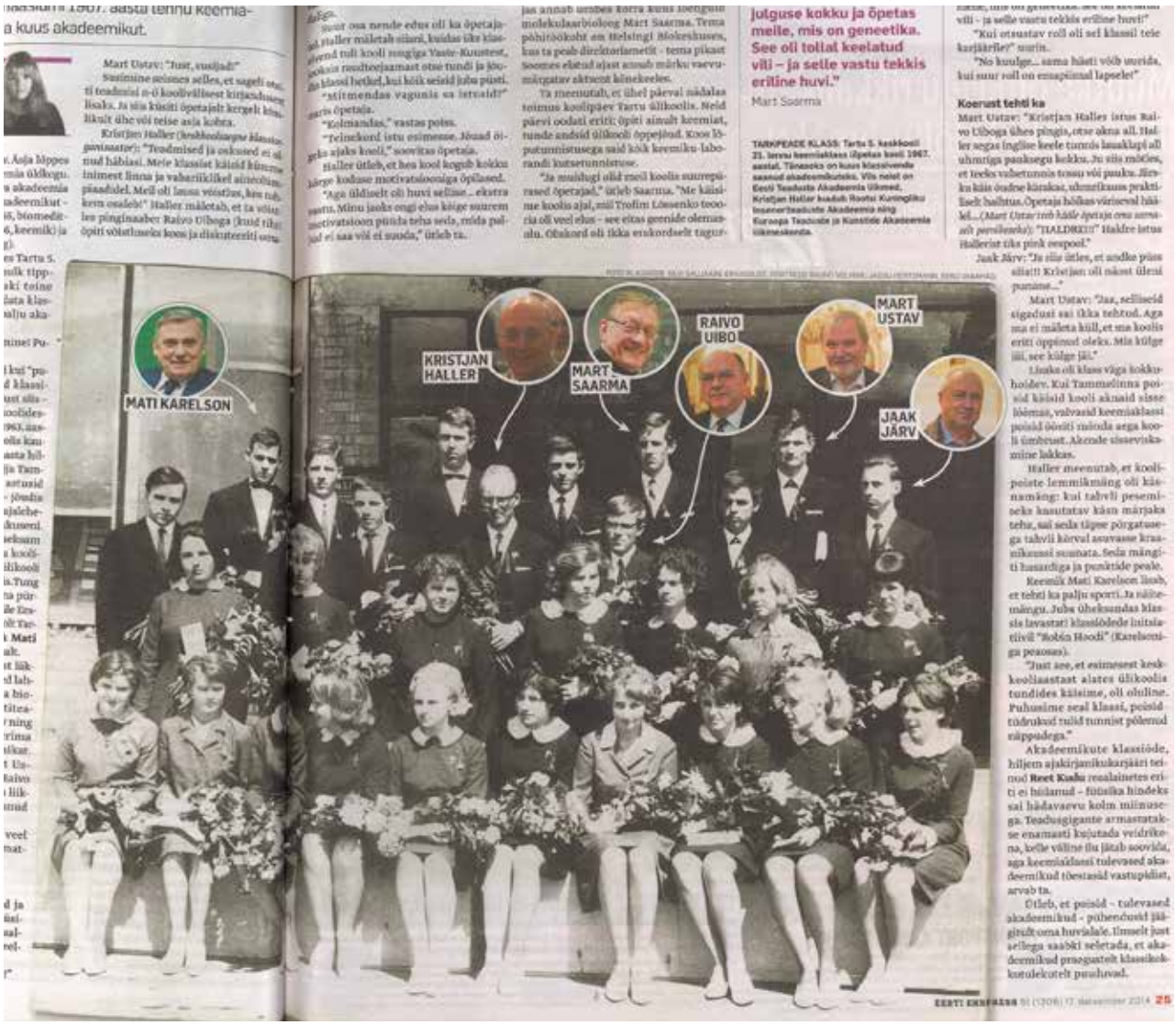


Photo: Eesti Ekspress

A class of geniuses: classmates Mart Saarma, Mart Ustav, Jaak Järv, Mati Karelson and Raivo Uibo became Members of the Estonian Academy of Sciences. Kristjan Haller is a member of several foreign academies.

By late 1975, I had decided it was worth a try, and I joined Artur Lind's laboratory as of 1 January 1976. I started out as a constructor. As a chemist, you have ertain advantages among doctors and biologists. You know how to synthesise, you have a molecular-level understanding of chemical processes that biologists might not entirely understand, and so on. This research group developed great complementarity and that was why I left Tallinn.

Did the state grant the Academy of Sciences system any special privileges during the Soviet time?

Definitely. The Academy of Sciences was the general staff of Soviet science. Saarma proceeded to first create a molecular genetics group at the Institute of Physics. Lippmaa then invited Saarma to Tallinn, where they were given the use of a purpose-built molecular genetics building. But we stayed in Tartu.

Why did you defend your thesis in Kiev?

It couldn't be done in Tartu, because the defence committee had to be certified by the national attestation committee. Tartu didn't have enough experts with Doctor of Sciences* degrees in the relevant field. There were just three such committees across the entire Soviet Union at the time: one each in Kiev, Moscow and Novosibirsk.

Kiev was home to the Institute of Molecular Genetics and it was Anna Yelskaya who helped and guided us in that environment. We could've chosen Moscow, but the waiting list was significantly longer. Novosibirsk was too far away for me to consider.

* The highest degree in the USSR and today's Russian system; usually obtained 15–20 years after Candidate of Sciences (equivalent to PhD) degree. – ed.

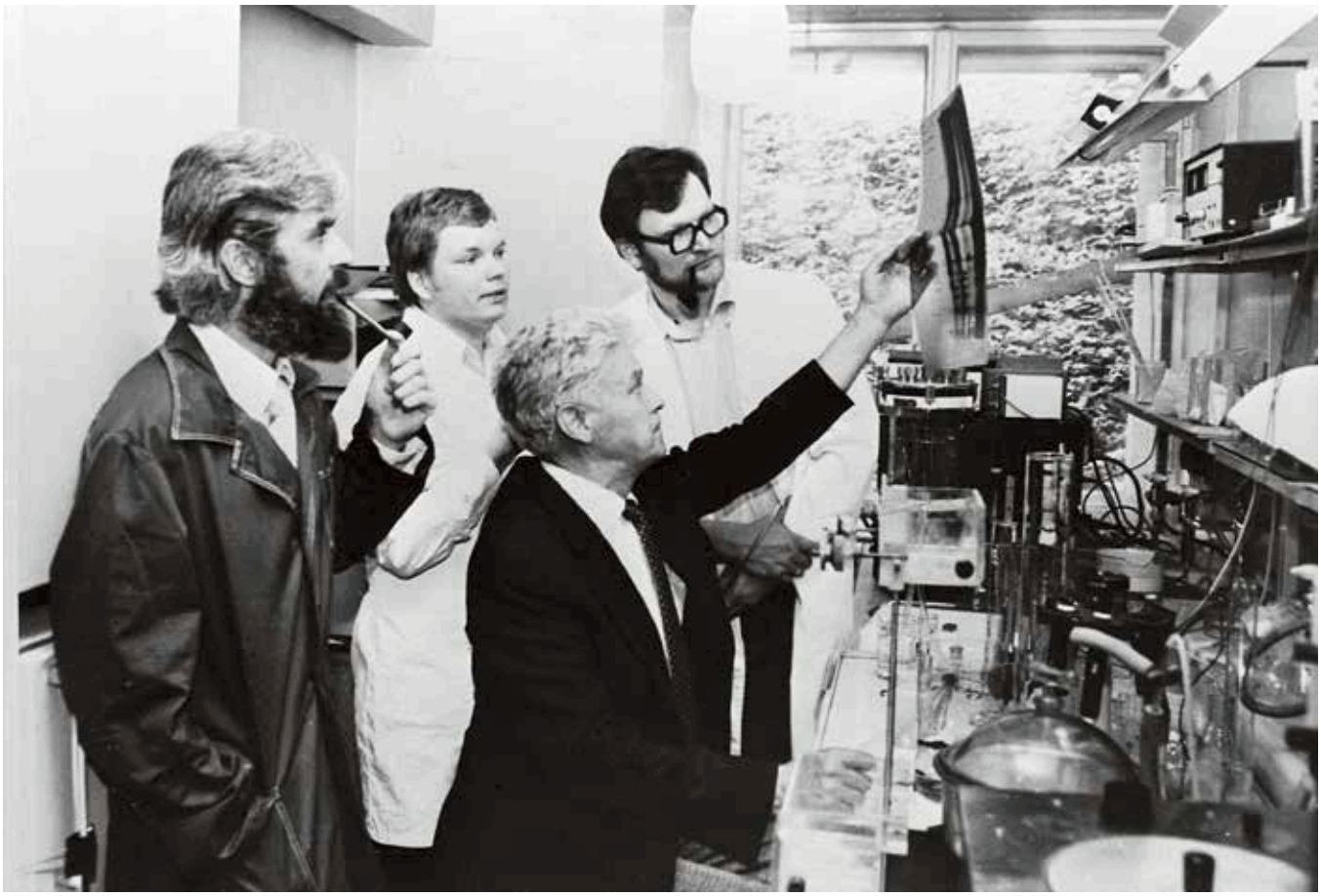


Photo: Estonian National Archive Film Archive

Future Academy members Richard Villems, Andres Metspalu and Mart Ustav at the laboratory of Professor Artur Lind in 1982.

You spent a long time abroad in the 1980s and 1990s. Life in the West was a far cry from life in Soviet Estonia. Did you experience culture shock?

The Swedish society was a society of equality among people. The ideas underlying the concept of socialism were clearly expressed, even though Sweden had its elitist streak, too. It had its rich and its super-rich. For me, the biggest shock in Sweden was finding that socialism could work. In the U.S., I was amazed by the racial and cultural diversity and the way friendship and fraternity among peoples were cultivated on this basis. Americans succeeded in this, while the Soviet Union never did.

In 1982, I arrived in Sweden barely a week before a Soviet submarine ran aground near the Karlskrona naval base. The mood in Swedish society was very much anti-Soviet and I was treated with some suspicion. But I was very well educated and had lots of laboratory work experience. In Tartu, in Room 414, we had been supplied with chemicals from the Academy warehouses in Moscow and elsewhere. Their degree of purity was not high enough to use them in experiments without modification. We had to apply our skills to purify them. Synthesis skills and enzyme purification were important as well. We were well versed in methodology, and were therefore able to rise quickly in the ranks.

When the Swedes had to break down plasmin – it's a long process – this required determining the concentration of caesium chloride in a centrifuge tube, which, in turn, requires a refractometer. But their refractometer had broken down and they had not realised it was broken. They had been stuck for two months. When I started, I noticed that the refractometer wasn't working properly and enquired what values they based their work on, and then they realised it was broken. This helped me gain some standing.

How did you end up in the United States?

I was invited by Magnus Stenlund, with whom I had worked in Uppsala. When I arrived in Uppsala as a post-doctoral researcher, he was defending his thesis and was getting ready to move on to Berkeley as a post-doc. In 1989, he started working as a principal investigator in Cold Spring Harbour and was looking for laboratory colleagues. Since we knew each other, he invited me. I took my family and mother along to the U.S. On 20 August 1991, we were watching TV and I really thought I would never be able to go back to Estonia. But thankfully, the coup attempt failed and Estonia regained its independence.

You returned to Estonia in the early 1990s and became a professor at the University of Tartu. Times were hard in Estonia and professors' salaries in Tartu were meagre. Weren't you tempted to stay in the States?
Of course I was. I taught seminars in Los Angeles, San Francisco, Rochester and Taft University and promoted myself as a beautiful and talented researcher, perfect professorial material. I had negotiations underway, too. But the family put a twist in these plans. My older daughter graduated from high school in the United States and started applying to universities. She was accepted to Georgetown University, where the annual tuition fee turned out to be 24,000 dollars. 24,000 dollars was my annual salary, the same as my spouse's. My other daughter was going to graduate the following year, and she was an A+ student with Harvard in mind.

The talk in Estonia 10–20 years ago was that everybody in the U.S. lived on borrowed money. Did you consider student loans?
Student loans require a green card, but we all had J1 or J2 visas: study and research visas. We couldn't afford tuition or apply for student loans because our income wasn't high enough. So I realised that since my wife and I went to the University of Tartu and we turned out just fine, why not have our daughters study in Tartu, too.

Had the August Coup* succeeded and Soviet rule over Estonia continued, we wouldn't have come back. But then came independence and our own currency. Richard Villems soon called and asked me to come and work as a professor in Tartu, telling me that Estonian research and university life would be restructured following the example of Finland and Sweden. I had been in the U.S. for three years and everything had settled into place, but I thought it would be good to come back to Estonia. Spending time among a foreign people is necessary to fight your way free of the traditional environment in which you were raised, to enter a different environment and understand how other people think and do things.

I thought I was wasting my life! But then, I remember, it was a January Sunday, I stepped out of the house and the sun was shining, the snow was glittering and a tit was merrily chirping in a tree. I thought maybe the situation wasn't irredeemable, after all!

What did your time in Sweden and the States contribute to your future career and life?
First and foremost, a network. It is undoubtedly very important.

How common was it in the Estonia of the 1990s to have a scientist establish his own company and how did you manage it?
We returned to Estonia in 1992 and in the autumn I was struck with deep depression: the conditions weren't right and neither was the money to create them. I thought I was wasting my life there! But then, I remember, one January Sunday I stepped out of the house and the sun was shining, the snow was glittering and a tit was merrily chirping in a tree. I thought maybe the situation wasn't irredeemable after all! And then things took off!

We received Soros grants**, and we had the money we needed.

If I understand correctly, Soros helped you purchase technology?
He helped a lot. 15,000 dollars was a lot of money in Estonian research at the time. We bought all the basics: the enzymes, the pipettes etc. I then received a grant from the Wellcome Trust***, which took us through another three years. In 1995, I received the Howard Hughes Medical Institute**** grant for the following ten years: 150,000 dollars annually.

Research took off. I was surrounded by young students. We were publishing articles in top journals. Everything we did in the old laboratories in Tartu was working smoothly, I was convinced that I was doing the right thing.

And then, in 1998, my mother was diagnosed with melanoma. And there I was, the head of a laboratory of oncogenesis, and I could do absolutely nothing to help my mother. This shocked me deeply: all that damned science was useless when a real problem needed solving! This meant I had to be doing something wrong!

In Estonia, in a situation where research is thoroughly focused on accumulating citations, getting funding for an applied project through the research funding system is unlikely. Right now, there's a lot of talk about channelling more money into engineering and medical sciences, and the situation was the same then. Therefore, after the crisis and the bereavement, I decided I had to change the way things were done. The only way was to use my knowledge and start a company. We had developed infectious disease diagnostics methods at university: seventeen different methodologies in total. In 1999, Marika Mikelsaar, Ain Laving, Helve Raukas and I founded Quatromed. The

* The 1991 Soviet coup d'état attempt, also known as the August Coup (19–22 August 1991), was a failed attempt made by reactionary Communist leaders of the Soviet Union to take control of the country. – ed.

** Officially titled the Open Estonia Foundation, a charitable foundation founded in 1990 by the Hungarian-American philanthropist George Soros to support the development of an open society in Estonia. – ed.

*** A United Kingdom foundation named after Sir Henry Wellcome. It supports top-level medical research development. – ed.

**** A U.S. foundation that supports top-level biomedical research. – ed.

name was chosen because we really liked the contemporary Audi Quatro ads and because there were four of us.

We gave the key intellectual property rights to the university and the university licensed them to Quatromed. The second floor in the Nooruse 9 building had formerly been occupied by the Department of Economics. They, however, moved out to the new Economicum down by the river, and the rooms were left empty. They let the rooms to us for two euros and 30 cents per square meter, just enough to cover the heating costs. We got a grant for 3.6 million Estonian kroons (EEK) from the Estonian Innovation Foundation and furnished the space. We took out a further loan of three million kroons to buy the necessary equipment for diagnostic services. We had no way of knowing whether the project would "take off". The turnover was a million and a half that first year. We made ends meet, and paid the salaries and the bills. The turnover was three million in the second year and six million the year after that. By the fourth year, we had reached 15 million! By 2009, the turnover was 65 million and investors came calling to see if we were willing to sell the company. Since the interpersonal relations in the company had got somewhat tangled, we decided to sell the diagnostics part. It sold well, too: for over ten million euros. It is now known as Synlab. We kept the biotechnology side.

The attitude that entrepreneurship is dirty and science is sacred has still not entirely disappeared in scientific circles. Didn't your university colleagues disapprove?
There was some of that.

Jealousy?
I don't know.... That would be their problem, not ours. Some spoke up, but I don't know of anyone working against us.

You have received much high acclaim and even a hat trick of national awards. You have achieved a lot in life. If you had a magic lamp and were granted three wishes, what would you wish for?
At 70, I am no longer as young as I used to be. Everything that begins must come to an end. My academic career started in 1967, when I entered the University of Tartu. Now I have decided that it is time for it to end. I have supervised 25 people defending their PhD theses, many master's theses, two companies built from scratch.... Everything must come to an end.

Your esteemed colleague, Academy Member Eero Vasar says that people could live to be 115 if they didn't drink or smoke or suffer from heavy stress.
There has definitely been stress. It would be neat to make it to one hundred. But thinking about what I'd like, I'd like

Photo: Reti Kokk

"I have always come back to Estonia: I returned from Cherlak, I returned from Sweden, and I returned from the U.S. There is something that ties me to Estonia," Ustav reflects.

"The laboratories of Icosagen are staffed with young and energetic men and women: they are our future", Mart Ustav believes.

certain developments related to the capacity of Icosagen*. I wish Icosagen would transition from an organisation offering research services into a pharmaceutical developer, and create a pharmaceutical production company, too. I'd like it to become a place where people with good educations and preparation could actualise themselves. I can see three potential outputs. We have started with research, and we have applied a lot of the research in this company to actualise various aspects. And now it should be the foundation of a functioning global enterprise. I'm not motivated by money. Money is simply a means to get where you want to go.

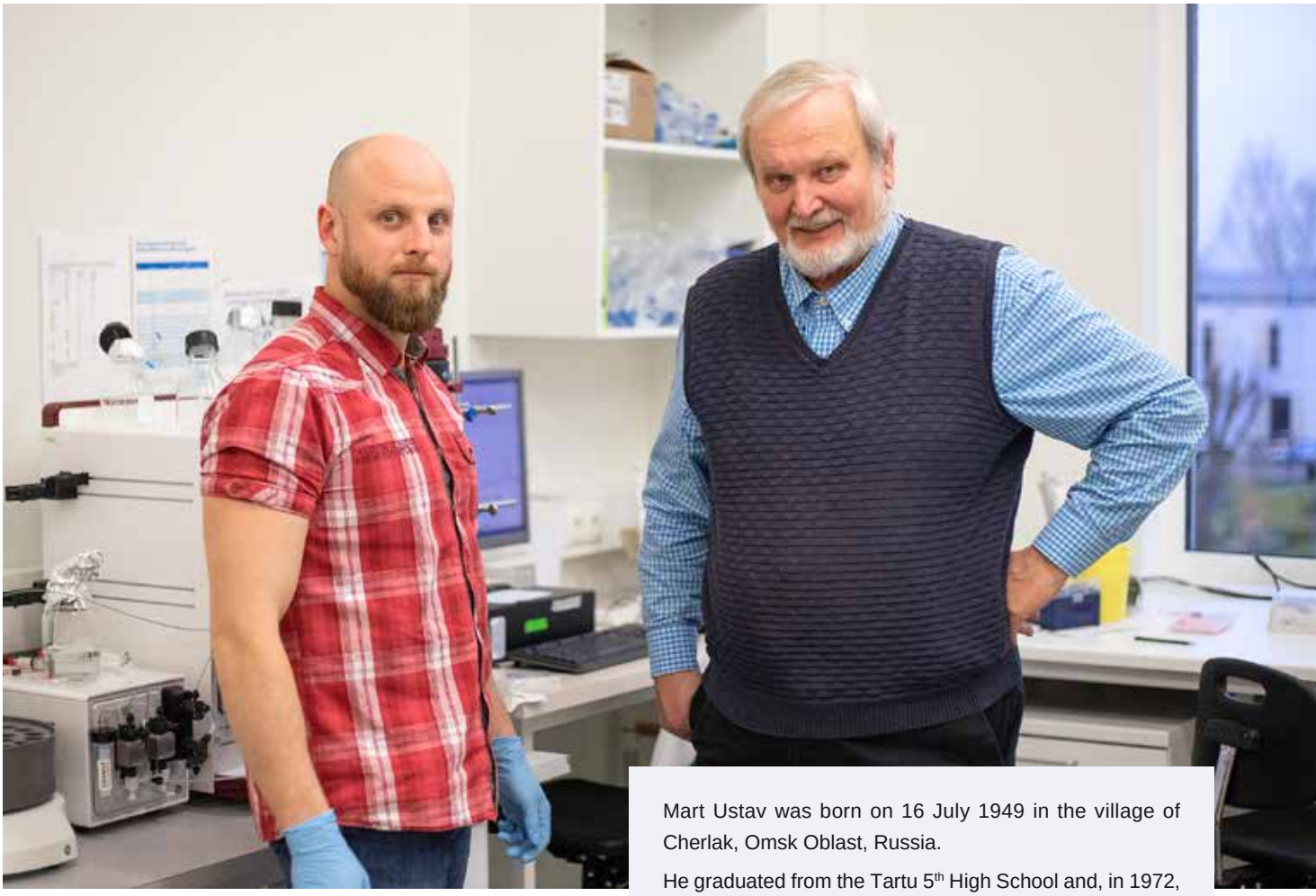
And you can always make more.
Absolutely. If you have the ability to reason, that's capital.

What is the status of the most important of all resources: human resources? Can we develop high-tech applied research in Estonia?
I believe we can. However, not many enter research in Estonia, because Estonian research is in a deep crisis. We cannot continue as we have been doing. In the 1990s, we carried out a revolution and replaced the Soviet-style scientific system with a Western system. It has grown up now. We are now able to see that simply generating articles and citations and producing knowledge is not enough. I felt disturbed when the whole commotion against the planned cellulose plant happened. Nobody even attempted to find a scientific solution to the problem. Yes, it pollutes, but the pollution can be neutralised with chemistry, and it can be taken even further. It was all cast aside. Everybody was shouting, "No, no way, let us live under a bush, clothe ourselves in moss and live happily ever after!" Instead they should engage their reason and knowledge.

The knowledge must be turned into intellectual capital to improve the state of Estonia and the lives of the people. Science must leave its ivory tower and think more broadly than just publication!

* Mart Ustav's current company. – ed.

Photo: Reti Kokk x2



Mart Ustav was born on 16 July 1949 in the village of Cherlak, Omsk Oblast, Russia.

He graduated from the Tartu 5th High School and, in 1972, the department of physics and chemistry of the University of Tartu. He gave his defence for the degree of Candidate of Chemistry in 1979 at the Institute of Molecular Biology and Genetics at the Ukrainian Academy of Sciences.

He worked as a senior engineer at the Institute of Cybernetics of the Estonian Academy of Sciences in 1974–1976, and as a senior engineer, junior researcher and senior researcher at the University of Tartu in 1976–1982. He underwent post-doctoral training at Uppsala University in 1982–1985 and headed the University of Tartu Laboratory of Oncogenesis in 1985–1989. He was a visiting researcher at Cold Spring Harbor Laboratory in the United States in 1989–1992. In 1992–2002, he was a professor and head of the chair of microbiology and virology at the Institute of Molecular and Cell Biology of the Department of Biology and Geography of the University of Tartu; he was the head of this institute in 1996–1999 and the Director of the University of Tartu Institute of Technology in 2002–2007. He has been a professor of Biomedical Technology at the Tartu University Institute of Technology since 2007.

Academy Member Ustav is the founder and CEO of the genetic technology company Icosagen Group.

His main research directions have been research on the papillomavirus, the molecular foundation of the episomal maintenance of genetic vectors in the creation of safe next generation DNA vaccines and the design of viruses and viral vectors.

The cellulose factory attracted active attention from humanities and social sciences researchers, but specialists in the field stayed back.
Nobody wanted to get involved in all that shouting: you'd be tarred and feathered! On the one hand, we have the problem, and on the other, we have intellect and education. Let's solve the problem and advance society! For example, look at the Swiss. Their population is small, and yet they have created various global technologies. The turnover of the two major Swiss pharmaceutical companies, Novartis and Hoffmann-La Roche, surpasses the Estonian national budget tenfold. This is because they create value. They create intellectual property and take it all the way to the output that people need: pharmaceuticals. Why couldn't we do the same? I'd like to establish, for example, a drug development company and a drug production company.

Maybe it would be easier to do it in Hong Kong or Shanghai and forget about Estonia for the time being?
I have always come back to Estonia: I returned from Cherlak, I returned from Sweden, and I returned from the U.S. Why would I leave now? There is something that ties me to Estonia. The grass is not greener on the other side: the same problems remain.

EVERYDAY MATTERS AND NEW BEGINNINGS

TWO PRESIDENTS DISCUSS THE ROLE OF SMALL NATIONS IN A CHANGING WORLD

Last summer, Estonia became a temporary member of the United Nations Security Council. Estonia will be closely involved in resolving global issues and regulating conflicts within and between countries for two years. In late October, we gathered at the great hall of the Academy to review small countries' opportunities to take part in global politics and to reflect on Estonia's first months in the new role.

On 29 October, the half-day conference "Small States in Global Affairs: Possible Impact of Estonia" was held at the Academy of Sciences. The speakers included the President of Estonia Kersti Kaljulaid, Minister of Foreign Affairs Urmas Reinsalu, State Secretary Taimar Peterkop, President of the Estonian Academy of Sciences Tarmo Soomere, Academy Member Lauri Mälksoo, Vice President and Director of the International Peace Institute Adam Lupel, researchers from Columbia University and the Estonian Foreign Policy Institute et al.

The conference was opened by the Director of the Estonian Foreign Policy Institute Kristi Raik, who emphasised that fluctuations in the international environment affect small states more than large ones and that small countries need to display great diplomatic skill in making their way in a world dominated by large states. Kristi Raik recalled experiences from Estonia's recent history and asked how small states could contribute to a world where justice prevails over power and the voices of small nations are heard.

The first agenda item was the introduction of the joint research work by Academy Member Lauri Mälksoo and Vice President of the International Peace Institute* Adam Lupel "A Necessary Voice: Small States, International Law, and the UN Security Council". The speakers emphasised that the Security Council is an important place for small states to be heard and that it has a moral obligation to remind all member states of their commitments under international law.

Adam Lupel offered an example specific to Estonia: "In early 2016, New Zealand, a small country with five million inhabitants, called a round table to discuss a proposed resolution before the Security Council to improve the foundations of international humanitarian law. Soon, five officials had entered negotiations over the draft resolution. The resolution reached after extensive negotiations reminded member states that attacks against healthcare institutions and medical personnel during armed conflicts constitute war crimes."

Academy Member Mälksoo admitted that in recent years the world has suffered setbacks in the interpretation of international law. Major states have started to lose sight of the reasons the use of armed force is so limited under international law. He added: "The primary duty of the Security Council is set out in the Charter of the United Nations: ensuring peace and security. Small states can remind the Security Council of this key task."

The discussion between the co-authors of the presentation, moderated by Kristi Raik, was followed by the first known public discussion between the two presidents. The President of the Republic of Estonia Kersti Kaljulaid and the President of the Academy of Sciences Tarmo Soomere discussed whether and how small states can initiate major global shifts.

* The International Peace Institute is an independent international non-profit think tank. It focuses on peace, security and sustainable development, the analysis and mitigation of related risks and the development of resilience. – ed.

President Kaljulaid emphasised that small states can not afford to reject international law. They must be its champions in the international arena. If they stand firm in upholding it, even their major allies will not resent them for occasional conflicts with their interests. “This is why small states must be involved in the United Nations Security Council: everybody knows that small countries must be champions of international law.” “There are countless examples in history where small groups of people have played large roles,” President Soomere added. Kersti Kaljulaid and Tarmo Soomere also highlighted Estonia’s success in exporting its digital success and innovations to larger countries.

Estonia is a member of the United Nations Security Council in 2020–2021. One of Estonia’s declared goals is safeguarding world order based on international law.

Photo: screen capture

Two presidents discussing whether and how small states can change the world.

PREPARING FOR THE CLIMATE CONFERENCES

On 5 September 2019, the Academy of Sciences hosted the science afternoon “The climate is changing: what technological solutions are Estonian researchers offering?”. Academy Members Enn Lust and Jarek Kurnitski gave presentations.

Foto: Taavi Minnik

The president finds climate matters concerning.

The science afternoon took place a week before the joint conference of the Prime Minister’s Office and the Academy of Sciences “Climate neutrality: Disaster or Success?” One of its goals was to clarify the Academy of Sciences’ message for the conference. The sizeable audience at the Academy’s Hall of Mirrors participated actively in the discussion.

The main focus was on ways Estonia could act as an example to others in implementing new technologies and how Estonia could best manage changes resulting from climate change.

President Soomere introduced the presentations, noting that the heart of the matter now lies in how much humanity is willing to pay to avoid the degradation of climate conditions.

Academy Member Enn Lust explained that while hydrogen-based technologies remain more expensive than fossil fuels, they are already in use. He emphasised that the use of hydrogen will, in the future, resolve energy storage problems. In discussing Estonian hydrogen technologies research, Lust joked that it is our historical obligation, referring to the work of the laureate of the Nobel Prize in Chemistry and graduate of the University of Tartu Wilhelm Ostwald.

Academy Member Jarek Kurnitski reviewed the opportunities and challenges related to the energy performance of buildings. He stressed that Estonia (70% of whose residential buildings were constructed during the Soviet period) had made great progress in improving the buildings’ energy efficiency. He also reminded the listeners that European Union directives require the reconstruction of all existing residential buildings as zero energy buildings within the next 30 years. The challenges involved will have a significant impact on Estonia’s future visual appearance.

THE PRESIDENT'S SECOND TERM IN OFFICE

The Academy's general assembly meeting of 25 September re-elected Tarmo Soomere as the President of the Academy of Sciences for his second consecutive term.

In the speech detailing his vision, Tarmo Soomere recalled the four goals that the Academy's General Assembly had adopted at the election of 2014: (i) increase the Academy's visibility and impact in society, (ii) clarify and carry out with dignity the Academy's role in research, (iii) clarify and carry out its role in the state of Estonia and (iv) represent Estonian research internationally. The plan further described smaller objectives to update the functioning of the Academy and of its Office.

While the goals at first seemed to be significant challenges, they proved surprisingly easy to meet thanks to the Academy's solid reputation and its members' valuable input.

(i) The Academy has, at times, been even too visible in society. Collecting clicks and providing entertainment have never been our goals; rather, they have been means to achieve our ends. And yet, it is a pleasure to see the especially large number of views of science promotion endeavours, such as the three-minute science competition and the Academy Members' column on the relevance of science in society in the Postimees' (daily newspaper The Postman) weekend issue *Arvamus. Kultuur*.

Photo: Taavi Minnik

Arvo Pärt receives his voting slips from Jakob Kübarsepp. Margus Lopp is waiting in line.

(ii) The Academy's logical role in the research sphere lies in consolidating the message of our researchers and amplifying the voice of the academic community. The creation of the Estonian Young Academy of Sciences (EYAS) was a major step forward. While the EYAS was, technically speaking, founded by young researchers themselves, it would most likely not have come into existence without the Academy Members' contribution.

(iii) The Academy has become an important scientific advisor for the state. This major, yet largely unnoticed, undertaking was technically realised in the coalition agreement and substantially through several key pieces of advice and the (climate) conference organised jointly with the Prime Minister's Office.

(iv) At the international level, the Academy established contacts both with major powers (the U.S. and Australia) and countries with which we have long-term relationships (Nicaragua and Scotland). Jointly with other European academies, we have regularly advised the European Commission. Collaboration was started with L'Oréal and UNESCO to award grants to young female researchers.

The continuous expansion of the Academy's budget allowed us to successfully manage the generation change in the Academy's office and to improve our communications capacity. Furthermore, it allowed us to renovate the Academy building's facades. This came not a moment too soon: the windows no longer kept the cold out and the stairwells had become prone to mould.

The above activities were based on the Academy's development plan, formally titled the conceptual basis for the development plan 2014–2020. The plan stipulated the following main goals:

- The Academy's role in supporting the social and economic development of the state must be substantially reinforced.
- The Academy's analytical capacity in enhancing expertise and offering recommendations, particularly for time-sensitive matters, must be significantly improved.
- Successful promotion of the scientific, knowledge-based world-view must be initiated.
- The exchange of views between the Academy and the society must be intensified at all levels.
- The ability of the Academy as an organisation to influence societal trends must be enhanced.

Photo: Taavi Mimik x2

Some decisions are adopted by consensus by the General Assembly, led by Secretary-General Jaak Järv.

Looking back on his first term in office, Tarmo Soomere opined that the Academy has taken long strides towards achieving each of these goals. Some of the initiatives (e.g. the Council of Estonian Centres of Excellence in Research) have found their natural places in the research sphere. Other developments have taken a turn away from the form envisioned nearly a decade ago (in 2011), while nevertheless staying true to the principles laid out in the development plan.

It is difficult to measure the Academy's contribution to the fact that Estonian researchers excel despite the small size of the country and to their increasing visibility in Estonia and abroad, but several of these activities have no doubt made a mark.

Discussing a potential second term, Tarmo Soomere reiterated his conviction that the four key fields of development mandated five years ago must continue. He also considered it reasonable and realistic to carry out the following tasks if re-elected:

(1) Modernising the scientific advice system. The Academy has become an important partner of the state and it is essentially fulfilling the function of the institution of national chief researcher. The scientists' message would be further amplified by joining the competencies of the Academy with those of the research coordinators of the ministries. The longer-term goal is to enhance the competitiveness of the state as a whole, which is one of our legal duties.

Member of the Academy Tarmo Soomere was confirmed for his second term as the President of the Estonian Academy of Sciences.

(2) The Academy has not provided any substantial **support to the functioning of general education**. There are no education specialists among the members of the Academy. Currently, our support is mainly expressed through Academy members' visits to schools. The largest effort is at the Poska Academy in Tartu.

Organising high school students' visits to the Academy is a straightforward task. It is more important to provide support to teachers and learners, e.g. by explaining the reasons certain topics are on the curriculum, their role in the advancement of science and current cutting-edge

research. The goal is to spark an interest in research by offering exciting, high-quality information directly from leading experts.

(3) Increase communication to society about the Academy's activities. The Academy's website should be updated. The general public should be systematically informed of the activities of the Academy (including through the "Words and Images" yearbook). A professional social media presence should be developed. Cooperation with popular science magazines has ample room for growth. The attractiveness of the Academy's publications could be further enhanced. The utilisation of the scientific societies' network has so far been modest. Collaboration with artistic associations should also be closer and more systematic.

(4) A gap exists in Estonian media: no web environment or portal currently systematically informs the Estonian society (and taxpayers) of research carried out in Estonia. The Academy cannot fill this gap alone; however, it could be done in cooperation with universities, the association of science journalists and such institutions as Estonian Public Broadcasting.

(5) International cooperation. Preparations are underway for the creation of a network of Baltic and Belarusian academies of sciences. This logical extension of the network of Baltic academies would provide international support for the scientific advice system.

Tarmo Soomere emphasised that by choosing these directions of development for the Academy, we as a collective and as single Academy members would choose a future where we are **a constant presence in social life**. He expressed his heartfelt conviction that this is a good choice for both the Academy and the state of Estonia. It is not a choice of convenience; rather, it is a significant challenge. It may cause setbacks, because the way we do things is at times at odds with the habits of the rest of the public sector or the private sector, but it is sure to bring advancement and excitement.

He urged his colleagues to mandate broader collaboration (and sharing functions) with other institutions. The role of scientific advisor requires a capacity for operative work, since the Academy's opinion is often requested with very little lead time.

He summarised his vision by stating that one of the goals in the current development plan should in fact be seen as a permanent task: to improve the analytical capacity of the Academy as an institution, while also enhancing its flexibility and rapid response capability.

The re-election threshold was 31 votes. Out of the 49 members who participated in the voting, 37 supported Academy Member Soomere's re-election. There were no opposing candidates.

After the results were announced, President Tarmo Soomere stated that the general assembly meeting had just proven that the faith of the Academy members in the relevance of their institution had been restored. However, he noted, the Academy must make a clear choice between the roles of lobbyist and scientific advisor. "Advice from lobbyists is ignored," President Soomere noted.


Photo: Academy archives

Svante Pääbo is the director of the Department of Evolutionary Genetics at the Max Planck Institute for Evolutionary Anthropology. He has earned international renown in the field of paleogenetics and is considered one of the founders of the field. He first entered public awareness in 1985, when he succeeded in isolating DNA material from a 2400-year-old Egyptian mummy. That made Svante Pääbo the very first researcher to successfully obtain DNA of a person who lived thousands of years ago. He has also worked on the Neanderthal genome. In 2009, his research group successfully reconstructed a draft Neanderthal genome. In 2002, the discovery of the "language gene", FOXP2, which is missing or damaged in individuals with speech impairments, gained great public attention. Pääbo was named one of the 100 most influential people in the world by *Time* magazine in 2007.

Appointment of New Foreign Members

The General Assembly of the Academy of Sciences elected three new foreign members: the computer scientist Margus Veanes, the geneticist Svante Pääbo and the linguist Raimo Raag. After the voting results were announced, Tarmo Soomere commented: "The foreign members elected today provide substantial reinforcement to the Academy to help make Estonia greater."

President Soomere presented Member of the Academy Jaan Einasto with the Harald Keres Medal.


Photo: Academy archives

Raimo Raag, Professor at Uppsala University, has studied the Estonian language, Finnic languages and the relationships between the Swedish and Estonian languages, including the Estonian written language in the 13th–19th centuries and Swedish loan words in Estonian. As a historian and a historian of culture, Raag has written on Baltic countries' history and culture, Estonian Swedish and Swedish Estonian populations, and the history of Estonian emigration. With great persistence and dedication, Raag has organised research and cultural contacts between Estonia and Sweden and maintained Estonian cultural objects in Sweden.


Photo: Academy archives

Margus Veanes's research is focused on automated theorem proving, model-based testing, and automated analysis of string-manipulating programmes and their theoretical foundations. Born in Tallinn, Veanes obtained his PhD degree at Uppsala University in 1997. Since 1999, Veanes has been working as Senior Researcher in the United States at Microsoft Research RISE (Research in Software Engineering).

Jaan Einasto Receives the Harald Keres Medal

President Soomere presented Member of the Academy Jaan Einasto with the Harald Keres Medal.

The Harald Keres Medal is one of the five named medals of the Estonian Academy of Sciences. Awarded no more often than once every four years, it is the Academy's highest award to an Estonian researcher in the fields of astronomy, physics and mathematics. Laureates are often taken by surprise by the obligations that come with the medal: the duty of delivering a research presentation at an Academy General Assembly meeting or a public academic lecture within the next half-year.

In 2007, the second ever Estonian national research award for a discovery that impacts the paradigm and world-view of a scientific area was granted to Jaan Einasto's research group [Maret Einasto, Enn Saar and Erik Tago] for their research work on the topic "Discovery of dark matter in the vicinity of galaxies and the large-scale structure of the universe". These are the two most pertinent keywords for this work, which was among the few that spearheaded Estonian research's arrival on the global stage. This research may be larger than life itself. It embodies the human drive to understand the structure and functioning of the entire universe, and it studies phenomena at scales at which our common understanding of time, space, matter and speed may no longer be valid.

Where many would answer "42", Jaan Einasto's number is 11577. Namely: "11577 Einasto" is the name of a small planet. *Nomen est omen*, ancient Romans believed. Let us, therefore, consider that Einasto is an anagram of Estonia. Jaan Einasto and the planet bearing his name show the world that Estonia exists and Estonia matters.

In his remark, the laureate Jaan Einasto expressed his gratitude to his teachers: Professor Taavet Rootsmäe and our late members Ernst Öpik, Aksel Kipper and Grigori Kuzmin. Ernst Öpik was the very first person to study our galaxy and find that it contained no dark matter. This represented the founding of this research direction: meaning that there is very little local dark matter. This was further explained by Grigori Kuzmin in his Candidate thesis (in modern terms, PhD thesis), the results of which matched Öpik's. It was only later established that two types of dark matter exist: the type gathered near the galactic plane, which was studied by Öpik and Kuzmin, and another, more extensive type, studied by our group. As he noted, this work goes back a long time. In Tartu, people in the laureate's generation and younger have studied it extensively. Key contributions have been made by his colleagues Enn Saar, Mihkel Jõeveer and too many younger colleagues to list. "Naturally, I received vital support from my late spouse, children and grandchildren, who have always supported me in my work," said the laureate.

THE GENERAL ASSEMBLY ACKNOWLEDGED CONTRIBUTORS AND ELECTED A NEW BOARD

At the General Assembly meeting of 4 December 2019, Member of the Academy Margus Lopp was awarded the Medal of the Academy of Sciences. The President of the Academy of Sciences Tarmo Soomere highlighted Lopp's contribution to amplifying the voice of the academic community and the voices of young researchers.

President Soomere stated that the voices of top researchers are loud and clear in Estonian society and there are plenty of channels to amplify them.

"However, the voices of younger researchers have long been absent," Soomere said. He noted that it is understandable that people who are still fighting for their place in the scientific domain would try to improve their working and living conditions.

"The creation of the Young Academy of Sciences was a major step. While it was established by young researchers, it would not have come into being without the contribution of members of the Academy. Its most active promoter on the Academy side was Margus Lopp, the Secretary-General of the Academy at the time."

Presenting the medal to Academy Member Lopp, Soomere stressed that the medal was awarded for his support and initiative in the creation of the Young Academy of Sciences rather than his tenure as the Academy's Secretary-General.

Margus Lopp was elected as a member of the Estonian Academy of Sciences in 2011. He served as the Academy's Secretary-General in 2014–2017.

At the ceremony, the certificate of Foreign Member of the Academy was presented to Svante Pääbo, who had been elected as a Foreign Member of the Academy at the autumn assembly meeting.

Before giving him the certificate, President Tarmo Soomere stated that Foreign Members of the Academy are ambassadors of Estonian research in the international community. "They are symbols of the visibility and strength of the entire country," Soomere noted.

Soomere said that while Svante Pääbo's research has had little direct relevance to Estonia, Pääbo is a top global researcher whose roots are undeniably in Estonia.

Svante Pääbo himself commented on his relationship with Estonia that while he was born in Sweden, he was brought up by his Estonian mother. "Estonia is my other homeland," Pääbo said. He added that he grew up listening to stories about his mother's homeland and when he visits Estonia, he recognises the places and names from the tales.

Professor Pääbo commented on his election as a Foreign Member of the Estonian Academy of Sciences: "It was a very emotional moment for me and I appreciate it deeply."

Pääbo gave a presentation to the general assembly, introducing his research group's work over the last decades and giving an overview of paleogenetics, a field of which he is a founder.

In addition to his address at the general assembly of the Academy of Sciences, Svante Pääbo visited his mother's old neighbourhood near Rakvere and gave a lecture at the University of Tartu.

Photo: Reti Kokk

The academic regalia has slight variations. Male researchers traditionally wear classic ties or bow-ties, while female researchers wear neck-ties.

The central task of this General Assembly meeting was electing the Academy's Secretary-General, Vice-President or Vice Presidents (considered as elected administrators jointly with the President) and other board members for the next five years. The board of the Academy includes, *ex officio*, the President, other elected administrators and heads of divisions. In the past, the board has been bigger: it has had as many as 16 or 17 members over the last five years. The Academy must have a Secretary-General, but the number of Vice Presidents and non-executive members of the board is determined by the general assembly.

Academy Members Toomas Asser and Jakob Kübarsepp continue as heads of divisions. A few weeks before the Assembly meeting, Marco Kirm was elected as the head of the Division of Astronomy and Physics and Valter Lang as the head of the Division of the Humanities and Social Sciences.

The General Assembly accepted the President's proposal to elect two Vice Presidents and set the total number of the members of the board at 12.

It is the President's obligation to nominate one set of candidates for all open positions. The President opined that the current Secretary-General Jaak Järv has discharged his tasks with distinction. Academy Member Järv took over the management of the Academy Office on very short notice, in a situation where the former Secretary-General had left and the advanced age of the staff was a cause for concern. The capacity of the Office has since been significantly increased and competence has been retained. Furthermore, the Academy Publishers, curated by the Secretary-General as the head of the board of the publishers, is functioning smoothly in all respects.

The current Vice Presidents, one of whom (Mart Kalm) was elected five years ago and the other (Arvi Freiberg) slightly over a year ago, have done excellent work. Arvi Freiberg, a member of the Division of Astronomy and Physics, picked up the baton from Ergo Nõmmiste, who had passed away in the spring. Jaak Järv is a member of the Division of Biology, Geology and Chemistry and Mart Kalm is a member of the Division of the Humanities and Social Sciences. This composition of the leadership ensures a reasonable representation of both Tallinn and Tartu, as well as of all four divisions of the Academy.

When considering the candidates for non-executive members of the Board, it seemed sensible to prioritise decreasing the average age of the board and ensuring the presence of female Academy members at the voting table. Martti Raidal's refusal to compromise, his in-depth knowledge of science policy and straightforward approach to thorny matters are valuable components in the functioning of the board. Academy Member Raidal is an inhabitant of Tallinn and represents the views of independent research organisations. Maarja Kruusmaa, the head of the Excellence in IT in Estonia Centre, is an extremely astute researcher with excellent social skills. Ülo Niinemets, the most active non-executive member of the previous board, is always ready to speak his mind; he is always a constructive partner in discussions. He represents the views of the Estonian University of Life Sciences. Tiina Randma-Liiv is a relatively new member (elected in 2018). She is the first member of the board representing the field of political science. This area is increasingly important in providing scientific advice to the state.

The nominees were accepted with a near-consensus vote. The new board took office on 1 February 2020.

Photo: Reti Kokk

Academy Member Margus Lopp was one of the initiators of the Estonian Young Academy of Sciences.

The President finished by citing Hiram's Law as presented in the complete collection of Murphy's Laws: If you consult enough experts you can confirm any opinion. It is backed up by Lowe's Law: Success always occurs in private, and failure in full public view. If the Academy is to be an integral part of scientific life and society, it is only logical that its activities will be assessed (and critiqued) from new and different perspectives. And thus, the Academy is also subject to the Worker's Dilemma: No matter how much you do, you'll never do enough, and what you don't do is always more important than what you do do.

THE THREE-MINUTE LECTURE GALA: JOY OF WINNING, JOY OF TAKING PART

On 8 February 2019, 18 young researchers gathered in the great hall of the Estonian Academy of Sciences for a selection of the five best, among whom the general public later elected the winner. This was the fourth iteration of the popular science lecture competition "Three-Minute Science", organised by the Academy of Sciences. For the first time, the winning lectures were broadcast live for voting on the TV show "Terevisioon".

The history of the Olympic movement details the story of the father of modern Olympics, Baron Pierre de Coubertin, including in London a sermon by the American Anglican pastor Ethelbert Talbot, who said that even though only one may wear the laurel wreath, all may share the equal joy of the contest. This gave rise to the motto of the Olympic movement: The most important thing in the Olympic Games is not to win but to take part. However, Olympics are no longer what they were in Baron de Coubert's days, since success is a matter of life and death for the competitors, all professional athletes. Unlike the Olympics, the "Three-Minute Science" contest offers the simple pleasure of taking part to all participants.

The grand finale of the competition, which was sponsored by the TeaMe+ programme and the European Regional Development Fund, took place at the Academy of Sciences; it was preceded by competitions in universities and research institutions, where candidates were challenged to explain their PhD thesis topics as simply as possible. Speaking skills and imagination were key, since complex topics needed to be explained to a broad, non-expert audience. Later, professionals turned the lectures into three-minute scientific videos, five of which were broadcast on the Terevisioon morning programme for the nation to choose their favourite. First, however, the Academy organised a gala evening to select the top five.

There were 18 candidates: Silva Lilleorg, Tiina Paet, Vaike Raudava, Liina Jakobson and Kristi Läll from the University of Tartu; Marju Tamm and Maksim Runin from the University of Life Sciences; Kristel Vene, Helery Tasane, Ljudmilla Klepinina, Anna-Liisa Kubo and Birgit Truumees from the Tallinn University of Technology; Elina Malleus and Karmen Reinpõld from Tallinn University; Piret Jaaks and Maria Korepanova from the Academy of Music and Theatre; and Siim Tuksam and Maris Mändel from the Academy of Arts. The top five were selected by a jury composed of President of the Academy of Sciences Tarmo Soomere, the interpreter Ülle Leis, Member of the Parliament Heidy Purga, the journalist Anvar Samost, the entrepreneur Tiit Pruuli, the TV host Anna Pihl and the musician Tanel-Eiko Novikov.

Announcing the jury's decision, President of the Academy Tarmo Soomere noted that the level was uniformly high, better than in some previous years. He added: "What matters is not what you or I say, but what people hear. Our words are not reflected by scientific boards, by your colleagues, your reviewers or supervisors. It is those who pay for our research who constitute our mirror. They hear our words differently."

The first announced finalist was Kristi Läll, a PhD student in mathematical statistics at the University of Tartu Institute of Genomics, whose research focuses on assessing genetic predisposition to complex diseases and whose presentation at the gala was titled "From genetic risk score to personalised medicine". The jury highlighted Läll's mastery of public speaking and noted that Läll explained clearly what she was working on, as well as why and how, spending less than a minute on each aspect.

The second jury selection was Ljudmila Klepinina, Junior Researcher at the National Institute of Chemical Physics and Biophysics and a PhD student in Chemistry and Genetic Engineering at the Tallinn University of Technology. Klepinina researches the energy metabolism of malignant tumours. Her presentation was titled "Cancer stem cells: the root of the evil". The jury members commended the clarity, clear structure and convincing delivery of her presentation. They noted that while this topic is relevant to many of us, the importance of the topic alone does not guarantee victory.

The jury's next choice was Maksim Runin, a PhD student at the Estonian University of Life Sciences, who researches processes taking place in the body fat of dairy cows. Titled "Deep in Fat", his presentation was considered particularly entertaining by the jury. "Science is rarely entertaining and it rarely lends itself to stand-up comedy, but Runin pulled it off," the jury said in explaining the decision. The

The five laureates: tired, but happy. From the left: Kristi Läll, Ljudmila Klepanina, Maksim Runin, Maria Korepanova and Maris Mändel.

Photo: Reti Kokk x2

Even though this was the fourth season of three-minute lecture training and competition, it is barely the beginning for the contest.

logical structure and effective use of time were praised in particular.

The fourth of the jury's selections comes from Udmurtia, near the Ural Mountains. Maria Korepanova, an Udmurt folk singer and an Estonian Academy of Music and Theatre PhD student who specialises in folk music, has been collecting, studying and performing folk songs of the Udmurts and the tiny Besermyan people for over 15 years. Her research subject is the globally unique Besermyan music genre *krez'*. Titled "Creative reconstruction of a Finno-Ugric people's improvisation tradition", her presentation impressed the jury with its creativity. "Unusual, but excellent music research," the jury said in explaining its choice.

The fifth laureate was Maris Mändel from the Estonian Academy of Arts. Mändel is captivated by the history of construction, particularly building materials and technologies invented in the 20th century and the way they are reflected in the local architecture. Her presentation was titled "Sand lime bricks: a material worth conserving?" "Choosing the right visuals to support the text is a great art," was the compliment given to Mändel.

The final choice between the five finalists was made by the Estonian public in the spring. The video clips were broadcast on a morning programme on national TV and voting on the Estonian Public Broadcasting science portal Novaator selected Estonian Academy of Music and Theatre PhD student Maria Korepanova's research on collecting, studying and performing Besermyan and Udmurt folk songs as the best. 587 people took part in voting. 32% of them voted for Korepanova. Maria Korepanova celebrated another significant moment in late 2019, defending her PhD thesis "Improvisation and variation in the Bessrman *krez'* based on the example of *soldat krez'*".

ACADEMY'S COLLABORATION WITH THE JAAN POSKA GYMNASIUM

Helmer Jõgi, Headmaster of the Poska Gymnasium

The concept behind the "Poska Academy" student conference came into being in Autumn 2013. It aims to offer students an opportunity to introduce their research in a friendly, non-competitive environment. The impetus was provided by research work having become compulsory in the high school curriculum. Furthermore, organisers felt that the number of research efforts submitted to various contests was lower than it could have been. The "Poska Academy" aims to encourage students and their supervisors to present their work and it offers an audience to those whose work is for some reason excluded by the official requirements for research work competitions. Since its inception, the main goals of the conference have been popularising science among students, showcasing student research and demonstrating that science is exciting, challenging and attractive.

The first "Poska Academy" was held on 28 March 2014. Students from 13 schools all over Estonia attended, and 21 presentations and seven workshops were held. The following year's "Poska Academy" maintained the format and lasted two days; in 2016, the "Poska Academy" took another step by inviting students and teachers from schools in the neighbouring countries of Latvia, Finland and Sweden. The 2017 and 2018 sessions were multinational as well. In 2019, the "Poska Academy", supported by the Nordplus Junior project, became an international rotating conference similar to the conferences common in higher education. It rotates on a three-year basis between three different countries: last year's edition took place at Tibble Gymnasium in Stockholm, this spring's conference will be organised by the conference's project partners in Jūrmala State gymnasium, and the 2021 "Poska Academy" will again be held at its birthplace, the Jaan Poska Gymnasium.

When the "Poska Academy" organisation team started preparing for the 5th edition at the beginning of the 2017/2018 school year, we decided to try to carry out our dream to collaborate with the Estonian Academy of Sciences. The idea paved the way for "The Road to the (Poska) Academy" lecture series, where, on the first Monday of every month, two Academy members visited the Jaan Poska Gymnasium to show young people the way to academia. In the first year of collaboration, Tartu's students met Professor Maaja Vadi and Academy Members Urmas Varblane, Jüri Allik, Anu Raud, Ene Ergma, Peeter Saari, Urmas Kõljalg and Andres Metspalu.

The 2018/2019 school year began with a clear understanding that the collaboration must continue: meetings with top researchers broaden the students' horizons, create cross-references among previously acquired knowledge and help students make better life choices. These meetings represent Academy Members' invaluable contribution to the future of the students. The opening lecture of the second season of the lecture series was given by Academy Member, Rector of the University of Tartu Toomas Asser; Academy Member Valter Lang gave a presentation titled "The Arrival of Finno-Ugrians in Estonia" and Academy Member Ülo Niinemets spoke about "Agriculture in a Changing World". Last year, Academy Member Lauri Mälksoo visited us on the anniversary of Jaan Poska's birth to speak about "Estonia as a Candidate Non-Permanent Member of the United Nations Security Council, 2020–2021: The Role of Small Countries in the Security Council". Academy Member Urmas Varblane paid a repeat visit to discuss developments in Brexit with students. The second season of the lecture series was concluded by Members of the EYAS Andra Siibak and Karin Kogermann.

School year 2019/2020 signified the third year of collaboration between the Estonian Academy of Sciences and the Jaan Poska Gymnasium. The opening lecture was delivered by Member of the Academy Professor Jaak Järv on the topic "Research and Researchers in the Information Society", followed by Member of the Academy Jaak Aaviksoo discussing the topic "Science and the Modern World". We are also looking forward to a visit by President of the Academy of Sciences Tarmo Soomere and another meeting with Academy Member Urmas Varblane.

Poska Academy meeting at the great hall of the Academy of Sciences, 20 February 2019.

Photo: Academy archives

Photo: Taavi Minnik

Academy Member Margus Lopp shows how much profit can be gained by using the substances in oil shale that provide the most added value. Simply burning it belongs on the trash heap of history.

THE SCIENCE AFTERNOON: COLLISION OF ENERGY, CLIMATE AND CURRENT POLITICS

The science afternoon organised on 24 October 2019 at the mirror hall of the Academy of Sciences focused on matters related to the construction of an oil shale pre-refining plant in Ida-Viru County. The speakers were the organic chemistry expert and Member of the Academy Margus Lopp, Member of the Parliament Marko Mihkelson, Chairman of the Committee on Energy of the Academy of Sciences Arvi Hamburg, and the green politician and ecologist Mihkel Kangur. Speakers presented the pros and cons of the plant.

Academy Member Lopp emphasised that refining oil shale does not increase the amount of carbon dioxide emitted compared to current oil shale use. In his opinion, we must implement technologies that enable the storage of oil shale carbon in final products rather than releasing it into the air or burying it in production residue. This is perfectly possible and contradicts no natural law. The oil shale industry must be based directly on oil shale rather than on its by-products.

Investments in research and development are key to solving ecological problems. “The current situation is poor. No studies have been conducted in this field in Estonia. Our latest decent research was done a couple of decades ago. Other priority areas in the use of our natural resources are equally poorly researched. Absent research, however, we cannot implement new technologies or stop emitting CO_2. Directives alone do not solve problems.”

Member of the Parliament Marko Mihkelson opined that climate neutrality and the reduction of the use of fossil fuels are inevitable. “Estonia’s weaknesses lie in oil shale use and CO_2 emissions. We must take care to avoid conflicts with European Union goals. The transition period must be handled wisely,” Mihkelson said. He emphasised the importance of energy security in the context of the refinery. “This is also relevant to the construction of liquefied gas terminals, where, for example, Poland, in collaboration with the U.S., has made great progress. Our strategic decisions must take into account the interests of our partners and allies,” Mihkelson said.

“We must take into account that it [the Ida-Viru County oil shale industry region] may be an object of particular attention for those who are looking for ways to erode our internal security,” Mihkelson warned. He noted that everything comes with a price. There are plenty of examples of us shrinking away from establishing companies creating added value for our economy or utilising the wealth hidden in our soil. “Current refining activities mean hundreds of millions in tax revenue for Estonia,” Mihkelson pointed out.

Arvi Hamburg admitted that foreseeing every risk is impossible. “Trying to predict the price of oil in the global market is pointless. The security of supply, the environment and price must be balanced. Otherwise, the developing problems will engulf the entire energy economy,” Hamburg said. Even though Estonia’s oil shale supplies are not among the biggest in the world, we have important know-how in the use of oil shale. We can sell the competence of utilising oil shale to others, too. It is one of our most valuable export articles.

The ecologist and politician Mihkel Kangur agreed that research and development activities in oil shale utilisation and energy production are crucial. He said: “We are poor not because we are not burning enough oil shale, but because we haven’t invested enough in research and development for a long time.” He believes the new refinery should not be built. Not only should we limit CO_2 emissions, but we should also rehabilitate ecosystems to allow them to fix carbon.

IN SHORT

The Academy of Sciences and the Mathematical Society concluded an association agreement. On 26 February 2019, President of the Academy of Sciences Tarmo Soomere and President of the Estonian Mathematical Society (EMS) Rainis Haller signed an association agreement.

The EMS is a voluntary association that promotes the development of mathematical sciences and mathematical education in the Republic of Estonia, as well as the application of the achievements and methods of mathematics in other fields.

The Academy celebrated scientific societies' terminology day. The Academy of Sciences, the Mother Tongue Society and the Institute of the Estonian Language organised the scientific societies' terminology day celebrations on 16 May. The day kicked off with a welcome by the President of the Academy of Sciences Tarmo Soomere. Presentations were given by Sirli Zupping from the language department of the Ministry of Education and Research ("Management of Professional Language: What's Next?"), Jakob Kübarsepp and Priit Kulu from the Estonian Association of Engineers ("Terminology Development in Engineering"), Toomas Kukk from the Estonian Naturalists' Society ("Creation of New Plant Names in Estonian"), and Tiina Soon from the Department of Terminology, Institute of the Estonian Language ("The Components of a Term Entry Explained"). After a lunch break, the day continued with the scientific societies' round table "What Is the Push that the Estonian Professional Language Needs?" The conference was moderated by Helle Metslang from the Mother Tongue Society.

The Estonian laureates of the 2019 "For Women in Science" scholarship were Kaarin Parts and Tuul Sepp. The ceremony, which took place at the University of Latvia on 11 June, was held to recognise two Estonian, three Latvian and two Lithuanian female researchers with the L'Oréal Baltic "For Women in Science" scholarships. The laureates of the L'Oréal grant of 6,000 euros, Tuul Sepp, a researcher of animal ecology, and Kaarin Parts, a PhD student in botanics and ecology at the University of Tartu, both research nature and the environment.

The global programme "For Women in Science" was created in 1998. Since that year, L'Oréal and UNESCO have jointly contributed to research, increasing the number of female researchers and promoting gender equality in research through the programme. In the Baltic states, the fellowship is awarded in collaboration with the Estonian Academy of Sciences, Latvian Academy of Sciences, Lithuanian Academy of Sciences and the UNESCO Baltic states national committees.

Tarmo Soomere took part in a United Nations informal consultative process meeting on the Law of the Sea. On 12 June 2019, President of the Academy of Sciences Tarmo Soomere gave a panel presentation at the 20th Meeting of the United Nations Open-ended Informal Consultative Process on Oceans and the Law of the Sea. The meeting was divided into two interactive sections: 1) the extent,

Photo: Ülle Raud

Vice-President of the Academy of Sciences Arvi Freiberg at the opening of the L'Oréal Baltic scholarship "For Women in Science 2019" photo exhibition at the University of Tartu library.

Photo: Anneli Leega Piiskop

President Tarmo Soomere gave a panel presentation at the 20th meeting of the United Nations informal consultative process on the Law of the Sea.

use and shortcomings of marine research and 2) the opportunities for international cooperation in furthering marine sciences. President Soomere's presentation focused on ways of bringing science together with policy-making at the national level.

The Delegation of Ukrainian Universities at the Academy. The seminar "Innovative Development of European Universities: the Baltic Way" was held at the Academy on 14 June in the framework of the Ukrainian universities' delegation's study visit. The delegation of Ukrainian universities was headed by Professor Alvydas Baležentis. Presentations were given by the Academy of Sciences Research Professor Dmitri Vinnikov, Secretary-General of the Estonian Young Academy of Sciences Dr Anastasiya Astapova and Science Advisor at the Ministry of Culture Dr Aleksandr Aidarov. The seminar was moderated by Professor Rein Vaikmäe, a scientific advisor to the President of the Academy.

The Estonian Association of Sociologists Entered into Association with the Academy. On 18 June 2019, the number of scientific societies associated with the Academy increased to 22: in order to promote mutual cooperation, the President of the Academy Tarmo Soomere and the President of the Estonian Association of Sociologists Mai Beilmann signed an association agreement. Research organisations and scientific societies whose activities and goals harmonise with the mission of the Academy may associate with the Academy.

Wellcome Trust Engagement Event for Early Career Researchers in the Baltics. On 19 June, the Wellcome Trust (United Kingdom), dedicated to promoting the inheritance of Sir Henry Wellcome (1853–1936), organised the Young Academy of Europe (YAE) and the Baltic States early career researchers' associations' event "Engaging in research policy discussions" at the great hall of the Academy. The Wellcome Trust supported the participation of the Lithuanian Young Academy of Sciences, the Association of Latvian Young Scientists and the Young Academy of Europe by covering the transportation and accommodation expenses for their representatives, as well as for the invited speakers.

The goal of the event was to empower and support young researchers in acquiring know-how and expertise relevant to scientific advisory work. The discussions analysed regional and international current affairs. The keynote speech was given by the youngest member of the Polish Academy of Sciences, Janusz M. Bujnicki (Group of Chief Scientific Advisors, European Commission's Scientific Advice Mechanism; European Science Advisors Forum), who highlighted the importance of trust building and encouraged the audience to understand and participate in the evolution of value systems over time. In the panel discussion, President of the YAE Mangala Srinivas encouraged Baltic scientists to take part in international organisations representing early career researchers, such as the Young Academy of Europe.

Current Top Researchers Met Rising Stars in Lindau. From 30 June to 5 July 2019, 600 young physicists in 89 countries met 39 Nobel Prize winners (including the laureates of the 2018 Physics Prize, Donna Strickland and Gérard Mourou). The meetings of young researchers (under 35) and Nobel Prize laureates have been taking place in Lindau since 1951. The meetings aim to encourage different generations of researchers to swap ideas and experiences, make new contacts and inspire one another. The Estonian representative was Priidik Gallagher, a physics student at the University of Tartu (see pp. 60–62).

The Role of Science and Knowledge was Discussed in Paide. The seventh *Arvamusfestival* (opinion festival) took place at Paide's Vallimägi Hill. Several members of the Estonian Academy of Sciences took part in the discussions on 9 and 10 August. Science and the evidence-based society

and economy were a key topic. The position and role of scientists in society attracted a great deal of attention.

The discussion "Cohesive Estonia: Researchers' Roles and Responsibilities" on 9 August dissected the role and contribution of scientists in the Estonian society. President of the Academy of Sciences Tarmo Soomere emphasised the role of humanities and social sciences researchers in pre-empting and defusing societal tensions (Sakova, A. Muutunud maailm, probleemide nõiaring ja teadlase vastutus. Vestlusringis Mari Sarv, Krista Kodres, Tarmo Soomere, Andres Koppel. *Sirp*, 39(3761), 04.10.2019, (33–35). Academy Member Jakob Kübarsepp participated in the same day's discussion, "Scientific Language(s): How and for Whom?" and Academy Member Jaak Aaviksoo took part in the discussion "Scientists in the Media". Academy Member Toomas Asser gave a speech at the "Our Future" festival area.

The Founding of Academia Pernaviensis. The 320th anniversary of Academia Pernaviensis was celebrated in Pärnu on 28 August and a think tank of the same name was established. The goal of the think tank is to connect thinkers who have a personal relationship with the town and contribute to the local intellectual life. Initially started a couple of decades ago by Academy Member Peeter Tulviste, the initiative had stalled for various reasons. Pärnu is home to at least two current members of the Academy of Sciences: Karl Pajusalu and Richard Villems. The promoters of the creation of the Academia Pernaviensis were two graduates of the Pärnu Co-Educational Gymnasium, Professor Emeritus Rein Veidemann and the entrepreneur Margit Raid, along with the head of the Tartu office of the Estonian Academy of Sciences, Ülle Sirk.

Margus Lopp Presented His Biography. The seminar "Reflections of Chemistry in Life and Reflections of Life in Chemistry", dedicated to the 70th birthday of Academy Member Margus Lopp, was held on 11 September 2019. In his opening words, President of the Academy of Sciences Tarmo Soomere highlighted Academy Member Margus Lopp's role as a promoter of scientific advice in Estonia. Academy Member Lopp's students, professors at the Tallinn University of Technology Allan Niidu, Riina Aav and Tõnis Kanger, presented their research. They also recalled various intriguing moments in Academy Member Lopp's life.

Rector of the Tallinn University of Technology and Academy Member Jaak Aaviksoo presented Margus Lopp with the University's letter of appreciation. Academy Member Lopp was the last to speak, recalling his first steps in science. The seminar was followed by the presentation of Margus Lopp's biography "Peegeldus" (*Reflection*).

The Academy Opened Its Doors to Schools. At the 25 September general assembly meeting, the re-elected President of the Academy Tarmo Soomere noted that the Academy must be even more accessible to the public and engage more with general education. In his general assembly speech, he noted: "It is important to support teachers and students. We must explain the reasons why certain subjects are on the curriculum and spark students' interest in them." In this context, the Academy of Sciences will be inviting graduating classes of general education schools to visit. The visitors will be shown around the Academy building at Kohtu Street 6 and given an overview of the activities of the Academy of Sciences. Each discussion will kick off with a short, yet thought-provoking presentation by a top researcher.

On 27 September, 10th–12th grade students of Türi Co-Educational Gymnasium visited the Academy. Academy Member Tiit Tammaru gave a lecture titled "Opportunities for Development: How to Escape the Vicious Cycle of Inequality?" Academy Member Tammaru's

Photo: Taavi Minnik

Freshly printed reflection of decades of work. Margus Lopp's biography.

Foto: Taavi Minnik

Offering greater support to general education schools is among the Academy's goals. This autumn, the Academy invited schools to visit. Pictured: Academy Member Tiit Tammaru meeting high school students from Türi.

demonstration of electronic devices for accumulating population and migration data created a lot of excitement. The Academy Member's summary of inequality and factors creating it was found to be very thought-provoking. Over biscuits and tea, the students posed numerous questions about the state of the Academy of Sciences and Estonian research. Matters relating to research funding were of particular interest. The development and future perspectives of the town of Türi and its youth were also discussed. Both the Academy Member and the students demonstrated optimistic outlooks.

The Researchers' Night Literature Experiment at the Academy of Sciences. On 28 September, the Under and Tuglas Literature Centre organised a visualisation of the Friedebert Tuglas short stories "Popi ja Huhuu" and "Maailma lõpus". Academy Member Jaan Undusk and the sand artist Madli Luuk experimented with words and images (in sand). The brain researcher Jaan Aru gave a video lecture from Berlin on how imagination creates mental images.

Photo:Academy archives

A clear sign 'No vacancy' signals that the Academy needs capacity building as the mirror hall was totally full at the researchers' night".

Photo: Academy archives

The Researchers' Night literature experiment at the mirror hall of the Academy of Sciences attracted 144 visitors.

Photo: Taavi Minnik

Academy Member Jaan Undusk spoke about Tuglas's work and the artist Madli Luuk provided real-time illustrations in sand (pictured: the eponymous characters of the short story "Popi and Huhuu").

The experiment was commented on by the President of the Academy Tarmo Soomere and publicised by Õhtuleht (Jaanus Kulli. Experiment at the Researchers' Night: "Introspection Is a Great Danger" (Teadlaste öö eksperiment: "Sisevaade endasse on üks kõige ohtlikumaid asju"), Õhtuleht, 30.09.2019).

When the sand had been swept back into the sandbox, the Academy of Sciences and Argo Publishers presented the collection *Science in three minutes, 2017–2019*. The collection presents the illustrated lectures of the 35 finalists of the "Three-Minute Challenge" competition from the 2017 and 2019 gala evenings, the opinions and impressions of the juries, long-form interviews with the 2017 laureates and a wealth of advice on creating an exciting, impressive presentation.

The "Three-Minute Challenge" initiative was jointly created by the Estonian Academy of Sciences and Estonian Public Broadcasting. The project was sponsored by TeaMe+ and the European Regional Development Fund. See also pp. 50–51.

The Academic Theological Society and the Academy concluded an association agreement. On 15 October, President of the Academy of Sciences Tarmo Soomere and Chairman of the Academic Theological Society Urmas Nõmmik signed an association agreement. With the agreement, the Academy recognises the statutory goals of the society and supports their achievement, promotes collaboration with the society and provides financial support. The society recognises the Academy's statutory goals and will regularly inform the Academy of its activities.

The Academic Theological Society is a descendant of the Academic Theologists' Society (founded in 1921) and its key goal is to promote theology research in Estonia. The society was reinstated in 1999 and currently numbers 66 members.

President Soomere Elected as a Foreign Member of the Lithuanian Academy of Sciences. The 1 October General Assembly meeting of the Lithuanian Academy of Sciences (LAS) elected President of the Academy Tarmo Soomere and the humanities professor Rein Raud as Foreign Members of the LAS. Member of the Estonian Academy of Sciences Richard Villems was elected as a Foreign Member of the LAS in 2007.

In the course of inauguration, new Foreign Members must give short lectures to the General Assembly of the Academy. President Soomere gave his presentation to the Lithuanian Academy of Sciences on 25 February 2020.

Academies of Sciences elect their Foreign Members from among foreign researchers who have made remarkable achievements in their field and whose research is connected to the country of the respective Academy. The Lithuanian Academy of Sciences has 64 Foreign Members.

The Academy Commemorated the Finnish Winter War and Estonia's Choices in 1939. On 27 November, the Academy of Sciences hosted a memorial seminar to commemorate the 80th anniversary of the Finnish Winter War. The seminar was organised by the Academy of Sciences and the Embassy of Finland in Tallinn. Ohto Manninen, Professor at the Finnish National Defence University, gave a lecture on the shelling of Mainila by the Soviet Union and its remembrance. In the discussion that followed, Member of the Estonian Parliament, Retired General Ants Laaneots and the historians Andres Adamson and Toomas Hiio analysed the different choices made by Estonia and Finland in 1939. The seminar was introduced by the Ambassador of Finland to Estonia Timo Kantola. The discussion was moderated by Taavi Minnik.

In autumn 1939, the Soviet Union needed a pretext to declare war on Finland. On 26 November, the TASS Soviet Union news agency announced that the Finnish artillery corps had fired on the Soviet border post near the village of Mainila on the Karelian Isthmus. The Finnish border guard had also recorded seven shots in the surroundings of Mainila on 26 November; however, they found that these shots had originated from the Russian side of the border. Furthermore, Finland did not have any artillery batteries in range of Mainila. Three days later, Finland was informed that due to the hostile attitude of Finland towards the Soviet Union, the latter no longer intended to respect the non-aggression pact between the two states. This meant an end to diplomatic relations and the beginning of war. See also (in Estonian): https://www.err.ee/1008678/ants-laaneots-meie-hoimurahva-imeline-kangelastegu.

Academy Members Met the Governor General of Canada. On 28 November, the Governor General of Canada H.E.R.H. Julie Payette visited the Academy of

Foto: Reti Kokk

The video project "Pop(up) Science" promotes Estonian researchers and research. The first participant in the project was Academy Member Jaan Einasto, with a video presentation on the end of the world. Pictured: the creation of the cover slide of Academy Member Urmas Kõljalg's short presentation titled "Why do zebras have stripes?" for the pop(up) science column "Children ask, scientists answer".

Sciences. The Governor General met President of the Academy of Sciences Tarmo Soomere and Members of the Academy Anne Kahru, Jarek Kurnitski and Andres Metspalu. The discussion panel also included Professor Ahto Buldas and Deputy Secretary-General of the Ministry of Finance Siim Sikkut. The key topics were the role of science in public policy design, life sciences and cybersecurity.

Governor General Payette told the attendees that her impressions from the Estonian visit were positive and deeply memorable. While the official head of the state of Canada is Queen Elizabeth II, the Governor General holds the position *de facto*. Julie Payette is the 29th Governor General of Canada. An engineer by education, she has taken part in two United States space missions.

Academy Members Took Part in the Bellingshausen Expedition. Members of the Academy Tarmo Soomere, Maarja Kruusmaa and Urmas Kõljalg participated in various stages of the historical Admiral Bellingshausen Antarctic Expedition.

President Tarmo Soomere enjoyed calm seas on the expedition's first stage from Kronstadt to Sillamäe. However, Member of the Academy Urmas Kõljalg, who joined the crew for the Sillamäe–Helsinki leg, described his experience as exciting, yet difficult. "The waves were very intense," Kõljalg said.

Member of the Academy Kõljalg was responsible for the expedition's research aspect. "The crew of the Bellingshausen collect water, dust and plastic particle samples throughout the journey. We are monitoring the results online. I was tasked with instructing the Bellingshausen cabin boy," Kõljalg noted.

Member of the Academy Kruusmaa boarded the Bellingshausen on 15 December at the port of Puerto Madryn. The ship then headed to the Malvinas (Falkland Islands in the British usage). The expedition arrived at the southernmost town of Ushuaia at Christmas. Kruusmaa arrived back home on 10 January. "A perfect opportunity to see penguins and polar bears in a single year," Kruusmaa joked before the trip.

The Academy's Awards. On 17 December 2019, the Medal of the Academy of Sciences was awarded to the historian Erki Tammiksaar, the public service veteran Andres Kollist and the former Academy of Sciences employee Helle-Liis Help. The Medal is the Academy's highest award and it is given for contributions to developing or supporting the development of Estonian research. Other 2019 laureates of the Medal are Academy Member Margus Lopp and Chancellor of Justice Ülle Madise. Vice President of the Academy Arvi Freiberg also presented the computer scientist Margus Veanes and the linguist Raimo Raag with their Foreign Member diplomas.

Andres Metspalu is the 2019 European of the Year. On 19 December 2019, European Movement Estonia proclaimed Academy Member Andres Metspalu as the European of the Year for his services in developing Estonian and European research. Academy Member Metspalu commented to Estonian Public Broadcasting: "Solid research is based on openness and freedom of thought: the very values that Europe promotes. Estonia's 15 years in the European Union have been exceptionally productive for Estonian research and I am proud to have done my part."

The European of the Year title has been awarded since 2005. The title recognises individuals and organisations who have contributed to Estonian-European relations or the development of the civic society, and who have increased Estonian society's awareness of Europe. Previous recipients include Presidents Arnold Rüütel and Kersti Kaljulaid and the novelist Jaan Kross.

INTERNATIONAL RELATIONS

Researchers can be likened to ambassadors of their countries to the academic world. The organisations that connect them (including academies of sciences) function as a highway of information, ideas, competencies and good practices. The Estonian Academy of Sciences represents Estonian science and Estonian scientists in the major European and global research organisations.

The **International Science Council** (ISC) was created in 2018 through the merging of two influential academies of sciences and a number of powerful international associations. Naturally, the Estonian Academy of Sciences is a founding member.

The International Science Council was formed by the eponymous classical natural sciences organisation (founded in 1931; named the International Council of Scientific Unions, or ICSU, until 1998 and the International Council for Science, also ICSU, thereafter) and its sister organisation for the arts and social sciences, the International Social Science Council (ISSC, founded in 1952). The Estonian Academy of Sciences had been a member of the ICSU since 1992 and has also participated in the work of the ISC European member organisations' group.

The organisation has two kinds of members. Under the territorial principle, the ISC includes one academy of natural sciences or scientific board and one academy of humanities and/or social sciences per member country. Leading international scientific societies are also included. The central goal of the ISC is to identify the key global problems facing science and society through cooperation between scientists from all countries and all fields. https://ics.org/

> The ICSU was one of the initiators of the sustainable development programme that has since gone global. The goal of its seventeen sustainable development goals is to organise our life to avoid overexploiting natural resources and excessively damaging the nature that surrounds us (in more modern terms: to avoid undercutting the ecosystem services that support our way of life). In Estonia, this task is the responsibility of the Commission of Sustainable Development, which was founded in 1996 (https://riigikantselei.ee/et/saastev-areng). The commission was reorganised in 2017. The Estonian Academy of Sciences continues to take part in its work.

The **InterAcademy Partnership** (IAP; formerly InterAcademy Panel) was founded in 1993 as a global network of academies of sciences. It is currently comprised of over 140 national and regional academies. The goal of this organisation is to advise society at large in cooperation

with its member organisations and to provide support to various decision-making bodies regarding the scientific aspects of global problems http://www.interacademies.org/. A number of member academies of the ISC and IAP believe that these organisations should either merge or increase collaboration significantly.

The **European Federation of National Academies of Sciences and Humanities "All European Academies"** (ALLEA) was founded in 1994 and brings together both classic natural science academies and academies of humanities and social sciences. The Estonian Academy of Sciences is a founding member of ALLEA. The goal of ALLEA is to facilitate the exchange of information and experiences between academies to achieve high standards in research and ethics, as well as to promote the independent discussion of scientific strategy and policy at the European level. Jüri Engelbrecht, a member of the board of the Estonian Academy of Sciences (at that time Vice-President) was President of ALLEA in 2006–2011. http://www.allea.org/

The **European Academies' Science Advisory Council** (EASAC, founded in 2001) is composed of individual members appointed by academies of sciences of EU member countries. Estonia joined this organisation in 2004. The goal of the EASAC is to direct the joint competencies of the academies in the advising of EU governmental bodies and politicians in decisions that require scientific expertise. In other words, it takes on the role of an independent academic counsellor to the EU, bringing together the top-level competencies and experiences of European academies.

Expert networks have been formed in the three main programmes (biosciences, energy and the environment). They deal with various societally relevant topics, analyse nascent problems and predict development trends and side effects. Through its members, the EASAC also engages in a steady dialogue with national policy-makers, striving to promote evidence-based decision-making in Europe.

The Estonian Academy of Sciences is represented in the EASAC Council by Secretary-General Jaak Järv. Academy Member Tarmo Soomere is on the Environment Steering Panel and Member Enn Lust is on the Energy Steering Panel. http://www.easac.eu/

Union Académique International (UAI, founded in 1919) celebrated its 100th anniversary. The Union connects academies of humanities and social sciences at a global level. Its goal is to promote joint research (including joint projects) and facilitate the publishing of research results. The Estonian Academy of Sciences joined the UAI in 1998. The Estonian representative is Academy Member Jaan Undusk. http://www.uai-iua.org/

For more than ten years (2000–2011), the Academy participated in the work of the **European Science Foundation (ESF)**. This organisation, founded in 1974, brought together scientific institutions of European countries (including the Estonian Research Foundation, later the Estonian Research Council). Several Europe-wide advisory science policy bodies, such as the European Marine Board and the European Polar Board, were active in the ESF. The Committee on Marine Sciences and the Polar Research Committee of the Estonian Academy of Sciences contributed to their work.

By 2017, the aforementioned advisory bodies had been reformed as independent legal entities (the European Marine Board and the European Polar Board) in the course of the reorganisation of the European Science Foundation. The Academy continues to provide scientific counsel to the European Commission through these institutions.

RESEARCHER EXCHANGE AND SCIENCE DIPLOMACY

The Estonian Academy of Sciences supports researchers' international mobility. One of the results of the cooperation agreements between the Academy and its partners abroad is academic researcher exchanges. They are open to all Estonian scientists. The grants are modest, but every little bit helps. The budget of the Academy also covers the reception expenses of foreign researchers in Estonia. The expenses of our scientists abroad are borne by the Academy's partners in target countries. The work of the programme is directed by the Academy's Council for International Exchanges (chaired by Academy Member Jüri Engelbrecht).

In 2019, the Estonian Academy of Sciences sponsored the visits of 51 visiting researchers to Estonian universities and research institutions, with a total duration of 331 days (compared to 339 days in 2018). The average visit length was approximately one week. Partnering academies supported the visits of 43 Estonian researchers for a total of 340 days. In 2018, the programme supported 59 visits for 425 days in total.

The biggest Estonian universities (the University of Tartu and the Tallinn University of Technology) continue to be the most active users of the researcher exchange programme both outbound and inbound. Research collaboration projects funded through bilateral co-operation agreements help us maintain our international visibility and contacts.

The Estonian-Czech and Estonian-Bulgarian three-year research collaboration projects that were initiated in 2018 will come to an end in 2020. Individual visits will be supported on the basis of cooperation agreements with partner academies in Latvia, Lithuania, Slovakia, Slovenia, Ukraine, Belarus and Sweden.

THE JOURNEY TO THE LINDAU NOBEL LAUREATE MEETINGS

The beautiful German town of Lindau has hosted dozens of Nobel Prize laureates and over 500 talented young researchers from around the world since 1951. In the spirit of its motto, "Educate, Inspire and Connect", the Lindau Meetings invite young researchers to hear lectures by Nobel Prize winners and rub elbows with top global scientists.

The meetings (see www.lindau-nobel.org) are invitation-only. The students and young scientists are chosen from among the best of their countries. The Estonian nominees are selected by the Estonian Academy of Sciences under an agreement made with the organisers (the Council for the Lindau Nobel Laureate Meetings and the Foundation Lindau Nobel Laureate Meetings). The competition has two phases and the organisers have the final say.

The Lindau Physics Meeting

By Priidik Gallagher

Every year, over 500 young researchers and dozens of Nobel laureates gather at Lindau (a town on the island of Lindau on Lake Constance, in southern Bavaria) to meet colleagues, introduce their work and brainstorm key contemporary issues in science and other areas. This year's meeting was a physics forum. The meetings alternate between physics, medicine and chemistry, along with an interdisciplinary meeting, organised every five years, covering all three; a meeting on economic sciences is also held every three years. Therefore, three sciences for which the Nobel Prize is

awarded are represented at Lindau, bringing together Nobel laureates and younger researchers. The author of this overview took part in the 69th Lindau Nobel Laureate Meeting, which was held in 2019 and focused on physics.

The first Lindau Meeting was held in 1951 and was dedicated to medicine. The idea was conceived by two local doctors, Franz Karl Hein and Gustav Wilhelm Parade, who suggested it to Count Lennart Bernadotte of Mainau, the grandchild of King of Sweden Gustav V. The first meeting was attended by seven Nobel Prize laureates. It has significantly expanded over time: the 2019 meeting was attended by 39 laureates and 580 young researchers from a record 89 countries. The meeting is sponsored by multiple supporters and academic partners, including companies, universities, research institutes, individuals and other organisations. This year's host country was the Republic of South Africa, which was also the organiser of the final event of the opening day.

The meeting programme was crammed with events. When pre-registration opened, the places were filled in a matter of hours. The number of places was limited for many events, leading each participant to have a different schedule. On several of the days, the activities started at seven in the morning with a "scientific breakfast" or partner meeting, and ended at midnight with a social gathering. The mornings were dedicated to Nobel laureates' lectures spanning a wide variety of subjects, from topics related to their research leading to the prize to the changes to the SI system or their own biographies. Each day had a main theme: laser physics, particle physics and cosmology, or biophysics. The lectures were punctuated by open talks where the laureates discussed their ongoing research and answered questions with "open discussions", where young researchers could ask the Nobelists questions freely. Additionally, thirty young researchers presented their research posters; the attendees voted for their favourites and the winners received awards on the final day.

The Lindau meetings were focused on the Nobel laureates, and young researchers were able to interact with them directly in such contexts as walks (each of which, however, was limited to a small number of participants). The Estonian representative went on a scientific walk with the laureate of the Nobel Prize Dr Arthur McDonald, who talked about his work in the experimental detection of dark matter. Some young researchers were able to present their research work to the laureates in "master classes". It was possible to talk to the laureates between other events, but this could prove difficult due to overwhelming interest.

The majority of the participants were invited young researchers, for whom it was obviously simpler to meet and discuss research or other matters of interest among themselves. Physics has many subfields, and the participants at the Lindau meeting were diverse. Quite a few early-career researchers found collaboration partners at Lindau. The most popular topics were largely the ones

Photo: private collection

Lindau's main street.

Photo: private collection

Nobel Prize laureate Dr George Smoot and Priidik Gallagher

currently most researched: quantum computers and related matters, quantum phenomena in materials, very low temperatures, gravitation waves and dark matter. The attendees included mathematicians and biologists whose work involves physics. Additionally, there were young researchers at various stages of their research careers: undergraduates, master's students, PhD students and post-doctoral researchers.

The diversity of topics was reflected in the daily programmes. For example, the Monday lectures were kicked off by Dr Strickland's presentation on laser physics in connection with the work that earned her the Nobel Prize. The following lecture by Dr Mourou discussed nonlinear optics, among other things. In the parallel open talks, the laureate Dr Moerner discussed trapping single molecules and the laureate Dr Phillips analysed the new international system of units. Afterwards, Dr Hell introduced the methods used in microscopy to circumvent the diffraction limit, whereas Dr Wiemann focused on physics teaching. The following lectures discussed materials of the future (Dr Novosjolov), ribosome biophysics (Dr Yonath), and the microscopy of biological molecules (Dr Frank). Each of the topics merits a dedicated conference in its own right. Each meeting, conversation and lecture was guided by the leitmotif "How can science improve the world?", which, in itself, is a complicated enough question that answering it will extend far into the future.

Lindau itself is an excellent location for conferences and meetings. Official lectures and events took place at the Inselhalle conference centre; the lake provided a background for the walks and talks; the fastest registrants even got to ride on a zeppelin. The agenda also featured entertainment activities. For example, the Ensemble of the Vienna Philharmonic Orchestra played after the opening ceremony, and a recently opened art exhibition and the "Science Trail" pylons as well as the old architecture of Lindau could be enjoyed. The Lindau Meetings have left their imprint on the town: a pier was opened next to the Inselhalle with the names of the Nobel Prize laureates, along with their first Lindau visit year noted on pier posts. There are about a thousand of those posts, so future laureates need not worry about running out of space. The meeting week concluded with a boat trip to Mainau, an island of flowers and gardens, to celebrate the closing ceremony and hold a laureate discussion.

Photo: private collection

The view of the Lindau lighthouse from the yacht harbour.

EXPLORING THE ACADEMIES OF SCIENCES OF THE SOUTHERN HEMISPHERE

By Tarmo Soomere

Estonians and Estophiles are present around the globe, and South America and its research centres are no exception. Regular routes of Academy members, however, tend to converge at the medium latitudes, around Montevideo, Córdoba, Buenos Aires and Santiago.

The Antarctic, too, has been on the radar of our polar researcher colleagues for over half a century. The history of the discovery of the continent burnishes our self-image. Our Argentinian and Chilean colleagues are mostly understanding, but add a few important "buts". Humans have lived in South America and its southernmost tip Tierra del Fuego for over ten thousand years. The climate and the wind and storm patterns have changed beyond recognition during this time. It could be that at some point, when climate conditions were different, indigenous people visited Antarctica long before the white race.

After all, the histories of the discovery of Australia, New Zealand and Antarctica are a reflection of the view that held Europe to be the centre of the world. In Australia, people had learned to make their way in nature when Estonia was still covered by kilometres of ice. The Maori people reached New Zealand several hundred years before Europeans did.

Even so, probably the first official representative* of the people and institutions of the northern hemisphere to set eyes on the continent of Antarctica was Fabian Gottlieb von Bellingshausen on 27 January 1820. German by ancestry, he was born on the Estonian island of Saaremaa and sailed under the Russian flag. What he saw is not entirely certain. The honour of first discovery is contested by the Irishman Edward Bransfield, who, sailing under the English flag, spotted the Trinity Peninsula three days later, on 30 January 1820. The American seal hunter Nathaniel Palmer reached the Antarctic Peninsula in November of the same year.

Even if Bellingshausen was not the very first, Estonia as a small country is proud to have one of our own among the first three in the world. No wonder, then, that certain active and well-to-do gentlemen found that celebrating this anniversary would show Estonia as significantly bigger than its headcount or gross domestic product per capita might suggest. The state decided to stay out of this**. If the rich are looking for an adventure, let them pay their own way.

However, the Academy of Sciences conducts its international interactions by much the same principle as those gentlemen did: physical size is much less important than what the country's best and brightest contribute to global skills and knowledge. The discovery of a continent is a landmark to be remembered for centuries.

URUGUAY

On its way to Antarctica, the steel body yacht Admiral Bellingshausen sailed through the waters of several countries whose Academies we had not yet been in contact with.

Founded in 2009, the Uruguay Academy of Sciences is among the world's youngest. Nevertheless, they have quickly become an important advisor to their state. Uruguay is a significant member of the research community in spite of its small size and tops the research indicator rankings among South American countries. So far, connections between Estonian and Uruguay researchers have mainly

At the seminar, chairman of the expedition Tiit Pruuli noted that, in addition to the historical dimension, the Admiral Bellingshausen journey also focused on contemporary problems, such as the condition of seas and oceans as a whole, maritime security and the potential impact of climate warming on the marine environment.

I contributed an overview of the role of the Academy of Sciences in Estonia, analysed the importance of academies in ensuring the competitiveness of small countries and spoke of new opportunities for mitigating environmental risks related to maritime affairs. Academy Member Maarja Kruusmaa's presentation on underwater robots elicited great interest. New sensors permit much more reliable measurement of, for example, movements of water close to the sea floor. Naturally, they allow detailed monitoring of various characteristics of water: salinity, temperature, oxygen level, etc.

The Uruguayan physicist Erna Frins described research carried out at Uruguayan research bases in Antarctica. The Admiral Bellingshausen visited one of the bases, the General Artigas Station on King George Island, in January 2020 with the President of the Republic of Estonia on board.

Director of the Estonian Maritime Museum Urmas Dresen recalled the extraordinary (and locally extremely sensitive) matter of Estonia once beating the Uruguayans in football, their favourite sport.

* A.G.E. Jones 1982. Antarctica observed: who discovered the Antarctic continent? Caedmon of Whitby, Whitby, Yorkshire, England, 118 pp.

** Kaur Maran. Uue ministri otsus sunnib Antarktika-ekspeditsiooni jätma ära Eestit tutvustavad üritused. (The new minister's decision cancels the Antarctic expedition's events promoting Estonia.) Postimees, online, 14.08.2019 at 17:50, https://heureka.postimees.ee/6753466/uue-ministri-otsus-sunnib-antarktika-ekspeditsiooni-jatma-ara-eestit-tutvustavad-uritused.

been based on personal contacts. For instance, President of the Uruguay Academy of Sciences Prof Rafael Radi has visited Estonia in connection with his research.

The visit of the Admiral Bellingshausen will hopefully have laid the foundation for a closer relationship between the science promotion and advancement institutions of the two countries. An Estonian Academy of Sciences and Uruguay Academy of Sciences joint conference was held on 10 December 2019, organised by the Head of the Marine Sciences Laboratory at Uruguay University, Member of the Academy Omar Defeo. Nearly a dozen researchers and marine experts from Estonia and Uruguay gave short presentations.

Even though Estonia and Uruguay are geographically distant, they have many concerns in common. Both countries are hard hit by the impacts of climate change. The average air temperature in Uruguay has increased by two degrees over the last 140 years and it's even more than that in Estonia. Whereas sea levels have rapidly increased in certain Estonian coastal areas, the coast of Uruguay is impacted by the rapid heating of the ocean water. The influx of warm water masses, combined with changes in the prevailing winds and waves, have had a noticeable impact on Uruguayan fisheries, as well as the stocks and availability of other seafood.

ARGENTINA

While the Admiral Bellingshausen was conquering the waves on its way from Montevideo to the Argentinian "oil capital" Comodoro Rivadavia, Academy Member Maarja Kruusmaa and I were establishing contacts with the National Academy of Sciences of Argentina. Just as we always do at the Academy, we talked about the interesting happenings in Estonian research and explained why our research, humble in numbers and finances, is at the cutting edge in several fields.

As suggested by the photo, the National Academy of Sciences of Argentina took the Bellingshausen journey extremely seriously. While Patagonian aborigines most likely knew about the existence of Antarctica, from the perspective of the northern hemisphere, the discovery of the continent took place 200 years ago.

On 12 December 2019, our small delegation was warmly welcomed at the National Academy of Sciences of Argentina in Córdoba by the President of the Academy Juan A. Tirao, Vice-President Hugo Maccioni, Academic Secretary Beatriz Caputto, and Member of the Academy Vicente Macagno. Early in the pleasant conversation, we experienced once again how small the world really is: one of the hosts, Member of the Academy Juan Jose Cantero, had earned his doctorate in plant biology and ecophysiology at the University of Tartu. The diploma is in Estonian and his supervisor Martin Zobel has been a member of the

The seminar in Montevideo. The organiser of the event, Member of the Academy Omar Defeo hidden behind Member of the Academy Maarja Kruusmaa (the lady in black) and the tall Urmas Dresen.

Estonian Academy of Sciences since 2010. According to Prof. Cantero, collaboration with the University of Tartu has been developing steadily.

The fact that the oldest university in Argentina, Universidad Nacional de Córdoba, was founded in 1613, a couple of decades before the University of Tartu, induces some jealousy. Currently, the number of its students is double the total number of university students in Estonia. But Argentina is a big country, bound to need many outstanding specialists.

The National Academy of Sciences of Argentina is considerably older than our Academy. It celebrated its 150th anniversary in September 2019. The Academy was initially created to complement the mainly humanities-oriented Argentinian universities and it quickly became the driver of the country's natural sciences research. Now, the Academy and the university are inseparable. The Academy has an amazing library. Not many books were printed in South America before the mid-18th century. Therefore, almost all books predating that period originate from Europe. Now, it includes some recent material on the Estonian Academy of Sciences, too.

Before we were allowed to take the dais, we had to take the traditional seats of PhD students defending their theses. Having gracefully passed the trial, Academy Member Kruusmaa explained in her lecture why seas need to be measured in places where few measurements have been taken and where taking them costs a lot. If we follow this approach, we will be similar to the storied hero who searched for his lost watch under a street light, not where he lost it. If we rely on measurements from places where measurements are simple and cheap to make, we may end up with an entirely incorrect picture of the world's seas and oceans. Measurements need to be taken where taking them is difficult, but where there is a lot of energy and processes happen fast. For example, in shallow water where waves expose the bottom.

For my part, I spoke about the way academies of sciences can serve the nation and how to persuade scientists to talk to the people who have been elected to decide our present and future in their own language. Our three-minute lectures and the climate conference organised jointly with the Prime Minister's Office raised many eyebrows and elicited many interested questions.

And then things proceeded as usual: a member of the younger generation – Academy Member Kruusmaa – boarded the Admiral Bellingshausen to battle the high seas and I took off by car to look for a red carpet to roll out for the Admiral Bellingshausen crew on the second day of Christmas at Ushuaia. Why does a marine scientist turn down a ship to travel by land? To avoid getting personally involved with the object of his research.

The great Estophile, who earned his doctorate at the University of Tartu, Juan Jose Cantero with our Academy Members.

Maarja Kruusmaa examines the century-old atlas of Argentinian territories under the watchful eye of President of the National Academy of Sciences of Argentina Juan A. Tirao.

Photo: private collection x3

Unlike Estonia, whose centre point near Adavere close to the Tallinn–Tartu road is known to all, no one knows where the centre of Patagonia is located. It could be somewhere between Colonia Sarmiento and Perito Moreno, a few hundred kilometres to the south of the parallel along which the search for Captain Grant took place. It's a classic non-place, just a dot on a map, defined by coordinates, yet without boundaries.

The area seems to be completely empty. Gravel covers the land. Another few hundred kilometres pass by, but the view is the same: yellow-reddish gravel, sparsely punctuated by tufts of grass. It looks like a desert, and that is exactly what it is: the Patagonian Desert. And yet the land manages to provide sustenance for herds of animals and flocks of birds. It is fertile enough even to support some humans. It has been home to people for at least 9,300 years, as evidenced by the Cueva de las Manos cave paintings.

The real diversity of the local nature is initially well concealed, and the boundless plains encourage thoughts to wander freely. It is a world without structure. Your thoughts will often be interrupted by a sleek guanaco dashing across the road. There are thousands of them grazing along the road. Or when nature calls. There is, after all, a difference compared to, for example, the similarly endless Australian roads. Whereas there is a roadside toilet every 50 kilometres in Australia, there are only similarly spaced meter-high bushes by the road in Patagonia.

The Patagonian Desert used to be a lush forest. Millions-of-years-old petrified tree trunks provide evidence. Sarmiento Petrified Forest (*Bosque Petrificado Sarmiento*).

Message from Ambassador Facundo Vila

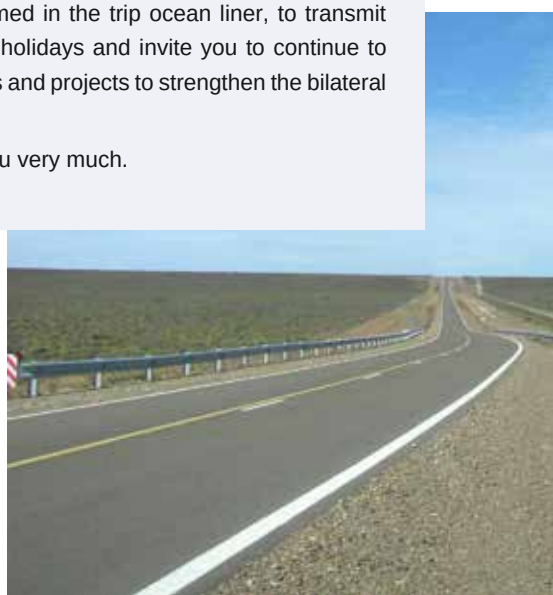
With great pleasure I send you a warm and fraternal greeting to Dr. Juan Tirao, Dr. Tarmo Soomere, Dr. Maarja Kruusmaa and everyone who are part of both National Academies of Sciences, with occasion of this illustrious visit that unites our countries in the scientific research field. A field that is the key to development.

I have the privilege of representing our country before such an important nation as Estonia when it comes to technological innovation policies. In this sense, it should be remembered that in areas such as digitalization and cybersecurity this great Baltic country has become an undisputed international benchmark.

It is one of my most dear wishes that this first meeting serves to promote the development of joint projects between both Academies, thus serving as an enhancement mechanism of the very good level of bilateral relations that we have in all fields.

I would also like to take this opportunity to congratulate you again for this great initiative framed in the trip ocean liner, to transmit my best wishes for these holidays and invite you to continue to explore common strategies and projects to strengthen the bilateral relationship.

Best regards and thank you very much.



CHILE

The belief that life is better, grass greener, wind balmier, water warmer and the sun higher in the sky elsewhere is losing its hold on the imagination. This (mis)belief is effectively dispersed by long visits to faraway lands.

The Chilean Academy of Sciences is relatively young, just 55 years old. Even so, it is relatively experienced among the academies of North and South America. The Academy is small: only 36 members and 45 corresponding members in Chile. But in one significant sense, it is a big step ahead of the Estonian (and other Baltic) academies of sciences: the President of the Academy is the brilliant neuroscientist Maria Cecilia Hidalgo of the University of Chile (Universidad de Chile). Furthermore, the previous President of the Academy was a female researcher as well.

The formal meeting on 6 January 2020 turned into a substantial discussion very quickly, as Prof. Hidalgo started by recalling her recent visit to Tallinn. In this context, Academy Member Maarja Kruusmaa quickly found common ground with Academy Member Osvaldo Ulloa, Marine Researcher at the University of Concepción. As with the Uruguayan and Argentinian academies of sciences, the visit to Santiago revealed that the duties and challenges of academies are fairly similar across the world.

In Estonia, we have been enjoying a peaceful life for nearly thirty years. We may not even realise how difficult things can become when society becomes restless. Chile is currently one of the countries where people have lost patience and anti-government protests occasionally turn violent. The air even carried a hint of tear gas near our hotel. The turmoil does not spare scientists and research infrastructure. The administrative building of the private Pedro de Valdivia University was set on fire in the course of the protests*. The Academy building is located in a quiet side street halfway between the epicentre of the protests (Plaza Italia) and the central square (Plaza de Armas).

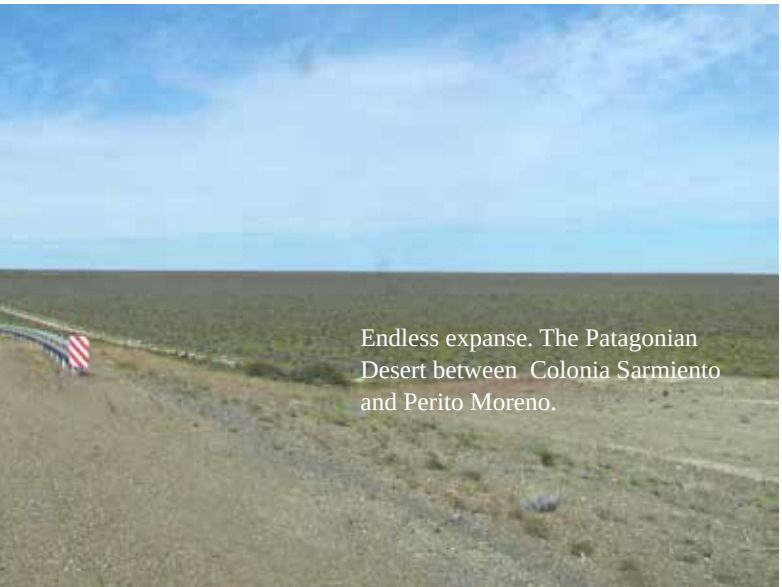
The 19 December 2019 issue of the journal *Nature* explores the views of researchers of countries in turmoil on the events taking place in those states**. It presents the thoughts of researchers from Syria, Bolivia, Sudan, Iran, Ecuador, Lebanon, Venezuela, Hong Kong and Catalonia, and of the President of the Chilean Academy of Sciences, Professor Hidalgo. Chile has long been known as the safest country in South America. Now, climate change is causing increasing desertification, obesity has reached the dimensions of an epidemic among the nation's youth, and the population is ageing at the same pace as in countries with the highest development level, yet the healthcare system and social welfare services are at the level of developing countries.

Professor Hidalgo's opinion is simple and convincing: in the long term, investment in research is the most effective way to reduce social tension. Chile's current level of science investments in relative terms is significantly lower than Estonia's: only 0.36% of gross domestic product.

* https://maailm.postimees.ee/6821886/meeleavaldajad-suutasid-tsiili-pealinnas-ulikoolihoone-ja-ruustasid-kirikut

** https://www.nature.com/articles/d41586-019-03872-y

Even clouds look different in Chile. Torres del Paine National Park.



Endless expanse. The Patagonian Desert between Colonia Sarmiento and Perito Moreno.

Photo: private collectio x4

GUESTS AND VISITS

The Academy Received a Visit from Italy

On 6 August 2019, the President of the Apulian Academy of Sciences and Vice President of the Union of Italian Academies of Sciences (Unione Accademica Nazionale), which unites 14 Italian academies of sciences, Professor Eugenio Scandale, visited the Academy. President Scandale's meeting with President Soomere was also attended by Professor Rein Vaikmäe.

The Accademia Pugliese delle Scienze di Bari is a personal academy established in 1925. Both Academies' responsibilities include their advisory role in representing science to society and the state, collaboration with universities and the public sector and science communication with the general public. The Presidents agreed that cross-border cooperation is an important component of carrying out those responsibilities and that informal networks may be more effective than formal ones.

The Prime Minister Visited the United States National Academy of Sciences

President Tarmo Soomere accompanied Prime Minister Jüri Ratas and Minister of Education and Research Mailis Reps on an official visit to the United States on 29–31 October. From the Academy's perspective, the trip culminated with the official meeting of the Prime Minister and the Minister of Education of Research with the President of the United States National Academy of Sciences Marcia McNutt in Washington DC.

The U.S. National Academy of Sciences is a powerful organisation whose capacity to analyse large problems and offer solutions inspires many.

The key topics of the meeting were cybersecurity, transnational relations in research and technology and opportunities to make progress towards carbon neutrality in the economy. Both parties agreed that scientific advice must remain separate from lobbying.

The National Academy of Sciences was founded in 1863 and was tasked with advising the government of the United States in the fields of research and technology. The Academy is currently comprised of 2350 active members and 450 foreign members, including nearly 200 Nobel Prize laureates. Nearly 1100 specialists provide analytical support.

Photo: Reti Kokk

Baltic Academies Enter into a Cooperation Agreement with the Hamburg Academy of Sciences

On 31 October and 1 November 2019, the Hamburg Academy of Sciences and Humanities received the Presidents of the Estonian, Latvian and Lithuanian Academies of Sciences. The delegation of the Estonian Academy of Sciences also included Member of the Academy Jakob Kübarsepp.

Opportunities for improving the cooperation between the academies were discussed. A cooperation agreement between the Hamburg Academy of Sciences and Humanities and the Baltic academies of sciences was signed.

The Hamburg Academy of Sciences is one of the eight academies of sciences in Germany. Established in 2005, it connects outstanding northern German researchers. The goal of the academy is to promote collaboration with domestic and international partners and to improve the visibility of science and scientists in northern Germany.

Photo: Üile Raud

Professor Eugenio Scandale surrounded by Rein Vaikmäe and Tarmo Soomere in the office of the President.

OPINION

FEATURE INTERVIEW: ARE MEN FROM MARS AND WOMEN FROM VENUS?

In an end-of-year interview, Professor Anu Realo told Marti Aavik about her personal experiences at an English university in the run-up to Brexit, the paradox of the widening gender gap in personality traits across cultures as a function of human development and gender equality and the research into the development of basic human values. The text of the interview has been upgraded by Professor Realo for this edition.

WHAT BREXIT MEANS FOR SCIENTISTS

You have been a Professor at the University of Warwick since early 2016. This entire period has been overshadowed by a major question: will the United Kingdom (UK) in the end go through with Brexit? It turns out they will. What does this mean for universities and academia in general? Would you describe the prevailing mood as worried or rather as relatively optimistic?

We do not actually know what will happen as the future relationship between the UK and the European Union (EU) is still being negotiated. From the perspective of universities, I foresee at least three significant problems.

The first one is research funding. UK researchers have been very successful in applying for grants through various EU funding programmes. Furthermore, a disproportionate share of EU grants has been brought into top UK universities by researchers originally from other European countries.

As of now, the UK has promised to secure the funding of ongoing Horizon 2020 programmes and current calls for proposals. However, we have no idea about what is going to happen next. There has been talk of the UK establishing its own large-scale research funding measures. But it is not known exactly what they will fund and in what capacity. This is clearly a major source of uncertainty, which hopefully should be settled in course of negotiations.

The free movement of labour and students represents another major issue. The number of European students trying to start their studies in the UK before Brexit is finalised has increased in recent years. The main problem lies in the size of their tuition fees – current regulations set EU students' tuition fees at the same level as for 'home' students, but post-Brexit rates are unknown.

This entails considerable uncertainty for universities. Many potential future students may decide against coming to the UK after Brexit, which would cause the amount of money to decrease accordingly. This is already evident at PhD level: we have fewer applicants than in previous years. The reason is the same uncertainty as PhD students are unable to predict their tuition fees, the cost of living, or potential problems with visas and residence permits. Collectively, this has placed universities under considerable stress.

At least my university – the University of Warwick – has been an outspoken opponent of Brexit. The Vice-Chancellor has repeatedly spoken out in British media about the damage Brexit will cause to universities and research in the UK and he has done his utmost to support EU professors and other staff at Warwick.

Thirdly, all UK universities currently employ a very large number of foreign academics, who make up over a quarter of all academic staff in total. The majority of them come from EU countries and a minority from third countries. This is a massively international environment and naturally people are discussing, debating and worrying.

Photo: Reti Kokk

Anu Realo has been among the world's most cited psychologists for years.

We are not really concerned about losing our jobs, people normally have permanent, lifetime contracts, as required by local legislation. So, at least we are not afraid of being forcibly deported. However, we do not know which social safeguards will remain available for us, and if there will be changes in pension rights, etc.

Do EU universities stand to gain anything from Brexit? After all, the shape of the competitive market of research and higher education is already changing.

The gains are already evident. After the Brexit referendum results came out in the summer of 2016, some countries in the continental Europe, especially the Netherlands and Germany, saw an explosive increase in the number of English-language courses. These countries moved quickly and astutely to take advantage of the situation.

Overall, Ireland emerged as a clear winner. After Brexit, Trinity College Dublin will become the biggest English-speaking university in the EU. They have taken advantage of the situation very well.

After all, we know that that English universities have traditionally got the cream of the crop among top universities. English universities have historically always been in huge demand not only in Europe, but globally. The uncertainty surrounding Brexit has already allowed universities in other European countries to gain more students.

Brexit is a vivid example of social polarisation. Can your areas of expertise, psychology, and sociology, offer a solid explanation and a predictive model for this phenomenon?

I do not think anyone dares to make any predictions about the future any longer. In 2016, after all, neither the result of the Brexit referendum in the UK nor the winner of the U.S. presidential elections were correctly predicted.

Having said that, there are of course several potential explanations for polarisation. On the one hand, the Brexit referendum can be viewed in the context of larger global trends. On the other hand, it has highly specific features that are particular to the UK. It will no doubt provide many years' worth of content to analyse what exactly led to this result and how the social division caused by the referendum and its aftermath can be fixed.

There are three main generally accepted reasons for the Brexit referendum outcome. Similarly to many other European countries, polarisation between the country's elite and the rest of the population had occurred. A small part of the society grew disproportionally wealthy, while large parts of the country failed to benefit from the economic growth arising from globalisation. In reality, the UK is ruled by a small number of privileged elites, who have all attended the same private schools. Basically this means that the entire ruling elite is bred in southern England's

private schools near London, and they do indeed have a very high quality of life. At the same time, the majority of people were losing ground in economic terms and saw no real prospects for their future.

The migration crisis also played an influential role in shaping the outcome of the 2016 Brexit referendum. It was preceded by the wave of migration of Eastern European unskilled workers after the expansion of the European Union. These two factors had a significant impact on the results of the Brexit referendum.

The third reason is that the former British Prime Minister David Cameron called the referendum in a bid to maintain the unity of the Conservative Party and to silence the dangerous Eurosceptic wing of the party. This has been the main criticism of Cameron's premiership: a responsible national leader should not have put the interests of his party ahead of the country.

What is the role of identity politics, that is, people feeling that this is no longer the country in which they were born and raised, and their fear of losing their identity?
The role of identity politics as a central theme of the process of polarisation was very well analysed by Francis Fukuyama in his latest book (*Identity: The Demand for Dignity and the Politics of Resentment*, 2018). This factor may be even more central in England than elsewhere. On the one hand, England is extremely liberal in anything to do with gender equality, racial diversity, and same-sex partnership. On the other hand, the people are very conservative when it comes to lifestyle matters. Looking around small towns and villages, almost any village could serve as the setting of a period film. Only traffic signs would have to be taken down. Most of the buildings look like they did 200 or more years ago when the village was built.

HOW TO EXPLAIN THE WIDENING GENDER GAP IN PERSONALITY TRAITS ACROSS CULTURES?

What research questions do you currently find the most interesting? For example: what is currently the most talked about question in personality psychology?
There is currently a lot of interesting research into gender differences in personality traits. We are aiming to examine and to hopefully solve one of the biggest paradoxes in the field: the widening gender gap in personality traits as a function of human development and gender equality. Although gender differences in personality seem to be universal across cultures, the differences increase with the level of human development: the largest overall gender differences in personality traits are found in countries where women and men have the same rights and opportunities.

Do these comparative studies compare different countries or groups in a single population?
We have some of each. If we examine 60–70 countries and see that the widening gender gap in personality traits across cultures does indeed result from the development of a society, we should see the same trend within those countries that have different regions and/or ethnic groups with a very varied economic performance and human development. There are many countries with large enough regional differences.

Italy might be an excellent example of this?
Indeed. The self-images of northern and southern Italians are as different as night and day as are their levels of economic development. Russia is another country with vast regional variation: wealthy Moscow versus the poor province. Russia's regions have fairly good statistics available, too. South Africa also provides an interesting case to study.

In a different study, we are trying to understand what drives the cultural variations in men's and women's personalities, is it human development or gender (in)equality or both in combination? The correlation between the two variables is usually very high, around 0.70–0.80. We chose four countries representing different combinations of these two factors: Switzerland is very wealthy and has high levels of gender equality; Qatar is also wealthy but has low levels of gender equality; Burkina Faso has low levels of both human development and gender equality while Moldova is economically struggling, yet has high levels of gender equality. Studying these countries will allow us to disentangle the effects of human development and gender egalitarianism on gender differences in personality across cultures and to understand how these differences evolve. We have almost all the data we need. Whether we find anything interesting is a different matter but the design of the study is certainly innovative.

Finally, we are planning to study the development in gender differences in personality traits longitudinally among children in single-sex and co-educational schools. We are interested in finding out whether differences in personality traits are larger in same-sex schools or among those who have always studied in co-educational schools.

SLEEP, THE NEW PANACEA

In recent years, I have also been doing a lot of work on the relationship between personality traits and chronotype. Chronotype refers to whether people go to sleep earlier or later: whether they are night owls or early birds. Sleep is a trendy topic in psychology right now and is almost seen as a new panacea that grants health, happiness, and a longer life. The number of sleep studies has increased sharply over the last decade, everybody wants to study it.

Together with a PhD student and colleagues from the University of Warwick and University of Tartu, we have been examining how personality traits are related to chronotype, both at the phenotypic as well as at the genetic level.

So, sleep is a trendy starting point for exploring a wide variety of questions right now?
Research is being conducted on sleep quality, its connections to health and well-being, and so on. For example, the

start of the school day was shifted to a later time in Switzerland owing to the work of my colleagues. Studies showed that letting teenagers sleep a bit longer has a huge impact on their health and well-being. It is well known that your chronotype changes over the course of life – toddlers wake up early and teenagers would rather sleep longer. As we age, we start waking up earlier again.

WE CANNOT ESCAPE HISTORY

You also study human values. How could we in Estonia understand one another better to avoid becoming increasingly polarised?

In Estonia, we should first define the type of polarisation that we are talking about. In recent years, there has been a lot of talk about the Estonian and Estonian-Russian parallel societies. For decades, the topic eluded public attention. Everybody ignored it and figured that people would somehow find a way to come together. Sadly, this is not quite what happened. The Estonian Human Development Report 2016/2017 ("Estonia in the Age of Migration", Estonian Cooperation Assembly [Eesti Koostöö Kogu] 2017) clearly showed that people from the two language groups barely interact with each other in their everyday lives. The report was extensively discussed in the Riigikogu (the Parliament of Estonia) as well as in media, so I would like to think that acknowledging the problem is a first step in a long way to solve it.

Another effect of polarisation is evident in the way how certain political parties' manipulative statements try to forcibly divide Estonians along the lines of political ideologies. Mutual understanding is unfortunately becoming increasingly rare.

Do we all have a natural inclination towards conservative or liberal ideologies?

I tend to think that the currently prevailing political trends are connected to Estonia's cultural and political past. We need to look far back in time, well beyond the Soviet period. It would certainly be hard to point to a single event in the long and fraught history of the Estonian people and say that the values we are seeing now are rooted in that moment. But at the same time, our cultural and historical background impacts what we consider important, which in turn influences our political views. Ultimately, our political views reflect a certain way of life and lifestyle that we see as right and want to promote.

This is evident to me now in England, and previously in the Netherlands and Sweden. After all, the egalitarianism and lifestyle characteristic to Swedes now was not just invented in the course of the last century by the Social Democrats. Earlier Scandinavian history already evidences a marked trend towards egalitarianism. In the case of the Netherlands, freedom of choice and the market economy are highly valued. The Dutch have historically been willing to trade with anyone and have offered a safe harbour to different thinkers and faiths on the basis that it promoted the economy.

The Estonians' love for the Reform Party can be viewed in a similar way. Over a third of our society supports them and their philosophical premises that can be summarised as follows: I am the master of my destiny; I am willing to work hard; I want to take home a lot of money because I work hard, and I am not overly concerned about the situation of people with a lower capacity for work and worse health. So, this involves a certain worship of success, along with a relatively low level of solidarity. This way of thinking is rooted in our history.

This is one of the saddest findings of our value research: compared to many other countries, we in Estonia care relatively little about others.

Does that mean that we cannot shake off our history?

No, we cannot. It took me quite some time to realise that, even though the idea is far from new. Of course, dramatic events and even revolutions happen, but as far as values go, we are still inevitably influenced by our history.

I have been observing how values of people living in Estonia change over time for many years now, using data from the World Value Survey. In Western Europe, the shift from survival to self-expression values began in the 1960s.

Photo: Reti Kokk

Anu Realo believes that many issues were left unresolved in the Estonian society in the 1990s.

When I started studying cultural values, I assumed that the value preferences of people living in Estonia would eventually begin to resemble those of Nordic countries and Western Europe. In terms of the economic development, we are now roughly at the level where Finland and Sweden were in the early 1990s. Our values, however, have not changed to the same extent.

It turns out that in Western Europe the value shift took place among the generation who were born after the World War II and later generations went along with it. Everything we consider to be beyond the self and one's own welfare, such as tolerance, environmental concerns, and social trust, became more important values. This shift took place in a very specific historical context, during which Estonia was on the other side of the Iron Curtain, operating within the constraints of a different system.

In the early 1990s, after regaining independence, our society underwent massive liberalisation though?
Even so, we never came to grips with many topics.

Such as?
Even homosexuality, for instance. It is incredible that even in 2018, 50% of the Estonian population still considers homosexuality unacceptable. It is true that the share of people who find homosexuality intolerable has decreased over the decades but in my view, it is still incredibly high.

Other countries have similar countermovements, but potentially proportionally smaller. Is the difference quite as dramatic as that?
People are not biologically coded to mistrust those who are not like them. Children in kindergarten are perfectly happy to play with kids whose skin colour is different, unless their parents or teachers have told them, either explicitly or inexplicitly, that this difference is a problem somehow. In the end, our values and opinions are developed through socialisation. I believe that the Estonian schools are generally a very progressive environment, but quite often, the schools are unable to override the home environment.

By and large, anti-discrimination laws have similarly come into force in most European countries. The difference is that in western Europe, the value shift initially took place among the generation that reached adulthood in the 1960s. The anti-discrimination laws that were later passed were a consequence of the value shift that had taken place in people's minds.

So, there is not much we can do to change the prevailing values in society?
Of course there are things we can do, and quite a lot. In my opinion, a party that thrives on hate speech and provocation should not have been included in the coalition government.

There are various theories on the evolution and development of values. Ronald Inglehart's theory, for example, holds that as societies become wealthier, people's values shift from survival values towards self-expression values. This is trivial and entirely logical. It resembles the Maslow pyramid*, which psychology has not been able to prove conclusively, but which intuitively makes a lot of sense and seems very credible.

The other hypothesis is based on socialisation. This hypothesis suggests that value shifts do not occur overnight. Estonia has become independent and is increasingly better off, but previous value patterns still persist. According to Inglehart, values change gradually through generational turnover: people's values are formed during the early years of their childhood and reflect the economic and social conditions prevalent at that time.

It is interesting to identify historical trends that explain modern phenomena. What are the transmission mechanisms? Indeed, national elites pass on their political history and memes. On the other hand, we know that regular people cannot see very far back in history: at best, through their grandmothers' stories to their childhoods.
The question of cultural transmission is one of the all-time-favourites in social sciences and humanities. Part of it is institutionalised: what we do on Midsummer's Eve or why we hold festive opening ceremonies to celebrate the beginning of the school year. Historical memory is passed on via experience. Headteachers organise such opening ceremonies because this is how it was done in when they were young. Naturally, small changes do take place but the overall format has remained the same for decades.

On the other hand, the transmission takes place via each person's individual story. It is passed on in tales told by our parents and grandparents.

Even so, it does not reach far beyond three generations?
True, but every grandmother had a grandmother in turn. Certain motifs will be reiterated from one generation to another. For example, for Estonians it is that we will manage no matter who rules the country: we will adapt and keep working. This is the way the nation survives.

Nowadays, Estonians speak of themselves as a forest nation. Some say this self-image has developed very recently, almost as if Valdur Mikita has narrated us into a forest people. On the other hand, we as Estonians no longer place as much emphasis on being extremely hardworking people as part of our national character. Perhaps self-image can shift very quickly?
The idea of seeing ourselves as a hard-working nation is indeed a myth. Most likely, it has its roots in our comparison with Russians. That is, we are everything that we think Russians are not: quiet, humble, hard-working and so on.

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* According to Abraham Maslow (1908–1970), human needs increase progressively: when lower-level needs have been satisfied, people try to fulfil the next tier of needs. The closer a person comes to satisfying a certain need, the more important the next higher need becomes. – ed.

Photo: Retl Kokk

"Self-withdrawal and isolation, whether biological or cultural, will prove unsustainable in the longer term," Anu Realo emphasises.

As for being forest people, it may be indeed that it has entered more deeply into the public consciousness and discourse in recent decades. In my view, even if people rarely visited or even feared the forest, they still could not do without it: the forest was always close. Now, we compare our deep forests with the relatively scarcely forested Western Europe and again, this supports our self-view as being forest people.

Do Estonians carry an existential fear of disappearing as a nation and does this fear force us to make an effort? Ultimately, the large Russian-speaking population group came here long before the 1990s as a result of the demographic policy of Stalin and subsequent leaders of the USSR. We have experienced that populations and nations can be replaced. How could we possibly view the other group that we live with as something good and familiar if the original reason for their presence was the intention of dissolving our nation?

We should remember that this plan did not work and admit that survival requires openness. If we fear for our survival, we should integrate foreign blood into ours. Self-withdrawal and isolation, whether biological or cultural, will prove unsustainable in the long term and lead to extinction.

If that's true, maybe openness should be described to people as an optimisation task rather than a yes/no problem?

In my view, several political parties addressed this idea fairly well during the parliamentary election debates last year. Of course, the message did not reach everyone equally. As psychologists, we know that it is hard for people to understand things that do not seem to fit into their existing ways of thinking and it is even harder to accept the views that are different from yours.

I am a huge patriot of Estonia, of our language, culture and people, and I passionately support the persistence of our nation. But I believe that the only way to grow is to become more open, diverse, and inclusive.

Anu Realo (1971) was elected as a Member of the Estonian Academy of Sciences in Cultural Studies in December 2018. She is Professor of Psychology at the University of Warwick, United Kingdom. In 2014–2019, she held a position of Professor of Personality and Social Psychology at the University of Tartu, Estonia. In 2012, she was awarded an Academy Research Professor position by the Estonian Academy Sciences for the period 2013–2015. Anu Realo is interested in personality and cross-cultural psychology and has conducted research on cultural and individual variation in personality traits, emotional experience, values, and subjective well-being. The focus of her recent academic work has been examining the genetics of personality traits, as well as the complex relationships among personality, health, and subjective wellbeing. In 2010, she received the National Science Award of the Republic of Estonia in social sciences for her studies on personality and stereotypes in a cross-cultural perspective. In 2016, she was awarded the Order of the White Star (IV Class) by the President of Estonia. She is the principal investigator for the World Values Survey in Estonia; in 2018, she was elected to the Presidency of the European Association for Personality Psychology.

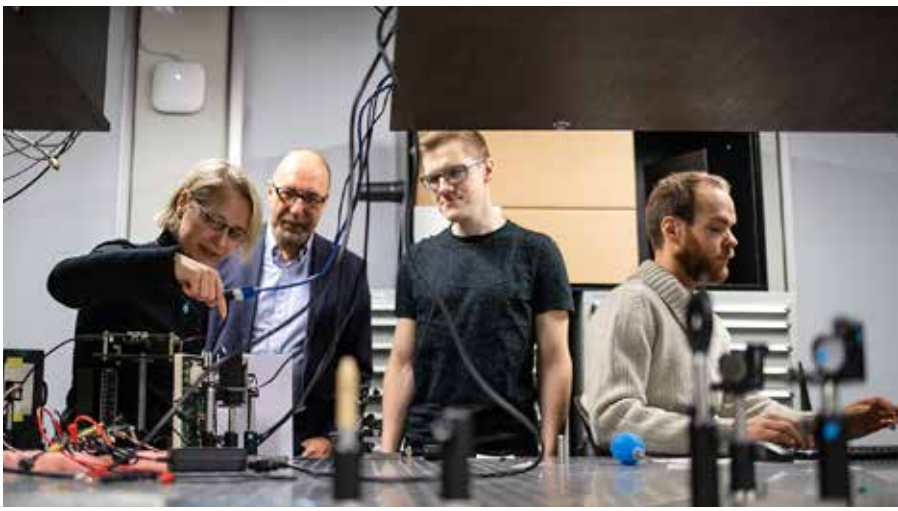
REPORT: "IN THE FIELD" WITH RESEARCHERS

Does the phrase "orders from above" ring a bell? Don't bother Googling it. In the USSR, the phrase had a special meaning. Every autumn, research institutes, factories, newspapers and other working collectives received "orders from above": "Allocate X people to work in the *kolkhoz** fields!" The respective instructions came to be called "orders from above", and the professors' and PhD degree holders' toil in potato and sugar beet fields was known as *šeflus*, or "patronage". Thankfully, modern scientists are free to dedicate themselves to cultivating research and knowledge. Taavi Minnik and the photographer Reti Kokk went to see where and how Estonia's best researchers work.

The Land of Photons

"This is a physical optics laboratory. We have been researching all kinds of light fields. But this specific group studies the use of light in new kinds of vision sensors. It is particularly important for self-driving vehicles. A lot can be done with light fields and sensors. Apart from photo cameras, there are many ways to gather information from a space as quickly as possible, and in ways that can be parsed by machines. This subject was initiated by our young researchers and several research articles have already been published," Member of the Academy and Professor of Wave Optics at the University of Tartu Peeter Saari explains the work of his research group. The experimental humanoid robot is visible around the corner.

Photo: Reti Kokk x2



Peeter Saari overseeing the work of (from the left) Member of the Estonian Young Academy of Science and Senior Researcher Heli Valtna, Andreas Valdmann and the PhD student Jan Bogdanov on an experiment at the physical optics laboratory.

Academy Member Peeter Saari being observed by the junior optics researcher Andres Valdmann.

* See footnote on page 30.

Photo: Estonian Genome Project (3x)

Andres Metspalu, European of the Year 2019 and the laureate of the national discovery award 2020.

Estonia's "Most Televised Hands"

"This is where we extract DNA from blood. We have a large robot to do it automatically. "Wet" work is increasingly rare and the work is done by robots and a couple of lab technicians. Data comes in vast sets. We have just two or three lab technicians and dozens of data scientists. We have a lot of data. We just need to find the important information in it," the head of the Estonian Genome Project and Member of the Academy Andres Metspalu explains.

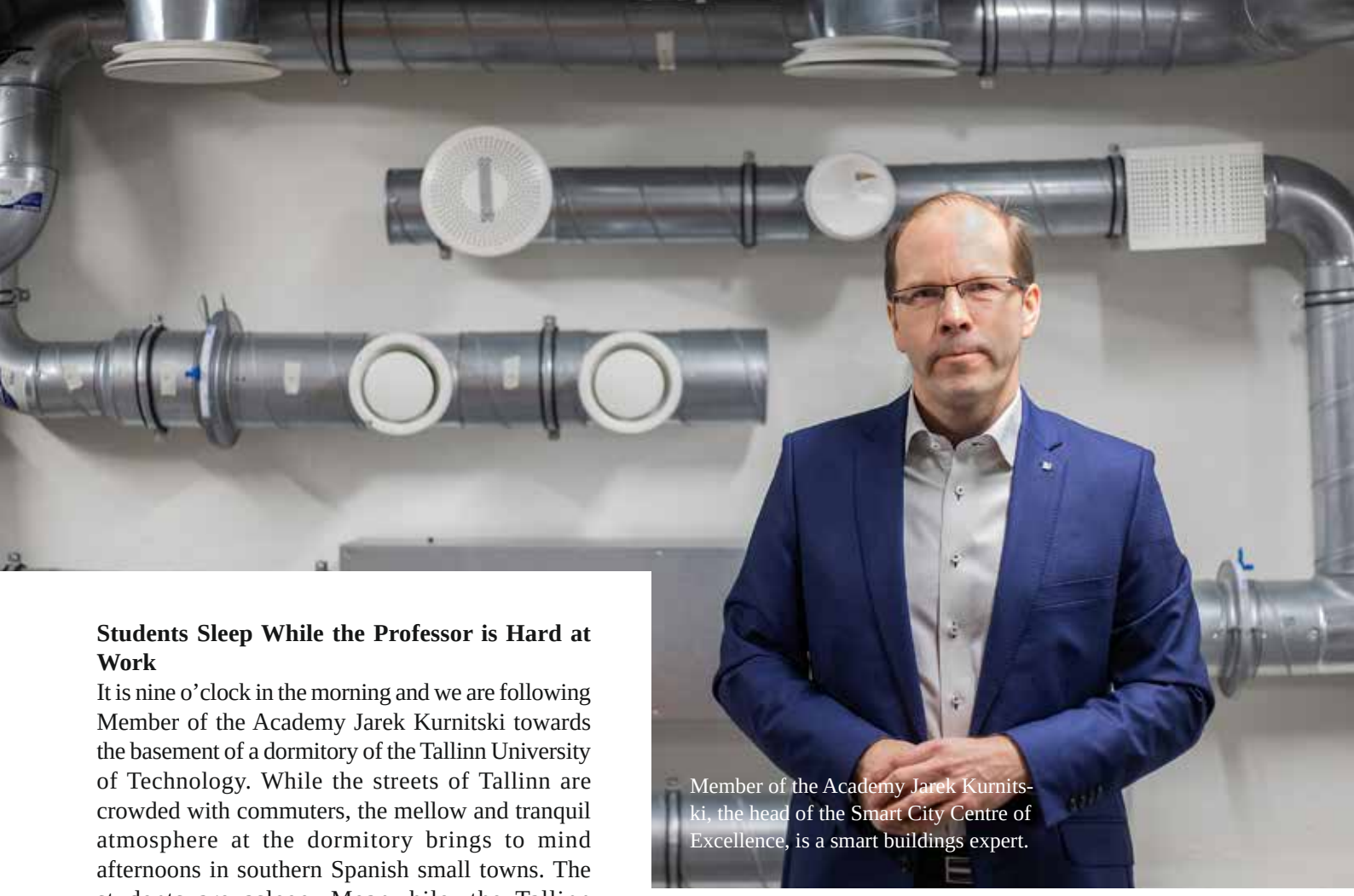
The young women working at the laboratory joke that theirs are the most televised hands in Estonia: many TV shows involving science use footage filmed at the Genome Project.

Photo: Reti Kokk

Lab technician Eva Mekk at the Estonian Genome Project extracting DNA from gene donors' tissue samples.

Lab technician Eva Mekk processing blood samples.

Head of the Laboratory Steven Smit at the biobank.



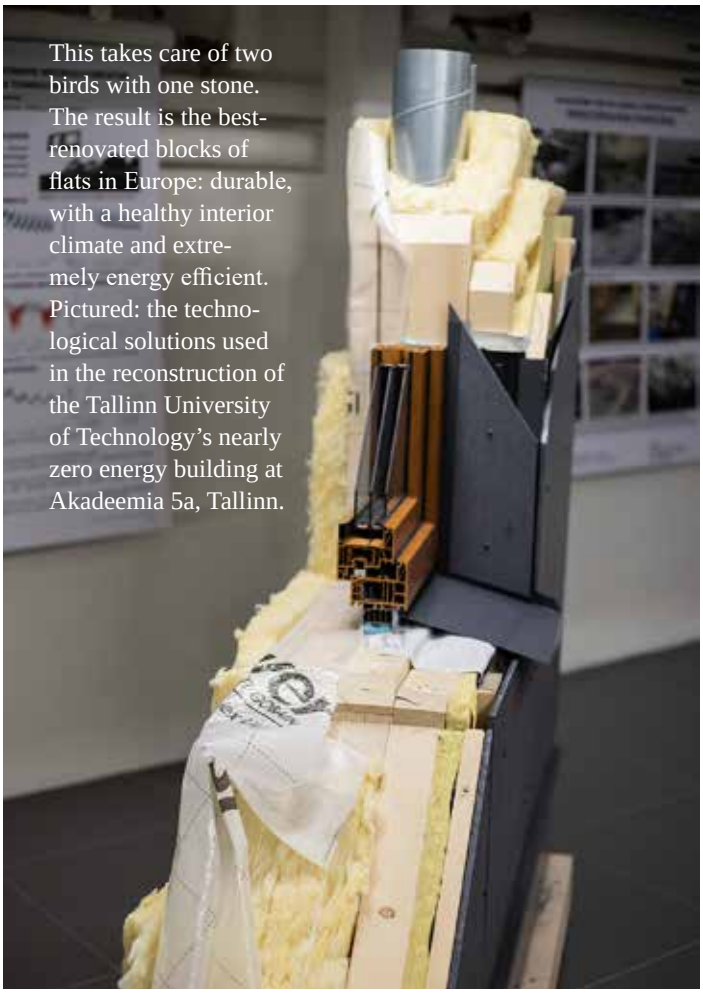
Member of the Academy Jarek Kurnitski, the head of the Smart City Centre of Excellence, is a smart buildings expert.

Students Sleep While the Professor is Hard at Work

It is nine o'clock in the morning and we are following Member of the Academy Jarek Kurnitski towards the basement of a dormitory of the Tallinn University of Technology. While the streets of Tallinn are crowded with commuters, the mellow and tranquil atmosphere at the dormitory brings to mind afternoons in southern Spanish small towns. The students are asleep. Meanwhile, the Tallinn University of Technology's nearly zero energy building study group headed by Academy Member Kurnitski is hard at work.

"The old dormitory was renovated as a nearly zero energy building," Kurnitski explains. The basement space is full of test benches and pipes. When asked about their purpose, Kurnitski answers: "This small fridge provides cold and mimics a balcony connector with a thermal break. We have also set up air leakage points. The thermal imager shows where cold air leaks out. This is a good resource for students to study cold weather and airtightness."

Member of the Academy Kurnitski presenting the Estonian Nokia: a way to simultaneously install insulation and ventilation pipes during the comprehensive renovation of blocks of flats.



This takes care of two birds with one stone. The result is the best-renovated blocks of flats in Europe: durable, with a healthy interior climate and extremely energy efficient. Pictured: the technological solutions used in the reconstruction of the Tallinn University of Technology's nearly zero energy building at Akadeemia 5a, Tallinn.

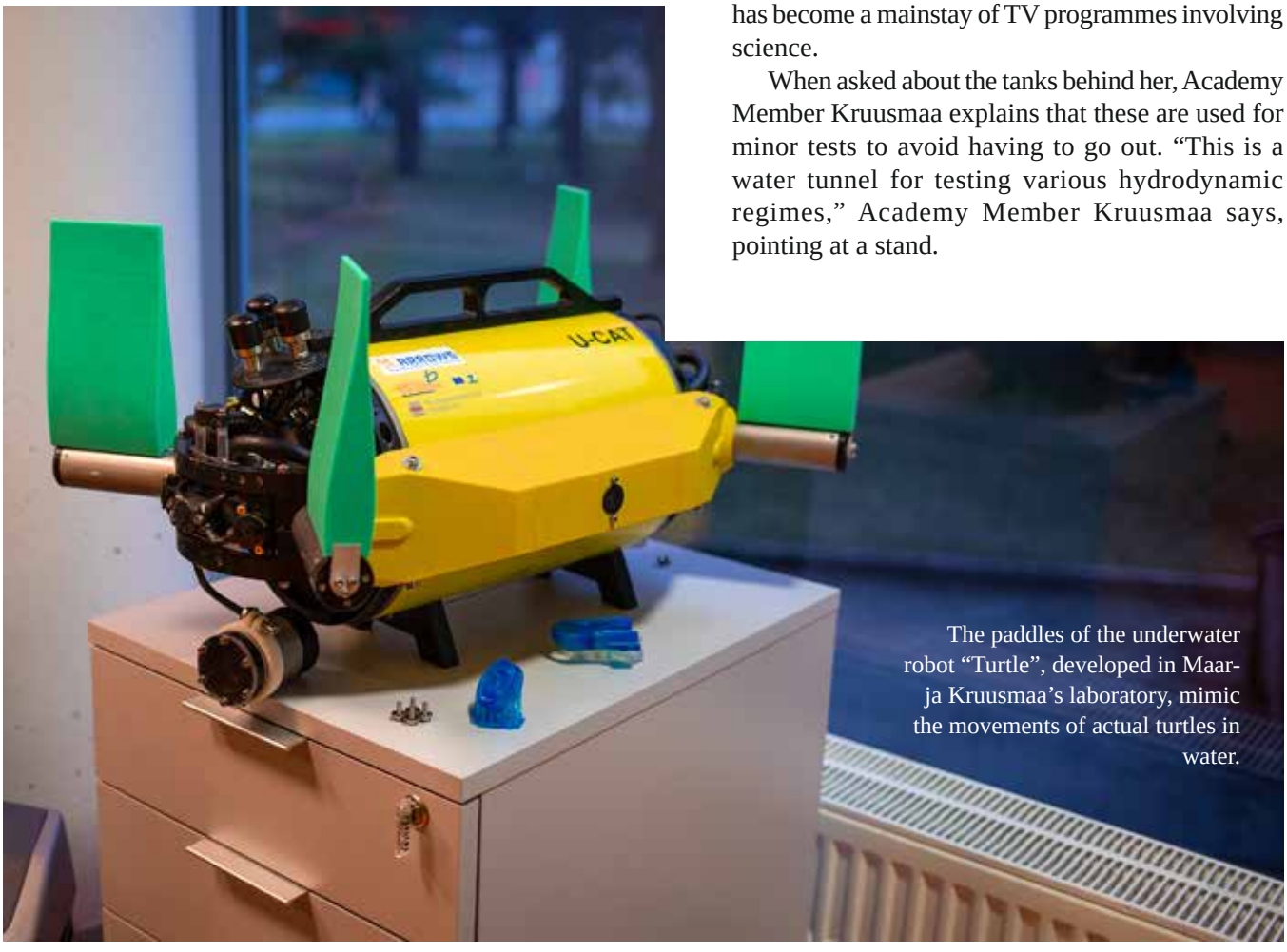
Photo: Reti Kokk x5

Expert in underwater robotics Maarja Kruusmaa is the head of the national IT centre of excellence EXCITE (Estonian Centre of Excellence in IC Research).

Yellow Submarine

"This robot was built to enter shipwrecks. It must be highly manoeuvrable: it needs to be able to get in, shoot the necessary material and get back out. We have tested it doing this, too," Member of the Academy Maarja Kruusmaa at the Tallinn University of Technology Centre for Biorobotics says. Her research group named the robot "Fish". Like Academy Member Metspalu's lab technicians, Fish has become a mainstay of TV programmes involving science.

When asked about the tanks behind her, Academy Member Kruusmaa explains that these are used for minor tests to avoid having to go out. "This is a water tunnel for testing various hydrodynamic regimes," Academy Member Kruusmaa says, pointing at a stand.



The paddles of the underwater robot "Turtle", developed in Maarja Kruusmaa's laboratory, mimic the movements of actual turtles in water.

CULTURE

THE JOY OF THE PLAY: THE ACADEMY ON THE STAGE

The Von Krahl Theatre play "JAIK" took the Academy's goal of openness to a new level, Ebe Pilt reports.

Around Christmas 2019, I happened to read Kirsten Shepherd-Barr's *Science on stage. From Doctor Faustus to Copenhagen*, which offers an excellent overview of the depiction of science in theatre through history. The book provides a reason to reconsider the Academy's 2018–2019 joint project with the Von Krahl Theatre and Vikerraadio national radio channel beyond its entertainment value. It also sparks curiosity about the causes of modern trends in the relationship between science and theatre (since science has been more frequently depicted in theatre over the last couple of decades than ever before).

The most famous science theatre stage is most likely the Faraday lecture theatre in London (officially named the Royal Institution Lecture Theatre). Since 1799, it has equally promoted the creation of new knowledge, its dissemination to the public at large and the implementation of research results to benefit society and the common purposes of life. The latter has even been considered its primary goal: the founding documents of the Royal Institution named it as its main mission (scientific studies were added later)*.

The London lecture theatre has a lovely tradition founded by Michael Faraday in 1825: the Royal Institution Christmas Lectures. The 2019 Christmas Lecture series, delivered by Professor Hannah Fry, was titled "Secrets and lies: the hidden power of maths". Hannah Fry (b. 1984) is a Professor of Mathematics at University College London, the author of three books**, a TV and radio host, a podcaster and a public speaker. Even though she is a mathematician, her attitude towards her research work is playful, even joyful, including everyday human topics, such as behaviour patterns and interpersonal relations, (online) dating and real-life applications of mathematics. An excellent example of staging science in the spirit of the joy of the play, it casts a touch of the sublime on scientific content, rather than debasing it, as some might think.

Michael Faraday realised as long as 200 years ago that theatre was one of the best ways to reach a broad audience. Today, the lecture theatre has hosted over 25,000 lectures and plays. If anything, they are only becoming more popular. While the 21st century is toppling traditional formats (such as academic seminars in the Academy hall), one of the greatest challenges facing the scientific community (including the Academy) is finding new and effective means of communication in the context of science and society. New trends and new formats require the courage to leave behind the comfort zone, as well as the openness and cleverness to use these formats for the benefit of science and society.

* Brown, M. 2007. Inside story of the Royal Institution's new-look theatre. LONDON BLOG: http://blogs.nature.com/london/2007/11/13/inside-story-of-the-royal-institutions-new-look-theatre.

** The Mathematics of Love: Patterns, Proofs, and the Search for the Ultimate Equation (2015); The Indisputable Existence of Santa Claus (2016, co-authored with fellow mathematician and colleague Thomas Oléron Evans); Hello World: Being Human in the Age of Algorithms (2018).

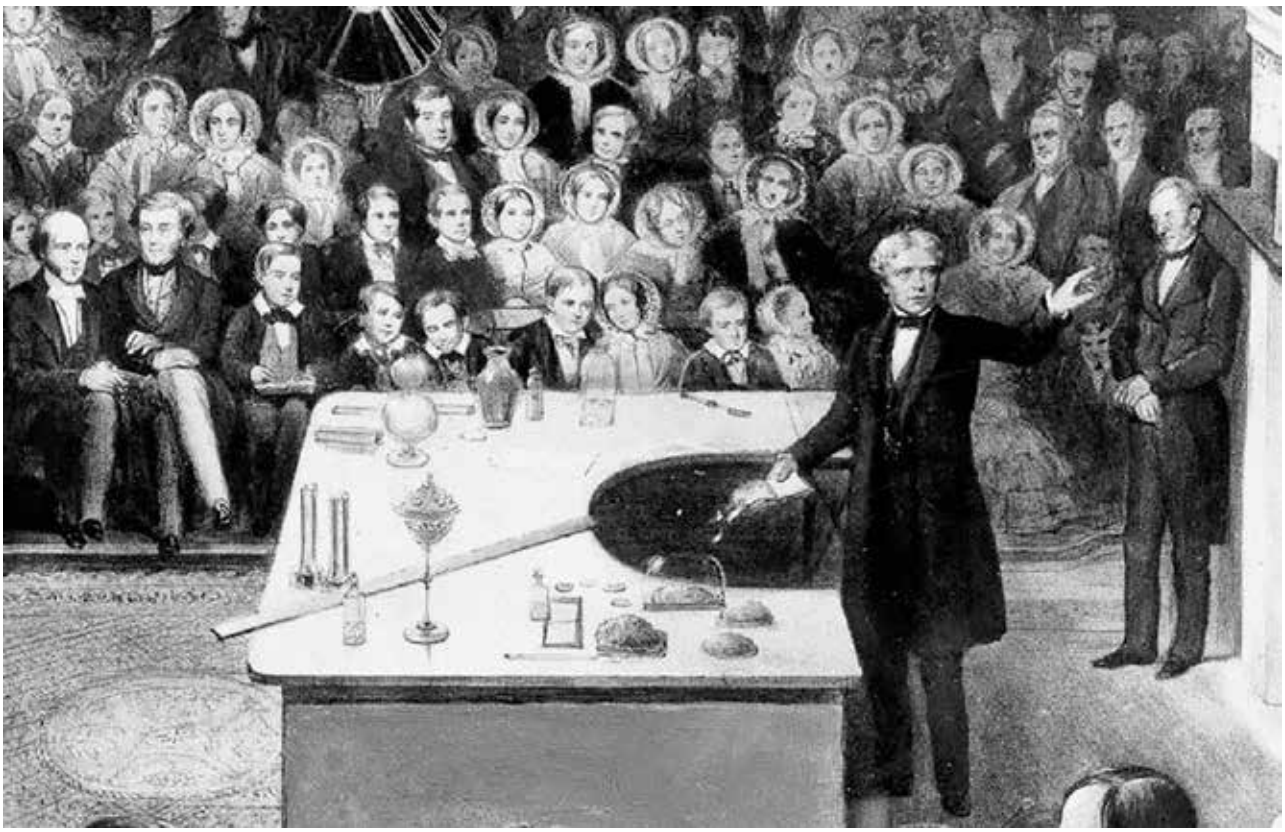
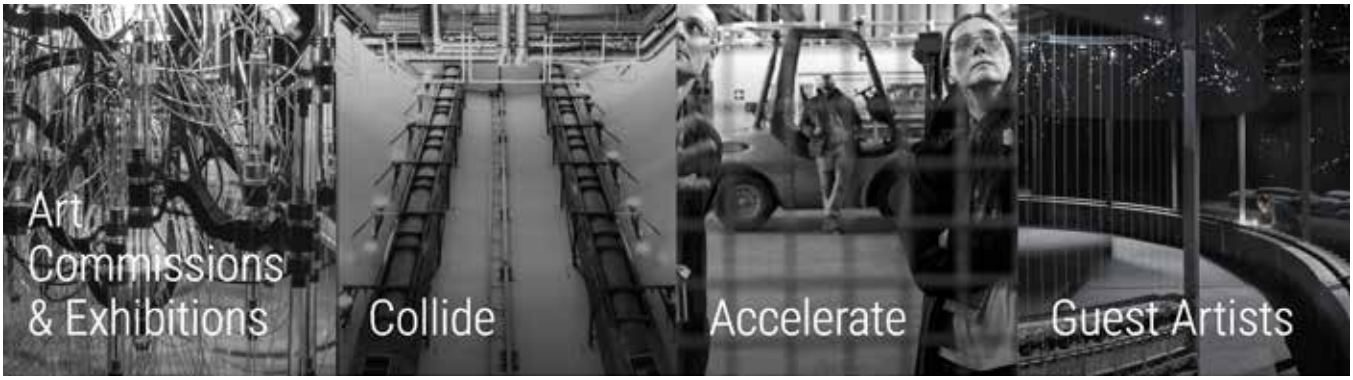


Photo: Wikimedia Commons

Michael Faraday delivering a Christmas lecture. A detail of a lithograph by Alexander Blaikley (1855)*.



Screenshot from the home page of the CERN art project.

Theatre plays and entertainment in general are not end goals: they are means of content creation with the end goal of expanding visibility and credibility. As a rule, the atmosphere in a theatre hall is more permissive and more open than in a strictly academic auditorium, freeing the public from their fears and subconscious complexes (including those related to science). Those complexes can be insurmountable in some ways, yet are easy to develop, particularly in the light of C.P. Snow's two-culture theory** which places science in a completely different culture than theatre.

Now, collaborations between researchers and actors attempt to bridge the gap between the two cultures by creating plays in which researchers and actors (or artists in general) think and work in a shared flow to bring together two mutually "hostile" cultures, cross the barriers of thought and vocabulary and stage plays that promote

* Lithograph, Alexander Blaikley (1816–1903). Notes and Records of the Royal Society of London, 2002, volume 56, page 370, https://commons.wikimedia.org/w/index.php?curid=4124440.

** Snow, C.P. The Two Cultures. Cambridge University Press, 1959.

Extract from the introduction of the play: ... Experiments, soil samples, antennae, instruments and pipes. Faustian researchers like cartoon heroes sit at their desks in crinkled overalls, waiting. For a signal. For an answer. Then, they stumble to their object. The vast universe around them remains incomprehensible. Yet the hope for answers keeps researchers in their research stations, year after year. They may be comic, and yet everything hinges on them*.

the goals of both art and science. In the broad sense, after all, both sides are preoccupied with finding out how the world works. Only the means are different**. Another example of attempts to bring together the means are the CERN "dialogue projects"***, blending art and science. They are complex arrangements where complex distinctions, rather than colliding, guide us into the depths of both art and science. It seems that sometimes entirely irrational motivators may lead us closer to understanding rationality****.

As part of the scientific world, the Estonian Academy of Sciences is subject to the impact of changes taking place elsewhere. We may not have a famous Faraday theatre or CERN art projects to play with mathematics or physics, like Professor Fry does, but the trends have reached us as well (even if on a smaller scale).

In autumn 2019, the Von Krahl Theatre staged the major five-hour epic play "JAIK"*****. The Academy of Sciences contributed to its preparation. This was not the first time a small alternative theatre had roped the Academy into its projects. The first time was during the preparation stages of the 2017 NO99 Theatre play "Päev pärast vaikust" ("The Day After Silence"), when the playwright Eero Epner requested that President of the Academy Tarmo Soomere consult and discuss with his troupe (in order to study an active researcher at close range). The results of the discussion were printed in the programme******.

Von Krahl's "JAIK" was largely a science fiction-inspired fantasy, a dramatic blend of possible and impossible realities. Its preparation, however, resulted in a lecture series. Held a year ago, this series as a process was an

* https://no99.ee/lavastused/no35-paev-parast-vaikust. See also: T. Soomere. Märkamatu intervjuu: märkmed kohtumiselt NO99 teatri trupiga. Published in: "Truudus Eestile" (*Loyalty to Estonia*), Argo, Tallinn 2017, 316–319.

** Mermikides, A. The scientist center stage. Nat. Immunol. 14, 416–418 (2013) doi:10.1038/ni.2592, https://www.nature.com/articles/ni.2592.

*** ARTS AT CERN: When Art Meets Science, https://arts.cern.

**** Brunello, A., Echard, P. & Oss, S. From science to theatre. Nat. Nanotechnol. 14, 402–403 (2019) doi:10.1038/s41565-019-0445-7, https://www.nature.com/articles/s41565-019-0445-7.

***** https://www.vonkrahl.ee/etendus/jaik/.

****** See also:T. Soomere. Märkamatu intervjuu: märkmed kohtumiselt NO99 teatri trupiga. Published in: "Truudus Eestile" (*Loyalty to Estonia*), Argo, Tallinn 2017, 316–319.

Photo:Screenshot from the website of the NO35 play "The Day After Silence"

intensive and rather novel experiment for the Academy. Far from novel in the world at large, it is nevertheless a milestone marking a new level of openness for our Academy. The Academy's participation in the small alternative theatre's art and science project was, on the one hand, thoroughly reasonable: it allowed us to make a connection to a broader, completely different audience that might never have come to the Academy to attend a scientific seminar. On the other hand, it took a certain degree of courage to overcome the widespread, even dogmatic view of activities being worthy or unworthy of the Academy's dignity.

The key to such theatre projects is to shatter an archetype, at least for a moment, so that the way of hinking prevalent in the Academy can stand (and, in fact, should stand) side by side even with the most esoteric of attitudes. Each lecture at the Von Krahl culminated with a summary by the President of the Academy. The summaries at the end of the lectures countered, if necessary, even harsh pseudoscientific attitudes. The twelve concluding vignettes (as they were called by the director and promoter of "JAIK", Peeter Jalakas) were turned into a series of articles published in various newspapers over the course of the year and ultimately handed out as a supplement to the programme of the play (called the travel magazine of JAIK Tours).

The thoughts of the President of the Academy created at least a theoretical possibility that the academic way of thinking might touch, and perhaps slowly and barely perceptibly affect, some people who think differently (because thoughts that have been thought cannot be unthought). That is also why the Academy would be wise not to ignore or rule out any subjects. Ignoring them would not help change the world or improve our society. Each topic can be given a knowledge-based answer without insulting or hurting anyone. It would be nice to think that this way of popularising science would fit the Academy, too: a style that, instead of destroying, helps create a new, shared thought space (even if on an initially very small common basis).

The project at the Von Krahl Theatre ensured that the academic way of thinking reached many who would normally prefer mysticism, magic or other alternatives to the part of culture populated by science.

The Von Krahl theatre's choices of lecturers and topics were probably thoroughly considered and rather provocative. The Academy would have chosen differently; it says a lot that the Academy managed to cooperate rather than intervene. It was thought important to trust the dramaturges, because theatre generally possesses a deep critical understanding of current developments in society. As a result, happenings in theatre and art should be closely observed and, if possible, engaged with: in general, they reveal societal pain points that would be easier and more convenient (including for the Academy) to arrogantly ignore.

The project (or perhaps we should say experiment) at the Von Krahl Theatre ensured that the academic way of thinking reached many people who would normally prefer mysticism, magic or other alternatives to the part of culture populated by science. In this sense, theatre is an excellent medium (perhaps even superior to film or literature) for popularising science, because good theatre can captivate the audience and get it directly involved*.

* Shepherd-Barr, K. Science on Stage: From Doctor Faustus to Copenhagen. Princeton University Press, 2012.

HISTORY

"OUR" FIRST ACADEMY MEMBERS

Deciding which legendary modern researchers are "ours" is a tricky matter, the historian Andres Adamson writes.

It is hard to say how many Academy members we had before the founding of the Estonian Academy of Sciences and who they were. Or rather, this question is impossible to answer conclusively. At best, we can discuss general developments and present examples. Why?

First of all, we would have to start by defining "us". Limiting it to only ethnic Estonians would make it relatively straightforward. Nationality is primarily a culture-based phenomenon; before the creation of Estonian-language higher education, technical vocabulary, personnel etc., following higher research ambitions required ethnically and linguistically Estonian aspirants to adopt what for all practical purposes amounted to another nationality. An Estonian-language university, science and top researchers came into being only with the establishment of our own republic a century ago. They were preceded by initiatives, efforts, preludes, and by the non-Estonian-speaking scientists in our land.

Choosing to claim as ours all scholars born in Estonia or connected to Estonia, however, opens a whole new can of worms. In many cases, nothing connects them to us but the fact, or accident, of having been born in this land. And then there were others who worked or studied at the University of Tartu, which played a fairly special role in the 19th century in particular, and yet are not "ours" in any other sense, either by origin or through integration.

Generally speaking, we are now leaving behind juvenile attitudes that are rooted in an ethnocentric mindset or a sense of inferiority, and we now consider at least the many Baltic German researchers who were born here as "ours". But not even this small group of people is clearly defined, and the territorial approach is equally fraught with problems. If we consider Baltic Germans as a local, regional sub-ethnos (while also drawing a distinction on the basis of whether they were born in Estonia or Latvia, to include the former and exclude the latter: for example, even though one of the founders of physical chemistry, Wilhelm Friedrich Ostwald, studied and worked in Tartu, he was a Latvian German), matters are fairly clear-cut.

But some researchers otherwise connected to Estonia, including various academies' full members, correspondent and honorary members, were born outside the home(s) of Baltic Germans in Estonia, Livonia and Courland, e.g. in the imperial capital St. Petersburg. Where would they fall in this scheme? Sometimes, we tend to count certain persons outside this sub-ethnos among Baltic Germans. For example, we consider among "our" famous explorers Admiral Friedrich Benjamin von Lütke, the President of the Saint Petersburg Academy of Sciences in 1864–1882, who also served as the military governor of Tallinn and was part of the Estonian knighthood as the landlord of Avanduse in Viru County, but who was born in St. Petersburg and had an Imperial German rather than Baltic German background. There were, and are, many Russianised Germans, such as Fjodor Petrovich Litke (as well as Russianised Swedes, Estonians, Latvians, Finns etc.), and their connections to "us" are generally indirect.

Furthermore, the "National Awakening" of the 19th century was not limited to Estonians and Latvians. Similar processes had developed among local Germans and at least educated Russians even earlier. At some indistinct time, the Baltic German people who had some roots and ancestors in common with us ceased to be "ours", a local, Estonian

and Latvian phenomenon, and became part of the larger German nation in more senses than that of a shared written language and cultural sphere. Initially, in mind only, they became part of Germany. They became German by their attitudes and goals: in a word, politically.

By the way, political Greater Germanism, German nationalism in the aggressive form that characterised it before and during the world wars, developed nearby, initially largely related to the University of Königsberg and with vigorous offshoots in Riga and later at Tartu University, at the edges of the German linguistic and cultural sphere, formerly (as in East Prussia, Pomerania and Brandenburg) and contemporarily (as in Latvia and Estonia) predominantly non-German areas, and essentially colonised land.

The more conservative Baltic Germans, often with higher status, particularly Estonian Knighthood, discouraged the change, yet they were quickly outnumbered. At that point, local language communities parted ways and place of birth lost its former meaning in separating **us** from **them** and **ours** from **others**.

Should we consider the nationally and politically German scientists who were born and worked in Estonia after the break as ours? Subconsciously, we probably do, but not otherwise, no matter how famous and successful they were and how many academies they were members of.

For example, the great German historian Johannes Haller (16 October 1865, Käina – 24 December 1947, Tübingen), probably the single most renowned German historian in the 1920s and 1930s, was the son of a pastor and was born in Käina in 1865, grew up on the island of Hiiumaa, studied at the University of Tartu and worked in Estonia for another couple of years; he was a full, foreign and honorary member of multiple academies and scientific societies; despite all that, we would be hard pressed to consider him one of "our" people who had worked abroad. Barely anybody in Estonia outside a small group of specialists has even heard of him.

Similar questions could be asked of local Russian scientists; furthermore, unlike in the case of Baltic Germans with whom our ways parted for good eight decades ago, these questions would still be relevant and topical.

In short: the matter must be approached on a case-by-case basis, non-formally. For the sake of balance, let's consider (as food for thought) an opposing example: is the foreign-born, Russian-speaking Jewish scientist Juri Lotman, the founder of an entire academic school at the University of Tartu and in Estonian research, one of "ours" or not? This question was settled long ago by his election as a Member* of the Estonian Academy of Sciences, but it exemplifies the matter well.

Next, we need to define who and what we consider to be an academy and members of an academy. The origin of

Photo: Reti Kokk

The historian Andres Adamson.

the term "academy" is well established. The philosophy school founded by Plato in Athens, and called an academy, persisted for over nine hundred years in spite of multiple interruptions and changes in form, until it was finally ended by Emperor Justinian in 529 AD. The name "academy" was later adopted in early higher education and was reborn during the renaissance as a term for scientific, or, in a broader sense, cultural societies. Many such societies subsequently came into being and disappeared, especially in the Romantic era; some of those focused specifically on sciences, but most harboured more general cultural ambitions.

Below, we will consider the previously mentioned Saint Petersburg Academy of Sciences. It was formally established in 1724 by Peter the Great and came into being in 1725 during the reign of Catherine I as an academy of sciences and "interesting" arts. A dedicated Academy of Arts was created only in 1757/1764. The first ethnically Estonian academy members were members of academies of arts rather than of sciences: an early example is Johann Köler in Saint Petersburg.

In our land, the creation of the first academies, in the sense of learned societies, was delayed by a cultural interruption arising from the Reformation and took place

* That was a complicated matter in its own right and may be elucidated in the future – ed.

Photo: National Archives of Estonia

During certain periods of the 19th century, the University of Tartu was the sole scientific university in the entire Russian Empire. Pictured: the main building of the University of Tartu in the last quarter of the 19th century.

only in the mid-17th century. Estonia was part of the Swedish Empire at the time and the initiative was led by the young, intellectually curious Queen Christina. The formerly poor and backwards Sweden began to change and develop during her reign. The constant foreign wars initially enriched only the upper class, but the loot carried off from Saxony and Bohemia and stored in the treasuries in Stockholm during the Thirty Years' War included numerous books, paintings, sculptures and other objects of culture waiting to be put to good use; learned refugees arrived in the country and the Swedes' cultural horizons started to expand.

Among other foreign intellectuals, the Queen managed to persuade the great René Descartes to join her court specifically for the purpose of founding an academy of sciences in 1649. Descartes, a Frenchman, soon caught a cold in the foreign climate (the story has it that he was dashing across a courtyard, lightly dressed, to heed the Queen's sudden call, but this is unlikely since they managed no more than a couple of brief meetings) and died of pneumonia, but he had submitted a plan in 1650 and the new society met a few times. It is likely that the Swedish polymath, cultural hero, poet and bully Georg Stiernhielm (1598–1672), who had spent his best decades in Tartu as an assessor at the Livonian *hovrätt* court, a member of the *Landrat* and the owner of the Vasula manor, was involved. Does that make him one of "our" first academy members or not?

Christina abdicated her throne soon afterwards, converted to Catholicism, made her home in Rome, founded at least three more academies, offered the garden of her palace by the Tiber (the Palazzo Corsini) as a meeting place for another academy, supported two more and, after her death in 1689, the influential, mainly literary Accademia dell'Arcadia was (re-)established in her memory. Christina retained her ties to our land during her life abroad, partly because Saaremaa was part of her retainment (*underhållsland*). Therefore, some of our countrymen could theoretically have been involved in her academies. But let us not found our hopes on such a slim chance, nor delude ourselves about the level of advancement of the period.

Let's take, for example, the University of Tartu – or rather the Tartu-Tallinn-Tartu-Pärnu Academy – during the Swedish times. How many doctoral theses are known to have been defended there? The correct answer is none. Or let's consider the story of Christina's first academy in Rome, the Accademia Reale, which discussed whether day or night, sunshine or moonlight, was the most conducive to poetic inspiration. The great scientific conclusion that moonlight was best was celebrated with a ballet starring the twelve hours of night and a star.

The current Royal Swedish Academy of Sciences was founded only in 1739. Almost from the outset, it included Baltic German members, later on people specifically connected to Estonia, and in recent decades even Estonians.

We can speak more confidently about Academy members of Estonian origin in the Saint Petersburg Academy of Sciences. This Academy was established in the brand new capital of the Russian Empire in part because the reputation of a developing major power that would exercise an influence in European affairs seemed to require the existence of an academy (everybody else had one!), and in part in the long-term view to modernise Russia and bring it culturally closer to Europe. The material base of the Academy – books, instruments and objects of art – had been looted from the Baltics during the war or bought in Europe, the buildings, still standing, were constructed on the Universitetskaya (University) Embankment at the River Neva (the Academy itself, however, has been based in Moscow for the last century), and the state provided the finances.

Initially consisting of foreign invitees (including thinkers such as the mathematicians and engineers Johan Bernoulli and Leonhard Euler), the Academy intended to train its own future members. For that purpose, it was supplemented with the first academic gymnasium in Russia and a very small university, initially with just a few and later with about twenty students. Russia did not yet have any researchers in the Western sense. They had to be trained.

The Russian cultural model had been completely different before Peter the Great's time. Western products, skills, know-how and experts had simply been imported as necessary. This is far from unique in history and continues well into the present: let's consider, for instance, the Muslim world (not during the early or later Medieval period, but in the Age of Oil), or Sweden under Queen Christina.

The first four presidents of the Saint Petersburg Academy were foreigners. The first, Laurentius Blumentrost, was a Russian-born German; the next two, Hermann Karl von Keyserling and Johann Albrecht von Korff, were Courlanders, and their successor, Carl Hermann von Breven, had been born in Riga. None of the presidents were, in fact, scientists. Blumentrost was one of the czar's personal doctors and the other three were diplomats. This lent significant weight to the role of the Academy's chancellor, advisor and secretary, a post long filled by the Alsace-born Academy member Johann Daniel Schumacher. Also German (though from an area ruled by France), Schumacher maintained his leading role for decades; the position of president even stayed empty for a time.

Photo: National Archives of Estonia

Wilhelm Ostwald was born and raised in Riga, his father had come to Livonia from Germany and the family's roots were in Hessen and Berlin. He is currently the only Nobel Prize winner who graduated from the University of Tartu.

The following story captures the spirit of the period in which "our" first "real" Academy member lived and worked. Late on the evening of 26 September 1742, by the Gregorian calendar, a small gathering was underway at the Academy's herbal garden caretaker Johann Sturm's home. The small flat, consisting of two rooms and a space in the attic, was situated on Vasilyevsky Island, Line 2, on the ground floor of a wooden block of flats used by the Academy. The ground floor was the building's only floor; below it stood a heated cellar (later used as a chemistry lab by the famous Lomonossov) and above it the aforementioned attic; the other two flats had five and three rooms, respectively. The building, designed by Schumacher's younger brother (a reasonably good architect whose work is known to this day), had formerly belonged to the Academy's previous president, Brevern (the position was vacant at the time).

Photo: National Archives of Estonia

Academy Member Friedrich Smith joining in a toast at the international geology congress of 1897.

The other guests shared to a greater or lesser extent the host's background: Baltic or Imperial Germans who had come to Saint Petersburg in the hope of finding well-paid positions and forging careers; not of noble descent, they were reasonably well-educated and had done well for themselves in Russia. The host's Russian wife was heavily pregnant and even his father-in-law was present. The evening was well underway, there was plenty of food and drink and the spirits ran high. Collars were loosened, and wigs taken off and hung on a special stand. Deep in conversation, the guests initially ignored the sudden commotion in the hallway.

Suddenly, the door flew wide open and a glowering giant strode in. Though clad in the Western fashion, complete with a gentleman's straight sword on his hip, he was clearly Russian. Behind the man, the Sturms' Russian maid was nursing a black eye and a bleeding ear, sniffling and holding together a ripped blouse; the uninvited guest's manservant hovered further back. The startled attendees recognised the Sturms' neighbour in the three-room flat, a famously ill-tempered man.

The party-crasher cast a stormy look across the room and roared at Sturm that the latter's lowlife guests had stolen his cape. The genteel petite bourgeois Germans were stunned into silence, until one of them, Doctor Braschke, a medic at the Ingrian infantry regiment, pointed out that such accusations were unbefitting of decent people. The ruffian wasted no more time talking, punched the good doctor in the face, got hold of the wig stand and started pummelling the guests with it, calling the manservant to his aid.

The hapless Sturm knew he wasn't a match for the man, jumped out of the window and ran down the street in search of patrolling soldiers. Another guest, a functionary at the *Kammerkontor* for Livonian and Estonian affairs (a state institution roughly equivalent to a current ministry, which was designed to handle matters pertaining to the local nobility that had its own language, religion, laws and affairs), Johann Donart, followed suit. He was ultimately the one who fetched the guards.

The scoundrel had meanwhile shattered a mirror, repeatedly punched the pregnant lady of the house and called her a tramp, pulled his sword, wounded a few guests

Photo: National Archives of Estonia

The Estonian Academy of Sciences was founded in 1938. The average age of its members was slightly above 50 in 1938; half of the members had received their higher education outside Estonia and four had fought in the Estonian War of Independence. Pictured: the first meeting of Academy Members in Tartu on 20 April 1938.

and put a dent in the door. The fight had spilled into the courtyard; the guests had managed to draw their swords, inflict a few light scratches on the villain and blacken his eye. The arrival of the guards brought momentary calm, but when one of the soldiers demanded that the aggressor surrender his sword, the latter punched the soldier in the face and tried to draw his blade again. He was subdued through a group effort and taken away.

At the main guard post, the detainee maintained a challenging attitude, rejected any blame and insisted that neither the police nor the regular judicial authorities were competent to handle him. Matters pertaining to him lay in the sole purview of the office of the Academy of Sciences, because, gentlemen, he was a member of the "academic conference". He was taken under guard to his requested destination two days later, and, to general astonishment, he walked out a while later as a free man. His short way home took him past Mrs Sturm, whom he insulted and promised bloody revenge for the injustice done to him. Another two days went by and he was summoned to the Academy office by the Academy secretary Schumacher. Our bully responded that he could not come and requested that a doctor be sent. Schumacher dispatched Doctor Wilde at once.

In fact, the scandalous blackguard was the Academy's physics adjunct Mikhail Lomonossov, who knew all too well that Schumacher – whom Russian-language history has consistently, misleadingly, yet likely intentionally depicted as Lomonossov's relentless foe – would protect him no matter what. Lomonossov was the Academy's long-time de facto head's personal (though in hindsight, Greater Russian, and hence national) project, a young man personally selected by Schumacher many years before for his many obvious talents, whom the chancellor intended to make – and soon did make – the first Russian professor and the first Russian full member of the Academy.

That was the purpose for which Lomonossov had been taught at the Academy's gymnasium and tiny university, dispatched to German universities, brought back with great difficulty and forgiven for all manner of sins. Lomonossov responded to the good will with a singularly characteristic arrogance, contempt and lack of gratitude, which in any other case, with any other benefactor, would have seen the man kicked to the curb.

Barely a week later, the Academy underwent a temporary coup. Schumacher's enemies accused him of wasting the crown's money and sundry other sins; he was put under house arrest and his activities were investigated. Lomonossov has been thought to have initiated the whole ordeal, but this is probably not true; after brief consideration, however, he realised which way the wind was blowing and joined Schumacher's opponents. His gambit failed:

the investigating committee concluded a few months later that the only shortcoming in the Academy's huge household was the disappearance of a hundred roubles' worth of spirit. The wheel turned and Schumacher was reinstated. It does not take a great deal of imagination to guess Lomonossov's response.

Lomonossov (and more so his biographers) made a point of highlighting his Russian-ness, because that was ultimately the foundation of his career. No matter how talented – and there is no doubt that he was talented – without the previously described support, his foul character, fuelled by binge drinking, would have forever denied him the self-actualisation opportunities that made him famous. His anti-German attitudes also didn't hurt.

As stated, his success was rooted in his Russian origin; this required that he be contrasted with non-Russians, and most of the non-Russians at the Saint Petersburg Academy were Germans. They were initially Imperial, and later Baltic Germans. On the one hand, that is all there is to say. On the other hand, Lomonossov himself had long studied and lived in Germany and had even married a German woman – in the reformed, i.e. Calvinist church, no less, blowing off the Russian Orthodox faith entirely – he had Imperial and Baltic German friends, etc.

One of these friends was probably the first Estonian-born Academy member in a sense close to the current meaning of the term, Georg Wilhelm Richmann (1711–1753) from Pärnu. He was the first who was definitely "ours"; furthermore, far from being a poet or other suspicious humanities type, he was a physicist, an inventor, an experimental researcher, and a martyr for science! The Saint Petersburg Academy was a national institution, the only contemporary research institution in the Russian Empire, and in the general sense, all of its academic staff were commonly called Academy Members.

In the stricter sense, only professors were considered to be Academy Members: after all, the Saint Petersburg Academy was also an institution of higher education. Member of the Academy was a position rather than a title. Regular professorships were few and far between, and those who had reached the necessary education level could be appointed as adjuncts (junior researchers or lecturers, usually pre-thesis defence) and later professors extraordinarius (now docent) until a full professorship became available. Richmann had been accepted into the Academy in 1735, first as a student, then, in 1740, as an adjunct, in 1741 as an extraordinary and in 1745 as a regular physics professor: a Member of the Academy in the strict sense of the word. His peer and friend Lomonossov became a chemistry professor in the same year.

Richmann's main source of renown is his death at work carrying out a scientific experiment. Atmospheric electricity was among his many research interests and he had invented the lightning rod at the same time as the American Benjamin Franklin had; however, rather than safe grounding of the lightning to eliminate fire hazard, the goal of his invention was "canning" the strikes. Quite literally so: his equipment of choice was the Leyden jar, the first means of preserving an electrical charge, which had been invented by two independent researchers in 1745–1746. Richmann equipped the jar with a metallic electrometer with a silk pointer, which he kept on improving through experiments. In 1752, Franklin had proposed that it might be possible to catch lightning using metal rods or wire; he had carried out experiments using a kite and grounding wire, and similar tests had already been conducted in France.

Photo: National Archives of Estonia

Member of the Academy Ferdinand Johann Wiedemann did great service on the research of the Estonian language. A language prize bearing his name has been awarded to recognise notable researchers of the Estonian language since 1989.

It is unclear whether Richmann had heard about the experiments or had come up with the same idea independently, but he was conducting similar tests at about the same time. On 6 August 1753, upon hearing approaching thunder, he hurried home from the Academy and set up his "lightning machine". Richmann succeeded in catching a lightning strike with the iron rod and wire set up on his rooftop, but this time ball lightning came forth from the

ungrounded device. It struck his forehead with a loud bang, killing him and even bursting the shoes on his feet. His assistant, Ivan Sokolov, better known as a copper engraver, who was in the same room but at some distance, was thrown over in his chair and deafened temporarily, but was otherwise unharmed.

The role of the Saint Petersburg Academy gradually changed as new universities were established in Russia: first Moscow University in 1755, with the next ones nearly half a century later. This is where the University of Tartu, which was reopened in 1802, and its special role came in. Lacking a language barrier with the German-speaking cultural and research space, the University of Tartu remained essentially the only research university in the Russian Empire for decades. Other universities were more concerned with teaching existing materials than researching new knowledge. That is also why the Professors' Institute, where lecturers for other Russian higher education institutions were trained, operated in Tartu for a period of time.

Meanwhile, the Saint Petersburg Academy of Sciences relinquished its functions as a higher education institution, while remaining a kind of ministry of research. Regular and extraordinary professors were replaced with regular and extraordinary Members of the Academy, each of whom was tasked with a set of duties full of bureaucratic routines. While the Academy had some correspondent members, accepting the position of a regular Member of the Academy required resigning from any other positions and moving to Saint Petersburg (with certain exceptions, such as the Tartu University astronomer Friedrich Georg Wilhelm Struve, also commonly considered to be one of "ours", who was, in fact, an Imperial German). Not all of those who were offered the position of Academy Member were necessarily inclined to accept it; therefore, the election of each member had to be preceded by advance preparations, discussions and job interviews.

Concerned by the turmoil of the French Revolution, Russia was meanwhile distancing itself from the world, the proportion of foreign researchers recruited to the Academy from Europe was decreasing and the role of domestic researchers whose backgrounds, due to the reasons explained above, were commonly related to Tartu was increasing. These researchers formed an absolute majority among natural scientists in particular for a long period of time. The majority decreased over time, but the situation remained stable until the second half of the 19th century.

In total, roughly a hundred scholars from Estonia or who had close ties to Estonia were elected members of the Saint Petersburg Academy of Sciences during the Russian Empire. Researchers, such as the polymath Karl Ernst von Baer, primarily known as the founder of the research field of embryology, the physicist Heinrich Friedrich Emil Lenz, the geologist Gregor von Helmersen, the biogeographer, explorer, zoologist and agronomist Alexander Theodor von Middendorff (who was born in Saint Petersburg, but whose mother was Estonian, a fact that he neither advertised nor denied), and the linguist Ferdinand Johann Wiedemann, who created an Estonian-German dictionary whose influence on our language lasts to this day, need no further introduction.

Photo: National Archives of Estonia

The Struve family was originally from near Hamburg. They are frequently considered to be Estonian researchers despite their origin. Pictured: Friedrich Georg Wilhelm Struve's astronomer son Otto in his old age.

The balance began to shift during the last third of the century, partly due to the general Russianisation efforts of the imperial government, which led to the Russianisation of the University of Tartu and an emigration wave among Baltic German intellectuals to Germany, and partly through the influence of other developments and regressions briefly touched on above. But the following period is a matter for another story.

BRIGHT MOMENTS: NEWS FROM SCIENTIFIC SOCIETIES AND INSTITUTIONS ASSOCIATED WITH THE ACADEMY

Scientific societies and associations whose activities and goals are in line with the Academy's and who are not part of its structure can associate with the Academy. Association takes place by a bilateral agreement laying down the goals of the association and the duties and obligations of each party.

In 2019, the Academy entered into association agreements with three societies: the Academic Theological Society, founded in 1912; the Estonian Mathematical Society, founded in 1926; and the Estonian Association of Sociologists, founded in 1990. At the time of writing, the Academy had 23 associated societies and associations and seven associated research and development and cultural institutions.

Institute of the Estonian Language

Proclaimed as the Year of the Estonian Language by the Ministry of Education and Research, 2019 was a special year in the history of the Institute of the Estonian Language. The institute organised numerous events. The highlights included the linguistic conferences "Language Act 30", "A Century of Estonian as the national language" and the October international conference, the annual meeting of the European Federation of National Institutions for Language (EFNIL) "Language and Economy: Language Industries in a Multilingual Europe". The EFNIL conference presentations focused on the relationships between multilingualism and the open economy, European Union language industries and surveys researching them, translation in the European Union, clear language and language technology. The event was attended by nearly a hundred European linguists, language managers, language technology experts, translators, interpreters and other linguistic specialists. Another major landmark was the publication of the Sõnaveeb language portal in February. For the first time, looking up information on Estonian words was made easy for smartphone users. The Institute

of the Estonian Language published two brand new dictionaries on the Sõnaveeb site: Dictionary of Estonian 2019 and Estonian Collocations Dictionary 2019.

Estonian Crop Research Institute

On 18 September, the Estonian Crop Research Institute opened a new cereals-breeding centre in the Jõgeva commune. The breeding centre is outfitted with all necessary areas and equipment for breeding new varieties of spring wheat, winter wheat, barley, oats and rye. According to Director of the Institute Andre Veskioja, the new centre makes it possible to prepare for the impact of climate change: "Plant breeding is a lengthy process. Breeding a new variety takes 10–12 years, and we need to prepare for the possibility that existing varieties will not be well suited for cultivation in future climatic conditions. Estonia should focus on breeding universal cereal varieties that deliver a stable, high-quality yield in the context of changing plant diseases and climate."

Photo: Alo Tänavots

Members of the Academic Agricultural Society in the Upitis Museum lilac garden.

Photo: Peeter Langovits

17th conference of the European Federation of National Institutions for Language in Tallinn, 9–11 October 2019.

Estonian Oriental Society

The Estonian Oriental Society held its 31st Oriental Days annual conference on 23–24 March at the University of Tartu. The topics of the two-day meeting ranged from the famous Battle of Cannae and the cross found at a holy site in the imperial palace of the Peruvian Incas to the hybrid character of the current constitution of Iran and the political and economic developments in the Arab Republic of Egypt. A book dedicated to the thoughts and memories of Linnar Mäll as well as the Estonian translation of Chögyam Trungpa's *Smile at Fear: Awakening the True Heart of Bravery* were presented.

Estonian Academic Agricultural Society

In May, we visited the Institute of the State Priekuļi Plant Breeding Institute in Latvia to learn about the work of the Institute's researchers and their current experiments. The next stop was Riga, where we met with the leaders of the Latvian Agronomist Association. The goal of the meeting was to establish bilateral relations with our southern neighbours, since agricultural matters are very similar in the two countries. The second day of the visit took us to the Dobele Upitis Museum and its gorgeous lilac garden.

Estonian Naturalists' Society

Since 2019, the Estonian Naturalists' Society has been managing the website of the societies associated with the Estonian Academy of Sciences: https://sisu.ut.ee/ymarlaud/. The year was spent developing and designing the site and implementing the societies' news feed.

Estonian Economic Association

The 14th annual conference of the Estonian Economic Association took place at Pühajärve on 31 January and 1 February 2019. The keynote speaker of the first day was

Photo: Veiko Kastanje

Participants in the Estonian Mycological Society autumn mushroom camp.

Photo: Kristina Õllek

The opening of the Michel Sittow exhibition in KUMU.

Vice President of the Bank of Estonia Ülo Kaasik, who analysed the state of the Estonian economy. The speech was followed by a panel discussion on the pension system reform. It concluded that due to high administration fees set by fund managers, the pension system has failed to meet many people's expectations. On the other hand, releasing Estonians from compulsory second savings pillar payments would not be an effective remedy, since it would simply reduce people's motivation to save.

Professor Gilles Saint-Paul of the Paris School of Economics and New York University discussed the relationships between economic experts, neutrality and social well-being from the perspective of economic theory. He demonstrated that the assumption that governments maximise social well-being by skilfully utilising expert advice is a naive one. Expert advice is rarely neutral and may therefore not contribute to increasing social well-being. He stated that expert advice is only input for the political process and its utilisation depends on the stakeholders involved.

Art Museum of Estonia

The Art Museum of Estonia celebrated its 100th anniversary on 17 November 2019. The programming of the anniversary year focused on three topics: history, collections and women in art. The extensive research collection "Art Museum of Estonia 100" (ed. Sirje Helme) and Mai Levin's impressive monograph on the founder of Estonian professional art, Johann Köler, were published.

Through seminars and preparatory texts, the museum explored its own development through the years. The museum's story began with a small group of intellectuals who sensed the need, the obligation, and the opportunity

to start organising Estonian cultural life. We attempted to get a sense of how the museum's collections were built, how exhibition activity began, what conservation of works of art and interaction with the public mean for the museum, how the special requirements of the occupation period were managed, what research was carried out during that period and what topics were left untreated. In brief: how the Art Museum of Estonia became an organisation with five branches that now impacts the research of the history of Estonian art from the medieval period to modernity and places a premium on research.

Learned Estonian Society

The years 2018–2020 are sure to be remembered as anniversary years in Estonian history. The Learned Estonian Society and the Museum of the University of Tartu iscussed various anniversary-related topics. The scientific conference "From serfdom to an Estonian-speaking university in 100 years" took place on 5 December 2019 and comprised ten presentations ranging from the abolition of serfdom in the early 19th century to the founding of the national university in the early 20th century. Serfdom was abolished in Livonia in 1819. Peasants gained personal freedom. The Estonian-speaking university was established a century later, and the first Estonian Song Festival was held exactly halfway between the two events, in 1869. These rapid developments took Estonians from an agrarian people to a cultured nation. The speakers at the conference were Hesi Siimets-Gross, Merike Ristikivi, Katrin Kello, Martin Seppel, Marju Luts-Sootak, Toomas Anepaio, Mariya Oinas, Ken Kalling, Erki Tammiksaar, Andris Šnē, Toomas Hiio, Terje Lõbu and Tiit Rosenberg. The conference can be viewed on demand via University of Tartu Television.

Estonian Literary Museum

The Estonian Cultural History Archives of the Estonian Literary Museum explored the functioning of the social colonialist power matrix through the population's cultural fantasies and the affective and physical-material aspects of everyday culture in the monograph "Sotskolonialism Eesti NSV-s. Võim, kultuur, argielu". The leitmotif of the complex research work was the exploration of the choices through which most opinions and knowledge characteristic of folkloric interaction have (or have not) reached folklore collections. The conference "Collection-based research" considered, among other things, ways that research archives could continue fulfilling their function in society without project-based funding.

The research work of the Estonian Folklore Archives highlighted the conflict between aspects of humanities scholars' work as observers and documenters of culture and as participants in the (national) culture process, along with the moral dilemma created by this conflict in cases where the perpetuation of certain material in cultural heritage is undesirable for individuals or the larger community or harmful to their reputation, but where documenting it is important in order to create an accurate depiction of the situation, the everyday culture and the folkloric communication.

The Department of Folklore published research on student folklore and family humour, as well as the study "Benevolent and Corrective Humor, Life Satisfaction, and Broad Humor Dimensions", which considers Estonian material in the broader European cultural context. Innovative treatments were published on the joint creation of metaphors, different communication styles and the balance of language and humour in the usage of sports commentators.

Photo: Observatory archives

Observatory researchers on a (coffee) break.

Tartu Observatory

The Tartu Observatory is in the process of merging with the Faculty of Science and Technology of the University of Tartu. One of the road signs was the transfer of valuable records on the history of astronomy to the university library, improving their accessibility through international databases. Among others, works by famous 16th–19th century astronomers, such as Kepler, Brahe, Newton, Knorre, Pfaff and Mädler, as well as the handwritten notes and observation diaries of the founder of the Tartu Observatory, the astronomer Fr.G.W. Struve and the founder of modern Estonian astronomy Ernst Öpik, were transferred for conservation in modern conditions. Visually speaking, the most attractive items in the collection are the 17th–19th century star atlases by the researchers Bayer, Hevelius, Flamsteed, Bode, Reissig and Braun.

The representatives of the Tartu Observatory, as internationally recognised experts, took part in the 2019 UNESCO conference "Astronomy and World Heritage" in Kazan. In light of the 100th anniversary of the national university, the deep roots of space research in Estonian research culture were highlighted to contextualise Estonia's modern achievements as a spacefaring nation. The newest

Photo: Fred-Erik Kerner

The annual conference of the European Association for the Study of Religions "Religion – Continuations and Disruptions" at the University of Tartu.

achievements in the field are the 2019 cooperation agreement between the University of Tartu and the European Southern Observatory 4MOST and the confirmation of participation in the European Space Agency mission "Comet Interceptor" with the instrument OPIC.

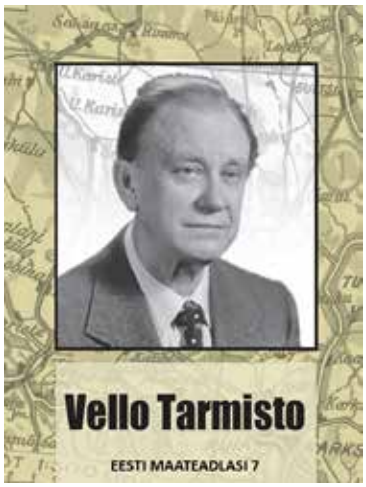
Estonian Society for the Study of Religions

The main event of the year 2019 for the Estonian Society for the Study of Religions was the annual conference of the European Association for the Study of Religions "Religion – Continuations and Disruptions" at the University of Tartu on 25–29 June 2019. The presentations covered multiple areas of research in the study of religions, including the history and psychology of religion.

Estonian Geographical Society

The Estonian Geographical Society published a book about one of the Society's founders, its first president, Academy Member Vello Tarmisto [Järvet, A. (ed.) 2019. "Eesti maateadlasi 7. Vello Tarmisto." Estonian Geographical Society, Tallinn, 267 p.] The work analyses the scientific inheritance of Vello Tarmisto (1918–1991), the substance of his publications and the factors that affected it. Furthermore, some information that he concealed from the authorities during his lifetime is revealed. This information helps to explain the development of Tarmisto's persona and illuminates how a young person had to adapt to the circumstances of Soviet occupation.

We celebrated the 200th anniversary of the discovery of Antarctica by the Saaremaa-born Fabian Gottlieb von Bellingshausen with Erki Tammiksaar's presentation



Vello Tarmisto was a member of the Estonian Academy of Sciences.

Photo: Estonian Society of Human Genetics

The Estonian Society of Human Genetics' annual conference in Pärnu.

"Science and politics in the story of the discovery of Antarctica" held at the general meeting of the Society.

Estonian Society of Human Genetics

The annual conference of the Estonian Society of Human Genetics on 21–22 November attracted roughly 250 attendees. The first day of the conference focused on genetic studies of tumours, innovative research methods in human genetics and more general matters related to health and genes. The second day continued with population genetics, genes and the environment.

The Estonian Society of Human Genetics connects a broad variety of experts and students in human genetics, genetic diseases and the genome, takes part in genomics communication and facilitates interdisciplinary cooperation.

Estonian Literary Society

One of the Society's main events in 2019 was the 24-hour continuous culture programme "Insomniacathon", which concluded the literary festival Prima Vista. Held at the Tartu Writers' House, it was initiated by the town's springtime foreign literary resident, the American poet Ron Whitehead. The marathon-like event was the first of its kind in Estonia; it attracted a large audience and offered a wide variety of experiences. The programme included an open workshop on translating Aristophanes, Ron Whitehead's and Andy Willoughby's seminar on beatnik literature and book presentations and lectures by Estonian writers and invited guests. The two-hour-long improvisational collaboration programme "Ootamatu koostöö" (*Unexpected collaboration*) married poetry with music.

Estonian Association of Engineers

The Estonian Association of Engineers, in collaboration with Enterprise Estonia, organised a round table on digitalising industry and the entrepreneurship competition "Tark tööstur" ("Smart industry"). At the roundtable, Enterprise Estonia and the Ministry of Economic Affairs and Communications introduced opportunities for state assistance in industrial digitalisation, researchers of the Tallinn University of Technology discussed possible future solutions and entrepreneurs shared their positive experiences.

Photo: Estonian Association of Engineers

Laureates of the "Smart industry" competition.

The "Smart industry" competition was organised to identify the companies that had made the most progress in the automation and digitalisation of production over the last year. It recognised entrepreneurs who had contributed to the improvement of the added value and efficiency of the Estonian economy and thus increased Estonia's competitiveness.

The "Smart industry" prize was awarded in three categories.

Company of the year (industrial company with over 250 employees): AS Viru Keemia Grupp.

Small business of the year (small or medium industrial enterprise): Adven Eesti AS

Digital innovation of the year (professional association or business federation that had carried out automation/digitalisation and supported others in the same): Estonian Association of Information Technology and Telecommunications.

Photo: Estonian Association of Engineers

Roundtable on industrial digitalisation. Professor at the Tallinn University of Technology Tauno Otto speaks.

Photo: Merike Kaste

Malle Salupere discussing J.V. Jannsen as the father of the Estonian song festivals and a promoter of choral culture.

Estonian sociologists at the annual conference in Tartu.

Estonian Musicological Society

For the Estonian Musicological Society, one of the key events of 2019 was the Tartu Day. Organised on 13 April, this year's event was dedicated to the Song Festival tradition and Estonian professional musical education. The year 2019 marked the 150th anniversary of the first Song Festival. The Tallinn higher school of music, the predecessor of the current Estonian Academy of Music and Theatre, celebrated its 100th anniversary.

Estonian Association of Sociologists

Estonian sociologists celebrated their 11th annual conference – the "song festival of Estonian sociologists" – in Tartu on 26–27 April. This year's conference explored society's and sociologists' functioning in special conditions and the future sustainability of their work. The conference was attended by nearly 150 sociologists and PhD students from Estonian and foreign universities and public servants who use the results of the Association's work. The former president of the Estonian Association of Sociologists, Marju Lauristin, analysed the state of social sciences in Estonia. The editor-in-chief of the Estonian Human Development Report 2019/2020, Professor Helen Sooväli-Sepping, reviewed developments in public space as reflected in the upcoming report. The guest speaker Professor Petr Jehlicka's keynote speech on geographical inequality in research was received with particular interest.

Mother Tongue Society

The Language Journey from Riga to Tartu, 8–15 June, saw students from all six high schools in Tartu, the Riga Estonian school and the Rõngu high school repeat the poet Kristjan Jaak Peterson's famous 269-kilometre journey, bearing the symbolic Peterson walking stick. The opening conference took place at the Estonian embassy in Riga on 8 June. The hike started at the Peterson memorial at the former Jakob cemetery on 9 June.

During the journey, talks were held in Riga on Kristjan Jaak Peterson, the translation of the national epic "Kalevipoeg" into Latvian and the teaching of Estonian in Latvia. The Cēsis St. John's Church hosted presentations on the "Landeswehr War", the church's altar painting by J. Köler, and Livonia and the Livonians. The Rubene church hosted talks on the Livonian Chronicle of Henry, the old Estonian written language in general and the names of Ümera, Estonia, Livonia and Latvia. Talks on the Cimze seminary, August Gailit and the dialect researcher Hella Keem, as well as the relationships between the Estonian and Latvian languages, were held in Valga. Meanwhile, the Rõngu culture centre hosted discussions on Ivar Ivask, Rossihnius' church handbooks and Estonian dialects. The conferences also discussed political independence as a prerequisite of a national language, the year of the Estonian language, and 100 years of Estonian as a national language.

The symbolic walking stick was received by the Rector of the University of Tartu, the chairman of the Mother Tongue Society, the mayor of Tartu and a representative of the Ministry of Education and Research on 15 June at the Tartu Toomemägi Hill. The stick is now housed at the University of Tartu museum.

Photo: Andres Tennus

Photo: Andres Tennus

Former president of the Estonian Association of Sociologists, Professor Marju Lauristin.

Photo: Merike Kaste

The language journey begins at the Kristjan Jaak Peterson memorial in Riga. From the left: students of the Peterson Gymnasium Lauri Voore and Tanel Pihlak, Ambassador Arti Hilpus, the initiator of the memorial Mart Kull, the student Kaja-Liina Korb, and the teachers Estra Tõnisson, Eve Seedre and Edda Kaimre (Tartu Kristjan Jaak Peterson Gymnasium).

Photo: Estonian Chemical Society

The international scientific seminar "Frontiers in Organic Synthesis", dedicated to Member of the Academy Margus Lopp's 70th birthday, took place on 15 November 2019.

Estonian Chemical Society

The traditional Estonian Chemical Society annual conference – the 34th Estonian Chemistry Days – was organised in Tallinn on 18 April 2019 to celebrate the society's 100th anniversary (the society was founded on 21 July 1919). See the agenda at: https://www.keemiaselts.ee/sites/default/files/inline-files/konverentsi_teesid.pdf

The international scientific seminar "Frontiers in Organic Synthesis" took place on 15 November 2019. Presentations were given by renowned chemists from Sweden, Canada and the UK, as well as University of Tartu and Tallinn University of Technology PhD students. The agenda is available at https://www.keemiaselts.ee/sites/default/files/inline-files/Booklet.pdf

Estonian Union of History and Philosophy of Science

On 5 September 2019, the member of the Estonian Union of History and Philosophy of Science Epi Tohvri presented her monograph "Georges Frédéric Parrot. The First Rector of the Imperial Tartu University" at the University of Tartu museum.

Memorably, Lecturer of the French language and culture at the University of Tartu Vincent Dautancourt assumed the persona of Parrot to read the letters in the book. Professor of Cultural History at Tallinn University Marek Tamm notes that the monograph has significantly influenced the study of 19th century Estonian history.

Photo: Malle Elvet

Presentation of the monograph "Georges Frédéric Parrot. The First Rector of the Imperial Tartu University" in the framework of the anniversary year events organised by the University.

FINAL WORD

On 23 October, Prime Minister Jüri Ratas gave a speech focusing on impressions from the joint climate conference organised by the Academy of Sciences and the Prime Minister's Office at the sixth science policy conference "Teadus kui Eesti arengumootor: targalt piiratud planeedil" ("Science driving the development of Estonia: smart choices on a small planet"). *A section of his speech follows.*

„I would like to present my heartfelt thanks to the Academy of Sciences. [A key message] at the climate conference some weeks ago was that the topic should increasingly become a part of society and that each and every individual should feel personally concerned. We all must expand our comfort zones and behaviour patterns. Therefore, it is good to see that the challenge represented by sustainable development is increasingly well understood in Estonia. The discussions are reaching a wide audience and the message of scientists is coming through louder and clearer than ever, both in explaining the problem and in offering potential solutions.

The climate conference organised by the Prime Minister's Office and the Academy of Sciences in early September proved to be so popular that we had to change the venue to accommodate the large number interested. The conference fulfilled its goal. It brought together representatives of various interest groups, politicians, state officials, entrepreneurs and international leaders in the field. New ideas and proposals were presented that we need to consider to achieve climate neutrality by 2050. We have chosen to initiate these significant changes in our country. Apart from the risks and obstacles, we must grasp the new business opportunities, innovation and R&D collaboration they offer, both for Estonian entrepreneurs and for the scientific community."

On 15 January 2020, Prime Minister Jüri Ratas addressed the Parliament on the state of research and development and the governmental R&D policy. The Academy was praised.

"We have become more open and international. Many leading international researchers are working in Estonia, providing priceless inspiration and knowledge transfer. Meanwhile, numerous Estonian researchers who have gained international experience are returning. Returning is easier when contacts have been retained with scientists working at home. The conference 'XXI sajandi suurimad väljakutsed' ('Major challenges of the 21st Century'), organised on the initiative of the Academy of Sciences early in the year, brought together early career researchers from all over the world. It was an excellent example of working to stay in touch."

MEMBERS AND FOREIGN MEMBERS OF THE ACADEMY 2019–2020

The membership of the Estonian Academy of Sciences was composed of 75 members and 21 foreign members as of 31 December 2019. Four members passed away in January–August 2020.

Heads of divisions are highlighted in green, female researchers in yellow, and outstanding cultural personalities in blue. More information is available at http://www.akadeemia.ee/en/membership/

Division of Astronomy and Physics

Jaan Aarik, exact sciences, 2013
Jaak Aaviksoo*, exact sciences, 1994
Jaan Einasto, astrophysics, 1981
Ene Ergma, exact sciences, 1997
Arvi Freiberg, exact sciences, 2009
Vladimir Hiznjakov, physics, 1977
Marco Kirm**, exact sciences, 2018
Tšeslav Luštšik, solid state physics, 1964; † 08.08.2020
Ergo Nõmmiste, exact sciences, 2012; † 11.04.2019
Eve Oja , mathematics, 2010; † 27.01.2019
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

* Head of Division 2009–2019
** Head of Division from December 2019

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
Jaak Peetre, mathematics, 2008; † 01.04.2019
Alar Toomre, applied mathematics, 2012

Division 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

Foreign members

Steven R. Bishop, nonlinear dynamics,2012
Michael Godfrey Rodd, process control and infotechnology, 1995
Gábor Stépán, applied mechanics, 2017
Esko Ukkonen, computer science, 2015
Margus Veanes, software science, 2019

Division of Biology, Geology and Chemistry

Toomas Asser, medical science, 2011
Jaan Eha, natural sciences and medicine, 2016
Jaak Järv, natural science, 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 ecolog, 2011
Hans Küüts, agricultural science, 1994
Agu Laisk, natural science, 1994
Ülo Lille, biotechnology, 1983
Margus Lopp, chemistry, 2011
Jüri Martin, ecology, 1990
Udo Margna, plant physiology, 1987; † 17.05.2019
Andres Metspalu, biotechnology, 2010
Ülo Niinemets, natural sciences, 2013
Anto Raukas, geology, 1977
Valdur Saks, biochemistry, 1993
Martin Zobel, ecology, 2010
Raivo Uibo, medical science, 2003
Mart Ustav, biomedicine, 2001
Eero Vasar, medical science, 2010

Foreign members

Ülo Langel, neurochemistry, 2015
Pekka T. Männistö, pharmacology, 2012
Svante Pääbo, genetics, 2019
Matti Saarnisto, geology, 2008
Helmut Schwarz, chemistry, 2002

Division of the Humanities and Social Sciences

Jüri Allik, psychology, 2010
Mihhail Bronštein,agricultural economics, 1975
Mart Kalm, art history, 2010
Valter Lang**, historical sciences, 2010
Lauri Mälksoo, law, 2013
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 sciences, 1994

* Head of Division 2009–2019
** Head of Division from December 2019

Foreign members

Juri E. Berezkin, cultural anthropology, 2012
Cornelius Theodor Hasselblatt, literature and culture, 2015
Raimo Raag, linguistics, 2019
Jānis Stradiņš, physical chemistry and history of science, 1998; † 29.11.2019
Päiviö Tommila, history, 1991
Endel Tulving, psychology, 2002
Jaan Valsiner, psychology, 2017

Photo: Maris Krūmvalds

Group picture of the Members of the Academy at the Annual General Assembly on 24 April 2019.

FACTS AND FIGURES

THE PRIORITIES AND CHALLENGES

Most of the members of the Academy have reached an age where hours drag on, yet years slip by five at a time. This is also evident from the list of celebrations at the end of this collection of facts and figures. The Academy's elected heads, half of the heads of divisions and all non-executive members of the Board have at least five years of tenure. In this context, let us remember that nobody is irreplaceable, not even Academy members. Any doubters ought to dip a finger in water and observe the hole left behind after removing it. And if some are re-elected, as happened this time, this is a one-off event. Additional terms are restricted by the Academy of Sciences Act and the Academy's statutes.

The goals formulated to complement the Academy's development plan five years ago, at the time of the election of the President, were essentially descriptions of strands of action. It is no surprise that the general assembly approved the principle that the voice of the Academy as a whole should be louder and the Academy more visible in society, that it would be good to clarify, and execute with dignity, the Academy's role in research and to give substance to the legal obligation to develop and represent science as a whole. Naturally, it is important to carry out our role in the Republic of Estonia in a dignified manner, even when there are differences of opinion regarding the nature of the role. Representing national research in the international arena, especially through the organisation of the exchange of information and the function of an ambassador for science, is as natural as everyday research efforts. In a sense, these are self-fulfilling wishes if we take the Academy and its activities seriously at all. Therefore, it is only natural that, after five years of work, the chief elected manager reported solid progress in all four key areas to the 25 September General Assembly meeting.

However, a more significant document – the Academy's development plan – is about to hit the milestone of two times five years. Never mind its nickname: "conceptual basis". The goals for which we are striving do not need to be stated in exhaustive detail. Clarity and precision would serve us better. Even if the point of preparing the development plan can be summed up (in the words of Nikolai Baturin) "To decide where to go, you need to know where you are", the tasks described in these documents are meant for execution by elected managers. In this respect, the widespread policy of considering the paper on which a development plan is printed to be worth less than a blank sheet ought to be disregarded. Furthermore, honest retrospection is very useful in determining new goals.

The September general assembly dissected the plan in detail to see how well predictions made nearly a decade ago (in 2011) had fared. Turns out that the plan did fairly well. The key goals were:

The Academy's role in supporting the social and economic development of the state must be substantially reinforced.

- The Academy's analytical capacity in enhancing expertise and offering recommendations, particularly for time-sensitive matters, must be significantly improved.
- Successful promotion of the scientific, knowledge-based world-view must be initiated.
- The exchange of views between the Academy and the society must be intensified at all levels.
- The ability of the Academy as an organisation to influence societal trends must be enhanced.

The first two goals are of a permanent nature, and it makes sense to give them due consideration going forward. Significant headway has been made towards fulfilling the latter three, and new challenges need to be formulated with respect to them. Some of the prioritised initiatives (e.g. the Council of Estonian Centres of Excellence in Research) have found their natural place in our research. Other developments have taken a turn away from the form envisioned nearly a decade ago, while staying true to the principles of the development plan. For instance, while no sensible niche has been found for the Institute for Advanced Study, we have been represented in numerous think tanks and have taken part in preparing analyses, policies and strategies.

Therefore, the recently elected leaders and other members of the board face an interesting challenge: we must imagine the future, draft a vision of an Academy worth participating in and deserving of the nation's approval many years from now, and soberly consider what can be done in the next five years to advance the achievement of these goals.

Tarmo Soomere
14.03.2020

CHRONICLE 2019: EVENTS, DECISIONS AND PLANS

14 January – The Secretary-General of the Academy of Sciences Jaak Järv and Academy Member Urmas Varblane met the representatives of the Estonian Association of Sociologists to discuss matters pertaining to association.

22 January – The off-site meeting of the Board of the Academy at the Estonian Academy of Arts confirmed the tasks of the members of the board and released Member of the Academy Anto Raukas from the responsibilities of the editor-in-chief and member of the editorial board of the journal *Oil Shale*. Andres Siirde, professor at the Tallinn University of Technology, was appointed the new editor-in-chief and a member of the Publishing Council of the Estonian Academy of Sciences. The decisions to associate with the Estonian Association of Sociologists and the Estonian Mathematical Society, as well as to enter into association negotiations with the Estonian Academic Theological Society, were approved.

24 January – The conference "A Century of Estonian as the national language", jointly organised by the Academy of Sciences, the Mother Tongue Society and the language department of the Ministry of Education and Research as the opening event of the year of the Estonian language 2019, took place at the great hall of the Academy (see pp. 6–7).

24 January – Member of the Academy Lauri Mälksoo delivered a presentation titled "Estonia as a Candidate Non-Permanent Member of the United Nations Security Council, 2020–2021: The Role of Small Countries in the Security Council" in the framework of the "Road to the (Poska) Academy" lecture series.

31 January–2 February – The Academy of Sciences hosted the international seminar-workshop "Towards bridging science and decision-making", organised by the Academy in cooperation with the European Commission Joint Research Centre (JRC) and the Foresight Centre in the framework of the initiative "Science meets Parliaments. Science meets Regions". The event discussed the best ways to deliver researchers' advice to those who need to make decisions that will impact our lives for many years to come based on limited facts and under intense time pressure (see pp. 12–15).

8 February – The Academy hosted the gala finale of the "Three-Minute Challenge" contest (see pp. 50–51). The training and the contest were funded by the Science Communication Programme TeaMe+ for the 2016–2020 period financed by the *European Regional Development Fund*. The Academy of Sciences contributes to the developing the next generation of science and shaping societal development processes (including different policies).

20 February – Researchers and politicians met at the Academy to discuss ways to divide the additional research funding laid out in the research agreement (national agreement on research funding) concluded on 19 December 2018 (see pp. 16–17). The participants included the Minister of Entrepreneurship and Information Technology Rene Tammist, the Minister of Education and Research Mailis Reps, the Deputy Secretary General for Higher Education Indrek Reimand, the head of the economic development department of the Ministry of Economic Affairs and Communications Kaupo Reede and representatives of other ministries.

20 February – Poska Academy participants visited the Academy. President Tarmo Soomere's lectures "The Point of the Academy of Sciences: Facts, Not Just Words" and "Estonia's Windy Beaches Caught Up in the Turmoil of Climate Change" were attended by approx. 110 students from the Tartu Jaan Poska Gymnasium, Tallinn Secondary School of Science, Gustav Adolf Grammar School and Tallinn French School (see p. 52).

21–22 February – At the invitation of the German National Academy of Sciences Leopoldina and the Leibniz Association, President Tarmo Soomere participated in the EU13 (eastern and central European countries', Maltan and Cypriot) academies of sciences and leading universities forum "Forum Future Europe. Raising Inclusion and Performance of European Research and Innovation".

24 February – National research awards, the F. J. Wiedemann language award and sports and culture prizes were presented at the great hall of the Academy on the anniversary of the Republic of Estonia (see pp. 24–27, 92–93, and 133).

26 February – The meeting of the board of the Academy approved the Academy's memorial medals statute and discussed establishing a memorial medal in the field of

social sciences. It was decided to award the Harald Keres Medal to Member of the Academy Jaan Einasto. The research, development and innovation funding plan for 2020–2022 was discussed.

26 February – President of the Academy Tarmo Soomere and President of the Estonian Mathematical Society Rainis Haller signed an association agreement.

2 March – A conference was held at the Estonian National Museum to celebrate Academy Member Jüri Allik's 70th birthday.

18 March – Member of the Academy Urmas Varblane presented a double lecture on "Economics, Populism and Brexit" at the Poska Academy.

3 March – The meeting of the Board of the Academy discussed possibilities for the creation of an Estonian innovation system. Overviews were presented by Chairman of the Board of Enterprise Estonia Alo Ivask and the director of the Centre for Entrepreneurship (Ettevõtluskeskus) Tanel Rebane. The execution of the research agreement concluded on 19 December 2018 was discussed and a declaration laying out the Academy's recommendations was approved for initial presentation to the Academy's General Assembly (see pp. 15–18). The execution of the Academy's summary budget for 2018 was reviewed and submitted to the General Assembly for approval, along with the 2019 budget. The agenda for the 24 April General Assembly meeting was approved. Member of the Academy Ain-Elmar Kaasik was released from his duties as a member of the evaluation committee of the L'Oréal-UNESCO grants (see p. 54) and a new membership of the evaluation committee was approved (chair: Member of the Academy Ergo Nõmmiste). The formation principles for the Evaluation Committee of the Estonian Research Council and the appointment of candidates for the Evaluation Committee were discussed.

Member of the Academy Dimitri Kaljo was released from his duties as the editor-in-chief of the *Estonian Journal of Earth Sciences* and a member of the Publishing Council of the Estonian Academy of Sciences. Olle Hints, Professor at the Institute of Geology of the Tallinn University of Technology, was appointed the journal's new editor-in-chief and a new member of the Publishing Council. Academy Member Kaljo was also released from his position as the chair of the Estonian National Committee for Geology. Member of the Academy Kalle Kirsimäe was appointed as the new head of the committee.

25 March – President Tarmo Soomere visited the University of Queensland School of Civil Engineering Coastal and Hydraulic Engineering teaching and research complex (Brisbane, Australia) and discussed the division of work for the 2019–2021 joint grant received by the University of Queensland, Queensland University of Technology and Tallinn University of Technology with the professor of hydraulic engineering and applied fluid mechanics Hubert Chanson.

26 March – President Tarmo Soomere delivered a public lecture titled "Retrieving the signal of climate change from simulated sediment transport" at the University of the Sunshine Coast School of Science and Engineering and discussed possibilities of applying methodologies of precision measurement of Estonian coasts to monitor Queensland's sandy beaches with Discipline Leader Engineering Dr Helene Fairweather and the lecturer Dr Adrian McCallum.

1 April – President Tarmo Soomere met the President of the Australian Academy of Science Professor John Shine in Sydney. The two presidents exchanged thoughts on structuring national scientific advice systems in general and the role of academies of sciences in such systems in particular.

2 April – President Tarmo Soomere visited the University of Sydney Faculty of Engineering and Information Technologies School of Civil Engineering, studied the wave flumes and hydraulics teaching equipment and discussed possibilities for joint work on the quantification of dangers originating from the sea (primarily long-lived rogue waves) in coastal areas with Associate Professor in Environmental Fluid Dynamics Amin Chabchoub.

2 April – The Kilingi-Nõmme Gymnasium science day was visited by Members of the Academy Ene Ergma, who explained to students how the solar system developed and how Earth would fare if a massive explosion on the Sun were to take satellites offline, and Kalle Kirsimäe, who spoke about the potential for life on Earth, in the solar system and elsewhere in the universe.

3 April – President Tarmo Soomere visited the Estonian embassy in Canberra. He discussed opportunities to expand collaboration between Estonian and Australian researchers with Consul Aivar Tsarski.

4 April – President Tarmo Soomere met the Director of Research Policy and Integrity of the Australian Research Council Justin Withers at the Australian Academy of Science. The discussion focused on measures to stimulate research and development activity in private enterprise.

4 April – President Tarmo Soomere delivered a public lecture titled "Rogue waves in shallow water and related issues" at the Department of Theoretical Physics of the Australian National University and discussed the potential for using the specific characteristics of the Baltic Sea for the development and experimental testing of the theory of rogue waves in shallow water with Prof Nail Akhmediev and Prof Peter Vassiliou.

5 April – President Tarmo Soomere visited the Vice-President of the Australian Academy of Science Dr T. J. Higgins and the Manager of International Programs Nancy Pritchard. Experiences were shared on organising young researchers and managing the academies' public communications. The Australian Academy of Science's

experience with preparing materials for general education teachers to reflect the curriculum's connection to cutting-edge research is particularly valuable for Estonia.

5 April – President Tarmo Soomere met Australia's Chief Scientist Dr Alan Finkel. Various possibilities for designing the state scientific advice system and measures for advancing private sector research and development were discussed.

11 April – President Tarmo Soomere discussed ways to retain and strengthen Australian Estonians' connection with their home country with Estonian Honorary Consul in Melbourne Lembit Marder.

11 April – President Tarmo Soomere had an extended meeting with Victoria's Lead Scientist Dr Amanda Caples, discussing the opportunities and challenges of scientific advice in a state comparable in size to Estonia.

12 April – President Tarmo Soomere visited Monash University in Melbourne. A meeting with the Dean of the Faculty of Science Prof Jordan Nash and Associate International Dean Tony Patti identified a systematic occurrence of identical problems in organising cooperation between the private sector and academia.

15–18 April – President Tarmo Soomere conducted a working visit to the Queensland University of Technology, participating in the reporting seminar of the PhD students of the Faculty of Mathematics and the Science and Engineering Faculty (working groups of Professors Scott McCue and Richard Brown) and the work of the PhD attestation committee, and delivering a public double lecture "Smart use of currents for the environmental management of maritime activities // Retrieving the signal of climate change from simulated sediment transport".

24 April – The Annual General Assembly meeting of the Academy (see pp. 15–18 and 121). Letters of appreciation were presented to the long-time editors-in-chief of the Academy Publishers' journals *Estonian Journal of Earth Sciences* and *Oil Shale,* Members of the Academy Dimitri Kaljo and Anto Raukas. Research presentations were delivered by laureates of research awards, Members of the Academy Peeter Saari and Mart Ustav. The Academy's activities in 2018 were reviewed, recommendations for the realisation of the research agreement were formulated and a political declaration regarding the same was approved.

2–3 May – The 16th Baltic Conference on Intellectual Co-operation "Genes: from the Past to the Future" took place in Vilnius and medals of the Baltic Academies of Sciences were presented at the event. The laureate from Estonia was Maris Laan, Professor in Human Genetics at the Institute of Biomedicine and Translational Medicine of the University of Tartu. Member of the Academy Andres Metspalu delivered a lecture titled "From biobanks to personalised medicine".

8–9 May – President Tarmo Soomere represented the Academy at the 2019 General Assembly of All European Academies (ALLEA) in Bern, Switzerland.

16 May – The terminology day of scientific societies, jointly organised by the Estonian Academy of Sciences, the Mother Tongue Society and the Institute of the Estonian Language, took place at the great hall of the Academy (see pp. 10 and 54).

27 May – The 11th science afternoon, focusing on the rousing thoughts of Academy Member Gustav Naan, took place at the Academy.

31 May – The information day of the constitutional law endowment took place at the Academy. The event was introduced by Ministers Urmas Reinsalu and Raivo Aeg. President of the Academy of Sciences Tarmo Soomere delivered a presentation titled "The state in the joint care of law and science". Head of the Council of the Endowment Uno Lõhmus introduced the action plan of the foundation. Professors Marju Luts-Sootak and Hent Kalmo delivered a lecture titled "One hundred years from the temporary procedure of governance of the Republic of Estonia". A competition for the constitutional law textbook was announced. The information day was moderated by Deputy Secretary General for Legal Policy at the Estonian Ministry of Justice Kai Härmand.

3 June – President Tarmo Soomere participated in a European Science Advisors Forum (ESAF) Skype meeting to discuss the agenda for the 5th meeting of ESAF, held on 26–27 June in Dublin, the activity and recent developments of the organisation and potential future key roles for academies. The meeting was also attended by Professor Janusz M. Bujnicki from Poland and Professor Gerd Folkers from Switzerland.

10 June – Member of the Academy Toomas Asser spoke to students of the Nõo Gymnasium about his work as a medical doctor and described the University of Tartu from the perspective of its Rector.

11 June – Two Estonian, three Latvian and two Lithuanian female researchers were awarded L'Oréal-UNESCO Baltic "Women in Science" grants at a ceremony held at the University of Latvia. President Tarmo Soomere delivered the welcoming speech, introduced the Estonian laureates (see p. 54) and, with the L'Oréal representative, presented the awards.

12 June – President Tarmo Soomere delivered a short presentation and participated in a panel discussion at the twentieth meeting of the United Nations Open-ended Informal Consultative Process on Oceans and the Law of the Sea at the UN headquarters in New York (see pp. 54–55).

13–14 June – Secretary-General Jaak Järv and Academy Members Jüri Engelbrecht and Tiina Randma-Liiv participated in a meeting of the Nordic and Baltic Academies of Sciences and in a consultation

of the European Academies' Science Advisory Council (EASAC) in Helsinki.

14 June – The Academy hosted the seminar "Innovative Development of European Universities: the Baltic Way" in the framework of the Ukrainian universities' delegation's study visit. The Ukrainian delegation was headed by Professor Alvydas Baležentis. Presentations were given by the Academy of Sciences Research Professor Dmitri Vinnikov, Secretary-General of the Estonian Young Academy of Sciences Dr Anastasiya Astapova and Science Advisor at the Ministry of Culture Dr Aleksandr Aidarov. The seminar was moderated by Professor Rein Vaikmäe, a science advisor to the President of the Academy.

18 June – The meeting of the Board of the Academy decided to nominate the geneticist Svante Pääbo and the linguist Raimo Raag as foreign member candidates to the General Assembly. The scientific board of the Under and Tuglas Literature Centre (chair: the *ex officio* Director, Member of the Academy Jaan Undusk), board of the Council for International Exchanges (chair: Member of the Academy Jüri Engelbrecht), the Estonian National Committee of INQUA (ESTQUA, chair: Senior Researcher at the University of Tartu Alar Rosentau) and the Committee on Energy of the Academy of Sciences (chair: Professor Arvi Hamburg) along with its statutes were confirmed. The 2019 base funding for scientific and learned societies was approved and additional funding in the sum of 40,000 EUR was allocated for the renovation of the Estonian Naturalists' Society building. A decision was taken to initiate association negotiations with the Estonian Academic Theological Society. The establishment of the Academy's economic development and innovation committee was decided on.

18 June – The publications "Teadusmõte Eestis (X). Tehnikateadused III" (*Scientific thought in Estonia (X). Engineering III*) and "Awards of the Republic of Estonia 2019" were presented at the Academy.
https://www.akadeemia.ee/wp-content/uploads/2019/05/teadusm6te_eestis_x_tehnikateadused_iii_sisu.pdf

18 June – President of the Academy Tarmo Soomere and President of the Estonian Association of Sociologists Mai Beilmann signed an association agreement.

19 June – The Academy hosted an engagement seminar, "Engaging in research policy discussions", jointly organised on the initiative of the Wellcome Trust by the Academy of Sciences and the Young Academy of Sciences. The meeting provided young researchers from the Baltic States an opportunity to discuss regional and international research policy matters that directly concern early-stage researchers. The keynote speech was given by Member of the Polish Academy of Sciences Janusz M. Bujnicki (Group of Chief Scientific Advisors, European Commission's Scientific Advice Mechanism, SAM) (see p. 55).

26–27 June – President Tarmo Soomere represented Estonia at the joint conference ESAF 5/INGSA of the European Science Advisors Forum ESAF and the national scientific advisors' network INGSA at Trinity College Dublin. T. Soomere was elected the chairman of ESAF.

1 July – The Academy held an open-door day in the framework of the ESTO 2019 global Estonian cultural festival. Young Estonians abroad learned about the history of the building and met with President Tarmo Soomere.

1 July – Member of the Academy Jüri Engelbrecht and Secretary-General Jaak Järv took part in the discussion "Estonian researchers abroad" organised at the Telliskivi Creative City in the framework of ESTO 2019. The discussion was moderated by President Tarmo Soomere.

11 July – President Tarmo Soomere participated in the reception organised by the Russian Geographical Society to celebrate the beginning of the year-long expedition of the Admiral Bellingshausen yacht, delivering a welcoming speech, and in the meeting of the expedition members.

25 July – President Tarmo Soomere delivered the presentation "Future Environment: From Problems to Solutions" at the summer school of the Estonian National Youth Council at Nelijärve to introduce the second section of the summer school's youth policy platform workshop.

6 August – The President of the Apulian Academy of Sciences, and Vice President of the Union of Italian Academies of Sciences (Unione Accademica Nazionale, UAN, which connects 14 Italian academies of sciences) Professor Eugenio Scandale visited the Academy (see pp. 70–71).

25–28 August – Member of the Academy Raivo Uibo represented the Academy at the meeting of the All European Academies (ALLEA) research and ethics committee in Berlin.

27 August – An online meeting of the board of the Academy approved the agenda for the 25 September General Assembly meeting and the nomination of the software researcher Margus Veanes as a foreign member candidate. The Committee on Energy of the Academy of Sciences was expanded. Its statute was approved, as was the composition of the Academy's Office. Vice President Mart Kalm was appointed the chair of the Member of the Academy Endel Lippmaa Memorial Lecture Committee. Member of the Academy Marco Kirm was appointed the contact person of the Estonian national committee of the International Union of Pure and Applied Physics. The conclusion of an association agreement with the Estonian Academic Theological Society was approved.

5 September – The Academy of Sciences hosted the science afternoon "The climate is changing: what technological solutions are Estonian researchers offering?" (see p. 43).

6 September – The renovations of the city-facing facade of the Academy building began.

9–10 September – Secretary-General Jaak Järv participated in the annual meeting of the European member organisations of the International Science Council (ISC) at the Royal Netherlands Academy of Arts and Sciences in Amsterdam.

11 September – the seminar "Reflections of Chemistry in Life and Reflections of Life in Chemistry", dedicated to the 70th birthday of Academy Member Margus Lopp, was held. His biography "Peegeldus" (*Reflection*) was presented (see p. 56).

13 September – The conference "Climate neutrality: disaster or success?", jointly organised by the Prime Minister's Office and the Academy of Sciences, was held at the Radisson Blu Sky hotel (see pp. 19–23). The conference brought together scientists and politicians to jointly explore potential solutions to reduce greenhouse gas emissions and guarantee energy supplies, while safeguarding the Estonian environment, advancing national welfare and promoting economic competitiveness. Estonian researchers introduced technical solutions developed and/or accessible in Estonia to facilitate adaptation to climate change and to advance Estonia as a future pioneer in the field. The keynote speakers were representatives of the European Academies' Science Advisory Council (EASAC) Professor Patrick Goodman, Technological University Dublin, and Professor Atte Korhola, University of Helsinki.

25 September – The General Assembly of the Academy re-elected President Tarmo Soomere for his second term and elected three new foreign members: the computer scientist Margus Veanes, the geneticist Svante Pääbo and the linguist Raimo Raag (see pp. 46–48).

27 September – The Academy hosted a literary experiment – a visualisation of short stories by Friedebert Tuglas – in the framework of the Researchers' Night festival on the initiative of the Under and Tuglas Literature Centre (see p. 55) The collection "Science in Three Minutes 2017–2019" was presented (see p. 58).

2–3 October – President Tarmo Soomere participated in a meeting of the environmental panel of the European Academies' Science Advisory Council (EASAC) in Bratislava.

4 October – President Tarmo Soomere met 10th grade students of Tallinn School No. 21 at the Academy. A tour of the Academy building was followed by the President's lecture on problems facing the Baltic Sea and climate change.

8 October – Member of the Academy Jaak Järv delivered the opening lecture of the new season of the Poska Academy "Research and Researchers in the Information Society".

11–13 October – President Tarmo Soomere participated in the 150th anniversary celebrations of the Bulgarian Academy of Sciences.

15 October – The meeting of the board approved the agenda for the December general assembly of the Academy and resolved to organise a competition for the position of the director of the Under and Tuglas Literature Centre for 2020–2025. The organisation committee for the Endel Lippmaa Memorial Lecture 2020 was confirmed (chair: Member of the Academy Mart Kalm). The member of the board of Kemotex Finance OÜ Riivo Sinijärv was invited to chair the committee on the lecture foundation. The composition of the Estonian Polar Research Committee was confirmed (chair: Rein Vaikmäe) and additional funding was granted to societies for various tasks. The board decided to award Medals of the Estonian Academy of Sciences to Member of the Academy Margus Lopp, Chancellor of Justice Ülle Madise, the historian Erki Tammiksaar, Director of the Tallinn University Academic Library Andres Kollist and the former long-time employee of the Academy Office Helle-Liis Help. The submission of amendment proposals for the regulations for scientific staff competitions for research institutions and the departmental statutes to the general assembly were decided on. Research funding and matters related to research grants for 2020 were discussed and the Academy's positions to be submitted to the Ministry of Education and Research and the Estonian Research Council were formulated.

15 October – President of the Academy of Sciences Tarmo Soomere and Chair of the Estonian Academic Theological Society Urmas Nõmmik signed an association agreement.

23 October – The research policy conference "Science driving the development of Estonia: smart choices on a small planet", co-organised by the Academy, took place in the conference room of the Parliament (Riigikogu) building. The discussion focused on the role of science in advancing the welfare of the nation and in achieving the UN's sustainable development goals. The conference was jointly organised by the Estonian Research Council, the Cultural Affairs Committee of the Parliament, Universities Estonia, the Academy of Sciences, the Estonian Young Academy of Sciences and the Ministry of Education and Research (see p. 103).

24 October – The science afternoon at the Academy focused on matters related to the construction of a shale oil pre-refining plant in Ida-Viru County (see p. 53).

29 October – The conference discussion "Small States in Global Affairs: Possible Impact of Estonia" was held at the Academy of Sciences. The President of the Republic of Estonia Kersti Kaljulaid was interviewed by the President of the Academy Tarmo Soomere. The Columbia University master's degree study "Estonia: A Global Leader. Amplifying Small States' Voices" was introduced by Professor Jenik Radon, Columbia University, and discussed by the astrophysicist and former politician Liia Hänni. The panel discussion featured Minister of

Foreign Affairs Urmas Reinsalu, Secretary of State Taimar Peterkop, Member of the Academy Tiina Randma-Liiv and Professor Marek Tamm (see p. 42).

31 October – President Tarmo Soomere participated in the official meeting of Prime Minister Jüri Ratas and the Minister of Education and Research with the President of the United States National Academy of Sciences Marcia McNutt in Washington (see pp. 70–71).

1 November – A cooperation agreement between the Hamburg Academy of Sciences and Humanities and the Baltic academies of sciences was signed. The Estonian Academy of Sciences was represented by President Tarmo Soomere and Member of the Academy Jakob Kübarsepp.

5–6 November – President Tarmo Soomere participated in the autumn plenary meeting of the European Marine Board in Berlin.

13 November – President Tarmo Soomere and Secretary-General Jaak Järv represented the Estonian Academy of Sciences at the joint symposium of the Finnish Academy of Sciences and Letters' initiative Science Advisory Initiative of Finland (SOFI) and the Science Advice for Policy by European Academies (SAPEA, part of the European Commission science advisory mechanism) in Helsinki.

15 November – The Estonian Association of Business and Professional Women elected Member of the Academy Anu Raud as woman of the years at its gala event.

21 November – The Academy hosted the 7th Estonian scientific language conference "Estonian language and global science", organised by Tallinn University, the Estonian Academy of Sciences and the Mother Tongue Society (see p. 10).

27 November – The Academy hosted a memorial seminar commemorating the 80th anniversary of the Finnish Winter War, organised by the Academy of Sciences and the Finnish Embassy in Estonia. Ohto Manninen, a professor at the Finnish National Defence University, delivered a lecture on the shelling of Mainila by the Soviet Union and its remembrance. In the discussion that followed, Member of the Estonian Parliament and Retired General Ants Laaneots and the historians Andres Adamson and Toomas Hiio analysed the different choices made by Estonia and Finland in 1939. The seminar was introduced by the Ambassador of Finland to Estonia Timo Kantola.

28 November – President Tarmo Soomere received the Governor General of Canada at the Academy. The meeting was attended by Members of the Academy Anne Kahru, Jarek Kurnitski and Andres Metspalu, Professor Ahto Buldas and Deputy Secretary-General of the Ministry of Economic Affairs Siim Sikkut (see pp. 58–59).

3 December – The Academy of Sciences hosted the seminar "New technologies tackling the carbon crisis". Speakers included Carl Wolf (Vice-president LanzaTech, Europe), Pekka Simell (Leading Researcher, the Finnish VTT Bioruukki gasification pilot plant), Kaspar Valgepea (Head of the Development lab of Gas Fermentation Technologies at the University of Tartu), Kristjan Vassil (Vice Rector for Research at the University of Tartu), a representative of the Ministry of the Environment, et al.

4 December – A General Assembly meeting of the Academy took place. The Foreign Member Svante Pääbo delivered a research presentation and was presented with the certificate of Foreign Member of the Academy. Member of the Academy Margus Lopp received the Medal of the Academy of Sciences. Amendments to the Academy divisions' statutes and to the regulations for the Academy's research organisations' research staff competitions were approved. The Academy's new board, composed of 12 members, was elected (see pp. 48–49 and below pp. 121–122).

7 December – 10 January – President Tarmo Soomere visited the academies of sciences of the South American states Uruguay, Argentina and Chile, and provided the Admiral Bellingshausen expedition with scientific and science diplomacy-related support while the ship was in Uruguayan and Argentine waters (see pp. 65–69).

10 December – President Tarmo Soomere and Member of the Academy Maarja Kruusmaa took part in a research seminar at the University of Uruguay (Universidad de la República de Uruguay) in Montevideo (see pp. 65–66).

12 December – President Tarmo Soomere and Member of the Academy Maarja Kruusmaa discussed common challenges and cooperation perspectives with the management of the National Academy of Sciences of Argentina (see pp. 66–67).

12 December – Members of the Academy Richard Villems and Karl Pajusalu participated in and delivered presentations at the Academia Pernaviensis II think tank.

13 December – President Tarmo Soomere and Member of the Academy Maarja Kruusmaa participated in a research seminar at the National Academy of Sciences of Argentina. The President delivered a presentation titled "Connecting science, society and policy in a small country. Insight into the Estonian Academy of Sciences" and Academy Member Kruusmaa delivered a presentation titled "Bio-inspired Underwater Technologies for Shallow Water Applications" (see pp. 66–67).

17 December – A conference of the research professors of the Academy of Sciences took place in the framework of an extended meeting of the board of the Academy. Presentations were delivered by Andres Merits, University of Tartu ("Interactions between the components of a virus and the host in the replication process of the RNA of the virus"), Toomas Rõõm, National Institute of Chemical Physics and Biophysics ("Magnetoelectric interaction in ordered systems) and Dmitri Vinnikov, Tallinn University of Technology ("Power electronics systems for nearly

zero energy and energy-efficient buildings"). The event was moderated by Secretary-General Jaak Järv. The research professors' reports and the schedule for the 2020 general assemblies and meetings of the board were approved. Maie Pihlamägi was released from her duties as editor-in-chief of the journal *Acta Historica Tallinnensia*. Professor at Tallinn University Marek Tamm was appointed the new editor-in-chief and Liisi Keedus, Anu Mänd, Maie Pihlamägi and Ulrike Plath were appointed editors. Marti Aavik was appointed Director of the Estonian Academy Publishers and former Director Ülo Niine was thanked for his work. The grants of the Academy of Sciences sub-fund of the Estonian National Culture Foundation were awarded. Member candidates were approved for the evaluation committee of the Estonian Research Council.

17 December – The formal Christmas reception of the board of the Academy was held. The new Foreign Members of the Academy Margus Veanes and Raimo Raag received Foreign Member of the Academy certificates. Erki Tammiksaar, Andres Kollist and Helle-Liis Help received Medals of the Academy of Sciences.

18 December – Foreign Member of the Academy Margus Veanes met representatives of the Estonian IT sector and delivered a lecture on research and development in Microsoft.

NATIONAL COMMITMENTS

NATIONAL RESEARCH AWARDS

The Estonian state has delegated the national research awards procedure to the Academy. Pursuant to the National Research Awards Selection Board's recommendation, the government decided to award the following prizes for 2019:

LIFETIME ACHIEVEMENT AWARDS (awards for long-term productive work in research and innovation):

Anne Luik – b. 1949, Senior Researcher at the Institute of Agricultural and Environmental Sciences of the Estonian University of Life Sciences, Professor Emeritus

Anne Luik is an internationally recognised researcher in the field of insect pests and, in recent decades, in organic farming. She has established the foundations of safe food production research and studies in Estonia (a key problem in a modern, globalised and chemicalised economy). She is a highly appreciated lecturer who has established the entire current plant protection teaching programme at the Estonian University of Life Sciences and has authored teaching materials and textbooks. Anne Luik successfully managed all of the research done at the Estonian University of Life Sciences in 2008–2012 as the university's Vice Rector for Research. A charismatic leader, she is a member of numerous international groups and is a prolific science promoter. She has led annual plant protection days and organic conferences. Her excellent communication skills have helped her bring together researchers, lecturers, producers and key staff at ministries to develop Estonian agriculture.

Peeter Saari: b. 1949, Member of the Academy (1986), Head of the Laboratory at the Institute of Physics at the University of Tartu, and Professor of Wave Optics (see p. 24).

Peeter Saari is a truly learned person who, in his many years of wide-ranging activities as a lecturer, researcher, science promoter, science organiser, research manager and promoter and communicator of scientific thought, has never lost sight of his role as a member of society. He made his first discovery very early in his career (1968). He has been active and prolific in his field ever since. He is recognised in modern physics as the founder of

nondiffractive light pulse research. His immense efforts in science organisation (he essentially established and organised the distribution of research grants in Estonia), unerringly civil attitude, keen eye and astute writing skills have made him one of the most eminent Estonian researchers of all times.

Peeter Saari: "Our small research group became one of the founders of nondiffractive localised waves research. /.../ We have published some six dozen articles in leading optics journals, along with chapters in two monographs discussing the field. We have used our numerous grants ... to develop a unique measurement device for the design and diagnostics of elements of high-tech optical devices with ultra-fast femto-second temporal and micrometer-level spatial precision /.../".

DISCOVERY AWARD (research award for scientific discoveries that impact a paradigm and world-view in a scientific area, or that create a new field of research or lead to the creation of innovative products with a significant socio-economic impact).

Mart Ustav: b. 1949, Member of the Academy (2001), Professor of Biomedical Technology at Tartu University Institute of Technology, and founder and head of the Icosagen Group – an award for research and development leading to the creation of innovative products with a significant socio-economic impact – "From research on the molecular mechanisms of the replication of DNA oncoviruses to the development of biological drug manufacture and development technologies" (see p. 27).

Mart Ustav has developed the results of his fundamental molecular biological research on DNA viruses, including the mechanisms of the persistence in the organism of papillomaviruses, which cause cervical cancer, into practical applications that benefit the entire society (e.g. the creation of an HIV vaccine). He has innovatively applied his discoveries about the replication of viral genomes and the production of relevant proteins to create an entirely novel technology for the large-scale production of diagnostic and therapeutic proteins. It is currently licensed by nearly all leading global pharmaceutical companies.

Mart Ustav: "In my benign naivety, I would like to define an alternative hypothesis for the potential synergy between research, society and business in Estonia. The additional research funding provided by taxpayers must stimulate the creation of commercialised intellectual property and thus advance the establishment and development of both local and global high-tech companies in the Republic of Estonia...".

ANNUAL AWARDS (awarded for the best research papers prepared and published within the preceding four years, i.e. 2015–2018)

Arvet Pedas: b. 1948, Professor of Differential and Integral Equations at the Institute of Mathematics and Statistics at the University of Tartu, received the exact sciences award for the research cycle "Effective numerical methods for solving fractional differential equations and singular integral equations".

Arvet Pedas has proved many fundamental principles regarding the properties of the solutions of fractional differential equations and their possible singularities. He has derived original, effective, stable and optimal methods for solving such equations and integro-differential equations containing singularities quickly and precisely.

Tõnu Esko: b. 1985, Assistant Director at the Institute of Genomics at the University of Tartu,

Reedik Mägi: b. 1978, Senior Researcher in Bioinformatics at the Institute of Genomics at the University of Tartu,

Krista Fischer: b. 1970, Professor at the Institute of Mathematics and Statistics at the University of Tartu; Senior Researcher of Biostatistics at the Institute of Genomics,

Lili Milani: b. 1981, a founding member of the Estonian Young Academy of Sciences, and Leading Researcher in Epigenomics and Pharmacogenomics at the Institute of Genomics at the University of Tartu – chemistry and molecular biology award for the research cycle "Basic research on genetics and genomics for the implementation of personal medicine in Estonia".

A major step towards the application of the data of the donors to the Estonian Genome Project to map the potential uses of personalised medicine in assessing the risks of both monogenic (a specific hereditary mutation) and polygenic (based on multiple genetic variations) diseases and the use of genetic variations impacting the efficacy and side effects of pharmaceuticals in determining optimal dosage.

Irina Hussainova: b. 1961, Professor at the Mechanical and Industrial Engineering Institute at the Tallinn University of Technology – technical sciences award for the research cycle "Network of nanofibers as a basis for multifunctional hybrid materials".

A series of technologies was created to produce materials composed of networks of appropriately oriented bundles of nanometres-thick fibres and utilise them in various fields. This structure makes it possible to retain the unique nano-scale properties of the fibres and to obtain the desirable properties on a macroscopic scale.

Allen Kaasik: b. 1970, Head of the Department of Pharmacology of the Institute of Biomedicine and Translational Medicine at the University of Tartu, Professor of Molecular Toxicology, Senior Researcher in Pharmacology – medical science award for the research

and development work "The role of mitochondria in nervous system diseases".

Allen Kaasik has demonstrated the importance of the cell energy crisis caused by damage to mitochondria (the main energy sources of cells) in the development of neurological disorders, has explored ways to promote the creation of new mitochondria in neural cells, and has shown how the Miro1 protein on the external membranes of mitochondria controls mitochondrial damage.

Urmas Saarma: b. 1967, Head of the Chair of Mammalogy at the Institute of Ecology and Earth Sciences at the University of Tartu, Leading Researcher – geology and biology award for the research cycle "Complex Studies on Life-threatening Zoonotic Pathogens and Their Carnivore Hosts in Estonia and Globally".

The implementation of new sensitive non-invasive techniques has granted us a completely new understanding of the frequency of the incidence of parasites common to Estonian wild animals and humans, genetic lineages of widespread parasites, such as *Echinococcus granulosus*, and the roles and migration of (intermediate) hosts of diseases. These results enable us to better predict the frequency of the incidence of parasites and to manage disease outbreaks in future.

Marika Mänd: b. 1954, Professor and Head of the Chair of Plant Health at the Institute of Agricultural and Environmental Sciences at the Estonian University of Life Sciences – agricultural science award for the research paper "Development of innovative technologies for precision plant protection through physiological and behavioural studies of pests and beneficial organisms".

Marika Mänd has developed a novel plant protection technology utilising both precision plant protection and pollination – bumblebees are used to carry the necessary compounds directly into the flowers of plants – and has determined the cumulative impact of multiple stress factors affecting the abundance, physiological processes and behaviour of insects on our agriculture.

Allan Puur: b. 1963, Professor and Leading Researcher at the Estonian Institute for Population Studies at Tallinn University – social science award for the research cycle "Studies of the demographic development of Estonia in country-centred and comparative perspectives".

In-depth analysis of sensitive topics (the specificities of marital behaviour and birth rates for native inhabitants and immigrants and by ethnic origin, mortality and possible external factors affecting it through the centuries, and the functioning of social policy measures) has brought attention to the unexpected patterns in those processes that are relevant to the entire society.

Rein Raud: b. 1961, Professor of Asian Studies at the Tallinn University School of Humanities – humanities award for the research effort "Studies in culture theory".

An original, broad, yet systematic review of the development and key approaches to culture theory, giving rise to a clear, independent and holistic (meta-)framework for understanding culture. Unlike the majority of current cultural studies, this framework makes it possible to comparatively analyse cultural phenomena in different eras and regions.

ACADEMY-NOMINATED MEMBERS TO UNIVERSITY COUNCILS AND THE ESTONIAN RESEARCH COUNCIL

The Academy appointed the following members to university councils:

Tallinn University: Foreign Member of the Estonian Academy of Sciences Ülo Langel, Professor of Neurochemistry and Molecular Neurobiology at Stockholm University, and Professor of Molecular Biotechnology at the University of Tartu.

Tallinn University of Technology – Member of the Academy Mart Saarma, a professor at the Institute of Biotechnology of the University of Helsinki.

Estonian University of Life Sciences – Member of the Academy Anne Kahru, Head of the Laboratory of Environmental Toxicology at the National Institute of Chemical Physics and Biophysics.

Estonian Academy of Music and Theatre – Erkki-Sven Tüür, freelance composer and a member of the Estonian Composers Union.

Estonian Academy of Arts – Eva Näripea, a founding member of the Estonian Young Academy of Sciences, and the director of the National Film Archives.

See also pp. 28–29.

Member of the Academy Jakob Kübarsepp, a professor at the Mechanical and Industrial Engineering Institute of the Tallinn University of Technology, was appointed as a member of the Board of the Estonian Research Council by the Minister of Education and Research at the Academy's recommendation.

Member of the Academy Maarja Kruusmaa, Professor of Biorobotics at the Tallinn University of Technology was appointed the joint representative of the Estonian Academy of Sciences and the Estonian Young Academy of Sciences of the Appointment Committee to the Evaluation Committee of the Estonian Research Council.

See also p. 30.

CONTRIBUTIONS OF AND HONORS TO THE ACADEMY MEMBERS

MEMBER OF THE ACADEMY AWARDED AN ESTONIAN STATE DECORATION

Decision No. 384 of the President of the Republic of Estonia, 29 January 2019

ORDER OF THE WHITE STAR CLASS III
Member of the Academy Tarmo Uustalu

Members of the Estonian Academy of Sciences continued to carry out their research and academic activities in 2019.

In addition to their principal occupation, various members of the Academy act as experts and advisers.

Several members serve in expert panels and councils of national significance:

Government of the Republic Research and Development Council – Jaak Aaviksoo, Toomas Asser, Mart Saarma and Tarmo Soomere;

Government of the Republic Sustainable Development Committee – Margus Lopp;

National Science Prize Committee – Tarmo Soomere (Chair), Jaan Aarik, Maarja Kruusmaa, Jüri Martin, Ülo Niinemets, Karl Pajusalu, Tiit Tammaru and Eero Vasar (Vice Chair);

Advisory Board of the Foresight Centre at the *Riigikogu* – Jaak Aaviksoo and Tarmo Soomere;

Board of the Estonian Research Council – Mart Ustav (until October 2019) and Jakob Kübarsepp (from October 2019);

Appointment Committee of the Estonian Research Council Evaluation Committee – Maarja Kruusmaa;

Estonian Research Council Evaluation Committee – Anne Kahru, Jarek Kurnitski, Tiit Tammaru and Andres Öpik;

Estonian Science Communication Award Appraisal Panel at the Estonian Research Council – Ene Ergma (Chair);

TeaMe+ Programme Advisory Board at the Estonian Research Council – Tarmo Soomere;

Supervisory Board of Eesti Pank – Urmas Varblane

Fiscal Council – Urmas Varblane.

A considerable number of members have been involved in the work of expert panels reporting to a particular ministry.

Ministry of Education and Research:

Research Policy Advisory Committee – Ülo Niinemets and Ergo Nõmmiste († 11.04.2019);

Working Group on the Internationalisation of Estonian Research and Steering Committee for the Internationalisation of Research Programme – Jüri Engelbrecht;

Programme Board of the national programme "Development of Values in Estonian Society (2015–2020)" – Olav Aarna and Jüri Engelbrecht;
Estonian Lifelong Learning Strategy 2020 Steering Group – Olav Aarna;
Estonian Science Communication Competition – Ene Ergma (Chairman of the Committee);
Estonian National Contest for University Students Evaluation Committee – Marco Kirm;
Steering Group of the Estonian Education Strategy 2035 and Working Group for the Estonian Innovation Strategy 2030 – Maarja Kruusmaa;
Gene Technology Committee – Eero Vasar.

Ministry of Finance:
Cohesion Policy Operational Programme Monitoring Committee – Tarmo Soomere (permanent member) and Andres Öpik (substitute member);

Ministry of the Environment:
Advisory Board of the Geological Survey of Estonia – Margus Lopp.

Ministry of Social Affairs:
Advisory Professional Committee for Neurosurgery – Toomas Asser;
Advisory Professional Committee for Cardiology – Jaan Eha;
Advisory Professional Committee for Allergies and Immunology – Raivo Uibo;
Health Research and Innovation Council – Eero Vasar.

Ministry of Economic Affairs and Communications:
Estonian Space Affairs Council – Ene Ergma (Chairman).

Estonian Centres of Excellence in Research were headed by five members of the Academy: Martti Raidal – Dark Side of the Universe; Ülo Niinemets – Ecology of Global Change: Natural and Managed Ecosystems; Enn Lust – Advanced Materials and High-Technology Devices for Energy Recuperation Systems; Andres Metspalu – Centre of Excellence for Genomics and Translational Medicine; and Maarja Kruusmaa – Excellence in IT in Estonia EXCITE.

Two members of the Academy belonged to the decision making bodies of doctoral schools: Karl Pajusalu (Chairman of the Council) – Doctoral School of Linguistics, Philosophy and Semiotics; and Enn Lust (Chairman of the Council) – Doctoral School of Functional Materials and Technologies.

Similarly to previous years, members of the Academy were widely represented in international scientific organisations and editorial boards of scholarly journals; e.g.:
Permanent Working Group on Science and Ethics of All European Academies ALLEA – Raivo Uibo;
European Academies' Science Advisory Council (EASAC) – Jaak Järv;
Environmental Steering Panel of the EASAC – Tarmo Soomere;
Energy Steering Panel of the EASAC – Enn Lust;
Union Académique Internationale (UAI) – Jaan Undusk.

Members of the Academy Mart Ustav and Peeter Saari were recognised with the national research awards (see pp. 26–27 and 32–41).

Members of the Academy were also publicly acknowledged by various institutions, associations and organisations in 2019:

- Toomas Asser was awarded the Cross of Recognition of the Republic of Latvia, third class;
- Jaan Einasto and Enn Saar were recognised with the University of Tartu Grand Medal;
- Jaan Einasto was awarded the decoration "Tartumaa Kuldne Tammeoks";
- Anne Kahru was elected the first Researcher of the Month in 2019 by the European Platform of Women Scientists;
- Maarja Kruusmaa was elected the Visiting Scholar of the Year of the Woods Hole Oceanographic Institute at the Massachusetts Institute of Technology by the institute's PhD and master's students;
- Andres Metspalu was proclaimed the European of the Year by European Movement Estonia for his services in developing Estonian and European research;
- Ülo Niinemets became an Honorary Doctor of the University of Eastern Finland and was elected one of the three laureates of the Sirp culture newspaper awards 2018;
- Karl Pajusalu was awarded the Cross of Recognition of the Republic of Latvia, fourth class;
- Arvo Pärt was awarded the Cross of Recognition of the Republic of Latvia, second class (Grand Officer), the Deutscher Musikautorenpreis award of German composers in the category of choral music and the Spanish Semana de Música Religiosa de Cuenca Honorific Award; he was elected an honorary citizen of Harju County and an honorary member of the "Toetan erilist elu" autism foundation; he was second in the most performed modern composers ranking, according to the Bachtrack database. He had held first place for the previous eight years;
- Anu Raud was awarded the title of Woman of the Years 2019 by the Estonian Association of Business and Professional Women;
- Tarmo Soomere was elected a foreign member of the Lithuanian Academy of Sciences;

The nine Estonian researchers to make the world's most cited researchers list (Clarivate Analytics Web of Science

database, 0.1% most cited researchers) in 2019 included Members of the Academy Anne Kahru, Urmas Kõljalg, Ülo Niinemets and Martin Zobel.

Members of the Academy Jüri Allik, Anne Kahru, Urmas Kõljalg, Andres Metspalu, Ülo Niinemets, Martti Raidal, Anu Realo, Martin Zobel, Richard Villems and Jaak Vilo were included among the scientists ranking in the top 1% by citations for field and publication year according to Essential Science Indicators.

Members of the Academy Anne Kahru, Maarja Kruusmaa and Anu Realo were listed among European top female researchers in the AcademiaNet portal (www.academia-net.org).

Estonia's Top Influencers list, compiled by Estonian journalists, includes Members of the Academy Arvo Pärt (8th position), Jaak Aaviksoo (85th position) and Tarmo Soomere (86th position).

Foreign members continued to participate in the activities of the Academy and research institutions of Estonia in compliance with time-honoured collegial relationships, scientific collaborations and research alliances.

GENERAL ASSEMBLY

The General Assembly of the Academy was convened three times in 2019.

The 24 April General Assembly meeting (pp. 15–18) reviewed the Academy's activities in 2018 and approved recommendations regarding the research agreement signed on 19 December 2018.

Detailed information regarding the Academy's activities during the accounting year is available in the *Estonian Academy of Sciences Year Book XXIV (51)* https://www.akadeemia.ee/en/publication/estonian-academy-of-sciences-yearbook-facts-and-figures-2018-xxiv-51/

The President presented Member of the Academy Dimitri Kaljo with a letter of appreciation for his long-time successful work as the editor-in-chief of the *Estonian Journal of Earth Sciences* and announced that Member of the Academy Anto Raukas will receive a letter of appreciation for his long-time successful work as the editor-in-chief of the journal *Oil Shale*.

As per tradition, the laureate of the 2019 national research award for long-term productive work in research and innovation, Member of the Academy Peeter Saari (see p. 26), delivered a lecture titled "A Journey through Equations". The laureate of the 2019 discovery award, Member of the Academy Mart Ustav (see p. 27), delivered a lecture titled "Research and Enterprise".

Division heads Jaak Aaviksoo, Jakob Kübarsepp, Toomas Asser and Urmas Varblane presented overviews of the Academy's activities in 2018 and President Tarmo Soomere summarised the year. Acting on the Secretary-General's proposal, the General Assembly approved the Academy's report for 2018 on the basis of the reports and the materials presented in the yearbook.

Secretary-General Jaak Järv presented a review of the discharge of the 2018 budget, presented the 2019 budget, which the General Assembly approved (see pp. 180–181), and presented a plan for the distribution of Academy member stipends for the period 01.05.2019–30.04.2020. The General Assembly adopted a decision to split the sum allocated for member stipends evenly between all members.

President Tarmo Soomere presented the Academy's recommendations for the realisation of the national agreement on financing of science (research agreement) signed on 19 December 2018 (see pp. 16–18). The General Assembly approved the decision titled "The opinion of the Estonian Academy of Sciences on investments in research, development and innovation in the context of the research agreement".

The second General Assembly meeting of the year, held on 25 September (pp. 44–47), focused on the election of a President and foreign members.

At the beginning of the meeting, President Tarmo Soomere presented the Harald Keres Memorial Medal to Academy Member Jaan Einasto.

Academy Member Andres Metspalu delivered the research lecture "From the Estonian Genome Project to Personalised Medicine".

Division heads spoke about discussions in their divisions about presidential candidates. The Division of Informatics and Engineering nominated the incumbent President, Tarmo Soomere, as a candidate. Tarmo Soomere delivered a programmatic presentation. A secret vote resulted in the election of Tarmo Soomere as the President of the Academy for the next five years.

Svante Pääbo, Director of the Department of Evolutionary Genetics at the Max Planck Institute for Evolutionary Anthropology, Raimo Raag, Professor of Finnic Languages (Estonian) at Uppsala University, and Margus Veanes, Senior Researcher at Microsoft Research, were elected new foreign members of the Academy.

The agenda of the 4 December meeting of the General Assembly focused on the election of the Board of the Academy (pp. 48–49).

Foreign Member Svante Pääbo, elected at the previous Assembly meeting, delivered a research presentation titled "Archaic Genomics".

The General Assembly approved amendments to the documents "Statute of the Academy Divisions" and "Regulations for the Academy's Research Organisations' Research Staff Competitions".

The next agenda item was the election of a new Board. President-Elect Tarmo Soomere proposed limiting the number of the members of the new Board to 12. It was decided to elect two Vice Presidents and four non-executive members. Tarmo Soomere proposed to elect Arvi Freiberg and Mart Kalm as Vice Presidents, Jaak Järv as the Secretary-General, and Martti Raidal, Division of Astronomy and Physics, Maarja Kruusmaa, Division of Informatics and Engineering, Ülo Niinemets, Division of Biology, Geology and Chemistry, and Tiina Randma-Liiv, Division of Humanities and Social Sciences, as non-executive members. Voting by secret ballot resulted in the election of all of these candidates for the respective positions.

The General Assembly acknowledged that division heads previously elected by divisions are included in the Board: Member of the Academy Marco Kirm for the Division of Astronomy and Physics, Member of the Academy Jakob Kübarsepp for the Division of Informatics and Engineering, Toomas Asser for the Division of Biology, Geology and Chemistry, and Valter Lang for the Division of Humanities and Social Sciences.

The oldest member of the Academy present at the meeting, Dimitri Kaljo (b. on 12 October 1928), countersigned the employment agreement with President Tarmo Soomere for his second term in office on behalf of the General Assembly.

BOARD

The Board of the Estonian Academy of Sciences was composed of the following members in 2019:

President	Tarmo Soomere
Vice-President until 11.04.2019	Ergo Nõmmiste († 11.04.2019);
Vice-President	Mart Kalm
Vice-President	Arvi Freiberg
Secretary-General	Jaak Järv
Head of the Division of Astronomy and Physics until December 2019	Jaak Aaviksoo
Head of the Division of Astronomy and Physics from December 2019	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 until December 2019	Urmas Varblane
Head of the Division of Humanities and Social Sciences from December 2019	Valter Lang
Non-executive Members	Jüri Engelbrecht
	Valter Lang until December 2019
	Ülo Niinemets
	Karl Pajusalu
	Martti Raidal
	Peeter Saari
	Andres Öpik
	Eero Vasar

During the year, the Board held seven working meetings and once a decision was passed using an electronic poll.

Since the election of new foreign members was planned for the end of the year, matters related to the elections were discussed on various occasions. Three new foreign members, one each to the Division of Informatics and Engineering, the Division of Biology, Geology and Chemistry and the Division of the Humanities and Social Sciences, were elected. The Board reviewed the proposals of the divisions and nominated candidates to the General Assembly for voting. The funding of societies associated with the Academy was also regularly discussed. Regular meetings and negotiations of the Management Board to discuss organisational aspects of science policy and in-house matters continued.

COUNCILS AND COMMITTEES

COMMITTEE ON METEORITICS

Set up in 1954
Chair: Jüri Plado, PhD

Pursuant to the decision of the 14 March 2017 meeting of the Board of the Academy, the membership of the Committee on Meteorics is composed of Jüri Plado (chair), Juho Kirs, Tõnu Pani, Ulla Preeden, Sten Suuroja, Reet Tiirmaa and Siim Veski.

On 22–25 August, Jüri Plado and Herbert Henkel participated in geological fieldwork at the Dellen impact crater in Sweden. Laboratory studies of charcoal and possible meteorite material from the Ilumetsa craters continued.

The research results were presented at four conferences: The 5th Finnish National Colloquium of Geosciences, 6–7 March 2019, Helsinki, Finland; XXIX Geophysics Days, 21–22 May 2019, Rovaniemi, Finland; Impacts and their Role in the Evolution of Life, 10–13 June 2019, Tällberg, Sweden; and Large Meteorite Impacts and Planetary Evolution VI, 30 September–3 October 2019, Brasília, Brazil.

In the course of the year, employees of the University of Tartu Museum of Natural History, the Department of Geology at the University of Tartu and the Tallinn University of Technology Department of Geology advised approximately a dozen people in matters related to meteoritics (potential connections of accidental finds to meteorites, and circular structures' potential connection to meteorite craters).

COMMITTEE ON NATURE CONSERVATION

Set up in 1955
Chair: Urmas Tartes, PhD

The headquarters of the Committee on Nature Conservation of the Estonian Academy of Sciences continue to be located at Baer House in Tartu. The membership of the committee did not change in 2019.

The slogan of the 2019 nature conservation month was "Everyone's nature conservation". At the opening event at the Tallinn Botanical Garden on May 13, the culture and folklore expert Marju Kõivupuu, a friend of nature and safe-keeper of diversity who has done a lot to bring together folklore and nature, was awarded the Eerik Kumari Award in the field of nature conservation.

Several exhibitions curated by the Society's Secretary Vaike Hang were displayed at the Baer House during the year. The exhibition "Eerik Kumari Award 30" was displayed from May to August and the exhibition "Laureate of the Kumari Award Ann Marvet 80" was displayed from April to July. Ann Marvet is a Candidate of Biology, editor of the journal "Eesti Loodus" (*Estonian Nature*) since 1967, an active participant in the Phosphorite War and in disputes concerning our bogs, and an author of numerous books („Eesti taimekoosluste määraja", 1970; „Siin mägi, seal mägi ... A. H. Tammsaare koduloodusest", 2008, etc.). The exhibition "Estonian Naturalists' Society's Research Secretary 90", displayed from January 18 until early May, was prepared in collaboration with the library employee Ulje Natus. Linda Kongo is a historian of science and a long-time research secretary of the Estonian Naturalists' Society. She has written several monographs on the history of the society and numerous research articles on famous Estonian and Baltic German natural scientists. A Linda Kongo appreciation evening took place at the Baer House on 20 March.

In November and December, the exhibition "Estonians in Australia" was displayed at the Tartu Public Library. Publications and memorabilia of Australian Estonians and works by Estonian artists were displayed.

The everyday work of the committee members is mainly focused on nature conservation activities. Several retirement-aged committee members are still active in its work. Vaike Hang has collected materials on wooded meadows at her farmstead: how hay used to be made there and what the meadows currently look like. Vilma Kuusk continued her years-long work monitoring the state of protected plant species at the Vana-Pärnu beach meadows, published the article "Olukorrast Pärnu rannaniitudel" ("The beach meadows of Pärnu at present") in the Pärnu Postimees newspaper and participated in a study trip to the island of Öland in May. Ingmar Ott co-authored a book "Eesti järved. Roheline Eesti." (Estonian Lakes. Green Estonia. Varrak 2019) and delivered the lecture "The state and the need for the remediation of Estonian

lakes" at the Estonian State Forest Management Centre nature conservation conference 2019
https://www.rmk.ee/metsa-majandamine/looduskait-setood/looduskaitsekonverents-2019/ettekanded#image_3

Kuulo Kalamees participated in the preparation of the Red List of Estonian nature for mushrooms, consulted on a mushroom exhibition hosted by the University of Tartu Natural History Museum in September, provided frequent valuable advice to members of the general public regarding the identification and edibility of mushrooms and researched the existence and value of protected species in Estonia. Urmas Tartes delivered natural education lectures at the Lilli Nature School, Energy Discovery Centre, at the Kohila natural education centre and at a student science festival. He also took part in the evaluation committees of the "Märka mind!" ("Notice me!") photo contest of the Vapramäe-Vellavere-Vitipalu foundation, the "Nature photo of the year" and the journal *Eesti Loodus* photo contests. He was a member of the Eerik Kumari Award committee, continued to represent the Academy in the council of the MTÜ Loodusajakiri non-profit association and consulted on the translations of nature films broadcast by Estonian Public Broadcasting. He dedicated a significant amount of time to explaining topics related to nature conservation, forest ecology and matter and energy circulation on social media.

ESTONIAN POLAR RESEARCH COMMITTEE

Set up in 1993
Chair: Rein Vaikmäe, Professor Emeritus

The European Polar Board (EPB) is an independent strategic expert board that represents the interests of its member states in polar research planning and infrastructure development and counsels the European Commission in relevant matters. Estonia has been a member of the EPB since 2001, and is represented by the Estonian Polar Research Committee (EPRC).

Estonia made a significant contribution to the implementation of the EU Polar Net project "Connecting Science with Society" in the framework of the Horizon 2020 Initiative in the period 2015–2020. The project aims to develop an integrated European polar research strategy. All stakeholders, including government agencies, industry representatives, polar inhabitants and academics, are involved. Estonia is represented by the Tallinn University of Technology Department of Geology. A draft European Polar Research Strategy was finalised in late 2019. The strategy was subjected to a public online discussion carried out in EPB member states. The Estonian Polar Research Committee mediated the discussion in Estonia. Researchers, entrepreneurs and polar inhabitants were involved in the creation of the strategy. The final document is intended to be used as input for the next European Union framework programme for environment and climate action. The European Commission requested that the consortium submit a follow-up proposal for a new project to develop an action plan for the polar research strategy, also defining the status of the European Union institution implementing it. The consortium began drafting a new proposal in late 2019.

The Estonian Polar Research Committee continued to promote polar research in Estonia. The proposal to initiate Estonia's adhesion to the Protocol on Environmental Protection to the Antarctic Treaty was submitted to the Ministry of the Environment. The Office of the President of the Republic of Estonia also raised the matter of adhesion to the Protocol in connection with the Admiral Bellingshausen Antarctic200 expedition and the planned participation of the Estonian President in the journey. According to the Ministry of the Environment, the Secretaries General of all relevant ministries have approved the proposal. The process is expected to be finalised in the first half of 2020.

The Estonian Polar Research Committee was also represented in the biggest popular science expedition in modern Estonian naval history (see also pp. 59 and 65–69), organised to commemorate the historic journey of Fabian Gottlieb von Bellingshausen and the 200th anniversary of the discovery of Antarctica, and participated in the preparation and execution of related public events. Several members of the Committee took part as crew members and delivered lectures at various stages of the expedition. The Committee also initiated a polar quiz and expedition programme for schoolchildren to introduce polar research.

Member of the Committee Priit Tisler took part in the Finnish Antarctic expedition FINNARP at the Aboa research station, initiated in December 2019, acting as head of the expedition and of the station. The planned research focus was primarily on general and specific meteorological matters and properties of snow and ice. At the end of the year, President of the Republic of Finland Sauli Niinistö awarded Priit Tisler the Order of the Lion of Finland cross for services performed for the Republic of Finland.

Several Estonian travel agencies have engaged or intend to engage our polar research experts (Enn Kaup, Andres Tarand and Erki Tammiksaar) as guides for tourist trips to the Antarctic.

Estonia's participation in the work of the EPB has allowed our researchers to directly and effectively contribute to the development of European polar research and development strategies and specific research programmes. It opens the way for our small, yet high-level and active research group's participation in international partnerships, provides logistic support and access to expensive and unique infrastructure, and has helped to create a positive image for Estonia in this internationally

prestigious field. The international visibility will hopefully contribute to the participation of our researchers in various new polar research and technological programmes, particularly the joint polar research projects planned in the framework of the Horizon 2020 Initiative.

COMMITTEE ON ENERGY

Set up in 1998
Chair: Arvi Hamburg, Professor

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.

The Committee's statutes were updated in 2019, its competences in renewable and nuclear energetics were expanded and the science advisors of the relevant ministries were added to the Committee. The Committee held three meetings in 2019.

The main topics discussed at the 3 April meeting were: a) possibilities of the use of hydropower in Estonia and b) a potential exit from the BRELL network and synchronisation with continental Europe. Estonia has historically had numerous hydroelectric power plants, which have affected river flow and water levels. Very few of them have been restored for a second duty cycle. Closing functioning hydroelectric power plants sends a negative signal to the field of renewable energy and investors. Managed hydropower is a safeguard of energy security. In restoring spawning grounds, potential technical solutions (fish ladders, lifts, etc.) and negative externalities (the destruction of landscape architecture, and the destruction of buildings subject to heritage conservation) must be considered. The Committee recommended that the Environmental Board analyse the current state of northern Estonian rivers and find a balance between renewable energy, architectural merit, heritage conservation, animal and plant communities and fishing potential.

Having discussed the second agenda item, the Committee considered the following necessary items to be incomplete: a scientific risk analysis, a reasoned security of supply and immunity analysis, a plan for the investments necessary to meet the requirements for the UCTE synchronous area and an end consumer price prediction, a power generation plan to replace the reduced capacity of the Narva area power plants and regulation capacity, and an action plan and economic impact analysis for a scenario in which the decoupling of the Estonian electric power system from the IPS/UPS synchronous area takes place on the initiative of the Russian Federation without sufficient notice. Considering the above, the Committee believes that changing the synchronous area of the Estonian electric power system requires a significantly more in-depth analysis and a more coordinated action plan.

The 12 May off-site meeting at the Eesti Gaas solar power station at Rääma, Pärnu discussed: a) the use of solar power in electricity generation, b) the developments and development opportunities of nuclear power and steps to be taken in Estonia, and c) hydrogen energetics. Taking into account likely grant aid, solar power plants are economically viable, the construction of solar panels on low-value land is justified, provisions for a balance of power should be included in plans for the construction of solar power plants involving investments, the solar solution provided by AS Eesti Gaas provides good value for the consumer, and the current renewable energy aid scheme should be replaced with an auction-based system.

Regarding the use of nuclear power, the committee noted that Estonia and neighbouring countries are in significant deficit regarding energy production and that interstate connections cannot guarantee supply security. To ensure energy security, the state must consider as a possible option the construction of a small fourth-generation nuclear power plant in Estonia. Nuclear energetics require the fostering of specific competence and a cooperation network.

The position was expressed that hydrogen fuel is an option in producing a balance of power in the electric power system. The construction of wind farms must be significantly boosted in order to produce the necessary hydrogen. The use of hydrogen as a transport fuel is an opportunity and a challenge in the near term.

The key topics discussed at the 11 November meeting were climate and energy policy. The Committee believes that Estonia's legal climate-related regulations are stricter than the respective EU regulations, that the 80% greenhouse gas reduction plan adopted by Estonia must be increased to 100% and that the absorption of carbon dioxide must be taken into account. An exit from oil shale-based power production is underway. The volume of the pulverised combustion of oil shale has decreased nearly three fourths in ten years. The cost of carbon emissions has increased fivefold in the last two years and in ten years' time, Estonian oil shale-based power plants will cover less than one half of the consumption capacity.

To achieve climate neutrality, individual citizens must change their consumption patterns and lifestyles. Achieving this goal in energetics requires setting national goals and enacting policy measures, channelling extensive investments into renewable energy, energy efficiency, ensuring energy security, elimination of barriers in the energy market and large-scale investments in research and development. Meeting climate goals is particularly difficult in the context of the intended changes in the energy economy (de-synchronisation from the BRELL

network, capacity deficit and digitisation).

The following goals were adopted by the Committee on Energy:

- Contribute to evaluating research and development funding needs;
- Provide innovative energetics solutions to policy-makers in partnership with World Energy Council Estonia;
- Facilitate public access to positions adopted by the Committee on Energy;
- Significantly enhance cooperation with the committees and associated institutions of the Academy of Sciences in order to identify and promote common positions.

COMMITTEE ON PHYLOGENY AND TAXONOMY

Set up in 2007
Chair: Urmas Kõljalg, Member of the Academy

The Committee on Phylogeny and Taxonomy represents Estonia at the research organisation Consortium of European Taxonomic Facilities (CETAF AISBL, http://www.cetaf.org). CETAF coordinates the research and development work of biodiversity and earth sciences archives 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 45th annual meeting of CETAF AISBL on 15–16 May, at the University of Tartu Museum of Natural History and the Botanical Garden, was this organisation's first meeting in Estonia. Estonia's voting representatives were the chair of the committee, Member of the Academy Urmas Kõljalg, and the vice-chair of the Commission, Olle Hints. In the context of the meeting, a conference on the communication of DNA-based species in international databases and portals was held at the University of Tartu Library.

On 14 May, the first Estonian Taxonomy Day, "Under-researched and endangered species", took place, jointly organised by the Committee, the Estonian Research Infrastructure Roadmap object NATARC (Natural History Archives and Information Network) and the Estonian Naturalists' Society. Top experts presented an overview of Estonian wildlife species, including under-researched taxons. Presentations were also given on the results of the Estonian endangered species evaluation (Estonian Red List). Members of the Committee participated actively in the work of the Estonian Research Infrastructure Roadmap object NATARC (http://natarc.ut.ee/en/index.php). Members of the Committee Academy Member U. Kõljalg (University of Tartu), O. Hints (Tallinn University of Technology) and Agu Leivits (Estonian Environmental Board) are also members of the council of NATARC.

The development of Estonian research collections' e-infrastructure continued. Its two main components are PlutoF (https://plutof.ut.ee) for biological and SARV (http://geokogud.info) for geological databases. In Winter 2019, a meeting of the Committee, the NATARC council and the Estonian Environment Agency was held at the Tallinn University of Technology off-site location at Särghaua. Topics included the Estonian national wildlife data governance development plan and wildlife digital services required for the work of researchers, civil servants etc. Members of the Committee also take part in the work of the Ministry of Education and Research Expert Council on humanities and natural sciences collections. Vice-Chair of the Committee Olle Hints is the Vice-Chair of the Expert Council. 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

Set up in 2007
Chair: Tarmo Soomere, Member of the Academy

The tradition of relying on digital meetings and electronic information exchange continued in 2019. The members of the Committee were updated on average twice a month on information received from the European Marine Board (EMB). Messaging from the EMB contained primarily systematised information regarding the EMB's activities and published vision papers, as well as information collection drives, initiated and completed marine sciences projects, media events and new informational material.

The spring plenary of the Marine Board took place on 13–14 June in Paris jointly with the conference EurOCEAN 2019. The Estonian representative was Vice-Chair of the Committee on Marine Sciences Kalle Olli. Gilles Lericolais (IFREMER, France) was elected as the new chair of the Marine Board. Two EMB Young Ambassadors were presented: Liam Lachs (Ireland) and Alba González Vega (Spain). Their mission is to communicate the activities of the Marine Board to top marine sciences specialists and the next generation of marine scientists. The statutes were strategically amended to allow each country to be represented by up to four institutions. The previous limit was three institutions per country.

The chair of the Committee on Marine Sciences Tarmo Soomere took part in the autumn plenary session, held in Berlin on 5–7 November. The adhesion application of the organisation financing marine sciences in France, CNRS, was ratified. This was a formal decision taken in connection to the reorganisation of the EMB as an independent legal entity. The leading Italian marine sciences research centre Stazione Zoologica di Napoli "Anton Dohrn" (SZN) was accepted as a member of the Marine Board. As of 31.12.2019, the Marine Board has 34 members from

18 countries. The membership of two of the members has not been formally ratified (FNRS, Belgium, and TÜBITAK, Turkey).

The success of the activities carried out by the Committee on Marine Sciences can be indirectly evaluated by the media attention received by marine sciences and related accomplishments. While the members of the CMS are extremely busy with professional work or with representing Estonian research as a whole, the frequent appearance of marine sciences and sea-related phenomena at nearly all TV and radio stations and journals was still achieved, frequently covering Tarmo Soomere's activities in connection with his position of President of the Academy.

The chair of the CMS took part in the European Academies' Science Advisory Council's (EASAC) environmental panel's autumn meeting in Bratislava (Slovak Academy of Sciences, 2–3 October 2019) as the contact person of the European Marine Board and the representative of the Estonian Academy of Sciences.

Influence was also exerted on Estonian policy-making. The Ministry of the Environment proposed that Tarmo Soomere represent Estonia at the twentieth meeting of the United Nations Open-ended Informal Consultative Process on Oceans and the Law of the Sea at the UN headquarters (New York, United States, 10–14 June 2019). The organisers of the consultations proposed the participation of President Soomere as a panellist in the discussion "Ocean Science and the United Nations Decade of Ocean Science for Sustainable Development" (12 June 2019), presenting a short paper "The science-policy interface at the national level". The resulting presentation was titled "Science-policy interface: [downscaling to] the national level with examples from marine science" (see pp. 54–55).

Matters related to the Committee also came up indirectly at the 13 September climate conference (see pp. 19–23). Member of the CMS Alvar Soesoo is the director of the Geological Survey of Estonia. Tarmo Soomere is a substitute member of the council of this agency. Vice-Chair of the CMS Prof Kalle Olli is an official representative of Estonia to the establishment of the Joint Programming Initiative Oceans, Climate, Water. Tarmo Soomere represented the Academy of Sciences in several fora, think tanks, councils and committees.

Tarmo Soomere continues as a member of the Baltic Earth Science Steering Committee, participating in the 13th meeting of this committee (Stockholm, Sweden, 22 August 2019). 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.

The Committee was represented at two stages of the Admiral Bellingshausen yacht Antarctic200 expedition (by T. Soomere and U. Lips). A series of meetings and marine sciences seminars were organised in the academies of sciences of Uruguay and Argentina (see pp.65–69).

The European Marine Board is one of the most trusted institutions among those counselling the European Commission. This follows from the balanced representation of research funding, research and higher education organisations. Plenary sessions of the Marine Board are regularly attended by senior European Commission officials, who often report on the Commission's strategic decisions.

The Marine Board provides us with a way to realise the position of Estonian marine sciences in research policy decisions that affect the entire Baltic Sea area and to make Estonian researchers heard on the European level. The opinions of Estonia as a member of the renewed European Marine Board 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. Furthermore, this is an excellent opportunity to popularise scientific studies carried out in Estonia and to achieve European funding for the implementation of our new ideas.

The CMS has been carrying out its primary task, representing Estonian marine sciences at the European Marine Board and our top marine sciences competence in European academia, for over a decade. Marine sciences' messages to society have been broadcast with continuing intensity and the government has been advised whenever possible. The work took on a significant new dimension during the reporting year: representing Estonia in the UN consultative process. Estonia has been able to keep the visibility of marine sciences at a uniformly high level for many years. Academia, media and society exhibit persistent interest in marine, lake and coastal science, further amplified by society's interest in climate change.

STANDING COMMITTEE ON MEDICAL SCIENCE AND HEALTH STRATEGY

Set up in 2011

Chair: Eero Vasar, Member of the Academy

In 2019, 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. Three significant meetings have taken place.

The 15 January meeting was held to discuss the following matters:

- Discussion of the proposal submitted by the Faculty of Medicine of the University of Tartu regarding the creation of an Estonian medical science council;
- Proposal and discussion of the role and tasks of the council;
- Priority medical research and development directions if additional state funding is received;

- Vision statement for the public health development plan;
- Estonia and the Horizon Europe programme negotiations;
- Medical sciences information days.

The agenda for the 21 June meeting included:

- The research and development budget and expenses of the Ministry of Social Affairs;
- Research and development activities in the Ministry of Social Affairs' application for the national budget 2020–2023;
- Additional applications by the Ministry of Social Affairs to the 2021+ EU Structural Funds, and an additional application for broader implementation of personalised medicine;
- Introduction: an analysis of scientifically informed health policy development in Estonia;
- Current situation and next steps for the public health development plan;
- Priorities and means of the Ministry of Social Affairs' health department's research and development activities, including potential research, development and innovation activities connected with the public health development plan;
- Other topics and partnerships and missions relevant to the Ministry of Social Affairs' health agenda in the framework of the European Union Research Framework Programme 2021–2027.

The Ministry of Social Affairs' medical research information day took place in October.

The 25 November meeting discussed:

- An overview of Estonian research and development, the innovation and enterprise strategy and an overview of the planning of the EU Structural Funds grants for the new period;
- Programmes planned by the Ministry of Social Affairs involving Structural Funds funding for the new budget period;
- An overview of the progress of public health development plan programmes;
- The Ministry of Social Affairs' health-related studies and analyses for 2020.

The next council meeting was scheduled for March 2020 and the preliminary agenda items include a discussion regarding the public health development plan programmes and an overview of the partnerships in the context of the new Horizon Europe research framework programme.

The Standing Committee continues to consider working towards significantly higher medical science funding as its key task. Unfortunately, funding medical and health studies is not among Estonian national priorities.

COUNCIL FOR ESTONIAN CENTRES OF EXCELLENCE IN RESEARCH

Set up in 2012
Chair: Andres Metspalu, Member of the Academy

The annual working meeting of the Heads of Centres of Excellence in Research took place on 17 September 2019 in Tartu. Dr Indrek Reimand, Deputy Secretary-General for Research at the Ministry of Education and Research, briefed the council on the current situation in state funding. Several problems concerning Estonian centres of excellence were discussed and further activities were planned for late 2019 and 2020. Centres of excellence have adapted to new reporting and funding schemes. However, tender procedures remain complicated, consume too much time (and money) and are difficult to adjust to certain types of orders (e.g. for biological solutions, for which long-term demand cannot be predicted).

Questions were raised regarding the future of the Centres of Excellence measure post-2021. In spite of excellent work done at the cutting edge of research, the visibility of centres of excellence (and science in general) in society must be enhanced. It was decided to organise an information day for centres of excellence in research in spring 2020, making it possible for each centre of excellence to promote its activities in a way tailored to reach the general public. Sufficient media coverage is essential.

As a result of the meeting and in connection with the issues surrounding Horizon 2020 research grants reporting at Tallinn University of Technology, the Council for Estonian Centres of Excellence in Research published a note calling on donor authorities to amend reporting principles and increase the sustainability of science funding. Furthermore, all researchers were reminded that taxpayers' money must be used responsibly and individual mistakes affect the reputation of the whole field. Several members of the Council of Centres of Excellence (incl. Members of the Academy Maarja Kruusmaa and Andres Metspalu) published their opinions in the media.

Regarding the plan of the Ministry of Education and Research to update the Organisation of Research and Development Act, Andres Metspalu published an appeal concerning the unequal treatment of researchers compared to other public sector employees: most researchers' salaries are dependent on their success in applying for research grants, and since the rate of success is approx. 20%, research professions may lose appeal and lose talent to other sectors that offer more security through permanent employment contracts.

ACKNOWLEDGEMENTS FROM THE ACADEMY

MEMORIAL MEDALS OF THE ACADEMY

The Academy's medals are the highest recognition in the field for Estonian researchers.

The Board of the Estonian Academy of Sciences decided to award

the Nikolai Alumäe Medal to Member of the Academy Rein Küttner (see p. 17)

and

the Harald Keres Medal to Member of the Academy Jaan Einasto (see p. 47).

MEDALS OF THE ESTONIAN ACADEMY OF SCIENCES

Medals of the Academy were awarded to:

Member of the Academy Margus Lopp

Margus Lopp, Member of the Academy (Secretary-General of the Academy 2014–2017, the organiser of the establishment of the Estonian Young Academy of Sciences)

Ülle Madise, Chancellor of Justice

Andres Kollist, Director of the Tallinn University Academic Library

Erki Tammiksaar, historian

Helle-Liis Help, former long-time language editor of the Academy Office

LETTERS OF APPRECIATION

The Board of the Estonian Academy of Sciences decided to present letters of appreciation to Member of the Academy Dimitri Kaljo for long-time successful work as the editor-in-chief of the *Estonian Journal of Earth Sciences* and to Member of the Academy Anto Raukas for long-time successful work as the editor-in-chief of the journal *Oil Shale* (see p. 15).

RESEARCH PAPER 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 representative of the Estonian Academy of Sciences on the appraisal panel of the National Research Paper Contest for University Students was Marco Kirm. A new appraisal sub-panel was formed to determine the best papers and nominate candidates for the special prizes awarded by the President of the Estonian Academy of Sciences – the π-prizes. The sub-panel included Marco Kirm (Chairman), Mati Karelson, Agu Laisk, Andres Metspalu, Lauri Mälksoo, Tõnu-Andrus Tannberg, Jaan Undusk, Gennadi Vainikko and Urmas Varblane. The laureates were announced at a prize award ceremony

on 12 December 2019 in the hall of the Ministry of Education and Science in Tartu.

Special Prize for the Most Elegant Paper (π × 1000 euro = 3141.59 euros) was bestowed on Johannes Heinsoo for the PhD thesis "Digital quantum computation with superconducting qubits" (ETH Zürich; supervisor: Prof. Andreas Wallraff, PhD).

Special Prize for an Unconventional Paper (π × 500 = 1570.80 euros) was awarded to Lehti Saag for the PhD thesis "The prehistory of Estonia from a genetic perspective: new insights from ancient DNA" (University of Tartu; supervisors: Mait Metspalu, Toomas Kivisild and Kristiina Tambets).

Special Prize for Auspicious Scintillating Sparks (π × 250 = 785.40 euros) was awarded to Karina Loid for her research paper "Do pop-up notifications regarding smartphone use decrease screen time, phone checking behaviour, and self-reported problematic smartphone use? Evidence from a two-month experimental study" (University of Tartu; supervisors: Karin Täht and Dmitri Rozgonjuk).

See also p. 31.

Letters of Appreciation were also granted to supervisors of the prize-winning papers.

The Academy of Sciences also issued its very first constitutional law endowment special prizes. The laureates were Karin Orgulas for the research paper "Rural law problems at the administrative department of the Supreme Court in 1930, through the example of the copy ERA.1356.2.102" (supervisors: Marju Luts-Sootak and Karin Visnapuu) and Sven Anton for the research paper "The Concept of Estonian Culture and Estonian Nationality in the Constitution. The Use of the Concept of Culture in Legal and Political Documents" (supervisors: Tõnu Viik and Raul Narits).

ESTONIAN SCIENCE COMMUNICATION AWARD

The Estonian Science Communication Award is an annual state award that has been granted since 2006. Its primary focus is on acknowledging members of the general public who have popularised science in Estonia, as well as attracting more attention to activities that introduce and foster research and technology in society. 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 14th year in 2019. The appraisal panel was chaired by Member of the Academy Ene Ergma.

The Tiiu Sild Memorial Lifetime Achievement Award for long-time systematic communication of science and technology was granted to the geographer Ain Kallis, who has been the most prolific meteorology communicator in Estonia for decades.

Grand Prize for science and technology promotion was awarded to Head of the Estonian Museum of Natural History Asta Tuusti. In over thirty years of activity as a teacher, trainer, environmental education promoter and manager, her work has sparked an interest in natural sciences among thousands of Estonians.

Motivational Prizes in that category were awarded to Marko Mägi, an outstanding Estonian ornithology promoter, and Ivo Kruusamägi, Program Manager at Wikimedia Eesti, who promotes Estonian research in words and images on Wikipedia.

Grand Prize for activities/series of activities communicating science and technology was awarded to Toivo Maimets, the organiser of the "Genetics Days" practical workshops aimed at high school students, and the Motivational Prize in the category was awarded to the organiser of the Haapsalu education and technology fair, Head of the INNOKAS innovation centre Angela Leppik.

Grand Prize for science and technology communication via audiovisual and electronic media was awarded to the project manager of the Huvitava bioloogia kool (Exciting Biology School), for the natural education cartoons "Miks? Miks? Miks?" (Why? Why? Why?), Helen Pikkat.

Grand Prize for science and technology communication via printed media was awarded to Jüri Liiv, author of the "Keemia õhtuõpik" chemistry textbook for independent learners. The Motivational Prizes went to Els Heinsalu, author of the "AHHAA!" science book for very young children, and the Estonian Young Academy of Sciences' article series "Milleks meile alusteadused?" ("Why basic research?").

Grand Prize for the best new science and technology communication initiative was awarded to the Estonian Fund for Nature and University of Tartu popular campaign "Looking for a Cowslip" and its organiser Silvia Lotman.

The 2019 prize fund was 21,500 euros. In keeping with tradition, the Tiiu Sild lifetime achievement award grant of 6,500 euros was 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 in communication.

The contest results were announced and prizes presented on 20 November at the research communication conference "Eesti teab? Eesti teab!" ("Does Estonia know? Estonia does know!" held at the Glass Hall of the Tallinn Song Festival Grounds.

L'ORÉAL–UNESCO BALTIC FELLOWSHIP

The L'Oréal-UNESCO "For Women in Science" global partnership was founded in 1998.

Since that year, L'Oréal and UNESCO have jointly contributed to research, increasing the number of female researchers and promoting gender equality in research through the programme. The goals of the programme include recognising female scientists for their contributions, supporting them in reaching their goals and publishing their achievements to a broad audience.

In Latvia, the stipend programme was created under the mentorship of the programme's patron Vaira Vike-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.

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. Additionally, 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.

A ceremony was held at the University of Latvia on 11 June to recognise two Estonian, three Latvian and two Lithuanian female researchers with the L'Oréal Baltic "For Women in Science" grants.

The laureates of the L'Oréal grant (6,000 euros), Tuul Sepp, researcher in the field of Animal Ecology, and Kaarin Parts, doctoral student in Botany and Ecology, University of Tartu, research nature and the environment. They are searching for solutions to a number of problems caused by climate and environmental change.

Tuul Sepp is among the most active and popular Estonian science communicators. She considers research to be her dream profession. She intends to use the grant to research whether fish in the Baltic Sea have developed defensive adaptations against the carcinogenic effects of environmental pollution. In the future, this research direction may also contribute to the treatment of cancer in humans.

Kaarin Parts, the doctoral student category winner, is inspired by the great variety and time-planning freedom that research provides. She has always been fascinated by complex interconnections in nature and living organisms' amazing adaptation capacities. On the other hand, she finds developments in our living environment extremely concerning. The grant enables her to complete her doctoral thesis on the reactions of tree roots and the fungus aggregates populating them to two climate change factors: increased atmospheric humidity and soil warming.

The Estonian applications were evaluated by a committee formed by the Academy of Sciences, composed of Members of the Academy Ergo Nõmmiste (chair), Jaan Aarik (vice-chair), Jaan Eha, Anne Kahru, Valter Lang, Professors Malle Krunks and Tiina Nõges, and the 2017 laureate Els Heinsalu. See also p. 54.

ESTONIAN ACADEMY OF SCIENCES FOUNDATION

The Estonian Academy of Sciences Foundation was established at the Estonian National Culture Foundation in 2006 to support research efforts of young Estonian doctoral level researchers. The Tiit Talpsep scholarship was additionally established in 2009 to support master's and PhD students' research efforts in molecular microbiology and virology.

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

The 2019 scholarships were awarded as follows:

Priit Ruberg (Tallinn University of Technology, researcher), Young Scientist Scholarship (3,000 euros);

Kärt Ukkivi (University of Tartu, doctoral student), Tiit Talpsep Graduate Student Scholarship (1,000 euros).

NATIONAL CONTEST OF YOUNG SCIENTISTS

The annual Young Scientists' Festival was organised by the Estonian Research Council on 16–17 April 2019 at the Estonian National Museum in Tartu. Poster presentations by the authors of the best works submitted to the National Contest for High School Students were presented and national prizes and awards were granted to the winners.

The Academy's award committee, chaired by Secretary-General Jaak Järv, awarded special prizes to the following works:

Richard Luhtaru (Hugo Treffner Gymnasium) for the paper "Fabrication of binary amplitude holograms using a film camera";

Merilin Radvilavičius (Viimsi Gymnasium) for the paper "The influence of the content of nutrients and soil pH on the needle measurements of the Scots pine (*Pinus sylvestris L.*) on the Puhatu cutaway peatland";

Tambet Tammemägi (Rocca al Mare School) for the paper "The functions of Estonian-English code-switching in young Estonian men's conversations in the context of computer gaming";

Cathrin Benita Poopuu (Saaremaa Co-Educational Gymnasium) for the paper "Ticks: biology, spread in Saare County and transmitted diseases".

PUBLICATIONS OF THE ACADEMY

Estonian Academy of Sciences Yearbook XXIV (51) in Estonian and English.

Estonian Academy of Sciences in Words and Images in Estonian and English.

This publication gathers some illustrations of the Academy's working routine, festive activities celebrating the anniversary year of the Republic of Estonia and the Academy and reflections on major events and everyday work. Three universities' rectors, all members of the Academy, provided us insight into their work behind the scenes. A retrospective essay provides context for the legacy of the Academy and its members. The collection is rounded off by an extraordinary travelogue.

The Estonian-language collection "Eesti Vabariigi preemiad 2019" (*Awards of the Republic of Estonia 2019*) is dedicated to the achievements of the laureates of the 2019 research, culture and sports awards and the F. J. Wiedemann language award.

Another Estonian-language collection, "Teadusmõte Eestis (X). Tehnikateadused III" (*Scientific Thought in Estonia (X). Engineering III*) is a sequel to the 2002 and 2007 collections introducing achievements in engineering to a wider readership. The edition contains 21 articles describing studies carried out at the Tallinn University of Technology and the University of Tartu in engineering and related fields.

Electronic versions of the publications are available online at www.akadeemia.ee.

INTERNATIONAL SCIENTIFIC RELATIONS

International cooperation through various organisations is an integral part of the Academy's work and networking activities. The Estonian Academy of Sciences Act states that "[i]n order to perform its functions, the Academy shall /---/ develop international academic cooperation". In keeping with tradition, the Academy represents Estonian research and researchers at numerous European and international research organisations (see pp. 60–61), such as the International Science Council (ISC), Inter-Academy Panel (IAP), European Federation of National Academies of Sciences and Humanities All European Academies (ALLEA), European Academies' Science Advisory Council (EASAC), the Union Académique International (UAI), which connects academies of humanities and social sciences, and the domain-specific institutions the European Marine Board (see pp. 61 and 128) and the European Polar Board (see pp. 61 and 125), which advise the European Commission. Key relevant events are listed in the Chronicle section.

The Academy continued supporting the contacts of the Estonian scientific community with international scientific unions (giving priority to ISC (formerly ICSU) member organisations) and scientific organisations.

Estonian researchers are represented in international scientific organisations by national committees. In some fields, this role is fulfilled by scientific societies. As of 21.01.2020, membership fees in the following international organisations were covered from an allocation by the Ministry of Education and Research:

Estonian contact point	International organisation
Estonian Physical Society Contact: Kaido Reivelt kaido.reivelt@ut.ee www.fyysika.ee/efs/	European Physical Society, EPS, www.eps.org
Estonian Geophysical Committee Chairman: Rein Rõõm rein.room@ut.ee	International Union of Geodesy and Geophysics, IUGG, www.iugg.org
Estonian National Committee for International Geographical Union Contact: Mihkel Kangur, geograafiaselts@gmail.com www.egs.ee	International Geographical Union, IGU, www.igu-net.org
Estonian National Committee for Geology Contact: Kalle Kirsimäe kalle.kirsimae@ut.ee	International Union of Geological Sciences, IUGS, www.iugs.org
Estonian National Committee for International Federation of Automatic Control Contact: Sven Nõmm sven@cc.ioc.ee	International Federation of Automatic Control, IFAC, www.ifac-control.org

Estonian National Committee for Mathematics Contact: Mati Abel mati.abel@ut.ee	International Mathematical Union, IMU, www.mathunion.org
Estonian Polar Research Committee Contact: Rein Vaikmäe rein.vaikmae@ttu.ee	European Polar Board, www.europeanpolarboard.org
Estonian National Committee on Astronomy Contact: Laurits Leedjärv leed@aai.ee www.aai.ee/ERAK/ERAK.html	International Astronomical Union, IAU, www.iau.org
Estonian National Committee for Mechanics Contact: Andrus Salupere salupere@ioc.ee	International Union of Theoretical and Applied Mechanics; IUTAM, http://iutam.org/, www.iutam.net
Estonian Consortium of Natural History Collections Contact: Prof. Urmas Kõljalg urmas.koljalg@ut.ee	Consortium of European Taxonomic Facilities, CETAF, www.cetaf.org
Marine Commission of the Estonian Academy of Sciences Contact: Tarmo Soomere tarmo.soomere@cs.ioc.ee http://www.akadeemia.ee/en/academy/councils/	European Marine Board, www.marineboard.eu
Estonian contact for Thesaurus Linguae Latinae Contact: Anne Lill anne.lill@ut.ee	Thesaurus Linguae Latinae (TLL), www.thesaurus.badw.de/
Estonian National Committee of International Association of Geomorphologists Contact: Tiit Hang tiit.hang@ut.ee	International Association of Geomorphologists, IAG, www.geomorph.org
Estonian National Committee for International Union for Quaternary Research (ESTQUA) Contact: Tiit Hang tiit.hang@ut.ee	International Union for Quaternary Research, INQUA, www.inqua.org
Estonian National Committee for IUPAP Contact: Marco Kirm marco.kirm@ut.ee	International Union of Pure and Applied Physics, IUPAP, www.iupap.org
Division of Methodology and Philosophy of Science of the Baltic Association for History and Philosophy of Science at the Estonian Association for History and Philosophy of Science Contact: Peeter Müürsepp peeter.muursepp@ttu.ee	International Union of History and Philosophy of Science, Division of Logic, Methodology and Philosophy of Science, IUHPS/DLMPS, www.dlmpst.org

SUPPORTING INTERNATIONAL MOBILITY

The Academy provides support to the international mobility of researchers. Scientific exchange programmes are the practical output of bilateral cooperation agreements and are available to all Estonian scientists. The scientific exchange programme is run on the traditional cost-sharing principle: living expenses of visiting researchers in the host country are covered by the receiving party, which in Estonia is the Estonian Academy of Sciences. In 2019, the Estonian Academy of Sciences hosted 51 researchers in Estonia for 339 days (see p. 62)

Cooperation agreements with partner organisations (with the date of signing the currently valid (framework) agreement in brackets):

- Austrian Academy of Sciences (12 November 2007)
- Azerbaijan National Academy of Sciences (27 October 2016)
- *Bashkortostan Academy* of Sciences (23 June 2012)
- The British Academy (4 August 2011)
- Berlin-Brandenburg Academy of Sciences and Humanities (16 May 2002)
- Bulgarian Academy of Sciences (2 April 1996)
- Georgian National Academy of Sciences (19 October / 1 November 2012)
- Royal Flemish Academy of Belgium for Science and the Arts (26 March 2004)
- Chinese Academy of Sciences (26 May 2000)
- Spanish National Research Council (19 June 2001)
- Israel Academy of Sciences and Humanities (19 July 1995)
- National Research Council of Italy (23 April 2004)
- Lithuanian Academy of Sciences (12 November 1991)
- Council for the Lindau Nobel Laureate Meetings and the Foundation Lindau Nobel Prizewinners Meeting (2 June 2016)
- Royal Society of London (30 October 1991)
- Latvian Academy of Sciences (12 November 1991)
- Macedonian Academy of Sciences and Arts (16 December 1996)
- Montenegrin Academy of Sciences and Arts (17 October 2005)
- Polish Academy of Sciences (17 June 1996)
- French Academy of Sciences (22 March 1994)
- Royal Swedish Academy of Letters, History and Antiquities (28 February 2017)
- Royal Swedish Academy of Sciences (17 November 2005)
- Romanian Academy (6 April 2016)
- Slovak Academy of Sciences (28 November 1993)
- Slovenian Academy of Sciences and Arts (28 April 1997)
- *Finnish Academy of Science* and Letters (10 March 1992)
- Swiss Academy of Natural Sciences (18 September 1989)
- Academy of Sciences of the Republic of Tajikistan (4 June 2012)
- Tajik National University (4 June 2012)
- Czech Academy of Sciences (4 April 2017)
- National Academy of Sciences of Ukraine (2 October 2000)
- Hungarian Academy of Sciences (20 June 1995)
- National Academy of Sciences of Belarus (1 March 2002)
- Russian Academy of Sciences (17 February 1993); complementary memorandum on cooperation in earth sciences (30 March 2012)

HIGHLIGHTS OF REGULAR ACTIVITIES

A consultation of the representatives of Nordic and Baltic academies of sciences took place in Helsinki on 13 June 2019 in the framework of the regional meeting of the EASAC. The invited speakers recalled the history of collaboration between the academies. They emphasised the need to safeguard the independence of the Academies and to identify new collaboration methods to facilitate international dialogue with policy-makers at the EU level and above, particularly in matters related to climate change and other global problems, some of which may have a significant impact on Europe despite occurring outside European boundaries.

Secretary-General Jaak Järv presented an overview of researcher exchanges between the Estonian Academy of Sciences and other Nordic and Baltic Academies of Sciences in 1993–2018 in the framework of collaboration agreements. The goal of researcher exchange is to enhance existing scientific cooperation through a cost-sharing principle. The decision on supporting individual visiting researchers is made by the receiving Academy. As mobility support measures improve through other national, regional and international sources, the number of research visits funded in the framework of inter-academy cooperation has decreased. They are being replaced by new collaboration forms, such as scientific advice expertise exchanges locally and internationally.

In autumn 2019, a representative of the Sudan Academy of Sciences contacted the Estonian Academy of Sciences with a proposal to consider collaboration opportunities

with Sudanese researchers. A cooperation protocol was signed on 6 December.

EURAXESS

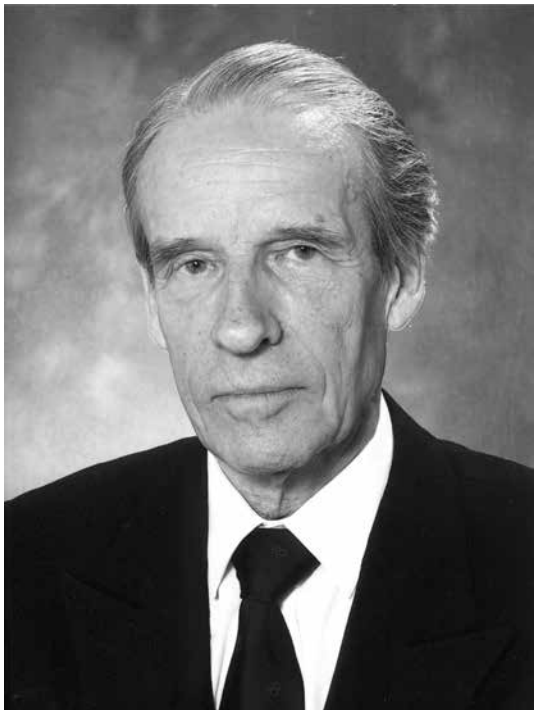
The Academy is involved in the EURAXESS Services Network (formerly called ERA-MORE). The Estonian network's activities are coordinated by the Estonian Research Council.

The pan-European information resources network EURAXESS was established to advise researchers heading abroad for work or doctoral studies 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.

The topics of the EURAXESS network annual meeting on 22.10.2019 in Brussels were brain circulation, symmetrical mobility and co-creation. Traditional excursions for foreign researchers working and studying in Estonia and their families took place on 19–20 May to Pärnu County in collaboration with the Estonian Fund for Nature and on 14–15 September to the Setomaa region to visit the Obinitsa and Värska farm museums. Both excursions included volunteering for outdoor work. In Pärnumaa, the group helped to restore Kurese's wooded meadows. A fence was built and other farmyard work was done at the Värska farm museum. Read more:
https://www.euraxess.ee/estonia/events/euraxess-networking-event-kurese and
https://www.euraxess.ee/estonia/events/euraxess-estonia-networking-event-setomaa

See p. 62 for the work done in the context of bilateral co-operation agreements between the Academy and its foreign partners, pp. 62–64 for the activities related to the Lindau Forum and p. 54 for the 2019 laureates of the L'Oréal-UNESCO international grant programme.

BIRTHDAYS



90

Member of the Academy Hillar Aben

Hillar Aben was born on 3 December 1929 in Tartu. His mother was a foreign language teacher, and his father an Estonian teacher and later a lecturer at the University of Tartu and a translator. In 1948, Hillar Aben graduated from the Tartu First High School (current Hugo Treffner Gymnasium) and was admitted to the Tallinn University of Technology, graduating in 1953 as a civil engineer. He became an aspirant in the same year, researching photoelasticity. In 1957, Aben defended the Candidate of Engineering (equivalent to PhD) thesis "Solutions for shell problems using the photoelasticity technique" at the Estonian Academy of Sciences. He continued to develop the optic theory of the photoelasticity technique, and in 1966 Hillar Aben defended the Doctor of Engineering thesis "The method of characteristic directions in three-dimensional photoelasticity".

In 1977, Hillar Aben was elected a member of the Estonian Academy of Sciences in Mechanics.

In 1955–1960, Hillar Aben worked as a junior researcher at the Institute of Construction and Construction Materials of the Estonian Academy of Sciences. For the following six decades, his work has been closely connected to the Institute of Cybernetics, where he has held the positions of Head of the Mechanics and Applied Mathematics Department (1960–1974), Assistant Director of the scientific area (1967–76), Director of the Institute (1976–1988), Head of the Laboratory of Photoelasticity (1989–2013) and Leading Researcher (2005–2016). Hillar Aben continues to work as a consultant at the Laboratory of Solid Mechanics.

The main modern field of application of the photoelasticity technique is the measurement of residual stress in glass. The Laboratory of Photoelasticity, in partnership with the OÜ Glasstress (private limited company), became an internationally renowned research and development centre under Hillar Aben's management. Hillar Aben and his colleagues have developed a methodology and the equipment for internal stress measurement of glass goods of various shapes. OÜ Glasstress's polariscopes, are used by nearly a hundred companies worldwide. Hillar Aben's work is an excellent example of how successful research can lead to broad technical applications.

Hillar Aben's work has twice been recognised with a national research award (in 1994 and 2009). He was awarded the Order of the White Star Class III decoration in 2001 and the Nikolai Alumäe Medal in 2009. In 2010, the United States Society for Experimental Mechanics awarded Hillar Aben its highest award, the William Murray Medal.

Hillar Aben is a member of the Academia Scientiarum Europaea (EURASC), the Academia Scientiarum et Artium Europaea, the Finnish Academy of Technology and several international research associations in his scientific area. He has worked as a visiting professor at the University of Waterloo, Canada, University of Poitiers, France, and the Polytechnic University of Bari, Italy. In Estonia, he was a member of the Academic Council of the President of Estonia in 1994–2001 and a member of the national research awards committee in 1999–2002. Hillar Aben was the editor-in-chief of the *Proceedings of the Estonian Academy of Sciences* in 1995–2007.

His hobbies include foreign languages, music and sport. In 1951–1953, he was a member of the republic's fencing team; he has also engaged in Alpine skiing and tennis.

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Member of the Academy Jaan Einasto

Jaan Einasto was born to a schoolteacher's family as the oldest child of eight in Tartu on 23 February 1929. In 1947, he graduated from the Tartu First High School, where he became interested in astronomy; he entered the Department of Physics of the University of Tartu to follow the special astronomy programme. Recommended by Grigori Kuzmin, he was able to start visiting the Sternberg Institute of Astronomy of Moscow State University. Jaan Einasto graduated from the University of Tartu in 1952. In 1955, he defended the Candidate's (PhD) thesis "Structures of regular galaxies in the main sequence", and in 1972, the Doctor of Sciences thesis "Structure and evolution of regular galaxies" at the same university.

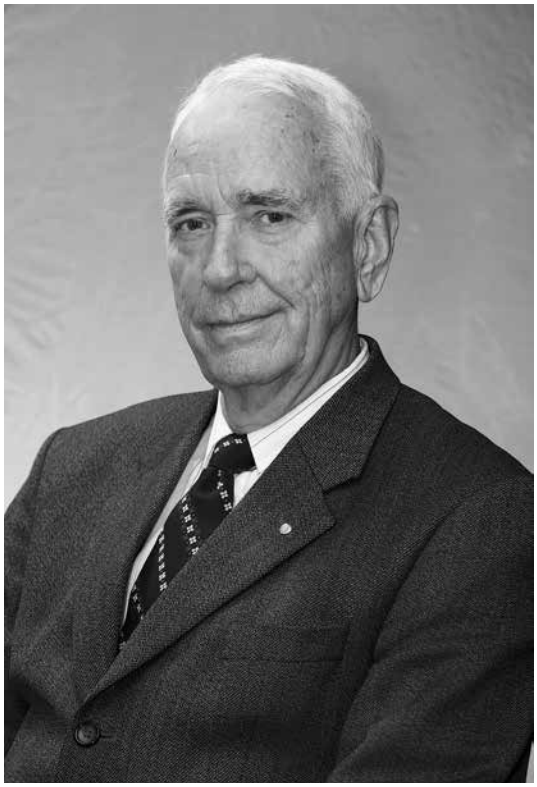
After graduation, Jaan Einasto took up the position of researcher at the Tartu Observatory, followed by the positions of Senior Researcher, Head of the Astrophysics and Galactic Physics Groups, Head of the Cosmology Department and Senior Researcher. In 1980–1994, he worked on various research projects and held various positions at the University of Paris, Cambridge University, the University of California and Harvard University. Jaan Einasto is currently working as a scientific advisor to the Tartu Observatory.

Jaan Einasto was elected a member of the Estonian Academy of Sciences in 1981. In 1983–1995, he was the Head of the Academy's Department of Physics, Mathematics and Mechanics, and later of the Department of Astronomy and Physics. As a member of the Board of the Academy, he participated in the overhaul of the Estonian research system in 1988–1995.

Academy Member Jaan Einasto has studied the structure of galactic systems and the structure and dynamics of galaxies and has researched equipment for observing Earth's artificial satellites. He has proven the existence of a massive galactic corona (1970–74) and the large-scale structure of the universe (1977–1997) in research efforts focusing on the missing mass of the universe. The latest period of his research has focused on dark matter and the large-scale structure of the universe.

Jaan Einasto established his own school of research at the Tartu Observatory. He has successfully supervised nine researchers' doctoral theses and has published over 300 scientific articles. He has been awarded four national research awards (in 1983, 1998, 2003 and 2007), including for an outstanding discovery impacting the paradigm and world-view of a scientific area. In 2009, Jaan Einasto was awarded the prestigious Marcel Grossmann Award for a trailblazing contribution to the discovery of dark matter and the large-scale structure of the universe; in 2012, he was awarded the Viktor Ambartsumian International Award for his fundamental contribution to the discovery of dark matter and the large-scale structure of the universe; in 2014, he received the Gruber International Cosmology Prize for research that led to the discovery of dark matter and the cosmic web. In 1998, Jaan Einasto was awarded the Republic of Estonia Order of the National Coat of Arms Class II decoration. The general public voted him one of the one hundred most outstanding people of the 20th century; he is a laureate of the Tartu Suurtäht decoration and an honorary citizen of Tartu. He was awarded the University of Tartu Grand Medal shortly before his 90th birthday.

Jaan Einasto's contributions to the study of cosmology and the birth of galaxies have resulted in him becoming one of the very few Estonians with an asteroid namesake: 11577 Einasto.



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Member of the Academy Ain-Elmar Kaasik

Ain-Elmar Kaasik was born the son of an education board official in Tallinn on 2 August 1934. His childhood was spent in the Nõmme district and he graduated from the Nõmme Gymnasium in 1953. He entered the Faculty of Medicine of the University of Tartu in the same year, graduating in 1959. Following post-graduate studies in neurology and neurosurgery, he defended a candidate (PhD) thesis on problems related to brain metabolism in 1967 and a Doctor of Sciences thesis focusing on the biochemical and bioneurological aspects of the brain in 1972. He was granted a professorship in 1975.

After graduation, Ain-Elmar Kaasik spent two years working at the Põltsamaa county hospital. He started working at the Neurology Clinic of the University of Tartu in 1961, holding the positions of urgent care doctor, neurosurgeon, assistant at the Department of Neurology and Neurosurgery, associate professor, Dean of the Centre for Continuing Education in Medicine, professor, Vice Dean of the Faculty of Medicine, Dean, Head of Chair and Head of the Hospital (1984–1996). He has been a professor emeritus of the University of Tartu since 1999.

Ain-Elmar Kaasik was elected a member of the Estonian Academy of Sciences in 1993; he was a Vice President of the Academy in 2004–2009.

While working as a neurosurgeon, he continued the medical research he had started during his studies. His main research areas have included circulatory and metabolism pathologies in cases of acute brain damage, vascular pathologies of the brain, the spread, diagnosis and treatment of neurological disorders, and problems related to intensive care. Ain-Elmar Kaasik has undergone training at the Moscow N. N. Burdenko Neurosurgery Institute and the Laboratory for Experimental Brain Research of the neurology clinic of Lund University; he has been involved in most fields of neurosurgery and has participated in nearly 3,000 neurosurgeries.

Ain-Elmar Kaasik has worked as a visiting professor in several US and European universities (in Pennsylvania, Uppsala, Copenhagen and Kuopio) and has participated in the medical doctors' continuing education course organised by the Montana and Wyoming Chapter of the American College of Surgeons. He has published over 500 scientific publications, including ten monographs, textbooks and book chapters. He holds the proof of invention of a treatment method for Parkinson's disease. He has supervised sixteen successful doctoral and medical candidate theses.

Academy Member Kaasik has carried out numerous societal, professional and administrative duties. He is an Honorary Doctor of Uppsala University, a member of the American Academy of Neurology, British Royal Society of Medicine, and Academia Scientiarum et Artium Europaea. He has been active in various national-level organisations: the Research and Development Council, national research award committee, Estonian Science Foundation, Estonian Cooperation Assembly, etc.

Ain-Elmar Kaasik's work has been recognised with several awards, including a letter of appreciation from the Finnish Neurological Society and the Ernst Homén Medal (1988), the Ludvig Puusepp Medal (1999), the Osvald Schmiedeberg Medal (2002) and an Estonian national research award for long-time productive research and development activity (2003). In 1998 he was awarded the Order of the White Star Class III decoration, and in 2004 he received the title of Honorary Citizen of Tartu.

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Member of the Academy Jüri Engelbrecht

Jüri Engelbrecht was born the son of an artisan in Tallinn on 1 August 1939. A wartime child, he attended several schools in Tallinn, graduated from the 7th High School in 1957 and earned an engineering diploma at the Tallinn University of Technology in 1962. In 1968, Jüri Engelbrecht defended a candidate of technology (PhD) degree at the same university. After a year as a post-doctoral researcher at the Czech Technical University in Prague, he took a position at the Institute of Cybernetics of the Estonian Academy of Sciences, where he is still employed. In 1981, he defended the degree of Doctor of Physics and Mathematics at the Institute of Mechanics of the Ukrainian Academy of Sciences. He was granted a professorship in 1984.

At the Institute of Cybernetics, Jüri Engelbrecht has held the positions of senior researcher (1969–1986), department head (1986–1989, 1994–2014), research director (1989–1994) and Head of the national Centre [of Excellence] for Non-linear Studies (1999–2015). In 2005–2016, he was an Extraordinary Leading Researcher at the Tallinn University of Technology; he has been a professor emeritus since 2016 and continues consulting for the university.

Jüri Engelbrecht was elected a member of the Estonian Academy of Sciences in Mechanics in 1990. He was the President of the Estonian Academy of Sciences in 1994–2004, a Vice President in 2004–2014, and has been a non-executive member of the Academy board since 2014.

Jüri Engelbrecht's main research interests are mathematical physics, biomechanics and non-linear dynamics. He has had a long teaching career, intermittently working as a professor at the Tallinn University of Technology between 1984 and 2016. He has also worked at several European universities (Newcastle University, the University of Surrey, Cambridge University, the University of Paris, Aachen University, the University of Turin, the University of Messina, the University of Duisburg-Essen, Budapest Technical University etc.). He has authored nearly 200 research articles and several monographs and textbooks.

Jüri Engelbrecht has actively promoted Estonian research and collaboration with other European countries. He was an initiator of the qualitative research funding system in Estonia and of the Centres of Excellence programme and he has acted as an advisor to the Ministry of Education and Research. He is one of the authors of the strategies "Knowledge Based Estonia 2002–2006" and "Knowledge Based Estonia 2007–2013". Jüri Engelbrecht has been a member of the council of the European Science Foundation, a member of the European Research Advisory Board (EURAB), a member of the General Assembly of the International Council for Science (International Council of Scientific Unions until 1998), an expert at the Organisation for Economic Co-operation and Development (OECD), etc. He joined All European Academies (ALLEA) in 1995 and held the position of its president in 2006–2011.

Jüri Engelbrecht has received national awards of the Republic of Estonia (in 1992, 2008 and 2015), the Alexander von Humboldt Research Award and the Nikolai Alumäe Medal of the Estonian Academy of Sciences. He has been elected an Honorary Doctor of the Budapest Technical University, a foreign member of the Hungarian, Latvian and Lisbon Academies of Sciences, a member of the Academia Europaea and of many other renowned associations and foundations. His work in research and research policy has been recognised with Estonian, Finnish, French, Polish and Belgian national awards, and medals of the Estonian, Bulgarian and Finnish Academies of Sciences and of the Tallinn University of Technology.

80

Member of the Academy Ülo Jaaksoo

Ülo Jaaksoo was born the son of civil servants in Mõisaküla on 16 April 1939. In 1957, he graduated from Mõisaküla High School and entered the Tallinn University of Technology to study electrical grid systems; having re-qualified, he graduated from the University in 1962 with a degree in automation and telematics. Ülo Jaaksoo earned a candidate of technical sciences (PhD) degree in 1969 and defended a Doctor of Technology thesis in 1982. In 1985, he was bestowed the title of professor, and in 1986 he was elected a member of the Estonian Academy of Sciences in informatics.

Ülo Jaaksoo joined the newly founded Institute of Cybernetics of the Estonian Academy of Sciences before graduating from university, and held senior mechanic, and junior and senior researcher positions between 1961 and 1979. He completed his post-graduate studies in 1965–1968 and spent a year gaining work experience in Moscow at the Institute of Automation and Telematics, also formulating the topic of his candidate thesis: adaptive control systems with active information collection systems. In 1980–1984 Ülo Jaaksoo was the Head of the Computer Control Department of the Computer Research and Design Office, in 1984–1989 Research Director of the Institute of Cybernetics, in 1981–1997 the Director of the Institute, and in 1997–2012 Chairman of the Board of AS Cybernetica. Since 2013, Ülo Jaaksoo has been Chairman of the Supervisory Board of AS Cybernetica.

Ülo Jaaksoo's main research interests have been adaptive control systems with active information collection systems, the analysis of multi-input multi-output automatic control system interactivity, and the control of dynamic systems and information security systems. He taught control science at the Tallinn University of Technology for many years. Following his doctoral thesis defence, he re-oriented towards administrative tasks and developed the private company Cybernetica, which is unique in Estonia and has significantly contributed to the reputation of Estonian information technology.

Member of the Academy Ülo Jaaksoo has been Vice President of the Estonian Academy of Sciences (1993–1995), Chairman of the Board of Eesti Telekom, a member of the Research and Development Council, a representative of Estonia in the NATO Science Committee and a member of the Academic Council of the President of the Republic. Currently, he is a member of the University Board of the Tallinn University of Technology. Ülo Jaaksoo has received an Award of Soviet Estonia (1967), an Award of the Council of the Ministers of the Estonian Soviet Socialist Republic, a Medal of the Estonian Academy of Sciences (1999), the Order of the White Star Class III decoration (2004) and the "Thinking man" prize (2004).

Raised in a family of avid readers and theatre and music lovers, Ülo Jaaksoo has had an intense interest in music since early childhood, and has played in the Horre Zeiger Big Band. He enjoys reading fiction and watching sports.

75

Member of the Academy Ene Ergma

Ene Ergma was born into a military family in Rakvere on 29 February 1944. In 1962, she graduated from the C. R. Jakobson High School in Viljandi and entered the University of Tartu to study physics. In 1964, she continued her studies at Moscow State University, graduating in 1969 with a degree in astronomy.

After graduation, Ene Ergma did post-graduate studies at the Astronomical Council of the USSR Academy of Sciences; in 1972, she defended a physics and mathematics candidate (PhD) thesis titled "Convection in Stars". In 1972–1974, Ene Ergma worked as a junior researcher at the Institute of Physics and Astronomy of the Estonian Academy of Sciences. She returned to Moscow in 1974 and defended a Doctor of Sciences thesis in physics and mathematics on thermonuclear processes in the late stages of stellar evolution at the USSR Academy of Sciences Institute of Cosmology. Until 1988, she worked at the Institute of Astronomy of the USSR Academy of Sciences, holding the positions of junior researcher, research secretary, senior researcher and leading researcher. She was granted a professorship by the USSR Higher Attestation Committee in 1990. Returning to Estonia, Ene Ergma took the position of professor at the Chair of Theoretical Physics and Astrophysics at the University of Tartu; she was Head of the Institute of Theoretical Physics and Department Head in 1992–1998. In 2003–2006 and 2007–2014, Ene Ergma was the President of the Estonian Parliament, and in 2006–2007, the Parliament's Vice President.

Ene Ergma was elected a member of the Estonian Academy of Sciences in 1997. She served as the Academy's Vice President in 1999–2004.

Ene Ergma has carried out research on physical processes in the convective shells of stars, pre-supernova evolution, thermonuclear processes in accreting neutron stars and on the surface of white dwarf stars, and the evolution of low-mass X-ray binary stars.

Ene Ergma is a member of numerous international research organisations. She is a member of the International Astronomical Union (IAU) and the European Astronomical Society (EAS), an associate member of the British Royal Astronomical Society and a foreign member of the Royal Swedish Academy of Engineering Sciences. Currently, Ene Ergma is a member of the advisory council to the European Space Policy Institute and a member of the Estonian Space Affairs Council; she was the Chairwoman of the Estonian Science Communication Award Committee in 2018. Ene Ergma is an honorary member of the Tartu academic tennis club.

Ene Ergma was awarded a national exact sciences research award in 2002. She has been awarded decorations of the Republic of Estonia twice: Order of the White Star Class IV in 2001 and Order of the National Coat of Arms Class II in 2008. She was awarded the Portuguese Order of Prince Henry Grand Cross in 2003, the Medal of the Estonian Academy of Sciences and the Grand Cross of the Order of Merit of the Italian Republic in 2004, the Commander's Cross with Star of the Order of Merit of the Republic of Poland in 2005, the Estonian Jüriöö Täht decoration in 2007, the Grand Decoration in Gold with Sash of the Decoration for Services to the Republic of Austria and the Swedish Royal Order of the Polar Star Class I in 2007, the Grand Cross of the Order of the Crown of Belgium, the Netherlands Order of the House of Orange Grand Cross and the medal of the Baltic Assembly in 2008, and the Latvian Order of the Three Stars Class II decoration in 2009.

Academy Member Ergma enjoys classical music, theatre, art and good books.

75

Member of the Academy Enn Saar

Enn Saar was born in Leppneeme Village in Harju County on 4 March 1944. He graduated from Tallinn School No. 21 in 1962 and entered the Department of Physics of the Faculty of Mathematics and Physics of the University of Tartu to study astrophysics. He graduated in 1967 with a degree in theoretical physics.

Enn Saar took up a position at the Institute of Astrophysics and Atmospheric Physics at Tõravere in 1968. In the same year, he did post-graduate work at the University of Tartu, defending the candidate of physics and mathematics (PhD) thesis "Inhomogenieties in cosmology" in 1972. In 1991, he defended the Doctor of Astronomy thesis "Geometry of the large scale structure of the universe" at the University of Tartu. Enn Saar has held all research positions at Tõravere, from junior researcher to leading researcher. He was the Head of the Department of Astrophysics in 1991–1992, the Head of the Department of Cosmology and the leading researcher of a work group in cosmology in 1998–2017. Enn Saar currently holds the position of senior researcher.

Enn Saar was elected a member of the Estonian Academy of Sciences in 2010.

Enn Saar's research focuses on cosmology and galactic and atmospheric physics. His main research interests are dark matter, the development of the structure, numeric models and large-scale structure statistics of the universe in the field of cosmology, the development and spiral structure of galaxies in the field of galactic physics, and atmosphere research from space in the field of atmospheric physics. Enn Saar has made significant contributions to the discovery of dark matter and the large-scale structure of the universe. He is the author of most of the mathematical methods used by the Tartu cosmologists and galactic researchers in researching dark matter and the structure of the universe. Enn Saar established research on the numerical modelling of the structure of the universe at Tõravere, based on a model of the universe that includes a homogeneous background of dark energy in addition to regular and dark matter. He led an analysis showing that this structure has multifractal properties. In collaboration with astronomers from Spain, France and the USA, Enn Saar has participated in the development of new statistical methods and their application to the research of the structure of the universe.

Since the late 1970s, Enn Saar has supervised all Tartu Observatory cosmologists in theoretical, statistical and calculation-related matters. He has supervised seven successful doctoral theses.

He has received two national research awards: in 1982 for the research cycle "Dark matter and the large-scale structure of the universe" as part of a work group and in 2007 for an outstanding discovery impacting the paradigm and world-view of a scientific area for the work "The discovery of dark matter in the vicinity of galaxies and the cellular structure of the universe", also as part a work group. He was awarded the Estonian Physical Society annual award for his research on the structure of the universe in 2006.

Earlier in his life, Member of the Academy Saar was a passionate alpinist, earning an instructor certificate in the field, and an orienteering enthusiast.

75

Member of the Academy Richard Villems

Richard Villems was born in Pärnu on 28 November 1944. He graduated from the Pärnu Second High School in 1962 and entered the Faculty of Medicine of the University of Tartu, following in the footsteps of his surgeon grandfather, medical doctor aunt and neurosurgeon uncle. After graduating from the university in 1968, he continued in post-graduate studies at the University of Tartu (1968–1971) and defended a candidate in medical science (PhD) thesis in biochemistry in 1972. Richard Villems defended a Doctor of Biology thesis at the University of Moscow in 1984; he was granted a professorship in 1987 and he was elected to the Estonian Academy of Sciences in the same year.

After graduating from university, Richard Villems spent some time working at the Tallinn port hospital and Pärnu hospital. He held the position of researcher at the University of Tartu in 1970–1977 (working in Akademgorodok, Novosibirsk in 1972–1973 and at Uppsala University in 1975–1976) and at the Institute of Physics of the Estonian Academy of Sciences in 1977–1989 (working at the University of Edinburgh in 1977–1978), the positions of senior and leading researcher at the Institute of Chemical Physics and Biophysics of the Estonian Academy of Sciences in 1981–1986, the position of professor of molecular genetics at the University of Tartu in 1987–1992, the position of professor of molecular biology in 1993–1997, the position of professor of evolutionary biology in 1997–2004 and has held the position of professor of archaeogenetics since 2004.

Richard Villems is one of the founders of the Estonian Biocentre and was its director in 1986–2014. He is currently the leading researcher of population genetics at the Estonian Biocentre and the Head of the Chair of Evolutionary Biology at the University of Tartu. Richard Villems was the President of the Estonian Academy of Sciences in 2004–2014.

Richard Villems' main research areas have been molecular biology, molecular evolution and population genetics. He started developing molecular biology research and teaching at the University of Tartu with the legendary Academy member Artur Lind in the late 1960s, leading to the development of the Tartu school of molecular biology. His early research focused on RNA proteins and ribosomes. He changed direction in the 1970s to do genetic engineering and cloning research. His research at the University of Edinburgh focused on the structure of bacterial plasmids. Since 1995, Richard Villems has focused on evolutionary biology, ultimately leading to the creation of a professorship in archaeogenetics. His research publications on the origin and migration of ethnic populations during various stages of history, our genetic development and the temporal and spatial origin of various mutations leading to the genetic evolution of humanity have received particular attention.

Academy Member Richard Villems has contributed to the organisation of research in Estonia. He has participated in the work of various research organisations and councils: the advisory council to the President of the Republic, the Research and Development Council, the national research award committee, etc. Richard Villems has been elected a foreign member of several academies of sciences: the Royal Swedish Academy of Sciences (1989), Finnish Academy of Sciences (2000), Latvian Academy of Sciences (2005), Lithuanian Academy of Sciences (2006) and the Academy of Sciences of the Republic of Bashkortostan (2012). He has been awarded the Medal of the Estonian Academy of Sciences (1994), the Order of the White Star Class III (1998) and the Order of the White Star Class II (2006). Richard Villems was elected an honorary citizen of the city of Tartu in 2000; he received the lifetime achievement award of the Estonian Society of Human Genetics in 2013; he received a national research award in chemistry and molecular biology in 2017 as a member of a work group and the national lifetime achievement award in 2020.

70

Member of the Academy Jüri Allik

Jüri Allik was born in Tallinn on 3 March 1949. After graduating from the Tallinn 7th High School, he entered the University of Tartu, graduating with a degree in psychology in 1973. He defended his candidate of psychology (PhD) thesis on visual perception at the University of Moscow in 1976. He earned his PhD in psychology degree for the thesis "Perception of visual kinematics" at the University of Tampere.

Jüri Allik's academic career has been closely connected to the University of Tartu. He held the positions of researcher and senior researcher at the department of psychology at the University of Tartu in 1973–1989 (and associate professor in 1978–1983). In 1991–1992, Jüri Allik worked as a senior assistant and associate professor at the University of Jyväskylä; he became a professor of psychophysics at the University of Tartu in 1992 and a professor of experimental psychology in 2002. Jüri Allik was the Head of the Department of Psychology of the University of Tartu in 1993–2012 (with interruptions); he was the Dean of the Faculty of Social Sciences in 1996–2001 and the Head of the Institute of Psychology of the University of Tartu from 2012 onwards. Currently, Jüri Allik is the Head of Programme for doctoral studies in psychology.

Jüri Allik was elected a member of the Estonian Academy of Sciences in 2010.

Jüri Allik's main research areas are visual perception, personality psychology, the mechanisms of the development of national stereotypes and the examination of mental abilities.

Jüri Allik was a member of the council of the Estonian Psychological Association in 1988–2004, and was its President in 1988–1994 and Vice President in 1994–2004. In 2003–2009, he was the chairman of the council of the Estonian Science Foundation and a member of the steering committee of the European Science Foundation. He has been a member of the advisory council to the President of the Republic of Estonia. He is an editor of the journal *Trames* and several other international research journals. Jüri Allik has supervised 22 successful doctoral and 18 master's theses; he has authored several monographs, collections of articles and high school and higher education textbooks.

Jüri Allik has received three national research awards (annual awards in 1998 and 2005, and a lifetime achievement award in 2020). He is a foreign member of the Finnish Academy of Sciences. He was awarded the Republic of Estonia Order of the White Star Class IV decoration in 2001.

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Member of the Academy Margus Lopp

Margus Lopp was born in Kuressaare on 11 September 1949. In 1957–1965, he studied at the Kaali primary and middle school, developing an interest in physics and chemistry. In 1968, he graduated from high school in Kuressaare. He entered the University of Tartu to study chemistry and graduated from the Faculty of Physics and Chemistry with a degree in chemistry.

After graduation, Margus Lopp was offered a position at the Institute of Chemistry of the Estonian Academy of Sciences, where he worked as a senior engineer, junior and senior researcher in 1973–1986. He was a leading researcher and the head of the prostaglandin chemical synthesis work group in 1986–1991 and the Head of the Department of Organic Synthesis in 1992–2002. In 1997, Margus Lopp was elected a professor of organic chemistry at the Tallinn University of Technology and the Head of the Department of Organic Chemistry. He was the Director of the Institute of Chemistry at the Tallinn University of Technology in 1997–2002; in 2002, he was elected the Dean of the newly established Faculty of Mathematics and Natural Sciences, which during the period 2004–2009 developed into the highest-potential natural sciences centre at the University of Technology. Margus Lopp was among the initiators of the construction of the new University of Technology natural sciences building; he was involved in its design and construction.

Margus Lopp was elected a member of the Estonian Academy of Sciences in 2011. He was the Academy's Secretary-General in 2014–2017.

Margus Lopp's main research interests are problems in stereochemistry and methods of asymmetric chemical synthesis, the asymmetric synthesis of bioactive compounds, new asymmetric reactions and their catalysts, and new methods and strategies of asymmetric synthesis. He has participated in the development and introduction of new prostaglandin-based preparations. He was the leader of the Tallinn University of Technology spin-off company Prosynest. Margus Lopp has been working at the Laboratory of Industrial Chemistry of the Tallinn University of Technology, which researches modern kerogen-processing methods, since 2016. He is involved in replacing oil shale combustion and oil production with high-tech precision chemistry.

Margus Lopp has been a prolific educator and researcher. He has published over 200 research articles and has supervised 15 successful doctoral theses. In 2004, he received a research award in chemistry and molecular biology as the head of his work group; he was awarded the Order of the White Star Class IV decoration in 2008. In 2017, Margus Lopp was voted the best lecturer of the School of Science of the Tallinn University of Technology.

Academy Member Lopp has also made contributions in the fields of research organisation and administration. In 2012–2014, he was the Head of the Research Council of the National Institute of Chemical Physics and Biophysics; he has been a member of the Board of Trustees of the Tallinn University of Technology since 2015 and the President of the Estonian Chemical Society since 2017.

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Member of the Academy Mart Saarma

Mart Saarma was born in Tartu, the third child of professors working at the university's faculty of medicine, on 29 June 1949. He attended the chemistry-oriented class of the Tartu 5th High School, followed by the Faculty of Biology and Geography of the University of Tartu, graduating in 1972 as a biochemist.

Mart Saarma's university studies coincided with the establishment of the field of molecular biology in Estonia; in 1974, he defended a candidate (PhD) thesis, supervised by Artur Lind and Richard Villems, on the RNA structure of the ribosome, the organelle responsible for protein synthesis in animal cells. In 1986, he defended a Doctor of Sciences thesis at the Institute of Molecular Biology of the USSR Academy of Sciences on the interactions of RNA-proteins of animal ribosomes. Mart Saarma was elected a member of the Estonian Academy of Sciences in 1990 in molecular biology.

Mart Saarma worked as a junior researcher at the chair of biological chemistry and the molecular biology laboratory of the University of Tartu in 1971–1977; he was the Head of the Institute of Physics of the Estonian Academy of Sciences in 1977–1980 and the Head of the Laboratory of Molecular Genetics of the Institute of Chemical Physics and Biophysics of the Estonian Academy of Sciences in 1980–1990. He was elected the director of, and appointed a professor at, the brand new Institute of Biotechnology of the University of Helsinki in 1990 and held the position until the end of 2008. Simultaneously, he was a leading researcher at the National Institute of Chemical Physics and Biophysics (1990–2005), a professor of molecular biology at the Institute of Molecular and Cell Biology at the University of Tartu (1990–1996), and a professor at the Department of Gene Technology of the Tallinn University of Technology (1997–2002). In 2008–2009, Mart Saarma managed Biocenter Finland. He now holds the position of professor of biotechnology at the University of Helsinki.

Mart Saarma's main research interests have included the molecular mechanisms of the development of the nervous system and the use of nerve growth factors in the treatment of neurodegenerative diseases. He has also studied the regeneration of insulin-producing beta cells in the pancreas and pharmaceuticals to combat diabetes. His research efforts in plant molecular biology have focused on the molecular mechanisms of the mutular interaction of viruses and plants.

Mart Saarma has been a thought leader in research organisation and administration in Estonia and abroad. He is a member of the Research and Development Council, the Board of Trustees of the Tallinn University of Technology and the Research Council of the National Institute of Chemical Physics and Biophysics; he holds memberships in several international research organisations, such as the European Research Council, whose Vice President he was in 2015–2016; he is a member of the board of editors of several journals (Experimental Neurology, Journal of Biological Chemistry, etc.).

In 1980, Mart Saarma received the Soviet Estonian national award for a research cycle on the structure of the protein biosynthesis system (as part of a group). He has been awarded the Order of the White Rose of Finland Class I, the University of Helsinki silver medal, the Finnish Cultural Foundation Science Prize, the Väinö Tanner Prize, the Runeberg Medical Science Prize, and the Karl Schlossmann Medal of the Estonian Academy of Sciences. He was awarded the Republic of Estonia Order of the White Star Class II decoration in 2001, and the Nordic Science Prize in 2009.

In his youth, Mart Saarma was an active basketball player, playing in the Estonian youth team for years. His relaxation activities include tennis, theatre and fiction.

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Member of the Academy Mart Ustav

Mart Ustav was born on 16 July 1949 in the town of Cherlak, Omsk Oblast, Russian SFSR, where his parents had been deported to earlier in the year. The family returned to Estonia in 1956 and he was able to attend an Estonian school. His first school was the Tartu 10th High School; he continued at the legendary chemistry class of the Tartu 5th High School and proceeded to join the Faculty of Physics and Chemistry of the University of Tartu, graduating in 1972. He earned a candidate (PhD) degree in chemistry at the Council of the Institute of Molecular Biology and Genetics of the Ukrainian Academy of Sciences in 1979. Mart Ustav was elected a member of the Estonian Academy of Sciences in 2001.

Mart Ustav started working at the Institute of Cybernetics of the Estonian Academy of Sciences in 1974. He has worked as a senior Engineer, and junior and senior researcher at the University of Tartu (1976–1982), worked at the Institute of Medical Genetics of Uppsala University (1982–1985), was the Head of the Laboratory of Oncogenesis of the University of Tartu (1985–1989), the Head of the Chair of Microbiology and Virology and a professor at the Institute of Molecular and Cell Biology (1992–2002; Head of the Institute in 1996–1999), and Director of the Tartu University Institute of Technology (2002–2007, 2012–2017). Mart Ustav has been a professor of biomedical technology at the University of Tartu since 2007.

In 1999, Mart Ustav became one of the founders of OÜ Quattromed, which focused mainly on infectious disease diagnostics. Quattromed's successor, the Icosagen Group, now employs 70 people (including 17 PhD degree holders); it is among the ten largest European organisations in the field offering research-intense and manufacturing services and it licences its QMCF technology to 17 partners, including leading pharmaceutical companies.

Mart Ustav's research has mainly been focused on animal and human papillomaviruses. He has studied the mechanisms the virus uses to achieve the processing of its genome, along with the cell's own, including being passed on to daughter cells, and the way the virus reproduces and forces cells to divide uncontrollably. Mart Ustav and his colleagues have made breakthrough discoveries about the start of the "multiplication" of the papillomavirus genome and the molecular mechanisms crucial to the process. They have discovered the causes of the reproduction, retention in the organism and danger of cancer-causing DNA viruses, including papillomaviruses, which pose a particular danger to humans (e.g. causing cervical cancer). The know-how created by Mart Ustav has been implemented in new and innovative technologies and products. Mart Ustav has used his discoveries to create an HIV vaccine and a novel technology for the large-scale production of diagnostic and therapeutic proteins.

Mart Ustav's work has been recognised with three national research awards (in 1980, 1996 and 2019). The latest award is the Discovery Award for a scientific discovery that has led to the creation of innovative products with a significant socio-economic impact, granted for the research and development work "From research on the molecular mechanisms of the replication of DNA oncoviruses to the development of biological drug manufacture and development technologies".

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Member of the Academy Tarmo Uustalu

Tarmo Uustalu was born in Tallinn on 19 January 1969. He graduated from the Tallinn 44th High School (currently Mustamäe Gymnasium) in 1987 and the Georg Ots Tallinn Music School in 1988, where he studied music theory. He went on to study automated control systems at the Tallinn University of Technology, where he earned an MSc in system engineering and computer science (1992). Tarmo Uustalu then entered the Stockholm Royal University of Technology, where he earned a licentiate degree (1995) and a doctoral (PhD) degree with the thesis "Natural deduction for intuitionistic least and greatest fixpoint logics, with an application to program construction" (1998).

Tarmo Uustalu was elected a member of the Estonian Academy of Sciences in 2010 in computer science.

In 1986–1992, Tarmo Uustalu worked as a senior technician and engineer at the Institute of Cybernetics of the Estonian Academy of Sciences (later merged with the Tallinn University of Technology), continuing as a senior researcher in 1999–2009 after earning his doctoral degree. He was an associate professor at the School of Information Technologies of the Tallinn University of Technology in 2002–2004 and a professor at the same in 2004–2017. Since autumn 2017, Tarmo Uustalu has been working as a professor at the School of Computer Science of the University of Reykjavik, continuing part-time as a leading researcher at the Department of Software Science of the Tallinn University of Technology.

Tarmo Uustalu's main research interests are structural proof theory and type theory, algebraic and categorical logic, the semantics of programming languages, programming logic, functional programming, the transformation and construction of programs, and computer science applications of modal logics. He has been an active member of steering and programming councils of international professional conferences and has organised summer and winter schools. He is an initiator and one of the main organisers of the Estonian computer science theory days and a member of the editorial board of the international research *Journal of Universal Computer Science*. He has supervised eight successful master's theses and three doctoral theses.

Tarmo Uustalu's first awards were earned during his studies: the best presentation award from the Belarus, Moldova and Baltic states student research conference (mathematics section) in 1989, 3rd degree diploma from the Union-wide student research conference in Novosibirsk (1990), and first prize in the Estonian Ministry of Education student research paper competition (1991). He received the Boris Tamm stipend in 2002. He was elected as the Tallinn University of Technology Researcher of the Year in 2010. Tarmo Uustalu was awarded a national research award in exact sciences in 2015.

Along with research, the member of the Academy enjoys reading, music (playing the piano) and orienteering.

ESTONIAN ACADEMY PUBLISHERS

Established in 1994
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In 2018 the Estonian Academy Publishers continued regularly issuing seven peer-reviewed open access scientific journals.

All of the journals have international editorial boards. In the Estonian Research Information System ETIS, administered by the Estonian Research Council, all of the journals have been placed in the category 1.1. The journals are published in collaboration with Estonian universities.

Since 2006, full texts of all of the articles published in all of the journals, along with information on the journals and their issues, have been available free on the Academy Publishers website, at www.kirj.ee.

All scientific articles of the journals have been supplied with doi-indices (Digital Object Identifiers), which allow them to be more easily found in online searches. Published texts are also distributed by the well-known electronic publishers and portals EBSCO, C.E.E.O.L., The Gale Group Inc., ProQuest LLC, H. W. Wilson (merged with EBSCO), Digital Publication with the Leading Asian Distributor (Airiti Inc.) and Join CNKI Scholar (China). All seven journals issued by the publishers have been included in Elsevier BV Bibliographic Database SCOPUS®, which is used in many countries as the benchmark of efficiency in research. Six of the journals are reflected in the database of Thomson Reuters Web of Science® Core Collection, which is often used as the basic source of bibliometric information for research evaluation:

Acta Historica Tallinnensia
Estonian Journal of Archaeology
Estonian Journal of Earth Sciences
Proceedings of the Estonian Academy of Sciences
Oil Shale (including Current Contents®)
Trames. A Journal of the Humanities and Social Sciences

Two journals are in the database ERIH: *Estonian Journal of Archaeology* and *Linguistica Uralica*.

The publishers produce the following electronic versions of the articles for the aforementioned portals: pdf-files, sgml-files of two types, xml-files of three types and a special file for the electronic library C.E.E.O.L.

In 2019, a total of 180 pieces of writing were released in 24 issues of the seven journals, including 161 scientific articles and 19 short pieces of writing. Electronic versions of the articles were published prior to the release of hard copies of the journals. Articles in the journals *Proceedings of the Estonian Academy of Sciences* and *Estonian Journal of Earth Sciences* were published immediately after the layouts of the articles were finalised.

Title	Number of issues per year	Total number of pages	Format of journal
Acta Historica Tallinnensia	1	170	168×240
Estonian Journal of Archaeology	2	172	168×240
Estonian Journal of Earth Sciences	4	242	210×285
Linguistica Uralica	4	320	168×260
Oil Shale	5	530	168×255
Proceedings of the Estonian Academy of Sciences	4	432	210×285
Trames	4	522	168×240
Total:	24	2388	

The number of authors totalled 502, of whom 211 were Estonian authors and 291 foreign authors. The overwhelming majority of articles appeared in English, except in the journal *Linguistica Uralica*: there were also many contributions in Russian (38% of the volume) and German (6.5% of the volume). Since the majority of authors of this journal are linguists of Russia's Finno-Ugric peoples, the prevalence of the Russian language is natural and important.

Articles of *Acta Historica Tallinnensia* appeared either in Estonian (with comprehensive summaries in English) or in another language (with summaries in Estonian). In the humanities, articles commonly have one to three authors whereas, in the sciences, it is not uncommon for one article to have up to ten authors.

Three special issues of journals were released in 2018:

Estonian Journal of Earth Sciences 2019, 68/2: Selected papers of the international conference "Modern Materials and Manufacturing 2019" (MMM2019). Edited by Priit Kulu.

Proceedings of the Estonian Academy of Sciences 2019, 68/4: Selected papers of the international conference "Modern Materials and Manufacturing 2019" (MMM2019). Guest Editor: Tauno Otto.

Oil Shale 2019, 36/2S: Special issue on the Second International Oil Shale Conference (BAU-SIOSC), October 9–11, 2018. Guest Editor: Omar Al-Ayed

Two books were also released in 2019:

Emakeele Seltsi aastaraamat 64 (*The Yearbook of the Estonian Mother Tongue Society*), editor-in-chief: Mati Erelt. Format 143 × 215, 316 pp., https://dx.doi.org/10.3176/esa64.01

Eesti suveräänsusdeklaratsiooni 30. aastapäeva konverents Tallinnas 16. novembril 2018. Tervitused ja ettekanded. = Международная конференция по случаю 30-й годовщины принятия декларации о суверенитете Эстонии. Таллинн, 16 ноября 2018 года. Материалы конференции ("Conference on the 30th Anniversary of the Declaration of Estonian Sovereignty, Tallinn, 16 November 2018: Greetings and Presentations"), ed. Jüri Kann, 128 p; texts in Estonian and Russian.

Two journals gained new editors-in-chief. Member of the Academy Anto Raukas was replaced by Professor Andres Siirde as the editor-in-chief of the journal *Oil Shale,* and Member of the Academy Dimitri Kaljo was replaced by Professor Olle Hints as the editor-in-chief of the journal *Estonian Journal of Earth Sciences*. The editor-in-chief of the journal *Acta Historica Tallinnensia* was scheduled to change in January 2020.

The digitisation of the Estonian Academy Publishers' scientific journals was completed in 2018. The Tallinn University Academic Library continued digitising older editions of the publications of the Estonian Academy of Sciences. Materials from 1945–1991 are now accessible for everyone. Full texts of later publications have been digitised by Google. The links are available on the publishers' website. The library is additionally planning the modernisation of digitised publications, including adding a digital identifier and metadata to all articles (titles, authors, authors' positions, journal names, editions and issues, page numbers, and abstracts in Estonian and in the original languages).

UNDER AND TUGLAS LITERATURE CENTRE OF THE ESTONIAN ACADEMY OF SCIENCES

Founded in 1993 (the Affiliate Museum in Nõmme, formerly called the Friedebert Tuglas House Museum, was founded in 1971).
Personnel: 18, including 12 researchers
Address: Roosikrantsi 6, 10119 Tallinn, ESTONIA, utkk@utkk.ee
Museum Department: Väikese Illimari 12, 11623 Tallinn, ESTONIA, tuglas@utkk.ee
www.utkk.ee
Director: Jaan Undusk, Tel.: +372 372 644 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 with an international scope for research on literature and culture. Its task is the investigation and theoretical modelling of Estonian-language written culture in its entirety and the multilingual Baltic-German culture from earlier eras, thereby making the historical Baltic and the later Estonian realm of written culture visible, interesting and open to comparison with similar realms in international scholarship.

The Literature Centre's main research areas 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 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 Foundation for Estonian Arts and Letters in the US 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, and whose enduring scientific value and high level of systematisation have earned it a place in the Estonian national collection in the field of the humanities.

In 2019, research at the Literature Centre focused on two main subjects: the institutional research topic "Entangled Literatures: Discursive History of Literary Culture in Estonia" (principal investigator: Jaan Undusk) and the personal research topic "Masterpieces of Humanism in Livonia: David Hilchen's epistolography as a source of language, and literary, juridical and

educational history" (principal investigator: Kristi Viiding).

Research into the institutional research topic began in 2014 and will be completed by spring 2020. It examines the emergence and development of literary culture on the Estonian territory as an entangled process (*histoire croisée*), reflecting intertwined relationships between manifold ethnic, colonial, cultural etc. impulses, involving criss-cross patterns, resistances and inertias. The character of investigation is predominantly discourse-based and follows the lines of important "territories of speech" (history, religion, language and environment) apparent in a historically multilingual society. A comprehensive rewriting of the literary history of Estonia in the 13th–19th centuries is the goal, while integrating into it the rich German component. Modernity is examined in tension with national strivings as a time of diverse emancipations; attention is paid both to social figures (decadents, upstarts and artists) as well as figures of thought (autonomy, time and infinity). In the post-Soviet period, the "multidirectionality" of memory culture is exemplified by fiction and theatre.

The Literature Centre began coordinating the second research topic, "Masterpieces of Humanism in Livonia: David Hilchen's epistolography as a source of language, and literary, juridical and educational history" (principal investigator: Kristi Viiding), in September 2017 and the project was completed in 2019. The research project focused on collecting and cataloguing the formerly unpublished and unexplored Latin correspondence of David Hilchen, secretary and syndicus of Riga, a central, yet controversial humanist scholar of Livonia, on the international English-language website Early Modern Letters Online. The correspondence, consisting of nearly 800 letters, was organised into a three-volume publication, in which each letter was provided with a brief summary and annotations in German (publisher: LIT Verlag, Münster). Articles on Hilchen's written legacy were also published. On the basis of the only large surviving humanist body of written works in north-eastern Europe, the project members published an extensive article on the Baltic states' and Polish literary history at the turn of the 17th century, an article on the topics, style and models evident in Hilchen's letters, two articles on local education history and its international links, three articles on Hilchen's position in the social networks of leading European humanists and/or lawyers (Dutch humanists, the German humanist J. Caselius and the European lawyers' network), four articles on the reception of antique law in Hilchen's legislative work and letters, four articles on Hilchen's poems in various genres and a collection of his poetry. Several events were organised in the framework of the research topic, such as the three-day joint workshop of University of Tartu and University of Münster legal historians and neo-Latinists, "Ein Juristenleben in der frühen Neuzeit: David Hilchen (1561–1610)" (The life of a lawyer in the early modern period: David Hilchen (1561–1610)) in Tartu in spring 2016, a section dedicated to David Hilchen at the "Recht und Wirtschaft in Stadt und Land – Law and Economics in the Urban and Rural Environment" at the 9th Conference on Legal History in the Baltic Sea Area in Tallinn in spring 2018, and the international conference "Letters, Law and Court in Polish Livonia – the Case of David Hilchen" at the Literature Centre in spring 2019. The results were additionally introduced in over 20 conference presentations and guest lectures across Europe (in Finland, Sweden, Latvia, Poland, Germany, the Czech Republic, Italy and Spain). One doctoral thesis and one master's thesis were defended in the framework of the research effort.

In 2019, most of the Literature Centre's researchers were investigating the institutional research topic "Entangled Literatures: Discursive History of Literary Culture in Estonia" (principal investigator: Jaan Undusk). The Literature Centre published several high-profile publications in the framework of the research topic in 2019. The Literature Centre Publishers published a special publication on the life work of one of the most colourful representatives of Estonian expatriates in the United States, the art and literary critic Paul Reets, *Hinge roppus ja vaimu õis* (*The Wretched Soul Will Bear the Blossoms of the Mind*). The editor of the book, Jaan Undusk, included almost all of Reets' texts on art, literature and culture in the 672-page publication. The illustrations (design: Tiiu Pirsko) feature art, books, photos and postcards that Paul Reets donated to the Literature Centre in 2011.

Another special publication by the Centre was the collection *Nordic Literature of Decadence*, edited by the Literature Centre's Senior Researcher Mirjam Hinrikus (with Pirjo Lyytikäinen, Riikka Ross and Viola Parente-Čapková), which focuses on a practically unexplored area of world literature. Featuring an extensive introduction and epilogue, and including articles by thirteen authors, the collection reviews literature from Denmark, Norway, Sweden, Finland and Estonia. The collection expands and complements research in the field of *fin de siècle* decadence, focusing on Nordic literature, which remains nearly unknown in the Anglo-American cultural space and therefore has not been subject to a significant amount of investigation. The book was published by Routledge (New York and London) as part of the series "Among the Victorians and Modernists" and it was presented in Helsinki in November.

A special issue of the journal *Methis. Studia humaniora Estonia* on literary urban studies was published in collaboration with the Literature Centre. The special issue was edited by Senior Researcher and Head of the Literature Centre Museum Elle-Mari Talivee, in collaboration with Ene-Reet Soovik, Jason Finch and Anu Printsmann, and it follows the urban literature symposium and discussion

day "Narva, an Industrial Border City: Literary Reflections", organised by the Literature Centre a year earlier in Narva. In addition to Elle-Mari Talivee's article on the reconstruction of Ida-Viru County after the war in literature and film, the special issue features an essay by the Literature Centre researcher Aare Pilv on the Kreenholm textile manufacturing mill as a work of art. The essay mainly focuses on the production "Oomen" ("Omen"), based on the Russian avant-garde poet Aleksei Gastev's work *Töölislöögi poeesia* (*Poetry of the Worker's Blow*), which was staged at Kreenholm and for which Aare Pilt and colleagues won an original dramaturgy prize.

The Literature Centre also published numerous other in-depth works. Its staff published a total of 11 research articles in Estonian and 21 articles in other languages. Highlights among the foreign-language articles include Eneken Laanes' two articles, one of which was published in the article collection *Narratives of Annihilation, Confinement and Survival: Camp Literature in a Comparative Perspective* (ed. Anja Tippner and Anna Artwinska; published by De Gruyter (Berlin)), investigating supracultural memory forms in post-Soviet prison camp memories, and the other in the article collection *The Aesthetics and Politics of Linguistic Borders: Multilingualism in Northern European Literatures* (ed. Heidi Grönstrand, Markus Huss and Ralf Kauranen; published by Routledge (New York)), on the Baltic Russian subject in Andrei Ivanov's short story "Tuhk" ("Ashes") and novel *Peotäis põrmu* (*A Handful of Dust*). Estonian-language highlights include Jaan Undusk's articles in the history journal Tuna: "Kuidas portreteerida Jaan Tõnissoni. Müüt ja psühholoogia" ("How to portray Jaan Tõnisson. The myth and the psychology") and "Enn Tarveli antiromantismid" ("Enn Tarvel's antiromanticisms").

Twenty-two research-intense reviews, theses and other short written works were published. Fiction reviews include reviews of Urmas Vadi's novel *Ballettmeister* (*Ballet Master*) by Elle-Mari Talivee, and Jaak Jõerüüt's short story collection *Elu lehekülgi lehitsetakse kiiresti* (*The Pages of Life Are Quickly Turned*) by Aare Pilv in the journal *Keel ja Kirjandus*, reviews of Eda Ahi's poetry collection *Sõda ja rahutus* (*War and Peacelessness*) and Andrus Kivirähk's novel *Sinine sarvedega loom* (*A Blue Beast with Horns*) by Elle-Mari Talivee in the journal *Looming*, Viivi Luik's novel *Seitsmes rahukevad* (*Seventh Spring of Peace*), Kazuo Ishiguro's novel *Never Let Me Go* and Julian Barnes's novel *The Noise of Time* by Eneken Laanes in the cultural journal *Sirp*. The latter earned Eneken Laanes a nomination for the Ants Oras literary criticism prize. The Literature Centre's employees also critiqued research papers, essays and theatrical productions, and published opinion articles.

Another highlight among the very diverse publications of 2019 is the story collection *Roomlaste teod* (*Gesta Romanorum*), published in the Loomingu Raamatukogu book series. Supervised by Senior Researcher Kristi Viiding and Maria-Kristiina Lotman, five young translators translated 50 stories from the late medieval Latin-language bestseller; Viiding and Lotman provided the collection with a comprehensive foreword and afterword. The Estonian female prose anthology *Baltic belles: the Dedalus book of Estonian women's literature* (Dedalus, Sawtry) was published, featuring 12 authors' texts and an extensive introduction by the publication's editor, Elle-Mari Talivee. The collection was presented in London in December. The Literature Centre Publishers published its first children's book: a colouring book titled *Väikese kirjaniku raamat* (*Young Writer's Book*), which is a guide to the Literature Centre Museum for 3–8-year-old children (edited by Digitisation Specialist Kri Marie Vaik, and designed and illustrated by Else Lagerspetz).

The Literature Centre organised several international research events in 2019. The joint seminar "Aspects of Multilingualism in the 17th Century" on 15 April was part of the "German Spring 2019" project jointly organised by Tallinn University, Baltisch-Deutsches Hochschulkontor and the Literature Centre (Literature Centre's project manager: Marin Jänes), where Estonian and German researchers introduced the many facets of historical plurilingualism to a large audience.

The international conference "Letters, Law and Court in Polish Livonia – the Case of David Hilchen" took place on 16–17 April at the Literature Centre (lead organiser: Kristi Viiding) and the legal, social and cultural developments in Livonia under the Polish-Lithuanian Commonwealth were discussed in the light of the epistolary legacy of the early modern lawyer and humanist David Hilchen. Invited speakers included legal history, history and literature experts, who focused on the amalgamation of Livonia and Poland at the turn of the 16th and 17th centuries, following the complex webs connecting private individuals and officials, the interactions between the respective legal systems and overlaps between different media in directing societal processes.

The Literature Centre participated in the organisation of the international symposium "Victims, Perpetrators and Implicated Subjects: Rethinking Agency at the Intersections of Narrative and Memory", which was held 28 July–4 August and focused on matters related to subject positions and responsibility connected to historical violence in the context of modern narrative and memory studies. The symposium took place in the framework of the research network "Narrative and memory: Ethics – Aesthetics – Politics" (lead organiser: Eneken Laanes).

The Literature Centre participated in the organisation of the largest European environmental history conference, "Boundaries in/of Environmental History", which was held 21–25 August in Tallinn and was attended by nearly 500 participants from all over the world. The conference

was part of the biannual conference series of the European Society for Environmental History (lead organiser in Estonia: Senior Researcher at the Literature Centre Ulrike Plath). Ulrike Plath received a Tallinn University School of Humanities award and a lifetime honorary ESEH membership for her work on organising the conference.

On 19 September, the Literature Centre, the Jochmann Society in Heidelberg and the Baltic German Cultural Society in Estonia organised the joint international research seminar "Carl Gustav Jochmann, der anonyme Aufklärer aus Pernau" (main organiser: Jaan Undusk). German and Estonian researchers presented short presentations on the mysterious Baltic German writer Carl Gustav Jochmann.

The Baltic literary researchers' conference "Life Writing and History Writing in Contemporary Baltic Cultures" took place on 14–15 November in Tallinn in the framework of a conference series organised biannually in Riga, Vilnius or Tallinn to introduce the newest research results of literary researchers from the three Baltic states. The 12th conference was organised by the Literature Centre and focused on life writing in literature and culture (organised by Marin Jänes and Anneli Mihkelev). Following the conference, the Literature Centre published a collection containing presentation abstracts, overviews of previous conferences and related publications.

In addition to international conferences and seminars, the Literature Centre organised several other events. A highlight was the Paul Reets Day, held on 1 July, when the Boston Estonian writer's remains were buried at Metsakalmistu and the collection of his works *Hinge roppus ja vaimu õis* (*The Wretched Soul Will Bear the Blossoms of the Mind*; Literature Centre Publishers) was presented at a literature evening organised in his memory at Writers' House Tallinn. The Paul Reets Day was organised by the Literature Centre in collaboration with the Estonian Writers' Union (main organiser: Jaan Undusk). On 2 July, the ESTO literary discussions "#VÕRGUSTIKUD Pagulased ja väliseesti kirjandus" ("#NETWORKS Refugees and Estonian emigrant literature") took place, organised by the Literature Centre jointly with the journal *Looming*. The Literature Centre also organised the children's literature event "ESTO lastekas" on the same day (ESTO literature events organised by Marin Jänes).

The Researchers' Night literary experiment on 27 September, visualising Friedebert Tuglas' short stories, jointly organised by the Literature Centre and the Academy of Sciences, was also well attended. On 11 October, the Literature Centre organised an urbanisation seminar at the National Library to mark the opening of the exhibition "Landscape with a City and a Townie" (curated by Lola Annabel Kass). The Literature Centre and Estonian Children's Literature Centre joint seminar "Laps kirjanduses" ("Children in Literature") took place on 22 October. The seventh seminar in the series discussed the nature of humour in children's literature (Literature Centre organiser: Elle-Mari Talivee). In addition to events organised, the Literature Centre was also represented at the HeadRead literature festival and the Kirjandustänav festival.

Regular research seminars organised by researchers of the Literature Centre continued in 2019. On 1 March, the Tallinn University doctoral student Merlin Kirikal delivered the presentation "Taimnaine ja tantsijatar Johannes Semperi loomingus" ("Herbwoman and dancer in the work of Johannes Semper"), on 27 May, Kristi Viiding and Thomas Hobbmann delivered the presentation "Oma tegudele saad üksnes sina ise ajalookirjutuse abil igavikku otsida..." (J. Caselius to D. Hilchen 01.02.1596). David Hilcheni historiseerimine" on the historicisation of David Hilchen, on 6 June, Ulrike Plath delivered the presentation "Kuusevõrse maitse suus: valgustatud keskkonnad, aistilised maastikud ja ajalooliste tehnikate taaselustamise katsed" ("The taste of spruce shoots: illuminated environments, sensory landscapes and attempts to revive historical techniques"), and on 11 November, Martin Klöker delivered the presentation "Deutschbaltische Frauen und die literatur. Eine kleine Erkundungstour zu den Anfängen und Grundlagen" ("Baltic German women and literature. Back to the roots").

The Literature Centre staff delivered 48 research presentations in 2019, 38 of which were given at international research events. Among other events, research results were presented at the following conferences and seminars: the Estonian Association of Comparative Literature conference "Current State of Literary Theory, Research and Criticism in (Non-'Centric') National Cultures" in Tartu (Mirjam Hinrikus and Elle-Mari Talivee), the 12th International Conference of Baltic Literary Scholars "Life Writing and History Writing in Contemporary Baltic Cultures" in Tallinn (Mirjam Hinrikus, Martin Klöker, Piret Kruuspere, Aare Pilv, Elle-Mari Talivee and Jaan Undusk), the University of Latvia Faculty of Law conference "Legal Science: Functions, Significance and Future in Legal Systems" in Riga (Thomas Hoffmann), the historical multilingualism seminar "Aspects of Multilingualism in the 17th Century" in Tallinn (Marin Jänes and Kristi Viiding), the University of Helsinki Faculty of Arts conference "Transnational Influences. Theatrical Interactivity in the Nordic/Baltic Region" in Helsinki (Piret Kruuspere), the annual seminar of the Finnish Literary Research Society "Memory and Imagination" in Oulu (Eneken Laanes), a Memory Studies Association conference in Madrid (Eneken Laanes), a Baltic Historical Commission conference in Göttingen

(Ulrike Plath), a conference organised by the Rachel Carson Center for the Environment and Society in Munich (Ulrike Plath), the environmental history conference "Boundaries in/of Environmental History" in Tallinn (Ulrike Plath and Elle-Mari Talivee), the digital humanities conference "Use of Digital Cultural Heritage in Research and Education" in Tartu (Elle-Mari Talivee and Kri Marie Vaik), the seminar "Kotzebue-Gespräche VIII" ("Conversations about Kotzebue VIII") in Tallinn (Jaan Undusk), a Swedish neo-Latinist network seminar in Uppsala (Kristi Viiding) and the Estonian and Polish history conference "Scripta manent" in Tartu (Kristi Viiding).

The Literature Centre Museum was also active in organising literary events and public lectures. The Museum organised the Tallinn qualification round of the Koidula poetry recitation contest on 26 January, and the anniversary of Marie Under's birth was celebrated on 27 March with a poetry evening, guests were received on 17 August in connection with the Kumu Art Museum exhibition "The Garden Retreat. The Tuglas family garden as photographed by Tanja Muravskaja". The winners of the 48th Friedebert Tuglas Short Story Award were announced. The jury selected Tiit Aleksejev's short story "Tõlkija" ("The Translator") and Jan Kaus' short story "Õnnelik lõpp" ("Happy Ending") as the winners. The Literature Centre was represented on the jury by Marianne Lind.

Literary events, lectures, trips and other events continued to attract numerous visitors to the Literature Centre in 2019. The former home of Marie Under, Artur Adson and Friedebert and Elo Tuglas received nearly 900 visitors during the year. The local community was also involved; for example, local Nõmme inhabitants visited the writers' home on the pan-European Museum Night "Night of Patterns". The many participants in the local "Let's Do It!" community day event refreshed the writers' garden after the winter.

The Centre collaborated actively with other research and development institutions. In 2019, the Literature Centre's museum department hosted research visits from nearly thirty scholars, who accessed a total of 6,500 documents in the Centre's collections. Distance access of the collections increased significantly following large-scale digitisation of collections and updates to the database website. The Literature Centre's website, which mirrors collections' entries on the Museums Public Portal, had 16,539 single visits (22,225, with repeat views included), by 5,342 visitors. Files in the Literary Centre's collections were accessed a total of 429,533 times. The digitisation, entry and description of the collections on the Museums Public Portal and updates to the website continued through the project "The Development of the UTKK Museum Department into a Modern International Research Centre" (project manager: Elle-Mari Talivee) in the framework of the programme "Institutional development programme for research and development institutions and higher education institutions", funded by the European Regional Fund.

Active collaboration with foreign academics continued: joint publications were authored and edited and events were organised. Employees of the Literature Centre supervised, assessed and acted as opponents for Estonian and foreign universities' undergraduate, master's and doctoral theses. Lecture courses and seminars were held at Tallinn University, the Estonian Academy of Music and Theatre, the Tallinn University of Technology and the Open Academy (Thomas Hoffmann, Piret Kruuspere, Eneken Laanes, Ulrike Plath, Jaan Undusk and Kristi Viiding). The Literature Centre also participates in the work of the Tallinn University Academic Library, the Estonian National Library and the Estonian Literary Museum research councils and the Estonian Academy of Music and Theatre doctoral council (Jaan Undusk). Jaan Undusk was the chair of the jury of the Jaan Kross Literary Award and a member of the Rahvusmõtte auhind ("National Identity" award) and national student contest award committees.

Eneken Laanes was a member of the Research Council of the Tallinn University School of Humanities, a member of the council of the Cultural Endowment of Estonia and a member and vice chair of the Literature Endowment; she received a KONE (Finland) scholarship to carry out research at the Helsinki Collegium of the University of Helsinki. Her project "Translating Memories: The Eastern European Past in the Global Arena" earned a prestigious grant of 1.5 million euros from the European Research Council. Ulrike Plath was a member of the board of the Estonian Centre for Environmental History and the Head of the Board of the School of Humanities of Tallinn University; she was a member of the board of editors of the University Publishers, the Estonian Historical Archives etc. Elle-Mari Talivee was a member of the juries of the Estonian-Latvian Language Award and the Cultural Endowment of Estonia Literature Endowment. Aare Pilv was a board member of the Estonian Writers' Union, a member of the board of editors of the Estonian Semiotics Association publication *Acta Semiotica Estica,* and was nominated for the August Sang poetry translation award. Kristi Viiding continued as the Secretary-General of the International Association for Neo-Latin Studies. Literature Centre staff members also participated in the work of many other organisations and juries. They were also members of the boards of editors of several other research publications and contributed to journals as peer reviewers.

ASSOCIATED INSTITUTIONS

The Estonian Academy of Sciences Act, passed by the *Riigikogu* (Parliament) in 1997, stipulates that research, development and cultural institutions, and scientific societies whose activities and objectives conform to those of the Academy may associate themselves with the Academy. The association is effected under bilateral agreements that specify the aims, tasks and commitments for the parties.

Surveys of the activities of such institutions have been published in the Academy Yearbook since 1998.

Reviews of the 2019 activities of the institutions associated with the Academy have been presented in chronological order by their association date:

TARTU OBSERVATORY

Associated with the Estonian Academy of Sciences since 8 May 1998

Founded in 1808, an institute of the University of Tartu since 01.01.2018

Personnel: 93, including 50 academic staff
Address: Observatooriumi 1, 61602 Tõravere, Tartu maakond, ESTONIA
kosmos@ut.ee
https://kosmos.ut.ee/en
Director: Anu Reinart, Tel.: +372 737 2505, anu.reinart@ut.ee

The transition period related to the incorporation of the Tartu Observatory into the Faculty of Science and Technology of the University of Tartu continues. Four mutually complementary research directions are being pursued: galactic physics and cosmology, stellar physics, remote sensing and space technology. National research funding has continued to be received for three institutional research topics and one centre of excellence:

- Galaxy evolution in the hierarchical universe (principal investigator: G. Hütsi);
- The role of dark matter filaments in the large-scale structure and assembly of galaxies (principal investigator: E. Tempel);
- Variability and evolution of massive stars in the Gaia era (principal investigator: I. Kolka);
- Centre of Excellence "Dark Side of the Universe", coordinated by the National Institute of Chemical Physics and Biophysics.

Three personal research grants, two post-doctoral grants (for internships at the Massachusetts Institute of Technology in the US and the Centre of Education and Research on Mediterranean Environments in France) and four mobility grants have also been funded. However, more than half of the Tartu Observatory research and development funding is received through private enterprise and international agreements.

A substantial step forward was made in the development of our observational astronomy, in which the international network Physics of Extreme Massive Stars (POEMS) was initiated in the framework of the Marie Skłodowska-Curie Research and Innovation Staff Exchange call of the Horizon 2020 Initiative. Three young talented astronomers were able to join the Observatory staff through grants

from the European Union cohesion policy funds 2014–2020 via the institutional development programme ASTRA/KOMEET.

A cooperation agreement was signed with the consortium of the new survey programme 4MOST (4-metre Multi-Object Spectroscopic Telescope) at the European Southern Observatory. Tartu Observatory is involved in the development of a surveying strategy and is responsible for the development of survey selection software. The data that can be collected on galaxies and stars with this powerful 4-metre spectroscopic telescope far exceed the currently available data. The project represents an opportunity for us to develop and implement innovative big data processing methods. The Observatory has also partnered with the Estonian company Milrem to execute the applied smart specialisation research programme "Applied research on a system of sensors and software algorithms for safety and driver assistance on remotely operated ground vehicles for off-road applications".

An applied research effort on remote sensing was initiated in the framework of the European Regional Development Fund RITA programme, with the goal of developing service prototypes for the Estonian public sector. At the end of the year, we received confirmation that the OPIC camera system we are developing will be used in the new European Space Agency mission "Comet Interceptor", planned for 2028.

In addition to several national contracts and services, various international cooperation projects (FP7: MULTPLY, AHEAD; H2020: HYPERNETS, EOMORES; FPCUP; ESA: MVT and FRM4SOC, IIS EOI and ESEO) and three INTERREG space technology and remote sensing projects (Test4SME, SpaceTEM and BalticSat-Apps) are continuing. Preparations were initiated to launch the European Space Agency educational programme European Space Education Resource Office (ESERO) in Estonia.

Boris Deshev and Tiina Liimets defended doctoral theses in astronomy and Indrek Sünter in space technology.

Nearly 6,000 students visited the Tartu Observatory through active learning programmes and field trips. We celebrated the 50th anniversary of humanity's first moon landing by organising a special exhibition. The traditional summer academy and research camp sponsored by the Tartu Hansa Rotary Club took place. An international remote sensing autumn school was organised in the framework of the above-mentioned RITA applied research effort in cooperation with the Baltic Earth network. In total, over 20 seminars, information days and conferences were held.

Celebrating Academy Member Jaan Einasto's 90th birthday and the University of Tartu Grand Medal award were particular highlights of the year. Academy Member Enn Saar received a University of Tartu Grand Medal for long-time outstanding work.

Ninety-two articles were published in various categories, 38 of them in international peer-reviewed journals in ETIS category 1.1.

A comprehensive overview of Tartu Observatory's activities has been published in the Tartu Observatory Yearbook 2019 and the traditional Observatory Calendar 2020.

ACADEMIC LIBRARY OF TALLINN UNIVERSITY

Associated with the Estonian Academy of Sciences since 17 June 1998

Founded in 1946
Personnel: 86, including two researchers
Address: Rävala pst 10, 15042 Tallinn, ESTONIA
tlulib@tlulib.ee
http://www.tlulib.ee/index.php/en/
Director: Andres Kollist, Tel.: +372 665 9401,
Fax: +372 665 9400, andres.kollist@tlulib.ee
Number of registered users: 40,294
Number of copies in the circulating collection: 2,653,786

Several events on antiquarian books and the international August von Kotzebue conference "Kotzebue-Gespräch" / "Conversations about Kotzebue VIII" took place in 2019. We organised high-level exhibitions, book fairs and library days and continued successful collaboration with our Estonian and international partners.

At the end of the year, Director of the Academic Library Andres Kollist was awarded the Medal of the Estonian Academy of Sciences for his significant contributions to enhancing the Academy's reach and visibility.

In the framework of the Centre for Early Printed Book lecture series "Researcher in the Baltica Department", the Baltic scholarship laureate Dorin-Ioan Rus, PhD, delivered the lecture "'Das Jahr ohne Sommer' 1816 in Estland und Lettland widergespiegelt in den lokalen deutschsprachigen Medien" ("1816: a year without summer in Estonia and Livonia, as reflected in local German-language media").

The first day of the Kotzebue conference on 4 October focused on reviewing the author's memoirs, plays, journalistic writing and librettos, and comparing and contrasting his work with Russian literature. Speakers included the researchers Anna Ananieva, Rolf Haaser, Zenaida des Aubris, Alexander Košenina, Nora Ramtke,

Nicolas Potysch, Jaan Undusk, Harry Liivrand, Tiina-Erika Friedenthal, Mari Tarvas, Mai Levin, Kairit Kaur (Academic Library), Tiiu Reimo (Academic Library) and Aira Võsa (Academic Library). The second day of the conference was held at the Estonian Academy of Music and Theatre.

The Tallinn University School of Humanities issued an exact language award on Mother Tongue Day. The Academic Library's professional language – the notices and answers sent to students – were declared by the jury to be the clearest and most concise.

The Pahlen family library, consisting of documents provided by the Academic Library, was opened at the Palmse Manor on 3 April. Library Nights were organised in cooperation with the Student Union in May and December, with over 200 visitors on each occasion. In October, the subject librarian Tambet Teder delivered the lecture "Plagiarism and its prevention: what can a library do?" at the Scientific and Special Libraries' Day.

The exhibition "75 years from the Great Escape to the West. Journals, Books, Photographs" proved to be the year's top exposition and photos from the exhibition were used in the Library's 2020 calender. Four book fairs were held in the lobby of the Library and the Library's bookshop was reopened. The Library café reopened after the completion of renovation work. A large publishers' sale took place in October during Library Days.

The Library organised dozens of tours for various target groups: Estonian students, foreign students, high school students, lecturers and professionals. International guests were hosted. Cooperation with several high schools and vocational schools continued.

In the spring, subject librarians carried out a survey on sources of information and their use to monitor the Library's readers' experiences with online information sources and their expectations for the future. The Statistical Package for Social Sciences software package became available at the Academic Library in April 2019.

The Estonian retrospective national bibliography centre project "Composition and editing of the Estonian retrospective national bibliography" received a 1,000 euro grant from the Cultural Endowment of Estonia folk culture endowment, a 500 euro grant from the Estonian National Culture Foundation daily newspaper "Kaleva" foundation and a 16,929.28 euro grant from the Tallinn University research fund.

Efforts connected with open research data and open publishing continued. The handbook "Open access: Publishing" was updated and translated into English; individual consultations were provided to researchers and doctoral students.

The centre for digitisation continued development and updated its work processes. All materials digitised at the library will be made available through the digital library ETERA; as of the end of the year, the website featured 70,184 objects. ETERA received 74,902 visits during 2019, 35.8% of which were first-time visits and 64.2% were repeat visits.

INSTITUTE OF THE ESTONIAN LANGUAGE

Associated with the Estonian Academy of Sciences since 11 May 1999

Founded in 1947
Personnel: 75, including 17 researchers, 46 lexicographers, terminologists, language planners, computer linguists and software developers
Address: Roosikrantsi 6, 10119 Tallinn, ESTONIA
www.eki.ee
https://www.eki.ee/en/
Director: Arvi Tavast, arvi.tavast@eki.ee, Tel: +372 617 7501
Academic Secretary: Jelena Kallas, Tel.: +372 617 7513, jelena.kallas@eki.ee

The institute has seven departments.

The Department of the History and Dialects of the Estonian Language and the Finno-Ugric Languages (Head Tiina Laansalu) carried out research in the framework of the personal research group grant "Identity and power relations as reflected in the literary Estonian of the 16th–18th centuries" (PRG34) and the post-doctoral grant "Proto-European substrate in the vocabulary of Southern Finnic languages" (PUTJD842). Compiling and editing the dictionary of Estonian dialects, the academic etymological dictionary and local dialect dictionaries continued. The *Kuusalu Coastal Language Dictionary* (in print and online), the *Estonian–Erzya dictionary* (online), the online version of the *Votic dictionary* and the Murdekiiker dialect portal were published. The compilation of the *Grammar of Estonian Dialects* was finished. The Archive of Estonian Dialects and Finno-Ugric Languages was updated and reorganised.

The Department of Language Resources and Technology (Head: Tõnis Nurk) continued developing the new dictionary and termbase system Ekilex and its dictionary portal Sõnaveeb. Data from 67 termbases and dictionaries were uploaded on Ekilex. The morphological database MAB was improved: the databases of compounds and morphological synthesis capability were integrated with the database. Research was carried out on the projects EKI-ASTRA (2014-2020.4.01.16-0034), "Federated Content Search for the Centre of Estonian Language Resources"

(2014-2020.4.01.16.0134, as a member of the CELR consortium); "External user interfaces and API of the dictionary and termbase system Ekilex" (2014-2020.12.03.18-0384); and "Lexical and grammatical profile of Estonian spoken as a second language by pre-schoolers and students of Stages I, II and III of school".

The main work of the Department of Speech Research and Technology (Head: Meelis Mihkla) included speech research and development and applications of Estonian-language speech synthesis. A speech synthesis interface for the Mac OS operating system and a synthesised girl's voice were completed. Advances were made in the projects "Speech styles, sentence prosody, phonological variation: description, theory and modelling" (IUT35-1), Centre of Excellence in Estonian Studies CEES (TK145) and "Diversification of Estonian text-to-speech synthesis" (EKTB21). The research collection *Aspects of speech studies II* was published as a special edition of the *Journal of Estonian and Finno-Ugric Linguistics.*

The Department of Language Planning (Head: Peeter Päll) published the *Handbook of Standard Estonian* as approved on 15.10.2019 by the Language Board of the Mother Tongue Society. Work continued on the collection of Estonian surnames and the language advice compendium. Language advice was provided via telephone and e-mail, and language management training sessions were organised. EU language planning and plain language promotion activities were carried out, the "Selge ja kasutajakeskne riik" ("Clear and User-Friendly Government") brainstorming session was organised and the survey "Riigiasutustes selge keele kasutust takistavate ja soodustavate tegurite väljaselgitamine" ("Identifying the factors helping and hindering the use of plain language in government agencies") was finished.

The Dictionary Department (Head: Marit Langemets) published the dictionaries *Estonian–Finnish Dictionary 2019, Explanatory Dictionary of the Estonian Language 2019, Dictionary of Collocations 2019, Estonian–Russian Dictionary 2019,* a basic Estonian–Mandarin dictionary and the *Dictionary of Estonian Word Associations.* The department participated in the development of the dictionary and termbase system Ekilex and the Sõnaveeb portal in the context of the institutional development programme ASTRA (see above). The department also participated in the Horizon 2020 Initiative project "European Lexicographic Infrastructure (2018–2022)". The department completed the personal research grant "Redefining Estonian parts of speech: a corpus-driven approach (2019–2022)" (PSG227).

The main work of the Terminology Department (Head: Tiina Soon) focused on the Esterm termbase and terminological activity management in accordance with the "Principles of Supporting Language Planning and Terminology Work in Estonian 2019–2027". The compilation of an aviation termbase, an education dictionary and a hobby education dictionary continued. An insurance terminology project was initiated. Terminology committees were trained on the use of the Ekilex dictionary and termbase system, and terminological advice was provided.

The Personnel and Administration Department (Head: Kai Oro) continued participation in the Ministry of Social Affairs' project "Family-Friendly Employer Label". The Institute received a family-friendly employer bronze label. A survey of psychosocial risk factors in the Institute's work environment was carried out. A new organisation of work rules was created. Internal training sessions and a summer seminar were organised for the employees.

ESTONIAN LITERARY MUSEUM

Associated with the Estonian Academy of Sciences since 11 May 1999

Founded in 1909 as the Archival Library of the Estonian National Museum
Personnel: 106, including 38 researchers, 13 librarians and bibliographers
Address: Vanemuise 42, 51003 Tartu, ESTONIA
kirmus@kirmus.ee
https://www.kirmus.ee/en
Acting Director: Martin Eessalu,
martin.eessalu@kirmus.ee,
Tel.: + 372 7354061
Secretary: Ave Soeorg, tel 737 7700,
ave.soeorg@kirmus.ee

The research highlights of the Estonian Cultural History Archives included studies on socialism, life writing and migration. Fieldwork was carried out in Norway. The central role of life writing in communicating (post-)traumatic memories was researched; the creation of an anthology of letters, journals, memories and biographies provided a panoramic overview of the development of life writing. The international impact of refugee literature was highlighted by I. Ivask's correspondence with B. Pasternak, and the intertwining of literary and life writing was explored in research into intratextual links in the works of B. Kangro and E. Mihkelson. A digital analysis of literary text corpora revealed a rapid change in values during independence as compared to the Young Estonia (Noor-Eesti) period.

Research carried out by the Estonian Folklore Archives highlighted the conflict inherent in humanities researchers' dual role as observers and documenters of culture, on the one hand, and participants in the (national) culture process, on the other hand. It noted the moral dilemma arising from the conflict in cases where the perpetuation of certain materials in cultural heritage is undesirable for individuals or a community, or where it would damage their reputation, yet where documenting it is required to create an accurate depiction of the situation, the everyday culture or folkloric communication. The observation of folkloric poetry collections and their research histories reveals that the former position has been predominant, which is consistent with the concept of the use of folklore in developing national culture, which has been prevalent since the beginning of folklore collection. Therefore, certain areas of folk culture that conflict with societal morals have hardly been documented. The research work raised important questions about the aspects of Estonian culture that we should strive to maintain in accordance with the Constitution of the Republic of Estonia (whether to maintain only the noble or also the reprehensible), where the responsibility of the researcher lies and in whose interests the researcher should act.

The Department of Folklore carried out theoretical and applied development efforts towards the initiation of a new project, including negotiations with partners and early-stage work on upgrading two research groups into research centres (humour and religious studies).

Functional differences in sacrificial traditions in modern Estonian and Finnish sacred sites were researched and the prevalence of healing landscapes over other sacral landscape forms was identified. Directions developing in the Estonian Russian religious and narrative tradition were described, identifying three independent areas, of which the Pechory and Setomaa regions form a single whole, with a strong Eastern Slavic dominant. Estonian and Belarusian 19th–21st century jokes featuring religious figures diverged noticeably due to variations in confessional, social and cultural practices. Systematisation work was carried out on northern European Mesolithic anthropomorphic sculptures, spoken healing spells, monuments, and cases of apparent death with realistic and religious backgrounds, as reflected in the media and in folklore. An overview of developments in charity medicine in the last decade was prepared.

The statistical analysis and mapping of legends continued, focusing on colours, emotions, healing spells and etiologies. Research continued into the history and methods of folklore studies, including the publication of the books *Pildi sisse minek. Artikleid välitööde alalt* (*Walking into the Image. Articles on Fieldwork*) and *Usundid ja vaimsed õpetused Eestis* (*Religions and Spiritual Teachings in Estonia*).

The Centre of Excellence in Estonian Studies CEES was rated as outstanding in the 2019 mid-term evaluation. The work of the centre focused on three main directions in 2019: 1) mythology, 2) performative forms of culture and 3) environmental matters. The year's achievements included: a) completion of holistic analyses positioning the development of the national history of thought against the background of broader European cultural dynamics, b) analyses of processes of change, including the modern and proactive forms of metamorphoses, c) continuation of preparations for the creation of practical language technology solutions and basic analyses of indigenous languages, and d) publication of the seminal works *Narrative Complexity: Cognition, Embodiment, Evolution, Modern Experiences of Time, Eesti loitsud* (Estonian Spells), *Maailmakirjandus muinasajast tänapäevani I–III* (*World Literature from Prehistory to the Present Day I–III*), *Critical Essays on World Literature, Variation in Folklore and Language*, etc.; work on solutions to ethical problems was prioritised.

ESTONIAN NATIONAL MUSEUM

Associated with the Estonian Academy of Sciences since 21 December 2006

Founded in 1909
Personnel: 136, including 16 researchers
Address: Muuseumi tee 2, 60532 Tartu, ESTONIA
erm@erm.ee
https://erm.ee/en
Director: Alar Karis, Tel.: +372 736 3003
Director for Research: Pille Runnel, Tel.: +372 736 3013, pille.runnel@erm.ee

2019 was a year of intense activity for the Estonian National Museum. The excitement of the opening had subsided. Several major international conferences took place, many research projects were completed and new projects were initiated in strategic research areas. The museum received nearly 170,000 visitors, making the total number of visitors since the opening over 700,000, from nearly 120 countries. The main attractions included permanent and temporary exhibitions, cultural and educational events (over 600 events took place), educational programmes (over 600) and tours (over 1,000).

The research of the Estonian National Museum focused on Estonian and Finno-Ugric ethnology and museology. The Museum is managing two research projects and participating in two international collaboration projects (topics: cultural heritage and museums, food culture and

research on Finno-Ugric peoples). Five research conferences took place in the course of the year, including "Museums as Agents of Memory and Change", organised in cooperation with the University of Tartu Department of Ethnology (24–26 April), hosting over 120 cultural memory researchers from all over the world, and the conference "Museums 2030", in collaboration with the Network of European Museum Organisations (7–9 November), bringing together over 240 museum practitioners and researchers.

The 2019 Nordic food culture researchers' conference was organised in the framework of the food culture research and development project sponsored by the European Union Cohesion Policy Funds' ASTRA institutional development programme 2014–2020; several conferences were attended and a number of articles were published in research journals. Seminars and workshops were organised in collaboration with the Ministry of Rural Affairs and the Võru Institute to promote and develop the food heritage of Vana-Võrumaa, the Estonian Culinary Region of 2019. For the first time, the Museum's researchers took part in joint product development with small enterprises active in the field of culinary heritage, working on films, annotated cookbooks and informational materials.

A special issue of the SCOPUS-listed *Journal of Ethnology and Folkloristics* (de Gruyter) on the history of science was published, focusing on collaboration with Estonian, Latvian and Lithuanian researchers. The research projects "Finno-Ugric dialogues: Soviet Estonian ethnologists researching our kindred peoples (1944–1991)" and the museology research project "MOI! Museums of Impact", bringing together eleven partners, were initiated.

The Estonian National Museum's researchers delivered presentations at 30 international conferences and 10 conferences in Estonia. Over 20 research publications and 50 popular science articles were published (main topics: cultural memory research, the Soviet period, museology, history of science and folk culture). Ten popular science presentations were delivered, over 50 media appearances took place, the museum collections were supplemented with materials on Estonian and Siberian modern everyday life, the museum was represented by its experts in programme councils and committees, research projects were supervised, nearly 50 lectures were delivered at the Estonian National Museum and in universities, and continuing education events on museum-related matters were organised.

ESTONIAN CROP RESEARCH INSTITUTE

Associated with the Estonian Academy of Sciences since 23 September 2008

Founded in 1920
Personnel 141, including 37 researchers
Address: J. Aamisepa 1, Jõgeva, 48309 Jõgevamaa, ESTONIA
info@etki.ee
https://www.etki.ee/index.php/eng/
Director: Andre Veskioja, Tel.: +372 77 66 903, Fax: +372 77 66 902, andre.veskioja@etki.ee

The Estonian Crop Research Institute is a research and development institution within the Ministry of Rural Affairs. The Institute's main fields of activity are selective crop breeding, seed production, research into crop science, and the collection and conservation of genetic resources. The Institute's work is focused on enhancing the competitiveness and sustainability of crop production. The Institute provides scientific support to farmers, lawmakers, supervisory authorities and the advisory system, and collaborates with Estonian and international teaching, research and development institutions, entrepreneurs and other institutions in the field of research, development, innovation and economics. In 2019, the Minister of Rural Affairs appointed Andre Veskioja as the new Director of the Institute; the new Director took office on 2 May.

The Institute's researchers began tests of several new crop varieties with the potential for cultivation in Estonia. Tests of winter barley, winter oats and hybrid rye were initiated. Tests of open field tomatoes, corn, sunflowers, chickpeas and lentils continued. The winter wheat variety "Perenaise" was entered in the Estonian catalogue. The variety features excellent baking quality, resilience to cold, falling number and bulk density, as well as resistance to crop diseases.

A cereal breeding centre featuring all necessary conditions for breeding spring wheat, winter wheat, barley, oats, rye, legumes and oil crops was opened on 18 September.

The Institute took part in five international projects in 2019. The opening seminar of the RYE-SUS project was organised by the Institute on 2–3 July. The project aims to enhance the attractiveness of winter rye to farmers and improve its adaptation to climate change-related challenges.

The project BARISTA focuses on developing modern intensive and sustainable agriculture methods and climate change adaptation in barley breeding.

The project SuMaNu was launched with the goal of enhancing the sustainability of the use of animal manure and nutrients in the Baltic region. SuMaNu is a follow-up project to the projects Manure Standards and Baltic Slurry Acidification, concluded in 2019.

The Institute purchased two combine harvesters for harvesting seed fields and field trials, an optical grain sorter, a threshing machine and equipment for determining the quality of cereal flour and the protein content of grasses.

The Institute organised five farming days. The presentation day at Rannu Seeme OÜ focused on field trials of chickpeas and lentils. Two organic farming days and one conventional farming day took place at the Jõgeva test field in July. The season was concluded at Voore Farm OÜ. The Institute's researchers delivered presentations at the Viljandi and Kuusiku Variety Testing Centres of the Agricultural Research Centre and the Frenord OÜ agricultural days at Lüüste.

The conference "Agronomy 2019" took place at the Jõgeva Cultural Centre on 27 February, featuring presentations from researchers and specialists of the Estonian Crop Research Institute, the Estonian University of Life Sciences, the University of Tartu and the Lithuanian Research Centre for Agriculture and Forestry.

The Estonian Crop Research Institute will celebrate its 100th anniversary in 2020. Preparation for the activities and celebrations of the anniversary year was carried out throughout 2019.

ART MUSEUM OF ESTONIA

Associated with the Estonian Academy of Sciences since 9 June 2015

Founded in 1919
Personnel: 146
Address: Weizenbergi 34 / Valge 1, 10127 Tallinn, ESTONIA
muuseum@ekm.ee
https://kunstimuuseum.ekm.ee/en/
Member of the Board: Sirje Helme,
Tel.: +372 602 6001

The Art Museum of Estonia (EKM) Foundation collects, preserves, researches and publicises Estonian and international art. The EKM is an umbrella organisation for five art museums: the Kadriorg Art Museum, Adamson-Eric Museum, Niguliste Museum, Mikkel Museum and Kumu Art Museum.

The Art Museum of Estonia celebrated its 100th anniversary in 2019. The programming of the anniversary year focused on history, collections and women in art.

The extensive research collection *Eesti Kunstimuuseum 100* (Art Museum of Estonia 100, ed. Sirje Helme) was published in November. Mai Levin's extensive monograph on the founder of Estonian professional art, Johann Köler, was also published. The anniversary exhibition "Open Collections: The Artist Takes the Floor" introduced the museum's collection, which includes local and international art from the medieval period to the present day. The Art Museum of Estonia jubilee programme's travelling exhibition "Open Collections: the Art Museum in Your Town" introduced the Museum's collections in Haapsalu and Valga. The anniversary exhibitions focusing on women and female artists included "Creating the Self: Emancipating Women in Estonian and Finnish Art", "Maire Männik: Estonian Legend in Paris" and "The Virgin Mary: Woman, Mother, Queen". Exhibitions abroad were organised in Finland and Japan: "Kaljo Põllu: A Mythological Ancient World", at the Okuni shrine in Japan, was organised in collaboration with the Saku local government and the Saku museum of modern art, and the exhibition "Estonian Art Classic. Adamson-Eric: a Versatile Modernist" took place at the Järvenpää Art Museum in Finland.

The Museum's biggest conference of the year was the international Kumu conference 2019 "Symbolist Art and the Baltic Sea Region, 1880–1930" (31 January–2 February 2019), which focused on the transcultural networks of symbolist art in the Baltic Sea region during those years (in collaboration with the Estonian Society of Art Historians and Curators).

The year's research projects include "Christian Ackermann – Tallinn's Phidias, Arrogant and Talented" exploring the Baroque legacy of the Baltics, "The Modern Woman – New Identities" (2017–2020), comparing and contrasting the works of Estonian and Finnish female artists, and "Forgotten Heritage – European Avant-Garde Art Online" (2016–2020). The exhibition of the art collection of one of the biggest early 20th century art collectors in Estonia, Alfred Rõude, in the Mikkel Museum was complemented by the biography *Alfred Rõude (1896–1968): Collector with a Mission* by Anu Allikvee, which was published in a series of archive research publications focusing on materials housed in the Art Museum's archives.

The year's publications continued the research and promotion of Estonian art classics. Four exhibition catalogues were published: Juta Kivimäe (ed.) "Maire Männik: Estonian Legend in Paris", Anu Allas and Tiina Abel (ed.) "Creating the Self: Emancipating Women in Estonian and Finnish Art", Kerttu Palginõmm (ed.) "The Power of Things" and Henrik Holm (ed.) "Dannebrog. The Flag That Fell from the Sky: The Golden Age of Danish Art".

The Museum continued to issue the peer-reviewed bilingual journal *Proceedings of the Art Museum of Estonia*; a special issue titled "Lost and found spaces: Displacements in Eastern European Art and Society in the 1990s" ((14), 2019) was published.

ASSOCIATED ORGANISATIONS

Organisations whose activities and objectives are compatible with those of the Academy, may associate with the Academy. Association is effected in the form of a bilateral agreement specifying the aims, duties and commitments of the parties.

Short descriptions of the organisations associated with the Academy have been presented in chronological order, according to their association dates. A selection of highlights of their activities in 2019 is given on pp. 94–102.

ESTONIAN NATURALISTS' SOCIETY

Associated with the Estonian Academy of Sciences since 23 January 1998

Founded in 1853
Membership: 13 honorary members, 659 active members and 67 trustees
Divisions: 23
Address: Struve 2, 51003 Tartu, ESTONIA
elus@elus.ee, www.elus.ee
President: Urmas Kõljalg, Tel.: +372 5341 2823

The Estonian Naturalists' Society has 23 sub-units, including sections on anthropology, botany, entomology, geology, forestry and theoretical biology, the Commission on Lakes, the Estonian Teriological Society, the Estonian Malacological Society, the Estonian Meteorological Society (formerly the Section of Amateur Meteorologists), the Estonian Mycological Society, the Estonian Citizen Science Association and the Jakob von Uexküll Centre. The Society also includes committees on nature education, the history of natural sciences, plant names in Estonian and observation networks, the library committee, an assembly of honorary members, the Estonian assembly on ecology, an Estonian-language ecological terminology committee, a botanical rarities committee, and a round table on nature conservation.

ESTONIAN GEOGRAPHICAL SOCIETY

Associated with the Estonian Academy of Sciences since 27 January 1998

Founded in 1955
Membership: 180 members, 16 honorary members, five foreign members
Address: Kohtu 6, 10130 Tallinn, ESTONIA
egs@egs.ee, www.egs.ee
President: Mihkel Kangur, Tel.: +372 619 9800, mihkel.kangur@tlu.ee
Academic Secretary: Tiit Vaasma, Tel.: +372 619 9828, egs@egs.ee

The Estonian Geographical Society connects professional and amateur geographers. The Society's main activities include the publication of geographical works, conducting research, the organisation of scientific events and the dissemination of geographical knowledge. To ensure the continuity of its work, the Society's Youth Club includes young people in academic activities and educates them in Estonian geographic conditions, often supplementing practical work at universities.

SOCIETY OF ESTONIAN AREAL STUDIES

Associated with the Estonian Academy of Sciences since 27 January 1998

Founded in 1939.
Membership: 195 members
Address: Kohtu 6, 10130 Tallinn, ESTONIA
ekus@ekus.ee, www.ekus.ee
Chairman: Andrus Ristkok, Tel.: +372 644 0475

The Society of Estonian Areal Studies celebrated its 80th year of activity in 2019. A key activity of the Society has been supporting the publication of research in areal studies to facilitate publication by amateur researchers. The Society emphasises methodologically rigorous work to ensure the usability of the results by future researchers.

ESTONIAN MOTHER TONGUE SOCIETY

Associated with the Estonian Academy of Sciences since 4 February 1998

Founded in 1920
Membership: 381 active members and 15 honorary members
Address: Roosikrantsi 6, 10119 Tallinn, ESTONIA
es@eki.ee, www.emakeeleselts.ee
Chairman: Helle Metslang, Tel.: +372 522 5074
Academic Secretary: Killu Mei, Tel.: +372 644 9311
Librarian: Annika Oherde, Tel.: +372 644 9311

The Mother Tongue Society is a voluntary philological non-profit association. It was founded at the University of Tartu on 23 March 1920. The Society aims to promote scientific research of the Estonian language and ethnology and closely related languages, to advance the use of Estonian as the national language, to popularise the Estonian language and related languages, and to enhance academic interaction and joint events among philologists and their cooperation with amateur Estonian language researchers.

ESTONIAN ASSOCIATION OF THE HISTORY AND PHILOSOPHY OF SCIENCE

Associated with the Estonian Academy of Sciences since 4 February 1998

Founded in 1967
Membership: 64 active members, seven honorary members and six member organisations
Address: Akadeemia tee 3, 12618 Tallinn, ESTONIA
Chairman: Peeter Müürsepp, Tel.: +372 620 4116, peeter.muursepp@taltech.ee
Academic Secretary: Kaija-Liisa Koovit, Tel.: +372 53 411 985, kaija-liisa.koovit@ut.ee

The Estonian Association of the History and Philosophy of Science. It is a member of the Baltic Association of the History and Philosophy of Science and a member of both autonomous branches of the International Union of the History and Philosophy of Science and Technology, one of which researches the history of science and engineering and the other focuses on their logic, methodology and philosophy. The Association publishes the journal *Acta Baltica Historiae et Philosophiae Scientiarum,* which is reflected in the SCOPUS database.

ESTONIAN LEARNED SOCIETY IN SWEDEN

Associated with the Estonian Academy of Sciences since 19 March 1999

Founded in 1945
Membership: 81 active members, including three honorary members
Address: Wallingatan 32/34, c/o Eesti Maja, 11124 Stockholm, SWEDEN
teadusselts@gmail.com, www.etsr.se
Chairman: Evelin Tamm, tammevelin@gmail.com
Co-chair and Secretary: Piret Villo

The Estonian Learned Society in Sweden had 81 members as of the end of 2019. The Society has three Honorary Members: Member of the Academy of Sciences Jüri Engelbrecht, a professor at Uppsala University and foreign member of the Estonian Academy of Sciences Raimo Raag, and the President of the Estonian Academy of Sciences and a professor at the Tallinn University of Technology Tarmo Soomere. Six presentation meetings, a group viewing of a documentary and a trip to Tallinn were organised in 2019. A celebration of the 100th anniversary of the Estonian-language university was organised jointly with the University of Tartu and the Embassy of Estonia in Stockholm.

ESTONIAN LITERARY SOCIETY

Associated with the Estonian Academy of Sciences since 23 January 2001

Founded in 1907
Membership: 270 members (including 36 lifetime members, six honorary members and 21 trusted members)
Address: Vanemuise 19, 51014 Tartu, ESTONIA
eks.kirjandus.ee
Chairman: Toomas Liivamägi, Tel.: +372 51 53 274, toomas.liivamagi@gmail.com
Academic Secretary: Marja Unt, Tel.: +372 7 427 079, eks@kirjandus.ee

2019 was a busy year for the Estonian Literary Society. Traditional activities and projects continued, new activities were developed and the upcoming five-year strategy was designed. Meetings and other literary events were organised, such as the annual literary review meeting and spring and autumn schools for literature students, organised jointly with the University of Tartu.

LEARNED ESTONIAN SOCIETY

Associated with the Estonian Academy of Sciences since 23 January 2001

Founded in 1838
Membership: 107 active members and 17 honorary members
Address: Jakobi 2, 51005 Tartu, ESTONIA
www.ut.ee/OES
Chairman: Taavi Pae, taavi.pae@ut.ee

The Learned Estonian Society (German: *Gelehrte Estnische Gesellschaft*) was founded on 18 January 1838. It was dissolved in 1950, restored in 1988, and is the oldest Estonian scientific society. The Learned Estonian Society brings together representatives of various fields to promote knowledge of the past and present, language and literature of the Estonian people and the land inhabited by Estonians.

ESTONIAN MUSICOLOGICAL SOCIETY

Associated with the Estonian Academy of Sciences since 21 May 2004

Founded in 1992
Membership: 94 active members, of whom four live outside Estonia, and one honorary member (Professor Emeritus of Lund University Folke Bohlin)
Address: Tatari 13, 10116 Tallinn, ESTONIA
kerri.kotta@gmail.com, www.muusikateadus.ee
Chairman: Kerri Kotta, Tel.: +372 528 8781

The Estonian Musicological Society brings together researchers of music and people with an interest in the scholarly study of music; it supports research in all fields of musicology in Estonia.

ESTONIAN PHYSICAL SOCIETY

Associated with the Estonian Academy of Sciences since 14 June 2005

Founded in 1989
Membership: 212 active members
Address: W. Ostwaldi 1, 50411 Tartu, ESTONIA
efs@fyysika.ee, www.fyysika.ee/efs
Chairman: Kaido Reivelt, Tel.: 7374623, kaido.reivelt@ut.ee

The tasks of the Estonian Physical Society include the promotion of physics and related fields among the general public, and connecting the physics community to and supporting and advancing physics education in the Estonian education system by e.g. organising the work of the physics teachers' network.

The Society includes two divisions: the division of physics teachers (chair: Siim Oks) and the division of physics students (Estonian Physical Society's Society of Physics Students, chair: Hans Hubert Sams). The Society organises the Science Bus initiative (head: Kenneth Tuul).

ESTONIAN ASSOCIATION OF ENGINEERS

Associated with the Estonian Academy of Sciences since 23 September 2008

Founded in 1921 as the Estonian Society of Engineers
Re-established on 10 December 1998 as the Estonian Association of Engineers
Membership: 19 legal entities
Address: Liivalaia 9, 10118 Tallinn, ESTONIA
inseneronlooja@hot.ee, www.insener.ee
President: Arvi Hamburg, Tel.: +372 516 2026, arvi.hamburg@taltech.ee

The Estonian Association of Engineers is a non-profit association connecting all of the stakeholders in the promotion of engineering and related research, such as professional organisations in the field of engineering, engineering professors and innovative employers. The mission of the Association is the promotion of engineering and related development activities, innovation and education policy in Estonia. The Association's membership includes 11 professional organisations, two universities, one higher education institution, one vocational school and four recognised enterprises. The priority for 2019 was to advance the activities laid out in the research and technology pact. The pact, as a cooperation agreement bringing together people, organisations, ideas and resources from diverse sectors, promotes a synergy of activities advancing natural and exact sciences, technology and engineering.

ESTONIAN BIOCHEMICAL SOCIETY

Associated with the Estonian Academy of Sciences since 13 November 2009

Founded in 1959
Membership: 96 active members, including 25 student members
Address: Akadeemia 15, 12618 Tallinn, ESTONIA
katrina.laks@gmail.com, www.biokeemiaselts.ee
President: Tiit Lukk, Tel.: +372 56 985 281, tiit.lukk@ut.ee
Academic Secretary: Katrina Laks, Tel.: +372 52 96 923, katrina.laks@gmail.com

The goal of the Estonian Biochemical Society is to advance and support research and teaching in the field of biochemistry and related theoretical and applied scientific areas, to popularise these fields and to promote the professional interests of the Society's members.

Estonian biochemists have a long tradition of organising spring schools for the Society's members and interested guests. The topic of this year's spring school was "Light in Biochemistry".

ESTONIAN SEMIOTICS ASSOCIATION

Associated with the Estonian Academy of Sciences since 15 December 2009

Founded in 1998
Membership: 66
www.semiootika.ee
President: Katre Pärn, Tel.: +372 566 19 492, katre.parn@ut.ee
Vice-President: Eva Lepik, Tel.: +372 737 5413, eva.lepik@ut.ee

The Estonian Semiotics Association brings together researchers and organisations in the fields of semiotics and cultural theory. Various research and popular science events were organised and social life was advanced in 2019.

ESTONIAN SOCIETY OF HUMAN GENETICS

Associated with the Estonian Academy of Sciences since 5 April 2011

Founded in 2000
Membership: 161 active members and one legal entity (Asper Biogene)
Address: Maarja Kõiv, Eesti Inimesegeneetika Ühing, Riia 23, 51010 Tartu, ESTONIA
estshg@ebc.ee,
President: Neeme Tõnisson, Tel.: +372 5668 4694, neeme.tonisson@ut.ee
Secretary: Maarja Kõiv, Tel.: +372 522 9126, maarjakoiv@gmail.com
www.estshg.ebc.ee

The Estonian Society of Human Genetics brings together a broad variety of experts and students in human genetics, genetic diseases and genome research, takes part in genomics communication and facilitates interdisciplinary cooperation.

The European Society of Human Genetics awards annual regional grants to young researchers. We nominated Rain Inno, doctoral student at the University of Tartu Institute of Biomedicine and Translational Medicine, as the Estonian regional grant holder. We have been organising annual European DNA Day. The Society features a permanent genetics terminology committee chaired by the Tallinn University of Technology senior specialist Mari Palgi.

ESTONIAN CHEMICAL SOCIETY

Associated with the Estonian Academy of Sciences since 5 April 2011

Legal successor to the Estonian Chemical Society founded in 1919
Membership: 72 active members
Address: Akadeemia tee 15, 12618 Tallinn, ESTONIA
President: Margus Lopp, Tel.: +372 620 2808, margus.lopp@taltech.ee

2019 was the 100th year of activity of the Estonian Chemical Society. The goal of the Society is to bring together chemists for joint professional work to advance the Estonian economy in the fields of chemistry, industrial chemistry, chemistry education, scientific and technical information and environmental chemistry. The Chemical Society's website, www.keemiaselts.ee, was updated to improve our communication.

ESTONIAN SOCIETY FOR THE STUDY OF RELIGIONS

Associated with the Estonian Academy of Sciences since 16 June 2011

Founded in 2006
Membership: 65 active members, one honorary member and one corresponding member
Address: Ülikooli 16, 50090 Tartu, ESTONIA
www.eaus.ee
President: Madis Arukask, Tel.: +372 737 5227, madis.arukask@ut.ee

Academic Secretary: Piret Koosa, Tel.: +372 735 0414, piret.koosa@erm.ee

The Estonian Society for the Study of Religions brings together theological researchers in various fields and is a member of leading organisations in the field: the International Association for the History of Religions and the European Association for the Study of Religions. Its main activity is the organisation of presentation meetings and conferences. The work of the Society is mainly associated with the University of Tartu.

ESTONIAN ECONOMICS ASSOCIATION

Associated with the Estonian Academy of Sciences since 16 June 2011

Founded in 1930
Re-established in 2002
Membership: 121 individuals members, four legal entities and one honorary member (Professor Jüri Sepp, University of Tartu)
Address: Estonian Business School, Lauteri 3, 10114 Tallinn, ESTONIA
www.emselts.ee
https://www.facebook.com/EMS-219560925131732/
President: Erkki Karo, Tel.: +372 620 2661, erkki.karo@taltech.ee

Re-established in 2002, the Estonian Economic Association is a non-profit scientific association of Estonian economists. Its goal is to promote modern economic research and the discussion of current economic issues. The Association contributes to the promotion and improvement of economic education and promotes cooperation among institutions involved in economic research and studies. The EEA promotes improvement in the quality of doctoral theses and supervision and contributes to the seminars of the Graduate School of Economics and Innovation.

ESTONIAN SOCIETY OF TOXICOLOGY

Associated with the Estonian Academy of Sciences since 31 May 2017

Founded in 1997
Membership: 66 active members
Address: Akadeemia 23, 12618 Tallinn, ESTONIA
www.kbfi.ee/ets
Chairman: Villem Aruoja, Tel.: +372 639 8368, villem.aruoja@kbfi.ee
Secretary: Angela Ivask, Tel.: +372 639 8361, angela.ivask@kbfi.ee

The goal of the Estonian Society of Toxicology is to develop and communicate toxicological research, training and popular education. The Society cooperates with other societies of toxicology abroad, communicates relevant information to its members and organises research conferences, courses and training events. The Society lists among its goals the promotion of the sustainable use of Estonia's natural resources and the solution of environmental problems. The Society has been a member of the Federation of European Toxicologists (EUROTOX) since 1998 and of the International Union of Toxicology (IUTOX) since 2004.

ESTONIAN ACADEMIC AGRICULTURAL SOCIETY

Associated with the Estonian Academy of Sciences since 6 March 2018

Founded in 1920
Membership: 216 active members and 31 honorary members
Address: Fr.R. Kreutzwaldi 1, 50114 Tartu, ESTONIA
aps.emu.ee
President: Marko Kass, Tel.: +372 731 3412, marko.kass@emu.ee
Secretary: Heli Kiiman, Tel.: +372 731 3454, heli.kiiman@emu.ee

The membership of the Estonian Academic Agricultural Society includes mainly agricultural researchers with scientific degrees. The primary goal of the Society is to promote the development of Estonian rural life and agriculture, and agricultural research in particular. The Society organises research conferences, presentation

meetings and study trips, and promotes international research networking. It takes part in international projects, and publishes a research journal and other printed material. The Society is organised as a non-profit association with a thirteen-member board.

ESTONIAN ACADEMIC ORIENTAL SOCIETY

Associated with the Estonian Academy of Sciences since 12 June 2018

Founded in 1935 (re-established in 1988)
Membership: 69 active members, six honorary members and 29 corresponding members
Address: Ülikooli 18–226, 50090 Tartu, ESTONIA
www.eao.ee
President: Märt Läänemets, Tel.: +372 551 8847, mart_laanemets@yahoo.com
Academic Secretary: Mart Tšernjuk, Tel.: +372 513 2660, mtsernjuk@gmail.com
Honorary President: Tarmo Kulmar, tel 552 0301, tarmo.kulmar@ut.ee

The Estonian Academic Oriental Society is an academic society bringing together Estonian orientalists and Asian experts, including translators, artists, musicians, composers, journalists, politicians and military experts. The Society regularly organises conferences, seminars, public lectures and other events to distribute high-quality information on Asian cultures and societies, and to promote oriental research and the study of Eastern languages. Since 2006, the Society has published a yearbook, which has been titled *Idakiri* since 2011.

ESTONIAN MATHEMATICAL SOCIETY

Associated with the Estonian Academy of Sciences since 26 February 2019

Founded on 23 February 1926 as the Academic Mathematical Society.
Re-established on 17 September 1987 as the Estonian Mathematical Society
Membership: 333 active members
Address: Narva mnt 18, 51009 Tartu
https://matemaatika.eu/
President: Rainis Haller, Tel.: 512 2386, rainis.haller@ut.ee

The Estonian Mathematical Society (EMS), a voluntary association, is a member of the European Mathematical Society. It promotes the development of mathematical sciences and mathematical education in the Republic of Estonia, and the application of the achievements and methods of mathematics in other fields.

ESTONIAN ASSOCIATION OF SOCIOLOGISTS

Associated with the Estonian Academy of Sciences since 18 June 2019

Founded in 1999 (successor to the Estonian Academic Association of Sociologists, founded in 1990)
Membership: 103 members
Address: Lossi 36, 51003 Tartu
https://sotsioloogia.ee
President: Mai Beilmann, tel 737 6156, mai.beilmann@ut.ee
Vice-Presidents: Airi-Alina Allaste, airi-alina.allaste@tlu.ee, and Veronika Kalmus, tel 737 6591, veronika.kalmus@ut.ee

The Estonian Association of Sociologists is a non-profit organisation connecting professional sociologists and sociology students. Its tasks include organising information exchanges among Estonian sociologists, promoting sociology education and knowledge in Estonia, protecting the professional interests of Estonian sociologists and maintaining the compliance of sociological studies in Estonia with international requirements. The Association promotes the high-quality scientific research of social processes in Estonia and maintaining rigorous standards among sociological studies.

ESTONIAN ACADEMIC THEOLOGICAL SOCIETY

Associated with the Estonian Academy of Sciences since 15 October 2019

Founded: 1921 (restored in 1999)
Membership: 63 members and two honorary members
Address: Ülikooli 18–310, 50090 Tartu
www.usuteadus.ee
Chair: Urmas Nõmmik, tel 503 6326, urmasn@hotmail.com
Secretary: Priit Rohtmets, tel 521 4966, priit.rohtmets@ut.ee

The Academic Theological Society is a professional theological society, which was restored in 1999 as the successor of the academic theological society founded in 1921 and dissolved in 1940 by occupying powers. The Society is a voluntary non-profit association for people holding at least a master's degree in Theology and its goal is to develop evangelical theology, and to promote higher evangelical theology education and the cultural activity of theology students. The Society's members work in higher education institutions in Estonia and abroad and in other institutions. The Society issues the journal *Usuteaduslik Ajakiri* (*Estonian Theological Journal*), the only Estonian high-level peer-reviewed professional journal in the field.

IN MEMORIAM

Member of the Academy Eve Oja

10.10.1948–27.01.2019

Eve Oja was born on 10 October 1948 in Tallinn. She graduated from Tallinn Secondary School No. 1 (now the Gustav Adolf Grammar School) with a silver medal and began her studies at the University of Tartu Faculty of Mathematics. After graduating with a diploma in applied mathematics in 1972, she enrolled in a doctoral (PhD) programme and defended her physics and mathematics thesis "Unconditional Schauder decompositions in locally convex spaces".

In 1975 Eve Oja began working as an assistant in the Faculty of Mathematics and Computer Science, where she later became a senior lecturer and assistant professor. In 1992 she became a full-time professor of functional analysis. In 1977–1978 she was a lecturer at the National School of Engineers in Bamako, the Republic of Mali, and in 1980–1981 she carried out postdoctoral research at Aix-Marseilles University, France, funded by a scholarship from the Republic of France (she had completed intensive French studies at St. Petersburg State University (then Leningrad State University)).

Eve Oja was elected a member of the Estonian Academy of Sciences in 2010.

Oja carried out varied, intensive and fruitful research at an international level. She was the founder of the school of Banach space theory in Estonia, with her main research fields being functional analysis and operator theory. She worked on basic research in relation to Banach space theory, developing innovative methods that lay on the frontiers of the field. Various renowned mathematicians have based their work on Oja's research.

Member of the Academy Eve Oja conducted research in Belgium, Spain, England, Yugoslavia, Latvia, Norway, Poland, France, Sweden, Romania, Germany, Finland, the Czech Republic, Ukraine, Hungary, the USA and Russia. She also coordinated presentations and consultations of renowned researchers from these countries at the University of Tartu, thus contributing to the development of students' and lecturers' foreign connections. She was invited to present the results of her research at various international science forums in Europe and the USA.

Eve Oja's pedagogical activities were equally successful. She taught all of the core subjects of mathematical analysis, integral and measure theory and functional analysis, organised a number of special courses and seminars, and published a comprehensive textbook on functional analysis, along with collections of tasks. She supervised 11 doctoral and 15 master's theses, as well as a considerable number of bachelor's dissertations and shorter projects. Eve Oja also held several administrative roles. She was editor-in-chief of the mathematics journal *Acta et Commentationes Universitatis Tartuensis de Mathematica* beginning in 1998, and was Head of the Estonian Doctoral School in Mathematics and Statistics in 2009–2015. She was Head of the Institute of Pure Mathematics at the University of Tartu and a member of the Estonian National Science Prize Committee, as well as being a member of numerous organising committees of science conferences.

Work done by Eve Oja was recognised with the Soros Prize of the International Science Foundation (1993), and she received the Estonian National Science Prize twice (in 2001 and in 2014).

Foreign Member of the Academy Jaak Peetre

29.07.1935–1.04.2019

Jaak Peetre was born in Tallinn on 29 July 1935, the son of a lawyer. His childhood and early school years were spent in Pärnu. In 1944, the family fled to Sweden and Jaak Peetre's education continued at the Lund Allhelgona (All Saints) School. In 1954, Jaak Peetre entered Lund University to study mathematics, his school-time special interest. He graduated from the university in 1956, earned a post-graduate degree in philosophy in 1958 and defended a PhD thesis on partial differential equations in 1959. He worked as a visiting researcher at New York University and the University of Maryland in 1960–1962. In 1963, Jaak Peetre was appointed a professor at Lund University. Having worked as a visiting professor at the University of Madrid in 1988, he continued in Stockholm University as a Professor of Mathematics in 1988–1992. Following that, Jaak Peetre returned to Lund University, working there until he was named a professor emeritus in 2000.

Jaak Peetre's research spanned many mathematical disciplines, including ordinary and partial differential equations, interpolation spaces of operators, singular integrals and Besov spaces, differential geometry, Clifford analysis, Fock space and Hankel operators, and Fourier and harmonic analysis. With the French mathematicians Bernhard Malgrange and Louis Lions, he established modern interpolation theory. His work was focused on multilinear forms, particularly trilinear forms, in the early 1990s. Jaak Peetre is the most prolific Estonian mathematician, having published over 230 research works. He supervised eight doctoral theses and eight licentiate theses. He was a member of the Royal Swedish Academy of Sciences, an honorary member of the Swedish Mathematical Society (serving as its president in 1984–1987) and a member of the boards of editors of several international research journals.

Jaak Peetre made a significant contribution to the development of the field of mathematics in Estonia. He was a founding member of the Estonian Mathematical Society in 1994. On his initiative, the Estonian Mathematical Society became a founding member of the European Mathematical Society. He visited Estonia repeatedly and delivered lectures here; he was a member of the editorial board of the physics and mathematics series of the Proceedings of the Estonian Academy of Sciences. Jaak Peetre was awarded the Republic of Estonia Order of the White Star Class III decoration in 2001.

He was elected a foreign member of the Estonian Academy of Sciences in 2008.

Member of the Academy Ergo Nõmmiste

27.06.1956–11.04.2019

Ergo Nõmmiste was born on 27 June 1956 in Kiviõli. He graduated from Nõo High School in 1974 and entered the Department of Physics of the University of Tartu, graduating in 1979. Ergo Nõmmiste defended his doctoral (PhD) thesis, "Electron emission of alkali halides induced by 70–140 eV photons", at the University of Tartu in 1991.

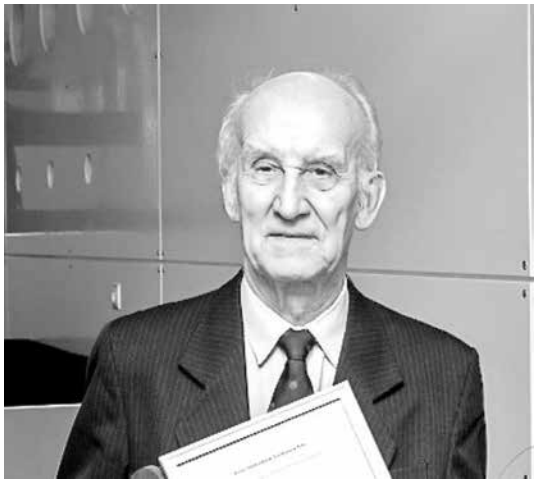
After graduation from university, Ergo Nõmmiste took up a position at the Institute of Physics of the Estonian Academy of Sciences, holding the positions of engineer, junior researcher and researcher until 1991. He began postdoctoral studies at the University of Oulu in 1992, holding various positions at the university until 1998. He was a beamline scientist at the MAX-lab in 1994–1995 and he was elected an associate professor at the University of Oulu in 1995. Returning to Estonia in 1998, Ergo Nõmmiste worked at the Institute of Physics of the University of Tartu, holding the positions of PHARE expert, research director (1999–2003), acting director and director (2004–2009). He was elected a professor of electroscopy at the University of Tartu in autumn 2009.

Ergo Nõmmiste was elected a member of the Estonian Academy of Sciences in 2012 in exact sciences. He was a Vice-President of the Academy from 2014 until his death.

Ergo Nõmmiste's main research directions were atomic and molecular physics, focusing on experiments with gas-phase methods at various MAX-lab beamlines. His research at the Institute of Physics of the University of Tartu focused on surface physics, particularly its practical applications, such as the biofunctionalisation of metal surfaces. This was later complemented by developing experiments to observe electrochemical reactions in situ and ionic liquid research using photoelectron and photoion coincidence spectroscopy.

Member of the Academy Nõmmiste was also a remarkable pedagogue. His lectures on experimental techniques, large-scale research centres, and atomic and molecular physics were always highly anticipated at the University of Tartu, University of Oulu, Tampere University of Applied Sciences, University of Turku and the MAX-lab. He supervised the work of doctoral students from Estonia, Finland, Sweden, Norway, England, the US and elsewhere.

Member of the Academy Ergo Nõmmiste represented Estonia in many international research organisations. In Estonia, he was a member of the national research award committee, the expert group on space technology, the steering committee on the construction of the Physics building, etc. Ergo Nõmmiste was awarded the Medal of the Estonian Physical Society, the Small and Grand Medals of the University of Tartu and the Medal of the Estonian Academy of Sciences. He was awarded the Order of the White Star Class III decoration in 2016.



Member of the Academy Udo Margna

18.11.1934–17.05.2019

Udo Margna was born in Viljandi on 18 November 1934. He graduated from the Viljandi Second High School in 1952 and entered the Department of Pharmacy of the Faculty of Medicine of the University of Tartu, graduating in 1957 as a pharmacist. Following graduation, he and his spouse, a former course-mate, were appointed to positions on the island of Muhu, where he worked for two years as the head of the local pharmacy.

In 1959, Udo Margna became a post-graduate student at the Institute of Experimental Biology of the Estonian Academy of Sciences and researched plant biochemistry. This marked the beginning of his research career. He defended his candidate (PhD) thesis, whose research results improved the understanding of the interconnections of metabolic processes in plants, making it possible to design plant growth and development direction methods, at the Institute of Botany of the Georgian Academy of Sciences in 1963. The following three decades of Udo Margna's research career were connected to the Institute of Experimental Biology, where he held various positions, from junior researcher to senior researcher and head of the laboratory. He held a position at the Institute of Experimental Biology in 1967–1987.

In 1987, Udo Margna was elected a member of the Estonian Academy of Sciences in plant physiology and biology. He was the Academy's Secretary-General in 1990–2000.

Udo Margna's research focused on elucidating the metabolic background and regulation mechanisms of flavonoid biosynthesis. His research publications include six monographs and textbooks, the last of which, *Fütoteraapia. Ravimine taimedega* (*Phytotherapy. Healing with Plants*), was published in 2014. He supervised seven doctoral and master's theses. Udo Margna worked as an extraordinary professor, scientific advisor and visiting lecturer at the University of Tartu, Tallinn University and Estonian University of Life Sciences for over 25 years. He worked as a visiting professor at the University of Münster in Germany in 1994. In 2000–2008, Academy Member Margna worked at the Tallinn Health Care College as a pharmacy lecturer and head of chair, continuing as an extraordinary lecturer until 2018.

Udo Margna was awarded the Medal of the Estonian Academy of Sciences in 1987. He received the Karl Ernst von Baer Medal for outstanding achievements in life and earth sciences, and the annual award of the Estonian Pharmacists' Association for long-time research activities in 1998. He was awarded the Order of the White Star Class IV decoration in 2006. Udo Margna received an award of the Estonian Academic Pharmaceutical Society in 2014.

Foreign Member of the Academy Jānis Stradiņš

10.12.1933–29.11.2019

Jānis Stradiņš was born to a family of medical doctors in Riga on 10 December 1933. He graduated from the Faculty of Chemistry of the University of Latvia in 1956, received a candidate (PhD) degree in chemistry at Moscow State University in 1960 and earned a Doctor of Sciences degree in chemistry at the Latvian Academy of Sciences in 1968. Jānis Stradiņš was elected an honorary doctor of the University of Latvia in chemistry in 1989 and an honorary doctor of the Latvian Academy of Sciences in history in 1992. He was elected an honorary doctor of the Latvia University of Life Sciences and the Riga Stradiņš University in 1999 and 2007, respectively.

After graduating from university, Jānis Stradiņš' research career continued at the Latvian Institute of Organic Synthesis, where he worked as a researcher, head of the laboratory of physical organic chemistry (1961–2006) and leading researcher (beginning in 1993) for over half a century. He taught at the University of Latvia as a professor of physical chemistry (1972–1976) and as a professor of the history of science at the Historical Institute of Latvia (beginning in 1990). He also held the position of leading researcher at the Riga Stradiņš University Institute of the History of Medicine (Medical Academy of Latvia until 2002) and at the Institute of Philosophy and Sociology of the University of Latvia.

Jānis Stradiņš was among the most outstanding and most cited Latvian researchers and his diverse body of research is well known internationally. His main research area in chemistry was the molecular electrochemistry of organic compounds. His main research topic at the Institute of Organic Synthesis was the development of polarographic analysis techniques for the identification of organic substances. He contributed significantly to the creation of new originator pharmaceuticals (Furagin, Solafur, Methindione etc.). As a historian of science, Jānis Stradiņš was mainly interested in the historical development of chemistry, pharmacy and medicine. He studied the history of the Baltic states and of the city of Riga, the development of research connections and the establishment of research centres in the three Baltic republics, the formation of the Latvian diaspora abroad, etc. He authored seven monographs and over 300 research articles in the field of electrochemistry, and 20 monographs and over 250 research articles in the field of the history of science.

Jānis Stradiņš became a member of the Latvian Academy of Sciences in 1973 in physical organic chemistry. He was the Academy's vice president (1992–1998), president (1998–2004) and the head of the Academy's Senate (beginning in 2004). During his tenure, he significantly advanced scientific cooperation between the Baltic and Nordic countries and contributed to the revival of the tradition of Baltic Conferences on Intellectual Co-operation. He founded the Baltic Association of the History and Philosophy of Science and held the position of its president (1990–1991, 1993–1996, 2001–2003 and 2006–2008) and vice-president. Jānis Stradiņš was a member of the German National Academy of Sciences Leopoldina, a corresponding member of the Saxon Academy of Sciences and of the Baltic Historical Commission at Göttingen, and a foreign or honorary member of numerous research institutions, associations and societies.

The Estonian Academy of Sciences elected Jānis Stradiņš a foreign member in physical chemistry and the history of science in 1998. He received distinguished research awards and national awards, including the Latvian Order of the Three Stars (1995), the French Legion of Honour Order (2001) and the Order of Merit of the Italian Republic (2004). Jānis Stradiņš was awarded the Baltic Academies of Sciences medal in 1999 for his outstanding contributions to the promotion of scientific cooperation between Estonia, Latvia and Lithuania. The President of the Republic of Estonia awarded Jānis Stradiņš the Order of the Cross of Terra Mariana Class III decoration on the proposal of the Academy of Sciences in 2004.

Member of the Academy Ilmar Koppel

16.01.1940–9.01.2020

Ilmar Koppel was born on 16 January 1940 in Võru. He graduated in 1958 from Puurmani High School and entered the Department of Chemistry of the Faculty of Mathematics and Natural Sciences of the University of Tartu. He graduated in 1963 in organic chemistry and proceeded to join the chair of organic chemistry as a post-graduate student. In 1969, Ilmar Koppel defended the candidate (PhD) thesis "The impact of solvent effects on the kinetics and mechanism of the solvolysis of tert-Butyl chloride". He defended the Doctor of Sciences thesis "The influence of structure on proton affinities and ionization potentials of organic compounds" at the N. N. Semjonov Institute of Chemical Physics of the USSR Academy of Sciences in Moscow in 1986. Ilmar Koppel received a professorship in 1990 and he was elected a member of the Estonian Academy of Sciences in 1993.

His activity was long connected to the University of Tartu, where he held the positions of senior researcher, head of the laboratory of chemical kinetics and catalysis, head of the Chair of Analytical Chemistry, head of the Institute of Chemical Physics and a professor of analytical chemistry. Ilmar Koppel was a University of Tartu research professor in 2005–2008, the Vice-Director for Research of the Institute of Chemistry of the University of Tartu in 2008–2015 and a leading researcher of physical and analytical chemistry until 2018. Ilmar Koppel was a professor emeritus of the University of Tartu beginning in 2008.

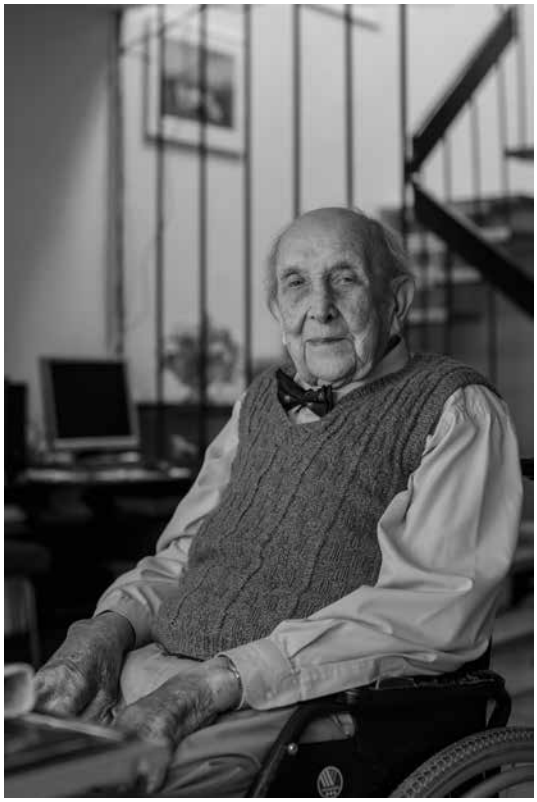
Ilmar Koppel's interdisciplinary research ranged from the design and research of superacids and superbases to neutrino physics, from processes in solutions and solvent effects to gas-phase reactions in high vacuums, from low-level abstractions and basic research in chemistry to research with potential high-tech applications.

Ilmar Koppel was a member of organising committees of numerous international conferences and he represented Estonia in several international organisations; he was the principal investigator and coordinator of several national and international research projects. He was the head of the Division of Biology, Geology and Chemistry of the Academy of Sciences in 2004–2014. Having published over 300 research publications, including five monographs, he became one of the most cited Estonian researchers; he supervised over thirty successful doctoral and master's theses.

Ilmar Koppel's work has twice been recognised with a national research award (in 1998 and 2005). He was awarded the Order of the White Star Class III decoration in 2006. He was appointed an honorary doctor of the Tallinn University of Technology in 2007 and he was awarded the Wilhelm Ostwald Medal of the Estonian Academy of Sciences in 2010.

Member of the Academy Valdek Kulbach

6.04.1927–31.01.2020



Valdek Kulbach was born a farmer's son near Narva in Ida-Viru County on 6 April 1927. His education started in Narva and he graduated from high school in 1945 in the Nõmme district of Tallinn. His decision regarding further education was influenced by Professor Ottomar Maddison, whose lectures he had attended as a high school student. Valdek Kulbach graduated from the Tallinn University of Technology in 1951 with a diploma in industrial and civil engineering. After post-graduate studies at the Hydrotechnical Faculty of the Leningrad Polytechnic Institute, he defended his candidate (PhD) thesis, "The effect of filtration on the stability of sandy slopes", at the same institution. He defended his Doctor of Sciences thesis, "Static analysis of deformable contours of saddle-shaped suspension constructions", in 1973 at the Tallinn University of Technology.

Valdek Kulbach worked at Eesti Projekt as an engineer, senior engineer and head of the construction group in 1948–1952. He was connected with the Tallinn University of Technology beginning in 1955, working as a research assistant, senior teacher, associate professor and professor. He was the Vice-Dean and Dean of Distance Learning of the evening faculty in 1963–1975, head of the chair of building technology in 1975–1990, a professor of steel structures at the Department of Structural Design in 1990–1998, and Dean of the School of Engineering in 1994–1995. Valdek Kulbach was a professor emeritus of the Tallinn University of Technology beginning in 1998.

He was elected a member of the Estonian Academy of Sciences in mechanics in 1986.

Valdek Kulbach's research focused on the analysis of steel structures, filtration and slope stability, temperature-related stresses in structures and the analysis of suspension structures. In addition to direct academic activities, Member of the Academy Kulbach focused on the assessment of the condition of buildings, bridges, reservoirs and landscape structures, and the design of complex structures (railway, highway and pedestrian bridges in Tartu, Pärnu, Narva and elsewhere, the great arcs of the Tallinn and Tartu Song Festival Grounds, the Saaremaa bridge etc.).

Academy Member Kulbach was a member of several domestic and international research organisations and professional associations, acted as an expert and consultant for Estonian design and construction organisations (1955–2010) and designed Estonian design standards for the Estonian Centre for Standardisation. He supervised numerous post-graduate and doctoral students, and acted in opposition and provided peer reviews for theses. He published over 150 research articles and authored several monographs and textbooks.

Valdek Kulbach received several intellectual property certificates and his work was recognised with several medals from exhibitions. He was awarded the Soviet Estonian national award (1970), the Estonian national research award (1995) and the Republic of Estonia Order of the White Star Class IV decoration (1999). Valdek Kulbach was appointed an honorary doctor of the Tampere University of Technology in 1995, he was elected the Engineer of the Year in 2000, and he was awarded the national research award for long-time productive research and development efforts in 2008.

FINANCIAL ACTIVITIES

The budget of the Estonian Academy of Sciences for 2019 and the funds spent (EUR)

INCOME	**BUDGET**	**FUNDS SPENT**
ALLOCATIONS TO THE ACADEMY FROM THE STATE BUDGET	1 584 000	1 584 000
For basic activities of the Academy, incl.	1 162 948	1 162 948
For Academy Publishers	275 000	275 000
For Remuneration to Members of the Academy	293 090	293 090
For Grants of Academy Research Professors	100 662	100 662
For bestowing science awards	27 300	27 300
OTHER REVENUE	316 810	316 884
Targeted allocations from the Ministry of Education and Research	243 400	243 400
Membership fees to international science organisations	43 400	43 400
For renovation and repair activities	200 000	200 000
Receipts from letting the premises	31 500	31 574
From the sale of printed matter (Academy Publishers)	41 910	41 910
ALLOCATIONS TO THE UNDER AND TUGLAS LITERATURE CENTRE	463 184	463 184
Through the Ministry of Education and Research, incl.	355 207	355 207
Targeted funding of research	148 200	148 200
For infrastructure expensess	41 111	41 111
Basic funding	157 896	157 896
For fulfilment of the state programme	8 000	8 000
For repayment of study loans		
Targeted allocations	103 769	103 769
From sale of publications	4 208	4 208
TOTAL INCOME	**2 363 994**	**2 364 068**
EXPENDITURES	**BUDGET**	**FUNDS SPENT**
GENERAL BREAKDOWN		
Main activities of the Academy (through the Academy Office)	1 006 148	1 005 309
Estonian Academy Publishers	316 910	314 805
Remuneration to Members of the Academy	293 090	293 090
Grants of Academy Research Professors	100 662	100 662
Awards, medals	7 500	7 490
Including Alumäe and Keres medals	2 000	1 992
Research paper prizes for university students	5 500	5 498
Allocations to the scientific and learned societies	105 800	105 734
Membership fees to international science organisations	43 400	38 156
Activities of the National Science Prize Committee	27 300	27 300
Under and Tuglas Literature Centre	463 184	420 247
TOTAL EXPENDITURES	**2 363 994**	**2 312 793**

DETAILED BREAKDOWN OF EXPENDITURES MAIN ACTIVITIES OF THE ACADEMY (THROUGH THE ACADEMY OFFICE)		
Wages (incl. social tax and unemployment insurance premiums)	426 100	425 886
Salaries of full-time employees	278 900	278 798
Salaries of division heads	18 800	18 793
Contractual fees	15 500	15 449
Support for widows of late Academy members	5 000	5 000
Taxes (social tax and unemployment insurance)	107 900	107 846
Office expenses	50 300	50 273
Maintenance expenses of registered immovables (incl. routine repairs)	363 108	362 999
Acquisitions	13 000	13 014
Transport expenses	5 600	5 524
Travel and subsistence	31 200	31 105
Expenditures of organising events	29 600	29 573
Popularisation of science expenditures	9 800	9 695
Estonian Young Academy expenditures	2 400	2 349
Training expenses	700	692
Expenses of commissions and divisions	5 740	5 722
Scientific exchange programme expenditures	21 850	21 845
Legal, accounting and auditing services	3 000	2 982
Science Advisory System's expenditures	9 100	9 069
Printing and other expenses	34 650	34 581
TOTAL EXPENDITURES OF MAIN ACTIVITIES	**1 006 148**	**1 005 309**
ESTONIAN ACADEMY PUBLISHERS		
Wages (incl. social tax and unemployment insurance premiums)	270 205	270 195
Full-time staff	200 380	200 372
External staff	1 010	1 010
Taxes (social tax and unemployment insurance)	68 815	68 813
Administration expenses	30 685	28 673
Printing expenses	12 020	12 018
Acquisitions	4 000	3 919
TOTAL EXPENDITURES OF THE PUBLISHERS	**316 910**	**314 805**
UNDER AND TUGLAS LITERATURE CENTRE		
Wages (incl. social tax and unemployment insurance premiums)	339 124	339 124
Full-time staff	225 671	225 671
External staff	32 466	32 466
Taxes (social tax and unemployment insurance)	80 987	80 987
Research and administration expenses	124 060	81 123
TOTAL EXPENDITURES OF THE LITERATURE CENTRE	**463 184**	**420 247**

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