ANNUAL REPORT 2016

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SLOVENIAN RESEARCH AGENCY

In 2016 the Slovenian Research Agency has spent (co-)financing research activities within the confirmed work programme, introducing a new instrument and further improving operating conditions and support for researchers. Time was also spent preparing for the start of the application of the new Rules on the Procedures for Financing, Co-financing, Evaluating and Monitoring the Implementation of Research Activities. The Agency submitted the Rules to the Ministry responsible for Science in December 2015; however, the inter-ministerial coordination process was relatively protracted. Therefore the Rules did not enter into force until August 2016, which meant that all major procedures conducted in 2016 were in accordance with the Rules which were valid at the time.

Past year was the first since 2010 when the financing of research via the Agency took a turn for the better. Although the increased financing fell short of the amount required to implement substantial changes, the Agency was able to cover the assumed commitments that resulted primarily from the increase in research projects. These limited funds notwithstanding, the Agency participated in a European Research Council (ERC) initiative aimed at increasing the involvement of scientists from countries less well represented or less successful at ERC grant competitions within the framework of the enlargement instrument. The Slovenian Research Agency became one of the research agencies from 7 EU Member States to implement Visiting Research Fellowships. In 2016 emphasis was devoted to promoting science and international cooperation, and the Agency continued to play an active role in the Science Europe association.

The Agency presents the results of the standard bibliometric and other quantitative indicators used globally to monitor research activities in the chapter entitled International comparisons. Note should be made that the relative impact factor of works published in scientific journals exceeded 1.06, which means that Slovenia's performance ranked above the global average for the first time. At the same time we should not overlook the fact that the trend of patent applications is still negative.

When preparing the 2017 and 2018 budgets, the Agency kept the Ministry responsible for Science up to date on the consequences of reduced resources, both financial and human, for the operation of the Agency and the research sector in general. The increase in funds, the first such occurrence in a number of years, is a trend that needs to continue. The impact funding has on indicators manifests itself over the long term; therefore, we cannot yet properly assess the full implications that the austerity measures enacted over the past few years have had on science.

Prof. dr. József Györkös,
Director

„The increase in funds, the first such occurrence in a number of years, is a trend that needs to continue."

Annual report 2016:

Published by: Slovenian Research Agency
Bleiweisova cesta 30
1000 Ljubljana
Slovenia

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Photography: Peter Irman, Žak Princič, m.a.

Print: Collegium Graphicum

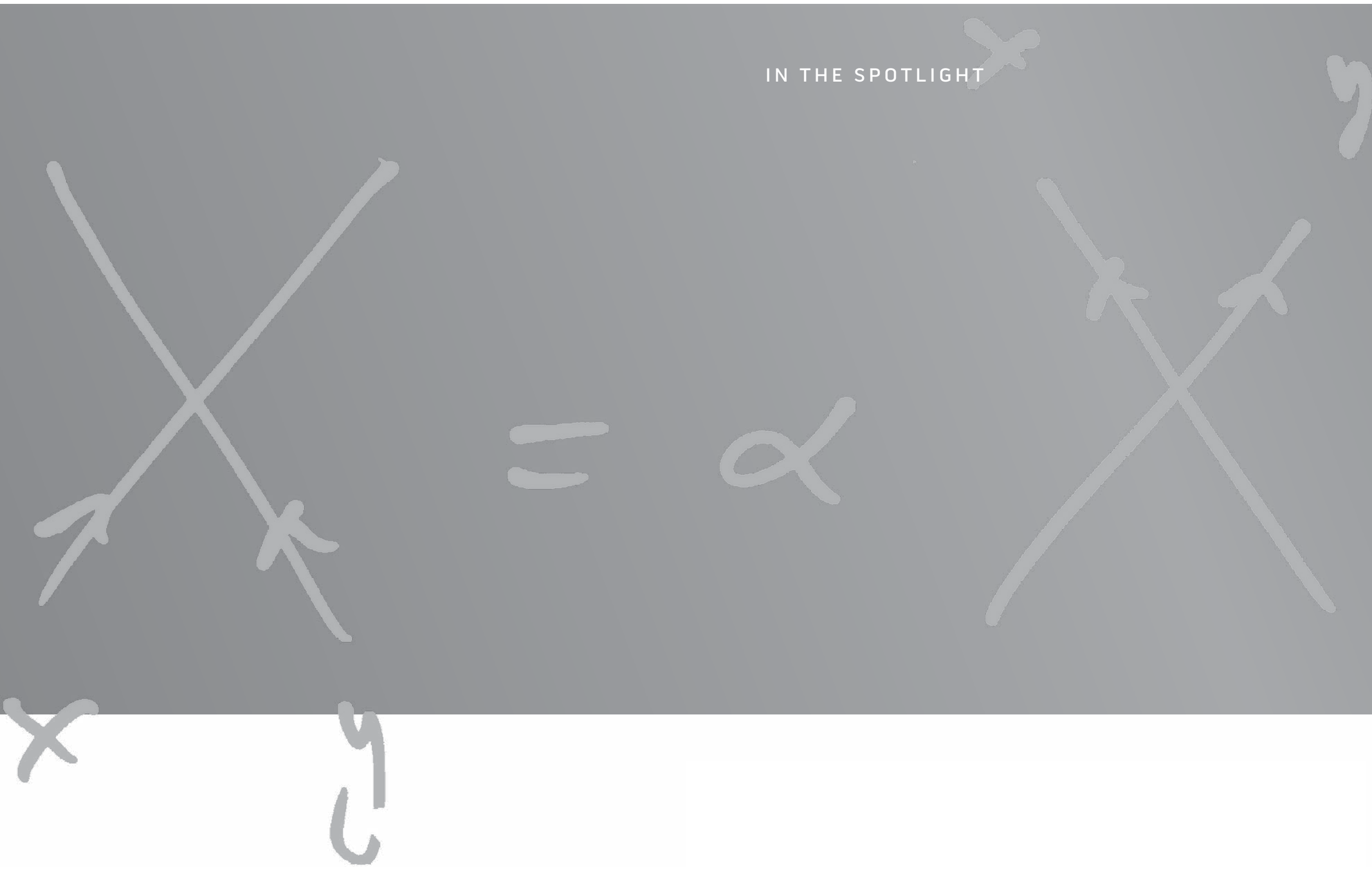
Published: Ljubljana, 2017

Number of copies in English: 200

Online access: www.arrs.gov.si/en/gradivo/dokum/

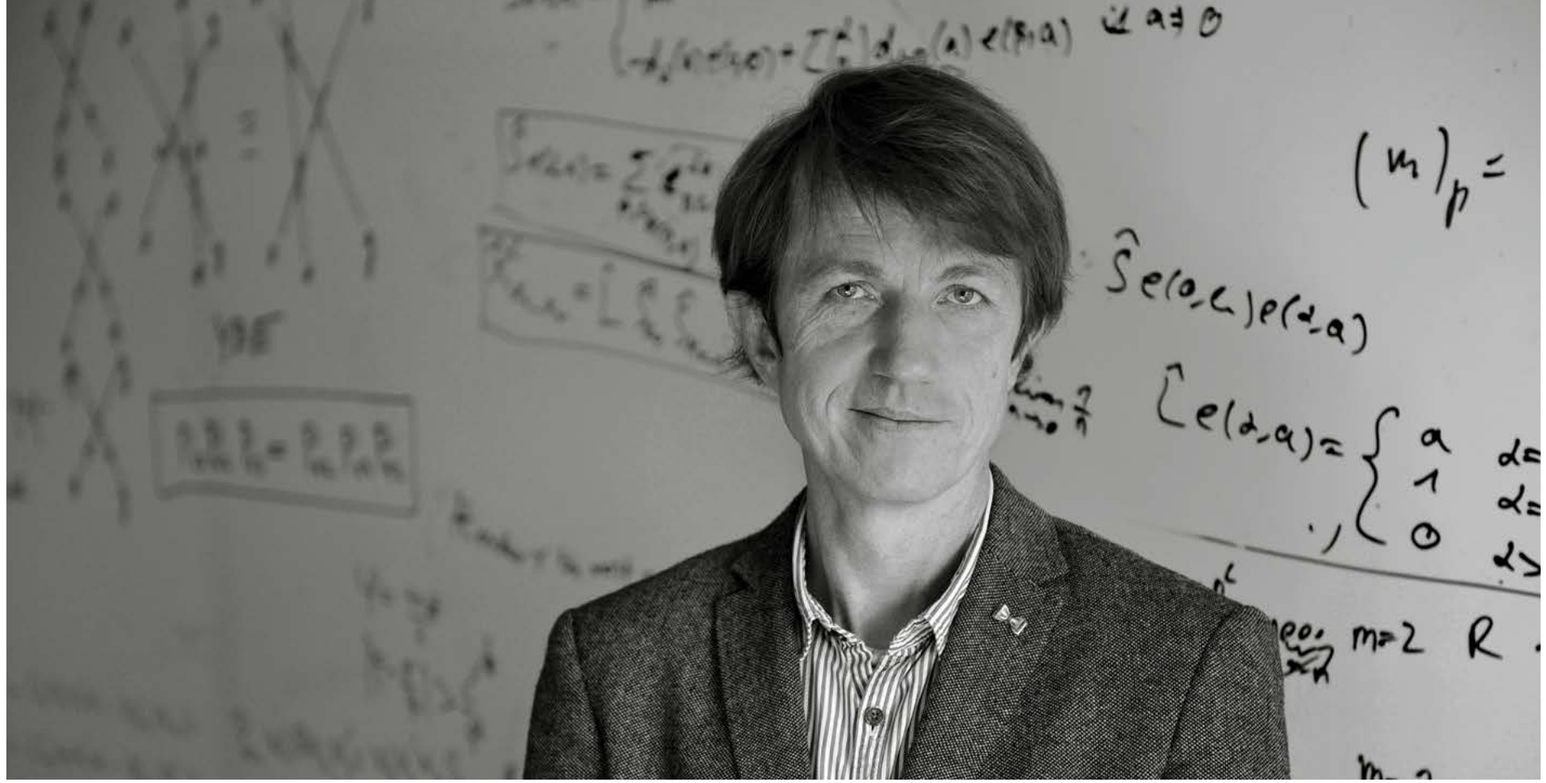
ISSN 2350-5885

Content



From Quantum Physics to Smart Phones

Prof. dr. Tomaž Prosen
Faculty of Mathematics and Physics, University of Ljubljana



You performed brilliantly over the last year and won a EUR 2 million European Research Council (ERC) tender. Can you explain the purpose of this research?
It is basic research on theoretical mathematical physics, for the purpose of exploring quantum transport in complex strongly interacted multi-particle systems. These are systems typically examined by statistical physics. Although quantum transportation sounds very useful and may have several real-world applications, the purpose of the research is to expand the envelope of human knowledge, but not to apply that knowledge as a technology.

What are the submission criteria for an ERC call?
The criterion is almost exclusively scientific excellence. Unlike other applications, which must take into account factors such as the composition of the consortium and usability, the sole purpose of the ERC is to fund excellent scientific ideas and applicants. The call is intended primarily for basic research, which is slightly less funded than applied research at the EU level.

Researchers who apply to various domestic and international calls often lament the proliferation of administrative procedures, which can dull the essence of research. What are your experiences?
The ERC application process is relatively effortless. There is very little bureaucracy associated with the application. The application form is simple. The document that needs to be prepared is also relatively straightforward and left to the researcher. If you have the right idea, not much more is required.
You will be conducting basic research to study non-equilibrium multi-particle systems. Will this help us predict the practical value of this theoretical research?
The aim of my research is to get a basic understanding of transport phenomena in simple model systems. If we gain a solid grasp of that, then things can develop and become useful in terms of finding materials that have the right transport properties. It is therefore directly linked to the physics of materials, but this is not my aim. My objective is to explore mathematical physics.

In this context the creation of a quantum computer is foreseen. Can you tell us what that is?
Quantum technology is a practical discipline that is highly relevant to my area of work –quantum multi-particle systems. I explore models that are fully coherent and well suited for quantum information processing, i.e. quantum computing models. More specifically, this is associated with so-called quantum simulators, which are the first generation of quantum computers or analogue quantum computers, i.e. machines that are designed for the simulation of other models. These are used in ultra-cold atom technologies in laboratories around the world, where systems of atoms are prepared at very low temperatures and their states manipulated precisely. These systems can simulate, for example, the theoretical models that I imagine in my research. Currently, for example, my colleagues and I are preparing an application for the European project QuantERA, the purpose of which is to develop quantum technologies. We will propose collaboration between experimental groups, including ours and other theoretical groups from Berlin. The quantum technologies currently being developed will, in my opinion, lead to the gradual evolution of a quantum computer. We talk a lot about this, and we may very well suddenly find ourselves living with quantum computers. Of course, this will not happen in one fell sweep. Quantum simulators must be developed first but, within a decade or so, they should be more digital and some day we may wake up in a quantum information society.

In what sense might a quantum computer change our lives, not just for scientists, but in general?
That is difficult to imagine. The main problem with digital quantum computing is that we do not know what we would use it for. People like new things and new ideas, but we really do not know what these computers would be used for. There are two algorithms which are likely to make quantum computers incomparably faster than classical computers. One of these is cryptography, or the factorization of prime numbers, which is an essential element in cryptographic methods. There is also the famous Shor algorithm, which operates significantly faster than any classical algorithm on classic computing machines, and the Grover algorithm which searches for an element in an unordered list. These are the only algorithms that are expected to be incomparably faster, given the best classical and best quantum algorithms. We do not imagine to use quantum computers for the general computational procedures, which we now perform on classic portable computers. Therefore, the problem is open on several fronts. Some are quantum algorithms: others are quantum hardware. Both are still in their infancy. This is in contrast, however, to the quantum simulator, which is an analogue quantum computer, and is already on the threshold of becoming an integral part of the physicist's laboratory.

You recently said that it is most profitable to invest in the unknown. Does your research address the unknown?
Isn't dealing with the unknown the whole purpose of the scientific endeavour? To me, it certainly is. Understanding the unknown is the challenge we face.

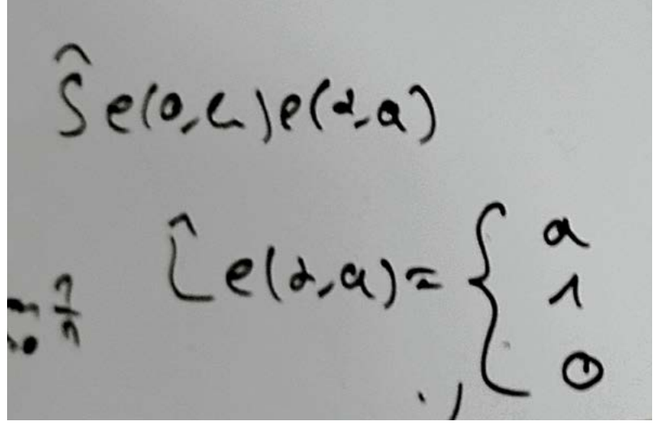
Do the ERC commissions agree?
Undoubtedly. They support the most daring proposals, but only those for which the applicant has already undertaken extensive research.

Why do the majority of studies still stress usefulness?
Society expects to benefit from science. Since its inception, science has always been the engine of development, pulling society up to a higher level. The scientific revolution has led to progress being made in several areas. Perhaps society has somewhat forgotten what the basic purpose of science is. Society wants to subordinate science as an instrument or service activity. This may function to some extent, for example, in health care, where we treat disease and improve lives. However, I would not call this science, but technology. But the dividing line between science and technology is becoming increasingly thin. There is nothing wrong with this, but it should be clear what is basic and what is applied science, what is technology and what we expect from each. We cannot expect basic science to bring a product to market in five years.
Slovenians have not been very successful with ERC calls. In your opinion, is there a reason for this?
This is a question I have heard several times during the past year. One of the reasons is more applicable to EU13 group (the nations of Eastern Europe) than to Slovenia. In these countries, the conditions for the development of top scientists are worse than in the West. The best scientists migrate to places where conditions are better. Although some say that we are experiencing a catastrophic brain drain, it pales into insignificance when compared with some other countries, where the situation became radicalised, such as in Serbia. During the nineties, a lot of people left Serbia. The brain drain has not been so significant in Slovenia, but has nevertheless had an effect. Some of the most esteemed Slovenian scientists work abroad. The ERC rewards only the very best and their number here is lower than it should be.

The means you have acquired will allow you to include additional collaborators in the study. Given the complexity of the work involved, how are you searching for them?
It is difficult to find the right employees for my project, because it is a tightly focused research undertaking with a very demanding methodology involved. We need to find colleagues who have been taught or are well on the way to learning the methodology. I must admit that I was initially sceptical about how I would find the right staff. I published two international calls and received between 30 and 35 applications; unfortunately, with one notable exception, none were the right fit thematically, because the areas were not sufficiently closely related. In the second attempt, I sent an e-mail to some fellow professors who mentor a group of brilliant young people, post-doctoral researchers who will be looking for work in the coming year. That was a far more productive endeavour. The word is now out that I am looking for staff, and I am still receiving requests from young people who are keen to work with us. Based on these inquiries I now have a team of talented individuals who I believe are up to the job.

Does this group include Slovenian researchers?
Slovenians are included primarily at the doctoral student level. The group will in fact be mixed, half doctoral students and half post-doctoral researchers. The latter will mostly be foreign. As I have said before, this is a very specialized area of knowledge, for which there are perhaps a hundred specialists around the world who understand the field and deal with it seriously.

What are your views on the opinion held by some apologists for applied science that nothing of importance has occurred in physics since the discovery of electricity?
Of course, I cannot agree with that. The main revolution that occurred in physics was not electricity, but quantum mechanics. However, to those who do not have an education in physics, this is quite an incomprehensible and abstract idea. It is relatively straightforward to conjure an idea of electricity in the mind, but this is not at all the case with quantum physics. Quantum mechanics has affected the development of technology and increased quality of life to at least the same extent as electricity. Without quantum mechanics, we would not have smartphones and computers today. Today so much is based on microelectronics; microelectronics are based on the transistor, the transistor on the semiconductor, and the semiconductor on quantum physics. Without our understanding of quantum physics and the semiconductor effect, there would be no modern technology. Of course, it is all based on electricity, but the discovery of quantum mechanics certainly was a comparable revolution. In my opinion, when it comes to our understanding of nature and the world around us, quantum mechanics represents



the greatest scientific revolution in human history. Indeed, it is something that completely exceeds our experience of the world. It is simply a case of getting used to quantum physics. It is not something you can imagine in the way you might imagine Newtonian physics.

Applied research of any kind raises questions about the relationship between basic and applied research. What do you think?
The two are interconnected parts of a whole. Applied science collects the results generated by basic science, and then sells them on. It is a food chain. Basic science is there at the beginning of the chain, with the industry producing the goods at the end.

How do you understand the phrase "science to market"?
I would say it is a political truism that has done some damage in recent decades. I do not know whether we have really profited from it. Perhaps I am too far removed from the market, but surely we have begun to mix apples with oranges. Science does not go to market, technology does.

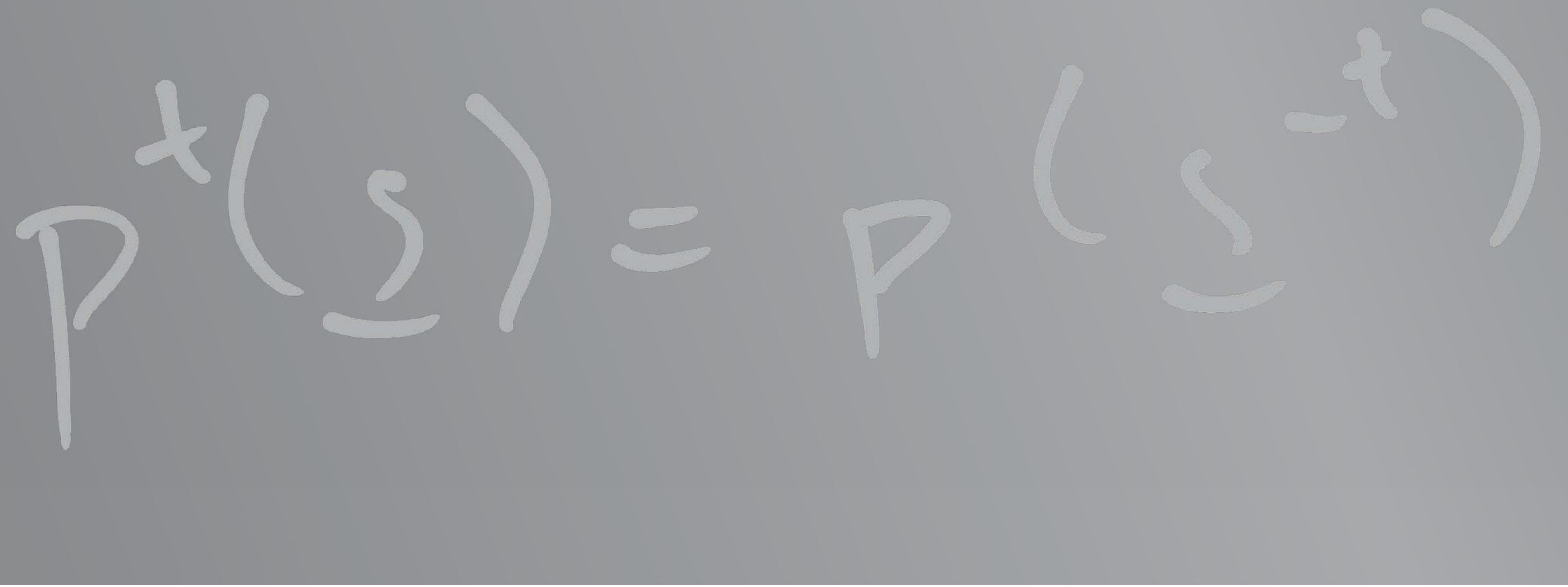
What are your views on the sciences in Slovenia? Do we have enough good projects underway or do we perhaps lack courage?
It could be argued that we are not sufficiently daring and ambitious. We have knowledge here, even though Slovenia's best minds are emigrating. I would suggest that the best scientists should be attracted back in the form of tempting offers. This strategy works well in many places, for example in China, which is attempting to repatriate the best Chinese emigrants.

As a college professor, you have a good overview of the performance of students, graduates and doctoral students. How would you rate the generations who have studied the Bologna curriculum in recent years?
I am satisfied. It seems to me that the generations of physicists are very similar. Although some complain that students are getting worse, I do not agree. We receive the most intellectually ambitious young people to study physics. There are of course some exceptions, but I believe that the Bologna reform has not affected this significantly. In fact, I would say that it has helped somewhat to consolidate studies and verify programmes. Students now have a slightly better established system of study, which forces their work to improve. I would not count myself among the critics who think that it was better before.

How does the knowledge of our graduates compare with the knowledge of graduates from internationally renowned universities?
The knowledge of our graduates is at the same level, and certainly comparable to the knowledge of graduates from the best universities in Europe, if not the world. I often hear colleagues comment that Slovenian physicists possess very advanced mathematical knowledge and that we have a relatively well-defined synthesis of mathematics and physics. This shows that our students are relatively strong when it comes to applying mathematics to physics, which is particularly important in theoretical physics. This is linked with the tradition and characteristics of Eastern European countries, which have always put an onus on mathematics. This also applies for Slovenia and I hope we do not allow things to slide in this regard.

Would you risk a prediction for any important scientific discoveries to be made in the coming decades?
I can try to predict the challenges or scientific topics where future progress is likely to be made. It appears to me that, in addition to quantum computing, the key issues in my area are cosmology and astrophysics. The situation is reminiscent of the end of the 19th century and the arrival of relativity. Phenomena such as dark matter and the accelerated expansion of the universe simply do not fit within existing theories. In order to frame these phenomena within existing theories, we need certain cosmological constants to be in place. The challenge we face is to combine cosmology, or rather relativity, with quantum physics. Although the latter is a very successful and fully functional theory, we do not yet understand how to apply it on the cosmological scale. I expect this to be where any revolutionary discoveries will be made in theoretical physics in the decades to come.

The full interview, conducted by Ina Petric, will be published on the website of Tromba Agency: www.tromba.si.



Over 30 years since the start of the Joung Researchers Programme

On the occasion of the anniversary of the start of the programme, the Agency issued a publication entitled Več kot 30 let programa Mladi raziskovalci (Over 30 years since the start of the Junior Researchers programme). The contributions describe the time when the programme was created, as well as first analyses responding to criticism the programme received in the early 1990s. Ciril Baškovič, Stojan Pečlin, Barbara Simončič, Mirjana Ule and Mitjan Kalin contributed their opinions and experience with the programme. The publication contains a list of almost 5,000 individuals who were either partially or fully involved in the Junior Researchers Programme and who, according to the information available to the Agency, obtained their PhDs as a result. Publication is available in Slovenian language.

ERC fellowships to visit ERC grantees

In accordance with the guidelines for a more equitable distribution of ERC grantees, the European Research Council established an instrument for encouraging applications to ERC calls. The funds acquired enable the researchers to visit the ERC grantees themselves. The Agency responded to the ERC invitation and published a call in November 2016 for visiting ERC grantees, becoming one the first six agencies in Europe to introduce the so-called ERC Fellowship to Visit ERC Grantee mechanism. The visits made by Slovenian researchers to ERC grantees represent a first-class science exchange involving leading scientists and the use of some of the best equipped research facilities in the world.

George Johnson, the multiple-award winning writer and columnist. In addition to his regular Raw Data column in The New York Times, he also writes for the National Geographic, Slate, Scientific American, Time, Wired and The Atlantic.

Workshop with The New York Times journalist and writer George Johnson

In cooperation with the Embassy of the United States of America, the Agency organised a workshop with the renowned journalist and science writer, George Johnson. The well-attended workshop, which was held for editors, journalists and researchers, confirmed the increasingly recognized relevance of keeping the public abreast of the work being carried out in the field of science and research.

The Communicating Science Programme features conversations with renowned journalists from well-established media outlets which report on science.

Slovenian research groups make headway at the Smart Urban Futures Call

In December 2015, the Urban Europe Joint Programming Initiative published the ERA-NET Cofund Smart Urban Futures Call (ENSUF). A total of 22 agencies from 18 EU Member States, Norway and Turkey took part in the preparations. The call had a budget of EUR 24.5 million in place and the agencies acquired an additional EUR 5 million by successfully applying for the European Commission ERA-NET Cofund call within the framework of the Horizon 2020 programme.

Three projects with Slovenian participants were successful at the call:

Urban Education Live, Faculty of Social Sciences, University of Ljubljana, team leader: Matjaž Uršič.

C3SPACES – Using ICTs to help create inclusive public spaces, Urban Planning Institute of the Republic of Slovenia, team leader: Barbara Goličnik Marušić.

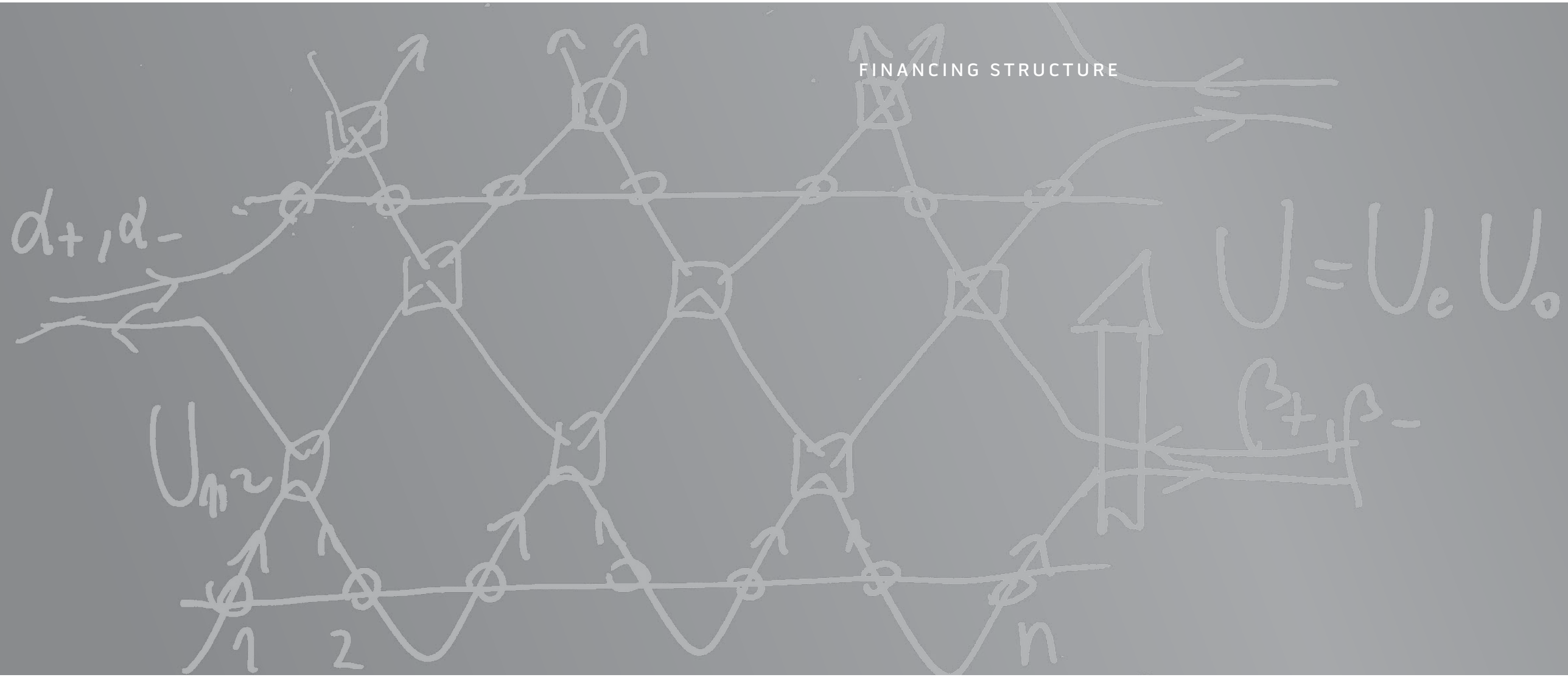
Bright Future for Black Towns: Reinventing European Industrial Towns and Challenging Dominant Post-Industrial Discourses, Research Centre of the Slovenian Academy of Sciences and Arts (project coordinator), team leader: David Bole.

The total value of Slovenian projects amounts to almost 700,000 EUR. The Agency will contribute 425,000 EUR from the national budget and has managed to acquire 39 % of funding or just under 270,000 EUR by submitting a successful grant application under the ERA-NET Cofund call for proposals.

20th anniversary of the House of Experiments

On International Science Centre and Science Museum Day, a joint initiative run by UNESCO, the International Council of Museums (ICOM), the Association of Science and Technology Centres (ASTC) and other leading science centres across the world, the House of Experiments prepared a special programme.

Supported by the Agency, the House of Experiments – Slovenian Science Centre has been carrying out activities in the field of science promotion, creativity, innovation and critical thinking for over 20 years. Its various events are geared towards different audiences. In addition to numerous other activities, the House offers "hands-on" experiment development, as well as popular science lectures in the style of Caffé Scientifique aimed at the general public, which were named TEAing Science. One of the House's main activities is the annual three-day Sciencetival international science festival. With its programme, House of Experiments successfully brings the world of science into primary schools and kindergartens – it organizes science competitions for children, runs science workshops for families and travels to various towns throughout Slovenia, transforming them into science centres for a day. The House of Experiments is one of the leading institutions in Slovenia when it comes to promoting science, helping the principle of lifelong learning become a reality, bringing formal and informal learning styles together, and encouraging the development of technical culture and the links between science and art.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Financing structure

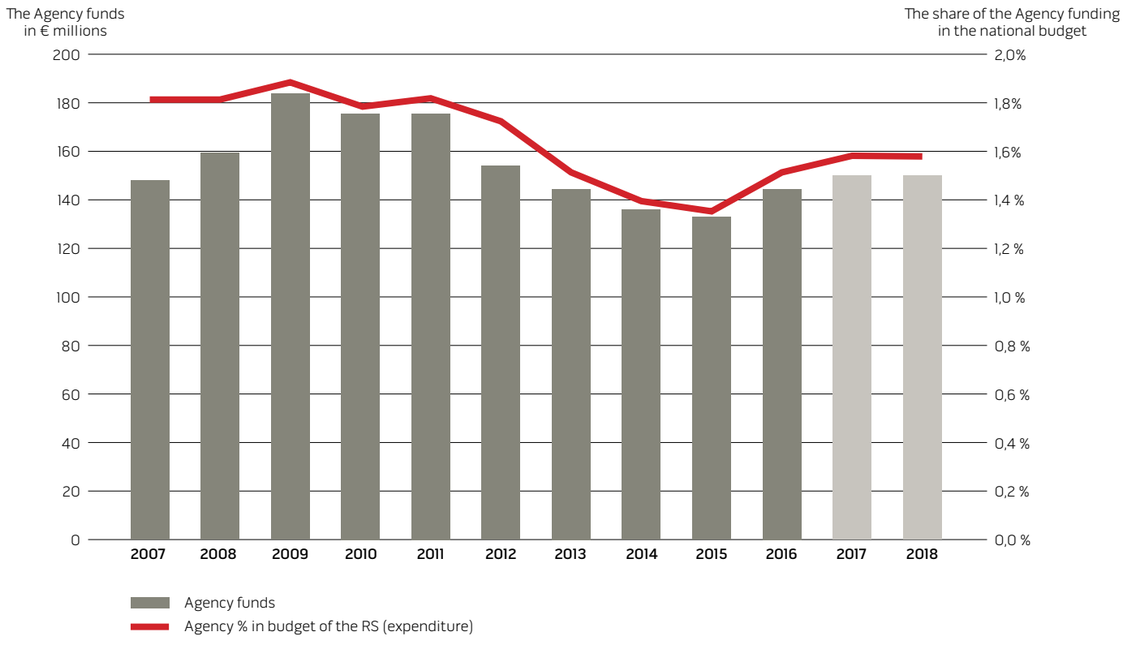
In 2016, the budget of the Republic of Slovenia provided EUR 144.6 million through the Slovenian Research Agency (henceforth: the Agency) for the financing of scientific research, which is 11.5 million or 8.6% more than in the previous year.

In 2016 there was the first increase in funding since 2009.

The Agency's budget for scientific research activities fell from 183.9 to EUR 144.6 million between 2009 and 2016, representing a difference of 21.4%.

In 2015, a total of 1.34% of the budget of the Republic of Slovenia was dedicated to the Agency for the purpose of financing scientific research activities; in 2016, this rose to 1.52%.

Agency funds for scientific research activities and their corresponding share of the budget of the Republic of Slovenia



A detailed overview of the financing of research activities is available on the Agency's website: www.arrs.gov.si/en/analize/

Agency Funds in 2016

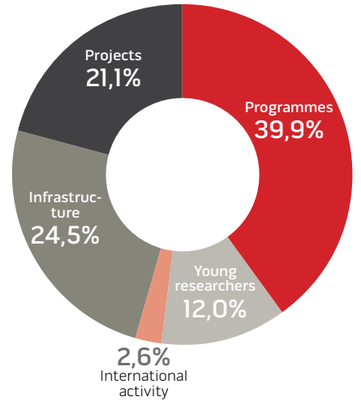
Research programmes: long-term financing of research, which is expected to be topical and produce usable results over a longer time period.

Research projects: co-financing of basic, applied and research projects, targeted research programs and those of young Doctors of science in the pilot public calls framework "Employment support of young Doctors of science".

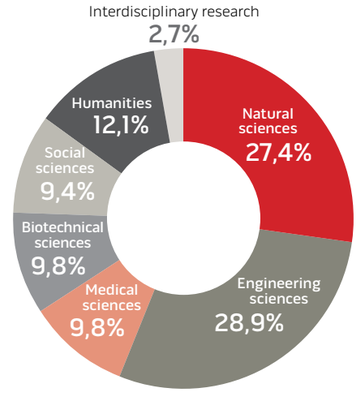
Young researchers: financing of postgraduate studies and training of researchers.

International activities: co-financing of bilateral international projects, promotion of cooperative research organizations in the Horizon 2020 calls, support of international congresses, co-financing of projects within the complimentary schemes of the ERC and the schemes of lead agencies.

Research infrastructure: co-financing of infrastructural programs, popular science publishing, founder obligations, COBISS and other library-informatic activities and infrastructures, international journals and databases.

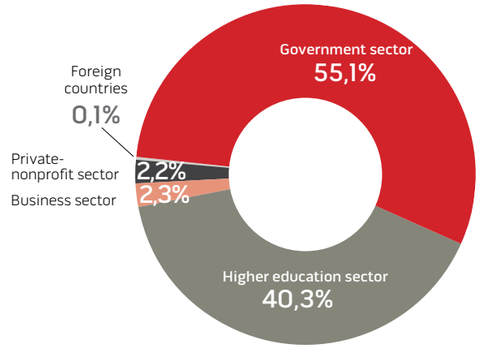


Agency funds per discipline[1]



[1] Funding for founder obligations, infrastructural programmes, international promotion of science, the operation of Slovenian congresses around the world, the promotion of applications to EU-projects, OSIC and foreign journal databases cannot be divided between disciplines and so are not taken into account.

Agency funds per activity sector[2]



[2] Government sector: public research institutions and other public institutions

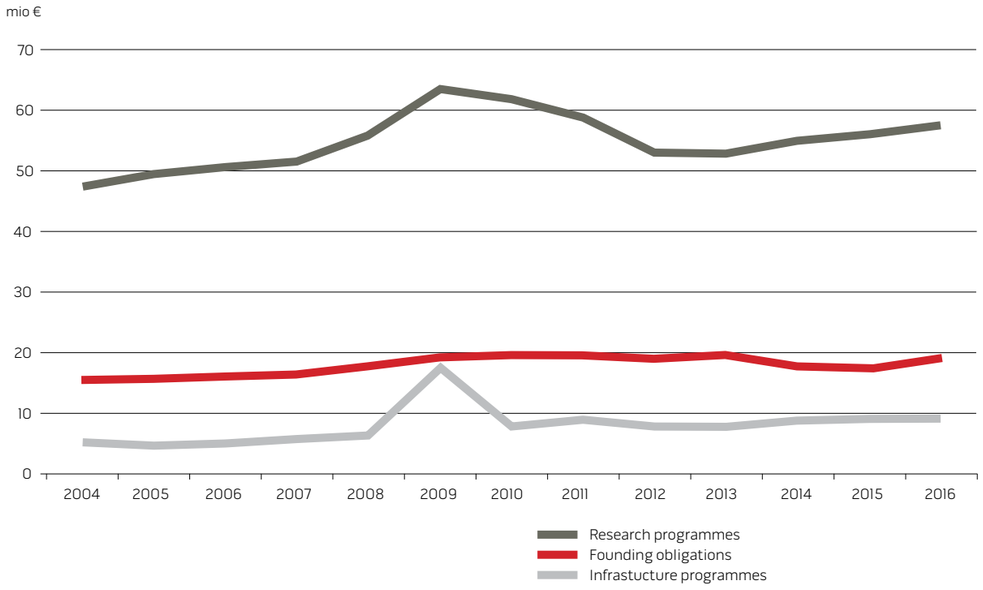
Institutional financing

Research programmes: **EUR 57.7 million**
Founding obligations: **EUR 18.4 million**
Infrastructures programmes: **EUR 9.5 million**

Research, infrastructure programmes and founder obligations comprise a stable aspect of research financing.

Due to austerity measures, the financing of programmes in 2012 was reduced by 10% in comparison with the previous year. In 2014 and 2015, the Agency made use of long-term stable financing to ameliorate the reduction of funding from 2012, allowing for an increase in research programmes funding. The trend of slight growth in research programmes funding continued in 2016.

Funds for institutional funding

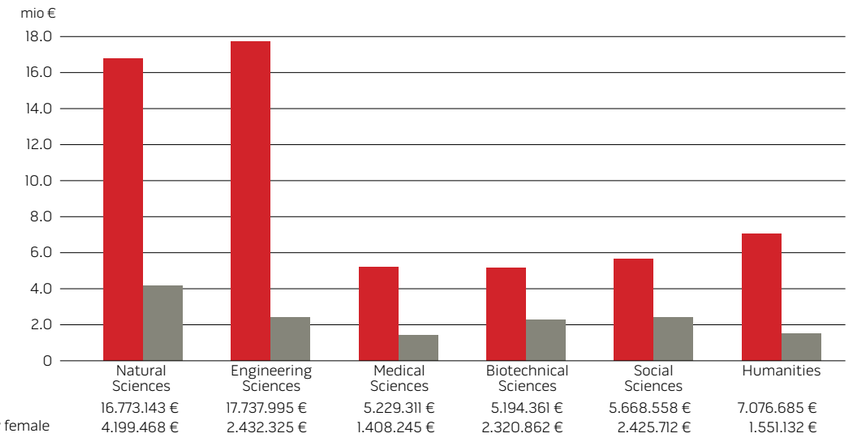


Research programmes

In 2016, the Agency paid EUR 57.7 million for the co-financing of research programmes, which represents 39.9% of the entire budget or 2.7 percentage points less than in 2015. In 2016 a total of 303 research programmes were financed, of which 63 were in the field of natural sciences, 90 were in engineering, 38 in medical sciences, 21 in biotechnical sciences, 47 in the social sciences and 44 in the humanities.

Tenders and calls in 2016

On the basis of public calls for tender, the Agency approved the extension of EUR 4.4 million of financing in 2016. A total of 36 research programmes were extended, for which financing ended in 2016, as well as one further programme, resulting from the merger of two previously existing programmes. Two research programmes were ended on the basis of review, and one research organization did not submit a public call application for the award of a concession. Three programmes were granted approval for a three-year extension, a further ten programmes were extended for five years, eight were extended for six years, and sixteen were extended for a four-year period.



Discipline	Natural Sciences	Engineering Sciences	Medical Sciences	Biotechnical Sciences	Social Sciences	Humanities
Total funds	16.773.143 €	17.737.995 €	5.229.311 €	5.194.361 €	5.668.558 €	7.076.685 €
Managed by female researchers	4.199.468 €	2.432.325 €	1.408.245 €	2.320.862 €	2.425.712 €	1.551.132 €

Funding per activity sector[5]

Public sector	30,577,960
Higher education sector	25,876,204
Business enterprise sector	832,275
Private - non-profit sector	393,613
Total	57,680,052

[5] Government sector: public research institutions and other public institutions

The funding for research programmes increased by 1,83% in comparison with 2015:

natural sciences:	up 1.7%
engineering sciences:	up 1.8%
medical sciences:	up 1.8%
biotechnical sciences:	up 1.6%
social sciences:	up 1.9%
humanities:	up 2.1%

Founding obligation and infrastructural programmes

The purpose of founding obligation financing and work related reimbursement is to ensure that the public research institution has a sound financial basis for research work. EUR 18.4 million was paid on founding obligations in 2016, which represents 5.8% more than in 2015.

Founding obligation funding per activity sector

Public sector	17,486,030
Higher education sector	927,541
Total	18,413,571

Infrastructural programmes support research works. The central role of research infrastructure is to ensure a high-quality research environment. EUR 9.5 million was paid for infrastructural programmes in 2016, which is a year-on-year increase of 0.2%.

Infrastructural programme funding per activity sector

Public sector	6,680,959
Business enterprise sector	122,821
Higher education sector	1,967,570
Private – non-profit sector	685,199
Total	9,456,549

Competitive financing

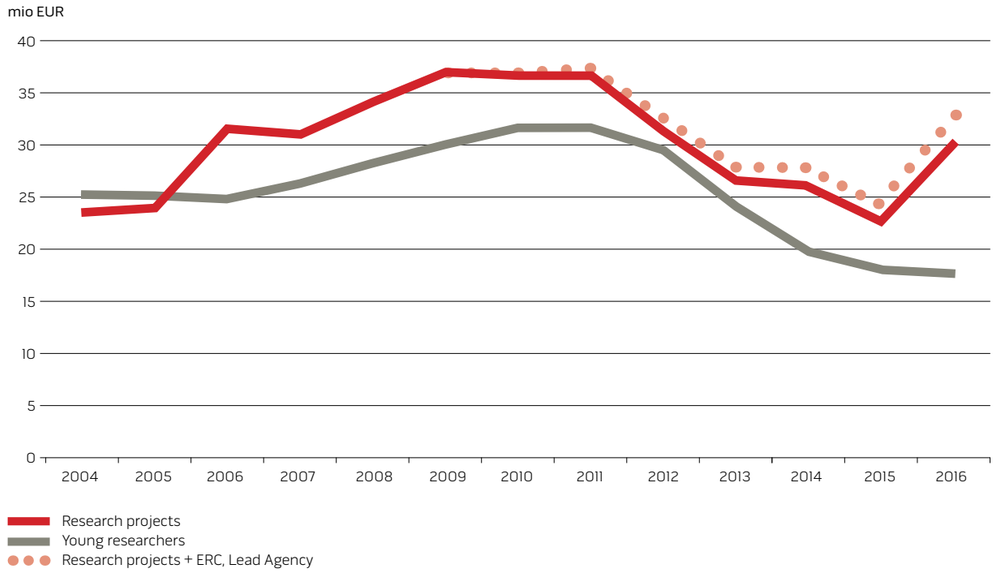
Research projects: **EUR 30.4 million**
Young researchers: **EUR 17.3 million**

In 2016, a positive growth trend in research project funding was recorded for the first time since 2009. Finances increased by 34.3% in comparison with 2015.

A significant decrease in funding was recorded in 2012, when the Agency did not finance any new research projects due to austerity measures. Finances decreased by 38.7% between 2009 and 2015. The decrease in research project funding in 2015 was the result of a delay in the start of financing, which commenced in 2016.

Since 2010, there has been a continued trend of reduced funding for young researcher training, though the decrease in 2016 was 2.8% or EUR 10.6 million less than in 2015. The reduction of finances in 2016, compared to 2015, was the result of the integration of a smaller number of young researchers into the training programme.

Funds for research projects and young researchers

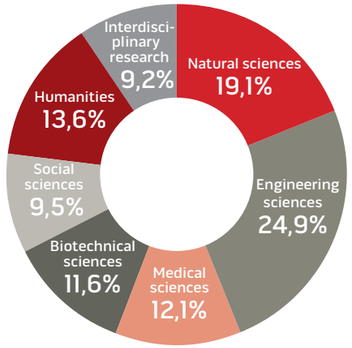


Research projects

In 2016, the Agency paid EUR 30.4 million for the co-financing of research programmes, which represents 21.1% of the entire budget, or 4.1 percentage points less than in 2015.

Basic research projects: **EUR 19.2 million**
Applied research projects: **EUR 7.1 million**
Postdoctoral research projects: **EUR 2.2 million**
Targeted research programme projects: **EUR 1.2 million**
Promoting of the employment of young doctors of science: **EUR 680 thousand**

Funds by discipline



The funding for research projects increased by 34.3% in comparison with 2015:

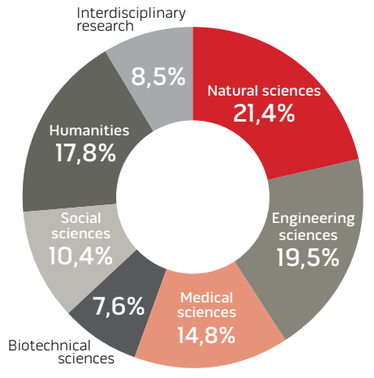
natural sciences: up 34.4%
engineering sciences: up 26.8%
medical sciences: up 35%
biotechnical sciences: up 34.6%
social sciences: up 46.2%
humanities: up 25.4%
interdisciplinary research: up 64.7%

Basic and applied research projects

In 2016, with finances from the state budget, the Agency co-financed 259 basic research projects, with a total value of EUR 19.2 million. Funding increased by 42.5% in comparison with 2015. Young researchers (up to 10 active years after defending their doctorate) conducted 96 basic projects, and received 39.3% of the funding allocated for basic research projects.

The evaluation methodology for public calls for tender dictates that the share of applied co-financed projects must be at least 30 % for engineering sciences, at least 20% for biotechnical sciences, at least 10% for medical sciences and social sciences, and at least 5% for natural sciences.

Funds for basic research projects by discipline



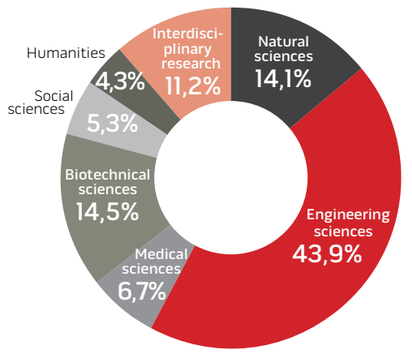
	Basic and applied projects (€ million)	female leaders	young leaders	of those female leaders
Natural sciences	5.1	29.4%	39.2%	30.2%
Engineering sciences	6.9	15.2%	34.4%	11.1%
Medical sciences	3.3	41.5%	35.9%	46.0%
Biotechnical sciences	2.5	39.8%	33.3%	43.8%
Social sciences	2.4	46.4%	39.9%	50.6%
Humanities	3.7	32.4%	47.6%	36.0%
Interdisciplinary research	2.4	25.7%	39.5%	15.0%
Total	26.3	29.8%	38.3%	30.2%

The funding of basic and applied research projects, and project shares, for projects led by female researchers and young researchers. Funding share data for projects led by young female researchers are given in the last column.

In 2016, the Agency co-financed 94 applied research projects through the state budget, with a total value of EUR 7.1 million, which is 12.6% more than in 2015. Young researchers conducted 35 applied research projects, and received 35.4% of the funding allocated for this purpose.

The evaluation methodology for applications on public calls for tender dictates that at least 20% of the projects chosen must be led by young researchers (male/female researchers, not more than 10 years after defending their doctorate). This is how the Agency promotes the integration of young scientists into its research activities.

Funds for applicative research projects by discipline



Postdoctoral projects

In 2016, the Agency co-financed 52 postdoctoral projects from the state budget with a total value of EUR 2.2 million, which represents a 16.5% year-on-year increase.

The evaluation methodology for applications on public calls for tender dictates that at least 10% of all projects within each discipline must be at post-doctoral level.

The funding of postdoctoral projects, and project shares, for projects led by female researchers.

	Funding in EUR	Female leaders
Natural sciences	437.239	20,6 %
Engineering Sciences	459.767	29,4 %
Medical Sciences	279.443	61,3 %
Biotechnical Sciences	242.277	44,2 %
Social Sciences	220.894	100,0 %
Humanities	225.381	88,0 %
Interdisciplinary research	365.198	70,4 %
Total	2.230.200	52,9 %

2016 call

The funding of research projects, which were accepted into co-financing in 2015, began in 2016. The funding of research projects for which the Agency published the public call in 2016, will begin in 2017.

Targeted research programme projects

EUR 1.2 million was paid for the co-financing of projects in 2016, which represents a EUR 0.4 million increase on the amount allocated in 2015.

The financing of targeted research project programmes means interested ministries and other users can gain research support for the design of strategic targets of Slovenian development, and with decisions about fundamental development tasks, which are imperative for the increase of Slovenian competitiveness, adaptability and innovation. The projects are thematically directed based upon the proposals of ministries and parties from the private sector who are competent to act in the public interest.

In 2016 the Agency published two calls within the TRP (CRP) framework.

In April 2016, the Agency published a public call for the selection of „CRP 2016" targeted research programmes, along with the approval of the State Council of the Republic of Slovenia, the Ministry for the Environment and Spatial Planning, the Ministry of Finance, the Office of the Republic of Slovenia for Slovenes Abroad and in the World, the Chemicals Office of the Republic of Slovenia, the Departments of the Government of Slovenia for Development and European Cohesive Politics, the Ministry of Health, the Ministry of Culture, the Ministry of Education, Science and Sport, and the Ministry of Economic Development and Technology.

The subject of the public call is decided with priority given to content in the framework of the following focal points:

- The development of democracy in Slovenia.
- Preservation of the ethnic identity of Slovenes living outside the Republic of Slovenia.
- Integration of measures for the prevention of disease.
- The determination of human and environmental exposure to chemicals.
- Fiscal and economic politics.
- Effective generation, bilateral flow and the use of economic development knowledge and good quality employment opportunities.
- Cultural diversity and social cohesion.
- Environment and spatial planning.
- School spatial planning.
- Reading literacy as a factor in childhood cognitive development.
- Effective management of the research and innovation system.

26 projects were accepted into co-financing.

In June of 2016, the Agency in cooperation with the Ministry of Agriculture, Forestry and Food, published a public call titled „Zagotovimo.si hrano za jutri" (‚Ensuring Food for Tomorrow') for the selection of targeted research programme projects.

The subject of the public call was decided, with priority given to content from the Ministry of Agriculture, Forestry and Food, within the framework of the following four focal points:

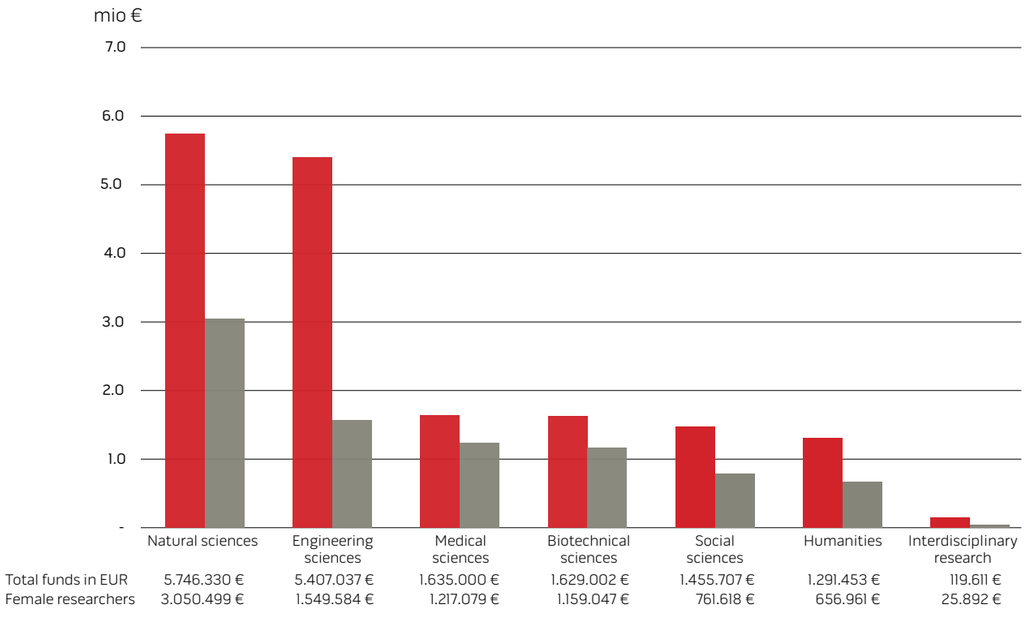
- Slovenian food security
- Competitiveness in food production and renewable natural resources.
- Sustainable management of natural resources.
- Rural development.

31 projects were accepted into co-financing.

Young researchers

In 2016, the Agency financed the training of 862 young researchers with a total funding amount of EUR 17.3 million, which represents 12% of the entire budget and is 1.4 percentage points less than in 2015.
The Agency facilitates the cooperation of young researchers in research work during their graduate studies on the basis of temporary employment contracts. Their salaries, social contributions,l costs of material and services are financed by the Agency. The average annual cost of financing one young researcher is EUR 30,000. Training funds are allocated for a temporary period which is not to exceed four years of a doctoral study programme.
The purpose of the programme is to rejuvenate the research staff by promoting new ideas and approaches. The young researcher programme is a source of highly trained and motivated employees, who represent significant potential for the Slovenian economy and other socially important areas.
Approximately 8,000 young researchers were trained between 1985 and 2016.

Young researcher funding, with shares of funds received by female researchers



The funding for young researchers decreased by 2,7% in comparison with 2015:

natural sciences:	down 0.6%
engineering sciences:	down 3.6%
medical sciences:	up 8%
biotechnical sciences:	down 0.7%
social sciences:	down 3.2%
humanities:	down 7.5%
interdisciplinary research:	down 62.2%

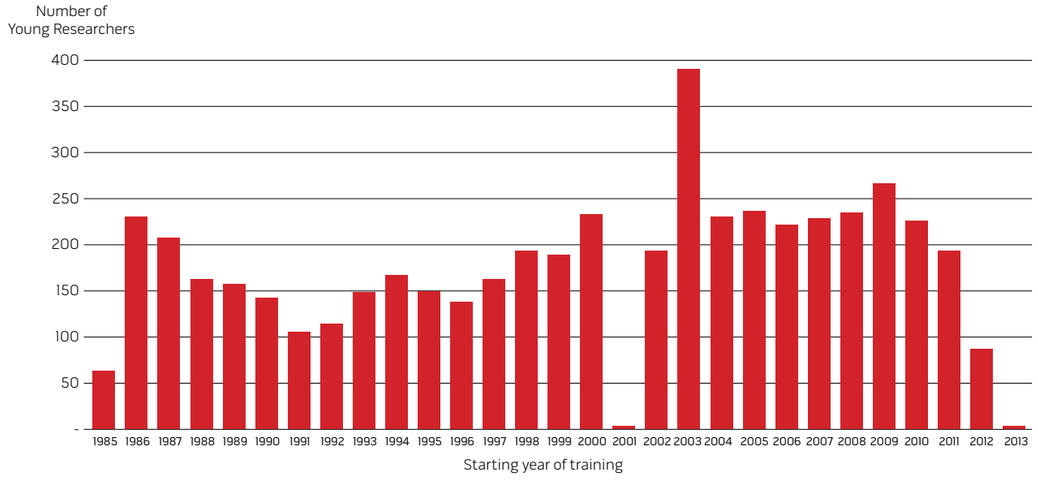
In 2016 three young researchers accepted rewards for the early completion of training.

The Agency rules state that 25% of the mentors of young researchers accepted within the research organizations must be young mentors.

2016 call

In February 2016, the Agency published a call for the allocation of mentorship positions within research programmes, which led to 175 mentorship positions being allocated among 154 research programmes: 54 in the natural sciences, 55 in engineering sciences, 18 in medical sciences, 16 in biotechnical sciences, 17 in the social sciences and 15 in the humanities.

Young researchers whose PhD, obtained by the end of 2016, is listed in the Database of Research and Development Actors



Scientific literature

Scientific literature: EUR 1.4 million
International journals and data collections: EUR 4.4 million

The Agency co-finances the purchase of international scientific literature and electronic access to the latest scientific databases in order to ensure the availability and accessibility of international scientific and expert information for the purposes of research, educational and development activities. The literature is publicly available in all libraries, research organizations and via the COBISS system.
The Agency also co-finances popular science publications on a request basis for the purpose of enabling the publication of popular science publications which are important for the promotion of interest in the general public and, especially, an interest among young people for science and technology.
The co-financing of the scientific literature, including domestic scientific and popular science publications, commanded a sum of EUR 1.1 million in 2016, while EUR 0.3 million was channelled towards scientific monographs.

International activities

The ERC complimentary scheme: EUR 1 million

Within the context of complementary schemes, applicants from Slovenian research organizations who have been positively evaluated by ERC calls have the option to apply to the Agency with a customised project, which, based on its objectives and scope of work, takes into account the time required to customise the project as well as the amount of available funding. The Agency co-finances customised projects in accordance with a proposal from the Scientific Council and with respect to the budgetary options made available for the co-financing of projects conducted primarily in Slovenia.
In 2016 the Agency co-financed 12 projects within the framework of the complimentary schemes, of which five were in the natural sciences (48.5% of funding), four were in the humanities (27.6% of funding), two in biotechnical sciences (20.4% of funding), and one in engineering (3.4% of funding). Institutions in the higher education sector received 68.5% of the funding available, while those in the public sector were allocated 31.5%.
Calls to the European Research Council (ERC) are aimed at individual projects focused on conducting leading pioneering research in all scientific fields and rank among some of the most competitive in the world, with a success rate of approximately 10 percent. The calls are open to all researchers, regardless of their current place of employment, on the proviso that the ERC project acquired is conducted within Europe.
The frontier research evaluation system established by the ERC is considered to be an exemplary "peer review" system, and is recognized by basic research funding agencies worldwide.

The European Research Council was established in 2007. It is currently working within the framework of the Horizon 2020 programme, and comprises 17% of the budget. Since its inception, the ERC has financed over 7,000 projects from more than 65,000 applications. ERC grantees have won 6 Nobel Prizes.

Source: https://erc.europa.eu/

The four researchers who have been or will be financed by the ERC, have conducted/shall conduct their research in Slovenia.

Professor Tomaž Prosen of the Faculty of Mathematics and Physics, University of Ljubljana, received an Advanced Grant in 2016 for a five-year project titled Open many-particle non-equilibrium systems, and in 2017 the honour of an ERC Advanced Grant was awarded to Professor Marta Verginella of the Faculty of Arts, University of Ljubljana for her project titled The post-war transition from a gender perspective: the case of the north-eastern Adriatic region, which represents the first ERC project from the social sciences and humanities.

The ERC publishes an annual work programme that serves as the foundation of three calls for the current year:

- Starting Grant – enabling the start of independent research (2–7 years after the award of a doctoral degree);
- Consolidator Grant – enabling the consolidation of independent research studies (7–12 years after the award of a doctoral degree);
- Advanced Grant – for recognised researchers.

Collaborative projects are currently underway between:

- The Austrian Fund for Scientific Research – **Fonds zur Förderung der wissenschaftlichen Forschung, FWF;**
- The Flemish Research Foundation – **The Research Foundation Flanders, FWO;**
- The Hungarian National Fund for Research, Development and Innovation – **National Research, Development and Innovation Fund, NKFIH.**

The lead agency scheme: **EUR 1.1 million**

The Agency promotes international scientific research via the lead agency scheme. Through a cooperation agreement between the agencies of various countries, researchers are able to apply collectively, as a joint project, under the auspices of one of the agencies (the lead agency), which is tasked with implementing the review process. If the peer review process for the application is successful and the lead agency proposes that the project is co-financed, then another agency takes on the co-financing of the researcher from their own country without conducting an additional review process.

In 2016 the Agency co-financed 27 projects within the lead agency scheme, of which 17 were in the natural sciences (59.2% of funding), five in engineering sciences (23% of funding), two in biotechnical sciences (5.4% of funding), one in the humanities (2.5% of funding), one in the social sciences (6.8% of funding), and one in medical sciences (3.2% of funding).

Institutions within the higher education sector received 67.1% of the funding available, while those in the public sector were allocated 32.9%.

International bilateral projects: **EUR 0.8 million**

A total of 385 projects were co-financed in 2016 within the framework of the international bilateral scientific cooperative through the coordinated efforts of the Agency and the Ministry responsible for Science.

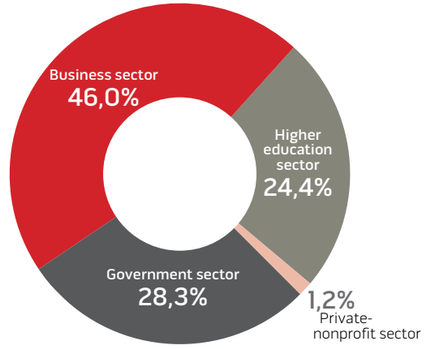
In all, 12 countries cooperated: Austria, Croatia, Bosnia and Herzegovina, Montenegro, Serbia, France, Turkey, India, Japan, Russia, Argentina and the United States of America. The majority of funds were allocated to cooperation with the United States of America (43.9%).
In 2016 the co-financing of bilateral cooperation with funds from the state budget amounted to EUR 0.5 million.
The Agency also cooperates with the French Commissariat for alternative and atomic energy (CEA). This cooperation is conducted via a public call for tender, the subject of which is the co-financing of international scientific research projects lasting for a period of two years. On the basis of two public calls in 2016, a total of 13 collaborative research projects were co-financed in the fields of new energy technologies, nuclear energy, adaptation to climate change, fundamental physics, life science and global safety.
The total amount co-financed for scientific collaboration in 2016 was EUR 294 thousand.

Horizon 2020 public call application incentive: **EUR 0.5 million**

The Agency encourages the participation of Slovenian research organizations in applications to the Horizon 2020 programme. This allows for a continuous open public call to project applicants under the EU Horizon 2020 Programme for Research and Innovation.

Slovenian organizations who are applicants, coordinators or partners in a project that is entered into the EU Horizon 2020 research and innovation framework are eligible for a one-time financial contribution toward the cost of the project's application. EUR 2,000 is the fee to help cover the costs incurred by the preparation and application of a project that has been coordinated and applied to the international consortium by a Slovenian organization, whereas EUR 1,000 is put toward the costs incurred by a Slovenian organization that submits a project independently to the international consortium, assuming the call was anticipated by the European Commission.

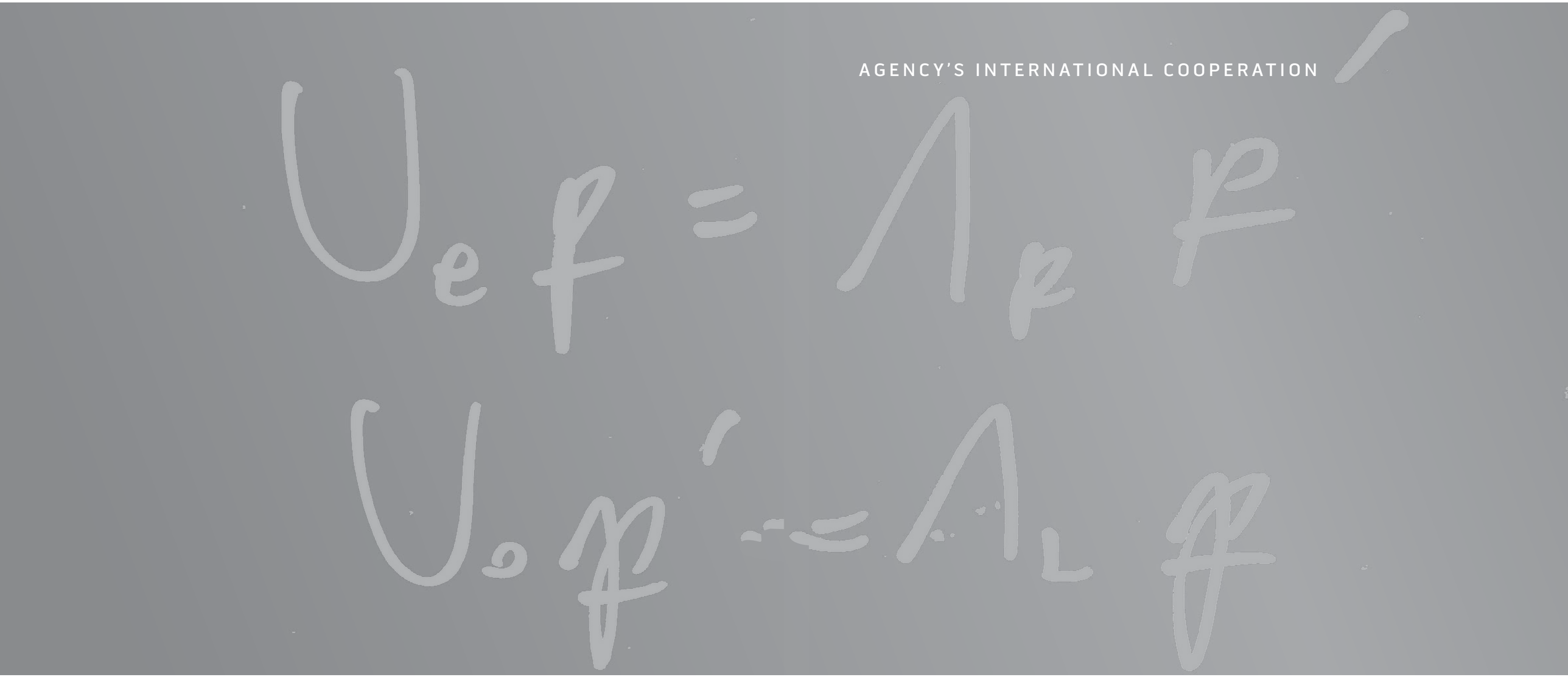
Funds by sector of activity



Government sector: public research institutions and other public institutions

Support for international associations: **EUR 0.3 million**

By promoting Slovenian science abroad as well as domestically, the Agency ensures that Slovenian research organizations are able to participate with researchers from countries with which Slovenia does not yet hold relevant international agreements. The programme also facilitates cooperation with Slovenian research organizations and researchers from neighbouring countries, as well as cooperation with Slovenian researchers working abroad.
The Agency co-finances the memberships of Slovenian scientific associations in international scientific associations and the works of Slovenian representatives elected to international scientific associations as presidents, vice-presidents, general secretaries and management body members.



Science Europe

Science Europe is an umbrella association of research-funding or research-performing agencies. The Agency is one of the eight founding members of the association. The association represents the collective interests of its members and shapes the European Research Area (ERA). Science Europe has 43 members from 27 European countries, whose annual contributions from national budgets dedicated to science amount to approximately EUR 30 billion. In Europe, national financing of research and innovation represents the vast majority of funds, which reflects the importance of national research policies and financing for a fully-fledged European Research Area. The association's operation is supported by an interdisciplinary Scientific Advisory Committee. In 2016, Professor Igor Emri from the Faculty of Mechanical Engineering, University of Ljubljana, took on the role of the Committee's Vice-Chair.

2016 marked the fifth anniversary of operation of the Science Europe association.

NORFACE

ERA-NET

The NORFACE network or New Opportunities for Research Funding Agency Cooperation in Europe is a network of 18 European national financing agencies. It is operational since 2004 and the Agency became its full member in 2005.

The NORFACE network is characterized by highly competitive calls with scientific excellence as the exclusive criterion for success. In 2016, the assessment of the fourth international call on the topic Dynamics of Inequality Across the Life-course (DIAL) was carried out. The call's budget amounts to EUR 15 million plus EUR 5 million, which were granted to the NORFACE network at the European Commission's call ERA-NET Cofund.

In 2016, the NORFACE network prepared a joint international call entitled Transformations to Sustainability (T2S) in cooperation with the Belmont Forum. The calls in question are, together with the SUGI international calls, pilot efforts at global research cooperation.

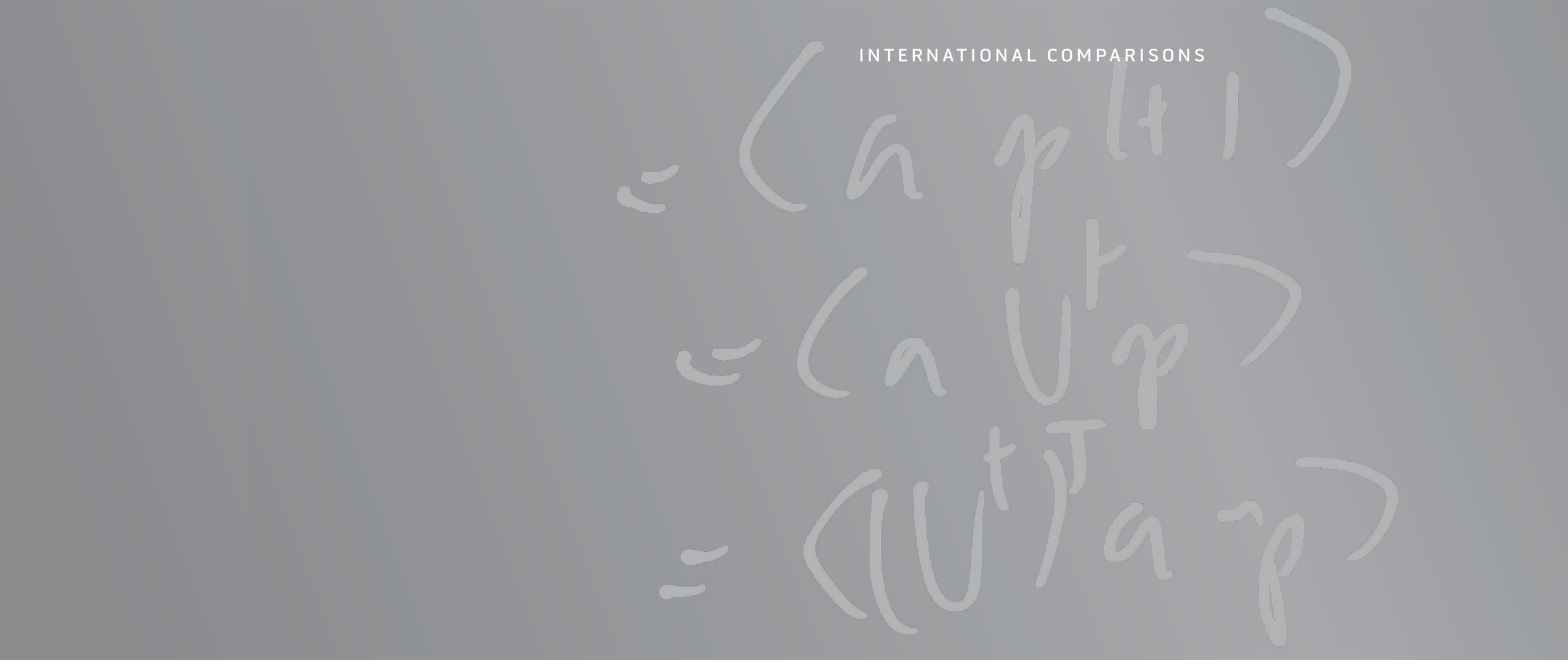
Urban Europe

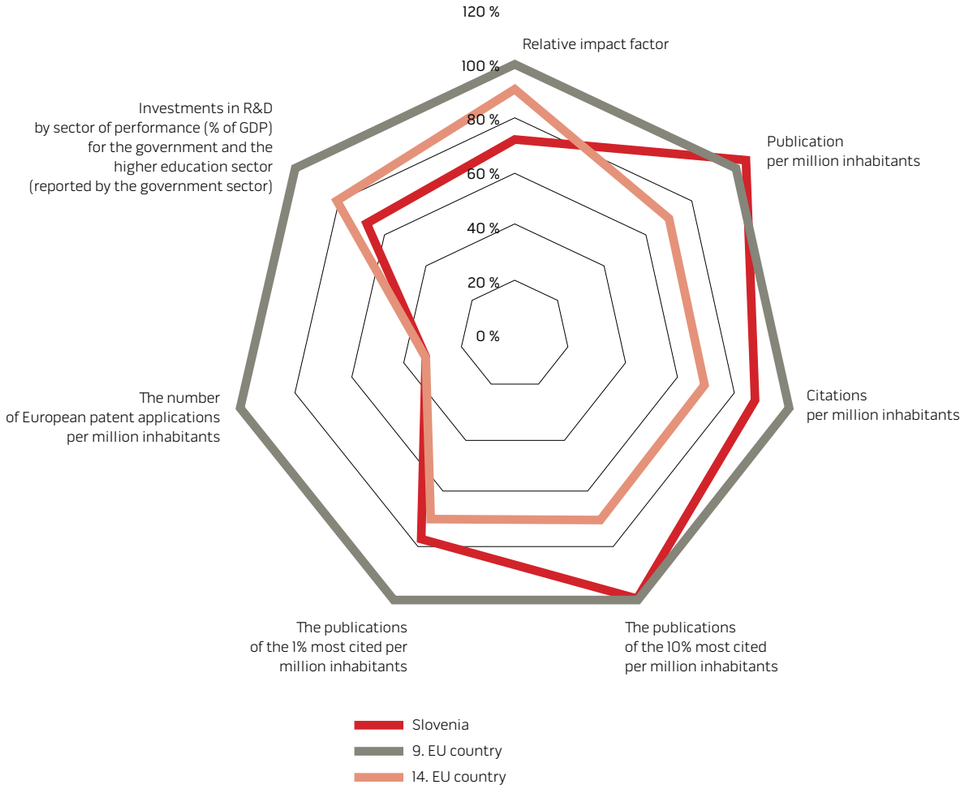
Joint programming initiative

In 2015, the Agency became a full member of the Joint Programming Initiative Urban Europe (JPI UE). JPI UE is one of ten joint programme initiatives of the European Union addressing ten wider social challenges. The aim of joint programming initiatives is to form joint advanced solutions to issues faced by all European countries (e.g. ageing, degenerative diseases, healthy living, urban progress, urbanization challenges etc.) with cooperation of national bodies from several European countries. The goal of JPI UE is to create attractive and environmentally and economically sustainable environments in which the European citizens and communities will be able to develop their full potentials. The themes covered by JPI Urban Europe are consistent with the Smart specialization strategy. JPI UE brings together 20 countries.

December 2015 saw the publication of Joint Programme Initiative's international call Cofund Smart Urban Futures (ENSUF), which enabled research teams from Slovenia to participate for the first time. In strong European competition, Slovenian research teams were successful with three projects, whose total value amounts to EUR 700,000. The Agency will contribute 425,000 EUR from the national budget and has managed to acquire 39% of funding or just under EUR 270,000 EUR by submitting a successful grant application under the ERA-NET Cofund call for proposals.

2016 saw the publication of the next international call, jointly established by the Joint Programming Initiative Urban Europe and the Belmont Forum. The call entitled Sustainable Urban Global Initiative (SUGI): Food-Water-Energy Nexus encourages research cooperation of partners at a global level for the first time. Within the framework of the ERA-NET Cofund's SUGI projects, the Agency leads the monitoring and impact assessment work package.





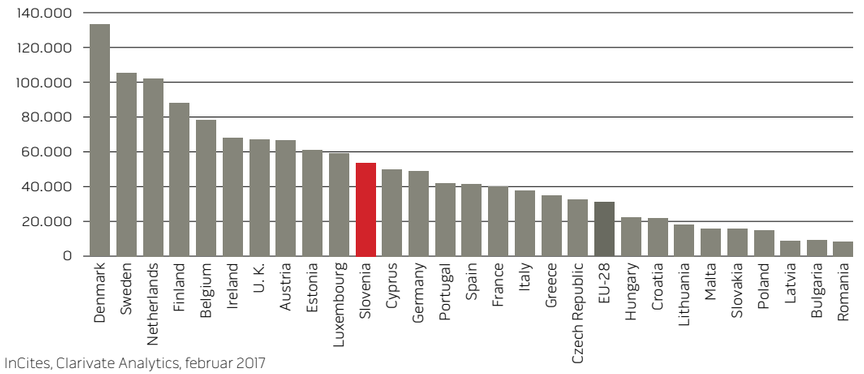
The diagram shows the majority of standard bibliometric and other quantitative indicators that are used for monitoring research activities worldwide and are also included in the Resolution of the Research and Innovation Strategy of Slovenia 2011-2020. The values for Slovenia are shown in relation to the EU member state ranked ninth (the upper third of member states). Information for the 14th country (the upper half of member states) is shown for comparison.

Sources: InCites, Thomson Reuters / Science Metrix / European Patent Office / Eurostat

Citations

According to the number of citations per million of population, Slovenia comes eleventh among the EU Member States with nearly 54.000 citations in the period 2012-2016. In the same period, Denmark is the country with most citations per million of population followed by Sweden, the Netherlands and Finland.

Number of citations of the EU Member States in the period 2012–2016

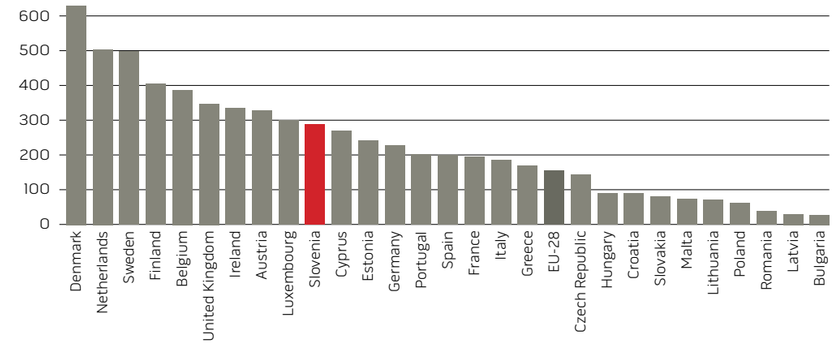


Source: InCites, Clarivate Analytics, februar 2017

10 % of highly cited publications

The established bibliometric indicator used for international comparison is the number of publications of researchers in a particular country who are ranked among the 10 % of highly cited publications globally in a specific scientific field. This includes the publications in journals indexed in the Scopus bibliographic database. A four-year period including the year of publication is taken into consideration.
From 2004 onwards, Slovenia has exceeded the average growth in the EU within the top 10 % of highly cited publications per million of population. In recent years Slovenia is ranked ninth or tenth among the EU Member States.

Number of publications within the top 10 % highly cited in 2012 per million of population in the EU Member States



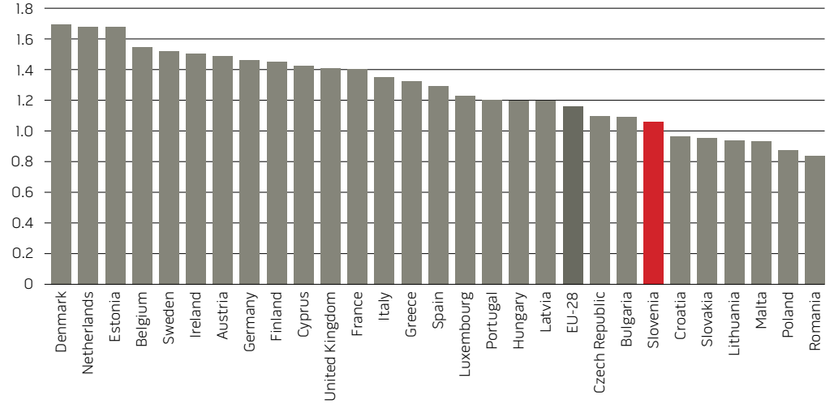
Source: Science-Metrix, 2016

Relative impact factor

The relative impact factor is a standard international bibliometric indicator measuring the ratio between the received citations and the number of publications in a particular country according to the worldwide average impact factor in a particular scientific field.

Among the EU Member States, Slovenia is ranked twenty-second based on the relative impact factor. The value of this indicator is still below the EU average despite the above-average growth of the relative impact factor.

Relative impact factor for the EU Member States in the period 2012-2016



The value of the relative impact factor increased to 1.06, which means that Slovenia exceeded the world average (1.00) for the first time since the Agency monitors this indicator.

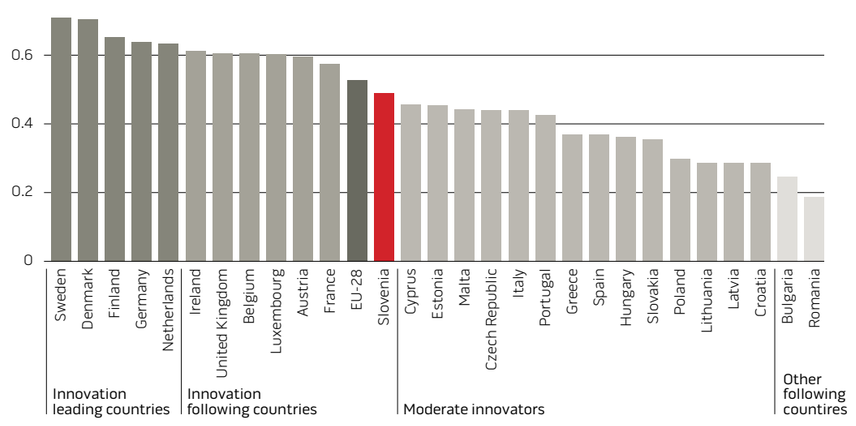
Source: InCites, Clarivate Analytics, 2017

Innovation index

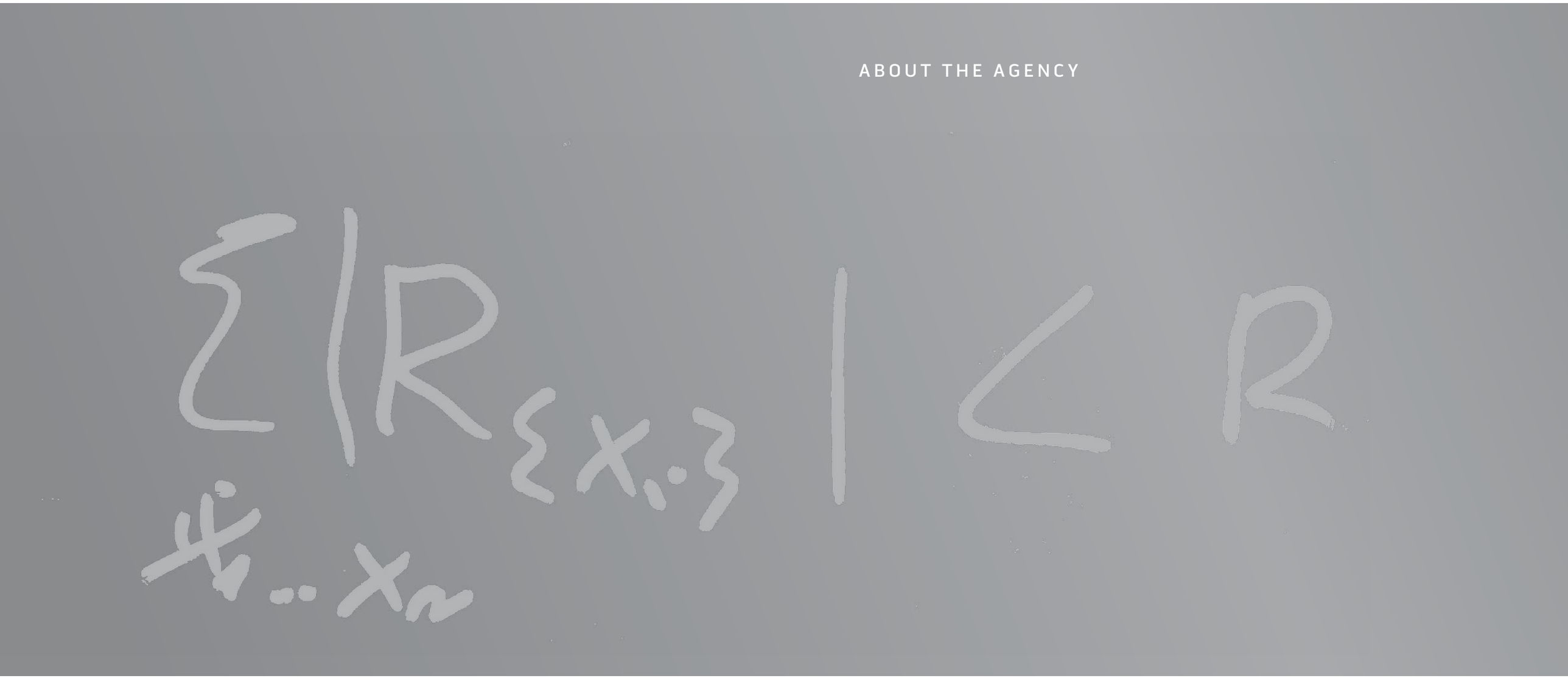
The Innovation Union Scoreboard provides a comparative assessment of the innovation performance of individual countries. It is a composite indicator building on data for more than twenty indicators covering the educational structure, openness and excellence of the research system, financing, support to investment, cooperation and entrepreneurship and on the intellectual capital.

The Member States are placed into the four country groups, with the innovation leaders representing the first group. Based on the above mentioned indicators Slovenia is ranked twelfth and classified into the second group, of the so called innovation followers.

Innovation index for the EU Member States in 2015



Source: Innovation Union Scoreboard, 2016



SLOVENIAN RESEARCH AGENCY

Strategic orientations of the Agency's operation and development

- Sound implementation of activities according to the legal bases, Decision Establishing the Slovenian Research Agency, and applicable national strategic documents.
- Transparency and responsiveness.
- Optimisation of existing instruments and setting-up pilot instruments.
- Monitoring the effects of the implementation of the activities.
- International integration and comparability.
- Transition to fully electronic services.
- Open public communication and science promotion.

Internal organisational units

Director's office

The Director's office carries out specialised, advisory, coordination and administrative-technical tasks, and coordinates the work on joint tasks with the Agency's internal organisational units and other bodies.

Prof. dr. József Györkös, Director

Dr. Lidija Tičar Padar, Deputy Director

Department of Research Programmes and Young researchers, Analysis and Monitoring

This department evaluates and selects research programmes and carries out the tasks related to the young researchers programme. It analyses and monitors the development of scientific research activity and actively develops the area of science promotion. The department is involved in the ERA-net Norface and the Joint Programming Initiative Urban Europe.
Open communication with the general public and the promotion of science represent one of the strategic orientations of the Agency. The main objective is to achieve a more competent reporting and public debate on science and functioning of the scientific system in Slovenia. Public relations rest upon three core principles: open, responsive and informative communication.
Head of Department: Dr. Marko Perdih, Assistant Director.

Tina Vuga, Public Relations

Department of Research Projects

This department carries out tasks in the field of evaluation and selection of research projects. Within its scope of operation, it organises the procedures for substantive monitoring and control of co-funding, implementation and attainment of the objectives of research projects. The main activities of this department are the launching of the call for proposals to receive co-funding for research projects and the launching of the call for proposals to receive co-funding for the Targeted Research Programmes projects.
Head of Department: Simon Ošo, Assistant Director.

Department of Research Infrastructure and International Cooperation

This department carries out tasks in the field of research equipment and infrastructure programmes, central specialised information centres, scientific literature and bibliographical databases, international scientific research cooperation, promotion of science abroad, involvement of researchers in the activities of international scientific associations, and scientific meetings. Its tasks range from activities within the mechanism of leading agencies to activities related to the fostering of participation in the calls for proposals for European research programmes, the setting up of complementary scheme in connection with the calls for proposals of the European Research Council and the hosting of third country researchers.
Head of Department: Mojca Boc.

Department of Legal and General Affairs

The Department of Legal and General Affairs carries out tasks in the fields of law, labour law procedures and human resource services, and public procurement procedures. It conducts administrative procedures regarding access to public information and keeping of private researchers register, and manages human resources.
Head of Department: Katarina Hren.

Department of Finance and Accounting

This department draws up the Agency's financing plans and annual accounts, and financial projections regarding the financing of scientific research activity, the securing of the Agency's solvency and the raising of funds to finance its activity. It is responsible for putting in place payment, recovery and control mechanisms, coordinating the conclusion of joint contracts with research activity operators and implementing other accounting tasks.
Head of Department: Mojca Kastelc Selan.

Department of Information Technology

The Department of Information Technology lays the expert groundwork for the determination and implementation of the Agency's information policy, provides information support for business processes and coordinates the development of information and communication infrastructure. The department manages projects for the installation, operation and maintenance of hardware, system software and basic user interface software tools.
Head of Department: Mitja Tomažič.

The review of the funding in 2016 according to the programme sub-items on an accrual basis

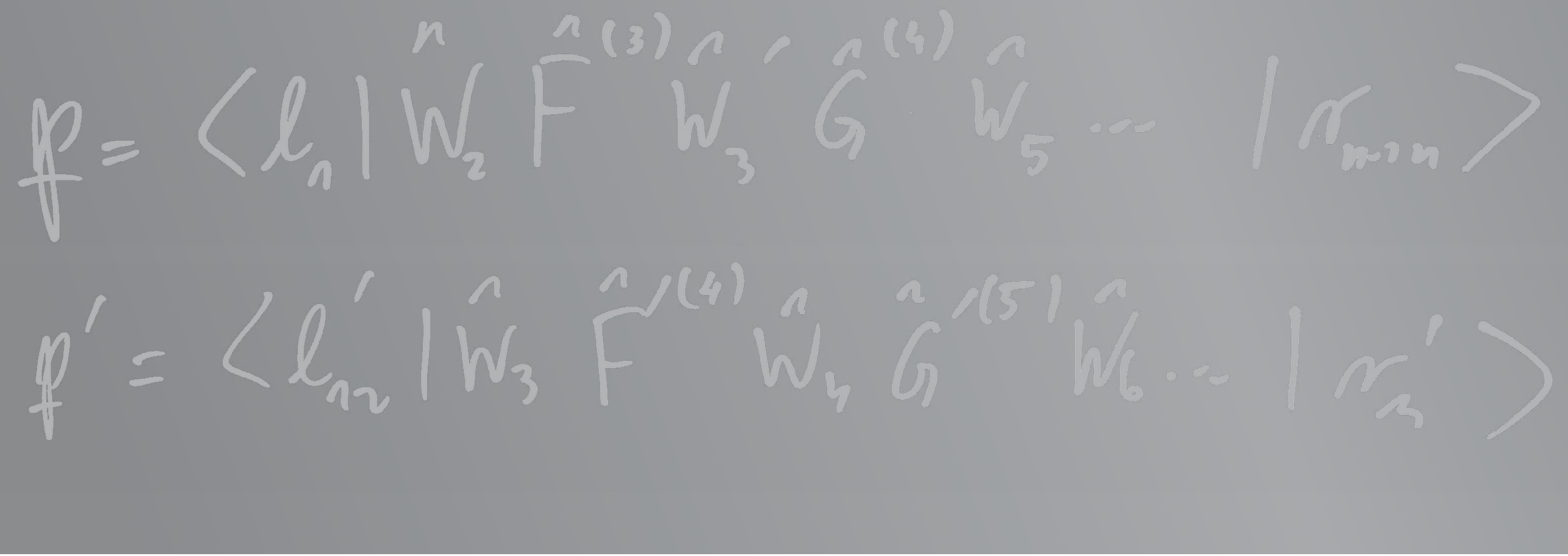
	Realised 2016 (v €)
FOUNDING OBLIGATIONS AND INFRASTRUCTURE PROGRAMMES	**27.870.119**
The PRI founding obligations	14.552.326
Infrastructure programmes - material costs	5.622.596
Reimbursement of work-related costs	3.861.245
Infrastructure programmes - salaries	3.833.952
RESEARCH PROGRAMMES AND PROJECTS	**87.425.398**
Research projects	26.318.439
Research programmes	57.680.052
ERC, LA projects	2.213.125
Target research projects	1.213.781
TRAINING AND DEVELOPMENT OF SCIENTIFIC STAFF	**20.198.044**
Young researchers	17.287.475
Postdoctoral projects	2.230.200
Promotion of the employment of young doctors	680.369
RESEARCH EQUIPMENT	**1.476.973**
Research equipment	1.476.973
SCIENTIFIC LITERATURE, LIBRARIES AND MEETINGS	**6.085.713**
Domestic popular science periodicals	77.834
Domestic scientific periodicals	1.000.282
Scientific monographs	299.911
Foreign periodicals and databases	4.449.999
Libraries and Information Centres	257.686
INTERNATIONAL SCIENTIFIC COOPERATION	**1.536.784**
CEA, cooperation within the EU	294.000
International projects, bilateral cooperation	463.878
Applications for EU projects	487.000
Promotion of Slovenian science abroad	209.876
Operation of Slovenian scientific associations worldwide	82.031
Total:	**144.593.031**

Public calls and tenders that commenced in 2016

Domestic tenders	Publication date
Public call for assigning mentor places to research programmes in 2016	11. 2. 2016
Public call for co-financing the publication of science monographs in 2016	18. 3. 2016
Public call for (co-)financing research projects for 2017	18. 3. 2016
Public call for proposals for financing research programmes for the next financing period and reports on results of research programmes for the previous financing period	1. 4. 2016
Public call for granting concessions for carrying out public service in the field of research activities in the form of research programmes	1. 4. 2016
Public call for co-financing the purchase of international science publications in 2016	22. 4. 2016
Public call for selecting research projects for the "CRP 2016" Target research programme	29. 4. 2016
Public call for selecting research projects of the "Zagotovimo.si hrano za jutri" Target research programme	10. 6. 2016
Public call for co-financing the publication of domestic science periodicals in 2017 and 2018	30. 9. 2016
Public call for co-financing the publication of domestic popular science periodicals in 2017 and 2018	25. 11. 2016

International calls

Title of the international tender or call	Publication date
Public call for co-financing science and research cooperation between the Republic of Slovenia and the French Alternative Energies and Atomic Energy Commission (CEA) in 2016–2018	15. 1. 2016
Public call for proposals for Slovenian researchers in joint Flemish-Slovenian research projects with the Flemish FWO as Lead Agency	26. 1. 2016
Public call for proposals for Slovenian researchers in customised projects under the complementary scheme for tenders of the European Research Council (ERC)	26. 1. 2016
Public call for proposals for Slovenian researchers in joint Austrian-Slovenian research projects with the Austrian FWO as Lead Agency	26. 1. 2016
Public call for proposals for project applicants under the EU Framework Programme for Research and Innovation, Horizon 2020, for the payment of the envisaged contribution to the costs of project preparation and application	26. 1. 2016
Public call for co-financing science and research cooperation between the Republic of Slovenia and the French Republic, PROTEUS programme in 2017–2018	26. 2. 2016
Public call for co-financing science and research cooperation between the Republic of Slovenia and the People's Republic of China in 2017–2018	11. 3. 2016
Public call for co-financing work in international scientific associations in 2016	18. 3. 2016
Public call for co-financing science and research cooperation between the Republic of Slovenia and the Republic of Macedonia in 2017–2018	25. 4. 2016
Public call for co-financing activities related to the promotion of Slovenian science abroad in 2016	13. 5. 2016
Public call for co-financing science and research cooperation between the Republic of Slovenia and Hungary in 2017–2018	27. 5. 2016
Public call for co-financing science and research cooperation between Slovenia and Japan in 2017–2019	1. 7. 2016
Public call for co-financing science and research cooperation between the Republic of Slovenia and the Republic of Turkey in 2017–2019	15. 7. 2016
Public call for co-financing science and research cooperation between the Republic of Slovenia and Russian Federation in 2016–2018	15. 7. 2016
Public call for co-financing science and research cooperation between Slovenia and Federal Republic of Germany	7. 10. 2016
Public call for co-financing science and research cooperation between the Republic of Slovenia and the United States of America in 2017–2018	11. 11. 2016
Public call for co-financing customized research projects under the complementary scheme for tenders of the European Research Council (ERC)	18. 11. 2016
Public call for (co-)financing potential ERC candidates to visit ERC grantees in 2017	25. 11. 2016
Public call for co-financing the Slovenian part of joint Flemish-Slovenian research projects with the Flemish Research Foundation (Flanders, FWO) as Lead Agency	9. 12. 2016
Public call for co-financing science and research cooperation between the Republic of Slovenia and the French Alternative Energies and Atomic Energy Commission (CEA) in 2017–2019	9. 12. 2016



Excellent in science 2016

Every year, the Slovenian Research Agency organises presentations of research achievements selected within the Excellent in Science project.

Members of the Agency's Scientific Research Councils select achievements which are presented by the researchers in the form of brief popular lectures.

In 2016, the presentations of achievements took place for the fifth consecutive year. The Excellent in Science project was included in the series of events entitled the Month of Science and organised by the Ministry of Education, Science and Sport.

These events were organised by the Agency in cooperation with the Faculty of Computer and Information Science of the University of Maribor, University of Nova Gorica and the Slovenian Academic Society for Science and Engineering (SATENA) which included individual events in its popular science lectures programme called Science on the Street. Prior to the presentations, the Agency gave the authors of achievements the possibility to attend the media skills workshop held by Igor E. Bergant and Jadranka Jezeršek Turnes.

All Excellent in Science events are open to the public and supported by the Videolectures.net portal.

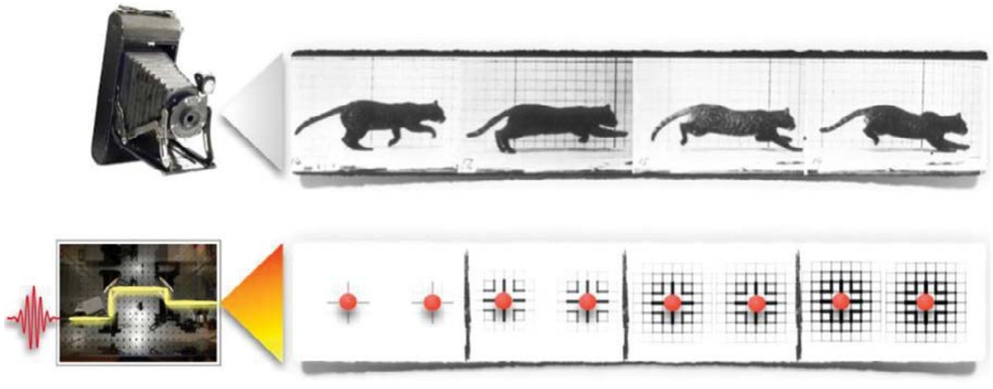
Direct observation of electron dynamics

Essential progress in the understanding of microscopic mechanisms of superconductivity

An important goal of contemporary research in physics is to follow extremely fast quantum dynamic processes in real time. It takes only about one femtosecond for an electron to travel one lattice site in a crystal.

Because electrons are strongly correlated in high-temperature superconductors, we expect an exceptionally fast transfer of information between charge carriers. After excitation with a short laser pulse there is a rapid increase in the energy of a charge carrier, followed by a relaxation process during which the excess energy is distributed among neighboring charge carriers as well as other bosonic degrees of freedom. Study of the above mentioned processes involves solution of extremely complex many-particle quantum problems. We have shown that the energy transfer between an excited charge particle and local spin degrees of freedom can be extremely fast, much faster than in conventional superconducting materials. Our results thus represent an important contribution to the understanding of the theory of high-temperature superconductivity.

Prof. dr. Janez Bonča, Faculty of mathematics and physics. University of Ljubljana, "Jožef Stefan Institute" janez.bonca@fmf.uni-lj.si



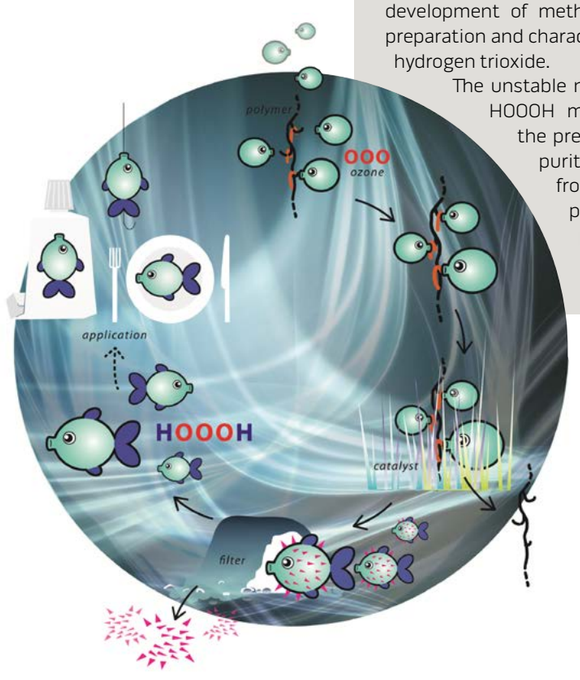
Source: S. Dal Conte, L. Vidmar, D. Golež, M. Mierzejewski, G. Soavi, S. Peli, F. Banfi, G. Ferrini, R. Comin, B.M. Ludbrook, L. Chauviere, N.D. Zhigadlo, H. Eisaki, M. Greven, S. Lupi, A. Damascelli, D. Brida, M. Capone, J. Bonča, G. Cerullo, C. Giannetti. Snapshots of the retarded interaction of charge carriers with ultrafast fluctuations in cuprates, Nature Physics, Volume: 11, Pages:, 421–426, Year published:(2015).

A Simple and Efficient Preparation of High-Purity Hydrogen Trioxide (HOOOH)

Water (HOH) and hydrogen peroxide (HOOH) are the only known natural stable compounds consisting of the elements hydrogen and oxygen. The existence of a higher homolog, namely hydrogen trioxide (HOOOH) has been assumed for more than 100 years, but the first reliable reports of its existence date to the sixties of the last century. In the past two decades, research in this field has become more intensive, mainly due to the development of methods for the preparation and characterization of hydrogen trioxide.

The unstable nature of the HOOOH molecule and the presence of impurities resulting from different preparation procedures are major obstacles to a wider accessibility of this compound among the research community. Significant progress in this area is represented by a simple and efficient method for the preparation of pure solutions of hydrogen trioxide, which has been developed at the Faculty of Chemistry and Chemical Technology, University of Ljubljana. Scientists assume that the HOOOH molecule is one of the key intermediates involved in biochemical oxidation processes (atherosclerosis, cancer, and neurodegenerative diseases), as well as in chain processes in the environment and atmosphere.

The method has been published in the prestigious journal Angewandte Chemie and has received a special compliment from the editor for excellent reviews. The contribution was ranked in the highest category (Hot Paper) and featured on the last page of the journal.



Prof. dr. Janez Cerkovnik, Faculty of Chemistry and Chemical Technology, University of Ljubljana
janez.cerkovnik@fkkt.uni-lj.si

Source: Strle Gregor, Cerkovnik Janez, Angew. Chem. Int. Ed. 2015, 54, 9917-9920. A Simple and Efficient Preparation of High-Purity Hydrogen Trioxide (HOOOH).

Fascinating four-stranded DNA structures in Human Papillomaviruses

Deoxyribonucleic acid (DNA) is the carrier of hereditary information in humans and almost all other organisms. The information in DNA is stored as a code made up of four nucleobases: adenine (A), guanine (G), cytosine (C), and thymine (T). DNA contains genes that code for proteins and sections that exhibit regulatory roles. In cells DNA typically adopts the form of a double helix. However, guanine-rich sequences adopt alternative four-stranded DNA structures called G-quadruplexes. These can be formed in telomeric sequences, in regulatory regions, and in the genomes of viruses. Human papillomaviruses (HPV) are pathogens that cause head, neck and skin cancer as well as cancer in anogenital regions of the body. We have identified areas within the genomes of certain HPV types that exhibit potential for the formation of G-quadruplexes which could serve as targets for the control of transcription and replication of HPV. Our structural studies with the use of Nuclear Magnetic Resonance (NMR) have demonstrated that changes in the orientation of G-rich sequences have a substantial impact on the polymorphic nature of the resulting G-quadruplexes and their potential physiological roles.

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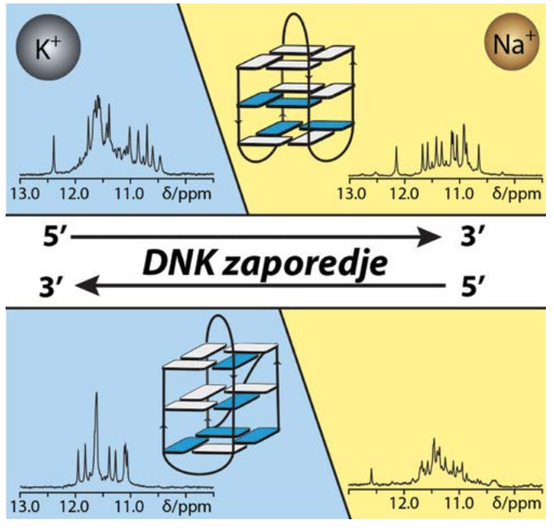


Source: Marušič, M.; Plavec, J.; The Effect of DNA Sequence Directionality on G-Quadruplex Folding; Angew. Chem. Int. Ed. 2015, 54, 11716-11719.

Using vibrational signals to control insect pests

Knowledge of vibrational communication by insects, one of the most widespread modalities in this animal group, has in recent years progressed to an extent which enables the first serious ideas about using this knowledge in applied scenarios, specifically for pest control. However, its potential is still underemphasized.

Our research on the American grapevine leafhopper (Scaphoideus titanus), the vector of a dangerous grapevine disease, illustrates a path from basic research of an insect species' biology, which with the help of modern technology, enables the development of an alternative pest control technique. This innovative approach on the basis of disruptive vibrational signals is still in the field research stage, but has already attracted the attention of professional and wider pulications. This is reflected by the fact that the Pest Management Science journal editor invited us to contribute a review paper on this topic. In the paper, we described the theoretical background and existing research by our and other laboratories.

Dr. Jernej Polajnar, National Institute of Biology jernej.polajnar@nib.si

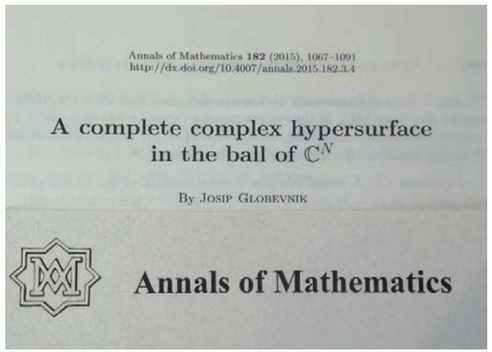
Research findings of studies in vibrational communication of insects open up possibilities in terms of developing alternative pest control methods.

Source: Polajnar J., Eriksson A., Lucchi A., Anfora G., Virant-Doberlet M., Mazzoni V. (2015): Manipulating behaviour with substrate-borne vibrations – potential for insect pest control. Pest Management Science 71(1): 15–23. DOI: 10.1002/ps.3848

Complete complex surfaces in the ball

A surface in the ball attached to the boundary of the ball is called complete if a point, travelling along the surface with constant speed, never reaches the boundary. It is not difficult to construct such a surface. The problem becomes difficult if we replace the usual (real) numbers with complex numbers, with the plane of complex numbers, and want to construct a complete complex surface in the ball of complex multi-dimensional space, i.e. such that the surface near each of its points looks like a piece of the complex plane. In the article "A complete complex hypersurface in the ball of C^N", published in a prestigious journal Annals of Mathematics, 182 (2015) 1067-1091, such a surface of maximal possible dimension in the ball is constructed, which solves the problem of existence of such surfaces, posed in 1977.

Prof. dr. Josip Globevnik, Faculty of Mathematics and Physics, University of Ljubljana and Institute of Mathematics, Physics and Mechanics, Ljubljana
josip.globevnik@fmf.uni-lj.si



Source:J. Globevnik, A complete complex hypersurface in the ball of C^N, Ann. of Math. 182 (2015) 1067-1091

Proteomic identification of cysteine cathepsin substrates on the surface of cancer cells

Proteases are enzymes that cleave the peptide bond and play an important role in extracellular signaling, and transformation of the extracellular matrix. Through peptide bond cleavage they can activate, inactivate or otherwise affect the functionality of membrane protein domains located on the cell surface. Cysteine cathepsins are a group of proteases known to be secreted to the extracellular space of the tumor microenvironment where they influence the processes of cancer development. However, little is known about their function at the molecular level. Our research used mass spectrometry to perform global identification of extracellular membrane substrates of cathepsins on the surface of five different types of cancer cells. We found that cathepsins cleave two specific groups of adhesion proteins and cell receptors, through which they can influence the signaling and invasiveness of cancer cells. With this discovery, we first demonstrated the potential physiological mechanisms which could explain the impact of cathepsins in tumor development.

Prof. dr. Marko Fonović, "Jožef Stefan Institut" marko.fonovic@ijs.si

Use of mass spectrometry for identification of extracellular substrate on the surface of cancer cells

Source: SOBOTIČ, Barbara, VIZOVIŠEK, Matej, VIDMAR, Robert, VAN DAMME, Petra, GOCHEVA, Vasilena, JOYCE, Johanna A., GEVAERT, Kris, TURK, Vito, TURK, Boris, FONOVIĆ, Marko. Proteomic identification of cysteine cathepsin substrates shed from the surface of cancer cell. Molecular & cellular proteomics, ISSN 1535-9476, 2015, vol. 14, no. 8, str. 2213-2228

How does water circulate?

In nature, water is constantly circulated. The proces of circulation can be described as a water cycle, powered by solar energy. There are numerous components of the water cycle, from atmospheric water and surface waters, to groundwater, all components are interconnected in a complex interaction. In science, but even more so in everyday practice, we are interested in where the water that feeds water sources comes from. Only a good understanding of its path will allow for adequate protection. Effective tracers for the determination of paths through the water cycle are stable isotopes, which form a molecule of water. With them, we have analyzed the origins of precipitation and constructed a mathematical model, which connects understanding of the isotopic composition of water in rainfall and the state of the atmosphere.

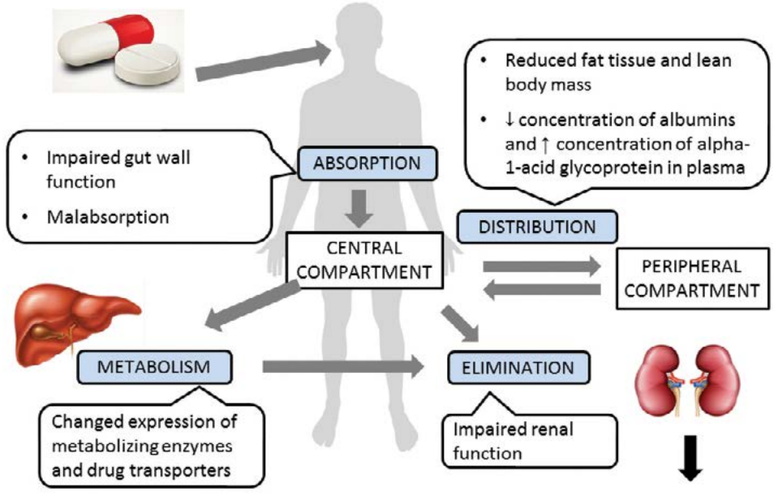
Assoc. prof. dr. Mihael Brenčič, Natural Sciences and Engineering Faculty, University of Ljubljana
mihael.brencic@ntf.uni-lj.si

Source: Brenčič, Mihael, Kononova, Nina Konstantinovna, Vreča Polona, 2015: Relation between isotopic composition of precipitation and atmospheric circulation patterns. Journal of Hydrology 529, 1422–1432

Does body wasting influence drug pharmacokinetics?

Cachexia is a syndrome of involuntary weight loss due to lean and fat tissue wasting. It is commonly associated with a number of chronic diseases, such as cancer, chronic heart failure, chronic obstructive pulmonary disease, etc. Body composition and the functions of many organs can be significantly changed in patients with cachexia, which can influence drug pharmacokinetics. In a rat model we investigated how cancer cachexia modifies liver metabolism and renal elimination of drugs. Compared to healthy animals both processes increased only insignificantly with tumor development. After development of cachexia, hepatic drug metabolism declined significantly (more than 80%) while renal elimination declined by 30% of the baseline value. In clinical practice, patients with cachexia could have greater fluctuations and higher maximal plasma concentrations of drugs, both increasing the risk of side effects, especially in drugs with a narrow therapeutic index.

Izr. prof. dr. Mojca Kerec Kos; Faculty of Pharmacy, University of Ljubljana
mojca.kerec-kos@ffa.uni-lj.si



Changes in pharmakinetics of active substances in cachexia.

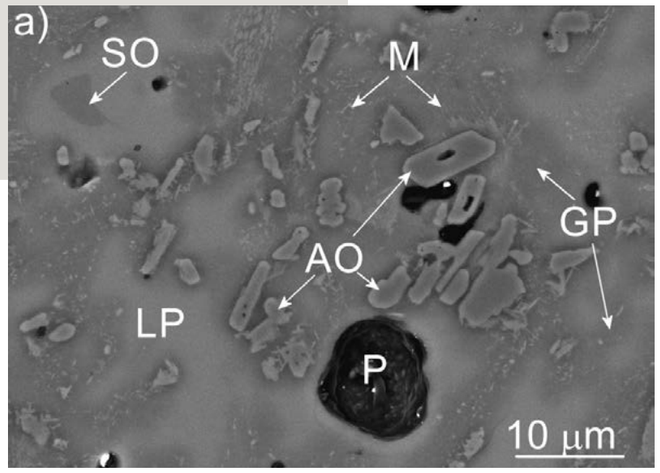
Source: ČVAN TROBEC, Katja, KEREC KOS, Mojca, TRONTELJ, Jurij, GRABNAR, Iztok, TSCHIRNER, Anika, PALUS, Sandra, ANKER, Stefan D., SPRINGER, Jochen, LAINŠČAK, Mitja. Influence of cancer cachexia on drug liver metabolism and renal elimination in rats. Journal of Cachexia, Sarcopenia and Muscle, 2015, 6 (1): 45-52.

Engineering sciences

Development of cordierite ceramics with a stable and low linear thermal expansion coefficient

Together with colleagues from the ETI Elektroelement d.d. company in Izlake, Slovenia, researchers of the P2-0105 programme group developed a non-porous cordierite ceramic, type C410, with controlled thermal and mechanical properties, then transferred the development process to production. Cordierite materials have a low linear thermal expansion coefficient and are used in production of components which are exposed to rapid changes in temperature. The cordierite ceramic with a low and reproducible thermal expansion coefficient in combination with excellent mechanical properties was manufactured by a designed use of natural and synthetic reagents. The invention was protected by a patent application.

Prof. dr. Barbara Malič, "Jožef Stefan Institute" barbara.malic@ijs.si



Microstructure of a cordierite ceramic after heating at 1300oC. GP-cordierite, LP-glassy phase, AO-aluminium oxide, M-mullite, SO-silicon oxide, P-pore

Fault detection in electrical drives by modified operation of the power supply converter

Electrical drives are becoming increasingly complicated due to increasing demands on reliable operation. Faults in electrical drives may arise within machines, in sensors, and in control electronics, but mostly occur in power supply converter circuits.
Members of the research programme have developed a method for very fast (few milliseconds) detection of faults in power converters. Unlike other more complicated methods, the proposed procedure runs in real time on already existing electronic control devices, without any additional hardware. Hence, it can also be applied to low cost drives. At the same time, a control approach was develped that enables almost uninterrupted operation of the drive immediately after the fault has been detected. The accomplishment has been presented in a high ranking journal within its area.

Prof. dr. Vanja Ambrožič, The Faculty of Electrical Engineering, University of Ljubljana
vanjaa@fe.uni-lj.si

Source: KONTARČEK A., BAJEC P., NEMEC M., AMBROŽIČ V, NEDELJKOVIĆ D. Cost-effective threephase PMSM drive tolerant to open-phase fault. IEEE trans. on ind. electr., Nov. 2015, vol. 62, no. 11, str. 6708-6718

Seismic resistance of buildings and civil engineering structures

The consequences of the earthquake in Italy, 2016

The research group at the Faculty of Civil and Geodetic Engineering at the University of Ljubljana has for many years been engaged in research in the field of seismic resistance of buildings and civil engineering structures. One of the recognitions for the results achieved is the Zois Award for lifetime achievements, which was won by the group leader. The ultimate goal of this basic research is to develop methods of analysis which can be easily used in practice, but nevertheless yield appropriately accurate results. The most important result is the so-called N2 method, which reliably simulates the behaviour of building structures during strong earthquakes. The method represents a combination of a nonlinear static analysis of the modelled structure and a dynamic analysis of a simplified model using inelastic response spectra. The method is included in the European standard for earthquake-resistant construction Eurocode 8.

Prof. dr. Peter Fajfar, Faculty of Civil and Geodetic Engineering, University of Ljubljana
peter.fajfar@fgg.uni-lj.si

Source: Fardis, Michael N., Carvalho, Eduardo C., Fajfar, Peter, 1943- Pecker, Alain. Seismic design of concrete buildings to Eurocode 8. Boca Raton : Crc Press : Taylor and Francis Group, cop. 2015. COBBIS ID: 6993505.

The serial hybrid aircraft concept currently represents the best compromise yet between the efficiency and reach of light aircraft, as it enables the aircraft to fly longer distances with lower noise emissions and in a more environmentally-friendly manner. Despite the powertrain's complexity, flying the aircraft will be a simple and user-friendly experience.

Hybrid powertrain for ultralight aircraft: Project FP7 Hypstair

In cooperation with Siemens AG, MBVision, the University of Pisa and the University of Maribor (Faculty of Electrical Engineering and Computer Science and Faculty of Civil Engineering, Transportation Engineering and Architecture), Pipistrel d.o.o. achieved a breakthrough in the field of electric-powered air travel at the beginning of 2016 – powering-up the most powerful hybrid electric powertrain for aviation to date. All of the powertrain components, which were developed by Siemens, represent cutting-edge technology in aviation propulsion. The drive motor (delivering 200 kW take-off power and 150 kW continuous power) and the generator (delivering 100 kW) feature a power density exceeding 5 kW per kg, as well as two dual windings connected by four power controllers to provide unprecedented reliability. An additional element in this unique innovative achievement is its user interface, which is designed to simplify the operation of the complex powertrain. The University of Maribor carried out pioneering work on the haptic feedback response for the user interface (HMI), enabling the pilot to apply power with a single lever and to identify any errors in or changes to the system.

Prof. dr. Miro Milanovič, The Faculty of Electrical Engineering and Computer Science University of Maribor miro.milanovic@um.si

The haptic interface for the aircraft's propulsion lever helps the pilot communicate more easily with the powertrain.

Source: http://www.hypstair.eu/tag/hypstairproject/

TransGen: A tool for identifying reconstruction potential to reduce energy consumption, costs and emissions

TransGen is a software tool aimed at identifying feasible and optimal possibilities to reduce energy consumption in companies. It also enables the identification of possibilities to integrate energy outside the company (e.g. for the district heating of buildings). This software tool has a general format and can be applied to any company with a potential to reduce energy consumption. TransGen allows for the identification of possibilities to improve energy efficiency for companies in fixed or variable operating conditions, taking into account the investment and energy costs. It enables the identification of a certain number of the most optimal modifications, all profitable modifications, modifications depending on the expected size of investment or the desired period of return on investment etc. Furthermore, it provides for an easy exclusion of modifications not feasible in practice in order to make the identified possibilities to improve energy efficiency realistically attainable. This tool has proved to be promising in the case of a medium-sized and relatively complex company. In addition to the identification of reconstruction potential, TransGen also enables the synthesis of heat exchanger networks of new processes and of entire areas with optimal energy consumption.

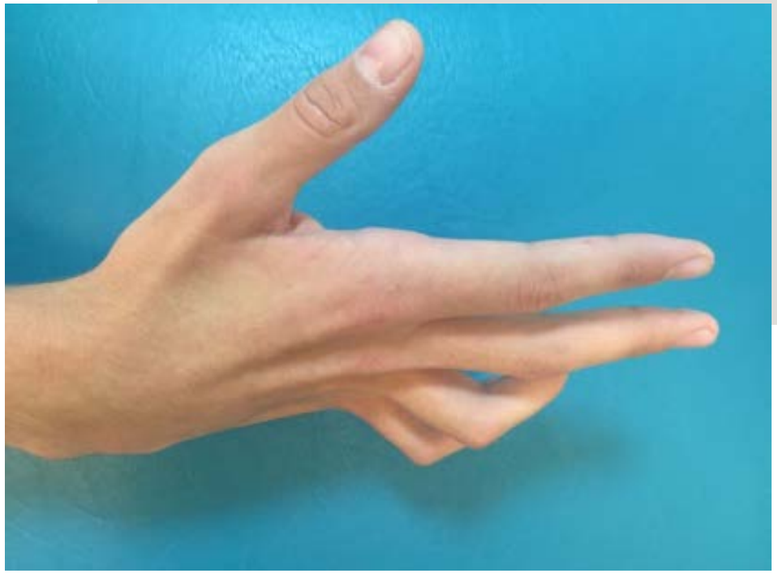
Prof. dr. Zdravko Kravanja, Assis. Prof. dr. Lidija Čuček, Faculty of Chemistry and Chemical Engineering, University of Maribor
zdravko.kravanja@um.si, lidija.cucek@um.si

Source: L. Čuček, Z. Kravanja, 2016, Retrofit of Total Site Heat Exchanger Networks by Mathematical Programming Approach. V: M. Martín (urednik). Alternative Energy Sources and Technologies: Process Design and Operation. Cham, Švica: Springer International Publishing; strani 297-340.

Medical Sciences

Study of ulnar neuropathy at the elbow

Ulnar neuropathy at the elbow (UNE) is the second most common focal neuropathy. It affects at least 500 Slovenians and 125,000 Europeans every year. It causes pain, tingling, numbness, hand muscle atrophy and weakness. Before the publication of our results the etiology of UNE was not known, and as a consequence therapy was chosen according to physicians' subjective preferences. Our prospective blinded study, included 220 UNE patients and 49 healthy controls. We determined normative values for neurophysiological and ultrasonographic parameters, their sensitivity and specificity, as well as ability of these two methods to precisely localize the lesion. We found that UNE actually consists of two focal neuropathies. The first is an entrapment neuropathy caused by decades of hard manual work that requires immediate surgical release. The second is caused by extrinsic compression of the nerve in the non-dominant arm. Most often this occurs by laying the arm on the desk while using a computer mouse with the dominant hand. In such patients only recommendation of appropriate arm positioning is needed. We expect that our findings will help to improve selection of treatment and long-term consequences of UNE.



Hand affected by the ulnar neuropathy at the elbow (UNE)

Prof. dr. Simon Podnar and
assist. Gregor Omejec
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gregor.omejec@kclj.si

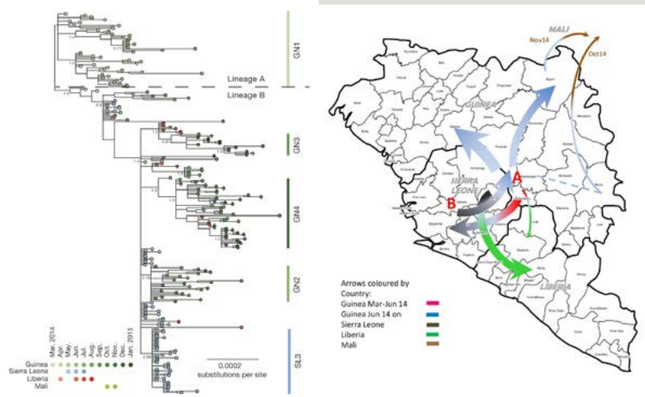
Source: Omejec G., Podnar S. What causes ulnar neuropathy at the elbow? Clin Neurophysiol. 2016 Jan;127(1):919-24. doi: 10.1016/j.clinph.2015.05.027. Epub 2015 Jun

The Ebola virus epidemic (2014–2015) in West Africa started with the death of a 2-year old boy infected by contact with an infected fruit-eating bat.

Temporal and spatial analysis of the 2014–2015 Ebola virus outbreak in West Africa

The Ebola virus has claimed the lives of over 11,000 people during the epidemic in West Africa. The origin of the virus is thought to have been a zoonotic transmission from a bat to a two year-old boy in December 2013. From this index case the virus was spread by human-to-human contact throughout Guinea, Sierra Leone and Liberia. However, the origin of the particular virus in each country and time of transmission was not known and concerns have been expressed that the virus might be adapting to humans and become more easily transmissible. Deep sequencing of 179 patient samples, published in the journal Nature, revealed the epidemiological and evolutionary history of the epidemic from March 2014 to January 2015. The genetic fingerprint of each isolate was defined and compared using mathematical modelling that confirmed the virus was introduced into the human population at a single source. From an initial lineage A linked to early Guinean cases, a second lineage B emerged in May/June 2014. As the epidemic expanded, lineage A was successfully confined in Guinea during the initial 4 months after the outbreak, but lineage B spread further into Guinea, Liberia and Sierra Leone. Data from the study together with epidemiological information are useful for retrospective testing of the effectiveness of control measures, and provide an unprecedented window into the evolution of an ongoing viral outbreak. The data also indicate that the Ebola virus has mutated at a lower rate than feared during the recent outbreak, giving hope that new diagnostic methods, treatments and vaccines under development should still be effective in the fight to eradicate the disease.

Phylogenetic relatedness and nucleotide sequence divergence of EBOV isolates from the 2013–2015 outbreak.



Prof. dr. Tatjana Avšič Županc, dr. Miša Korva,
Faculty of Medicine University of Ljubljana
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misa.korva@mf.uni-lj.si

Source: CARROLL, Miles W., MATTHEWS, David A., HISCOX, Julian A., ELMORE, Michael J., POLLAKIS, Georgios, RAMBAUT, Andrew, KORVA, Miša, AVŠIČ-ŽUPANC, Tatjana, et al. Temporal and spatial analysis of the 2014-2015 Ebola virus outbreak in West Africa. Nature, ISSN 0028-0836., 6. avg. 2015, vol. 524, iss. 7563, str. 97–101, doi: 10.1038/nature14594.

Electroporation as a technological platform

Observation of a bacterial culture after electroporation

Electroporation is a phenomenon in which increased permeability of a cellular membrane occurs when the cell is exposed to an electric field of sufficient strength. Electroporation can be performed on eukaryotic, prokaryotic or archaeal cells, and on unicellular or multicellular organisms (tissues). Increased permeability of the cell membrane is transient and non-selective, i.e. molecules can be driven into or out of the cell. The latter class of application – extraction of molecules by means of electroporation – is of special interest in biotechnological processes, where bacteria, yeasts and microalgae may be used as bioreactors. Furthermore, electroporation of tissue changes the diffusion of water and water-soluble molecules, allowing for more successful and effective biomass processing.

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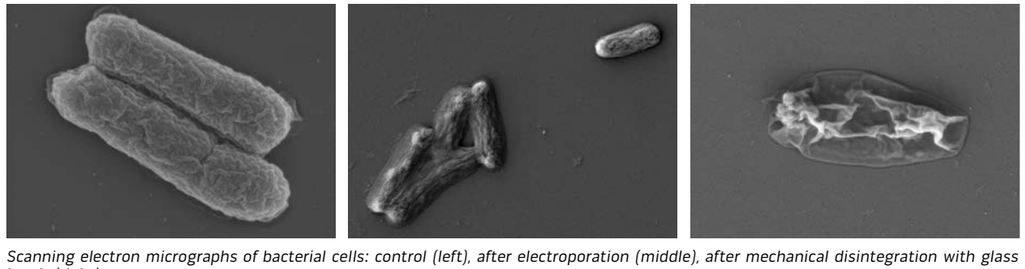
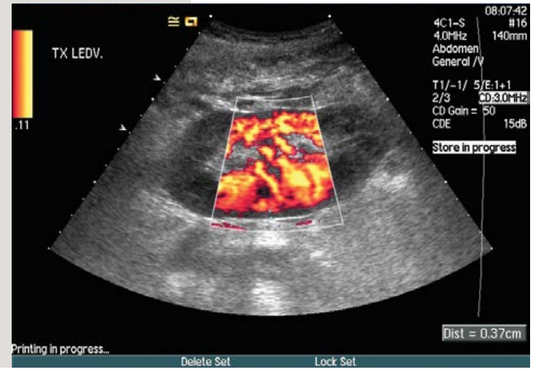


Scanning electron micrographs of bacterial cells: control (left), after electroporation (middle), after mechanical disintegration with glass beads (right).

Source: Kotnik T, Frey W, Sack M, Haberl Meglič S, Peterka M, Miklavčič D. Electroporation-based applications in biotechnology. Trends Biotechnol. 33: 480-488, 2015

Overcomming challenges in contemporary kidney transplantation

Kidney transplantation is the best replacement treatment for end-stage renal failure. One of the major challenges of contemporary kidney transplantation is suboptimal long-term graft survival. In an observational study of 319 recipients with kidney grafts from deceased donors, we have found that decrease in first year kidney graft size (from 1 month to 1 year after transplantation) predicted inferior outcomes as compared to increase in graft size in the same period. By means of a simple, non-invasive Doppler-ultrasonography examination during the early post-transplant period, we can detect patients with an increased risk of shorter long-term survival of the transplanted kidney. With additional diagnostics the cause can be detected and treated.



Doppler ultrasonography of the transplanted kidney (white arrow – bipolar kidney length).

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Source: ČERNE, Senka, ARNOL, Miha, KANDUS, Aljoša, BUTUROVIĆ-PONIKVAR, Jadranka. Decrease in first year kidney graft size predicts inferior outcomes after deceased donor kidney transplantation. Transplantation, 2015; 100: 1759-1766 (online first 2015). [COBISS.SI-ID 2665388]

Effective programme for detection of familial hypercholesterolaemia in children to prevent early mortality and morbidity caused by cardiovascular diseases

In the developed world, familial hypercholesterolaemia is rarely detected early, however, in untreated young adults, the risks for early cardiovascular complications are up to 100 times more common compared to those who are unaffected. Most of these cases of early mortality and morbidity rates of people in their most active years of life can be prevented with early treatment. The most effective method for the early detection of familial hypercholesterolaemia is population screening. Currently, Slovenia is the only country in the world with a hypercholesterolemia screening programme for children at 5 years of age, performed in the context of a regular health check. The research group led by Tadej Battelino was the first to publish the findings on the effectiveness of the programme of population screening of children in detecting the patients with familial hypercholesterolaemia in the leading cardiology journal, the Journal of American College of Cardiology. A disease-causing genetic variant for familial hypercholesterolaemia was identified in 57% of total 272 children with a positive screening test, which means that in children born in 2008, assuming the familial hypercholesterolaemia incidence of 1 in 500, we detected practically all expected patients. This report has received a lot of attention from the international professional public and will feed into further expert recommendations on early detection of familial hypercholesterolaemia.

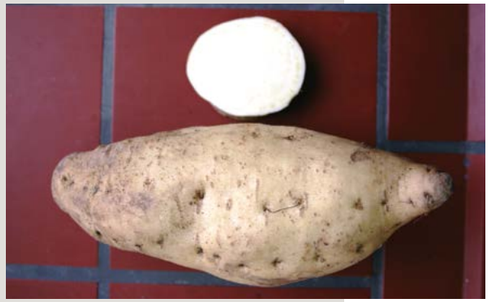
Prof. dr. Tadej Battelino, Division of Paediatrics, University Medical Centre Ljubljana, Faculty of Medicine, University of Ljubljana, tadej.battelino@mf.uni-lj.si

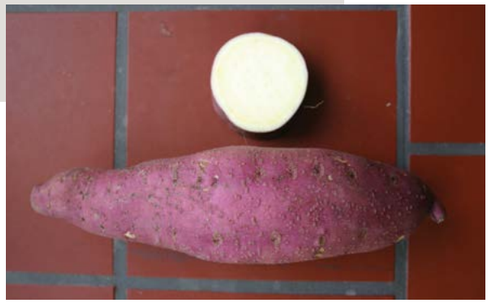
Source: KLANČAR, Gašper, GROŠELJ, Urh, KOVAČ, Jernej, BRATANIČ, Nevenka, BRATINA, Nataša, TREBUŠAK PODKRAJŠEK, Katarina, BATTELINO, Tadej. Universal screening for familial hypercholesterolemia in children. Journal of the American College of Cardiology, ISSN 0735-1097. [Print ed.], Sep. 2015, vol.

'Lučka', 'Janja' and 'Martina' – new varieties of the sweet potato

Increased self-sufficiency in food is one of the key goals of the Resolution on the Strategic Orientations of the Development of the Slovenian Agriculture and Food Industry before 2020. The changed structure of crop production, environmental protection, biodiversity conservation and climate change, require constant adaptation of the composition of species.

Farmers cannot avoid natural conditions as these cannot be prevented, but they do need to adjust to them. Therefore, new crops resistant to extreme weather conditions are needed. To this end, the Programme Group of Horticulture at the Department of Agriculture began to test the cultivation of (sub) tropical perennial crops - sweet potato (Ipomoea batatas L.). After several years of work, we have managed to grow three varieties: a variety with an orange peel and orange flesh ('Lučka'), one with white skin and white flesh ('Janja') and one with purple skin and white flesh ('Martina').





Sweet potato belongs to the morning glory family (Convolvulaceae) and so is not related to the potato (Solanum tuberosum L.). The tubers and young leaves of the plant are suitable for human consumption.

The tubers contain the polysaccharide inulin, belong among the foods with a low glycemic index (around 50), which are suitable for the nutrition of diabetics.

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Source: Registry number: IPB001, COBISS.SI-ID: 8112505//Registry number: IPB002 COBISS.SI-ID: 8112249

Construction of a New Class of Tetracycline Lead-Structure with Potent Antibacterial Activity Using Biosynthetic Engineering

In recent decades bacterial resistance development and the shortage of novel antibiotics has led to an urgent need for new antibacterial drug leads. The worldwide rising occurrence of multi-resistant pathogens currently presents one of the greatest challenges to modern health care. Researchers from Biotechnical faculty and biotechnology SME Acies Bio Ltd. (Ljubljana), which licensed the technology from the University of Ljubljana, have developed novel atypical tetracycline antibiotic carboxyamido-chelocardin by applying modern methods of biosynthetic engineering. Thereby they generated a broad-spectrum antibiotic lead structure exhibiting significantly improved activity against all Gram-negative pathogens of the ESKAPE panel, including Pseudomonas aeruginosa, which is causing heavy hospital infections such as sepsis and lung infections of the cistic fibrosis patients. The work on the development of this atypical tetracicline was published in high-impact journal Angewandte Chemie. University of Ljubljana filed international patent application in collaboration with Acies Bio Ltd. New tetracycline antibiotic is currently in preclinical evaluation in collaboration with Helmholtz Institute (Germany).

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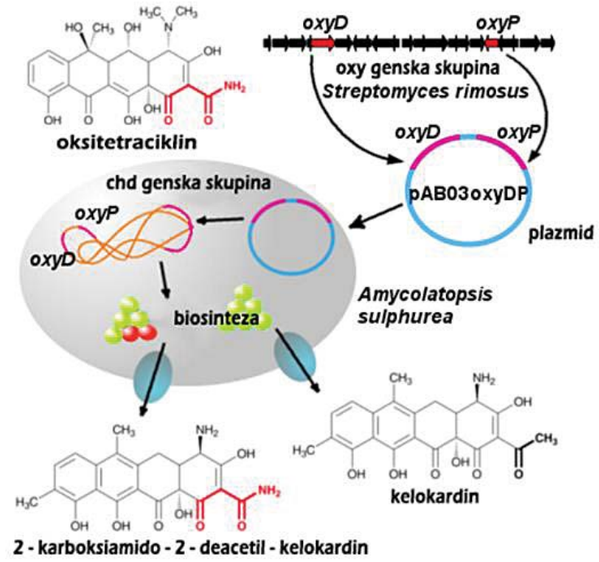
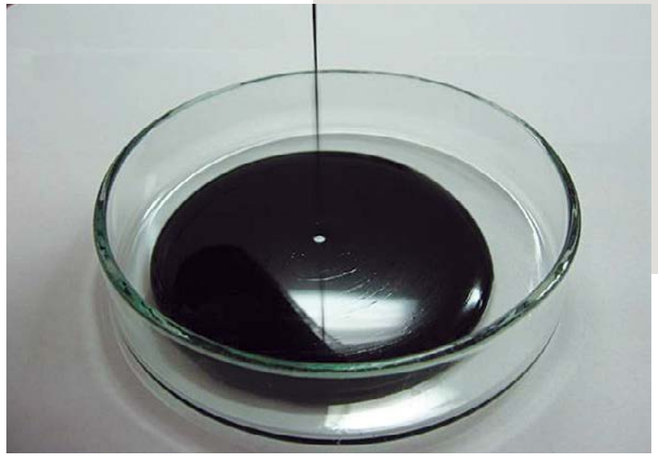


Source: Lešnik UI, Lukežič T, Podgoršek A, Horvat J, Polak T, Šala M, Jenko B, Harmrolfs K, Ocampo-Sosa A, Martínez-Martínez L, Herron PR, Fujs Š, Kosec G, Hunter IS, Müller R, Petković H.(2015) Construction of a new class of tetracycline leadstructure with potent antibacterial activity using biosynthetic engineering. Angew Chem Int Ed Engl. 23;54(13):3937-40. IF = 11,261

Hydrophobic polyurethane coating for protection of wood made from a natural renewable resource – wood

Environmental concerns have initiated extensive investigations of wood coatings made from sustainable and renewable resources. One such resource is wood that has been transformed into a liquid state by a simple chemical method. Liquefied wood is an excellent raw material for the preparation of polyurethane type coatings. Hydrophobicity of the bio-polyurethane wood finish was increased with the addition of a water repellent agent and silica nanoparticles. Mechanical properties of the coating and its resistance against ethanol were improved as well. Hydrophobicity is the consequence of the formation of a silane layer on the surface of a cured polyurethane film. Our investigation showed that the properties of bio-coatings are comparable to those of commercial wood finishing products made from non-renewable resources – oil derivatives.



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Source: Anuj Kumar, Marko Petrič, Borut Kričej, Jure Žigon, Jan Tywoniak, Petr Hajek, Andrijana Sever Škapin, and Matjaž Pavlič: Liquefied-Wood-Based Polyurethane–Nanosilica Hybrid Coatings and Hydrophobization by Self-Assembled Monolayers of Orthotrichlorosilane (OTS)

Mechanism of neurotoxic action of the ostreolysin A/pleurotolysin B pore-forming complex isolated from edible oyster mushrooms (Pleurotus ostreatus)

This work aimed to reveal the mechanisms responsible for respiratory arrest induced by cytolytic complex OlyA/PlyB (Ostreolysin), isolated from edible oyster mushrooms (Pleurotus ostreatus). Previous studies have demonstrated that at low concentrations Ostreolysin causes acute respiratory arrest in rats. Based on that two hypotheses were postulated: i) Ostreolysin produces swelling of neuroblastoma NG108-15 cells; and ii) Ostreolysin increases neuronal intracellular Ca2+ activity. Experiments were performed on differentiated neuronal cells using confocal microscopy and spectrofluorometry to reveal changes in morphology and intracellular Ca2+ activity, respectively. Ostreolysin affected the morphology of neuronal cells and increased the intracellular Ca2+ activity, which could lead to neuronal dysfunction and respiratory arrest. Using pharmacological tools, the possible mechanisms underlying this toxic action were described. These observations are important steps toward understanding the toxic respiratory effects of Ostreolysin.

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Source: Milka Vrecl, Monika Babnik, Uroš Diacci, Evelyne Benoit in Robert Frangež. Effect of the ostreolysin A/pleurotolysin B pore-forming complex on neuroblastoma cell morphology and intracellular Ca2+ activity. Toxicological sciences, 2015, vol. 144, no. 2, str. 276–283.

Predicting the nutritional niche of Prevotella spp. with bioinformatics.

There has been a radical improvement in the ability to study dense microbial consortia of the animal gut, owing to the advent of next generation sequencing in the past decade. While a multitude of studies essentially cataloged the microbial genera found,, studies focusing on the actual niche occupied by these microbes were scarce. Here we present a bioinformatic approach to predict the nutritional component of the niche occupied by species of the bacterial genus Prevotella, a numerically dominant genus in the rumen. According to our analyses Prevotella species are heterogeneous in their glycan degrading capabilities. This is probably the basis of their cohabitation in the rumen/large intestine and also explains their ability to colonize other habitats like the oral cavity.

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Source:Tomaž Accetto, Gorazd Avguštin, Systematic and applied microbiology :Polysaccharide utilization locus and CAZYme genome repertoires reveal diverse ecological adaptation of Prevotella species, 2015.

Social Sciences

A business model approach to supply chain management

The paper was published in a special issue of the top-ranked journal Supply Chain Management. We upgraded the paper on business process management from 2007, which provided researchers and practitioners with rationale for business process reengineering and substantially affected research on business process management. In the award-winning 2016 paper A business model approach to supply chain management, we placed emphasis on the importance of the development, evolution and co-existence of multiple business models within a supply chain. In addition we drew on the concept of knowledge sharing and dynamic capabilities theory to show how supply chains can reach a level of strategic flexibility and change their business model elements (partners, processes, customers, products, and employees) without knowing which changes will be required in the future. The paper developed two frameworks showing the elements of an SC business model to assist management supply chains in turbulent environments.

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Source: TRKMAN, Peter, BUDLER, Marko, GROZNIK, Aleš. A business model approach to supply chain management. Supply chain management, ISSN 1359-8546, 2015, vol. 20, iss. 6, str. 587-602, doi: 10.1108/SCM-06-2015-0219. [COBISS.SI-ID 22809574]

Two sides of the same coin? The role of rumination and reflection in elementary school teachers' classroom stress and burnout

Even when exposed to similar environmental stressors, teachers differ in their perceptions of classroom stress and burnout. In understanding teachers' strain, both environmental and individual characteristics, as well as their interactive effect have to be taken into account. The purpose of the study was to investigate the role of rumination and reflection in teachers' classroom stress and burnout, thereby assessing their predictive value per se, and their role as moderators between teacher-reported job characteristics,„stress and burnout. 439 elementary school teachers participated in the study. Dispositional characteristics explained additional variance in teachers' stress and burnout beyond job characteristics. Rumination was a significant predictor of both stress and burnout, whereas reflection was not. However, reflection moderated the relation between job characteristics and stress. Among others, the combination of high workload and high reflection predicted higher levels of stress. These results highlight the importance of simultaneously investigating environmental and dispositional characteristics of teachers' strain. In addition, they indicate that reflection and rumination function in a more similar way than predicted.

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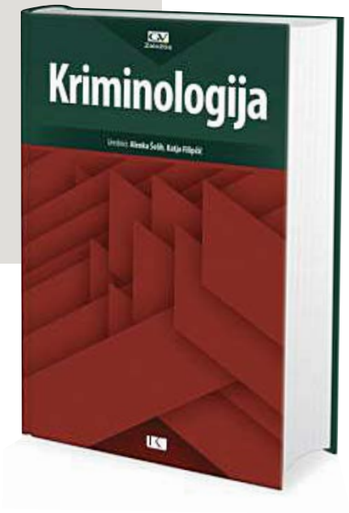
Source: KOŠIR, Katja, TEMENT, Sara, LICARDO, Marta, HABE, Katarina. Two sides of the same coin? : the role of rumination and reflection in elementary school teachers' classroom stress and burnout. Teaching and teacher education, ISSN 0742-051X. [Print ed.], 2015, vol. 47, str. 131-141, doi: 10.1016/j.tate.2015.01.006. [COBISS.SI-ID 21087240]

The slovenian system of criminology

Criminology is a systematic, complete and multifaceted presentation of criminological problems dealing with questions like the causes of crime, crime phenomenology. ways of reacting to crime problems in contemporary society, problems of crime prevention, and others. Crime is dealt with as an individual, as well as a social problem. The system of criminology has been written by Slovenian criminologists and other specialists from the field and is based upon the results of foreign research which have been compared with and assessed by domestic criminological research. The researchers of the Institute of Criminology at the Faculty of Law, University of Ljubljana, who represent the majority of authors of the volume, have thus joined those academic institutions that have produced in-depth, well documented and complete presentations of crime problems.



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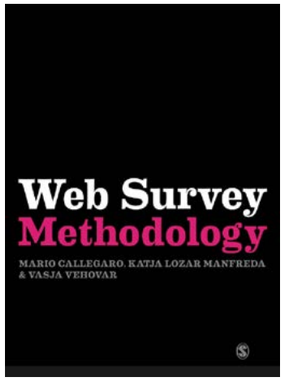
Source: KRIMINOLOGIJA/(authors Matjaž Ambrož... /et al./: Editors: Alenka Šelih, Katja Filipčič. Ljubljana; IUS Software. GV založba; Inštitut za kriminologijo pri Pravni fakulteti, 2015.COBIS. SI-ID 280033536



The profession and science of web surveys

The use of web surveys is crucial for research of voting behaviour, public opinion polls, business surveys, customer satisfaction surveys, online phenomena, etc. They have been introduced into these research areas over 15 years ago as a cheaper, faster and simpler data collection mode. Nevertheless, we now face several problems related to their usage: people are not always willing to respond, they have low trust in institutions and reservations about revealing personal data, oversurveying.... These issues make the survey research profession more difficult and require thoughtful and complex survey designs, including mixed-mode surveys, complex sampling designs, and sophisticated strategies for nonresponse conversion, as well as complex data editing and modelling. The methodology of web surveys is thus becoming a demanding scientific field that is not only a creative profession, but demands thoughtful scientific elaboration and knowledge from the fields of survey methodology, psychology, sociology, statistics, informatics and familiarity with current social contexts. The monography Web Survey Methodology systematically covers the whole process of a web survey project and offers considerations and solutions for the above mentioned salient issues.

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Source: Callegaro, Mario, Katja Lozar Manfreda in Vasja Vehovar. 2015. Web Survey Methodology. Los Angeles: Sage.

Humanities

19th century architecture in Slovenia

19th century architectural creativity has had a profound influence on the appearance of the Slovenian space. It took shape in the controversial era of the emerging modern nations, a period of rapid population growth and irrepressible optimism and faith in the power of science, which seemed to possess the final answers to the final questions. During this period, an unprecedented number of buildings were erected. New building types began to emerge alongside the traditional building types. Social, economic and political factors enabled the highly versatile architectural production of the 19th century to reach all fields of public and private life. Distancing from Baroque culture, the architecture resulted in new levels of development, as distinguished by its pervasive creative progress. However, the architectural achievements of this period have so far remained virtualy unknown. We wish to change this with an extensive research.

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Source: Igor Sapač, Franci Lazarini. Arhitektura 19. stoletja na Slovenskem. Ljubljana, 2015. COBISS.ID: 276146688

The Beka-Ocizla cave system: karstological railway planning in Slovenia

Once again the effort to develop comprehensive karstology that uses select approaches for getting to know and understand the uniform, three-dimensional karst landscape, has proved to be the best choice. Under specific research conditions we have been able to obtain a good understanding of the karst across which the railway will run. It is true that we could not precisely determine the locations of caves that will be opened up during construction and all the paths of the waters that shape and connect the karst, but we could clearly predict what is to be expected during construction and what this construction should be like. This will make the construction more successful; it will be possible to protect more of the newly-discovered karst phenomena, which are an important part of our natural heritage; moreover, the waters that are also important for the water supply will be protected more efficiently.

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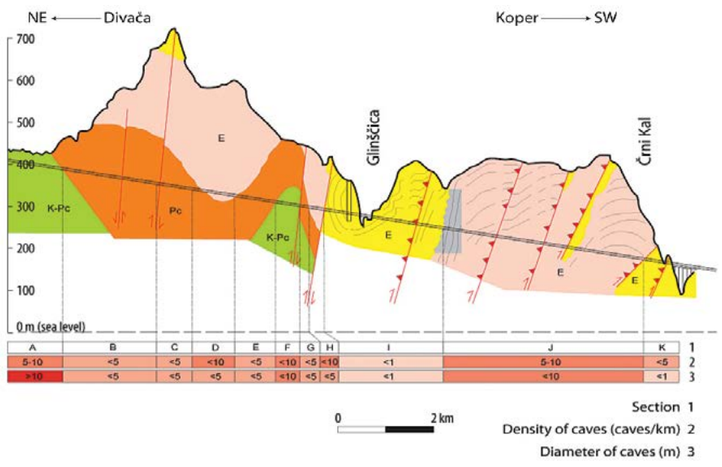

Source: The Beka-Ocizla cave system : karstological railway planning in Slovenia / co-authors Franci Gabrovšek [et al.] ; editors Martin Knez [et al.], editors Cham [etc.] : Springer, cop. 2015 (Alphen aan Den Rijn (Nizozemska) : Printforce)

History, Memory, Heritage

The Ljubljana music society "Glasbena matica" until the end of World War II (Založba ZRC, 2015)

The Ljubljana music society Glasbena matica (founded in 1872) has operated in the Slovenian territory during the time of fateful political developments as well as vital ideational and artistic currents. The society set the institutional foundations for all forms of musical work on the national level (the publishing house, the music school, the concert agency, the archives of musical works by Slovenian composers, the Folklore Institute) and ensured its professionalization by establishing the music conservatory. Glasbena matica is considered a paradigmatic example of a Slovenian cultural institution, as its activities co-shaped not only the musical but also the cultural and national (self-) image and identity of Slovenes.
The book History, Memory, Heritage is the first comprehensive and contemporary historiographical portrait of what was once the central and largest Slovenian musical and cultural society, and opens a new critical insight into the cultural and political history of the Slovenes up until World War II. By conducting a thorough examination of sources, and a critical analysis of prior knowledge, the author presents an innovative interpretation that elucidates how the widely acknowledged Central European canon was introduced in the Slovenian territory and with what specific characteristics. It also describes the development of the notion of the peculiarities of Slovenian music, which drew on folk songs, as well as the formation of the attitude towards common lore and traditional awareness. In doing so, the author re-evaluates the progressive concept of Glasbena matica's cultural activities.

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First photo of the 'Glasbena matica' choir depicting its members that sang in the Vienna concerts in 1896.

Source: Cigoj Krstulović, Nataša . Zgodovina, spomin, dediščina: ljubljanska Glasbena matica do konca druge svetovne vojne. Ljubljana, 2015. COBISS.SI-ID: 279469312

Fran Dictionary Web Portal: Dictionaries of the Fran Ramovš Institute of the Slovenian Language ZRC SAZU

The Fran Dictionary Web Portal enables users to simultaneously search all essential linguistic reference works for the Slovenian language. The portal contains 31 dictionaries and 2 dialect atlases with a total of 590,033 entries. It also consists of two counselling sites that answer users' questions about both general language and terminology, a subportal with descriptions of Slovenian grammar and orthography reference books and their scanned images, and a database with descriptions of problematic categories of the new orthography dictionary. Moreover, the portal is linked to all relevant Slovenian linguistic databases, especially corpora. The portal presents the knowledge of several generations of linguists with different expertise in a way that is accessible to the general user, while also facilitating the advanced searches of more ambitious users.
On one hand, the portal offers the totality of all the relevant works of the Slovenian lexicography and grammar-writting, and can be perceived as a great research achievement in the field of language technology. The Fran Portal is an approximation of the ideal of a virtual thesaurus integrating a large number of language reference works that complement one another in one virtual place, and for the first time in Slovenian history the language is simultaneously presented in its diastratic, diatopic and diachronic dimensions. The portal is not based on any existing language portal and is one of the largest originally created portals in Europe and worldwide.

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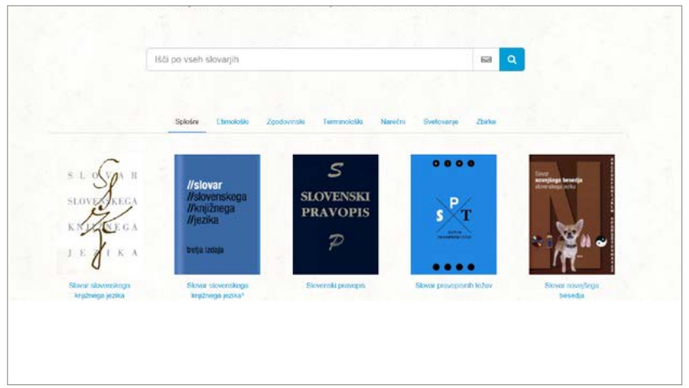

The portal is edited by the editorial board (dr. Helena Dobrovoljc, dr. Nina Ledinek, dr. Andrej Perdih, Alenka Porenta, dr. Marko Snoj, dr. Peter Weiss, dr. Mojca Žagar Karer) under the guidance of dr. Kozma Ahačič.

Source: http://www.fran.si/

ZBORZBIRK – Cultural Heritage in the Collections between the Alps and Karst

The international ZBORZBIRK project aimed to evaluate (identify, register, digitalize, contextualize, arrange, present, and promote) local cultural heritage collections on the Slovenian-Italian border area, from Canale to the Natisone Valley in Italy, and from the Upper Sava Valley to Brda in Slovenia. We registered thirty-four cultural heritage collections, implemented five investments, arranged equipment for the presentation of twelve collections, established eleven info-points, published different scientific, expert and promotional publications (a guidebook, a collection of scientific papers, CDs, leaflets, promotional roll-ups and posters), established a website enabling access to the digital repository and gathered material, and organized more than twenty events for experts and the general public. The network of collections and info-points is a potential for development of cultural tourism. Collaboration among experts of different disciplines (ethnology, folklore studies, linguistics, digital humanities, and museology) with representatives of local communities enabled the transfer of research findings into practice.

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Dr. Špela Ledinek Lozej: spela.ledinek@zrc-sazu.si

Gornjesavski Museum Jesenice, photo: Špela Ledinek Lozej, 2013

Source: http://zborzbirk.zrc-sazu.si/sl-si/domov.aspx

arrs
SLOVENIAN RESEARCH AGENCY

	Slovenian Research Agency
Abbreviated name:	ARRS
Year of foundation:	2004
Core activity:	Performance of professional, development and executive tasks relating to the implementation of the Resolution on Research and Innovation Strategy of Slovenia 2011-2020 and other tasks with statutory duties in public interest in order to ensure permanent, professional and independent decision-making on the selection of programmes and projects financed from the national budget.
Internal organisational units:	Director's Office Department of Research Projects Department of research Programmes, Young Researchers and Analysis Department of Research Infrastructure and International Cooperation Department of General Affairs Department of Finance and Accounting Department of Information Technology
Number of employees:	47
Funds received from the national budget for scientific-research activities in the 2016 financial year:	EUR 144.6 million
Basic documents:	Research and Development Act (Official Gazette of the Republic of Slovenia, nos. 22/06 – official consolidated text, 61/06 – ZDru-1, 112/07, 9/11 in 57/12-ZPOP-1A) Decision establishing the Slovenian Research Agency (Official Gazette of the RS, nos. 123/09 and 105/10) Resolution on Research and Innovation Strategy of Slovenia 2011-2020 (Official Journal of the RS, no. 43/11)
Website:	www.arrs.gov.si/en