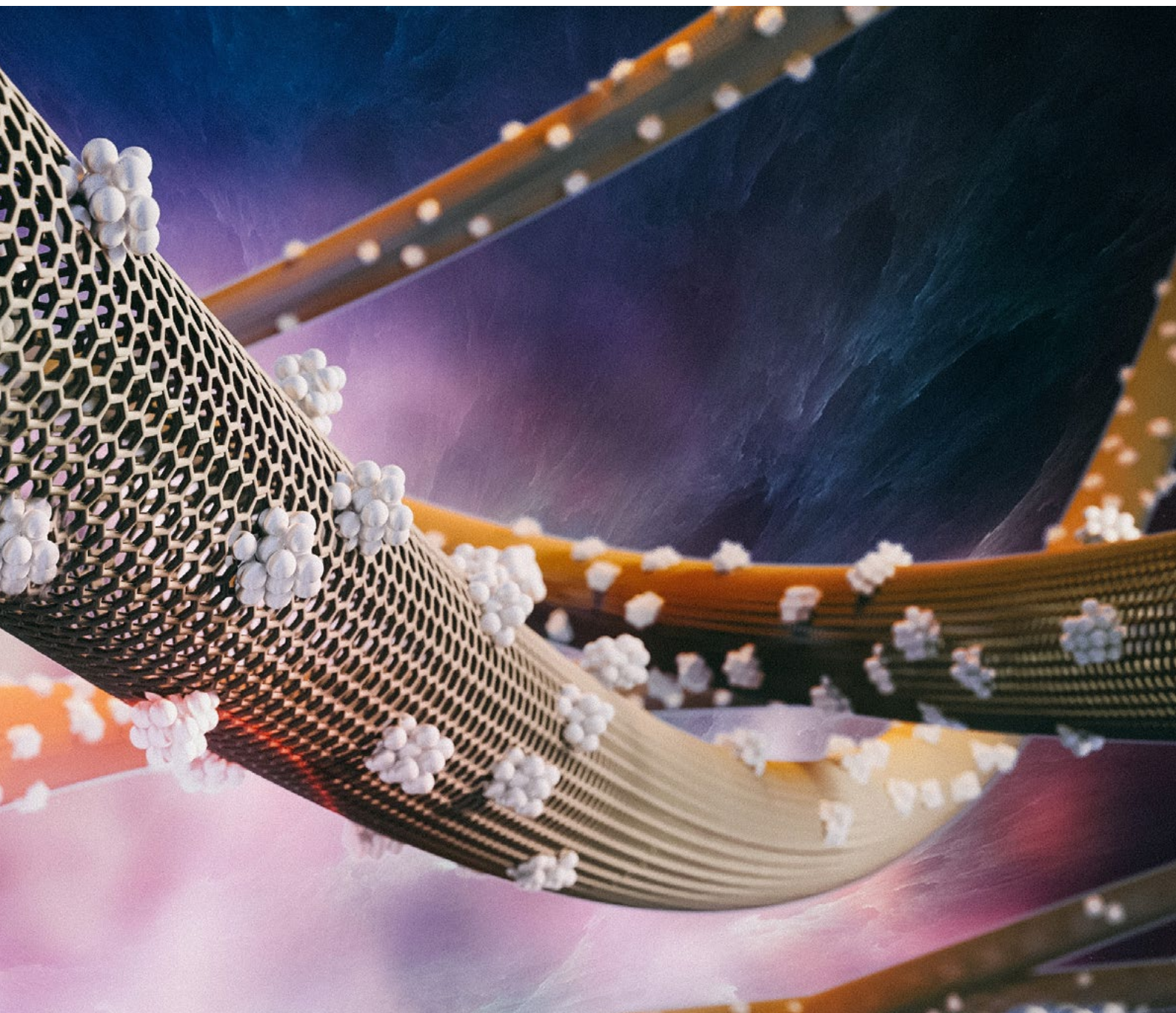


ANNUAL REPORT 2019



arrs
SLOVENIAN RESEARCH AGENCY

Introduction



In accordance with the decision issued by the Government of the Republic of Slovenia of 24 April 2020 I became the acting director of ARRS on 30 April 2020. In 2019, the Slovenian Research Agency was headed by prof. dr. József Györkös. More precisely, he acted as the director until 29 October 2019 when his five-year term of office expired, then as the acting director until 29 April 2020, so we summarize the operation of the Agency in 2019 by part of his introductory words from the Annual Report for 2019 which was adopted at its 3rd meeting by the Management Board of the Agency on 26 February 2020:

"The Slovenian Research Agency is a highly professional institution. If, at the end of the mandate, we allow ourselves to express our wishes for the Agency's future, we would definitely include, firstly, further growth of funds for research which was undoubtedly ensured by the competent ministry and the government, secondly, empowerment of the Agency not only in terms of statutory instruments but also in terms of sufficient number and quality of staff, and thirdly, introspectively, even greater

precision, commitment, initiative and responsibility of all employees in the Agency. Only in this way it will be possible to further exercise the Agency's slogan, 'Supporting excellence'.«

ARRS carries out its mission in collaboration with 49 colleagues and 90 members of permanent expert bodies. Compared to our counterparts in other European countries, we experience substantial human resource constraints. Together with our colleagues we are currently focused on solving the Agency's problems regarding the insufficient number of staff. This issue has a long history and the Agency's bodies have long been pointing out the aggravation of the problem of staff shortages. This has been confirmed also by the results of the risk analysis that was carried out before my term at the Agency. I believe that together with the Ministry of Education, Science and Sport we will succeed in solving this problem in the future.

Prof. dr. Blaž Zmazek,
acting director

The ARRS Scientific Council will continue with the changes that will pave the way for achieving scientific excellence on a global level

Every process requires time and energy. This also applies to processes in science and to the direction of scientific policy. Nothing comes from nothing, and the road from the idea to its realisation is long and thorny, and the road to new scientific knowledge is complex, unpredictable and often risky. Stability of boundary conditions and the entire system is crucial in all of this.

The Slovenian Research Agency is the central pillar of Slovenian science funding, which is why the members of the ARRS Scientific Council continued to ensure stable processes with detailed and rigid boundary conditions also in 2019. The volume of budget funds for 2019 increased; unfortunately, no additional positions of employment were approved for the Agency. Reinforcement of personnel through the introduction of scientific editors thus remains at the level of a proposal and as a necessity that is reaping more and more support.

The vortex of activities and obligations of the entire Agency and the ARRS Scientific Council in 2019 was intended to provide comments and proposals for the revision of the Scientific Research and Innovation Activities Act and focused on the preparation of amendments to the Rules on procedures, which enabled the launching of a call for research projects with single-phase proce-

sure. This way, we eliminated the favouring of individual research programmes by directly entering the second phase. A great deal of energy was devoted to convincing about the deviation from quantitative criteria in the evaluation of scientific excellence. To increase the quality of reports and applications for calls, seminars for research programme principal investigators were introduced, with a surprisingly high turnout.

Despite the increased budget investments in science, the volume of the public co-financing of Slovenian science remains low and in the "tail" of EU members, which is unacceptable and harmful in the long term. Success and achievements of Slovenian science still aren't receiving enough attention in the media. We would like to point out the Excellent in Science and ARRS Day as examples of good practice and an opportunity to show to the general public what we know and can do, and also that Slovenian scientists, with their dedicated work, can compete with the best in many fields.

The ARRS Scientific Council will continue with the changes that will pave the way for achieving scientific excellence on a global level; that, however, will not be possible without the increase in investments and a critical mass of people and equipment. Investments in scientific re-



search activities need to increase dramatically, which we have been pointing out for several years. Knowledge is one of the key factors in promoting the competitiveness of the national economy, and increasing investments in knowledge and human development is essential for a knowledge-based society. Therefore, excellent basic and applied science is also the basis for the successful transfer of knowledge and personnel to the Slovenian economy and for raising its technological competence and competitiveness.

prof. dr. Marko Topič
President of the
ARRS Scientific Council

Annual report 2019

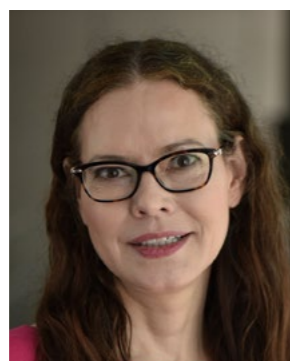
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Cover photo:

Carbon nanofibers with platinum nanoparticles (clusters of silver beads) used as a catalyst in low temperature fuel cells (author: Jaka Birsa).

Content

In the spotlight: Prof dr. Nejc Hodnik, Doc. dr. Matjaž Humar	10
News and events	18
Financing structure	22
Institutional financing	24
Research programmes	25
Infrastructural programmes and founder's obligations	26
Competitive financing	27
Research projects	28
Junior researchers	32
Scientific literature	34
International activities	35
The Agency's international cooperation – highlights	40
International comparisons	42
About the Agency	46
Excellent in Science 2019	54
Natural sciences	55
Engineering sciences	60
Medical sciences	64
Biotechnical sciences	66
Social sciences	70
Humanities	75
Interdisciplinary research	79



Dr. Jana Kolar
president
CERIC-ERIC

Management board

The Management Board directs and monitors the activities of the agency. It consists of seven members, nominated by the government for a period of five years. In its current position, the management Board has been operating since 2019. The term of current members ends in 2024.



Prof. dr. Egon Pelikan
vice president
Institute for Historical Studies,
Science and research centre
Koper



Dr. Emilija Stojmenova Duh
University of Ljubljana,
Faculty of Electrical
Engineering



Dr. Tonček Kregar
Museum of Recent History
Celje



Dr. Justina Erčulj
National School of
Leadership in Education
(retired)



Prof. dr. Janez Bonča
University of Ljubljana,
Faculty of Mathematics
and Physics



Prof. dr. Marta Klanjšek Gunde
National Institute of
Chemistry

Scientific Council

The Scientific Council is the Agency's highest professional and advisory body. It consists of six members, covering all the research studies within the Agency's classification. The term of current members ends in 2020.



Prof. Dr. Marko Topič
president
(engineering sciences)
University of Ljubljana,
Faculty of Electrical Engineering



Prof. Dr. Roman Jerala
(natural sciences)
National Institute of Chemistry



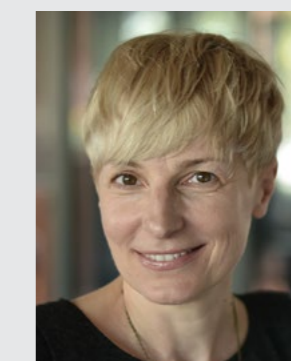
Prof. Dr. Nina Zidar
(medical sciences)
University of Ljubljana,
Faculty of Medicine



Prof. Dr. Tatjana Avšič Županc
(biotechnical sciences)
University of Ljubljana, F
aculty of Medicine



Prof. Dr. Mitja Žagar
(social sciences)
Institute for Ethnic Studies



Prof. Dr. Mihaela Koletnik
(humanities)
University of Maribor,
Faculty of Arts

ARRS funding mechanisms

	Doctoral level up to doctoral degree	Post-doctoral level up to 3 years after attaining a doctoral degree	Post-doctoral level until 5 years after attaining a doctoral degree	Young doctor up to 10 years after defending the first doctorate	Established researcher
				Research programme <i>Public tender and call</i>	Research programme <i>Public tender and call</i>
		Post-doctoral research project (basic or applied) <i>Public call for (co-)financing research projects</i>	Research project (basic or applied) <i>Public call for (co-)financing research projects</i>	Research project (basic or applied) <i>Public call for (co-)financing research projects</i>	Research project (basic or applied) <i>Public call for (co-)financing research projects</i>
Young researchers <i>Public tender MR and MR+ (calls from research organizations)</i>				Young mentor <i>Public tender MR</i>	Mentor MR and MR+ <i>Public tender MR</i>
	The ERC complementary scheme <i>Public tender for (co-)financing adapted research projects</i>	The ERC complementary scheme <i>Public tender for (co-)financing adapted research projects</i>	The ERC complementary scheme <i>Public tender for (co-)financing adapted research projects</i>	The ERC complementary scheme <i>Public tender for (co-)financing adapted research projects</i>	The ERC complementary scheme <i>Public tender for (co-)financing adapted research projects</i>
	Visits to ERC Grantees <i>Public tender</i>	Visits to ERC Grantees <i>Public tender</i>	Visits to ERC Grantees <i>Public tender</i>	Visits to ERC Grantees <i>Public tender</i>	Visits to ERC Grantees <i>Public tender</i>
				The lead agency scheme <i>Public tenders of partner LA agencies</i>	The lead agency scheme <i>Public tenders of partner LA agencies</i>
MSCA Seal of Excellence <i>Public call</i>	MSCA Seal of Excellence <i>Public call</i>	MSCA Seal of Excellence <i>Public call</i>	MSCA Seal of Excellence <i>Public call</i>	MSCA Seal of Excellence <i>Public call</i>	MSCA Seal of Excellence <i>Public call</i>
		Reimbursement of expenses – H2020 <i>Public tender</i>	Reimbursement of expenses – H2020 <i>Public tender</i>	Reimbursement of expenses – H2020 <i>Public tender</i>	Reimbursement of expenses – H2020 <i>Public tender</i>
				JPI Urban Europe <i>International tender</i>	JPI Urban Europe <i>International tender</i>
					NORFACE <i>International tender</i>
		International bilateral projects <i>Public tenders for individual countries</i>	International bilateral projects <i>Public tenders for individual countries</i>	International bilateral projects <i>Public tenders for individual countries</i>	International bilateral projects <i>Public tenders for individual countries</i>
COST actions	COST actions	COST actions	COST actions	COST actions	COST actions

- Research programmes
- Research projects
- Young Researchers
- International cooperation

Information on other available mechanisms available at: <http://www.rrs.gov.si/sl/razpisi/>

IN THE SPOTLIGHT

TOWARDS NANOSTRUCTURED ELECTROCATALYSTS WITH SUPERIOR STABILITY

Prof. dr. Nejc Hodnik
Institute of Chemistry



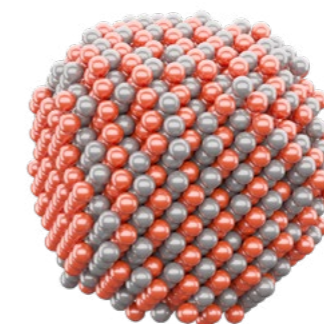
Prof. dr. Nejc Hodnik received funds from the European Research Council available to researchers at the beginning of their independent research career (ERC Starting Grant 2019). His outstanding scientific idea convinced the panel for physical and analytical chemistry to support his five-year project "Towards Nanostructured Electrocatalysts with Superior Stability" (I23STABLE) with a grant of EUR 1.5 million.

Dr. Nejc Hodnik, your ERC Starting Grant winning project which you received last year in exceptional competition sounds very complicated to laymen, but on the other hand it is an important area of clean energy research. What is the research about?

Basically, it is a research that will yield knowledge and ultimately the result, a catalyst that will enable the hydrogen economy. It means exploiting renewable resources to replace the fossil fuels we are currently using. It will convert electricity into hydrogen and that hydrogen back into electricity.

So it is about the hydrogen economy, clean energy. Hydrogen, however, is available in unlimited quantities. It would be obtained by splitting water in a catalytic process and basically your research is aimed at developing optimal catalysts.

In short, the process of splitting water into hydrogen and oxygen and then back into water releases or uses electricity; through this process we could store excess electricity which we get, for example, from solar cells or from the wind. The more efficient the process, the greater the efficiency.



Nanoparticle of platinum (silver ball) and copper (orange ball) alloy used as a catalyst in low-temperature fuel cells (author: Jaka Birsa).

We are referring to the catalyst activity. In addition to catalyst activity, my project also addresses its stability. We will investigate the stability of nano particles and use the results in the application allowing for greater device efficiency.

That is to say, with the introduction of this technology we would no longer rely on fossil fuels in the future which would mean a great asset for social development?

This would allow the transition to renewable resources which will be inevitable in the future. Fossil fuels contribute

to CO2 emissions which warms up the atmosphere and threatens our existence and way of life.

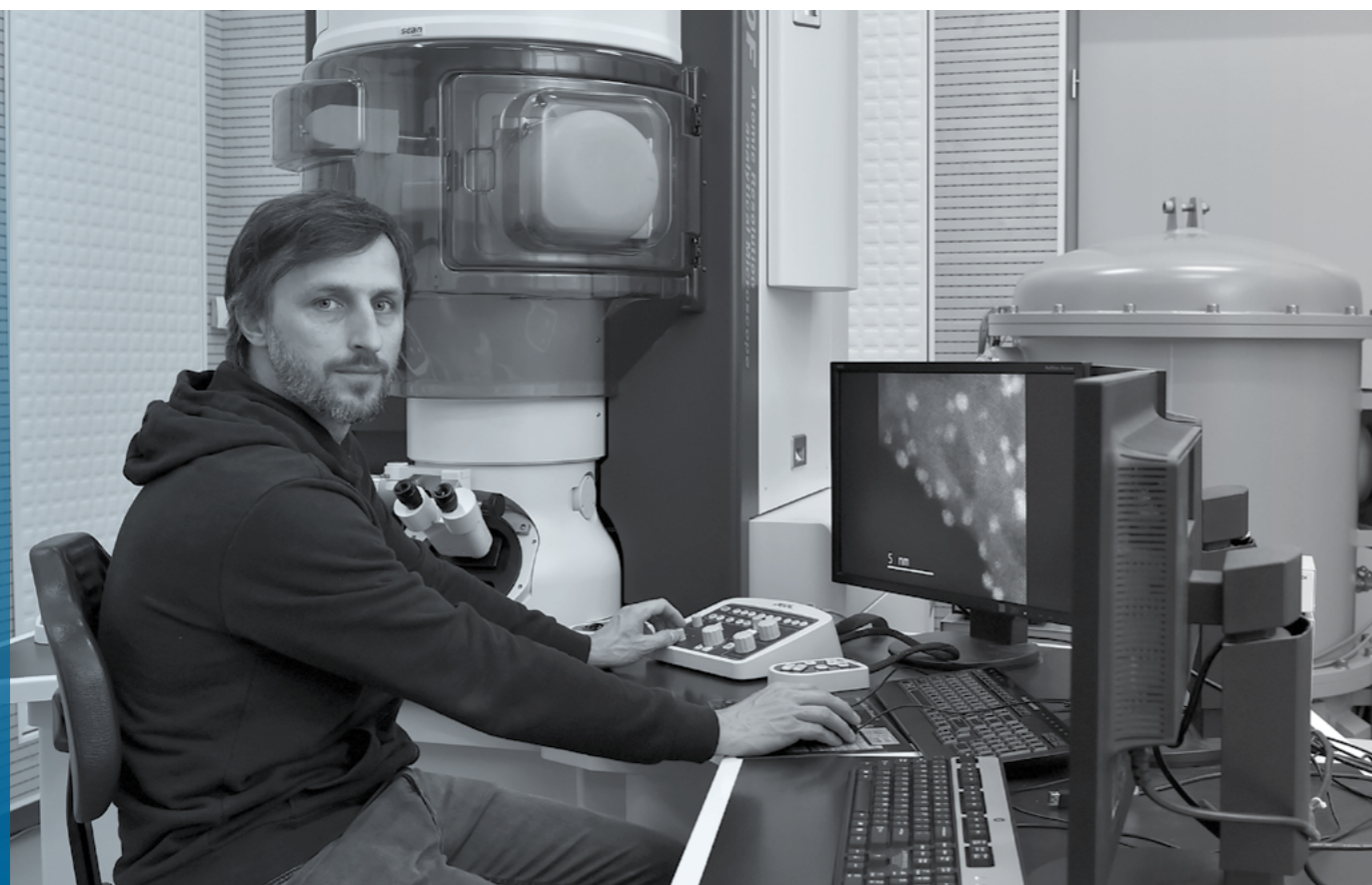
How could the development of your technology affect our (economic) situation? Recently, we have been arguing about the use of fossil fuels which is unusual as we are committed to development of clean energy or Development 4.0. Also, the European Commission's agenda strives for development and implementation of green energy. That is, most industrial processes are supposed to be based on electrochemical (e.g. batteries) and electro-catalytic reactions (e.g. fuel cell). Has the industry realized that?

I think that the fact is perfectly clear to the industry and they are already making preparations. Hydrogen is already being used in industry, say for the production of ammonia. Most of this hydrogen, however, is produced from fossil fuels. And if we are to replace this process by obtaining hydrogen from renewable resources through electrolysis of water, we are already doing a lot. However, it is not necessary to make all industrial processes electrochemical, because most of these processes already use hydrogen from fossil fuels. The electrochemical process allows you to do this reaction with electricity, with a catalyst, while in heterogeneous catalysis you use hydrogen and a catalyst without electricity.

At the heart of your research there is a catalyst which is vaguely known also to non-professionals, but it requires a bit more clarification in this context.

Catalyst is an interesting concept that may not be understood by everyone. It is like a kind of a policeman who directs traffic: if the policeman performs well, the traffic will





run faster, if we take the policeman out of the intersection, there will be traffic jams, confusion. Namely, traffic is a reaction and the catalyst helps the reaction to run faster, to produce higher efficiency. The better the catalyst, the higher the efficiency and if the catalyst is stable, the reaction takes longer. In other words, the concept of catalyst is something that speeds up processes.

You mentioned earlier that precious metals are the best catalysts. What are these metals and why are they so effective in the catalysis process?

Precious metals are those used for jewellery. They are very durable and do not oxidise. We are talking mainly about platinum, iridium, ruthenium, rhodium. These materials are already used in car exhaust systems.

They have special properties because they catalyse reactions. And because they are stable, we can break them down into small particles to increase their efficiency. Catalysis is proportional to the surface. It is a surface phenomenon, so we need to get as much surface area as possible from a given mass which is why we need to make the nano particle as small as possible. In doing so we come across a new problem, the stability of nano particles. There is a question of balance here between smallness of particles and their stability. In my project, I am looking for a way to find a perfect harmony between stability and activity at the atomic level.

You say, to achieve greater efficiency you break metals into nano particles. Where can the problem occur?

These are known processes of synthetic chemistry. Nano particles are not so difficult to synthesize, but the difficulty is that they are so small that they are harder to characterize and to see what they are like at the atomic level. We are already doing this with the electron transmission microscope we have at the institute. In my project, we will have a look at the same particle before and after the reaction. At the atomic level, we will determine how this nano particle has changed and what types of degradation it has suffered. At the same time, we want to know if any parts of this particle have remained unchanged which would mean that they are stable. In synthesis we can then make particles of such shapes that are made only of unchanged particles. We may also be able to

make an alloy of particles from three different metals. Once you find the optimal combination, you can explain it with a simulation. And hopefully this will be the superior stability we are looking for.

You received EUR 1.5 million for your five-year research. Where are you going to work?

I will work at the Institute of Chemistry where we have all the necessary equipment. It seems to me that five years is just a period to study and process a certain topic in detail. We will try to determine what can be done with our approach which will open up new areas and new questions. In addition, we will train and educate some new people because my group consists of doctoral and post-doctoral students.

How much freedom does the fund provider leave you with the project? Here I mean your co-workers. Do all your co-workers have to come from your institute or can your group be constituted according to the professional references of individuals?

I think one of the good things about this call is that it leaves you with complete freedom. Who you hire is entirely your decision. You should have already stated in your answer to the call what profile of people you will work with in order not to hire more experienced people than yourself. The research should be organized so that you are the leader of the group and at the same time you should not employ only students but post-doctoral students as well. The group should be balanced in terms of participants.

When does a researcher decide to apply for ERC projects? The global scientific community is extremely broad. How do you make sure no one has already taken your place in your search for the Holy Grail?

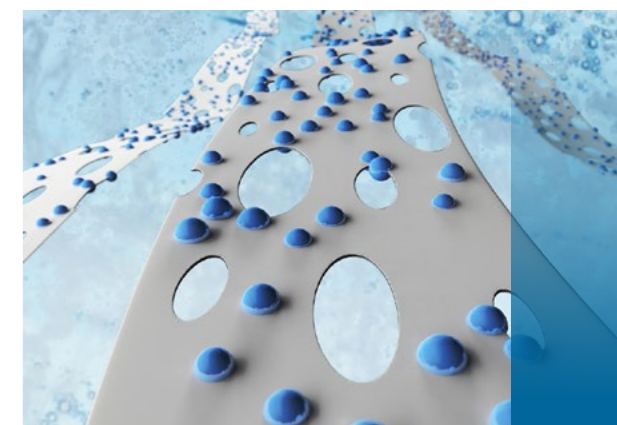
It is a long process. You may have heard of this call during your doctoral studies and later in post-doctoral studies you may already hear that someone is applying. You have to have a good idea that basically generates itself. You monitor the idea many years to see whether it is the right one, what is already being done in this direction in the world, you are discussing it with colleagues at conferences and at home, and at the same time you have to make sure you publish enough and show the relevance of your idea. It is a process of an individual and his/her mentor. The mentor should encourage you and let you have enough freedom at the same time. Not only does a good idea count when applying, but the candidate must also be the right one.

Were you successful with your first application or do the researchers as a rule apply more than once?

I succeeded with my second application. I'd say it is not unusual that you fail the first time and realize what went wrong. The experience makes you richer in the second attempt. ERC is a project where you have to propose something that is very risky, but feasible at the same time. They have to believe that you are on to something. In my first application, I suggested something general, that I will develop an area that no one else has done before, so in the second application with minimal changes I focused on making the best catalyst and looking for information that would clarify the question – what is the best possible catalyst.

What drives the researcher to search for something new, despite conditions that sometimes seem hopeless in society?

Every researcher has his/her own personal reason. My reason is to do something I know will be useful in



Iridium nanoparticles (blue beads) on a TiONx base used as a catalyst in low temperature electrolyzers (author: Jaka Birsa).

society. It's a good feeling. At the same time, I am also interested in it. It would be hard for me to do something if it wasn't useful.

However, winning the ERC project which is considered to be the most prestigious in science is also important for your institute, as it makes it increasingly one of the most important research institutions both at home and internationally. What bonuses will you get personally?

ERC is a sign of scientific excellence. Academic institutions like to brag about how many Nobel laureates and also ERC projects they have. The more they have, the better known and recognized the research institution is. Scientific excellence opens additional doors for you on a personal level as well. We all respect the ERC evaluation process which is at the highest level and the scientific excellence is the only thing that counts. The whole process is run by scientists with no politics in the background. This is really the highest level of researcher. ■

The entire interview, prepared by Ina Petric, is available at: www.tromba.si



CELL-LASERS – INTRACELLULAR LASERS

Coupling of optical resonances
with biological processes

Doc. dr. Matjaž Humar
Jožef Stefan Institute

Doc. dr. Matjaž Humar, associate of the Department of Condensed Matter Physics at the Jožef Stefan Institute and the head of the Laboratory for Bio-integrated Photonics, has obtained ERC Starting Grant funds in the amount of EUR 1.5 million. The project objective is to study interactions between lasers embedded inside individual cells, and biological processes in cells. The “Cell-Lasers” project will in the long run transform lasers inside cells, which are currently only a scientific curiosity, into a powerful technique that will enable the study of biophysical and biochemical processes within individual cells, and their subsequent use in research and medicine.

Dr. Matjaž Humar, a few months ago you were once again in the limelight of scientific, professional and partly also general public. This was due to the fact that you are the winner of the ERC project, the most coveted recognition when speaking of earning the title of the most prestigious research project. What is the project about?

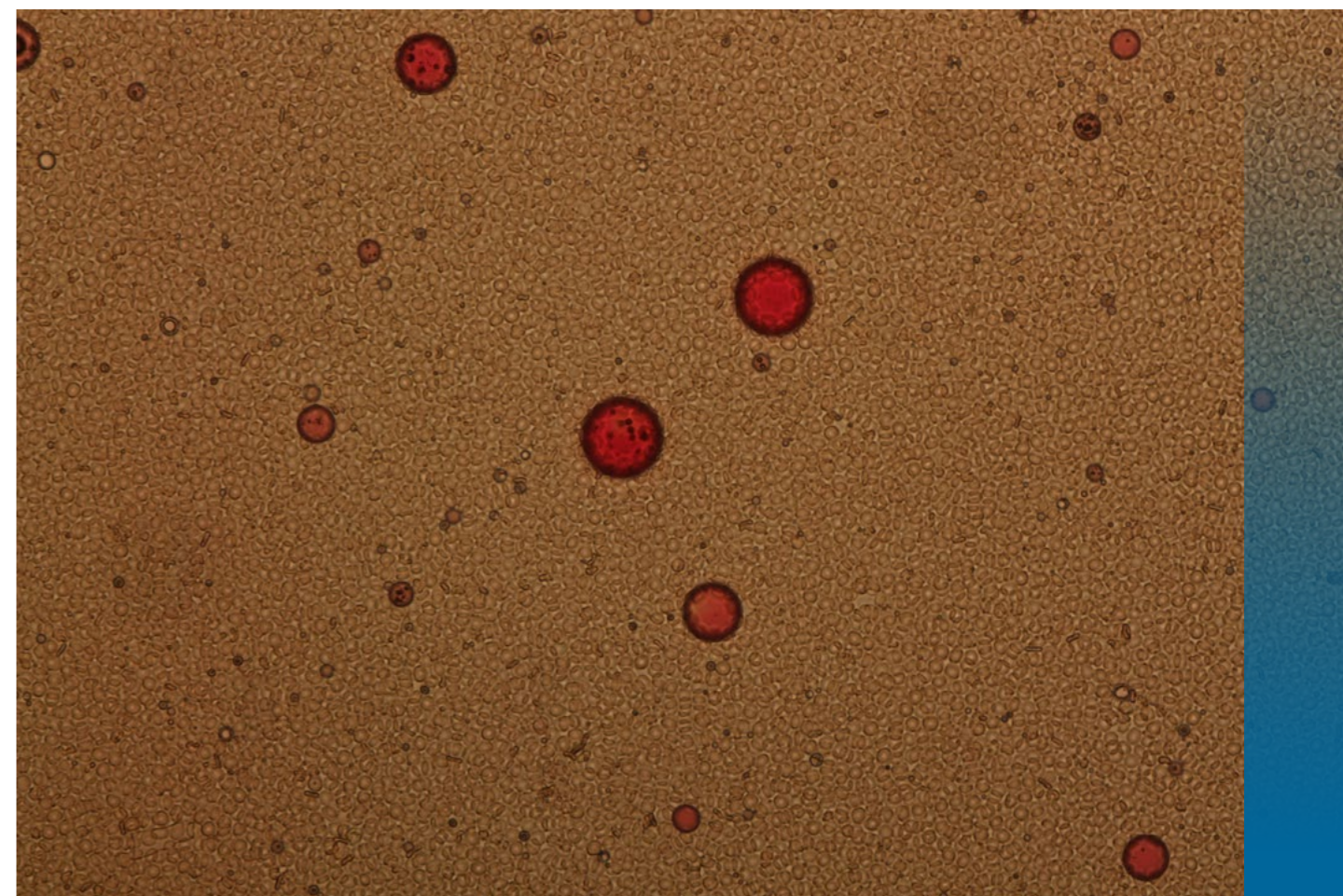
Laser is a device that emits directed monochromatic light. With my colleagues, we started out with the idea that lasers can be incorporated into living organisms, even into cells. Such lasers must be very small and are made of beads or droplets that are 10 times smaller than the thickness of a human hair. These beads can be put into cells in the tissue, the cells eat these beads and we get a laser in a cell. A few years ago, we actually succeeded in making a laser embedded inside a living cell for the first time. That was during my post-doctoral training at the Harvard Medical School. By illuminating a laser inside a cell with external light, this laser emits its own laser light and, depending on the spectrum of light, we can determine the properties of the

cell; in other words, measure the parameters inside the cells. Before the ERC project, we actually only showed that a laser can be embedded inside a cell, whereas no applications have been shown at the time.

You already had this realization when starting your post-doctoral training at Harvard?

I had previously dealt with small lasers made of liquid crystals during my doctoral studies. This was during my work at the Jožef Stefan Institute (JSI). Then, biology spurred my interest and I wanted to combine the two fields, namely lasers and biology. I first encountered biological tissue at Harvard. During the very first month of my stay there, I was put in the operating theatre with a live pig on the operating table to be cut by me. I started doing biology and medicine from the very basics.

Applying to become a recipient of the most prestigious projects is not an easy task. How long have you been cultivating the idea which you considered was bound to succeed? Have you lived under the pressure



of having to win the ERC because that was supposed to be an indicator of a successful scientist?

For my first ERC application, the subject of cell lasers seemed quite old to me, which is why I applied with a brand new idea, the edible lasers. I proposed lasers made from completely edible substances, useful for monitoring food quality, origin, etc. I succeeded in entering the ERC second round with this idea, but it was then rejected. I had been developing the idea of live lasers for about three or four years before putting it down on paper. As the idea received no recognition, I decided not to proceed any further. The following year, when reapplying, I proposed the continuation of the work on cell lasers. I believed that my chances will

be better with this project. This is why I prepared a completely new application. This was rather risky, as it makes sense to just polish the idea the next time you apply, once having already entered the second round.

What is the situation in terms of competitive projects, given that applications are not limited regionally?

The competition is fierce. These are the most prestigious European projects, and the ones that make it to the second round are indeed excellent. You also have to prove yourself very well in an interview, answering the questions asked by experts from a variety of fields for about fifteen minutes. The whole process is very demanding and time consuming. I ap-

Biodegradable lasers visible as red balls in the blood. The small plates around the lasers are red blood cells.

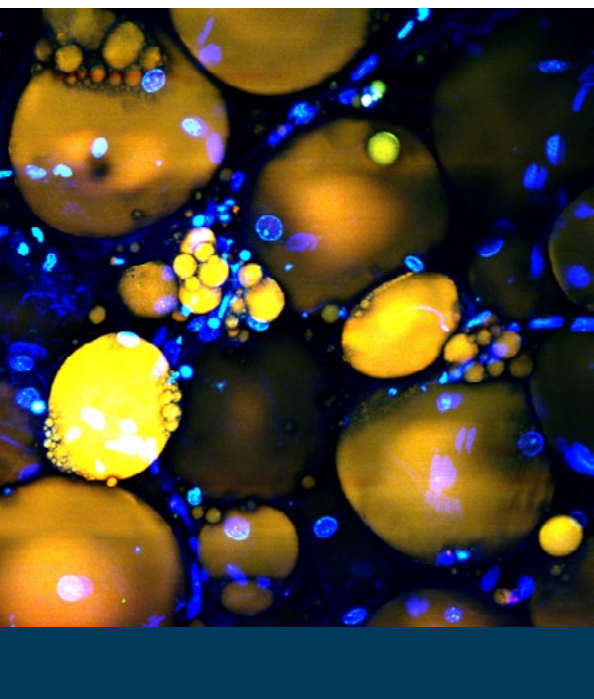
plied three times, having been writing each application for several months and preparing for the interview. I practised defending my application with my colleagues here at the JSI, and I also sought advice in other settings and abroad. More than 40 people contributed their advice and assistance.

Speaking of the difficulty in defending the application before the committee and project's success: should applicants anticipate that the projects that offer something new, a new idea, will be accepted as opposed to the well-tested ideas?

Well, yes, but on the other hand, the idea should also be proven as functioning. Substantial funds are put at stake, and if you offer something you can't prove that it will actually work, you will be denied funding. As far as I know, most of those who got the ERC already had some important discovery, a paper where they had already proven that the idea works. It was the same case with me. Together with my colleagues at Harvard we first demonstrated that the cell laser actually works, and my proposed project suggests that lasers can be used for diagnostics, cell imaging, and so on. With edible lasers, however, it was an entirely new subject.

The idea you are competing with must be, so to speak, unique in the world. How do you make sure to know that no one has come up with the same idea thus far?

Fat droplets (orange) inside adipose tissue. These droplets can be used as natural lasers.



This is hard to know, but on the other hand, for example, biological lasers are such a new subject that much more can be done in this area. Even if ten research groups were working on this topic, there would still be plenty of room for a variety of discoveries. The goal of discovery is not just a specific aspect, but a whole range of research about the many ways we can use such lasers, for example for cell tracking, diagnostics, force measurement, droplet size ... there are many questions like this. We have opened this field, and there are many exploration options left. The field is really new, and as no one has dealt with it before we started to explore it. Besides the idea, it is extremely important who is the researcher standing behind the project. This has to be someone who has the experience and potential to make the idea a reality.

How is a new idea born in a scientist? What kind of cognitive process is this?

I think that by merely sitting in the office and reading articles it is hard to come up with any really good ideas. For me, the inspiration for new ideas comes from attending conferences. By attending lectures, you get to know new subjects and fields, previously unknown to you, and you have the time to reflect on things. Conferences are really the way to maximize new ideas. This is why I recommend everyone to visit as many conferences as possible and to talk to and collaborate with other researchers. In this time of the coronavirus crisis, we connect online, but nevertheless I still find personal contacts the most productive.

You impressed the committee with an original scientific proposal and received EUR 1.5 million for a five-year project. What does this commit you to? Although this is a fundamental kind of research, ERC's

expectations are that the candidate considers the possibility of a breakthrough in terms of its application?

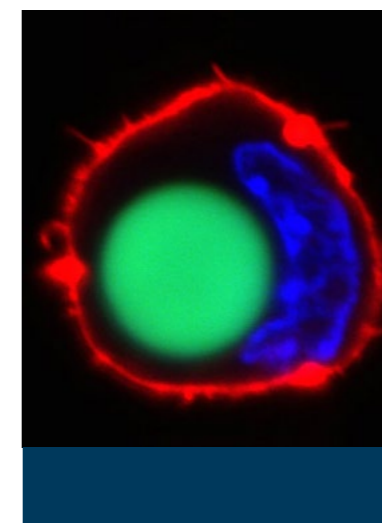
The researcher actually has very open possibilities. Researchers are not required to do exactly what was written in the project. These are new things, and although a research plan has been defined, in the real world, things don't always go according to the plan. That's why researchers are quite free in their work. However, I agree that practical application is expected. The goal of fundamental research is to get to know how things work in nature, and the long-term goal is definitely the practical application. In our case, these are cell lasers that can be applied in research as a tool to study cells. In the long run, I desire and anticipate that cellular lasers would also be useful in medicine, specifically for diagnostics, by means of embedding lasers inside tissues and cells in order to obtain certain information.

How are you going to put together a research team? Is science in the domestic environment strong enough to assist you, or will you be looking for suitable collaborators in an international environment?

Both. Presently, there are six full-time employees and three students in our group. Most of them are Slovenes, but we have one Indian and probably someone else will come from abroad. Most of them are physicists, but we also have a biologist. Fortunately, we are close to the Faculty of Mathematics and Physics (FMF) and other faculties where there have really excellent students. Students can come and work with us as a part of their practical training after the first year of their studies, and start learning to work in the laboratory. We often welcome researchers from abroad for a shorter period of time, as the goal is to have as dynamic and heterogeneous a group as possible.

What plans and thoughts do you have regarding the future research based on existing knowledge? What will you develop further?

We must first determine in the research what parameters within the cell can be measured, why these lasers are good, and then we will upgrade the use of lasers. But I also have other, even more interesting ideas. Just recently, my colleagues from Harvard and the National University of Seoul and I got the prestigious Human Frontier Science Program (HFSP) project, with which we go a little further with lasers. We intend to prove optical communication between cells. Neural cells in the brain communicate with each other by means of electrical signals, and we will try to make optical circuits to enable the cells to communicate with each other by means of light.



A cell containing a laser (visible as a green bead). Blue indicates the cell nucleus and red indicates the cell membrane.

What could be the result of this idea?

For now, we are not sure what would this be useful for. It was the same case with the cell lasers. At first, I was just wondering whether this could be done

at all, and later it turned out to be useful for a whole range of applications. In this case, it's a matter of curiosity, and in the future we may be able to make some sort of artificial brain where the cells will communicate with each other quickly by means of light. We do know, however, that light pulses travel faster than electrical signals in neurons. We will also continue to work on edible lasers, as we already have good results. We already know how to make an artificial laser from substances that are edible. We are currently working very intensively in this area. ■

The entire interview conducted by Ina Petric is available at www.tromba.si



ARRS Day 2019: Supporting Excellence

In line with the ARRS operation and development strategy 2016–2020, the vision of Agency's operation and development is based on seven strategic guidelines, including Open communication with the public and promotion of science. The main goal of the activities in the field of communication with the public is to improve the scholarly aspect of reporting, as well as the public debate on science and the operation of the science system in the Republic of Slovenia. Communication with the public is based on three values: openness, responsiveness and providing information of value. Openness is understood as a dialogue and responsiveness as providing information that is up-to-date, whereas providing information of value means communi-

cating on current topics and relevant issues present in the media.

Since 2014, the Agency has been increasing its activities in the field of science promotion.

In November 2019, the Agency held the "ARRS Day 2019: Supporting Excellence" event for the second time, aiming at the new generation of junior researchers and addressing current international issues concerning the support to science.

The event took place under the auspices of Borut Pahor, President of the Republic of Slovenia.

250 participants took part in the event. 338 viewers tuned in the ARRS Day 2019 livestream broadcast by our media partner STA on the STA

science portal and STA Facebook profile. Online broadcasts of the plenary and welcome reception for the new generation of junior researchers



(From left to right) dr. Žiga Zaplotnik, Faculty of Mathematics and Physics, University of Ljubljana, prof. dr. Robert Dominko, National Institute of Chemistry, prof. dr. Aljoša Valentinčič, Faculty of Economics, University of Ljubljana, prof. dr. Janja Hojnik, Faculty of Law, University of Maribor and Renata Dacinger, European Journalist of the Year. (Photo: STA, Jure Makovec)

draw about 3900 viewers, whereby recordings of the events reached 980 views the next day.

The introductory part of the national event was dedicated to the panel discussion "Social Responsibility of Science for Planet A" reflecting on the broader mission of science and researchers in addressing climate change and environmental and sustainable issues in regards to which younger generations took on a globally active role in raising awareness and demanding change during the last year. Renata Dacinger, the discussion moderator, and her guests dr. Žiga Zaplotnik, prof. dr. Robert Dominko, prof. dr. Aljoša Valentinčič and prof. dr. Janja Hojnik talked about the role of science and the changing role of researchers in relation to broader social issues.

The panel discussion was followed by a practical workshop for young people in science, and was especially dedicated to the new, already 35th generation of junior researchers. The Young Academy of Slovenia (Društvo Mlada akademija) held a workshop on first-hand experi-

ence in starting out as a junior researcher.

In the afternoon sessions, it was followed by presentations of the most prominent research achievements in all disciplines in the framework of the ARRS science promotion project – Excellent in Science 2019.

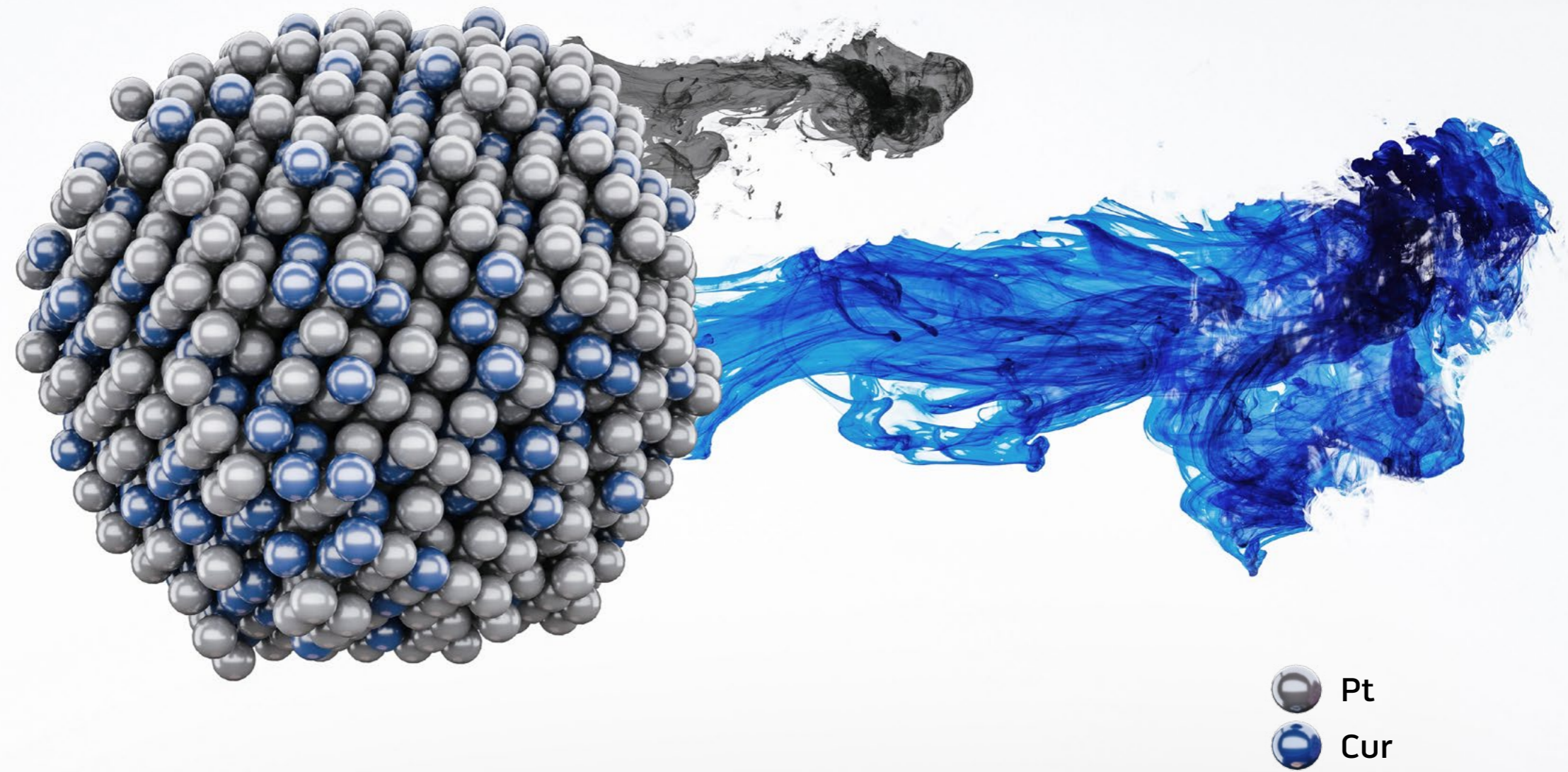


Recipients of the Excellent in Science 2019 title, as chosen by the Scientific councils of the various disciplines, presented their work at the event to inspire the new generation. Presentations of the most prominent research achievements in the framework of the ARRS science promotion project, Excellent in Science 2019, are included in the Agency's annual report. (Photo: STA, Jure Makovec)



Commemorative photo of the 35th generation of junior researchers. (Photo: STA, Jure Makovec)

The event was concluded with a reception to wish the 35th generation of junior researchers all the best on their paths towards obtaining doctoral degrees. To inspire the younger generation of future researchers, the recipients of prestigious projects of the European Research Council (ERC), doc. dr. Jaka Tušek from the Faculty of Mechanical Engineering, University of Ljubljana, doc. dr. Matjaž Humar from the Jožef Stefan Institute and prof. dr. Matevž Dular from the Faculty of Mechanical Engineering, University of Ljubljana, have shared their experience. Prof. dr. Jernej Pikalo, Slovenian Minister of Education, Science and Sport, was the keynote speaker.



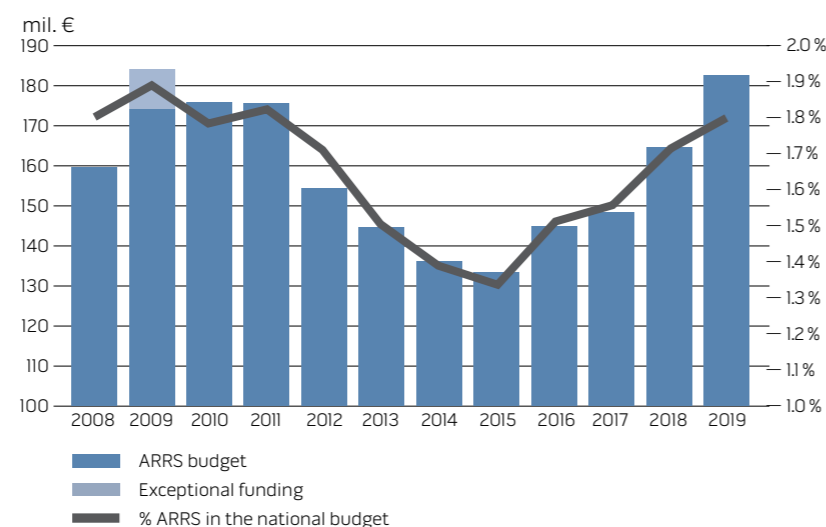
FINANCING STRUCTURE

In 2019, the budget of the Republic of Slovenia, through the Public Agency for Research Activities (henceforth: the Agency), provided EUR 182.8 million for the financing of scientific research. Compared to the year before, the budget increased by EUR 18.6 million or 11.3 %.

The Agency's budget for scientific research activities increased from EUR 175.9 million in 2011 to EUR 182.8 million in 2019, representing a difference of 3.92 %. The first budget increase since 2011 took place in 2016, when the budget was increased by 8.6 % compared to the year before.

In 2016, 1.52 % of the budget of the Republic of Slovenia was dedicated to the Agency for scientific research, in 2019 the share was 1.80 %.

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 following website: <http://www.arrs.si/sl/finan/letpor/>. More data and charts on the scope and structure of financing received by the Agency from the national budget are available on the following website: <http://www.arrs.si/sl/analyze/obseg01/pr.asp>.

Agency funds in 2019

Research programmes: long term financing of research, which is expected to be current and applicable over a longer period of time.

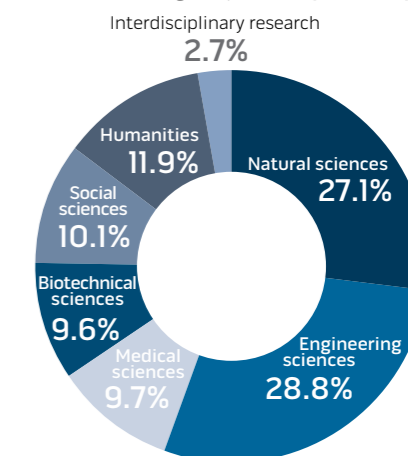
Research projects: co-financing of basic, applied and postdoctoral research projects, targeted research programme projects and those of young doctors of science within the framework of the pilot public call entitled "Promotion of the employment of young doctors of science".

Junior researchers: financing of postgraduate studies and training of researchers aiming to obtain a doctorate.

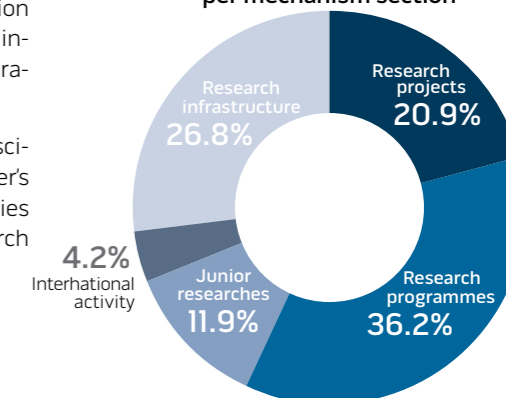
International activities: co-financing of projects within the ERC complementary scheme and the lead agency scheme, visits to ERC project principal investigators, introducing projects on the basis of the Marie Skłodowska-Curie seal of excellence, co-financing of bilateral cooperation, promotion of cooperation between research organisations in the Horizon 2020 calls and supporting international associations, promotion of Slovenian science abroad and integration of scientific achievements.

Research infrastructure: co-financing of infrastructural programmes, science and popular science periodicals and scholarly monographs, founder's obligations, the COBISS system and other library and information activities and infrastructures, international journals and data collections and research equipment.

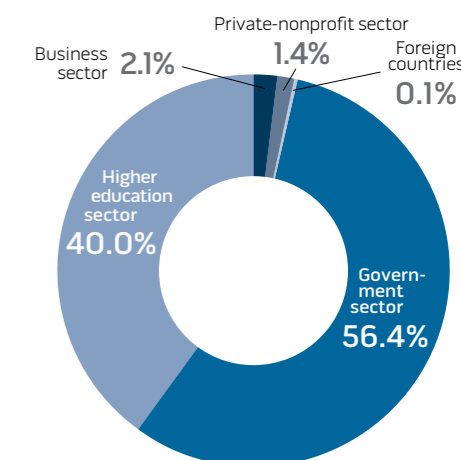
Distribution of Agency funds per discipline¹



Distribution of Agency funds per mechanism section



Distribution of Agency funds per activity sector²



¹ Funding for founder's obligations, infrastructural programmes, international promotion of science, the operation of Slovenian associations around the world, promotion of applications to EU projects, OSIC and foreign journal databases cannot be broken down per disciplines and are therefore not taken into account

² According to the Frascati methodology, research and research and development organisations and research and development units are divided into four to five sectors according to core activities, economic and legal status and source of financing:

- **business enterprise sector:** for-profit and non-profit companies, public enterprises within the framework of economic public services and private non-profit institutes;
- **state sector:** non-financial companies with public oversight, other national authorities, other local authorities and direct budget recipients;
- **private non-profit sector:** private non-profit institutions serving private citizens and households;
- **higher education sector:** universities and other institutions carrying out tertiary education programmes, research institutes, experimental units and clinics;
- **foreign entities sector:** institutions, international organisations and individuals outside the political borders of the Republic of Slovenia.

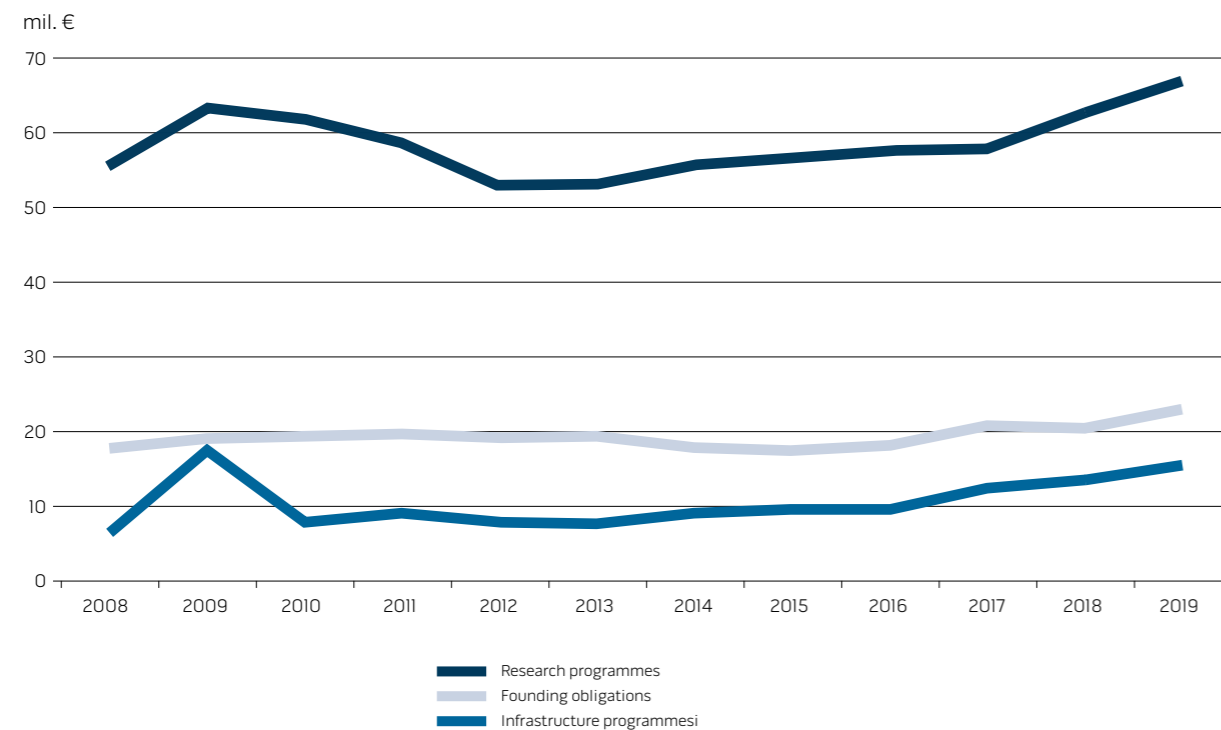
Institutional financing

Research programmes: **EUR 66.7 mil.**

Founder's obligations: **EUR 23.0 mil.**

Infrastructural programmes: **EUR 15.6 mil.**

Research programmes, infrastructural programmes and founder's obligations comprise a stable aspect of research financing. Due to austerity measures, the financing of research programmes in 2012 was reduced by 10 % compared to 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 programme funding. The trend of slight growth in research programme funding was continued in the period from 2016 to 2019.

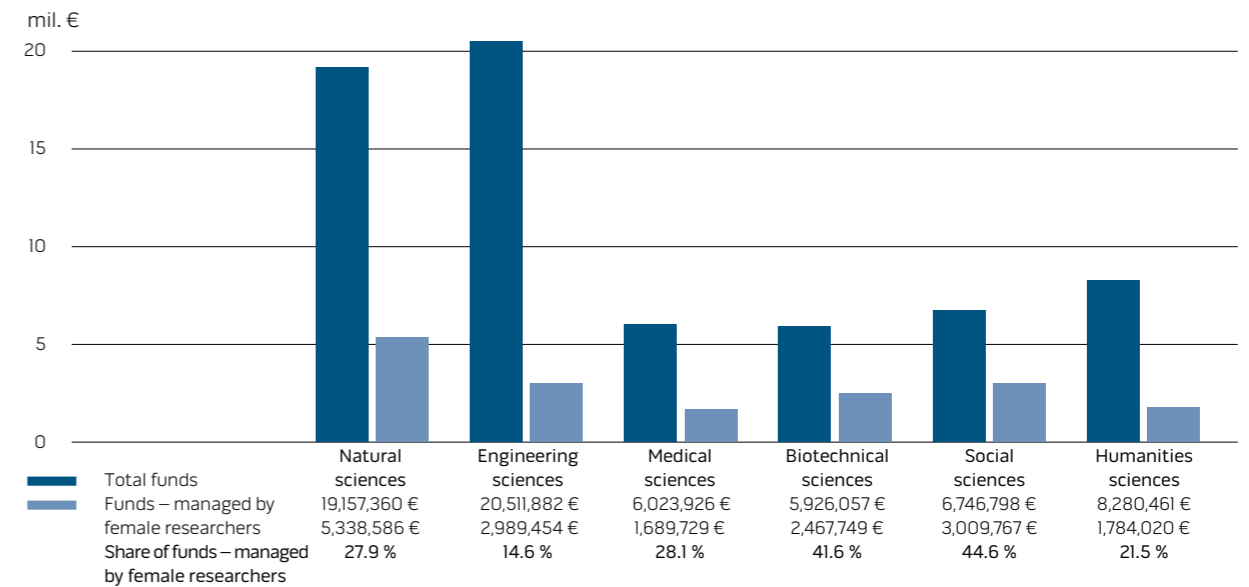


Research programmes

In 2019, the Agency paid EUR 66.7 million for the co-financing of research programmes, which represents 36.2 % of the total budget. 305 research programmes were funded in 2019, of which 90 were in the field of engineering, 65 in natural sciences, 47 in social sciences, 45 in humanities, 37 in medicine and 21 in the field of biotechnology.

Call and tender in 2019

65 programmes whose financing period concluded in 2019 received an extension for the next six years in the total amount of EUR 15.6 million on the basis of a public tender and a public call.



Distribution of funding per activity sector in EUR

State sector	35,928,172
Higher education sector	29,609,725
Business enterprise sector	852,099
Private non-profit sector	256,488
Total	66,646,484

The funding of research programmes increased by 5.9 % compared to 2018.

Infrastructural programmes and founder's obligations

Founder's obligations are obligations the founder has towards public research and infrastructure institutes, whereby the Agency covers fixed operation costs related to the core research or infrastructure activity. EUR 23.0 million was paid for founder's obligations in 2019, which represents an increase of 5.0 % compared to 2018

Founder's obligation funding per activity sector in EUR

State sektor	21,828,991
Higher education sector	1,189,488
Total	23,018,479

Infrastructural programmes support research works. The central role of research infrastructure is to ensure a high quality research environment. EUR 15.6 million was paid for infrastructural programmes in 2019, which represents an increase of 15.3 % compared to 2018.

Infrastructural programme funding per activity sector in EUR

State sector	10,392,760
Business enterprise sector	163,800
Higher education sector	3,894,638
Private non-profit sector	1,113,056
Total	15.564.254

Competitive financing

Research projects: **EUR 38.4 mil.**

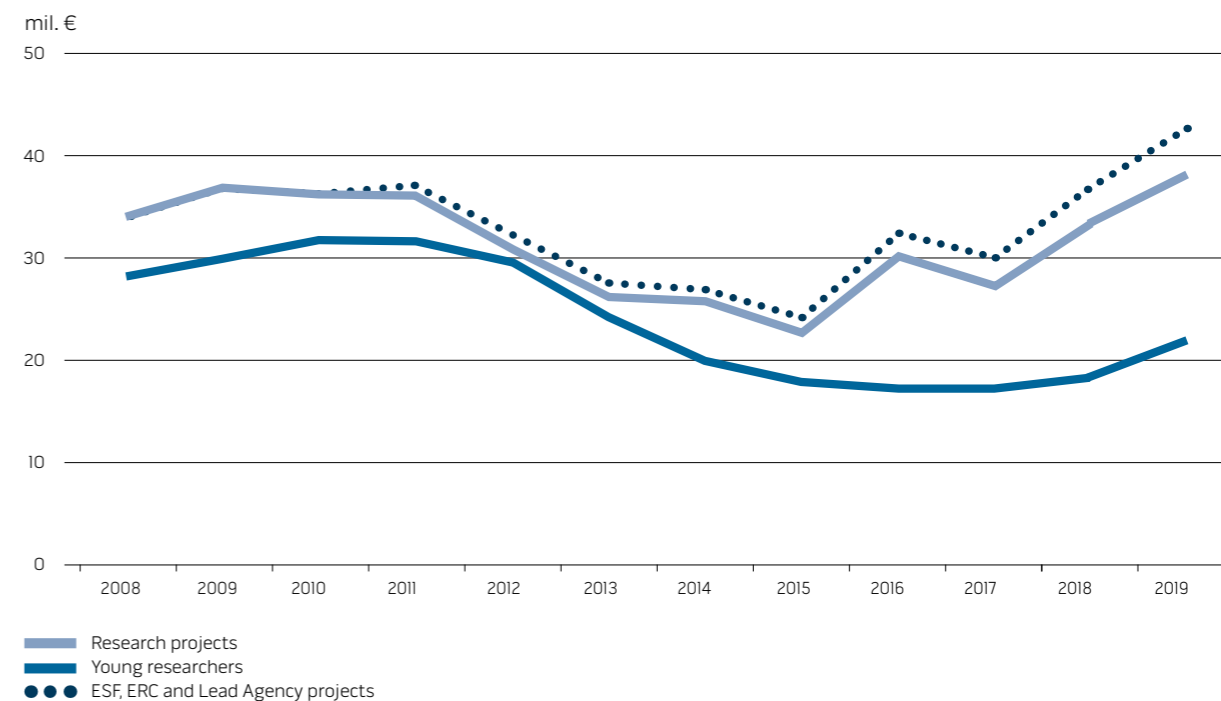
Junior researchers: **EUR 21.9 mil.**

In 2018, the funding of research projects increased by 13.9 % compared to 2017. A significant decrease in funding was recorded in 2012, when the Agency did not finance any new research projects due to austerity measures. Financing of research projects decreased by 5.4 % between 2011 and 2018.

The increase in funding for research projects in 2016 was due to austerity measures in previous years and consequent delays in the start of financing research projects, particularly in 2013, which meant that 2016 saw the financing of more projects than usual in the past years.

Since 2010, there has been a continued trend of reduced funding for junior researcher training; in 2017, the funding decreased by 0.9 % compared to 2016. In 2019, the funding increased by 20.3 % compared to the previous year.

Funding for research projects and junior researchers



Research projects

In 2019, the Agency co-financed research projects in the amount of EUR 38.4 million. Project funding represents 20.9 % of the Agency's total budget and is higher than in 2018 by 0.4 percentage points.

Basic research projects: **EUR 27.2 mil.**

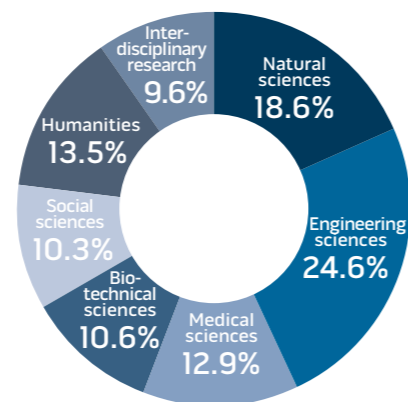
Applied research projects **EUR 6.4 mil.**

Graduate research projects: **EUR 3.5 mil.**

Targeted research programme projects: **EUR 1.3 mil.**

Promotion of the employment of young doctors of science: **EUR 5,700**

Distribution of funding for research projects per discipline



Basic and applied research projects

In 2019, with finances from the state budget, the Agency co-financed 369 basic research projects, with a total value of EUR 27.2 million. Compared to 2018, the funding increased by 16.7 %, and compared to 2015, the increase amounted to 101.5 %. Junior researchers (up to 10 active years after defending their doctorate) conducted 63 basic projects, and received 21.6 % of the funding allocated for basic research projects.

In 2019, using the funds from the state budget, the Agency co-financed 100 applied research projects with a total value of EUR 6.39 million, which is 0.3 % less than in 2018.

Junior researchers conducted 18 applied projects, and received 16.7 % of the funding allocated for applied research projects.

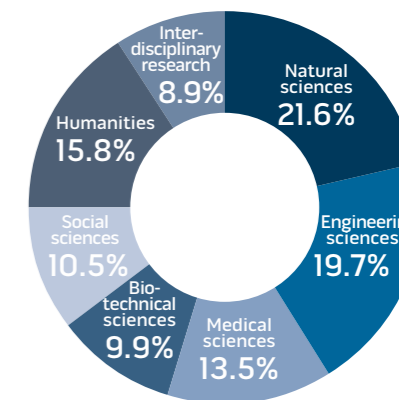
The evaluation methodology of applications on public calls dictates that among co-financed applied science projects, at least 30 % must be projects in the field of engineering, at least 20 % in the field of biotechnology, at least 10 % in the field medicine and social sciences, and at least 5 % in the field of natural sciences. The structure of all (co) financed projects closely follows the implementation of the aforementioned required methodology.

Discipline	Basic and appl. projects in mil. EUR	Female principal investigators	Junior principal investigators	Of those female researchers
Natural science	6.4	40.5 %	17.7 %	32.6 %
Engineering	8.4	21.0 %	21.9 %	17.1 %
Medicine	4.0	43.7 %	27.1 %	53.8 %
Biotechnology	3.5	38.1 %	12.5 %	48.5 %
Social sciences	3.2	36.2 %	13.7 %	27.5 %
Humanities	4.7	43.7 %	31.9 %	42.5 %
Interdisciplinary research	3.3	30.0 %	14.5 %	12.6 %
Total	33.5	37.0 %	20.6 %	20.6 %

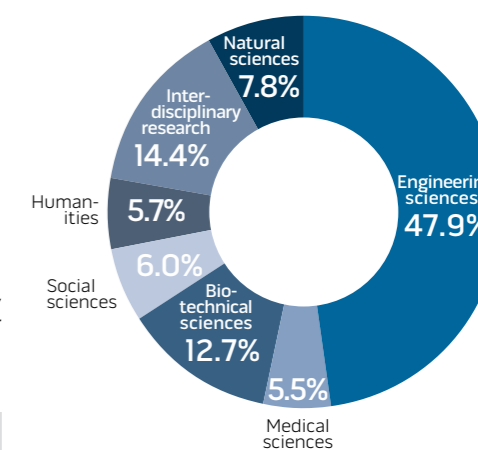
The funding of basic and applied research projects, and project shares, for projects led by female researchers and junior researchers. Funding share data for projects lead by junior female researchers are given in the last column.

The evaluation methodology of applications on public calls dictates that at least 20 % of chosen projects must be lead by junior researchers (researchers with up to 10 active years after defending their doctorate). This is how the Agency promotes the integration of young scientists into research activities.

Distribution of funding for basic research projects per discipline



Distribution of funding for applied research projects per discipline



Postdoctoral projects

In 2019, with state budget funds, the Agency financed 95 postdoctoral projects, in the total amount of EUR 3.5 million, which represents an increase of 32.9 % compared to 2018.

The evaluation methodology of applications on public calls 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 lead by female researchers

Discipline	Funding in EUR	Share – female principal investigators
Natural science	708,862	20.5 %
Engineering	881,737	28.4 %
Medicine	636,197	84.2 %
Biotechnology	190,378	57.9 %
Social sciences	275,490	65.5 %
Humanities	448,365	66.5 %
Interdisciplinary research	315,553	61,9 %
Total	3,456,581	49,6 %

2019 call

The funding of research projects, which were accepted into co-financing on the basis of the 2018 call, began in 2019. The funding of research projects for which the Agency published the co-financing of public calls in 2019, will begin in 2020.

Targeted research programme projects (CRP)

In 2019, the funds for the co-financing of targeted research programme projects amounted to EUR 1.3 million or 0.7 % less than in 2018.

In 2019, 137 projects received funding in the framework of targeted research programme projects.

The financing of targeted research project programmes enables research support to interested ministries and other users, 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 2019, the Agency published a public call on selection of research projects within the framework of the targeted research programme project "CRP 2019".

In May 2019, the Agency, in cooperation with the Ministry of Labour, Family, Social Affairs and Equal Opportunities, the Ministry of Finance, the Ministry of Economic Development and Technology, the Ministry of Education, Science and Sport, the Ministry of Public Administration, the Ministry of Culture, the Ministry of Interior Affairs, the Ministry of Foreign Affairs, the Ministry of Agriculture, Forestry and Food, the Ministry of the Environment and Spatial Planning, the Ministry of Justice, the Ministry of Health, the Government Office for Development and European Cohesion Policy, the Government Office for Slovenians Abroad, the Chemicals Office, the Government Office for National Minorities, the Advocate of the Principle of Equality and the Slovenian Traffic Safety Agency, published a public call for the selection of research projects of the Targeted Research Programme Project "CRP 2019".

The subject of the public call is defined with priorities in terms of subject matter within the "CRP 2019" focal points: :

- inclusive, sound, secure and responsible society;
- highly productive economy that creates added value for all;
- learning for and throughout life;
- preserved healthy natural environment;
- high level of cooperation, competence and management efficiency.

The call concluded in July 2019 and saw 46 projects accepted for co-financing.

Junior researchers

In 2019, the Agency financed the training of 948 junior researchers, with a total funding of EUR 21.9 million, which represents 11.9 % of the Agency's total budget and an increase of 0.8 percentage points compared to 2018. The Agency enables junior researchers to take part in research during their postgraduate studies on the basis of temporary employment contracts. Their wages, social contributions and material and service costs are financed by the Agency. The average annual financing for one junior researcher amounts to approximately EUR 30,000. Training funds are allocated for a temporary period, not exceeding four years of a doctoral study programme. The purpose of the programme is to rejuvenate the research staff and thus promote new ideas and approaches. The Junior Researchers programme is a source of highly trained and motivated employees, who represent a large potential for the Slovenian economy and other socially important areas. Within the framework of the Junior Researchers programme, more than eight thousand junior researchers were trained between 1985 and 2019.

In 2019, five junior researchers received the award for the early completion of training.

Promotion of young mentors

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

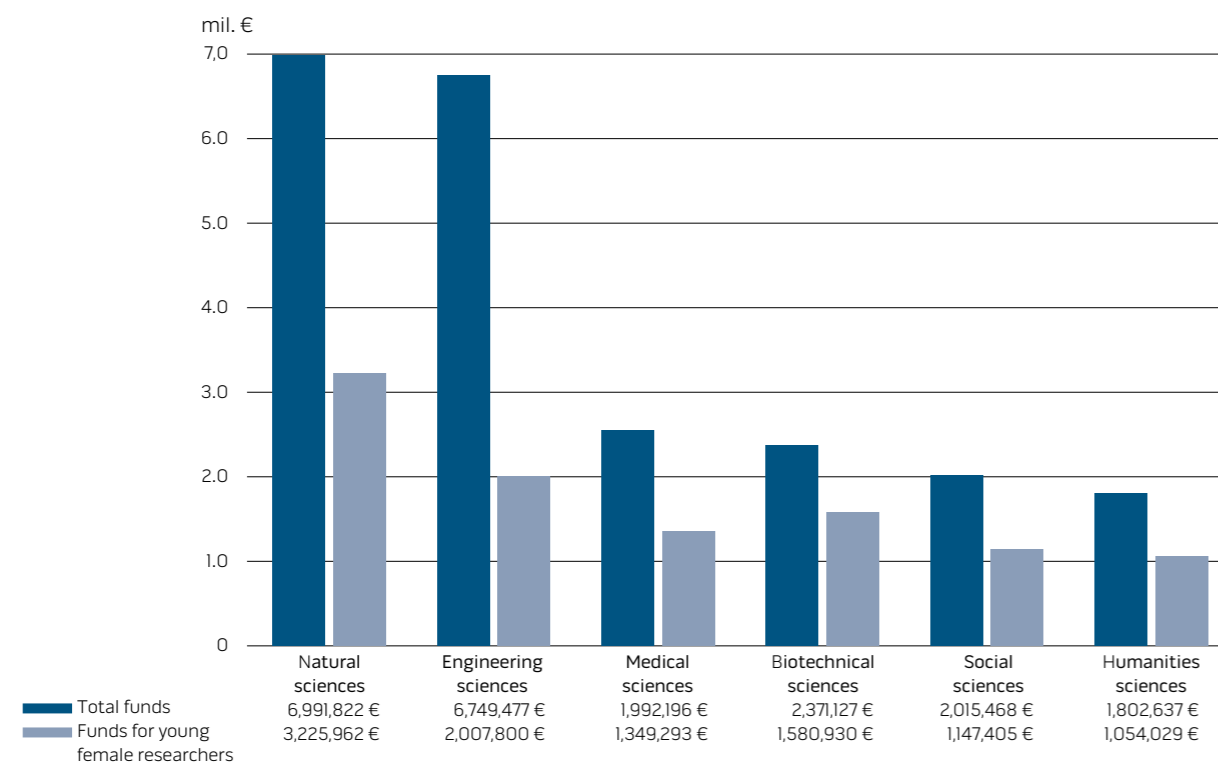
Call in 2019

In January 2019, the Agency published a call for the allocation of mentorship positions within research programmes, leading to 178 mentorship positions being allocated among 152 research programmes: 55 in the natural sciences, 56 in engineering, 18 in medicine, 18 in biotechnology, 16 in social sciences, and 15 in humanities.

MR+ tender

In November 2018, the Agency published the MR+ pilot public call for the selection of mentors to new junior researchers in 2019. The subject of the call were 51 mentorships to junior researchers in the total amount of EUR 1.5 million. The training began in October 2019.

Funding for junior researchers



Scientific literature

Scientific literature: **EUR 1.76 mil.**

International publications and data collections: **EUR 5.58 mil.**

The Agency co-finances electronic access to the latest scientific databases and the purchase of international scientific literature, 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 organisations and via the COBISS system. The Agency also co-finances science and popular science publications on the basis of a public call, with the aim of enabling the publication of those popular science publications which are important for the promotion of interest in science and technology among the general public, particularly among young people. The Agency also co-finances the publication of scholarly monographs important for the development of Slovenian scientific terminology, for presenting scientific achievements and findings in Slovenia and abroad and for promoting scientific culture. Co-financing of the scientific press, including domestic science and popular science publications, commanded a sum of EUR 1.34 million in 2019, while EUR 0.42 million was paid for scholarly monographs.

International activities

The ERC complementary scheme: **EUR 1.54 mil.**

Within the complementary scheme, applicants from Slovenian research organisations who have been positively evaluated on European Research Council (ERC) calls, but were not selected for co-financing, have the possibility of applying for Agency funding with an adapted project, which, based on its objectives and scope of work, takes into account the time required to complete the adapted project as well as the amount of available funding. The Agency co-finances adapted projects, which are primarily carried out in Slovenia, based on a proposal from the Scientific Council, and taking into account the available funding.

The purpose of the complementary scheme is to co-finance adapted research projects that have exceeded the determined success threshold in the process of an international evaluation, so as to ensure that the applicants have the appropriate conditions to further their scientific excellence and the initial idea of the research project. At the same time, the aim of the public call is to enable the principal investigator of the adapted research project to submit an application for the ERC call after the project in question is completed. Within the complementary scheme, funding was approved to six out of a total of thirteen recipients of ERC projects in Slovenia.

In 2019, the Agency co-financed 22 projects within the complimentary schemes framework, of which 11 were in the natural sciences (50.0 % of funding), nine were in engineering (40.9 % of funding), one in the social sciences (4.5 % of funding), and one in the humanities (4.6 % of funding).

Organizations in the public sector received 69.8 %, organizations in the higher education sector 26.3 %, and organizations in the business sector 3.9% of funding.

The calls are aimed at individual projects for excellent frontier research in all disciplines and are among the most competitive on a global level; the total success rate in the call is approximately 10 %. The calls are open to all researchers, regardless of their current place of employment, with the condition that the acquired ERC project 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 Horizon 2020 programme, and comprises 17 % of the budget. Since its inception, the ERC has financed more than seven thousand projects, selected from more than 65,000 thousand applications. Among the recipients of ERC funding are six Nobel laureates. In 2018, the total budget of the European Research Council amounted to approximately EUR 2.02 billion. More than 70 % of the projects evaluated by an independent study resulted in scientific breakthroughs or major progress, while 25 % contributed to important improvements. Source: <https://erc.europa.eu/>

The ERC publishes an annual work programme that acts 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 researchers (7–12 years after the award of a doctoral degree);
- **Advanced Grant** – for renowned researchers.

The ERC also enables applicants to apply for two additional calls that are not eligible for the complementary scheme:

- **ERC Proof of Concept** – constitutes a bridge between research and the earliest stage of market innovation. This call is open to researchers that have received ERC support.
- **Synergy Grants** – intended to support two to four excellent researchers and their groups in joining their complementary knowledge and resources and tackling demanding research projects together. The aim is to make new discoveries where different scientific disciplines overlap as well as use new methods and techniques in research.

In 2019, prof. dr. Nejc Hodnik from the National Institute of Chemistry received a grant for researchers who are starting out on an independent career (Starting Grant) in the amount of EUR 1.5 million. The goal of the five-year project "I23STABLE" is to improve the durability of electrocatalysts using a new approach. In 2019, doc. dr. Matjaž Humar from the Jožef Stefan Institute also became the recipient of the ERC grant for starting independent research (Starting Grant) in Slovenia; he received EUR 1.5 million for his five-year project "Cell-lasers – Intracellular lasers: Coupling of optical resonances with biological processes". In 2019, a grant for renowned researchers (Advanced grant) was allocated also to prof. Jernej Ule from the National Institute for Chemistry. He received EUR 2.4 million for a 5-year project entitled "RNP Dynamics".

The lead agency scheme: **EUR 2.1 mil.**

The Agency promotes international scientific research via the lead agency scheme. By means of a cooperation agreement between the agencies of various political states, researchers are able to apply collectively, as a joint research 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 of the application is successful and the lead agency proposes co-financing of the project, another agency takes on the co-financing of the researchers from their own political state without conducting an additional review process. In 2019, the Agency co-financed 44 projects within the lead agency scheme, of which 25 were in the natural sciences (51.7 % of funding), six in engineering (14.1 % of funding), three in medicine (9.2 % of funding), three in the biotechnology (8.9 % of funding), four in the social sciences (9.92 % of funding), and three in the humanities (6.1 % of funding). Institutions in the higher education sector received 60.0 %, institutions in the public sector 38.7 %, and organisations in the private non-profit sector received 1.3 % of funding.

In 2019, projects were conducted in cooperation with:

- The Austrian Fund for Scientific Research – Fonds zur Förderung der wissenschaftlichen Forschung, FWF;
- The Research Foundation Flanders, FWO;
- The Hungarian National Research, Development and Innovation Fund, NKFIH;
- The Swiss National Science Foundation, SNSF;
- Croatian Science Foundation, HRZZ.

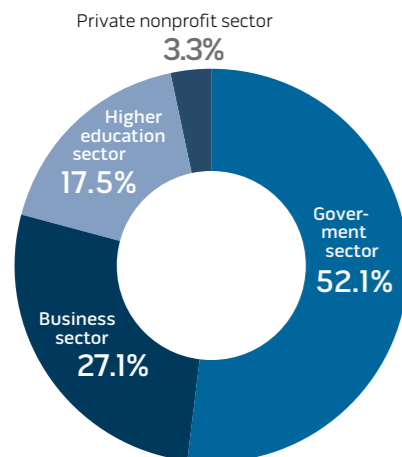
International bilateral projects **EUR 1.6 mil.**

In 2019, international bilateral scientific cooperation took place by coordinated efforts by the competent ministry and the Agency.

Cooperation involved 15 countries, comprising Argentina, Austria, Bosnia and Herzegovina, China, Germany, France, Croatia, Hungary, Italy, Japan, Montenegro, Serbia, Russia, Turkey and the United States. The majority of funds were allocated to cooperation with the United States of America (33.0 %).

The Agency cooperates with the French Alternative Energies and Atomic Energy Commission (CEA). This cooperation is conducted via a public call, the subject of which is the co-financing of international scientific research projects lasting for a period of two years. In 2019 cooperation with CEA was financed in the amount of EUR 421,000, which represents an increase of 2,6 % compared to 2018. International bilateral research projects are financed in the fields of new energy technologies, nuclear energy, adaptation to climate change, fundamental physics, life science and global safety.

Distribution of funds



Horizon 2020 public call application incentive: **EUR 0.3 mil.**

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

One-time payment towards the costs of project application is available to research organisations that are registered in the registry of research organisations, maintained by the Agency, on the day of submitting the application for the public call, and that act as coordinators or partners in a project applied for funding on a call within the Horizon 2020 Framework Programme for Research and Innovation. A sum of EUR 2,000 is contributed 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 research organisation, whereas a sum of EUR 1,000 is contributed towards costs incurred by a Slovenian research organisation, which has submitted a project independently to the international consortium, assuming the call was anticipated by the European Commission.

Support for promoting science abroad and for membership in international associations: **EUR 0.3 mil.**

The Agency co-finances the promotion of Slovenian science and knowledge by supporting active cooperation in events organised by renowned international associations, international organisations or the European Commission. Additionally, the programme facilitates cooperation with Slovenian research organisations and researchers from neighbouring states, as well as cooperation with Slovenian researchers working abroad. The call includes innovative activities for promoting Slovenian science abroad with the aim of supporting new breakthrough ideas in the field of science promotion and communication. In 2019, the Agency co-financed the following innovative activities:

- Slovenska tiskovna agencija d. o. o. (STA) - STAznanost 4.0,
- SiNAPSA, Slovenian neuroscience society – zdravaglava.si (zg.si)),
- Kvarakadabra – Innovative tool for promoting science,
- Tromba portal – Pitia promotion activity – synergy of different viewpoints for the advancement of the modern society,
- Science on the Street, Knowledge and Ideas on the go (ZNC) and
- META scientific podcasts Meta PHoDcast and Metamorfoza.

In 2019, the Agency once again included the new element of the public call, introduced in 2017 – supporting the establishment and development of global cooperation platforms.

The Agency also co-finances the memberships of Slovenian scientific associations in international scientific associations and the works of Slovenian representatives elected in international scientific associations as presidents, vice-presidents, general secretaries and members of management bodies.

THE AGENCY'S INTERNATIONAL COOPERATION – HIGHLIGHTS

Central European Science Partnership (CEUS) partners sign an agreement on multilateral scheme of the lead agency

The founding partners of the Central European Science Partnership (CEUS), including the ARRS, signed an agreement in Vienna on the establishment of a multilateral scheme of the lead agency. This is the first agreement of its kind in Europe that involves more than three agencies. By signing the agreement, the agencies confirmed the mutual coherence of evaluation procedures and established the principle of trust on which the lead agency scheme is based. CEUS founding partners, the Austrian, Czech, Polish and Slovenian research agencies, reached the agreement to establish a closer partnership intended to promote international cooperation in the field of science and strengthen cooperation in Central Europe based on existing mechanisms and development of new ones.

The agreement will allow researchers from four countries to apply for joint, at the maximum trilateral research projects, and the use of the lead agency scheme will significantly reduce their administrative burdens.

ARRS as the second agency from the EU-13 countries sign a cooperation agreement with the Swiss National Science Foundation (SNSF)

ARRS is thus the second agency from the EU-13 countries with which the SNSF has signed an agreement on direct mutual cooperation under the mechanism of the lead agency. The process of the agencies getting to know each other's operation and a detailed review of the call for proposals procedures and evaluation of research projects began in the spring of 2018. The proposal for cooperation with the ARRS was discussed and supported in two stages by the SNSF International Committee in the role of a specialised committee of the SNSF Scientific Council, which features 100 members. The ARRS Scientific Council also gave the consent to participate. A public call for Slovenian applicants to apply for joint Swiss-Slovenian projects with the SNSF as the lead agency was published at the end of February 2019.

ARRS and the Croatian Science Foundation (HRZZ) agree on a lead agency

By signing the agreement, HRZZ and ARRS upgrade long-term cooperation between the two countries in the form of mobility incentives within the execution of the annual bilateral public call for the co-financing of scientific research cooperation, on the basis of which 52 bilateral Slovenian-Croatian projects were confirmed for implementation in 2018.

HRZZ is the fifth agency with which ARRS has signed an agreement on direct mutual cooperation in the mechanism of the lead agency. This is the second agreement ARRS signed in 2019, the first one being the agreement on cooperation with SNSF.

ARRS guiding principles for international cooperation: opening up opportunities for closer international cooperation in the field of science (ARRS operation and development strategy 2016–2020)

First stage: establishing and strengthening international connections

Incentives:

1. **Bilateral cooperation** – mobility incentives, concluded agreements between the Republic of Slovenia and 48 countries across the globe
2. **COST actions** – strengthening international connections
3. **Horizon 2020** – contributions towards application costs
4. **Scholarships for visits to ERC project holders (since 2016)**
 - 3- to 6-month visits to ERC project holders
 - after the visit, the researcher visiting the ERC project holder must submit an application to one to three ERC calls (the time period is determined in the call)

Second stage: incentives for closer international cooperation in the field of science

Possibilities: public calls and invitations:

1. **Lead agency scheme – bilateral research projects**
 - Austria (FWF), Hungary (NKFIH), Belgium – Flanders (FWO), Switzerland (SNSF), Croatia (HRZZ)
2. **ERC complementary scheme (since 2011)**
 - Possibility for adapted research project that have achieved a grade exceeding a given threshold in ERC calls to be accepted for financing as national research projects (duration of up to 3 years, funding up to EUR 200,000)
3. **Marie Skłodowska-Curie seal of excellence – MSCA (since 2017)**
 - Applicants for individual scholarship calls (MSCA IF) that receive a seal of excellence in the evaluation procedure (grade of 85 % or over), can obtain funding as national research programmes (duration of up to 2 years, funding up to EUR 77,000)
4. **ERA projects – international calls of ERA networks**
 - JPI Urban Europe (since 2015)
 - NORFACE (since 2005)
 - PRIMA (since 2018)

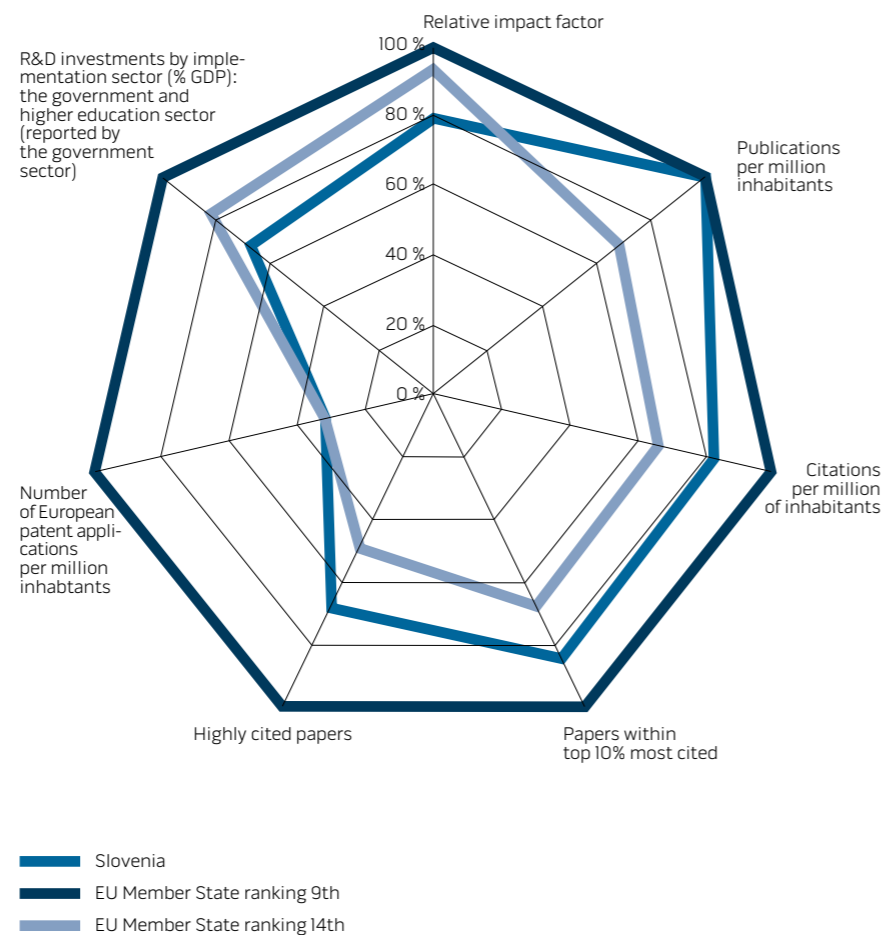
Forthcoming mechanism:

Multilateral lead agency scheme (MLA)

Science Europe working group to review possibilities to conclude an agreement on a multilateral pan-European lead agency (cooperation between 18 European agencies)

More information: <http://www.arrs.si/sl/medn/>

INTERNATIONAL COMPARISONS



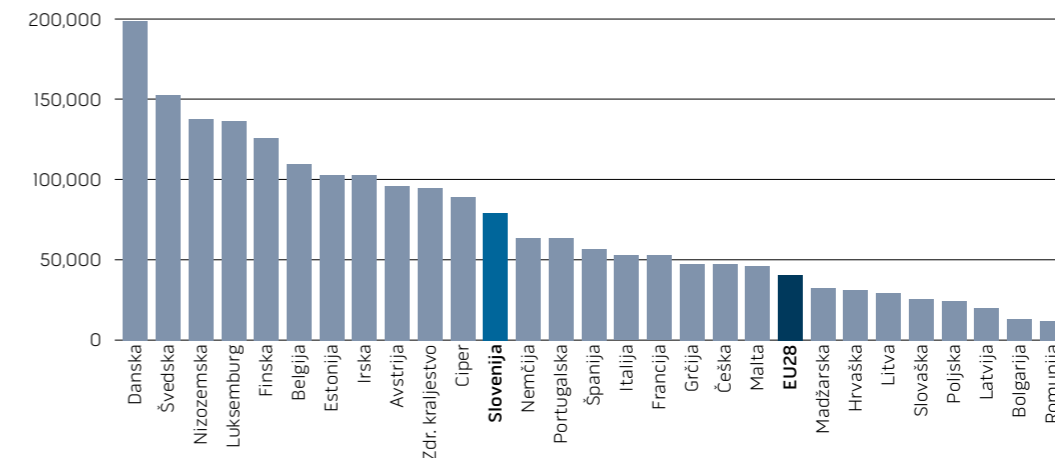
The diagram shows the majority of standard bibliometric and other quantitative indicators that are used to measure research activities across the world and that are also included in the Resolution on the research and innovation strategy of Slovenia 2011–2020. The scores for Slovenia are shown as relative according to the EU country ranking ninth (upper third of the countries). For comparison, data for the EU country ranking 14th (upper half of the countries) is also given.

Source: InCites, Thomson Reuters/Science Metrix/Innovation Union Scoreboard/Eurostat

Citations

According to the number of citations per million inhabitants, Slovenia with 79,531 citations, and is above the EU average. In the same period, the number of citations per million inhabitants was the highest in Denmark, followed by Sweden, the Netherlands and Luxembourg.

Number of citations per million inhabitants for EU countries in the 2015-2019 period

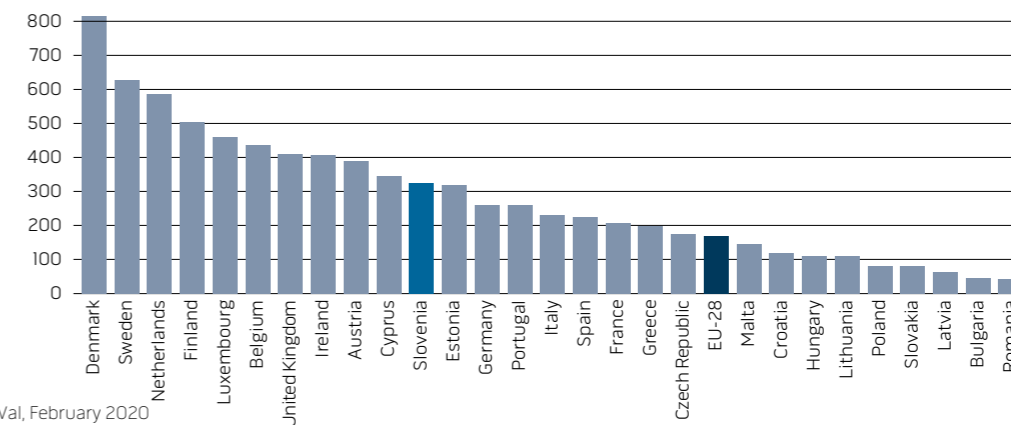


Source: InCites, Clarivate Analytics, February 2020

Published works among the 10 % of the most cited

An established bibliometric indicator for international comparisons is the number of published works that rank among the 10 % of the most cited works in the world for the given field of research. This encompasses works published in journals indexed in the Scopus bibliographical base. A four year citation window is taken into account, including the year of publication and the three subsequent years. Since 2004, Slovenia has exceeded the EU average in terms of 10 % of the most cited published works per million inhabitants. According to the latest data for 2016, Slovenia ranks 11th among the EU member states.

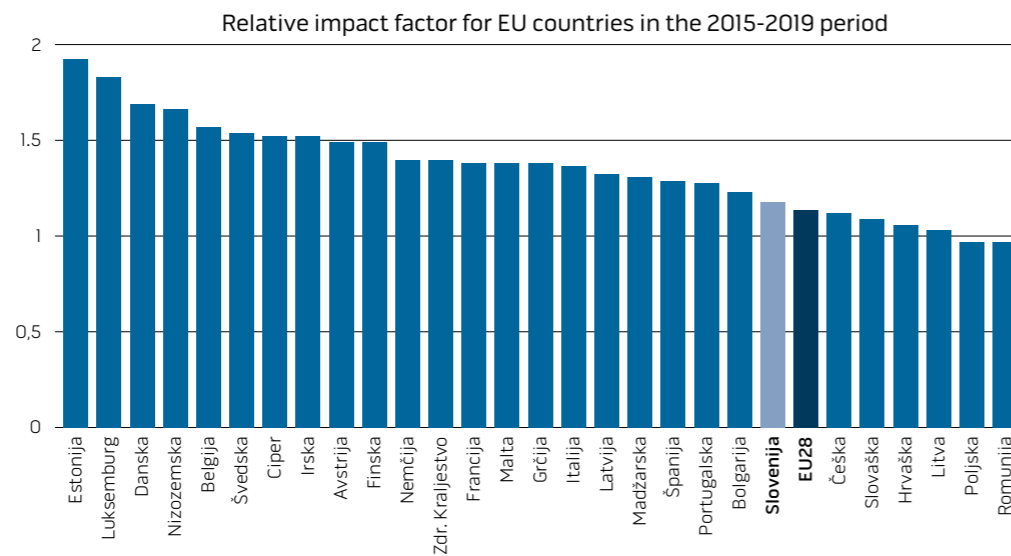
The number of published works ranking among the 10 % of the most cited works per million inhabitants for 2016 for EU member states



Source: SciVal, February 2020

Relative impact factor

The relative impact factor is the standard international bibliometric indicator measuring the ratio between the number of received citations and the number of published works in a given country compared to the global average impact factor for an individual field of research. In terms of the relative impact factor, Slovenia ranks 22nd among EU member states. In the last few years, Slovenia has recorded above-average growth. In the last year, the value of the indicator has reached the European average.



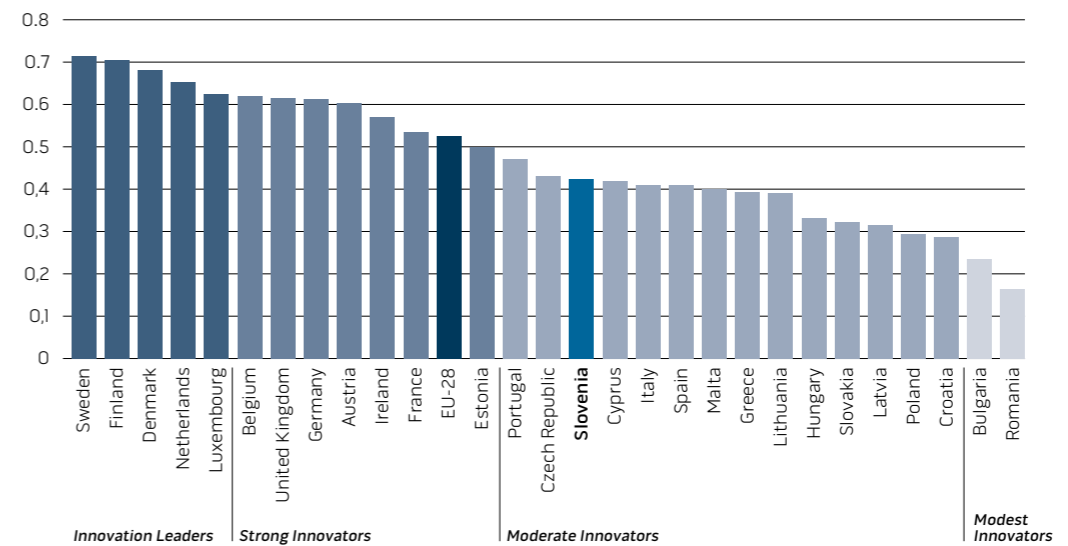
Data for 2019 shows that the relative impact factor is higher than in 2018, which amounted to 1.18. In 2018, Slovenia was just below the European average (1.14).

Source: InCites, Clarivate Analytics, February 2020

Innovation index

The joint innovation index (Innovation Union Scoreboard) provides an overview of the innovation activities of individual countries. It is comprised of over 20 indicators that include data on the educational structure, openness and excellence of the research system, financing, support and investment, connections, entrepreneurship and intellectual capital. In terms of the level of innovativeness, the countries are divided into four groups: innovation leaders, strong innovators, moderate innovators and poor innovators. Given the listed indicators, Slovenia is among the moderate innovators and ranks 15th among EU member states.

Innovation index for EU countries in 2018



International comparisons and other analyses are published on the following website: <https://www.arrs.si/sl/analize/>.

Source: Innovation Union Scoreboard, 2018

ABOUT THE 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;
- communication with the public and science promotion based on three values: openness, responsiveness, providing information of value.

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 Agency bodies. Public relations is also carried out within the Director's office.

Department of Research Programmes, Junior Researchers and Analysis and Monitoring

This department evaluates and selects research programmes and carries out the tasks related to the junior researchers programme. It analyses and monitors the development of scientific research activity and actively develops the area of science promotion. Department activities include international cooperation in the Norface network and the Urban Europe joint programming initiative. Part of the activities for the promotion of science is also carried out within the department.

Head of Department: *dr. Marko Perdih*

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*

Department of Research Infrastructure and International Cooperation

The department performs tasks in the field of research equipment and infrastructure programmes, scientific and popular science publications and scholarly monographs, international scientific research cooperation, promotion of science abroad and the work of researchers in international scientific associations. Its tasks range from activities within the mechanism of lead agencies and the seal of excellence 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 field of law and labour law procedures and conducts administrative procedures regarding access to public information and keeping of private researchers register. The department is also responsible for keeping the register of research and development activity operators. The department also carries out tasks regarding staffing and manages human resources. In addition, it carries out public procurement procedures and other procedures related to takeover of resources and services, and is responsible for ensuring the regular maintenance of Agency offices and equipment. The department also carries out main office tasks, as well as the tasks related to storing the documentary material and maintaining the archive.

Head of Department: *Katarina Hren*

Department of Finance and Accounting

The department carries out tasks related to the Agency's financial operations. It is responsible for planning, implementing, keeping records and reporting on funding for scientific research activities, as well as the Agency's programming tasks and operation. It secures the Agency's solvency. The department is responsible for putting in place payment, recovery and control mechanisms; it also carries out accounting tasks and coordinates the conclusion of joint contracts with research activity operators.

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*

Overview of financing in 2019 per programme items in accordance with the accrual principle

	Realisation in 2019 (in EUR)
FOUNDER'S OBLIGATIONS AND INFRASTRUCTURE PROGRAMMES	38,582,733
Founder's obligations for PRO	17,518,985
Infrastructure programmes – material costs	10,921,044
Reimbursement of work-related costs	5,499,494
Infrastructure programmes – salaries	4,643,210
RESEARCH PROGRAMMES AND PROJECTS	106,133,297
Research projects	33,639,359
Research programmes	66,646,484
ERA projects	221,990
ESF and ERC projects	4,196,475
Targeted research programme projects – competitiveness	1,272,672
Open access	156,315
TRAINING AND DEVELOPMENT OF SCIENTISTS	25,400,827
Junior researchers	21,938,546
Postdoctoral projects	3,456,581
Promotion of the employment of young doctors of science	5,700
RESEARCH EQUIPMENT	3,148,479
Research equipment	3,148,479
SCIENTIFIC LITERATURE, MEETINGS AND OSIC	7,431,865
Slovenian popular science periodicals	90,000
Slovenian science periodicals	1,251,955
Scholarly monographs	384,283
Foreign periodicals and databases	5,449,999
OSIC – Central Specialised Information Centres	255,629
INTERNATIONAL SCIENTIFIC COOPERATION	2,085,927
Cooperation with the EU (CEA)	722,207
International projects, bilateral cooperation	724,466
Promotion of applications to EU projects	332,000
Visits to ERC project principal investigators	24,921
International science promotion	192,028
Operation of Slovenian science associations abroad	90,305
Total:	182,783,128

The overview of funding per individual years is available on the following website: www.arrs.gov.si/sl/finan/

Public calls and tenders, published in 2019

Domestic tenders and calls

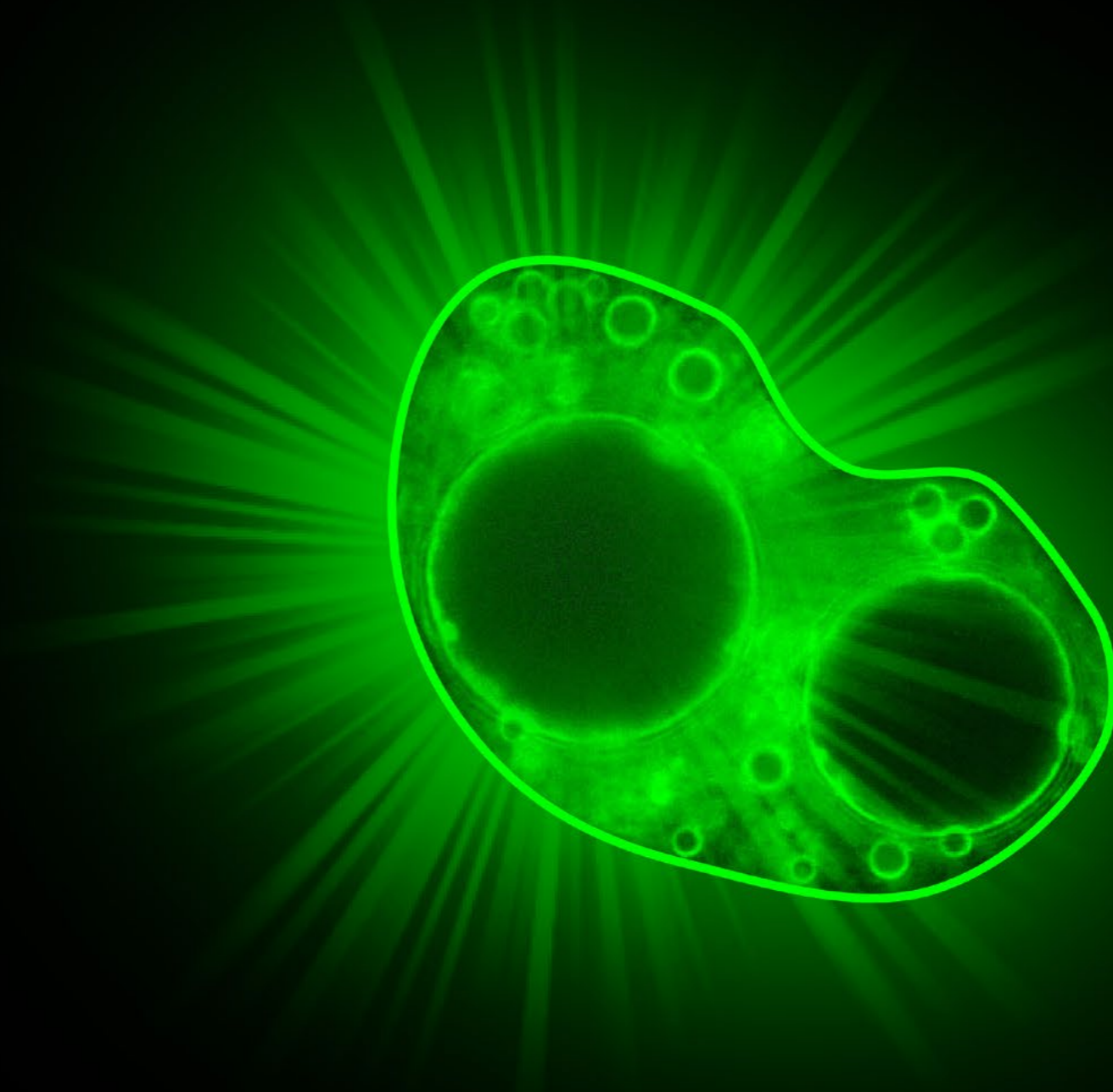
	Publication date
Public tender for the allocation of mentorship positions to research programmes in 2019	25. 1. 2019
Public call for co-financing the publishing of scholarly monographs in 2019	22. 2. 2019
Public call for financing research programmes by public research organisations – 2019	22. 2. 2019
Public tender for co-financing research programmes with concession – 2019	22. 2. 2019
Public tender for selecting research projects within the framework of the "CRP2019" targeted research programme project in 2019	31. 5. 2019
Public call for co-financing the purchase of research equipment – package 18	7. 6. 2019
Public call for co-financing the purchase of international scientific literature in 2019	13. 9. 2019
Public call for the reimbursement of costs for scientific publications in golden open access (for 2019)	11. 10. 2019
Public call for co-financing the programmes of activities of the central specialised information centres in the period 2020–2022	18. 10. 2019
Public call for co-financing research projects in 2020	13. 12. 2019

International tenders and calls

	Publication date
Public tender for co-financing scientific research cooperation between the Republic of Slovenia and the French Republic – the PROTEUS programme in 2020 and 2021	25. 1. 2019
Public tender for co-financing the Slovenian part of joint Swiss–Slovenian projects with the Swiss National Science Foundation (SNSF) as the lead agency	22. 2. 2019
Public tender for co-financing scientific research cooperation between the Republic of Slovenia and the Republic of Austria in 2020 and 2021	1. 3. 2019
Public tender for co-financing memberships and activities in international science associations in 2019	1. 3. 2019
Public tender for co-financing scientific research cooperation between the Republic of Slovenia and the Republic of Serbia in 2020 and 2021	29. 3. 2019
Public tender for co-financing scientific research cooperation between the Republic of Slovenia and the Republic of Croatia in 2020 and 2021	19. 4. 2019
Public tender for co-financing scientific research cooperation between the Republic of Slovenia and the Federal Republic of Germany in 2020 and 2021	19. 4. 2019

	Publication date
Public call for co-financing Marie Skłodowska-Curie Seal of Excellence research projects	19. 4. 2019
Public tender for co-financing the Slovenian part of joint Hungarian–Slovenian projects with NKFIH (National Research, Development and Innovation Office) as the lead agency	19. 4. 2019
Public tender for co-financing activities related to the promotion of Slovenian science abroad and integration of scientific achievements in 2019	17. 5. 2019
Public tender for co-financing adapted research projects within the complementary scheme for applications to European Research Council (ERC) calls	17. 5. 2019
Public tender for co-financing scientific research cooperation between the Republic of Slovenia and Japan from 1 April 2020 to 31 March 2022	24. 5. 2019
Public tender for co-financing the Slovenian part of joint Austrian-Slovenian projects with FWF (FWF Der Wissenschaftsfonds) as the lead agency	7. 6. 2019
Public tender for co-financing scientific research cooperation between the Republic of Slovenia and the United States of America in the period from 1 October 2019 to 30 September 2021	26. 7. 2019
Public call for co-financing visits to ERC project principal investigators in 2020	6. 9. 2019
Public tender for co-financing scientific research cooperation between the Republic of Slovenia and Montenegro in the period 2020–2022	13. 9. 2019
Public tender for co-financing scientific research cooperation (bilateral research projects) between the Republic of Slovenia and the People's Republic of China in the period 2020–2023	4. 10. 2019
Public tender for co-financing research projects between the Republic of Slovenia and the French Alternative Energies and Atomic Energy Commission (CEA) for the period 2020–2022	4. 10. 2019
Public tender for co-financing scientific research cooperation between the Republic of Slovenia and the Republic of Turkey in the period 2020–2023	25. 10. 2019
Public tender for co-financing scientific research cooperation between the Republic of Slovenia and the Kingdom of Denmark, the Kingdom of Norway, the Republic of Finland, the Republic of Estonia, the Republic of Latvia and the Republic of Lithuania in the period 2020–2022	22. 11. 2019
Public tender for postdoctoral research scholarships in Japan for researchers from the Republic of Slovenia in 2020	22. 11. 2019
Public tender for the payment of a one-time contribution towards the costs of preparing and submitting the applications for projects within the Horizon 2020 Framework Programme for Research and Innovation (for the period from 1 December 2019 to 30 November 2020)	2. 12. 2019

EXCELLENT IN SCIENCE 2019



Excellent in science is a project carried out by the Slovenian Research Agency (ARRS) as part of its endeavours to promote science. The project presents a selection of most prominent achievements from the past year.

In 2019, some of the selected achievements were presented at the national event titled **ARRS Day 2019: Supporting Excellence** held on **19 November 2019**. The selection of achievements was proposed by members of Scientific Research Councils for each scientific discipline, and was confirmed by the Agency's Scientific Council.

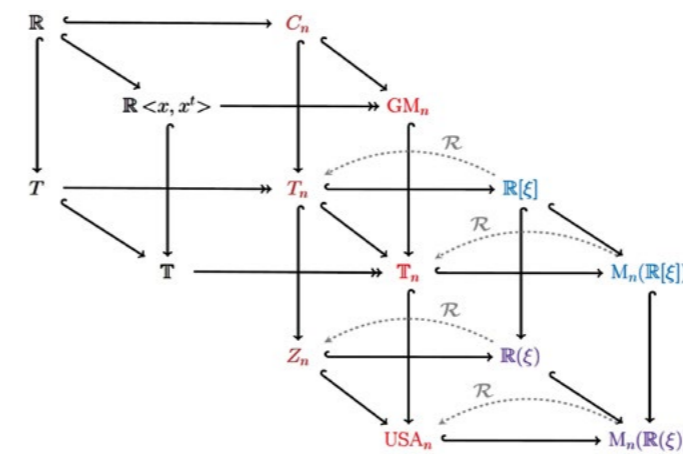
Photo on the previous page: Live laser. A laser inside a cell made up entirely of living matter.

Dr. Jurij Volčič

Positive polynomials and matrix trace

In the article Positive trace polynomials and the universal Procesi-Schacher conjecture, published in a prestigious journal Proceedings of the London Mathematical Society, Slovenian researchers Klep, Špenko and Volčič solve a 40-year-old open problem, posed by Claudio Procesi and Murray Schacher in the famous mathematical journal Annals of Mathematics: is every polynomial, positive on $n \times n$ matrices, a sum of squares? This problem arose in real algebraic geometry, which studies systems of polynomial equations and inequalities. The solutions of such a system form a semi-algebraic set. In this paper, the authors give a negative answer to the Procesi-Schacher question for $n=3$; on the other hand, they prove several positivity theorems (Positivstellensätze) that describe polynomials which are positive on semialgebraic subsets of $n \times n$ matrices. Authors used methods inspired by various areas of mathematics, such as invariant theory, noncommutative algebra, real algebraic geometry and functional analysis.

Dr. Jurij Volčič, Texas A&M University, (volcic@math.tamu.edu)



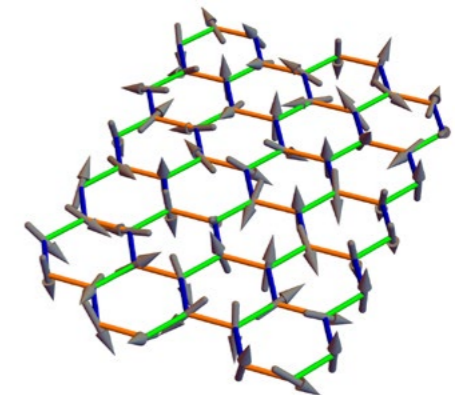
Source: KLEP, Igor, ŠPENKO, Špela, VOLČIČ, Jurij. Positive trace polynomials and the universal Procesi-Schacher conjecture. Proceedings of the London Mathematical Society, ISSN 0024-6115, Dec. 2018, vol. 117, iss. 6, pp. 1101-1134. Hyperlink: <https://londmathsoc.onlinelibrary.wiley.com/doi/abs/10.1112/plms.12156>.

Dr. Martin Klanjšek

Neither fermions nor bosons, but rather anyons

All naturally occurring elementary particles are either fermions or bosons. Fermions, such as the electron, cannot be in the same quantum state, so that electrons in the atom occupy different shells, which is the basis of the periodic system of elements. Bosons, such as photon, tend to occupy the same quantum state, which is the basis of the operation of lasers, strong coherent light sources. Four decades ago, the Nobel Prize winner Franck Wilczek was considering unusual particles, which would be neither fermions nor bosons, but rather anything in between, hence anyons. Such particles have not yet been detected in nature. In 2006, Alexei Kitaev predicted that anyonic quasiparticles could exist in a special kind of the planar quantum magnet on a honeycomb lattice (figure). The most promising realization of such a quantum magnet, the layered crystal ruthenium trichloride, has been widely studied only in the last four years, with the aim to confirm or disprove the existence of anyons. We have indeed observed two types of anyonic quasiparticles in ruthenium trichloride and hence confirmed the famous Kitaev prediction.

Dr. Martin Klanjšek, Jožef Stefan Institute (martin.klanjsek@ijs.si)



Source: N. Janša, A. Zorko, M. Gomilšek, M. Pregelj, K. W. Krämer, D. Biner, A. Biffin, Ch. Rüegg & M. Klanjšek, Observation of two types of fractional excitation in the Kitaev honeycomb magnet, Nature Physics 14, 786-790 (2018). Hyperlink: <https://www.nature.com/articles/s41567-018-0129-5>

Dr. Jernej Fesl Kamenik

Lepton flavor universality violation without new sources of quark flavor violation

Jernej Fesl Kamenik, researcher in the group of Theoretical physics of nuclei, particles and fields research program, with collaborators Yotam Soreq (MIT) and Jure Zupan (University of Cincinnati) published an article in Phys.Rev. D97 (2018) no.3, 035002 entitled Lepton flavor universality violation without new sources of quark flavor violation, which has since received considerable attention in the scientific community. According to the InSPIRE database, the work had been cited more than 70 times in the scientific literature until the end of 2019, while its main findings have been highlighted by the authors and other researchers at several international research conferences and meetings.

Lepton universality of electro-weak interactions is one of the key predictions of the standard model of elementary particles. The electric charge is the same for all generations of fermions, so that the photons couple to the electron with the same strength as to the muon or the tau. Similarly, the weak Z boson couples in the same way to all lepton generations. In the past few years, several measurements of lepton universality in rare semileptonic B meson decays have indicated possible deviations from standard model predictions. Because quark flavors change in these processes, most explanations of the anomalies in terms of standard

model extensions assume the existence of new couplings and degrees of freedom that violate quark flavors. This work, however, demonstrates the existence of solutions, which violate flavor universality, while preserving actual individual fermion flavors. Such scenarios predict the chiral structure of the new contributions, which at the quark level, coincides with that of the standard model contributions. Explicit model realizations of this idea have also been constructed in the form of renormalizable U(1) gauge theories or strongly coupled composite dynamics. Finally, the most promising searches for the relevant degrees of freedom at the LHC have been outlined in the form of di-muon resonances, which could confirm or exclude the suggested solutions.

Popular science summary of the result: This work shows, for the first time, that the observed lepton universality violations in rare B meson decays do not necessarily imply new significant violations of quark flavor, which was assumed by all previous studies. Consequently, experimental constraints on models predicting lepton universality violations from measurements of quark flavor violating processes are significantly reduced. It also helps to understand why deviations from standard model predictions could first be observed precisely in lepton universality tests.

Dr. Jernej Fesl Kamenik, Institut Jožef Stefan (jernej.kamenik@ijs.si)

Source: KAMENIK, Jernej, SOREQ, Yotam, ZUPAN, Jure. Lepton flavor universality violation without new sources of quark flavor violation. Physical review. D, ISSN 2470-0010, 2018, vol. 97, no. 3, str. 035002-1-035002-7. Hyperlink: <https://arxiv.org/abs/1704.06005>

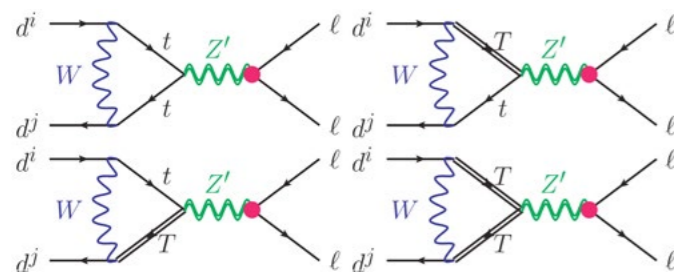


Diagram of Lepton Universality violations mechanism in hadronic decays without new violations of quark tastes on the example of a model with calibration symmetry U(1).

Dr. Martina Orlando Bonaca

Ten inconvenient questions about plastics in the sea

The paper aimed to investigate some of the hottest issues that concern the increasing presence of plastics in the sea, through ten thought-provoking questions. The investigation found that knowledge gaps include not only intrinsic aspects of plastics (e.g. quantification, typology, fate), but also biological, ecological and legislative implications. The current scenario shows that science is still far from assessing the real magnitude of the impact that plastics have on the sea. In particular, the transfer of plastics across marine trophic levels is one of the most critical knowledge gaps. Current regulations seem not sufficient to tackle the massive release of plastics into the sea. This serious environmental issue can only be effectively addressed through the combined efforts of the three main stakeholders: ordinary citizens through more eco-friendly behaviours, scientists by filling knowledge gaps, and policymakers by passing conservation laws relying on prevention and scientific evidence.

Dr. Martina Orlando Bonaca, National Institute of Biology (martina.orlando@nib.si)

Ten inconvenient questions about marine plastics

- 1: Are there realistic estimates of the quantity of plastics released into the sea?
- 2: Do we know all the sources of plastics that end into the sea?
- 3: Which categories of plastics reach the sea?
- 4: What is the fate of plastics released into the sea?
- 5: What are the ecological effects of plastics on the sea?
- 6: What do we know about the transfer of plastics across marine trophic levels?
- 7: To what extent are plastics harmful to marine life?
- 8: Are there demonstrated harmful effects on human health due to marine plastics?
- 9: Is the presence of plastics underreported for some seas?
- 10: Are current regulations able to tackle marine pollution due to plastics?



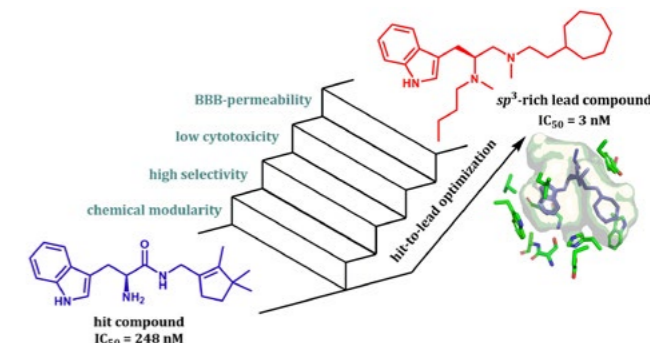
Source: BONANNO, Giuseppe, ORLANDO-BONACA, Martina. Ten inconvenient questions about plastics in the sea. Environmental science & policy, ISSN 1462-9011, 2018, vol. 85, pp. 146-154. Hyperlink: <https://www.sciencedirect.com/science/article/abs/pii/S1462901118302442?via%3Dihub>

Dr. Uroš Grošelj, dr. Stanislav Gobec

Searching for leads in Alzheimer's disease: new butyrylcholinesterase inhibitors

Alzheimer's disease is a complex neurodegenerative disorder characterized by progressive decline in memory and other cognitive functions. Due to the aging of the human population, it is predicted to affect every 85th person by 2050. Cholinesterase inhibitors enhance cholinergic transmission in patients with Alzheimer's disease, thereby improving their cognitive function and quality of life. Butyrylcholinesterase (BChE) is a promising target in advanced Alzheimer's disease because of the diminished activity of acetylcholinesterase, a similar enzyme targeted by most currently approved drugs for treating Alzheimer's disease. A new class of low nanomolar selective tryptophan-based BChE inhibitors has been discovered. The compounds are highly selective for BChE, have low cytotoxicity and predicted high permeability of the blood-brain barrier. Combined with the high chemical modularity of their scaffold, these lead compounds have great potential for further structural optimization and *in vivo* investigations of their therapeutic potential for symptomatic treatment of cholinergic hypofunction for patients with Alzheimer's disease.

Dr. Uroš Grošelj, Faculty of Chemistry and Chemical Technology (uros.groselj@fkkt.uni-lj.si)
Dr. Stanislav Gobec, Faculty of Pharmacy, University of Ljubljana (stanislav.gobec@ffa.uni-lj.si)



Source: MEDEN, Anže, KNEZ, Damijan, JUKIČ, Marko, BRAZ-ZOLOTTO, Xavier, GRŠIČ, Marija, PIŠLAR, Anja, ZAHIROVIČ, Abida, KOS, Janko, NACHON, Florian, SVETE, Jurij, GOBEC, Stanislav, GROŠELJ, Uroš. Tryptophan-derived butyrylcholinesterase inhibitors as promising leads against Alzheimer's disease. Chemical communications, ISSN 1359-7345, 4 Apr. 2019, vol. 55, iss. 26, pp. 3765-3768, illustr. Hyperlink: <https://pubs.rsc.org/en/content/articlelanding/2019/cc/c9cc01330j#divAbstract>

Dr. Janez Plavec

Adenine-dependent G-quadruplex structural switch

We determined the high-resolution NMR structure of a G-rich DNA sequence found in the regulatory region of RANKL gene. RANKL plays an important role in bone homeostasis by maintaining the delicate balance between bone formation and re-sorption. Our structural study is the first to suggest that expression of the RANKL gene may be regulated by putative folding of its G-rich region into unusual DNA structures, such as G-quadruplexes. A 20 nt long G-rich sequence with three GGG-tracts, 5'-d(GGG-TA-GGG-AGC-GGG-AGA-GGG)-3', folded into a two-quartet G-quadruplex stabilized by two base-triads. Detailed analysis of high-resolution NMR structure uncovered the critical role of a single loop adenine for the formation of distinct two-quartet and not three-quartet topology that would be expected based on the sequence alone. Understanding the impact of loop residues on the overall stability and formation of G-quadruplexes advances our ability to predict structures adopted by G-rich sequences and may also facilitate structure-based drug design. G-rich sequence, found in the regulatory region of the RANKL gene associated with osteoporosis, folds into two different G-quadruplex structures that strongly depend on the interactions of a single loop adenine. Comparison of both topologies reveals significant structural changes induced by modification of critical adenine to thymine including a switch from two- to three-quartet G-quadruplex.



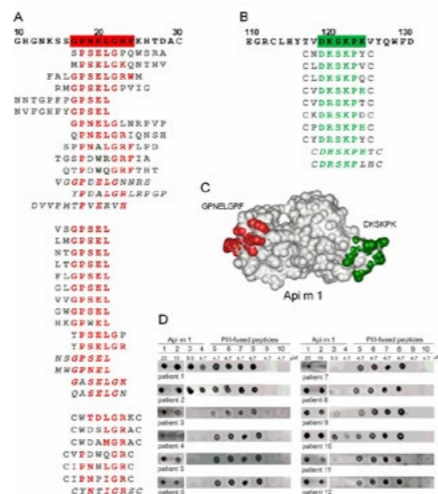
Dr. Janez Plavec, National Institute of Chemistry (janez.plavec@ki.si)

Source: LENARČIČ ŽIVKOVIČ, Martina, ROZMAN, Jan, PLAVEC, Janez. Adenine-driven structural switch from a two- to three-quartet DNA G-quadruplex. *Angewandte Chemie: International edition*, ISSN 1433-7851. [Print ed.], 19 Nov. 2018, vol. 57, iss. 47, pp. 15395-15399. [Hyperlink: https://www.onlinelibrary.wiley.com/doi/10.1002/anie.201809328](https://www.onlinelibrary.wiley.com/doi/10.1002/anie.201809328)

Dr. Mojca Lunder

Important step towards precise and safer bee venom immunotherapy

Conventional immunotherapy for bee venom allergy is associated with frequent side effects, including systemic reactions. Peptide mimotopes show great potential for the development of safer immunotherapy. We identified IgE epitopes of the major bee venom allergen Api m 1 and evaluated the immunotherapeutic potential of peptides mimicking these epitopes (mimotopes). Epitopes have been found to be located on the accessible loops protruding from the allergen surface and do not include glycosylated sites. Peptide mimotopes were prepared as fusions with the carrier and their binding to IgE from the serum of allergic patients was determined. Cellular testing of peptides in allergic patients has shown that mimotopes are not allergenic. In combination with a suitable carrier, they are also capable of stimulating an appropriate immune response.



Peptide mimotopes and their alignment to primary (A, B) and tertiary structure (C) of Api m 1 (C). Binding of allergen and peptide mimotopes to patient sera IgE (D).

Dr. Mojca Lunder, Faculty of Pharmacy, University of Ljubljana (mojca.lunder@ffa.uni-lj.si)

Source: ZAHIROVIČ, Abida, KOREN, Ana, KOPAČ, Peter, ŠTRUKELJ, Borut, KOROŠEC, Peter, LUNDER, Mojca. Identification of bee venom Api m 1 IgE epitopes and characterization of corresponding mimotopes. *The journal of allergy and clinical immunology*, ISSN 1097-6825. [Online ed.], Feb. 2019, vol. 143, iss. 2, pp. 791-794.e5, illustr. [Hyperlink: https://www.sciencedirect.com/science/article/abs/pii/S0091674918314337?dgcid=raven_sd_aip_email](https://www.sciencedirect.com/science/article/abs/pii/S0091674918314337?dgcid=raven_sd_aip_email)

Dr. Ana Novak

Thickness of marine Holocene sediment in the Gulf of Trieste

After the last ice age, global sea level rose by more than 100 meters. Therefore, many shallow continental shelves were submerged by the sea, including the northern part of the present-day Adriatic Sea. The northeasternmost part of this area is represented by the Gulf of Trieste, where shallow marine sediments have been depositing for the last 10 thousand years since the Early Holocene. In recent years, high-resolution geophysical methods are increasingly used for geological investigations of the seabed sediments. These methods allow fast mapping of individual sedimentary units, which could previously be studied only using rare and expensive boreholes. Our study presents a compilation of different geophysical datasets from the broader area of the Gulf of Trieste. Our collaboration resulted in the first map of the thickness of Holocene marine sediment in the Gulf of Trieste which includes both the Slovenian and Italian part of the Gulf. The published map represents a basis for future investigations of seabed sediments of the Gulf of Trieste as it facilitates sample and/or study site selection depending on the scientific goals. In addition to the study being published in an Open Access scientific journal, all the created models are freely available through an open web repository, which allows their future use in a wide variety of scientific disciplines.

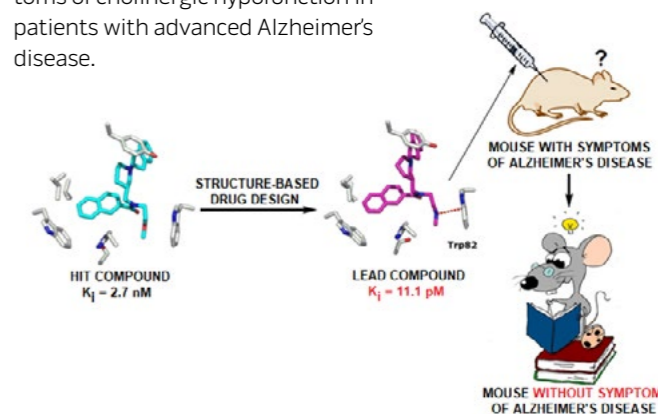
Dr. Ana Novak, Faculty of Natural Sciences and Engineering, University of Ljubljana (ana.trobec@geo.ntf.uni-lj.si)

Source: TROBEC, Ana, BUSETTI, Martina, ZGUR, Fabrizio, BARADELLO, Luca, BABICH, Alberto, COVA, Andrea, GORDINI, Emiliano, ROMEO, Roberto, TOMINI, Isabella, POGLAJEN, Sašo, DIVIACCO, Paolo, VRABEC, Marko. Thickness of marine Holocene sediment in the Gulf of Trieste (northern Adriatic Sea). *Earth System Science Data*, 2018, vol. 10, iss. 2, pp. 1077-1092. [Hyperlink: https://www.earth-syst-sci-data.net/10/1077/2018/](https://www.earth-syst-sci-data.net/10/1077/2018/)

Dr. Urban Košak

The development of a butyrylcholinesterase inhibitor with picomolar affinity and in vivo activity

The enzymatic activity of butyrylcholinesterase (BChE) in the brain increases with the progression of Alzheimer's disease, thus classifying BChE as a promising drug target in advanced Alzheimer's disease. We used structure-based drug discovery approaches to develop potent, selective, and reversible human BChE inhibitors. The most potent, compound 3, had a picomolar inhibition constant versus BChE due to strong cation-π interactions, as revealed by the solved crystal structure of its complex with human BChE. Additionally, compound 3 inhibits BChE ex vivo and is noncytotoxic. In vitro pharmacokinetic experiments show that compound 3 is highly protein bound, highly permeable, and metabolically stable. Finally, compound 3 crosses the blood-brain barrier, and it improves memory, cognitive functions, and learning abilities of mice in a scopolamine model of dementia. Compound 3 is thus a promising advanced lead compound for the development of drugs for alleviating symptoms of cholinergic hypofunction in patients with advanced Alzheimer's disease.



Dr. Urban Košak, Faculty of Pharmacy, University of Ljubljana (urban.kosak@ffa.uni-lj.si)

Source: KOŠAK, Urban, BRUS, Boris, KNEZ, Damijan, ŽAKELJ, Simon, TRONTELJ, Jurij, PIŠLAR, Anja, ŠINK, Roman, JUKIČ, Marko, ŽIVIN, Marko, PODKOWA, Adrian, NACHON, Florian, BRAZZOLOTTI, Xavier, STOJAN, Jure, KOS, Janko, COQUELLE, Nicolas, SAŁAT, Kinga, COLLETIER, Jacques-Philippe, GOBEC, Stanislav. The magic of crystal structure-based Inhibitor optimization: development of a butyrylcholinesterase inhibitor with picomolar affinity and in vivo activity. *Journal of medicinal chemistry*, ISSN 0022-2623, 2018, vol. 61, iss. 1, pp. 119-139, illustr. [Hyperlink: https://pubs.acs.org/doi/10.1021/acs.jmedchem.7b01086](https://pubs.acs.org/doi/10.1021/acs.jmedchem.7b01086)

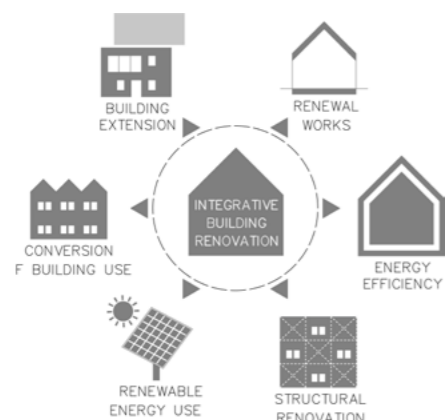
Dr. Vesna Žegarac Leskovar, dr. Miroslav Premrov

Integrative approach to comprehensive building renovations

The scientific monograph Integrative Approach to Comprehensive Building Renovations was written in order to present various priorities of renovation processes in addition to emphasizing the importance of interdisciplinary and integrative approach when considering the issue of building renovation. It combines aspects of various professional and scientific disciplines such as sustainable building design, structural stability and energy efficiency. It draws attention to several often overlooked properties of buildings that should be comprehensively integrated into the context of building renovation. The general aim of the monograph is to expose various approaches to renovation of existing buildings and to combine practical experience with existing research findings in order to disseminate knowledge and raise awareness on the importance of interdisciplinary solutions, which can lead to multiple benefits.

Dr. Vesna Žegarac Leskovar, Faculty of Civil Engineering, Transportation Engineering and Architecture, University of Maribor (vesna.zegarac@um.si)

Dr. Miroslav Premrov, Faculty of Civil Engineering, Transportation Engineering and Architecture, University of Maribor (miroslav.premrov@um.si)



Source: ŽEGARAC LESKOVAR, Vesna, PREMROV, Miroslav. Integrative approach to comprehensive building renovations, (Green energy and technology (Print)), (Green energy and technology (Internet)). Cham: Springer Nature, cop. 2019. VIII, 159 pages, ISBN 978-3-030-11476-3. ISBN 978-3-030-11475-6. [Hyperlink: https://link.springer.com/book/10.1007%2F978-3-030-11476-3](https://link.springer.com/book/10.1007%2F978-3-030-11476-3)

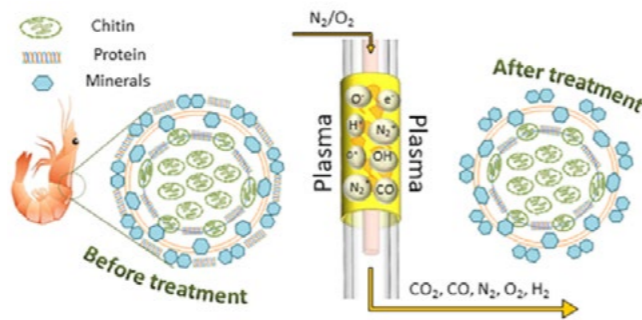
Dr. Uroš Novak

Intensified isolation of chitin biopolymer from marine biomass waste using atmospheric plasma

Researchers have introduced a methodology that allows an intensive removal of proteins from crustaceans and shrimp shells using atmospheric pressure produced dielectric barrier discharge plasma (DBD plasma) as a green alternative, instead of using a toxic solvent. The plasma-based treatment of waste shrimp shells showed an efficient ability to remove proteins within minutes without significantly affecting the chitin biopolymer, shortening the conventional process time by more than 10 times. The article was published in 2018 in the prestigious Green Chemistry journal with an impact factor of 9,405.

This technique represents a green alternative to conventional chemically-based process in the production of chitin biopolymer, without the need of solvents. Using relatively cheap gaseous O₂/N₂ mixture and working under atmospheric pressure without using any expensive vacuum components enable straightforward scale-up of this technology to an industrial level.

Dr. Uroš Novak, National Institute of Chemistry (uroš.novak@ki.si)



Source: Borić et al. Green Chem., An intensified atmospheric plasma-based process for the isolation of the chitin biopolymer from waste crustacean biomass, 2018, 20, 1199-1204. [Hyperlink: https://pubs.rsc.org/en/content/articlelanding/2018/gc/c7gc03735j#divAbstract](https://pubs.rsc.org/en/content/articlelanding/2018/gc/c7gc03735j#divAbstract)

Dr. Ivan Jerman

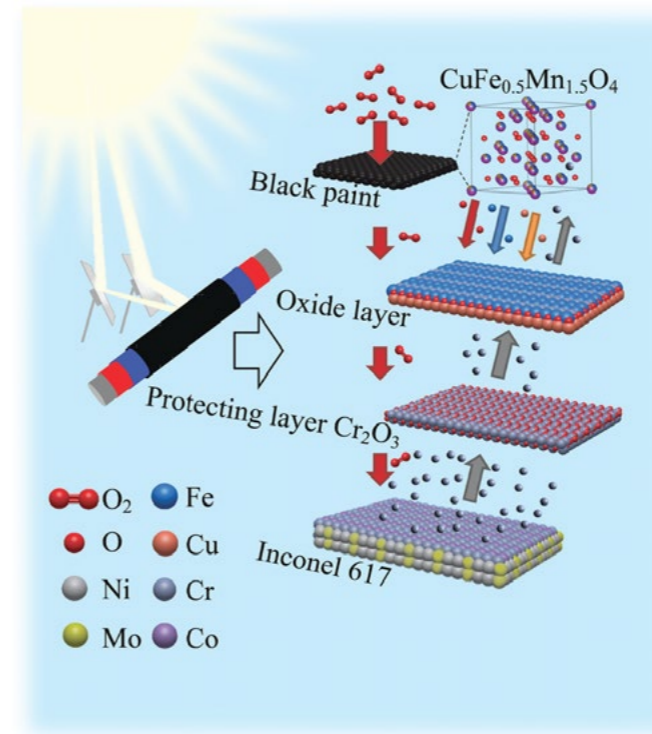
High-solar-absorptance CSP coating characterization and reliability testing with isothermal and cyclic loads for service-life prediction

Concentrated solar power (CSP) technology is based on the solar energy collection of over several square kilometres surface area, where 50,000 mirrors, through Wi-Fi technology, direct and concentrate solar energy on 1000 m² reservoir placed on a tower over 200 m high. The energy collected at the absorber heats water vapour or melted salt, which serves as a transport medium. The energy is then used directly to power a conventional turbine, similar to the one in Šoštanj, or is stored in an energy storage unit and consumed when no solar power is available. In our case, we wanted to investigate the properties of the absorber coating that a leading industrial partner uses on future concentrated power plants. Due to extreme thermal and environmental stresses during CSP operation, premature failure is expected. The lifetime of the absorber coating is directly reflected in the energy conversion

efficiency in comparison to the operating time and is proportional with the profit expected by investors. Using advanced material characterization that provides detailed insights into long-term stability and degradation mechanisms under simulated operating conditions, we determined the relationship between coating performance and its lifetime prediction. By publishing the results of the study in the renowned scientific journal Energy and Environmental Science, a standard for determining the lifetime of coatings has been set in the field of concentrator solar power plants. A similar approach could be used to evaluate future absorber materials, where operating temperatures in air atmosphere will be as high as 800°C.

The Department of Materials Chemistry has been in charge of the development of laboratory environments that illustrate the loading of materials during the operation of the power plant, the development of methodologies for evaluating the decomposition of materials and the interpretation of decomposition processes. In the theoretical section, the work was upgraded with a model description of the aging process, through which the lifetime of the absorber material can be predicted. Credibility of the work is enhanced by the fact that the study was conducted on the basis of realistic materials and data obtained from the largest solar power plant in the world, »Ivanpah«, provided by industrial partner Brightsource Company.

Dr. Ivan Jerman, National Institute of Chemistry (ivan.jerman@ki.si)



Source: NOČ, Luka, ŠEST, Ervin, KAPUN, Gregor, RUIZ-ZEPEDA, Francisco, BINYAMIN, Yaniv, MERZEL, Franci, JERMAN, Ivan. High-solar-absorptance CSP coating characterization and reliability testing with isothermal and cyclic loads for service-life prediction. Energy & environmental science, ISSN 1754-5706, 1 May 2019, vol. 12, iss. 5, pp. 1679-1694. [Hyperlink: https://pubs.rsc.org/en/content/articlelanding/2019/ee/c8ee03536a#divAbstract](https://pubs.rsc.org/en/content/articlelanding/2019/ee/c8ee03536a#divAbstract)

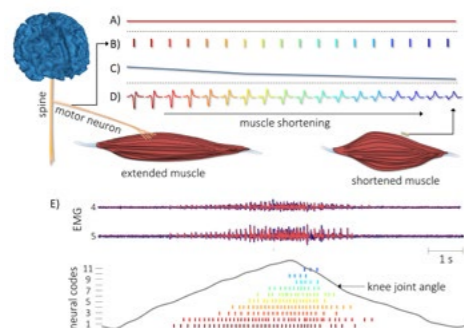
Dr. Aleš Holobar

Motor unit identification from high-density surface electromyograms in repeated dynamic muscle contractions

We developed a method for direct identification of neural codes (Figures 1.A, 1.B and 1.E) from multichannel surface electromyograms, which are non-invasively acquired on the skin surface during dynamic (eccentric and concentric) contractions of skeletal muscles. The method extends the neural code identification from isometric (fixed muscle length) to dynamic muscle contractions. In the latter, the geometry of the muscle and the distances between the measuring electrodes and the muscle fibres change. This causes deformations in surface electromyograms (Figure 1.D) that can obscure information about the muscle control strategies of central nervous system (Figure 1.C). The methods developed so far do not detect and do not eliminate these deformations, which results in imprecise estimates of neural codes. Our method surpasses these limitations and extends the applicability of surface electromyograms in the fields of neurophysiology, neurology, ergonomics, rehabilitation, bionics, kinesiology and sport sciences.

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Estimates of muscle excitation during dynamic contraction: A) simulated constant excitation; B) constant neural codes assessed by our method; C) wrong estimation with the state-of-the-art techniques; D) the recorded muscle responses to neural codes depend on the muscle geometry, causing the estimation errors in C). E) Experimental electromyograms (blue), identified muscle responses (red) and identified neural codes during dynamic contraction of the quadriceps muscle.



Source: V. Glaser, A. Holobar: Motor unit identification from high-density surface electromyograms in repeated dynamic muscle contractions IEEE Transactions on neural systems and rehabilitation engineering; 2018; pp. 1-9; COBISS ID 21986838

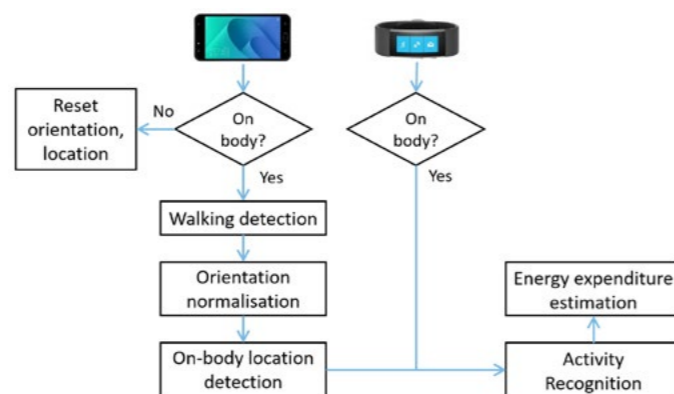
Hyperlink: <https://ieeexplore.ieee.org/document/8579211>

Dr. Mitja Luštrek

Human activity recognition using sensors

Smartphone manufacturers are transforming their devices into personal assistants who understand our situation and can adapt to it. A part of this situation is our physical activity, which can be recognised using sensors in phones and wearables. Knowing the activity facilitates services related to health, traffic, travel and others. Activity recognition using artificial intelligence is consequently a subject of intense research. We developed a new method that is capable of automatically adapting to the devices users currently have on them. The method first detects which devices are present, and for the smartphone also where on the body it is located and how it is oriented. It then uses location-specific machine-learning models to recognise the activity and estimate the users' energy expenditure (intensity of activity). We used a version of this method to participate in the Sussex-Huawei locomotion recognition challenge, where we ranked first among strong competitors from all over the world.

Dr. Mitja Luštrek, Jožef Stefan Institute
(mitja.lustrek@ijs.si)



Source: CVETKOVIĆ, Božidara, SZEKLICKI, Robert, JANKO, Vito, LUTOMSKI, Przemyslaw, LUŠTREK, Mitja. Real-time activity monitoring with a wristband and a smartphone. Information fusion, ISSN 1566-2535, 2018, vol. 43, pp. 77-93, doi:10.1016/j.inffus.2017.05.004. [COBISS.SI-ID 30521383]

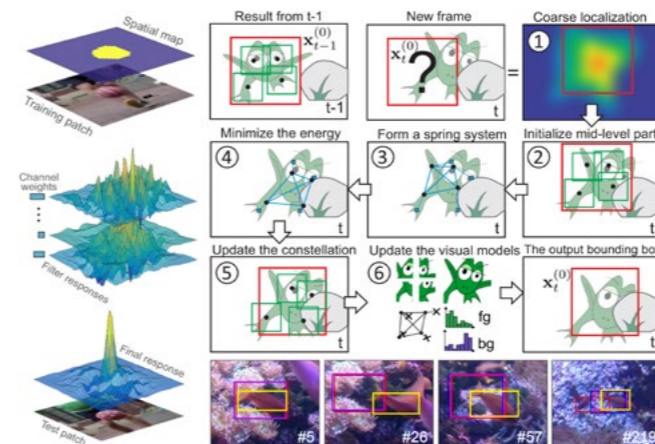
Hyperlink: <https://www.sciencedirect.com/science/article/abs/pii/S1566253517303421>

Dr. Matej Kristan

Robust algorithm for visual tracking of objects in videos

Visual object tracking includes algorithms for reporting of target location in each frame of the video given a single training image in the first frame. Tracking algorithms thus have to self-adapt to the target appearance changes as well as distinguish the target from near-by visually similar objects and cope with objects occluding the target. This makes tracking a challenging research problem with a large industrial application potential. We have developed new algorithms that robustly adapt to the target appearance under substantial view changes and deformation. The advances, published in two top computer science journals [1,2], are based on self-adaptive deformable geometric models and interactive discriminative regression guided by target segmentation. The algorithms are a scientific contribution in computer vision and autonomous systems and have a practical potential in automated driving safety systems for autonomous cars, drones and boats and entertainment industry for automated camera control and video stabilization

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Source: TABERNIK, Domen, ŠELA, Samo, SKVARČ, Jure, SKOČAJ, Danijel. Segmentation-based deep-learning approach for surface-defect detection. Journal of intelligent manufacturing, ISSN 0956-5515, 2019, pp. 1-18, illustr. Hyperlink: <https://link.springer.com/article/10.1007/s10845-019-01476-x>

Dr. Jelena Vasiljević

Development of new sustainable flame retardant polyamide 6 textile fibres

As a high-performance fibre-forming polymer, polyamide 6 (PA6) represents one of the most important raw materials used for the production of technical textile fibres. However, the flammability of PA6 textiles still represents a major problem because standard technology of melt-compounding of PA6 with flame retardant additives inhibits the continuous melt-spinning of textile fibres. The goal of our research was to solve the core of this problem and to develop a new process for the production of spinnable flame retardant PA6, with the respect to the economic, social and environmental sustainable development. Our innovative solution is based on the incorporation of a highly effective flame retardant organophosphorus compound into PA6 matrix during the polymerization process. The high stability and uniform distribution of the nanodispersed flame retardant compound in the PA6 matrix enabled the achievement of maximum flame retardant effectiveness at low concentrations with minimal impact on the fibres mechanical properties.

Dr. Jelena Vasiljević, Faculty of Natural Sciences and Engineering, University of Ljubljana
(jelena.vasiljevic@ntf.uni-lj.si)



Source: Vasiljević J., Čolović M., Jerman I., Simončič B., Demšar A., Samaki Y., Šobak M., Šest E., Golja B., Leskovšek M., Bukošek V., Medved J., Barbalini M., Malucelli G., Bolka S. (2019) In situ prepared polyamide 6/DOPO-derivative nanocomposite for melt-spinning of flame retardant textile filaments. Polymer Degradation and Stability, 166, 50-59. (2) Jerman I., Čolović M., Vasiljević J., Simončič B., Šehić A., Demšar A. Method for the preparation of a polyamide 6 copolymer and filaments, flame retardant polyamide 6 copolymer and copolymer filaments: European patent application, No. 18.180251.3 dated June 27, 2018 »FR PA6«: O/Ref: UN 2320-BE 17702-Cas 1, AV/DU. Toulouse: Industrial and Intellectual Property in France and Worldwide, 2018. 31 pages, illustr. [COBISS.SI-ID 3584624]

Hyperlink: <https://www.x-mol.com/paper/5683388>

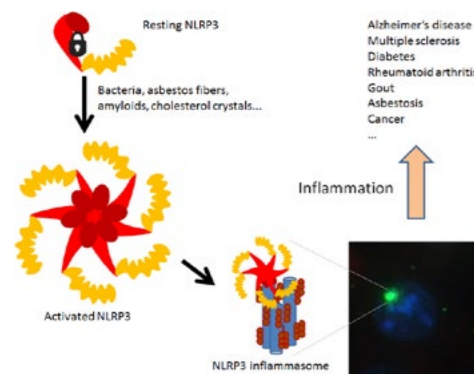
Dr. Iva Hafner Bratkovič

Molecular mechanisms of NLRP3 inflammasome activation

Inflammation contributes to the first line of defence against invading pathogens, but can be harmful as well. NLRP3 is an important innate immunity receptor that is triggered by a variety of different activators. One could say that NLRP3 senses that something is wrong with the cell and responds with inflammation and cell-destruction program to further alarm other cells about the present danger. Upon activation, NLRP3 sensor forms an inflammasome, which drives inflammation in diseases such as diabetes and Alzheimer's disease and growing evidence shows that NLRP3 is connected to other aging-related conditions. In the present study, researchers provide important clues on the role of NLRP3 domains in the mechanism of activation and regulation. In contrast to what is known for other innate immune sensors, researchers show that a large part of NLRP3 protein is unnecessary for response to triggers and inflammasome activation. This provides a more defined target for development of anti-inflammatory drugs.

Dr. Iva Hafner Bratkovič, National Institute for Chemistry (iva.hafner@ki.si)

Mechanisms of activation and regulation of NLRP3 inflammasome, the proinflammatory complex involved in a variety of diseases



Source: HAFNER BRATKOVIČ, Iva, SUŠJAN, Petra, LAINŠČEK, Duško, TAPIA-ABELLÁN, Ana, CEROVIČ, Kosta, KADUNC, Lucija, ANGOSTO-BAZARRA, Diego, PELEGRIN, Pablo, JERALA, Roman. NLRP3 lacking the leucine-rich repeat domain can be fully activated via the canonical inflammasome pathway. Nature communications, ISSN 2041-1723, 5 Dec. 2018, vol. 9, article no. 5182, pp. 1-18, illustr. Hyperlink: <https://www.nature.com/articles/s41467-018-07573-4>

Dr. Helena Podgornik

From genes to chromosomes and back

Chronic lymphocytic leukemia (CLL) is clinically and biologically a very heterogeneous disease. In patients requiring treatment, FISH (fluorescence in situ hybridization) analysis is performed to identify four recurrent chromosomal changes associated with the progression of the disease. In the last decade, a new cell culture technique has been established that also enables the chromosomes banding analysis. Due to the lack of data on the role of cytogenetic aberrations in the karyotype, a multicentre retrospective study was set up as part of the European Research Initiative on CLL (ERIC). 17 European institutions included 5479 patients with CLL in the study. The basic finding of the study is that in CLL, a highly complex karyotype is unambiguously associated with an adverse disease course. This is the one where we find 5 or more independent chromosomal aberrations at a time. It proved to be the most unfavourable predictive factor regardless of the clinical stage of the disease, changes in the TP53 gene or mutational status of the IGHV gene. The study thus provided a definition of a complex karyotype in CLL.

Dr. Helena Podgornik, University Medical Centre Ljubljana (helena.podgornik@kclj.si)

Source: BALIAKAS, Panagiotis, JEROMIN, Sabine, ISKAS, Michalis, PUIGGROS, Anna, PLEVOVA, Karla, NGUYEN-KHAC, Florence, DAVIS, Zadie, RIGOLIN, Gian Matteo, VISENTIN, Andrea, XOCHELLI, Aiki, PODGORNIK, Helena, et al. Cytogenetic complexity in chronic lymphocytic leukemia: definitions, associations and clinical impact. Blood, ISSN 0006-4971, 2019, vol. 133, no. 11, pp. 1205-1216, doi: 10.1182/blood-2018-09-873083. [COBISS.SI-ID 5644204] Hyperlink: <https://www.ncbi.nlm.nih.gov/pubmed/30602617>

Dr. Alja Videtič Paska, dr. Katarina Kouter

Genome-wide DNA methylation in suicide victims revealing impact on gene expression

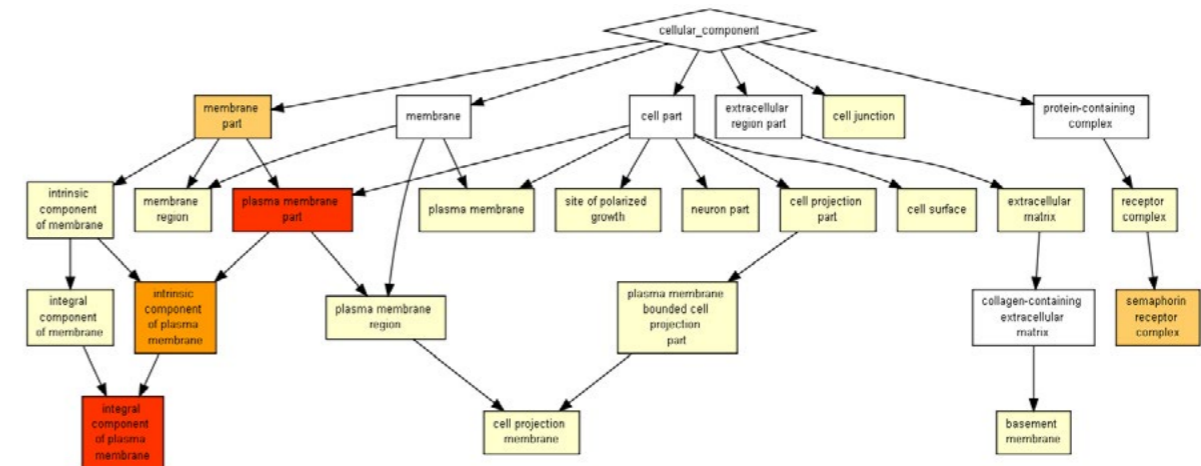
Suicidal behaviour is a multifactorial, polygenic state that affects millions worldwide. Slovenia is one of the countries with the highest suicide rate in Europe and worldwide. Many risk factors are associated with suicidal behaviour, but its molecular mechanisms are not well known. Interesting and promising molecular mechanisms include epigenetic mechanisms that link environmental and genetic factors.

In our study, we focused on DNA methylation, which can significantly affect the level of gene expression. Using a next-generation sequencing method, an association study

of genome-wide DNA methylation in two brain regions revealed many differences in methylation levels between suicide victims and control group, with gene ontology analysis showing that these differences reside mainly in genes related to brain plasticity. Furthermore, by conducting gene expression analysis, we confirmed that changes in methylation patterns coincide with the level of gene expression.

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Dr. Katarina Kouter, Faculty of Medicine, University of Ljubljana (katarina.kouter@mf.uni-lj.si)



Source: KOUTER, Katarina, ZUPANC, Tomaž, VIDETIČ PASKA, Alja. Genome-wide DNA methylation in suicide victims revealing impact on gene expression. Journal of affective disorders, ISSN 1573-2517, Jun. 2019, vol. 253, pp. 419-425, illustr. <https://www.sciencedirect.com/science/article/pii/S0165032719304379?via%3Dihub>, doi: 10.1016/j.jad.2019.04.077. [COBISS.SI-ID 34289881] Hyperlink: <https://www.sciencedirect.com/science/article/abs/pii/S0165032719304379?via%3Dihub>

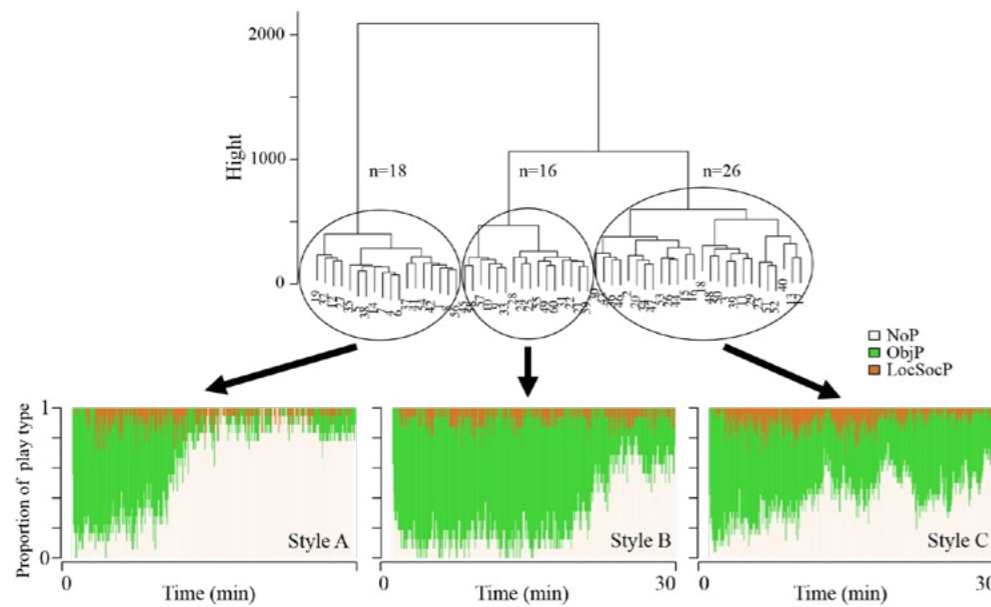
Dr. Manja Zupan

Individual play patterns stimulated by a familiar object are group-driven

Play is considered to be behaviour with a motivational state of liking and finding strong group-determined play behaviour in pigs, supports that play is a pleasurable socio-emotional interaction. Maintaining proximity and showing synchronised behaviour during exploration and play allows animals to continuously exchange information about their emotional states. Such behaviour responses may enable an individual pig to emotionally benefit from being in a group or improving individual abilities to gain food resources and increasing the chance of survival. The study of group play patterns help us better understand the general behavioural needs of group-living animals using

the novel application of statistical methodologies to the behaviour data. We applied the cluster analysis and the statistical modelling of sequence data, which allowed us to demonstrate that individual decisions of what play type to perform or for how long to play are strongly influenced by communal decisions. Our findings may stimulate us to create better conditions for forming groups that would provide captive animals with an adequate social and physical environment and ultimately better welfare and health.

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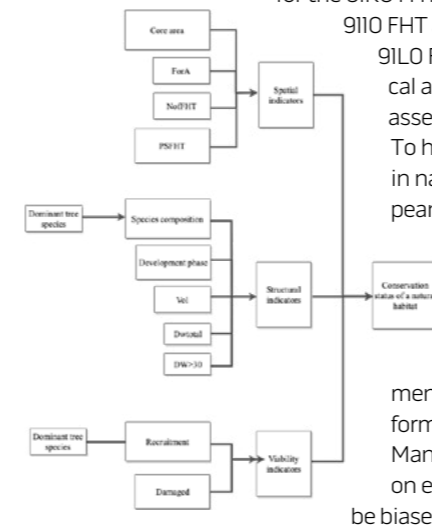
Cluster dendrogram (above) and the three clusters of pigs depending on the sequence of play (below). A detailed analysis of the behavioural patterns in the groups made it possible to identify the behavioural patterns of individuals and their functioning in the group. The study identified three types of activity: NoP-no play activities; ObjP-object play; LocSocP-locomotor and social play.

Source: ZUPAN, Manja, REHN, Therese, OLIVEIRA, Daiana de, MALOVRH, Špela, KEELING, Linda J. Individual play patterns stimulated by a familiar object are group-driven. Scientific reports, ISSN 2045-2322, 2019, vol. 9, pp. 1-8, [e]6092, illustr. <https://www.nature.com/articles/s41598-019-42382-9>, doi: 10.1038/s41598-019-42382-9. [COBISS.SI-ID 4205192]
Hyperlink: <https://www.x-mol.com/paper/5644154>

Dr. Petra Grošelj

Toward objective assessment of the conservation status of (the Natura 2000) forest habitat types: a comparison of a qualitative and a quantitative modelling approach

The objective of our study was to contribute to the more consistent assessments and reporting about the conservation status of forest habitat types in Natura 2000. We developed two decision support models based on the evaluation of a set of indicators: spatial, structural and viability indicators. The first model is simple, qualitative model, based on the Slovenian model DEX. The second model is based on fuzzy logic with numerical inputs and larger sensitivity. Both models were tested with data from Slovenia's three largest forest habitat types, namely 9110 - Luzulo-Fagetum beech forests, 91K0 - Illyrian Fagus sylvatica forests (Aremonio-Fagion) and 91L0 - Illyrian oak-hornbeam forests (Erythronio-Carpinion). The DEX model produced uniform results and defined the conservation status of all three FHTs as least favourable. The fuzzy model produced a favourable conservation status for the 91K0 FHT, least favourable for the 91L0 FHT and unfavourable for the 9110 FHT. The results were logical and in line with the existing assessments.



To halt the loss of biodiversity in natural habitats, the European Union adopted the Habitats Directive and established the Natura 2000 network. The harmonization of habitat assessment methods and reporting formats are a critical issue. Many reports are largely based on expert opinions and tend to be biased and incomparable.

Dr. Petra Grošelj, Biotechnical Faculty, University of Ljubljana (petra.groselj@bf.uni-lj.si)

Source: KOVAČ, Marko, GROŠELJ, Petra. Toward objective assessment of the conservation status of (the Natura 2000) forest habitat types: a comparison of a qualitative and a quantitative modeling approach. Ecological indicators: integrating monitoring, assessment and management, ISSN 1470-160X, Jun. 2018, vol. 89, pp. 281-289, graphs.
Hyperlink: <https://www.sciencedirect.com/science/article/abs/pii/S1470160X18300773>

Dr. Zlata Luthar

Breeding varieties of buckwheat provide high quality products

The common buckwheat variety Trdinova and the Tartary buckwheat Zlata were created by crossing Slovenian genetic resources, which are stored at the Biotechnical Faculty. In 2017, a two-year project of international registration and entry into the National Variety List of the Republic of Slovenia was completed. The breeding of variety Trdinova has improved the properties of interest to growers (higher yields and resistance to lodging), the milling industry (greater grinding efficiency and easier peeling to obtain groats) and consumers (the tendency for lighter flour is achieved by light gray and gentle hull, and kept the flour products and porridge brighter). In the Tartary buckwheat Zlata, which is the first officially certified variety in Europe, we gained golden yellow flour, reduced folds and shedding of seeds and plant lodging. Both types of buckwheat are gluten free and are grown in Slovenia.

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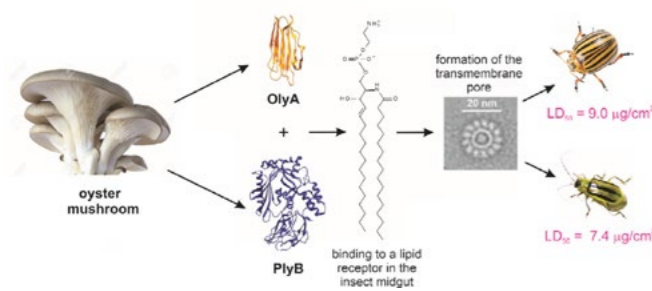
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Hyperlink: <https://plus.si.cobiss.net/opac7/bib/8946553>

Dr. Kristina Sepčić

Protein complexes from fungal genus *Pleurotus* as new biopesticides for controlling Colorado potato beetle and western corn rootworm

The results of this study offer new solutions in finding an effective strategy for the control of two economically important plant pests: the western corn rootworm and the Colorado potato beetle. We clearly demonstrated the potential of the aegerolysin proteins isolated from the fungal genus *Pleurotus* to (i) interact with artificial and biological lipid membranes that contain physiologically relevant concentration of an insect-specific lipid, ceramide phosphoethanolamine, (ii) efficiently form transmembrane pores in these membranes in concert with their protein partner PlyB, and (iii) selectively kill larvae and adults of two coleopteran pests; namely the western corn rootworm and the Colorado potato beetle. These aegerolysin-based protein complexes exert their insecticidal activity through interaction with a specific insect membrane lipid receptor, and not with pest proteins that can be prone to mutation, like in the case of the insecticidal Cry proteins produced by bacterium *Bacillus thuringiensis*. Therefore, the chances of evolving resistance to these aegerolysin/PlyB protein complexes should be extremely small.

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Source: Panevska, A., Hodnik, V., Skočaj, M., Novak, M., Modic, S., Pavlic, I., Podržaj, S., Zarič, M., Resnik, N., Maček, P., Veranič, P., Razingar, J., Sepčić, K. 2019. Pore-forming protein complexes from *Pleurotus* mushrooms kill western corn rootworm and Colorado potato beetle through targeting membrane ceramide phosphoethanolamine. *Scientific reports*, 9, 1-14.
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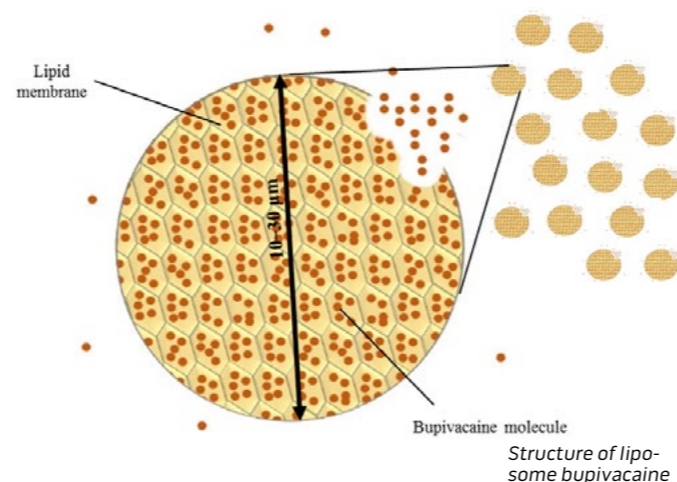
Dr. Alenka Seliškar

Neurological and histological outcomes after subarachnoid injection of a liposomal bupivacaine suspension in pigs: a pilot study

Injectable liposomal bupivacaine suspension is an extended release local anaesthetic bupivacaine, formulated as an aqueous solution of multivesicular liposomes, organized in a honeycomblike structure. When the outer liposomes burst, they release the encapsulated content and the remaining liposomes reorganize until all encapsulated bupivacaine is gradually released.

The pilot study investigates the neurological and histological outcomes of escalating doses of liposomal bupivacaine suspension administered intrathecally in pigs. Pigs are an excellent model for translational research because of the similarities between human and pig spine anatomy. Intrathecal administration of liposomal bupivacaine in pigs exhibited a dose-response effect, and resulted in longer duration of neuraxial block than bupivacaine hydrochloride without histologic evidence of neurotoxicity.

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Source: Žel in sod. Neurological and histological outcomes after subarachnoid injection of a liposomal bupivacaine suspension in pigs: a pilot study. *British Journal of Anaesthesia* 2019; 122(3): 379-387.
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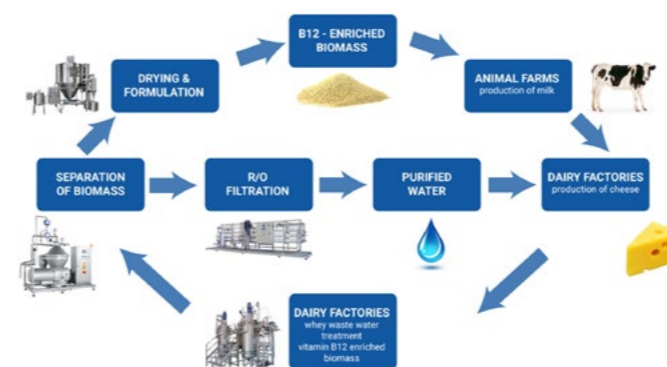
Dr. Mirjan Švigelj

Development of vitamin B12 production technology using waste whey

Waste whey represents a significant problem for the dairy industry. Due to its high organic load, it needs to be processed before disposal to avoid environmental damage, which, however, calls for technologies for efficient utilisation. The biotechnological potential of waste whey is significant as more than 200 million tonnes are produced annually and only 50% is currently being processed in wastewater treatment plants or used for other low-value applications. Acies Bio Ltd, a member of the program group P4-0116 led by Ines Mandič-Mulec, PhD, developed a novel technology for the utilisation of waste whey. The technology is able to process waste whey to produce vitamin B12, a high value product. A novel approach was used by co-culturing two microorganisms where one produces vitamin B12 while the other reduces the remaining organic load. The approach was novel and enabled Acies Bio to secure a patent, which was granted in 2018.

The whey processing technology has a big potential to reduce the negative impacts of whey, reduce costs to dairy companies and enables the transition to a circular economy.

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Source: ŠVAGELJ, Mirjan, FUJS, Štefan, KOSEC, Gregor, PETKOVIČ, Hrvoje. Co-cultivation of propionibacterium and yeast: US 9938554 (B2), 2018-04-10. [Alexandria: United States Patent and Trademark Office], 2018. [8] p., illustr. [COBISS.SI-ID 4907128]; Patent family: US 2017/0145467 (A1), 2017-05-25; WO 2015/169967 (A1), 2015-11-12; EP 2 942 397 (A1), 2015-11-11; EP3140416 (A1), 2017-03-15; JP2017514526 (A), 2017-06-08

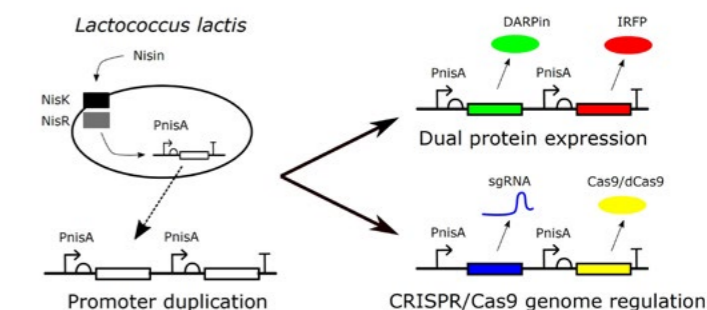
Dr. Aleš Berlec

Single plasmid systems for inducible dual protein expression and for CRISPR-Cas9/CRISPRi gene regulation in lactic acid bacterium *Lactococcus lactis*

The bacterium *Lactococcus lactis* is a safe lactic acid bacterium used in the dairy industry and as a probiotic; it is also gaining importance in biotechnology as a host for the recombinant protein expression. Approaches to improve genetic engineering of *L. lactis* are therefore highly desirable, as they significantly extend the applicability of this bacterium and facilitate research of its physiology.

As part of the research, we developed a system that, on the basis of duplication of an inducible nisin promoter, enabled the simultaneous expression of two model proteins. The resulting system was then used for Cas9 protein expression and sgRNA transcription, which are key elements of genome regulation by the CRISPR technique. We were the first to establish a functioning CRISPR system in *L. lactis*, which was confirmed by targeting the three model genes *htrA*, *ermR* and *upp*. Gene *upp* was effectively silenced using CRISPR interference technique (CRISPRi), further expanding the possibility of using the developed technique.

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Source: Berlec Aleš, Škrlec Katja, Kocjan Janja, Olenic Maria, Štrukelj Borut. Single plasmid systems for inducible dual protein expression and for CRISPR-Cas9/CRISPRi gene regulation in lactic acid bacterium *Lactococcus lactis*. *Scientific reports*, 2018, vol. 8, pp. 1-11.
Hyperlink: <https://www.nature.com/articles/s41598-018-19402-1>

Dr. Eva Klemenčič

League tables in educational evidence-based policy-making: can we stop the horse race, please?

International large-scale student assessments (ILSAs) in education represent a valuable source of information for policy-makers, not only on student achievements, but also on their relationship with different contextual factors. However, league tables are often the only evidence used in policy debates and decisions on education. The use of league tables more often turns into 'horse-ranking', ignoring the contexts of teaching and learning. This is often supported by the media, turning the use of results into their abuse. The purpose of this paper is to discuss the use and misuse of league tables in reporting ILSA results, vs. the use of data for in-depth analysis in order to make informed decisions. The argumentation is based on methodological limitations of ILSAs, as well as on examples from the IEA' Progress in International Reading Literacy Study (PIRLS). The findings are useful for researchers in education, policy makers, media, teachers, etc.



Dr. Eva Klemenčič, Educational Research Institute (eva.klemencic@pei.si)

Source: KLEMENČIČ, Eva, MIRAZCHIYSKI, Plamen. League tables in educational evidence-based policy-making: can we stop the horse race, please?. Comparative education, ISSN 1360-0486, 2018, iss. 3, pp. 309-324, doi: 10.1080/03050068.2017.1383082. [COBISS.SI-ID 3097431]
 Hyperlink: <https://www.semanticscholar.org/paper/League-tables-in-educational-evidence-based-can-we-Klemenčič-Mirazchiyski/eaf0f852a183549c466465d921c48c03a6fd1b>

Dr. Gregor Čehovin

Meta-analyses in survey methodology: a systematic review

Meta-analysis is a statistical synthesis of a comprehensive set of results from primary studies. Various classifications place it at the very top of the hierarchy of scientific approaches in terms of their epistemological strength. The importance of meta-analyses is indicated by the very high citation score of such publications. While meta-analyses are highly recognizable in areas such as medicine and psychology, there are relatively few meta-analyses in survey methodology. The systematic classification of past meta-analyses in the field of survey methodology contributes significantly to promoting the use of meta-analysis in survey methodology, as it points to two main gaps in the current research. The first gap involves five of the seven dimensions of the total survey error paradigm, which are not addressed by current meta-analyses. The second main gap comprises areas within the dimensions of nonresponse error and measurement error, where past meta-analyses have not taken into account all possible survey design characteristics. The paper therefore opens the way for new meta-analyses in the field of survey methodology and thus encourages further development of methods for achieving the quality of survey data.

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An example hierarchy of empirical evidence strength according to research design



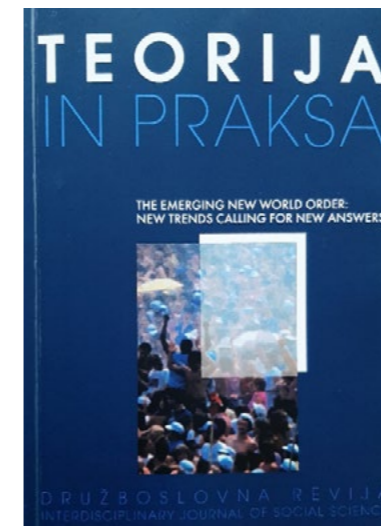
Vir: Povzeto po Evans (2003), Rodgers et al. (2010), Melayk in Fineout-Overholt (2011), Costa in Poe (2012), Straus, Glasziou, Richardson in Haynes (2018).

Source: ČEHOVIN, Gregor, BOŠNJAK, Michael, LOZAR MANFREDA, Katja. Meta-analyses in survey methodology: a systematic review. Public opinion quarterly, ISSN 0033-362X, Win. 2018, vol. 82, no. 4, pp. 641-660, illustr.
 Hyperlink: <https://academic.oup.com/poq/article-abstract/82/4/641/5183321?redirectedFrom=fulltext>

Dr. Marjan Svetličič

The emerging new world order: New trends calling for new answers

The world is at a crossroads. We are faced with Thucydides' trap (the danger of war), which is exacerbated by growing populism/fascism within countries. It is therefore essential to find new answers to the crisis. Growing inequality impedes progress, protectionism threatens a rule based international system. All this and tectonic geopolitical shifts (the rise of China) have been overlooked by over-mathematization. To counteract the tendency of political and corporate power to grow in the VUCA world, to enhance the resilience of states, businesses and individuals to black swans, it is necessary return to a politico-economic, interdisciplinary approach. The articles question the existing theories, underestimating the costs of international trade/globalization, and the role of the market/government (redistribution policy). Academics are too responsible for the crisis because we do not know how to communicate the theories findings to the public/students clearly. The articles also provide concrete proposals for economic policy and firms strategies.



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Source: GRIZOLD, Anton, SVETLIČIČ, Marjan. The emerging new world order: new trends calling for new answers. Teorija in praksa: revija za družbena vprašanja, ISSN 0040-3598, May 2019, iss. 56, special iss., pp. 333-337. [COBISS.SI-ID 36164957]
 Hyperlink: <https://plus.cobiss.si/opac7/bib/36164957>

Dr. Katja Filipčič

Special Part of the Criminal Code – A Scientific Commentary

The Special part of the Criminal Code covers descriptions of all (more than 270) criminal offences in the Slovenian legal system. In other countries, large and in-depth commentary on Criminal Code is a standard part of the legal culture, and in Slovenia, the Criminal Code has not yet been extensively commented. As the offences span different fields of social life and law (e.g. constitutional law, family law, medicine, pharmacy), 56 experts and 33 expert assistants from different disciplines participated in the four-year research project. The result is a comprehensive, theoretically in-depth and systematic analysis of all aspects of criminal offences, published in three volumes, containing more than 3,500 pages. The commentary represents an important step in the development of Slovenian criminal law theory and unification of case law.

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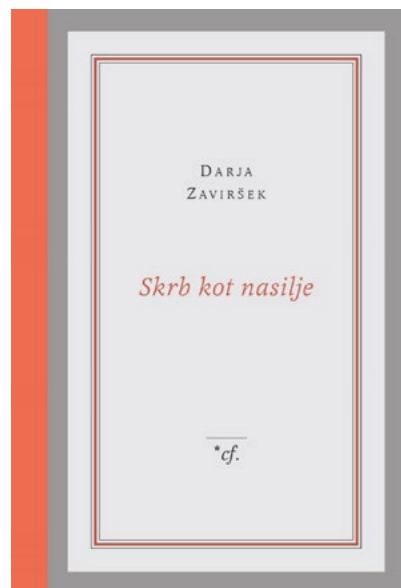
Source: KOROŠEC, Damjan, et al., KOROŠEC, Damjan (editor), FILIPIČIČ, Katja (editor), ZDOLŠEK, Stojan (editor), KORITNIK, Boštjan (editor), KREČA, Klemen (editor). Veliki znanstveni komentar posebnega dela Kazenskega zakonika (KZ-1), (Zbirka predpisov). 1st edition. Ljubljana: Uradni list Republike Slovenije: Faculty of Law, University of Ljubljana, 2018-2019. Vol. 3 ISBN 978-961-204-654-5. ISBN 978-961-204-655-2. ISBN 978-961-204-656-9. ISBN 978-961-204-652-1. [COBISS.SI-ID 298075136]
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Dr. Darja Zaviršek

Care as Violence

The Scientific Monograph *Skrb kot nasilje – Care as Violence* (Publishing House /**cf.*, Ljubljana, 2018) is a theoretical analysis based on the empirical evidence of post-socialist societies and Slovenia in particular. The book notes that care and violence are mostly perceived as two mutually exclusive phenomena, even binary oppositions. The issues of care are linked to areas of social life such as family, parenting, religious activities, social policy, multi-generational solidarity. By contrast, violence is associated with emergencies and crises, exceptional situations and as caused by individual pathology. However, different views are possible. A scientific monograph analyses particularly those social phenomena that manifest themselves on the surface as care (for persons with disabilities, the poor, women, children), while a deeper analysis reveals their disciplining and violent effects. The

book intertwines theories of asylum practices, the construction of migrant people as a security, cultural and social threat, theories of neopatriarchy, child sexual abuse in church settings. It also reflects on the contemporary shift of tertiary education which became a form of charitable care for young people.



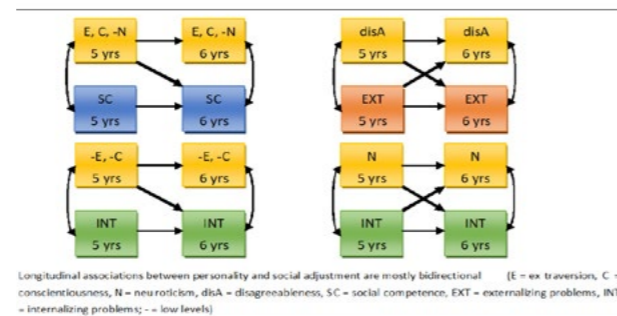
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Source: ZAVIRŠEK, Darja. *Skrb kot nasilje*, (Oranžna zbirka). Ljubljana: Publishing House/**cf.*, 2018. 299 pages, illustr. ISBN 978-961-257-087-3. [COBISS.SI-ID 294022144] Hyperlink: <https://plus.cobiss.si/opac7/bib/nuk/294022144>

Dr. Maja Zupančič, dr. Anja Podlesek, dr. Tina Kavčič

Adjustment associations at the transition from kindergarten to school: Evaluating the vulnerability and the scar model

The paper explores whether child personality shapes the development of social adjustment (vulnerability model) and whether social adjustments lead to changes in personality (scar model). In support of the vulnerability model, child extraversion, conscientiousness and emotional stability in kindergarten lead to higher social competence after school entry. Low extraversion and conscientiousness at age five represented personality vulnerability for later internalizing problems, while these problems showed bidirectional associations with neuroticism, i.e. early internalizing problems also predicted subsequent increase of neuroticism. Consistent with vulnerability and scar models, results also showed bidirectional links between disagreeableness and externalizing problems. Thus, links between personality traits and social adjustment at the transition to school are differential and mostly consistent with co-responsive principle. Kindergarteners' personality characteristics enable the identification of children with increased risk for problematic adjustment to school.



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Source: Zupančič, M., Podlesek, A. and Kavčič, T. (2018). Child personality - adjustment associations at the transition from kindergarten to school: Evaluating the vulnerability and the scar model. *Child Indicators Research*, ISSN 1874-8988, 11(1), 97-116, doi: 10.1007/s12187-016-9423-x. [COBISS.SI-ID 62208610] Hyperlink: <https://link.springer.com/article/10.1007%2F-s12187-016-9423-x>

Dr. Aleš Filipčič

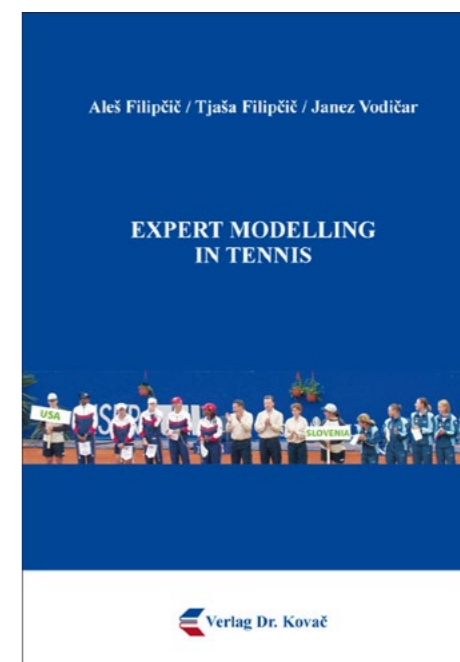
Expert modelling in tennis

We live in the age of information, where data has become a commodity. This is as true for sports as many other fields since data is collected for both spectators and sports enthusiasts, but especially for athletes and sports professionals who plan, organise, implement, and control the process of sport training. As in many other fields, data analysis, notation, video analysis, and monitoring of various statistics have become a part of the tennis training process. The effectiveness of tennis players is monitored from various perspectives and with different goals and purposes. In any case, from the point of collecting, evaluating, and using data, data transformation into information is important, as well as the transformation of information into knowledge. It is a continuous and cyclical process. Expert modelling is an approach where different knowledge and experience is collected, evaluated, and organised in a user-friendly manner. On the basis of data collected in a period of 25 years, a model of performance potential of young tennis players for selected abilities, traits, and characteristics has been constructed and presented. Results of a young tennis player testing were presented in the form of an expert tree and compared with results of competitive successfulness. By comparing the competitive success and the results of measurements, we get a comprehensive picture of the performance of the tennis player. In particular, the expert model allows ongoing monitoring of tennis players progress and analysis of training process effectiveness.

Nowadays, we can no longer imagine sports training without the support of science-based theoretical and practical knowledge, experience, and a coach's specific set of skills. The coach guides the athlete in order to find the limits of his or her abilities. With the help of testing and screening processes, the coach and the athlete determine the player's level of athletic preparation. Concurrently, the collected measurement data is used as the basis for the analysis of

the effectiveness of sports training and allows the coach to guide and select athletes. Modern technologies based on the processing of large amounts of data along with machine learning have also become a part of tennis research in recent decades. With the help of Expert Modelling, the knowledge and experience of sports professionals are presented in a way that approaches the tennis player comprehensively. Emphases are on specific dimensions that influence a tennis player's performance to the greatest extent. The »Expert Modelling in Tennis« monograph presents a unique way of combining the thinking and functioning of successful tennis experts using modern technologies.

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Source: FILIPČIČ, Aleš, FILIPČIČ, Tjaša, VODIČAR, Janez. *Expert modelling in tennis*, (Schriften zur Sportwissenschaft, band 146). Hamburg: Verlag dr. Kovač, 2019. 169 pages, illustr. ISBN 978-3-339-10694-0. [COBISS.SI-ID 12277577] Hyperlink: <https://plus.si.cobiss.net/opac7/bib/pefij/12277577>

Dr. Mojca Doupona

He's ours, not yours! – Reinterpreting of national identity in post-socialist context

Jakov Fak is not the only Croatian athlete to have taken another country's passport in search of better conditions; there are also cases in swimming, football, water polo, etc. The same situation is also typical of Slovenia, as well as numerous other nation-states.

This paper focuses on the relationship between sport, national identity and the media in the post-socialist nation-states of Croatia and Slovenia. It describes what has changed during the eight years since Jakov Fak, a Croatian-born Slovenian biathlete, changed his citizenship and began competing for the Slovenian national team. It also examines how the perception of Jakov Fak as an athlete and of his success has changed through time in different socio-political circumstances. To analyse this case, we have used different media interpretations of Jakov Fak case, analysing four sports events. The results of discourse analysis of the Biathlon World Championships in 2009 and the Olympic Games in 2010 show that the case of Jakov Fak did not reach the level of moral panic, but that the public was provoked by and exposed to national symbolism in multiple

ways, especially in political discourse. The media discourse did change between the years 2012 and the 2018, and discourse typical of civic nationalism began to dominate. The article notes that in the case of Jakov Fak, two types of nationalism are mixed in a post-socialist context.

This paper contributes to an understanding of the relationship between sport, national identity and the media, and to an understanding of political discourse and the discourse of the actors themselves – the athlete and his coach. In this case, as well, it has been shown that national identity and nationalism are not fixed, immutable categories. Their significance changes depending on socio-political circumstances and events on the broader social scene. Ethnic and civic forms are ideal types of nationalism, usually mixed in the social world. Sport and sporting events not only provide insight into events and value systems in society – they show the potential of sport as a communications channel and a means by which to attain social change.



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Source: BARTOLUCCI, Sunčica, DOUPONA, Mojca. He's ours, not yours!: reinterpreting national identity in a post-socialist context. *International review for the sociology of sport*, ISSN 1461-7218, 2019, 17 pages
Hyperlink: <https://journals.sagepub.com/doi/full/10.1177/1012690218819966>

Dr. Uroš Košir, Dr. Matija Črešnar, Dr. Dimitrij Mlekuž Vrhovnik

Monograph: Rediscovering the Great War: Archaeology and enduring legacies on the Soča and Eastern fronts

The First World War is one of the pivotal events, setting the 20th century dynamics. It is the birthplace of industrial, modern warfare, which changed the course of history. The remembrance, significance, and knowledge of the conflict and of those who participated in it and were affected by it differs from country to country. While in some countries, the war was mythicized and commemorated as national trauma, elsewhere the memory has faded and has been pushed out of collective memory, usually overshadowed by the events of the Second World War.

For a long time, archaeology could not, was not able or even wanted to research this first globalised and industrialized conflict. However, in the last few decades, new research strategies emerged, spreading the understanding of the First World War. The role of modern conflict archaeology in this research is of great importance. The monograph "Rediscovering

the Great War" consists of multidisciplinary approaches of the First World War heritage research on the Soča and Eastern fronts. It focuses on the research of conflict landscapes and on understanding the conflict heritage problematic. The approaches range from analysis of archive sources and aerial photographs interpretations, to remote sensing, GIS and field research, attributing to multi-layered understanding of this historical event.



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Source: Rediscovering the Great War: Archaeology and Enduring Legacies on the Soča and Eastern Fronts (Uroš Košir (editor), Matija Črešnar (editor), Dimitrij Mlekuž (editor)), New York: Routledge, 2019.

Hyperlink: <https://www.routledge.com/Rediscovering-the-Great-War-Archaeology-and-Enduring-Legacies-on-the-Soča/Kosir-Cresnar-Mlekuz/p/book/9781138282667>

Dr. Barbara Ivančič Kutin

Krivopete – Wild women with backward-facing feet in the Slovenian folklore

Krivopete – Wild women with backward-facing feet in the Slovenian folklore is one of fundamental works of ethnology, folklore and cultural anthropology explaining areas, individual phenomena or concepts. The author explores wild women with backward-facing (twisted or rotated) feet, a phenomenon that is known in Slovenia only in the Slovenian ethnic territory. In the monograph, the author first outlines the ethnological, cultural-historical and socio-demographic characteristics of the territory, the continuity and variability of the records. In the main part or substance of this book, Kutin focuses on content-motivational analysis of linguistic material. The author identifies as many as 22 versions of names for wild women with backward-facing feet in Slovenian folklore tradition. The author concludes the theoretical part of the discussion with a chapter dedicated to an examination or review of the contemporary contexts that popularise the krivopete tradition. The monograph shows an exemplary, holistic and distinctly interdisciplinary approach of this unusual phenomenon.



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Source: IVANČIČ KUTIN, Barbara (author, photographer), KROPEJ TELBAN, Monika (editor). *Krivopete: divje žene z nazaj zasukanimi stopali v slovenski folklori*. (Zbirka Studia mythologica Slavica, Supplementa, suppl. 13). Ljubljana: Publishing House ZRC, ZRC SAZU, 2018. 174 pages, illustr. Hyperlink: <https://isn2.zrc-sazu.si/sl/publikacije/krivopete#v>

Dr. Svanibor Pettan

An Oxford Handbook of Applied Ethnomusicology in three books (2019):

1. Theory, Method, Sustainability & Conflict
2. De-Colonization, Heritage & Advocacy
3. Public Ethnomusicology, Education, Archives, & Commerce

The books contain articles written by twenty-four ethnomusicologists from eleven countries: Australia, Austria, Canada, China, Finland, Malaysia, Slovenia, Sweden, Switzerland, the United Kingdom and the United States of America. The chapters, all newly written for these representative volumes, theorize applied ethnomusicology and offer regional and historical insights as well as practical examples from all continents. Their aim is to encourage further developments within the internationally fast-growing field of applied ethnomusicology. The books offer diverse opinions, approaches, and methodologies in search of an answer to the basic question: how to proceed from the basic scholarly goals of broadening and deepening of knowledge and contribute to the betterment of the participating individuals and communities by using ethnomusicological understandings and skills.

Each book starts with an in-depth introduction, which clarifies the aims of applied ethnomusicology in spatial and temporal contexts. Individual studies in most cases highlight individuals and communities, which are marginalized due to ethnicity, religion, language, age, gender, economy, psychophysical condition, and other reasons. The articles encompass a considerable range of themes, from ethnomusicological work with indigenous people, minorities, and refugees to the study of conflicts, education, archives, and music industry. The books advocate activism and analytically and systematically unveil the modalities of the use of music in reaching ecological ideals. They make a substantial academic contribution and address diverse audiences worldwide.

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Sources:

1. Pettan, Svanibor and Jeff Todd Titon, ed. Theory, Method, Sustainability & Conflict. An Oxford Handbook of Applied Ethnomusicology, Volume 1. New York and Oxford: Oxford University Press, 2019.
2. Pettan, Svanibor and Jeff Todd Titon, ed. De-Colonization, Heritage & Advocacy. An Oxford Handbook of Applied Ethnomusicology, Volume 2. New York and Oxford: Oxford University Press, 2019.
3. Pettan, Svanibor and Jeff Todd Titon, ed. Public Ethnomusicology, Education, Archives, & Commerce. An Oxford Handbook of Applied Ethnomusicology, Volume 3. New York and Oxford: Oxford University Press, 2019.

Hyperlinks:

<https://global.oup.com/academic/product/theory-method-sustainability-and-conflict-9780190885694?cc=pt&lang=en&>

<https://global.oup.com/academic/product/de-colonization-heritage-and-advocacy-9780190885731?cc=pt&lang=en&>

<https://global.oup.com/academic/product/public-ethnomusicology-education-archives-and-commerce-9780190885779?cc=pt&lang=en&>

Dr. Rada Cossutta

The monograph Tromeja skozi čas (The Tripoint through time)

The monograph with the phonological transcription of the film text and the enclosed dialectological documentaries Rateče, yesterday and today, and Log pod Mangartom, yesterday and today, is the result of the basic ERC-ARRS adapted project Tripoint over Time: the Case of Linguistic Intertwining in the Slovene, Austrian and Italian Borderland, set in the context of audio-visual recording of Slovene dialects and speeches in the linguistically diverse Alpine Adriatic area that lies at the juncture of Slavic, Romance and Germanic world. The Tripoint is a remarkable example of several language and dialect coexistence and a rich cultural heritage, which, because of the socio-structural and lifestyle changes, is sinking into oblivion or has already entirely died out. The visual documentation of the Slovene speeches of the Tripoint, that are daily subjected to constant linguistic interference influences, based on the film The Tripoint speaks (Tromeja ž b ri), which was written by the same author and was recorded twenty years



ago, and the parallel recordings of the Tripoint from today, represents a genuine innovation of the inclusion of audio-visual technologies in the dialect researches.

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Source: COSSUTTA, Rada: Tromeja skozi čas. Koper: Science and Research Centre Koper, Publishing House Annales ZRS Koper, 2018, 54 pages. ISBN 978-961-7058-11-6. [COBISS.SI-ID 300492800]
Hyperlink: <https://www.zrs-kp.si/index.php/research-2/za-lozba/monografije/>

Dr. Nike Kocijančič Pokorn

Interpreting and linguistic inclusion - friends or foes?

The article responds to the existing political claims that translation and interpreting reduce the incentive of recent immigrants to learn the language(s) of the host country and thereby impede their integration. To verify these claims, quantitative and qualitative research was conducted among asylum seekers in Slovenia, i.e. a group of recent immigrants who have access to free interpreting and translation services and free courses in the dominant language of the host country. A questionnaire was used to gather quantitative data on the language profiles of 127 current and former residents of the asylum seeker centres in Slovenia, while qualitative data were obtained through semi-structured interviews conducted with a representative group of 38 asylum seekers. The results show that all surveyed migrants had a positive attitude towards the host country language and that all of the interviewed migrants who had been in the host country for 7 months or more, regardless of their educational attainment, also took the state-funded course of the host country language. Additionally, although the provision of translation and interpreting is recognised as essential in high-risk situations, it is not the preferred communication strategy of the migrants, and therefore does not hinder their functional linguistic inclusion.



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Source: KOCIJANČIČ-POKORN, Nike, ČIBEJ, Jaka. Interpreting and linguistic inclusion - friends or foes?: results from a field study. The Translator: studies in intercultural communication, ISSN 1355-6509, 2018, vol. 24, issue 2, pp. 111-127, illustration. <https://www.tandfonline.com/doi/full/10.1080/13556509.2017.1396406>, doi: 10.1080/13556509.2017.1396406. [COBISS.SI-ID 66256738]
Hyperlink: <https://www.tandfonline.com/doi/full/10.1080/13556509.2017.1396406>

Dr. Jurij Snoj

Gregorian chant in medieval manuscripts in Slovenia

It is a known fact that after losing their practical value, many medieval manuscripts, including music manuscripts, were destroyed, their parchment folios having been used for various purposes, and especially as bookbinding material. In Slovenian libraries, too, there are, besides two dozens of completely preserved medieval music manuscripts, more than 600 parchment folios coming from more than 200 once complete but later dismembered medieval music manuscripts. All this material is presented, reconstructed and described in the monograph Gregorian Chant in Medieval Manuscripts in Slovenia, offering for the first time information of nearly all the extant medieval music sources to be found in the country, the monograph could be considered as exhibiting an important segment of medieval culture in the territory of Slovenia. The systematically laid out catalogue of medieval music sources is accompanied by 23 independent essays discussing single manuscripts, portions of their contents, single creations, and various aspects of this intriguing material.



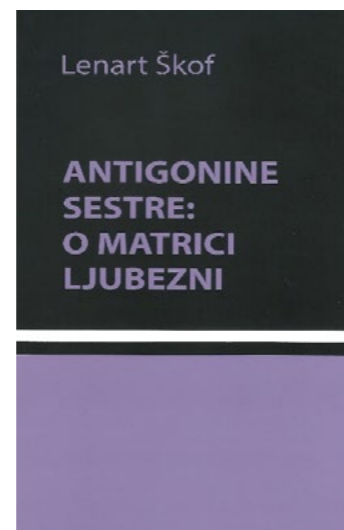
Dr. Jurij Snoj, Research Centre of the Slovenian Academy of Sciences and Arts (jurij.snoj@gmail.com)

Source: SNOJ, Jurij, ŠTER, Katarina (editor). Gregorijanski koral v srednjeveških rokopisih na Slovenskem. 1st edition. Ljubljana: ZRC SAZU, Publishing House ZRC, 2018. 480 pages, illustr., tables, notes. ISBN 978-961-05-0098-8. [COBISS.SI-ID 295531264]
Hyperlink: <https://mi.zrc-sazu.si/en/publikacije/gregorijanski-koral-v-srednjeveskih-rokopisih-na-slovenskem#v>

Dr. Lenart Škof

Antigone's Sisters: On the Matrix of Love

Antigone's Sisters: On the Matrix of Love is a monograph on the genealogy of love and is an original contribution to the contemporary philosophical theology. As Jesus for Christianity, also Antigone represents the original ethical place of ethics for the ancient Greek world: she stands for unwritten laws, archaic ethical principles and the ultimate law of love. In this book, Antigone is put into dialogue with feminine goddesses of the archaic Greece, with an ancient cosmological matrix, then with Alcestis from the play of Euripides, and with Lepa Vida from the Slovenian mythological tradition. This work also deals with the role of women and of the feminine within the Judeo-Christian tradition, with Schelling's Clara and with feminist interpretations of Heidegger. Finally, Luce Iriagaray's philosophy is presented as a transition towards the coming "Age of the Spirit", founded on horizontal transcendence and spiritual-bodily gestures of compassion and love.



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Source: ŠKOF, Lenart. Antigonine sestere: o matrici ljubezni, (Slovenska filozofska misel, vol. 18). Ljubljana: Slovenska matica, 2018. 325 pages, illustr. ISBN 978-961-213-286-6. [COBISS.SI-ID 297071360]
Hyperlink: <https://plus.cobiss.si/opac7/bib/297071360>

Dr. Barbara Malič, Dr. Andrej Kitanovski

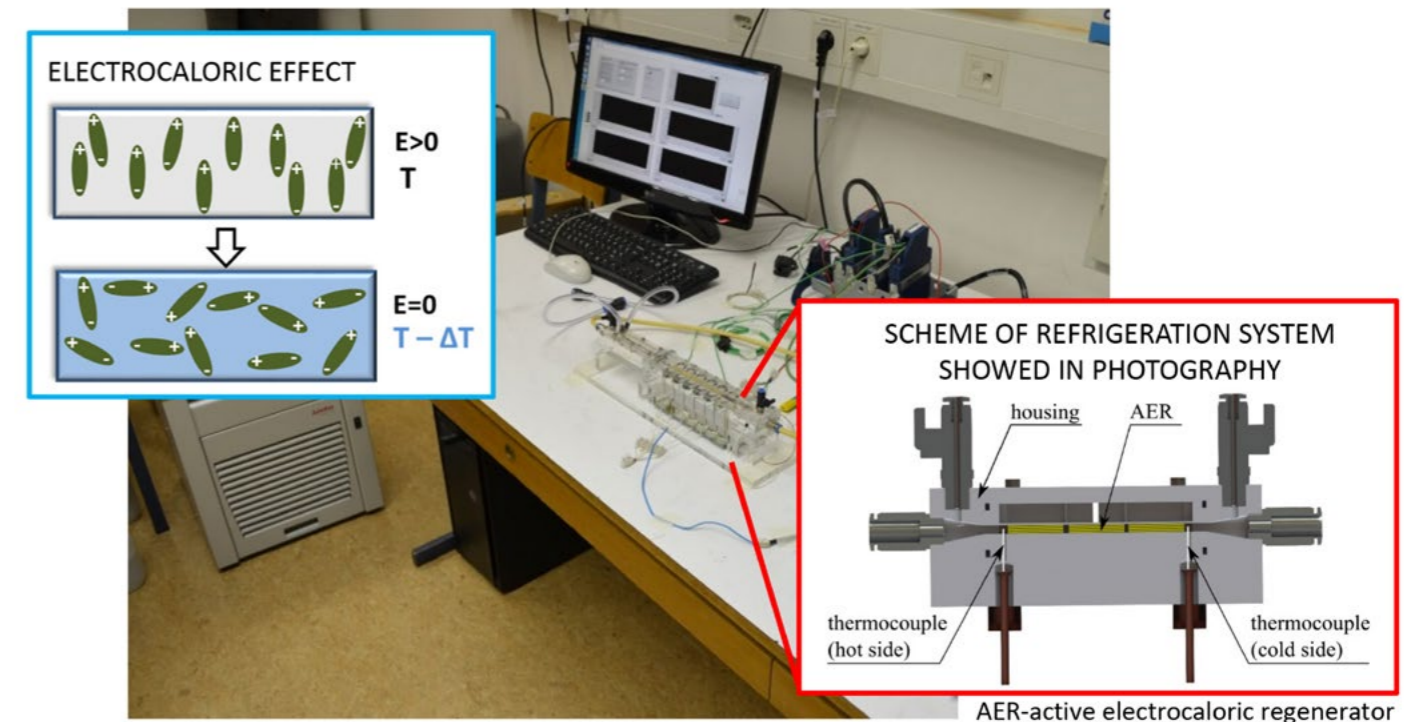
Demo cooling device based on the electrocaloric effect

Researchers from Electronic Ceramics and Condensed Matter Physics Departments of Jožef Stefan Institute and from Laboratory for Refrigeration and District Energy, Faculty of Mechanical Engineering, University of Ljubljana, were among the first in the world to realize a demo cooling device based on the electrocaloric effect. Relaxor-ferroelectric lead-based perovskite ceramic exhibits the electrocaloric temperature change of ≈ 3.5 K upon applied electric field of 160 kV/cm, which is among the best reported values for such materials. The concept of the heat-transfer with active regeneration in a device with cooling elements in the form of

thin ceramic plates, where the cooling fluid is in contact with the heat sink and heat source, is schematically shown in the figure. The electrocaloric cooling is characterized by high efficiency in comparison to existing cooling technologies and has no harmful effects on the environment. The invention was patented in EU, USA and China, the patent of the prototype was sold to the house-appliance company Gorenje.

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Marija, DRNOVŠEK, Silvo, CILENŠEK, Jena, KUTNJAK, Zdravko, ROŽIČ, Brigita, FLISAR, Uroš, KITANOVSKI, Andrej, OŽBOLT, Marko, PLAZNIK, Uroš, POREDOŠ, Alojz, TOMC, Urban, TUŠEK, Jaka. Method for electrocaloric energy conversion: United States Patent US9915446 (B2), 2018-03-13. [S. I.]; United States Patent and Trademark Office, 2018. [16] [COBISS.SI-ID 29642791]
Hyperlink: <https://plus.cobiss.si/opac7/bib/29642791>



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.

*Number of employees as of 1 January 2019
in accordance with the staffing plan:* 48

*Funds received from the national budget
for scientific-research activities in the
2019 financial year:* EUR 182,8 mil.

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, 57/12-ZPOP-1A and 21/18-ZNOrg)
Decision establishing the Slovenian Research Agency (Official gazette of the Republic of Slovenia, nos. 123/03 and 105/10)
Resolution on Research and Innovation Strategy of Slovenia 2011-2020 (Official gazette of the Republic of Slovenia, no. 43/11)

Website: <http://www.arrs.si/en/>