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OF THE SLOVENIAN RESEARCH AND INNOVATION AGENCY
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Slovenian Research and Innovation Agency

Annual Report of the Slovenian Research and Innovation Agency for 2023

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Content

Introduction

Dr. Špela Stres,
Agency Director

For me, 2023 began on 5 May 2023 after I arrived at ARIS for the first time as the ARRS Acting Director and continued on 5 November 2023 when I took over the tasks of the Director of ARIS.

One of the first challenges in 2023 was associated with IT support for the Agency's operational processes.

In its wish for support of key substantial processes of the Agency not to be dependent on external providers and based on the assessment that the Institute of Information Science (Izum) is also active in the field of IT support in Slovenia, the Ministry of Higher Education, Science and Innovation proposed that the Agency seek IT support primarily from providers within the public sector and to sign an agreement with the Izum Institute to receive Digital Forms support, whereby it is planned, at least for the time being, to keep the services of external providers, in particular in the field of supporting the management of the Agency's financial processes as Izum has not been able to manage the substance of processes so far, especially in the AURA backend system.

On 27 November 2023, ARIS and the public infrastructure institute Izum signed an agreement on providing and developing IT support in the field of records and forms for communicating with the research sphere, and on 30 November 2023 completed a semi-annual public procurement process to provide and develop IT support in the field of ARIS internal operations by concluding an agreement with Stroka d.o.o.

The second major challenge in 2023: after almost 20 years of operation, the Agency has transformed into the Research and Innovation Agency in terms of substance and structure. It has become a new legal person with a new name and significantly extended activity. For the Agency to pursue its mission in a new form, the new ARIS Agency had to be entered into the court register, and ARRS deleted from it. Employees, funding, sub-accounts, etc., had to be transferred to the newly established entity, a series of internal acts had to be changed, and, last but not least, two annual reports had to be submitted, i.e. for ARRS and for ARIS.

A new Management Board had to be established, while a new Agency body is also expected to be appointed: in addition to the Scientific Council, the Agency will have an Innovation Council; the proposal of its members had already been adopted by the Slovenian Development Council on 11 December 2023. Changes in terms of structure and substance also included the renovation of the premises leased by the Agency in 2023 at the initiative and expense of the owner. Working side by side in smaller facilities in terms of space has bound us together and strengthened our relationships. Many thanks to all our colleagues for the patience and organisational efforts, while relocation also presented us with an opportunity to arrange archive documents.

In order to stabilise our operation and expand substantive duties, the number of our personnel was increased by a little over one third (only 5 new employees joined us due to the Agency's operation in the field of innovation, while other employment contracts were signed due to dismissals and vacancies in specific departments, including work associated with the Recovery and Resilience Plan – NOO). In early May 2023, the Agency had 21 vacancies. By the end of 2023, the number of employees had increased from 66 to 73. The target number of employees as of 1 January 2024 was 92, but was unfortunately not reached. On 24 January 2024, 79 people were employed by ARIS, and by 1 February 2024 the number of colleagues had increased to 82.

We prepared a new ARIS strategy (as an upgrade to the 2016–2020 strategy) which was adopted by the ARIS Management Board on 20 December 2023 (on the same day, the Management Board also took note of the new communication strategy).

In accordance with the previous provisions of the Scientific Research and Innovation Activities Act, we concluded an appropriate contractual relationship with a sister agency, SPIRIT, on 14 December 2023.

Given the needs of the research environment and internal development, the Agency has already undergone a partial organisational restructuring and established a department of innovation and department of analyses, as well as an open science office (department since January 2024), but there are still many challenges in the field of arranging the Agency's key operational processes waiting to be tackled in 2024.

Coordination regarding the revision of general acts and the feasibility of institutional evaluations took place mainly at the meetings and joint meetings of the Coordination of Independent Research Institutes of Slovenia (KOsRIS) and the Slovenian Rector's Conference (RKRS), and meetings of KOsRIS management with individual Public Research Organisations (PROs), within the scope of informal working group meetings of the RKRS, KOsRIS, the Slovenian Quality Assurance Agency for Higher Education (NAKVIS), and ARIS. On 8 January 2024, the Agency appointed a working group for general acts (members from the Management Board, Scientific Council, ARIS, KOsRIS, RKRS). We also participated in a working group in charge of drawing up rules of the minister to implement Article 64 of the Scientific Research and Innovation Activities Act and a working group dealing with the amendment of the Scientific Research and Innovation Activities Act, in particular with regard to provisions for evaluation (programme, self-evaluation, external evaluation), the keeping of records, Agency tasks, provisions regarding project funding, etc.

We have agreed to collaborate with various ministries on the investment part of the activities pursued by the new Agency. In 2024, the financial consequences of these agreements are reflected in the starting points for the Agency's operation received by the Ministry of Higher Education, Science and Innovation and the Ministry of the Economy, Tourism and Sport, both transferring part of the implementation of cohesion calls to ARIS. We have also established an ongoing cooperation with the Ministry of Defence (MORS) and the Ministry of Agriculture, Forestry and Food (MKGP) and hope to strengthen collaboration in the form of joint calls in 2025.

After the review of the Ministry of Higher Education, Science and Innovation as an intermediate body, the Agency, as an implementing body, on 7 December 2023 and 4 January 2024, received a positive assessment in terms of its capacities to perform tasks laid down by the Regulation of ECP, and was thus awarded consent to implement tasks from cohesion funding sources for the Ministry of Higher Education, Science and Innovation.

In 2023, the Agency carried out several activities within the framework of the Recovery and Resilience Plan, e.g. call for mobility and thematic call for green transition and digitalisation; however it focused less on implementing the Reform "A" of the Recovery and Resilience Plan, under which the Agency would be internally restructured and prepared for the implementation of new sources of funding, i.e. from the Recovery and Resilience Plan as well as cohesion, and for the implementation of tasks due to the new system of funding, established by the the Scientific Research and Innovation Activities Act.

The most significant change of Agency processes was with the internal Agency procedures regarding project evaluation, which define the tasks of scientific editor in the process of project evaluation under the Scientific Research and Innovation Activities Act. In the call for projects in 2023, the Agency took into account the recommendation of the Scientific Research and Innovation Activities Act and the Research and Innovation Strategy of Slovenia and fell within the scope of ERC panels. The transition has not been completed yet as a transfer of reviewers has to be carried out from old ARRS fields and sub-fields into new ERC panels and sub-panels. To implement the call for projects in 2023, the transfer was carried out based on the decision of programmes for transfer into the ERC panel. However, responses from the research sphere clearly indicated that the shares specified for individual fields are most likely obsolete and not adequately defined for current use.

The processes are not yet optimal and still need to be upgraded.

Introduction

Prof. Dr. Zoran Ren,
the president of the Agency's
Management Board

Research activity contributes to the general progress of humanity, and that has been visibly reflected in major technological changes over the last few decades. Unfortunately, changes in society have not kept up with this tremendous progress and it seems that new technologies are changing our way of life and values in a random, even trendy way. This is reflected in society at large, and in science as well. It appears that progress in all branches of science follows its own increasingly diverging pathways. There is less mutual understanding and respect, all-encompassing individualism represses the creation of interactions and stifles the cooperation that is required to achieve critical links with knowledge for solving problems of the present and the future. Artificial intelligence is here and will influence these processes even more.

Every researcher knows that sometimes one needs to make a full reset, rethink things and start from scratch in order to realign research with the desired path. This can be done at the level of an individual or group, but not in society at large. Therefore, changes must be approached wisely, with a broad consensus and with determination.

By adopting the new Scientific Research and Innovation Activities Act in 2021, the Regulation of the Government of the Republic of Slovenia on the financing of scientific research activities from the Budget of the Republic of Slovenia in 2022 and ongoing amendments to ARIS acts, the foundations are laid for the necessary changes in the Slovenian research landscape. These changes are aimed at increasing the Slovenian research potential, creating integration at the national level to reach a necessary critical mass of research infrastructures for further leading edge developments in all fields of science.

Since the beginning of its operation in the summer of 2023, the current Management Board of ARIS together with the management has been consistently pursuing the vision of gradual convergence of system-based management of the Slovenian research space with the established good practices in the ERA by taking into account some national specificities. In this context, we seek ways to integrate the Slovenian research domain by introducing some systematic actions, further consolidating successful research fields, while at the same time creating systemic opportunities to develop new fields. We believe that our vision will be gradually followed by an appropriate increase in funding for research activities, which is currently lagging behind compared to the majority of EU Member States.

That said, we are again witnessing the end of another year full of breakthroughs by excellent Slovenian science, innovative engagements and influential incentives within our research community. The pages of this report attest to the determined efforts of our researchers. Their relentless search for new knowledge and understanding and their unwavering passion for advancing the frontiers of science and technology lead us on the path of progress, which is all the more important in the current era of unpredictable challenges.

In a year marked by global uncertainty, rapid changes and devastating disasters, the understanding and resourcefulness of our research community were a sign of maturity. From fundamental research on the mysteries of the universe to practical solutions for pressing social issues, the breadth and depth of our research efforts emphasise the vital role of science in shaping our common future, which offers plenty of opportunities to improve our way of life.

Looking back at the achievements of the past year, we can calmly face the opportunities and challenges that await us. Regardless of the challenges the future may bring, we are equipped with the experience, strength and dedication to continue to push the limits of knowledge, promote innovation and use the power of research to build a better world for all.

Introduction

Prof. Dr. Peter Križan,
President of the Agency's
Scientific Council

The Scientific Council, in collaboration with the agency's associates, is committed to enabling the efficient and transparent financing of the best research ideas, thereby contributing to a favorable research environment in Slovenia.

In 2023, we continued to align the agency's operations with the new research legislation. A consultative working group, comprising representatives from universities and institutes alongside agency representatives, provided constructive discussions. The Scientific Council aims to contribute constructively to the successful transition of research organisations to a new mode of operation with greater autonomy.

Research projects serve as a crucial instrument for supporting research. This highly competitive funding method allows us to finance only about two hundred of approximately one thousand submitted project proposals. We endeavor to simplify procedures and enhance transparency through regulatory amendments. Among other initiatives, we continuously update the database of international reviewers, experts who evaluate research proposals in their respective scientific fields. The project evaluation process has been fortified with scientific editors, and we anticipate the medium-term introduction of evaluation panels modeled after the European Research Council and certain European research funding agencies. In the project call for 2024, we transitioned to funding within the European Research Council (ERC) domains, improved the reviewer appointment process, and strengthened the role of scientific editors.

We continued to issue project calls designed to facilitate the return of successful young Slovenian scientists from abroad, making these opportunities more attractive through increased flexibility. We are also considering a scheme to attract established researchers. Additionally, we have continued to issue calls for multilateral projects. We are pleased to observe an increasing number of successful applications for prestigious European Research Council projects, and ARIS calls in the complementary scheme provide significant incentives for applicants.

Research programs ensure a stable component of research funding. We have continued preparations for the panel evaluation of research programs based on the European Research Council domains, which we will gradually introduce in the coming years. Excellent research equipment plays a vital role in providing suitable research conditions. The ARIS Scientific Council strives to increase funding for this type of research support, with substantial increases anticipated in the coming years. For the upcoming calls, we are considering reducing the share of matching funds and expanding the range of eligible applicants.

The agency's Scientific Council remains receptive to comments and suggestions from the scientific community to further enhance the agency's functioning as a vital element of the research climate in Slovenia. We look forward to a successful collaboration with the scientific community.

Management Board of the Agency

The Management Board of the Agency is the managing authority of the Agency.

It is composed of nine members appointed by the Government of the Republic of Slovenia for a term of five years with an option of reappointment. The president and vice-president are elected by the members of the Agency's Management Board.

In 2023, as of 4 June, the members of the Agency's Management Board were as follows:

- **Prof. Dr. Zoran Ren,** President
- **Dr. Stojan Sorčan**
- **Dr. Jernej Štromajer**
- **Dr. Nataša Vrh**
- **Dr. Tatjana Zagorc**
- **Žiga Lampe**
- **Dr. Andreja Gomboc**
- **Dr. Egon Pelikan**
- **Dr. Marta Klanjšek Gunde**

Scientific Council of the Agency

The Scientific Council is the top expert body of the Agency.

It is composed of six members and covers all scientific disciplines. Based on the proposal of the Science and Technology Committee of the Republic of Slovenia, the minister responsible for science appoints the members for a five-year term, without the option of reappointment.

In 2023, the Scientific Council of the Agency was composed as follows:

- **Prof. Dr. Peter Križan**, President
  Natural sciences and mathematics
- **Prof. Dr. Željko Knez**, Deputy president
  Engineering
- **Prof. Dr. Ksenija Geršak**
  Medical sciences
- **Prof. Dr. Janko Kos**
  Biotechnical sciences
- **Prof. Dr. Miha Škerlavaj**
  Social sciences
- **Prof. Dr. Alenka Zupančič Žerdin**
  Humanities

1 ANNUAL REPORT

HIGHLIGHTS

ABOUT THE AGENCY

FINANCIAL REPORT

INTERNATIONAL COMPARISONS

Promotion and spreading of scientific knowledge

The fundamental objective of the Agency in the field of communication with the public is to contribute to a more comprehensive, objective and credible reporting and public discussion on scientific research and innovation activities in the Republic of Slovenia.

In 2023, the Agency enhanced its operation in the field of promoting science with the awareness that successful communication with interested parties and the target public is based on an appropriately designed communication strategy that defines the main communication objectives and activities. In accordance with the Public communication strategy, the Agency started to develop measures for implementing communication activities in 2023, and in November organised the national event **"ARIS Day: Supporting Excellence"** for the sixth time.

ARIS DAY 2023: SUPPORTING EXCELLENCE

ARIS Day 2023 was dedicated to the new generation of researchers, stakeholders in the field of scientific research and economy, respective decision-makers and interested general public. It took place on 21 and 22 November at the Grand Hotel Union in Ljubljana.

The event presented new developments in the Agency's operation, the role of the European Innovation Council in promoting innovations in Slovenia, the challenges of implementing open science, efforts to improve collaboration between science and the economy, and the most prominent research achievements under the project Excellent in Science 2023.

The plenary part of the first day was highlighted by a discussion on the role of the European Innovation Council (EIC), in particular emphasising EIC programmes designed to support the most groundbreaking innovation projects and the possibilities for making even better use of EIC opportunities for Slovenian researchers and companies.

The roundtable titled *Challenges of implementing open science in the Slovenian scientific research space* discussed the importance of open science for achieving EU objectives in the field of science.

Within the scope of the first day, there was the 12th edition of the project promoting science **Excellent in Science**. Under the project, 49 scientific achievements were selected in 2023, of which the 19 most prominent in all scientific disciplines were presented at the event. The first day was rounded off by an evening reception in the honour of the new generation of young researchers.

An important feature of ARIS Day 2023 was the second day organised by the Agency together with SPIRIT Slovenia under the scope of the Recovery and Resilience Plan as a joint networking and connecting event funded by the European Union – NextGenerationEU. It was intended for stakeholders in the scientific research and economic sphere, decision-makers from both fields and interested general public. The focus was on improving cooperation between science and business, with a roundtable held to discuss the relevant topic. The existing good practices of bridging the gap between academic society and the user sphere were presented together with over 40 research projects and targeted research programmes completed in 2022.

In two days, over 170 young and established researchers, mentors, representatives of education, research organisations and the economy from Slovenia and abroad attended the event.

ARIS Day 2023 in numbers:

- **2** days
- **2** round tables
- **19** research achievements presented
- over **100** participants in discussions
- over **170** domestic and foreign participants

dan aris
Podpiramo odličnost

More information on the event is available at: **https://www.aris-rs.si/sl/dogodki/23/najava-dan-aris.asp** (only in Slovene).

Stable funding

Pursuant to the Scientific Research and Innovation Activities Act (ZZrID) that entered into force in 2022, the Agency introduced a significant new feature, i.e. the stable funding of scientific research activities and thus provided autonomy to the recipients of stable funding for scientific research activities. The first contractual period of stable funding covers the 2022–2027 period.

Research organisations that had research and infrastructure programmes or only research programmes on the day ZZrID entered into force are entitled to stable funding during the first contractual period; this excludes companies, which are not entitled to stable funding.

The stable funding of scientific research activities comprises funds that cover four pillars according to the purpose of funding.

PILLAR NAME	PURPOSE OF FUNDING
INSTITUTIONAL FUNDING PILLAR (ISF)	Funding of infrastructure, management and supporting activities, and other institutional infrastructure.
PROGRAMME FUNDING PILLAR (PSF)	Funding of research programmes and young researchers.
DEVELOPMENT FUNDING PILLAR (RSF)	Funding activities to promote the development of scientific research and infrastructure activities (in terms of quality, creativity and innovation, internationalisation, openness, knowledge transfer and cooperation with the environment that contribute to achieving the objectives and results, and implementation of measures or tasks in the field of scientific research activities defined in the strategic documents of the country and the EU, while taking into account the mission and strategy of the individual recipient of stable funding).
NATIONAL RESEARCH PROGRAMMES (PNR)	Funding of national research topics determined by the Government of the Republic of Slovenia at the proposal of the line ministry.

More information on stable financing is available at:
https://www.aris-rs.si/sl/stabilno/
(only in Slovene).

ARIS mechanisms of competitive funding

DOCTORAL LEVEL	POSTDOCTORAL LEVEL	POSTDOCTORAL LEVEL	YOUNG DOCTOR	ESTABLISHED RESEARCHER
Up to doctoral degree	Up to 3 years after obtaining a doctorate degree	Up to 5 years after obtaining a doctorate degree	Up to 10 years after successfully defending the first doctorate	
	RESEARCH PROJECTS			
	Postdoctoral research project (fundamental or applied) Public call for (co)financing research projects	**Research project (fundamental or applied)** Public call for (co)financing research projects	**Research project (fundamental or applied)** Public call for (co)financing research projects	**Research project (fundamental or applied)** Public call for (co)financing research projects
	Research projects of the Targeted research programme Public call for awarding research projects within the Targeted Research Programme (CRP)	**Research projects of the Targeted research programme** Public call for awarding research projects within the Targeted Research Programme (CRP)	**Research projects of the Targeted research programme** Public call for awarding research projects within the Targeted Research Programme (CRP)	**Research projects of the Targeted research programme** Public call for awarding research projects within the Targeted Research Programme (CRP)
	+ INTERNATIONAL COOPERATION (INCLUDING INTERNATIONAL PROJECTS)			
	ERC complementary scheme Public call for (co)financing adapted research projects	**ERC complementary scheme** Public call for (co)financing adapted research projects	**ERC complementary scheme** Public call for (co)financing adapted research projects	**ERC complementary scheme** Public call for (co)financing adapted research projects
	ERC Potential Public call for (co)financing ERC Potential research projects	**ERC Potential** Public call for (co)financing ERC Potential research projects	**ERC Potential** Public call for (co)financing ERC Potential research projects	**ERC Potential** Public call for (co)financing ERC Potential research projects
	ERC New Horizons Public call for (co)financing ERC New Horizons research projects	**ERC New Horizons** Public call for (co)financing ERC New Horizons research projects	**ERC New Horizons** Public call for (co)financing ERC New Horizons research projects	**ERC New Horizons** Public call for (co)financing ERC New Horizons research projects

DOCTORAL LEVEL	POSTDOCTORAL LEVEL	POSTDOCTORAL LEVEL	YOUNG DOCTOR	ESTABLISHED RESEARCHER
Up to doctoral degree	Up to 3 years after obtaining a doctorate degree	Up to 5 years after obtaining a doctorate degree	Up to 10 years after successfully defending the first doctorate	
+ INTERNATIONAL COOPERATION (INCLUDING INTERNATIONAL PROJECTS)				
	Visits to ERC grantees Public call	**Visits to ERC grantees** Public call	**Visits to ERC grantees** Public call	**Visits to ERC grantees** Public call
	Lead agency scheme Public call with an individual agency call for PROJ	**Lead agency scheme** Public call with an individual agency call for PROJ	**Lead agency scheme** Public call with an individual agency call for PROJ	**Lead agency scheme** Public call with an individual agency call for PROJ
MSCA Seal of Excellence Public call	**MSCA Seal of Excellence** Public call	**MSCA Seal of Excellence** Public call	**MSCA Seal of Excellence** Public call	**MSCA Seal of Excellence** Public call
	Reimbursement of expenses – Horizon Europe Public call	**Reimbursement of expenses – Horizon Europe** Public call	**Reimbursement of expenses – Horizon Europe** Public call	**Reimbursement of expenses – Horizon Europe** Public call
	Projects of bilateral cooperation Public call for individual countries	**Projects of bilateral cooperation** Public call for individual countries	**Projects of bilateral cooperation** Public call for individual countries	**Projects of bilateral cooperation** Public call for individual countries
COST actions	**COST actions**	**COST actions**	**COST actions**	**COST actions**

Information on other available mechanisms of (co)financing is available at: **https://www.aris-rs.si/sl/razpisi/** (only in Slovene).

Research projects

ARIS (co)finances fundamental, applied and targeted research programmes (CRP), postdoctoral research programmes, projects under international cooperation, such as Lead Agency schemes and ERC complementary scheme projects. According to the content of research, projects may be general or thematically oriented.

The recipients of funds to implement fundamental and applied research projects may be legal or natural persons that are entered in the Database of Research and Development Actors and fulfil the conditions laid down.

FUNDAMENTAL RESEARCH PROJECTS

Fundamental research projects are original experimental or theoretical works aimed at acquiring new knowledge on the fundamentals of phenomena and perceptible facts.

APPLIED RESEARCH PROJECTS

The aim of applied research projects is to gain new knowledge in particular directed at a practical objective or purpose.

POSTDOCTORAL PROJECTS

A postdoctoral project is a fundamental or applied project carried out by a single postdoctoral researcher. A postdoctoral researcher is a researcher who has not yet completed more than 3 years since obtaining a doctorate of science.

CRP

By co-financing targeted research project programmes, ARIS helps to provide research support in designing strategic objectives related to the development of Slovenia, and in making decisions on essential development tasks which are imperative for the increase of Slovenian competitiveness, adaptability and innovation. Projects under the targeted research programme (CRP) are designed, implemented and financed in cooperation with individual ministries and other interested budget users.

INTERNATIONAL PROJECTS

International projects are described in detail under the section on international cooperation of the Agency.

More information on research projects is available at:
https://www.aris-rs.si/en/progproj/rproj/index.asp and
https://www.aris-rs.si/en/progproj/crp/index.asp.

International cooperation of the Agency

The Agency aims to open up new opportunities for strengthened international scientific research cooperation.

FIRST PHASE: ESTABLISHING AND STRENGTHENING INTERNATIONAL CONNECTIONS

Incentives:

- **Bilateral cooperation** – (co)financing bilateral cooperation activities; concluded agreements between the Republic of Slovenia and 37 countries around the world.
- **COST actions** – strengthening international connections.
- **Horizon Europe** – encouraging applications to EU framework programmes by co-financing the preparation and application of EU framework programme projects.
- **Scholarships for visits to ERC grant holders** – visits for a duration of 1 to 6 months to ERC grant holders. After the visit, the researcher visiting the ERC grant holder must submit an application to one of three ERC calls (the time period is determined in the call).

SECOND PHASE: INCENTIVES FOR ENHANCED INTERNATIONAL SCIENTIFIC RESEARCH COOPERATION

Options – public calls and invitations:

- **Lead Agency scheme – Weave research projects:** Austria (FWF), Belgium–Flanders (FWO), Czech Republic (GACR), Poland (NCN), Switzerland (SNSF), Croatia (HRZZ), Luxembourg (FNR).
- **Lead Agency scheme – bilateral projects:** Hungary (NKFIH).
- **ERC complementary scheme:** offers the opportunity for adapted research projects entered into the European Research Council (ERC) international call and exceeding the co-financing ceiling established by the Agency to be awarded funds as national research projects (duration up to 3 years).
- **ERC potential:** the possibility of obtaining a research project for successful applicants to the ERC call with the aim of providing initial support for the preparation to implement the awarded ERC project, in the interim period, between the ERC notification on (co)financing the ERC project and its actual start of implementation.
- **ERC New Horizons:** holders of an ERC project may submit an ERC New Horizons research project proposal with the Agency within one year before or one year after the completion of the ERC project with

the aim of preserving the core of the already established research group for implementing the ERC research project, preparing for resubmission of the application to the ERC call or to calls of the European Union framework programme for research and innovation, and also to promote cooperation and transfer of knowledge between research organisations in Slovenia.

- **Marie Skłodowska-Curie Seal of Excellence – MSCA:** applicants to the MSCA IF calls for individual scholarships who are awarded the Seal of Excellence (score of 85% or more) in the evaluation procedure can be awarded funds as national research projects (with a duration of up to 2 years).
- **MSCA COFUND – Seal of Excellence:** applicants awarded the Seal of Excellence in the review process of the European Commission for carrying out a doctoral study scheme or a postdoctoral Marie Skłodowska-Curie COFUND programme were allowed to apply for (co)funding of the respective training schemes with the Agency in 2023.
- **ERA projects** – international calls of networks in ERA:
  - PRIMA *(Partnership for Research and Innovation in the Mediterranean Area)* (since 2018).
  - CHANSE (*Collaboration of Humanities and Social Sciences in Europe*) (since 2021).
  - DUT (*Driving Urban Transitions towards a Sustainable Future*) (since 2022).

More information on international cooperation is available at: **https://www.aris-rs.si/sl/bilat/predstavitev.asp** (only in Slovene).

Research infrastructure and open science

Within the research infrastructure, ARIS (co)finances:

- Research equipment
- Supporting activities

RESEARCH EQUIPMENT

Research equipment provides significant research and infrastructure support to research personnel in carrying out scientific research activities. Applicants to the public call for co-financing the purchase of research equipment can be public research organisations carrying out a public service in the field of scientific research activities.

SUPPORTING ACTIVITIES

Scientific press

The Agency co-finances the issue of science monographs and domestic science and popular science periodicals. In this way it endeavours to develop scientific fields and strives to make publication of Slovenian scientific achievements possible, promotes Slovenian science, and preserves and promotes the development of Slovenian scientific technologies. Popular science periodicals are intended to educate and stimulate interest of the youth and general public in science.

OSIC operation

The Agency co-finances OSIC activity programmes – central specialised information centres whose aim is to monitor the appropriateness of the classification of bibliographical records of researchers by the applicable COBISS typology, and provide for integration with bibliographical databases abroad.

Foreign scientific literature and databases

The Agency co-finances the purchase of foreign scientific literature and access to the latest international scientific databases for the libraries of research and higher education organisations with the aim of providing access to the latest foreign scientific and expert information required in Slovenian scientific research, education and development activities.

Popularisation of Slovenian science

By co-financing promotion and popularisation activities, the Agency encourages cooperation and dissemination of information on Slovenian science at home and abroad.

Costs of open access publications

The Agency provides reimbursement of the costs of open access scientific publications. Research organisations or private researchers are allowed to apply to public calls.

More information is available at: **https://www.aris-rs.si/sl/infra/** and **https://www.aris-rs.si/sl/dostop/predstavitev.asp** (only in Slovene).

Innovations

By establishing ARIS, which is the universal legal successor of the Slovenian Research Agency (ARRS), the operation of the Agency has expanded to the field of innovations in accordance with the Scientific Research and Innovation Activity Act – ZZrID (Official Gazette of the Republic of Slovenia, No. 40/23). In accordance with the Decision establishing the Agency (Official Gazette of the Republic of Slovenia, No. 48/2023) in the field of innovation activity, ARIS: implements programmes and measures to promote technological development and innovation activities by continuous implementation of instruments in accordance with Article 14 of the ZZrID; promotes technological development and innovation activities and the transfer of knowledge between the economy, higher education institutes, research and education organisations, the government and other stakeholders; provides advice and expert support to project holders to develop products, the development of systemic solutions, production processes and services in obtaining information and financial resources; promotes international cooperation, transfer and use of international technological knowledge and innovation activities; encourages integration and transfer of knowledge from the economy to higher education institutes, research and education organisations, the government and other stakeholders; monitors the implementation of programmes and measures, evaluates the effects of innovation and technological development policy and investments in scientific research and innovation activities with a view of enhancing the competitiveness of the economy; provides data to steer and implement innovation policy and, within the scope of its activity and within the framework of its powers, cooperates with other organisations in the field of scientific research and innovation activities; obtains additional funding for the implementation of the Scientific Research and Innovation Strategy of Slovenia; participates in the planning of national technology, research and innovation policy; regularly reports on the implementation of annual programmes, the carrying out financial plans and the effects to the ministry responsible for economy and the ministry responsible for innovation, in compliance with the regulations; carries out other professional tasks in line with the purpose for which it has been established.

In 2023, the innovation activities at ARIS and the Department of Innovation were in the process of establishment which comprised arrangements with the Ministry of Higher Education, Science and Innovation (MVZI), the Ministry of the Economy, Tourism and Sport (MGTŠ) and other ministries on implementing the first calls and invitations in the field of innovation in 2024, which are all expected to be financed from the 2021–2027 EU cohesion policy funds, for which ARIS will take over the function of implementing body.

More information is available at: **https://www.aris-rs.si/sl/inovac/predstavitev.asp** (only on Slovene).

Recovery and Resilience Plan

In accordance with the Recovery and Resilience Plan, which includes ARIS as a final recipient (reform "A") and a body implementing measures ("B" investment and "C" investment), reinforcement and empowerment of ARIS are foreseen in the 2022–2026 period with 10 additional temporary project employments with the aim of transforming or reorganising the management system in the field of research and innovation to carry out Recovery and Resilience Plan investments, cooperating in the programme board, establishing mechanisms to integrate stakeholders in the research and innovation system based on joint events, strengthening the provision of advice to stakeholders and thus supporting them in applying to centralised EU programmes, providing support in enhancing international cooperation, strengthening the competencies of companies, cooperating with the supporting environment abroad, and transferring knowledge and good practice to Slovenia (reform "A").

In 2023, ARIS approached the implementation of co-financing research and innovation projects to support the green and digital transition, where long-term major research and innovation collaboration projects ("B" investment) are co-financed, and the implementation of co-financing projects and programmes to strengthen the international mobility of Slovenian researchers and research organisations and to promote international inclusion of Slovenian applicants with the aim of strengthening staff capacities and encouraging the circulation of knowledge via mobility beyond national borders and integration ("C" investment).

RECIPIENTS:

REFORM "A":
ARIS
(employments and events)

"B" INVESTMENT:
consortia composed of public research organisations and companies (RDI programmes)

"C" INVESTMENT:
public research organisations (research projects for strengthening international mobility)

More information is available at: **https://www.aris-rs.si/sl/NOO/** (only in Slovene).

Public invitations and calls published in 2023

NUMBER OF PUBLISHED PUBLIC INVITATIONS AND CALLS ACCORDING TO THE MONTH OF PUBLICATION

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	**TOTAL 2023**
Domestic	1	1	2	1	4						1		**10**
International	1	2	5	4		3	2		1	1	3	2	**24**

OVERVIEW OF DOMESTIC INVITATIONS AND CALLS

	Date of publication
Public call for (co)financing research projects in 2023	11/ 01/ 2023
Public call for co-financing projects to strengthen the international mobility of Slovenian researchers and research organisations, and to promote international engagement of Slovenian applicants – MSCA Horizon Europe	02/ 02/ 2023
Public call for the evaluation of research programmes – 2023	30/ 03/ 2023
Public call for co-financing long-term major collaborative programmes for research and innovation on the TRL 3-6 scale	31/ 03/ 2023
Public call for co-financing the publishing of scholarly monographs in 2023	20/ 04/ 2023
Public call for co-financing the purchase of international scientific literature in 2023	10/ 05/ 2023
Public call for reimbursement of costs for scientific publications published in open access (for 2023)	12/ 05/ 2023
Public call for the selection of research projects within the framework of the "CRP 2023" targeted research programme for 2023	12/ 05/ 2023
Public call for co-financing the purchase of research equipment (package 22)	24/ 05/ 2023
Public call for (co)financing research projects in 2024	14/ 11/ 2023

OVERVIEW OF INTERNATIONAL INVITATIONS AND CALLS

	Date of publication
Public call for co-financing scientific research cooperation between the Republic of Slovenia and the French Republic in the framework of the PROTEUS programme in the 2024–2025 period	27/ 01/ 2023
Public call for co-financing science and research cooperation between the Republic of Slovenia and the French Alternative Energies and Atomic Energy Commission (CEA) in the 2024–2025 period	10/ 03/ 2023
Public call for promoting active participation of young researchers in high-profile international young researcher programmes	30/ 03/ 2023
Public call for (co)financing ERC New Horizons research projects	06/ 04/ 2023
Public call for co-financing scientific research cooperation between the Republic of Slovenia and Bosnia and Herzegovina in the 2024 and 2025 period	14/ 04/ 2023
Public call for co-financing activities to popularise science abroad in 2023	24/ 04/ 2023
Public call for (co)financing ERC Potential research projects	07/ 06/ 2023
Public call for co-financing scientific research cooperation between the Republic of Slovenia and Japan in the 2024–2026 period	12/ 06/ 2023
Public call for the payment of a one-time contribution towards the costs of preparing and submitting applications for projects within the Horizon Europe Framework Programme for Research and Innovation in the EU (for the period from 01/ 06/ 2023 to 30/ 11/ 2023)	21/ 06/ 2023
Public call for co-financing the doctoral study scheme Marie Skłodowska-Curie COFUND – Seal of Excellence	28/ 07/ 2023
Public call for postdoctoral research scholarships in Japan for researchers from the Republic of Slovenia in 2024	30/ 10/ 2023
Public call for (co)financing ERC New Horizons research projects	20/ 11/ 2023
Public call for (co)financing ERC Potential research projects	20/ 11/ 2023
Public call for (co)financing postdoctoral education scheme Marie Skłodowska-Curie COFUND – Seal of Excellence	22/ 11/ 2023
Public call for co-financing scientific research cooperation between the Republic of Slovenia and the United States of America in the 2024–2026 period	12/ 12/ 2023

OVERVIEW OF INTERNATIONAL CALLS AND INVITATIONS – APPLICATIONS BASED ON DIRECT CONTRACTS

	Date of publication
Application for co-financing the Slovenian section of joint research projects with FWO (The Research Foundation – Flanders) as the lead agency	03/ 02/ 2023
Application for co-financing the Slovenian section of joint research projects with FWF (Österreichischer Wissenschaftsfonds) as the lead agency	20/ 02/ 2023
Application for co-financing the Slovenian section of joint research projects with GA ČR (The Czech Science Foundation) as the lead agency	06/ 03/ 2023
Application for co-financing the Slovenian section of joint research projects with SNSF (Swiss National Science Foundation) as the lead agency	06/ 03/ 2023
Application for co-financing the Slovenian section of joint projects with NKFIH (National Research, Development and Innovation Office of Hungary) as the lead agency	30/ 03/ 2023
Application for co-financing the Slovenian section of joint research projects with SNSF (Swiss National Science Foundation) as the lead agency	04/ 04/ 2023
Co-financing of Marie Skłodowska-Curie – Seal of Excellence research projects	21/ 07/ 2023
Application for co-financing the Slovenian section of joint research projects with NCN (Narodowe Centrum Nauki) as the lead agency	15/ 09/ 2023
Application for co-financing the Slovenian section of joint research projects with FNR (Swiss National Science Foundation) as the lead agency	21/ 12/ 2023

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Strategic guidance on Agency operation and development

- Sound implementation of activities according to the legal basis, the Decision Establishing the Slovenian Research and Innovation 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 activities
- International integration and comparability
- Transition to fully electronic services
- Open communication with the public and promotion of science

Organisational structure of the Agency

Scientific Council of the Agency	Agency Director	Management Board of the Agency
	Director's office	
	Department of Stable Funding	
	Department of Research Projects	
	Department of International Cooperation and Popularisation of Science	
	Department of Innovation	
	Department of Legal and General Affairs	
	Department of Information Technology	
	Department of Finance and Accounting	
	Department of Recovery and Resilience Plan	
	Department of Analyses	
	Open Science Office	
Permanent expert bodies (scientific research panels for individual disciplines)	External expert panels Commissions	Reviewers

Internal organisation units

To implement its tasks, the Agency is structured into internal organisational units that are in terms of organisation subordinated to the Director, and through the execution of their tasks combine meaningfully connected fields in terms of substance to enable expert, efficient and economic performance of activities for which the Agency has been established. The General Act on amendments of the General act on internal organisation and systematisation of posts, No. 100-148/2023-1 of 23 October 2023, restructured departments as provided below.

DIRECTOR'S OFFICE

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

DEPARTMENT OF STABLE FUNDING

Head of department:
Dr. Primož Pristovšek

The Department is in charge of core funding for scientific research activities, which enables research organisations to make long-term plans and implement their strategies and goals. Currently, it carries out tasks in the field of the first three out of four pillars of stable funding: (1) the institutional pillar of funding scientific research activities with the view of funding infrastructure, management and supporting activities and other institutional infrastructure; (2) the programme pillar of funding scientific research activities with the aim to fund research programmes and young researchers; (3) the development pillar of funding scientific research activities with the aim of funding activities for promoting the development of scientific research and infrastructure activities; and (4) the national research programme.

DEPARTMENT OF RESEARCH PROJECTS

Head of department:
Dr. Nika Razpotnik Visković

The department carries out tasks in the field of evaluation and selection of research projects. Within its scope of operation, it organises procedures for substantive monitoring and control of co-funding, implementation and attainment of research project objectives. The main activities of this department are the launch of the call for co-funding research projects and the launch of the call for awarding research projects of the Targeted Research Programme (CRP).

DEPARTMENT OF INTERNATIONAL COOPERATION AND POPULARISATION OF SCIENCE

Head of department:
Mojca Boc

The department carries out tasks in the field of bilateral and multilateral international scientific research cooperation. It performs tasks within the scope of the lead agency mechanism, Seal of Excellence, encouraging applications to public calls of EU framework programmes for research and innovations, and in the field of cooperation of Slovenian research organisations in international research and development projects. It also carries out activities to promote and popularise science.

DEPARTMENT OF INNOVATION

Acting head of department:
Dr. Levin Pal

By establishing ARIS, which is the universal legal successor of ARRS, the Department of Innovation started to develop innovation activities and carry out tasks associated with the implementation and monitoring of programmes and measures aimed at encouraging technological development and innovation activities, the promotion of technological development, innovation activities and transfer of knowledge to enhance the integration and transfer of knowledge between higher education institutes, the economy, research and education organisations, the government and other stakeholders.

DEPARTMENT OF FINANCE AND ACCOUNTING

Head of department:
Mojca Kastelc Selan

The department carries out tasks related to the Agency's financial operations. It is responsible for planning, implementing, record keeping, and reporting on funding for scientific research activities, as well as the Agency's programming tasks and operation. It ensures 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 and controls specifically allocated funds.

DEPARTMENT OF LEGAL AND GENERAL AFFAIRS

Head of department:
Katarina Hren

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 the private researchers register. The department is also responsible for keeping the register of research and development activity operators, and carries out tasks regarding personnel and human resource management. In addition, it carries out public tendering procedures and other procedures related to the takeover of resources and services and is responsible for ensuring the maintenance of Agency offices and equipment. The department also carries out the main office tasks, as well as tasks related to the storage of documentary material and maintenance of the archive.

DEPARTMENT OF INFORMATION TECHNOLOGY

Head of department:
Tomaž Žitnik

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 software tools for users.

DEPARTMENT OF RECOVERY AND RESILIENCE PLAN

Head of department:
Dr. Lidija Tičar Padar

The Department of Recovery and Resilience Plan is aimed at executing reform activities and two investment measures from the Recovery and Resilience Plan. The reform part – operation and management of the RDI system – is carried out under the programme of Activities to Enhance the Agency and R&I Management System. The planned projects under the first investment for co-financing research and innovation projects to support the green transition and digitalisation are intended to co-finance long-term major collaborative programmes for research and innovation

on the TRL 3–6 scale. The second investment is intended to co-finance projects and programmes to enhance the international mobility of Slovenian researchers, research organisations, and to encourage the international integration of Slovenian applicants, and to reintegrate postdoctoral researchers into Slovenian research institutions.

DEPARTMENT OF ANALYSES

Head of department: /

The department carries out tasks in the field of collecting and processing data on the involvement of researchers in obtaining funds of other users, analyses and monitors the development of scientific research and innovation activities, and participates in planning national research and development policy. It draws up and publishes reports to support ARIS operation and the operation of its bodies, as well as specific analyses, such as annual reports on the government budget allocations for research and development activities, reports on the structure, results and effects of research projects within the allocated state aid schemes, and other reports. The Department of Analyses monitors the quality of Agency work, draws up the Agency's annual reports and is in charge of the substantive part of the work programme proposal.

OPEN SCIENCE OFFICE

Head of Office:
Dr. Mirjam Dular

The office carries out tasks in the following fields: measures of open science in line with regulations governing the implementation of scientific research work in accordance with the principles of open science, including the Action plan for open science; research equipment and research infrastructure and providing necessary open access; international scientific literature and bibliographical databases and coordinating and harmonising with IZUM and OSIC; science and popular science press; open access to scientific publications and research data; procedure of collecting and processing data on the engagement of researchers in acquisition of funds from other users (A3 call for engagement), and popularisation and communication of science.

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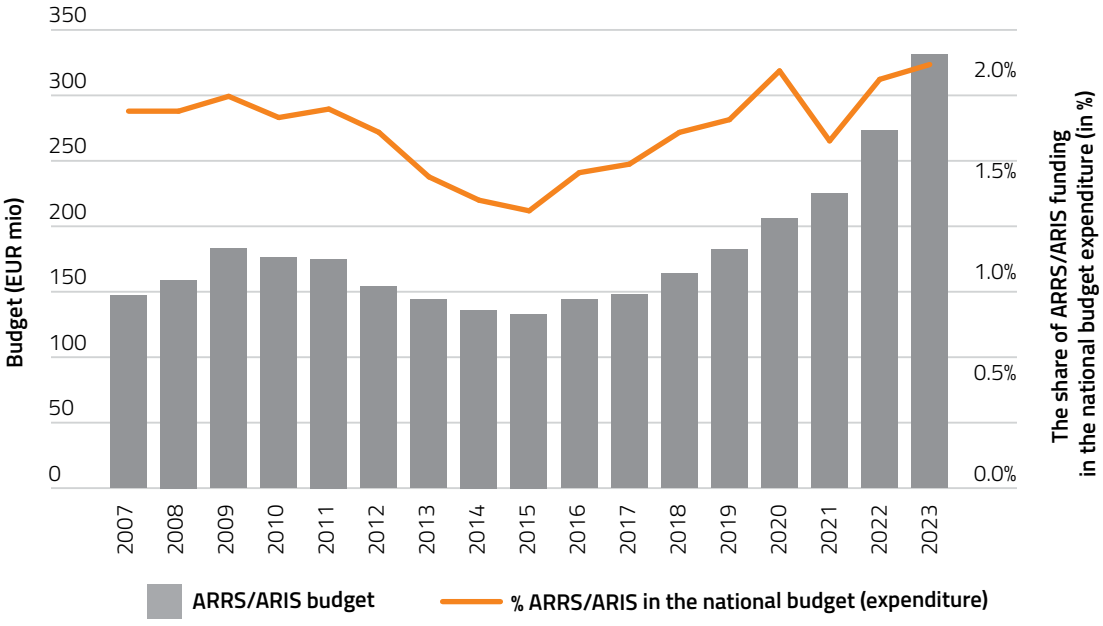
Financing structure

In 2023, the tasks were focused on providing the conditions for carrying out scientific research activities and monitoring the purpose of carrying out scientific research activities. An extensive part of the activity was the implementation of stable funding for scientific research activities and fundamental, applied and postdoctoral projects.

In 2023, EUR 331.5 million were allocated from the budget of the Republic of Slovenia via the Slovenian Research and Innovation Agency to fund scientific research activities, which was EUR 57.5 million or 21.0% more than in 2022 and represents approximately the same increase compared to 2021. The Agency's budget for funding scientific research activities has been increasing since 2015.

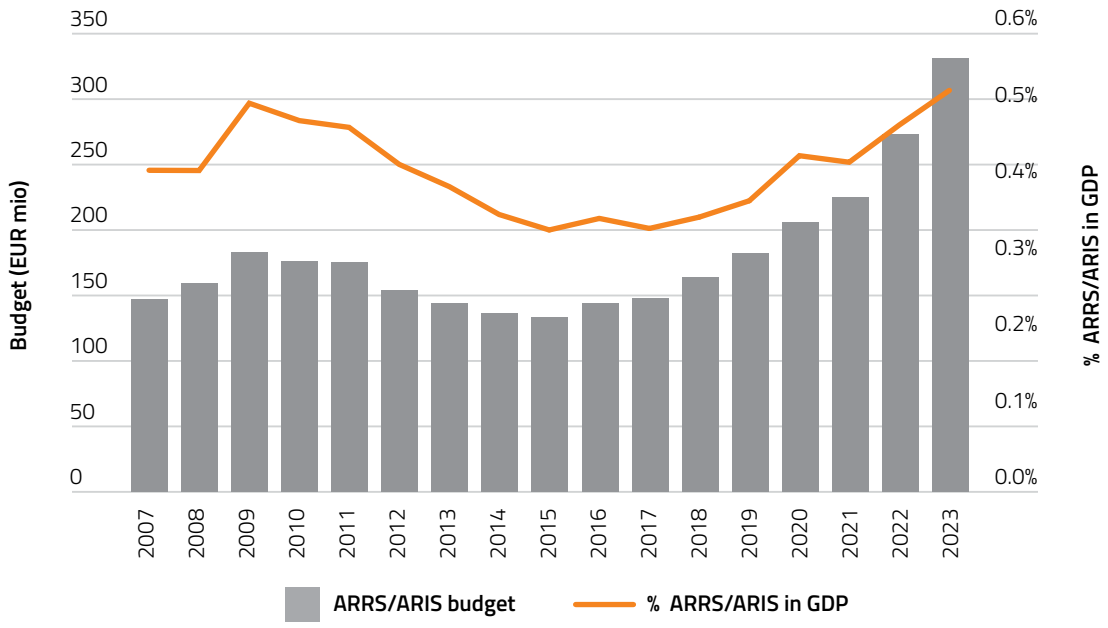
In 2023, the share of Agency resources for funding scientific research in the budget of the Republic of Slovenia again increased, specifically from 1.96% (in 2022) to 2.03% (in 2023) and thus slightly exceeded the share from 2020, i.e. 2.0%.

AGENCY RESOURCES FOR FUNDING SCIENTIFIC RESEARCH ACTIVITIES AND THEIR CORRESPONDING SHARE IN THE BUDGET OF THE REPUBLIC OF SLOVENIA IN THE 2007–2023 PERIOD



Since 2017, the share of ARIS resources in the GDP (with the exception of the COVID year of 2021) has also been increasing, i.e. 0.5% in 2023.

AGENCY FUNDS FOR FINANCING SCIENTIFIC RESEARCH ACTIVITIES AND THEIR CORRESPONDING SHARE IN THE GDP IN THE 2007-2023 PERIOD



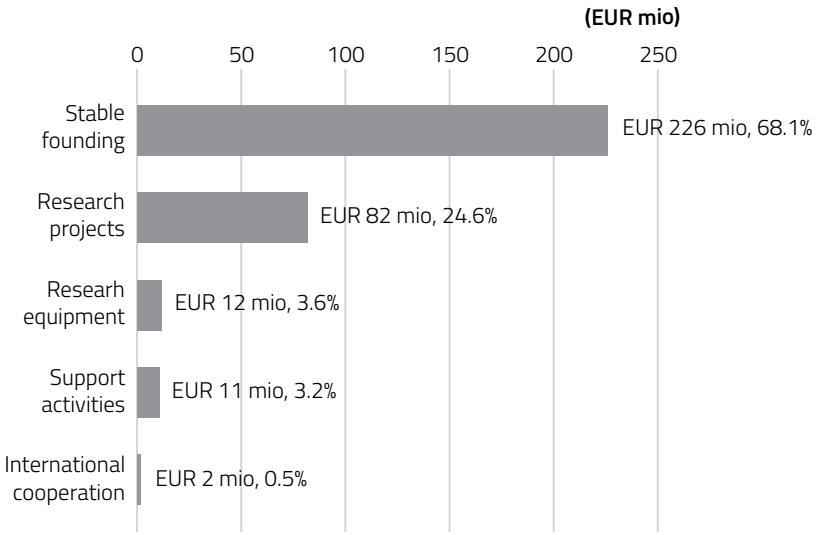
A detailed overview of the financing of research activities by year is available at: **https://www.arrs.si/sl/finan/letpor/** (only in Slovene).

More data and charts on the scope and structure of financing received by the Agency from the national budget are available at **https://www.aris-rs.si/en/analize/obseg01/index.asp.**

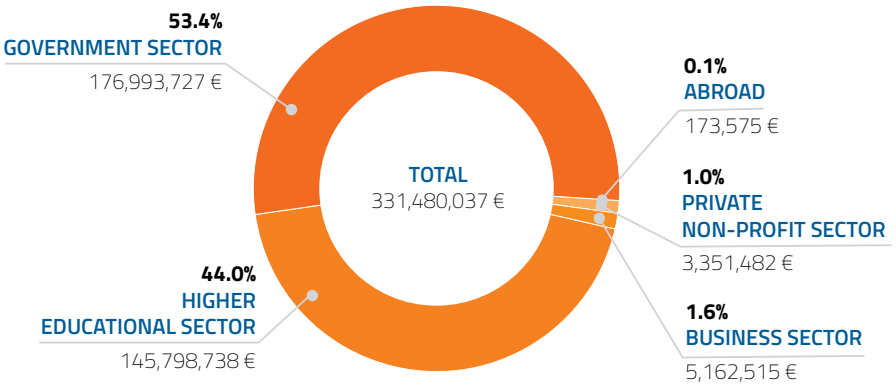
Agency funds in 2023

In 2023, the majority of Agency funds went to stable funding (68.1%), followed by research projects (almost 24.6%), research equipment (3.6%), supporting activities (3.2%) and in the smallest part international cooperation (0.5%). According to activity sectors, 53.4% of Agency funds were allocated to the government sector, and 44.0% to the higher education sector.

AGENCY FUNDS PER MECHANISM SET



DISTRIBUTION OF AGENCY FUNDS BY ACTIVITY SECTOR



RESEARCH PROGRAMMES:

represent a field of scientific research work, which is expected to be current and applicable over a longer period of time. In 2022, the financing of a majority of research programmes was transitioned into stable funding.

RESEARCH PROJECTS:

co-financing fundamental, applied, and postdoctoral research projects and targeted research programme (CRP) projects. CRPs are designed, implemented and financed in cooperation with individual ministries and other interested budget users.

YOUNG RESEARCHERS:

financing doctoral students employed by the recipient of stable funding to obtain doctoral education and who are funded under the programme funding pillar.

INTERNATIONAL ACTIVITIES:

(co)financing projects within the ERC complementary scheme, calls for ERC Potential and ERC New Horizons, Lead Agency Agreement, visits to ERC project leaders, introduction of projects based on the Marie Skłodowska-Curie Seal of Excellence, (co)financing international bilateral cooperation, promoting cooperation of research agencies in Horizon Europe calls, ERA projects, promotion of Slovenian science abroad and integration of scientific achievements.

RESEARCH INFRASTRUCTURE:

co-financing purchases of research equipment, science and popular science periodicals and scholarly monographs, COBISS system via financing IZUM, purchase of international scientific literature and databases, financing and co-coordination of OSIC.

Stable funding

STRUCTURE OF STABLE FUNDING IN 2023

ISF-Infrastructure activity	EUR 18.3 mio
ISF-Management and supporting activities	EUR 52.2 mio
PSF-Research programmes	EUR 99.8 mio
PSF-Young researchers	EUR 35.6 mio
RSF-Development funding pillar	EUR 13.1 mio
Founder obligations for PRI	EUR 1.7 mio
Infrastructure programmes – material costs	EUR 2.8 mio
Infrastructure programmes – salaries	EUR 1.4 mio
Research programmes	EUR 0.9 mio

In 2023, funds for the stable funding of scientific research activities were funds from three of four pillars financed in 2023, namely the institutional, programme and development pillars.

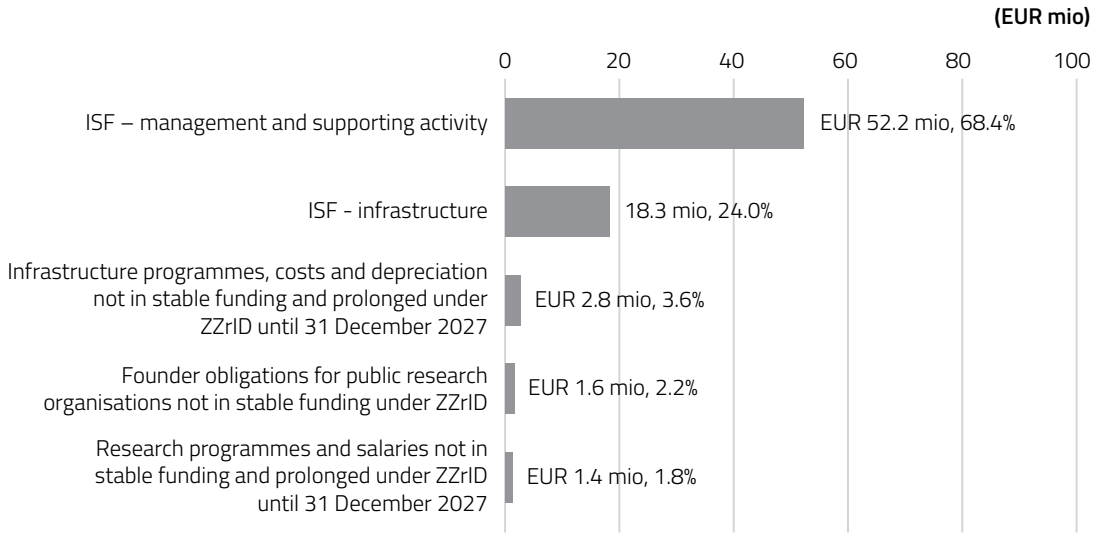
Within the framework of stable funding, in 2023 also research and infrastructure programmes and priority projects with the Research Infrastructure Roadmap not transferred to stable funding (Research programmes, Infrastructure programmes – material costs and Infrastructure programmes – salaries), operation of newly founded public research institutes ZIS Pomurje and Rudolfovo, and partial reimbursement of salary to a trade union representative (founding obligations for PRI) were (co)financed.

The highest share of stable funding in 2023 was allocated to research programmes (44.6%), followed by management and supporting activities of stable funding recipients (23.8%) and young researchers (15.8%).

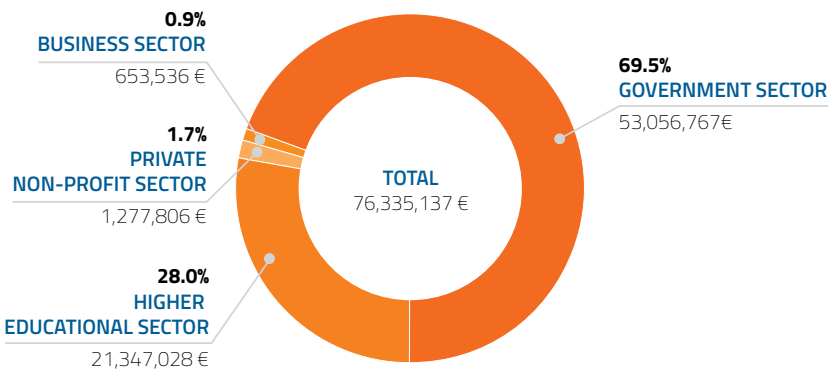
INSTITUTIONAL FUNDING PILLAR

The institutional funding pillar includes funding of infrastructure, management and supporting activities for recipients of stable funding and other institutional infrastructure. In 2023, EUR 1.6 million were allocated for the operation of two newly founded public research institutes, while EUR 4.2 million were provided for (co)financing infrastructure programmes and priority projects under the Research Infrastructure Roadmap not included in stable funding.

FUNDING MECHANISMS INCLUDED IN THE INSTITUTIONAL FUNDING PILLAR IN 2023



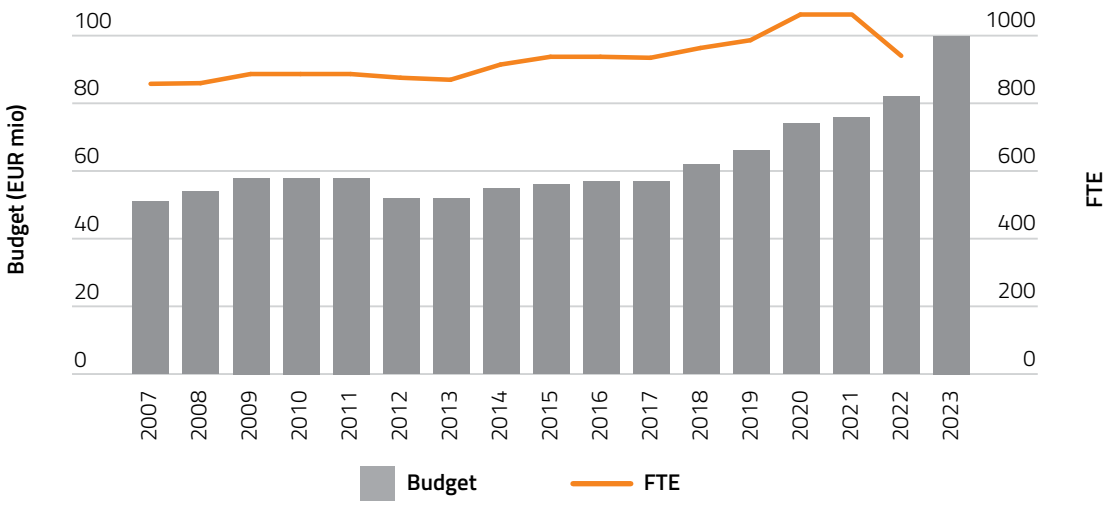
FUNDING OF THE INSTITUTIONAL PILLAR BY ACTIVITY SECTOR IN 2023



RESEARCH PROGRAMME

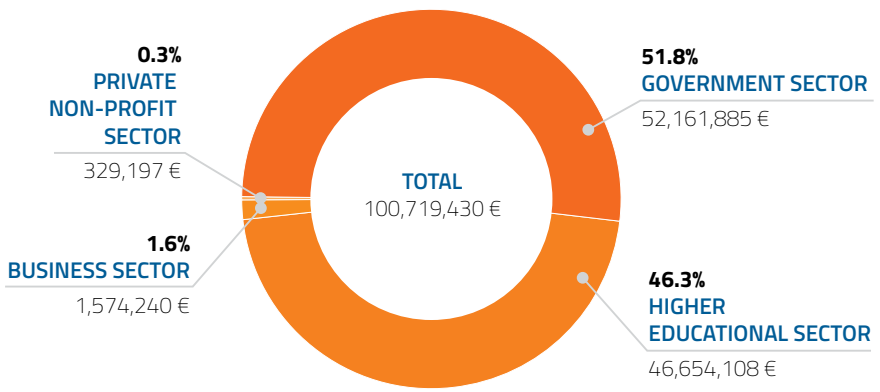
In 2022, **research programmes** became a part of the programme funding pillar, except the part implemented in companies during the first contractual period. Recipients of stable funding determine the substance, scope and method of carrying out the research programme and the head of the research programme, while taking into account the norms and standards adopted by the government, the ARIS general act and act of the stable funding recipient. In 2023, there were 71 recipients of funds for research programmes. In 2023, the Agency paid EUR 100.7 million for the co-financing of research programmes, which represents 30.4% of the total budget for scientific research activity.

FUNDS AND FTE – FOR RESEARCH PROGRAMMES (WITHOUT YOUNG RESEARCHERS)*



*Data on FTE for 2023 are not yet available

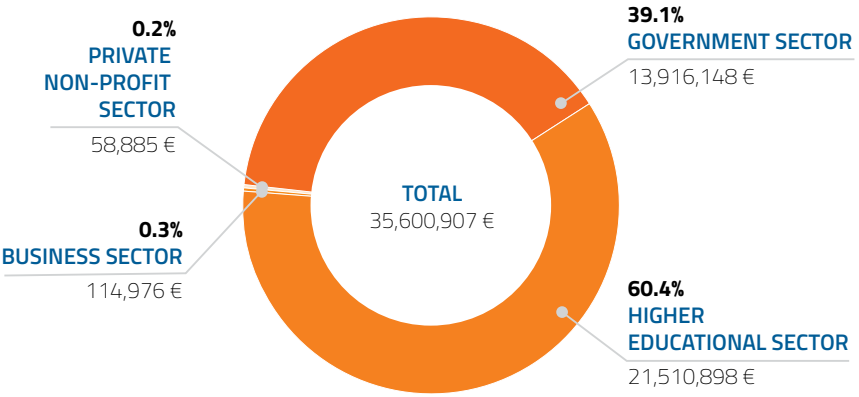
AMOUNT OF FUNDS FOR RESEARCH PROGRAMMES BY ACTIVITY SECTOR IN EURO AND SHARES AS PERCENTAGE IN 2023



YOUNG RESEARCHERS

The Young Researchers programme has been successfully running since 1985 and has significantly contributed to the increase in quality and volume of research and provided more young researchers to research groups. By financing young researchers, the Agency wishes to renew research and research-teaching staff in research organisations, enhance the research capacity of groups to carry out public service programmes in the field of research activities of fundamental, applied and development projects, and increase human resources potential for the Slovenian economy and other socially significant fields. Since 2017, after the negative trend had reversed, funds for young researchers have increased on an annual basis, i.e. in 2023, EUR 35.6 million were allocated for this purpose, which is EUR 4.2 million more compared to 2022.

DISTRIBUTION OF FUNDS FOR YOUNG RESEARCHERS BY ACTIVITY SECTOR IN EURO AND SHARES AS PERCENTAGE IN 2023

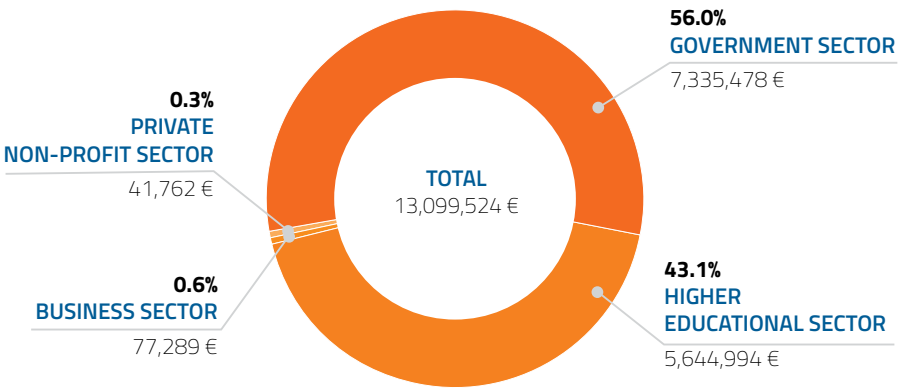


By including the training of young researchers in the programme pillar of stable funding, an arrangement has been introduced so that the publication of the call, selection of mentors and candidates for young researchers fall under the competence of the recipient of stable funding. In its act, the recipient of stable funding determines the number of places for doctoral students, mentors, training programmes, criteria, assessment methods, and selection of candidates for young researchers.

DEVELOPMENT FUNDING PILLAR

The development funding pillar is intended to promote the development of scientific research and infrastructure activities. Funds for the development funding pillar were first allocated to recipients of stable funding in 2023, i.e. in the total amount of EUR 13.1 million, which is 5.8% of all funds earmarked for stable funding.

TOTAL AMOUNT OF FUNDS FOR THE DEVELOPMENT FUNDING PILLAR BY ACTIVITY SECTOR IN EURO AND SHARES AS PERCENTAGE IN 2023



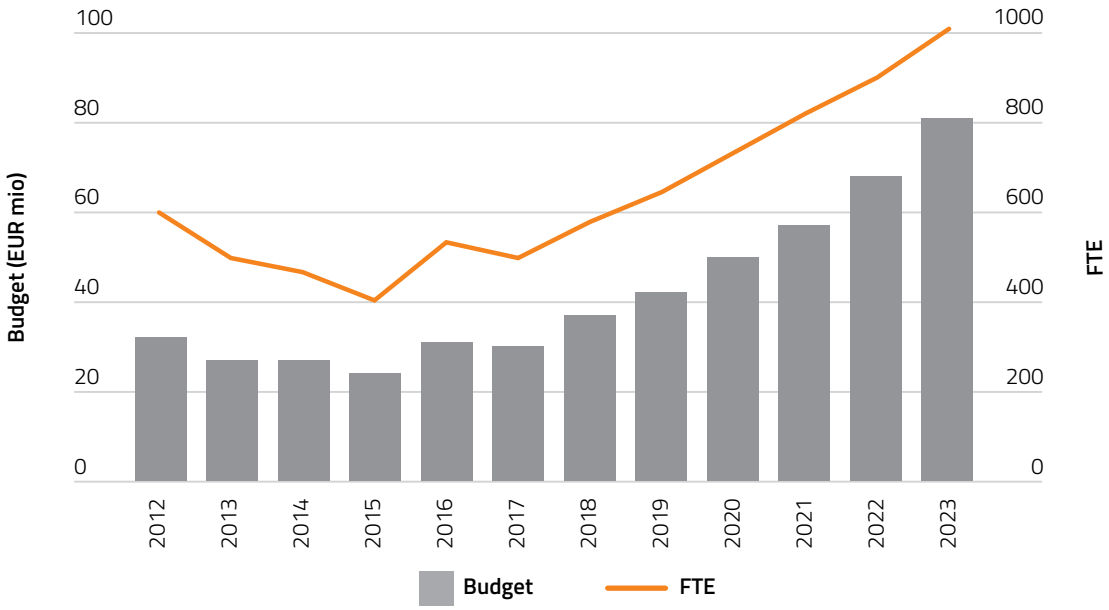
Competitive financing

FUNDS ALLOCATED TO RESEARCH PROJECTS IN 2023

Research projects	EUR 81.6 mio

Winning and co-financing a research project is linked to a public call. Successful proposals of projects meeting all conditions prescribed and that have been selected in a two-phase procedure based on reviews from foreign reviewers and the proposal of specialist bodies of the Agency are co-financed for the period laid down in the call. In 2023, the funding for research projects increased again. The trend of increasing funds for research projects has continued since 2017. In 2023, the funds for research projects increased from EUR 68.3 million (in 2022) to EUR 81.6 million.

FUNDS AND FTE (FULLY EMPLOYED RESEARCHERS) FOR RESEARCH PROJECTS*



*Funds for international research projects are also added

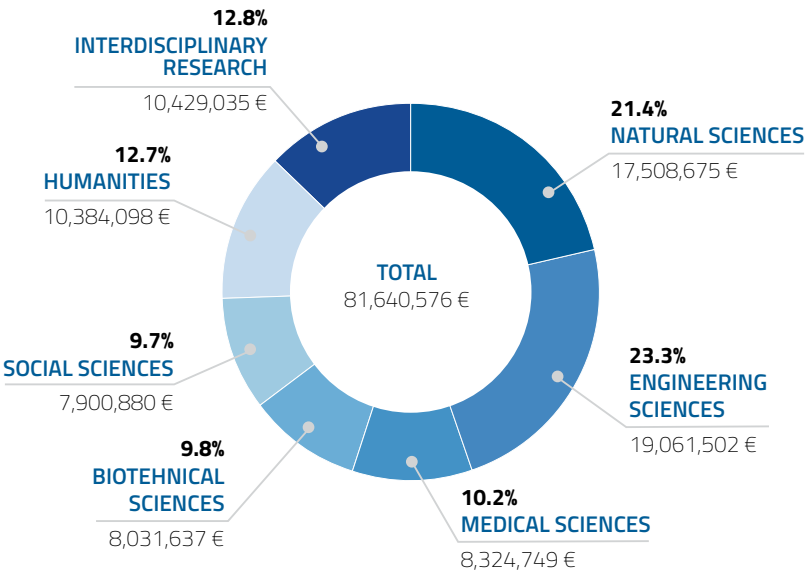
Research projects

FUNDS ALLOCATED TO RESEARCH PROJECTS BY PROJECT TYPE

Fundamental research projects	EUR 50.2 mio
Applied research projects	EUR 8.8 mio
Postdoctoral research projects	EUR 5.6 mio
Targeted research programme projects	EUR 4.0 mio
International projects	EUR 13.1 mio

Research projects include fundamental research projects, applied research projects, and postdoctoral research projects, targeted research programme (CRP) projects, and international research projects (ERA, ESF, ERC). In 2023, the Agency co-financed research projects in the amount of EUR 81.6 million. The share for projects was 24.6% of the total budget of the Agency. The funding increased by EUR 13.3 million compared to the year before.

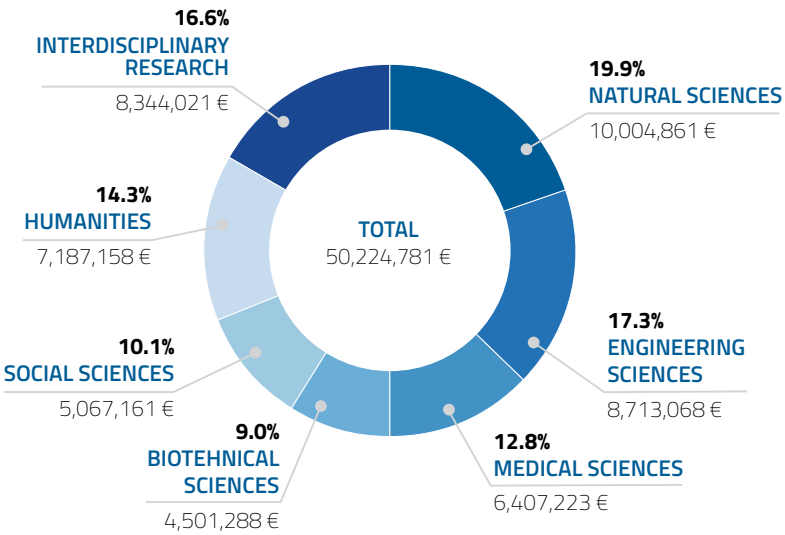
FUNDS FOR RESEARCH PROJECTS BY DISCIPLINE



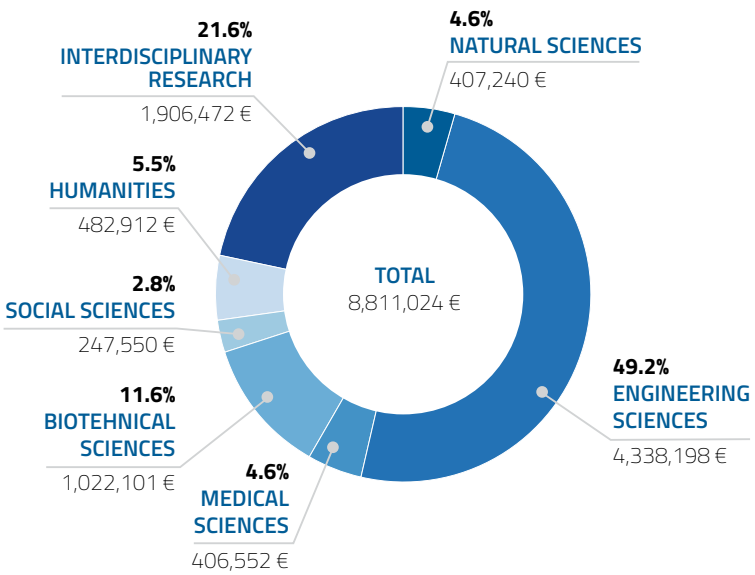
FUNDAMENTAL AND APPLIED RESEARCH PROJECTS

Fundamental research projects are original experimental or theoretical works aimed at acquiring new knowledge on the fundamentals of phenomena and perceptible facts. The aim of applied research projects is to gain new knowledge in particular directed at a practical objective or purpose. In 2023, with resources from the state budget, the Agency co-financed fundamental research projects in a total value of EUR 50.2 million and applied research projects in the total value of EUR 8.8 million.

AGENCY FUNDS FOR FUNDAMENTAL RESEARCH PROJECTS BY DISCIPLINE



AGENCY FUNDS FOR APPLIED RESEARCH PROJECTS BY DISCIPLINE



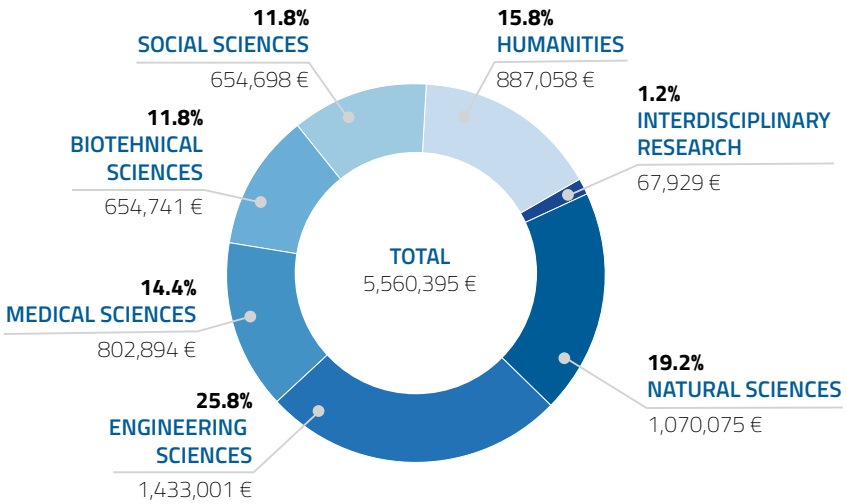
THE FUNDING OF FUNDAMENTAL AND APPLIED RESEARCH PROJECTS BY DISCIPLINE WITH SHARES FOR PROJECTS LED BY FEMALE RESEARCHERS AND JUNIOR RESEARCHERS. DATA ON THE SHARE OF FUNDING FOR PROJECTS LED BY JUNIOR FEMALE RESEARCHERS ARE PRESENTED IN THE LAST COLUMN

DISCIPLINE	FUNDAMENTAL AND APPLIED PROJECTS IN EUR MILLIONS	FEMALE RESEARCH LEADERS (share of projects managed by women)	JUNIOR LEADERS	
			JUNIOR LEADERS (share of junior research leaders)	JUNIOR FEMALE RESEARCH LEADERS (share of women among junior leaders)
Natural science	10.4	29.0%	28.2%	29.7%
Engineering	13.0	23.8%	23.1%	27.0%
Medicine	6.8	45.1%	34.3%	37.1%
Biotechnology	5.5	43.5%	29.0%	35.0%
Social sciences	5.3	37.6%	25.8%	37.5%
Humanities	7.7	48.4%	31.2%	62.1%
Interdisciplinary research	10.2	39.8%	29.5%	46.2%
Total	**58.9**	**36.3%**	**28.3%**	**38.5%**

POSTDOCTORAL RESEARCH PROJECTS

As an important instrument for integration, mobility and circulation of researchers, the Agency uses funds from the state budget to co-finance postdoctoral research projects which can be fundamental or applied and are carried out with the aim of providing additional research experience and knowledge to researchers after obtaining a doctoral degree. The number and value of projects increased compared to 2022. In 2022, the Agency used funds from the state budget to finance 111 postdoctoral projects amounting to EUR 3.7 million, while in 2023 there were 112 such projects with a total value of EUR 5.6 million.

FUNDS FOR POSTDOCTORAL PROJECTS BY RESEARCH DISCIPLINE IN 2023



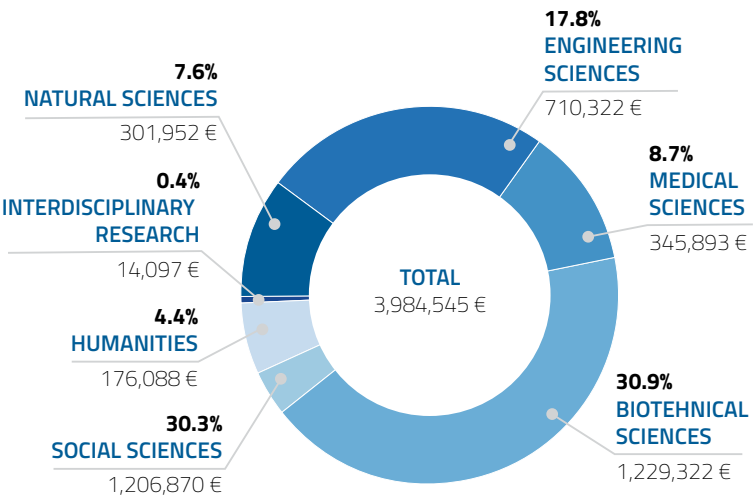
FUNDS FOR POSTDOCTORAL PROJECTS BY DISCIPLINE WITH SHARES FOR PROJECTS LED BY FEMALE RESEARCHERS

DISCIPLINE	FUNDING IN EUR	FEMALE RESEARCH LEADERS (share of projects managed by women)
Natural science	1,070,075	45.5%
Engineering	1,433,001	44.8%
Medicine	802,894	68.8%
Biotechnology	654,741	83.3%
Social sciences	654,698	61.5%
Humanities	877,058	66.7%
Interdisciplinary research	67,929	100.0%
Total	**5,560,395**	**58.9%**

TARGETED RESEARCH PROGRAMME PROJECTS (CRP)

CRP is a form and manner of implementing the Slovenian Development Strategy and the Slovenian Scientific Research and Innovation Strategy and is designed as an instrument to integrate the country to meet its needs, research community and wider public in terms of specific priority topics. The basic purpose of CRP is to provide research bases for decisions in preparing, adopting and implementing development policies of public interest and monitoring and supervising their execution. Compared to the previous year, the resources for co-financing CRP increased in 2023. In 2023, EUR 4.0 million were allocated to CRP (in 2022: EUR 2.5 million).

FUNDS FOR CRP BY RESEARCH DISCIPLINE IN 2023



FUNDS FOR CRP PROJECTS BY DISCIPLINE WITH SHARES FOR PROJECTS LED BY FEMALE RESEARCHERS

DISCIPLINE	FUNDING IN EUR	FEMALE RESEARCH LEADERS (share of projects managed by women)
Natural science	301,952	54.9%
Engineering	710,322	37.1%
Medicine	345,893	74.0%
Biotechnology	1,229,322	43.3%
Social sciences	1,206,870	52.6%
Humanities	176,088	19.5%
Interdisciplinary research	14,097	100.0%
Total	**3,984,545**	**47.5%**

In 2023, the public call on selection of research projects within the framework of the targeted research programme titled "CRP 2023" comprised the following fields:

- Inclusive, healthy, safe, and responsible society,
- Highly productive economy that generates added value for all,
- Learning for and through life,
- Preserved healthy natural environment,
- High level of cooperation, training and effective governance.

INTERNATIONAL PROJECTS

FUNDS FOR INTERNATIONAL PROJECTS IN 2023

Lead Agency scheme	EUR 7.9 mio
ERC supporting instruments	EUR 4.3 mio
MSCA Seal of Excellence	EUR 0.5 mio
PRIMA	EUR 0.1 mio
DUT	EUR 0.04 mio
CHANSE	EUR 0.05 mio
JPI EU	EUR 0.08 mio
NORFACE	EUR 0.05 mio

The first pillar of the Agency's international activity is composed of international research projects comprised of: the Lead Agency scheme, ERC supporting instruments scheme (ERC complementary scheme, ERC Potential, ERC New Horizons), research projects of the Marie Skłodowska-Curie Seal of Excellence, research projects of the PRIMA programme, and international partnerships.

The Lead Agency scheme enables researchers to apply for a joint research project to one of the agencies (Lead Agency) that is responsible for implementing the evaluation procedure of the joint application of the research project. Cooperation according to this principle is ensured by the fact that the Agency acts as the lead or partner agency. In 2023, the Agency allocated EUR 7,9 million to (co)finance the Lead Agency scheme and thus (co)financed 107 international research projects.

ERC supporting instruments are intended for researchers who have achieved a threshold for potential (co-financing) but were not selected for (co)financing by the ERC. The purpose of the instrument is to provide the applicants with conditions to elaborate the initial idea of a research

In 2023, cooperation according to the Lead Agency principle was possible based on bilateral agreements and within the Weave financing scheme under which the Agency cooperated with agencies from: Austria (FWF), Belgium/Flanders (FWO), Czech Republic (GA ČR), Croatia (HRZZ), Poland (NCN), Switzerland (SNSF) and Luxembourg (FNR). In addition, cooperation with the Hungarian national institute of research, development and innovations (NKFIH) was also possible, namely based on a bilateral agreement on cooperation according to the Lead Agency principle.

project so that a research project leader through re-application has a greater chance of being awarded an ERC project.

ERC Potential research projects are intended for researchers who have been awarded an ERC project with the aim of providing initial support for preparing the implementation of the awarded ERC project, during the interim period, between the ERC notification on (co)financing the ERC project and the beginning of its actual implementation.

ERC New Horizons research projects are intended for researchers who are holders of an ERC project during the period of one year before the conclusion of the ERC project or no later than one year after the end of the ERC project with a view of providing for the preservation of the core of the established research group for implementing the ERC research project, preparing for the resubmission of the application to the ERC call or to calls of the EU framework programme for research and innovations acting as a coordinator of the project under the EU framework programme for research and innovations, while promoting cooperation and the transfer of knowledge between research organisations in Slovenia.

In 2023, the Agency allocated EUR 4.3 million for (co)financing the three ERC supporting instruments indicated above. In 2023, there were 51 such projects.

Slovenia participates in the **Marie Skłodowska-Curie (MSCA) – Seal of Excellence scheme of the European Commission,** which awards all MSCA research projects achieving a score of 85% or more, the so-called Seal of Excellence, on an annual basis. This is a certificate on internationally recognised excellence of research projects and encourages countries to finance such research projects from national funds without any additional national evaluation procedures. In 2023, the Agency also published two public calls for (co)financing the **doctoral or postdoctoral education scheme Marie Skłodowska-Curie COFUND – Seal of Excellence.** For both Marie Skłodowska-Curie seals of excellence, the Agency allocated almost EUR 494 thousand and (co)financed 8 research projects of this type in 2023.

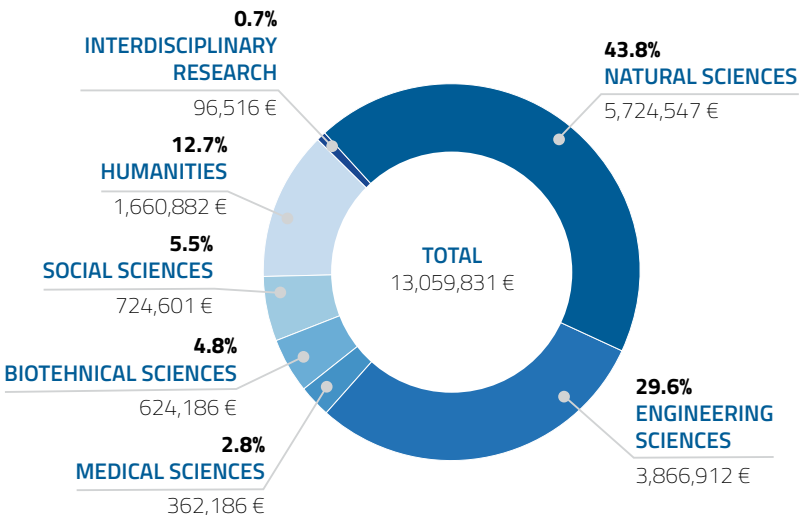
PRIMA is a partnership of 19 countries in the field of research and innovation in the Mediterranean region and acts as a joint scientific, financial and administrative management through a single secretariat. The partnership is active in three key areas focusing on the Mediterranean: management of waters, agricultural systems and agri-food chains. Activities associated with the participation of Slovenia in the PRIMA programmes are coordinated by the Ministry of Higher Education, Science and Innovation of the Republic of Slovenia. The Agency follows the starting points of the line ministry and (co)finances the Slovenian part of the joint research project in accordance with its legal norms in PRIMA joint research projects that have been positively assessed in the PRIMA call in the procedure of international review procedure and proposed for co-financing. In 2023, the Agency (co)financed 6 PRIMA research projects with a total value of EUR 135,428.27.

Joint Programming initiative Urban Europe (JPI UE) and **NORFACE** are networks that published joint international calls (ERA-Net(s)) before the Horizon Europe programme had started. With the new Horizon Europe framework programme, the European Commission suspended co-financing of individual (ERA-Net(s)) calls and moved to co-financing long-term partnerships. Under JPI, the DUT partnership was established, while the CHANSE partnership is a result of NORFACE. Within the framework of JPI and NORFACE there are also projects implemented following the old system (ERA Net(s)), while there will be no new calls organised by these networks.

The European partnership **Driving Urban Transitions towards a Sustainable Future – DUT** is one of 49 European partnerships of the Horizon Europe framework programme which includes 67 partners from 28 countries, including national and regional policy-makers, research and innovation funders, and agencies active in the field of urban policy. The partnership is based on the achievements of Joint Programming Initiative Urban Europe – JPI UE and is closely linked to the European mission of 100 climate-neutral and smart cities. In 2023, the Agency (co)financed three DUT research projects with a total value of EUR 38,371.72.

The **CHANSE consortium – Cooperation of Humanities and Social Sciences in Europe** operating within the ERA-NET framework has been created by the HERA and NORFACE networks with the aim of integrating and supporting research in the field of humanities or social sciences, with the joint incentive being supported by a total 24 organisations for funding research. In 2023, the Agency (co)financed four projects with a total value of EUR 52,268.16 that were selected in the call *Transformations: social and cultural dynamics in the digital age.*

FUNDS FOR INTERNATIONAL COOPERATION PROJECTS BY RESEARCH DISCIPLINE IN 2023



INTERNATIONAL ACTIVITY

Science and research are becoming more integrated in the international environment and directly and complementarily connect different fields. With the aim of promoting international cooperation and networking, the international activity of the Agency is focusing on three main pillars: international research projects, international mobility and other international activities. In 2023, the Agency allocated EUR 14.8 million to financing international activity. The majority of funds were allocated for the Lead Agency scheme. More information on international projects is available in the Chapter "Research Projects".

The first pillar of the agency's international activity is composed of international research projects, which are in detailed explained in the previous subchapter.

The second pillar of the international activity covers: bilateral projects, ERC hosting, COST, JSPS scholarships and hosting researchers from third countries.

International mobility

FUNDS ALLOCATED TO BILATERAL COOPERATION

International projects – bilateral cooperation	EUR 0.5 mio
Active international participation of excellent young researchers	EUR 0.01 mio
Visits to ERC project leaders	EUR 0.02 mio

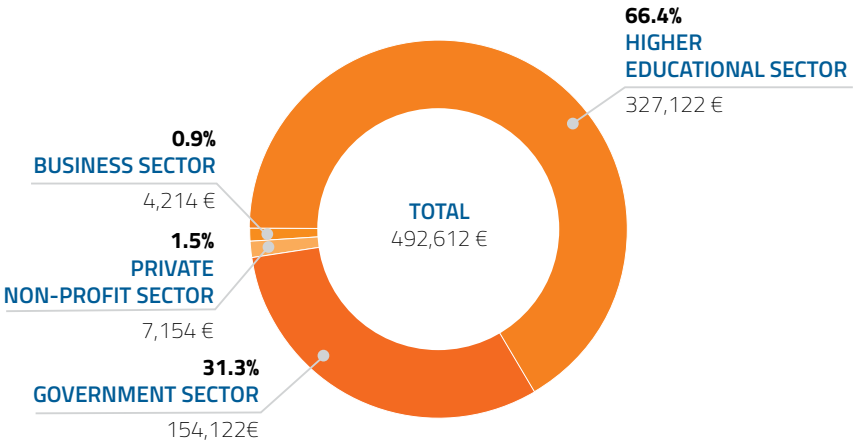
In the field of bilateral cooperation, the competent ministry makes decisions on concluding intergovernmental agreements and decisions on active bilateral cooperation, and seeks agreements with partner countries regarding tender specifications that do not stem directly from the Agency's legal basis. The latter has a role of executive agency that (co) finances bilateral cooperation with the aim of strengthening scientific research cooperation with partner countries, establishing new, sustainable international partnerships, and increasing the share of junior researchers in consortia for international research projects. The Republic of Slovenia has international agreements with 37 countries and in 2023 actively cooperated with 11. The Agency allocated over EUR 461 thousand for (co)financing 427 activities of bilateral cooperation.

The **ERC visiting scheme** is part of international mobility; it enables researchers to visit former and current ERC project leaders abroad. Its purpose is to train applicants for preparing their applications with the aim of increasing the possibility of being awarded their own ERC project. The Agency recognises the potential of this scheme as some research-

ers awarded co-financing were later successful in applying to ERC calls. In 2023, an additional 3 visits at ERC project leaders were approved.

The **COST instrument,** which is an intergovernmental framework for cooperation of research organisations from different European countries in the field of science and technology, is also included in international mobility and enables coordination of nationally funded research at the European level by research organisations that operate in the same field. The Agency does not (co)finance activities under this instrument, but rather encourages the active participation of Slovenian researchers in COST actions, also by appointing members of the so-called COST action board members.

INTERNATIONAL MOBILITY BY ACTIVITY SECTOR IN 2023



Other international activities

FUNDS ALLOCATED TO OTHER INTERNATIONAL ACTIVITIES

MSCA COFUND	EUR 0.2 mio
Scientific research cooperation: CEA and China	EUR 0.4 mio
Promotion of applications to EU projects – framework programme	EUR 0.3 mio
International science promotion	EUR 0.3 mio

In order to improve international, interdepartmental and interdisciplinary postdoctoral education and mobility of researchers, the Agency also (co) finances the **Marie Skłodowska-Curie COFUND** – Seal of Excellence schemes. In 2023, there were two public calls published for this purpose. The first was a Public call for (co)financing the Marie Skłodowska-Curie COFUND – Seal of Excellence doctoral study education scheme with the purpose of (co)financing research organisations awarded the Seal of

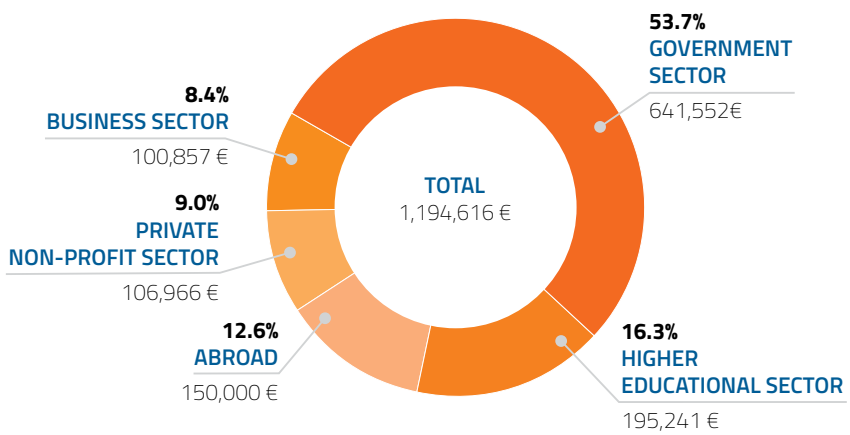
Excellence for implementing Marie Skłodowska-Curie COFUND doctoral study scheme under the review procedure carried out by the European Commission. The second was a Public call for (co)financing the Marie Skłodowska-Curie COFUND – Seal of Excellence postdoctoral education scheme aimed at (co)financing research organisations awarded the Seal of Excellence for implementing the Marie Skłodowska-Curie COFUND postdoctoral education scheme under the review procedure carried out by the European Commission.

(Co)financing **bilateral research projects** in 2023 also took place under the coordinated cooperation between the Ministry and the Agency. In 2023, the Agency (co)financed 5 bilateral research projects with the **French Alternative Energies and Atomic Energy Commission (CEA)** and two bilateral research projects with the **People's Republic of China.** In 2023, the Agency allocated over EUR 416 thousand to (co)finance 7 bilateral research projects.

Under the Public call for promoting Slovenian science abroad, the Agency encourages activities of **promoting Slovenian science** abroad and integrating scientific achievements where adequate international and expert participation is ensured. The programme facilitates cooperation with Slovenian research organisations and researchers from neighbouring states, as well as cooperation with Slovenian researchers working abroad. To promote Slovenian science abroad, the Agency allocated almost EUR 300 thousand in 2023.

With a one-time financial contribution, the Agency also promotes cooperation of Slovenian research organisations that exceeded the threshold of points achieved in the evaluation procedure at the calls of EU framework programmes **(Programme for research and innovation in the EU – Horizon Europe).** In 2023, the Agency allocated EUR 302 thousand for this purpose.

OTHER INTERNATIONAL ACTIVITIES BY ACTIVITY SECTOR IN 2023



Research equipment

FUNDS ALLOCATED TO RESEARCH EQUIPMENT

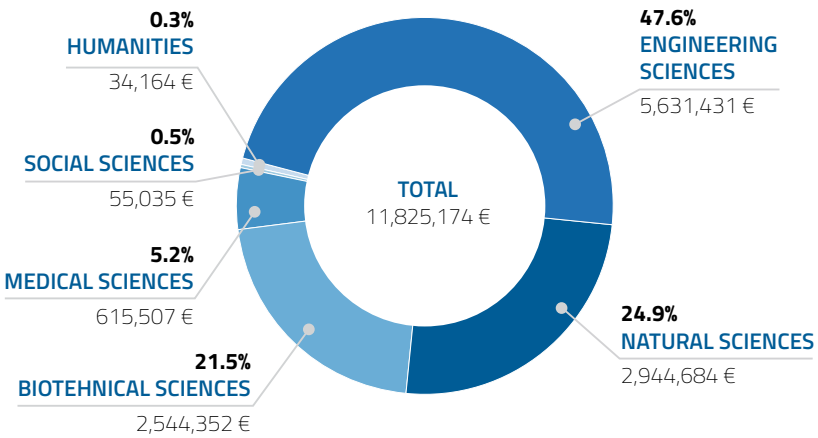
Research equipment	EUR 11.8 mio

ARIS co-finances purchases of high-value research equipment. Research equipment is an important research and infrastructure support for research personnel to carry out scientific research activities in performing research and development projects and programmes.

Applicants to the public call for co-financing the purchase of research equipment may be public research organisations carrying out public service in the field of scientific research activities in the form of a programme pillar for stable funding scientific research or infrastructure activity under the institutional pillar of stable funding the scientific research activity.

In 2023, the Agency allocated EUR 11.8 million for research equipment.

FUNDS ALLOCATED TO RESEARCH EQUIPMENT BY RESEARCH DISCIPLINE IN 2023



SUPPORTING ACTIVITIES

FUNDS ALLOCATED TO SUPPORTING ACTIVITIES

Open science	EUR 1.3 mio
IT support, international literature	EUR 7.1 mio
Journals and textbooks*	EUR 2.2 mio

*A sum of data for Slovenian popular science periodicals, Slovenian science periodicals and scientific monographs.

In addition to scientific literature, supporting activities include the field of open science, financing IT support and purchase of international literature.

Open science is a modern approach to scientific research work and dissemination of its results (knowledge and expertise) in a transparent and collaborative manner. Opening science via a rapid exchange of information and knowledge between researchers increases the possibilities for more rapid progress in science. Open science is a part of the comprehensive and extensive changes of scientific research work in the European community. It comprises of various policies, guidelines, processes, methods, practices and technologies that determine the fundamental principles and essential features of open science.

The Agency also co-finances **OSIC activity programmes** or programmes of specialised and academic libraries performing tasks aimed at building a system of bibliographical databases of researchers in Slovenia. The purpose of OSIC is to monitor and control the appropriateness of classifying bibliographical records according to the applicable typology in the COBISS.si system, organise arbitration in the event of disputed typologies and correct bibliographical records in the event of incorrect classification of bibliographical units, and participate in developing and preparing a unified and controlled dictionary for the COBISS.si system.

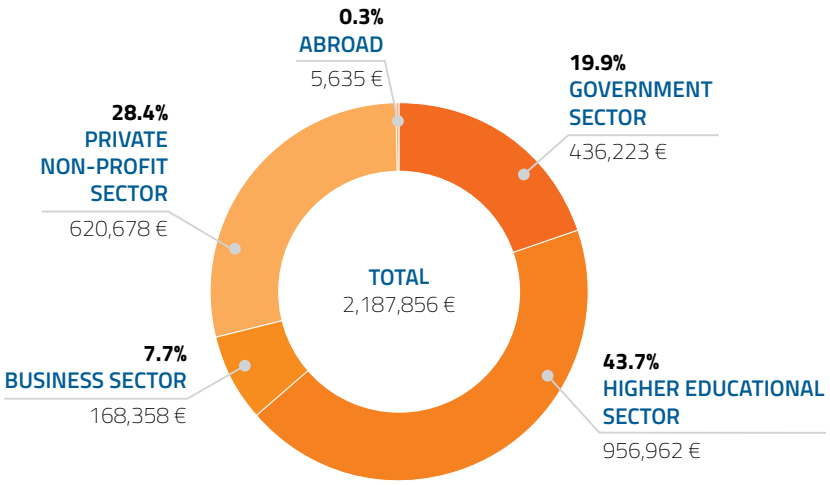
The Agency co-finances **purchases of foreign scientific literature** and **electronic access** to the most recent **scientific databases** in the world with the aim of providing necessary inflow and availability of scientific and technical information required in the fields of scientific research, education and development. The literature is publicly accessible in all libraries of research organisations and via the COBISS system.

In 2023, ARIS allocated EUR 2.2 million to issuing periodicals and textbooks. It earmarked EUR 1.3 million to finance open science (reimbursement of costs of publications in the open access) and EUR 7.1 million to IT support and purchase of international literature.

Co-financing of the scientific press, including domestic science and popular science publications, commanded a sum of EUR 1.9 million in 2023, while EUR 0.3 million was paid for scientific monographs.

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 scientific monographs** that are important for the development of Slovenian scientific terminology, intended for presenting scientific achievements and findings in Slovenia and abroad, and for promoting scientific culture.

FUNDING OF JOURNALS AND TEXTBOOKS BY ACTIVITY SECTOR IN 2023



OVERVIEW OF FINANCING IN 2023 BY PROGRAMME ITEM IN ACCORDANCE WITH THE ACCRUAL PRINCIPLE AND COMPARISON WITH 2022

	2022	2023	INDEX	% IN THE ARRS/ARIS BUDGET (2023)
ARIS budget	**273,986,199**	**331,480,037**	**121**	**100.0%**
Stable funding	**187,576,727**	**225,754,997**	**120**	**68.1%**
Research programmes	82,785,620	100,719,430	122	30.4%
Young researchers	31,443,284	35,600,907	113	10.7%
Infrastructure activity	17,750,613	22,500,001	127	6.8%
Development funding pillar		13,099,524		4.0%
Management and supporting activity	55,597,210	53,835,136	97	16.2%
Research projects	**68,277,849**	**81,640,576**	**120**	**24.6%**
Fundamental projects	41,851,238	50,224,781	120	15.2%
Applied projects	7,864,318	8,811,024	112	2.7%
Postdoctoral projects	4,516,530	5,560,395	123	1.7%
CRP	2,494,089	3,984,545	160	1.2%
International cooperation projects	11,551,673	13,059,831	113	3.9%
International cooperation	**1,743,410**	**1,687,228**	**97**	**0.5%**
International cooperation	1,743,410	1,687,228	97	0.5%
Research equipment	**6,723,743**	**11,825,174**	**176**	**3.6%**
Research equipment	6,723,743	11,825,174	176	3.6%
Supporting activities	**9,664,471**	**10,572,062**	**109**	**3.2%**
Open science	1,001,766	1,264,034	126	0.4%
IT support, international literature	6,876,806	7,120,172	104	2.1%
Periodicals and textbooks	1,785,899	2,187,856	123	0.7%

The overview of funding per individual year is available at: **https://www.aris-rs.si/sl/finan/letpor/** (only in Slovene).

1 ANNUAL REPORT

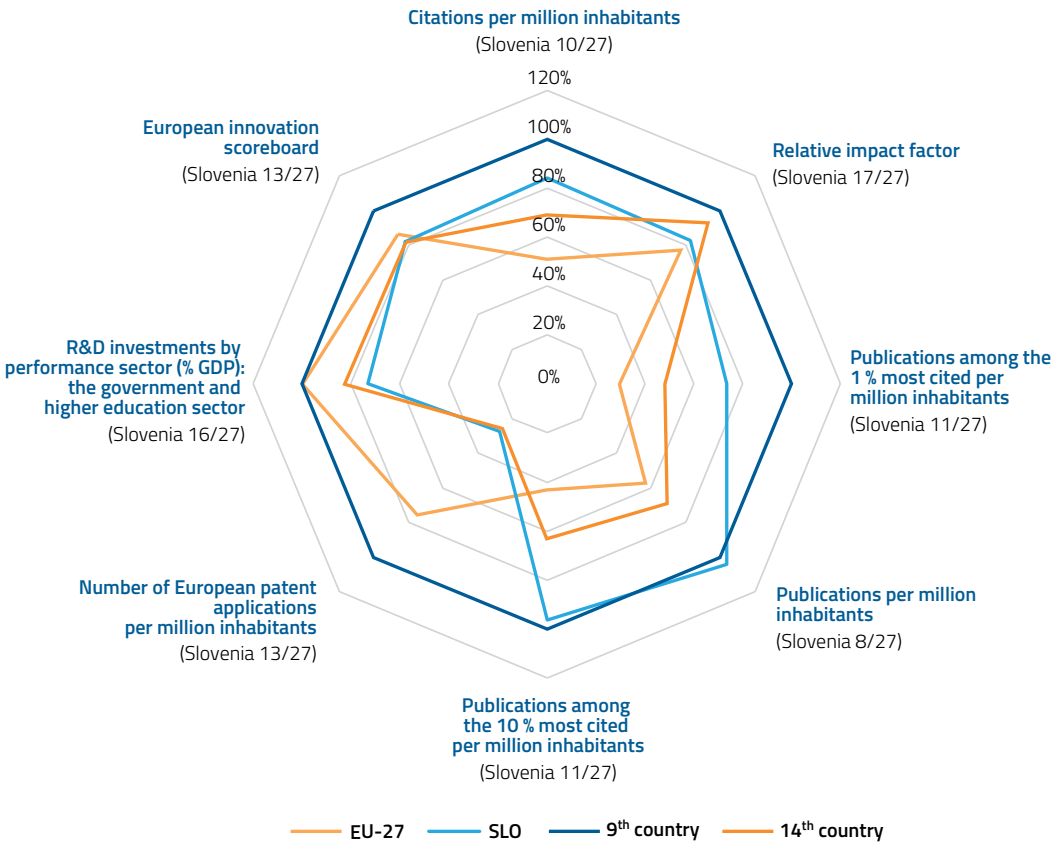
HIGHLIGHTS

ABOUT THE AGENCY

FINANCIAL REPORT

INTERNATIONAL COMPARISONS

COMPARISON WITH RESPECT TO THE 9TH COUNTRY IN THE EU (9TH COUNTRY = 100%)



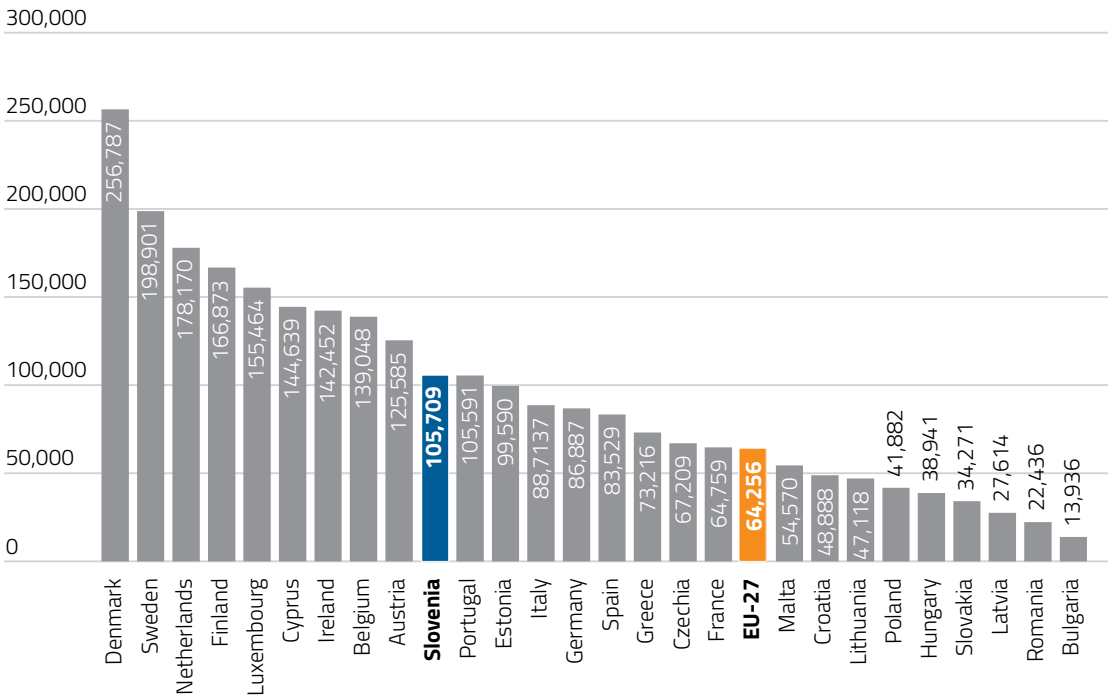
Source: InCites, Thomson Reuters/Science Metrix/Innovation Union Scoreboard/Eurostat, May 2024

The diagram shows the majority of standard bibliometric and other quantitative indicators that are used to measure research activities across the world and some of them are also included in the Resolution on the Slovenian Research and Innovation Strategy 2030. The scores for Slovenia are shown relative to the 9th EU country (upper third of the countries). For comparison, data for the 14th EU country (upper half of the countries) are also given. The rank achieved by Slovenia among 27 EU Member States is indicated next to each indicator. Slovenia ranks in the top third of countries in terms of publications per million inhabitants, while with regard to other indicators it falls in the middle third of countries.

Citations

In terms of the number of citations per million inhabitants in the 2019–2023 period, Slovenia ranks 10th, which is above the EU average. In the chosen observation period, the number of citations per million inhabitants was the highest in Denmark, followed by Sweden, the Netherlands and Finland.

NUMBER OF CITATIONS PER MILLION INHABITANTS FOR EU COUNTRIES IN THE 2019–2023 PERIOD

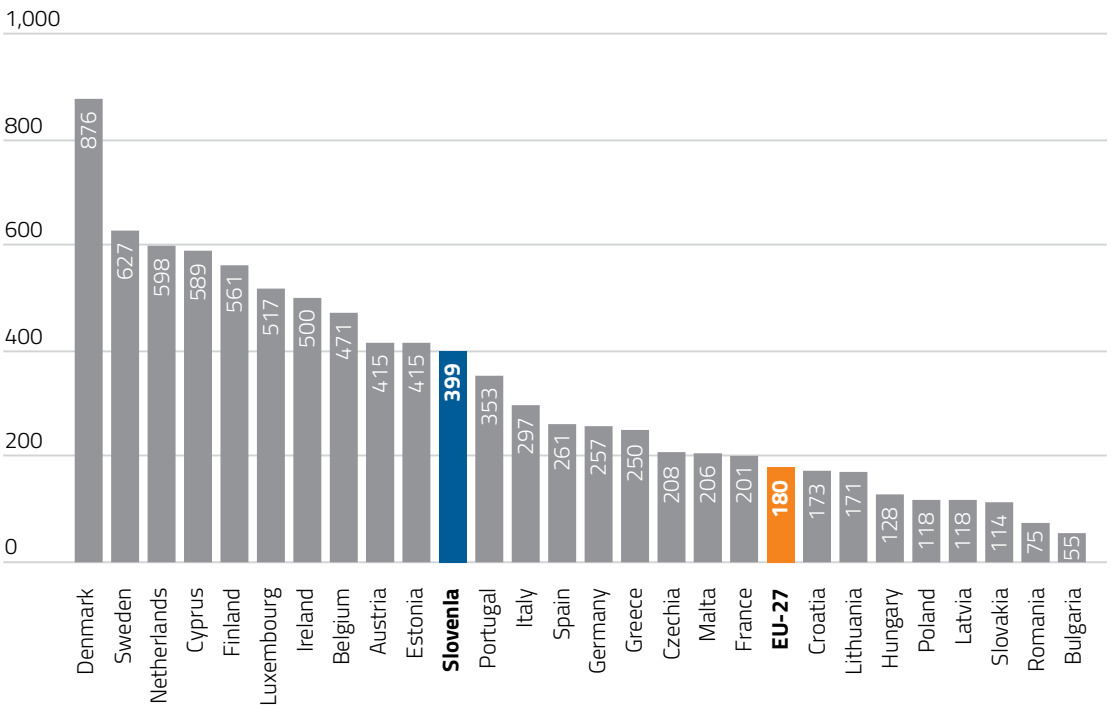


Source: InCites, WoS, May 2024

Published works among the 10% most cited

An established bibliometric indicator for international comparisons is the number of published works that rank among the 10% most cited works in the world for a given field of research. This encompasses works published in journals indexed in the Scopus bibliographical database. A four year citation window is taken into account, including the year of publication and three subsequent years. Since 2004, Slovenia has exceeded the EU average in terms of the 10% most cited published works per million inhabitants. According to the latest data for 2019, Slovenia ranks 11th among EU member states.

THE NUMBER OF PUBLISHED WORKS RANKING AMONG THE 10% MOST CITED WORKS PER MILLION INHABITANTS FOR 2020 FOR EU MEMBER STATES

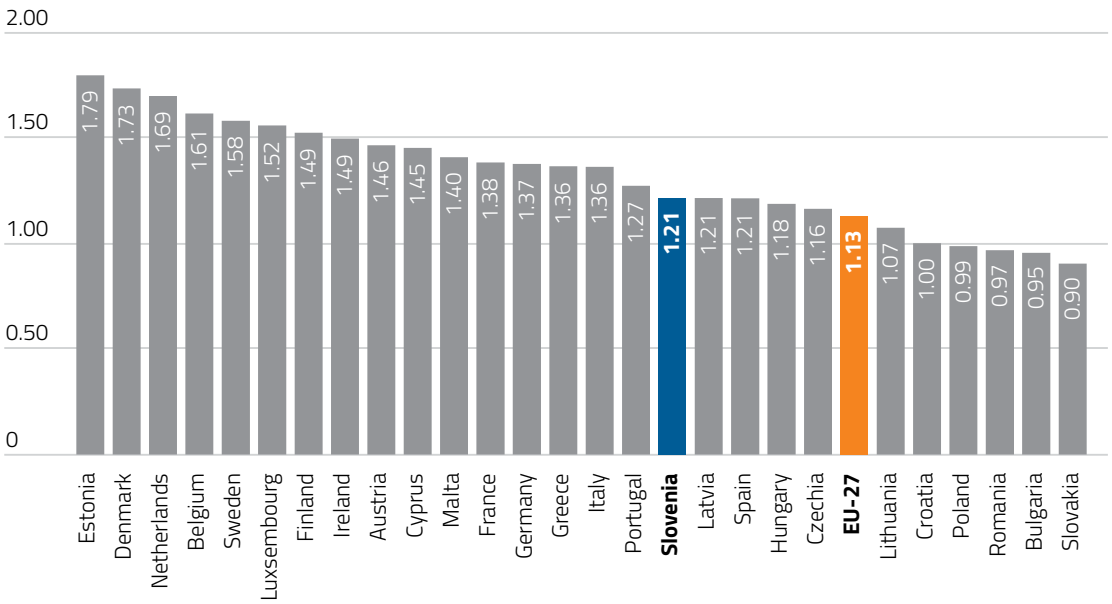


Source: SciVal, May 2024

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. Of the EU Member States, Slovenia ranks 17th in the last observation period in terms of the relative impact factor, which is a place higher than the year before.

RELATIVE IMPACT FACTOR FOR EU MEMBER STATES IN THE 2019-2023 PERIOD

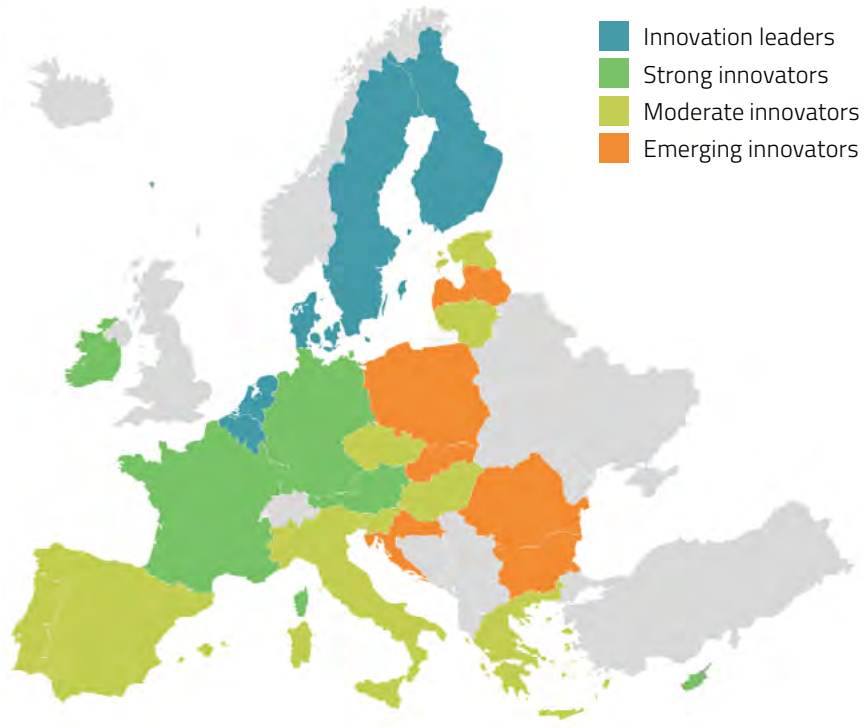


Source: InCites, WoS, May 2024

The relative impact factor value for Slovenia in the 2019–2023 period is 1.21, which is somewhat lower than the year before (1.24). In 2023, Slovenia was again just above the European average (1.13).

Innovation index

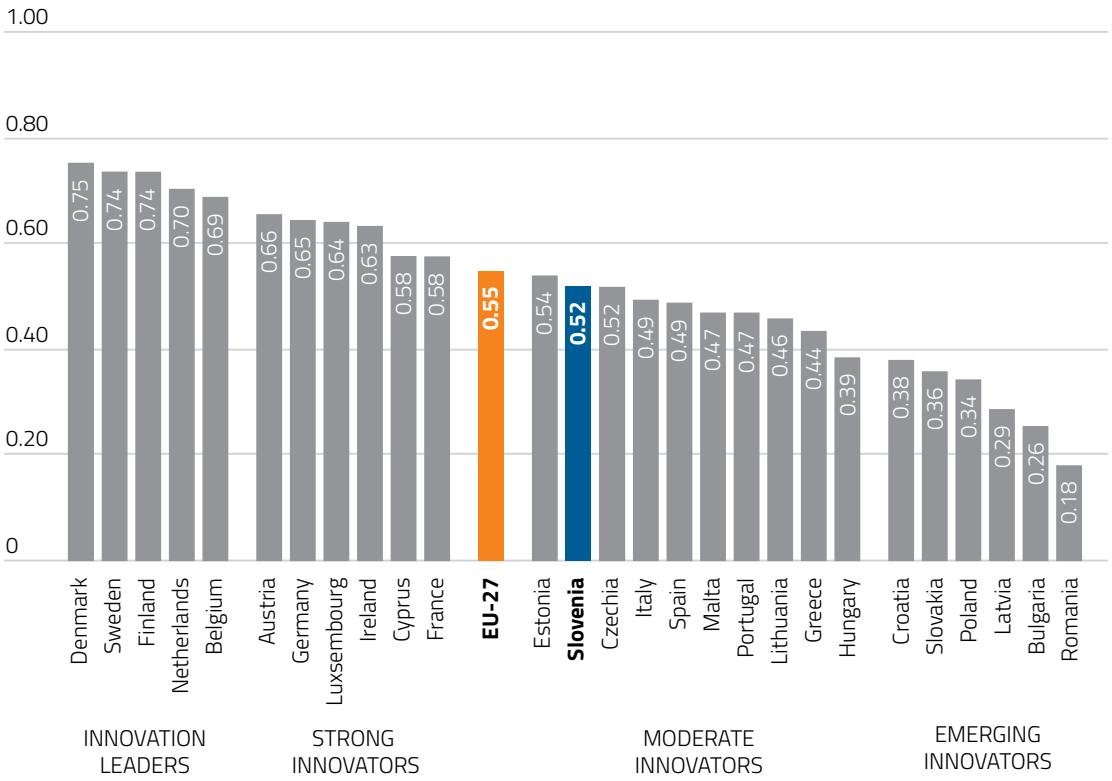
The joint innovation index (Innovation Union Scoreboard) provides an overview of the innovation activities of individual countries. It is comprised of over 32 indicators that include data on the educational structure, openness and excellence of the research system, financing, support and investment, connections, entrepreneurship and intellectual capital.



Europe heat map

In terms of the level of innovativeness, the countries are divided into four groups: the first group being innovation leaders, the second being strong innovators, the third being moderate innovators, and the fourth being emerging innovators. According to the respective indicators for 2023, Slovenia belongs to the group of countries that fall under the category "moderate innovators".

JOINT INNOVATION INDEX FOR EU MEMBER STATES IN 2023



Source: European and Regional Innovation Scoreboards, May 2024

International comparisons and other analyses are available at: **https://www.arrs.si/en/analize/index.asp.**

2 EXCELLENT IN SCIENCE

Excellent in science is a project carried out by the ARIS as part of the agency's endeavours to promote science. The project presents a selection of the most prominent achievements from the past year.

In 2023, some of the selected achievements were presented at the **national event titled ARIS Day 2023: Supporting Excellence held on 21 November 2023** in Ljubljana. The selection of achievements was proposed by members of the Scientific Research Councils for each scientific discipline and was confirmed by the agency's Scientific Council.

Laplacians on infinite graphs

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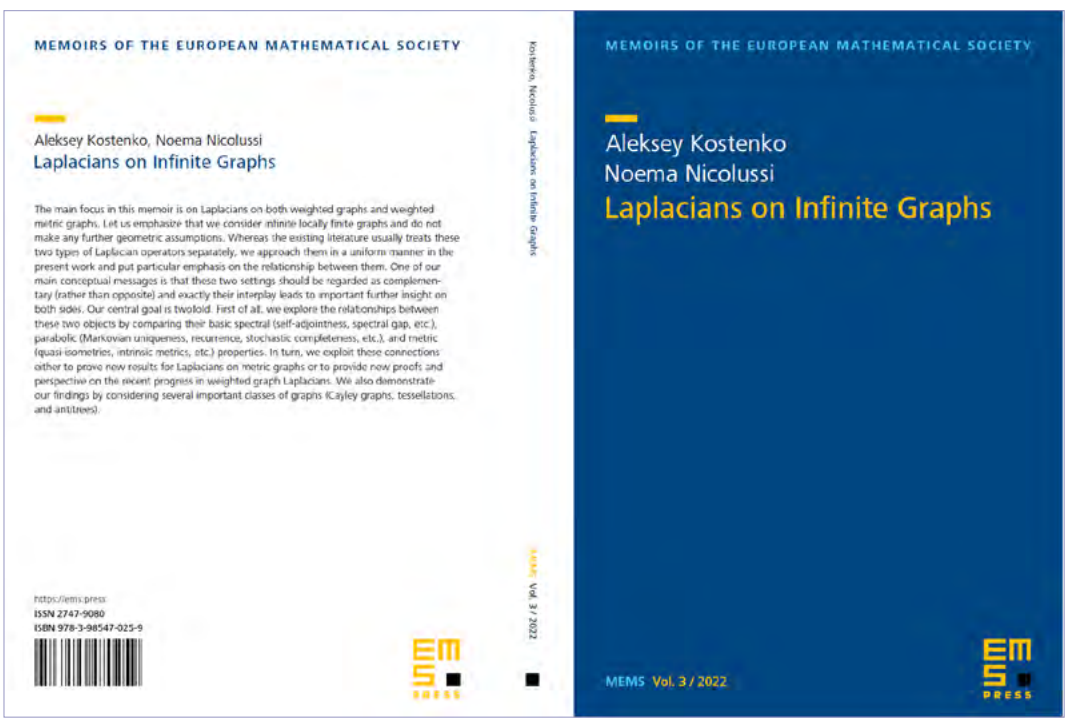
10.4171/MEMS/3

The main focus in this memoir is on Laplacians on both weighted graphs and weighted metric graphs. Let us emphasise that we consider infinite locally finite graphs and do not make any further geometric assumptions. Whereas the existing literature usually treats these two types of Laplacian operators separately, we approach them in a uniform manner in the present work and put particular emphasis on the relationship between them. One of our main conceptual messages is that these two settings should be regarded as complementary (rather than opposite) and precisely their interplay leads to important further insights on both sides. Our central goal is twofold. First of all, we explore the relationships between these two objects by comparing their basic spectral (self-adjointness, spectral gap, etc.), parabolic (Markovian uniqueness, recurrence, stochastic completeness, etc.), and metric (quasi-isometries, intrinsic metrics, etc.) properties. In turn, we exploit these connections either to prove new results for Laplacians on metric graphs or to provide new proofs and perspectives on the recent progress in weighted graph Laplacians. We also demonstrate our findings by considering several important classes of graphs (Cayley graphs, tessellations, and antitrees).



Source: KOSTENKO, Aleksej Sergejevič, NICOLUSSI, Noema. *Laplacians on infinite graphs.* Berlin: European Mathematical Society, 2022, cop. 2023. VIII, 232 pp., illustr. Memoirs of the European Mathematical Society, vol. 3. ISSN 2747-9080.

A detailed map of Higgs boson interactions by the ATLAS experiment ten years after the discovery

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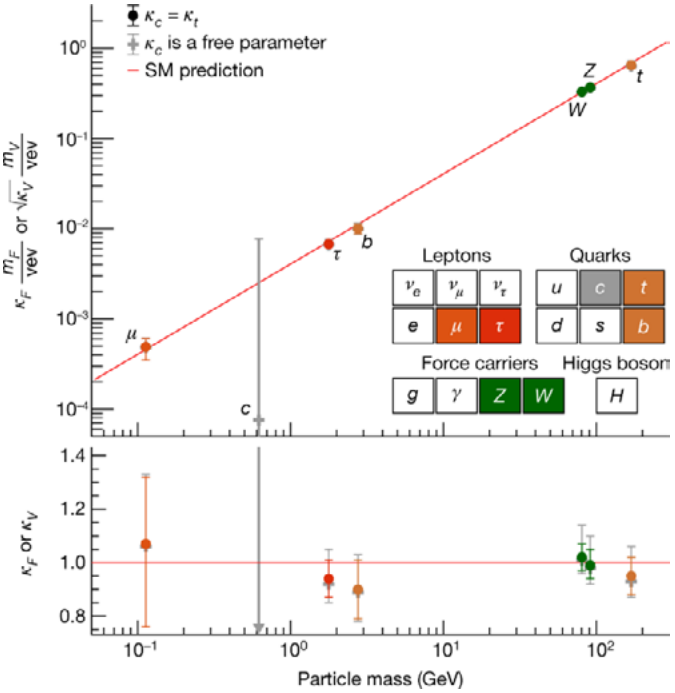
https://www.nature.com/articles/s41586-022-04893-w

DOI:
10.1038/s41586-022-04893-w

The discovery of the Higgs boson, which gives other particles mass, in the year 2012 is considered by scientists to be one of the most fundamental achievements in physical science of all time. The discovery of the Higgs boson was the final missing building block in the Standard Model of the fundamental interactions. Physicists have been searching for the Higgs particle for more than half a century. Theoretical calculations predicted its existence as early as 1964, but experimental confirmation of the Higgs boson was only possible when the Large Hadron Collider (LHC), a 27-kilometre particle accelerator where protons are accelerated to the highest energies ever achieved in a laboratory, was launched at CERN. Particle collisions produce extremely high energies, comparable to the energy conditions in the very early Universe, shortly after its creation in the Big Bang. This generates a number of new particles in the collider, including the Higgs boson, which physicists at the ATLAS and CMS experiments have identified through computational analysis. Theoretical physicists Peter Higgs and François Englert won the Nobel Prize immediately after their prediction was finally confirmed. Now, after ten years of further research, the properties of the newly discovered particle are much more accurately determined and agree well with the predictions of the Standard Model, which is however certainly not the definitive final answer in fundamental particle physics.



Source: CINDRO, Vladimir, FILIPČIČ, Andrej, GORIŠEK, Andrej, HITI, Bojan, KERŠEVAN, Borut Paul, KRAMBERGER, Gregor, MAČEK, Boštjan, MANDIĆ, Igor, MIJOVIĆ, Liza, MIKUŽ, Marko, *et al.* A detailed map of Higgs boson interactions by the ATLAS experiment ten years after the discovery. *Nature: the international weekly journal of science.* [Print ed.]. 2020, vol. 607, pp. 52-59. ISSN 0028-0836.

Functional diversity of vibrational signalling systems in insects

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https://pubmed.ncbi.nlm.nih.gov/36198397/

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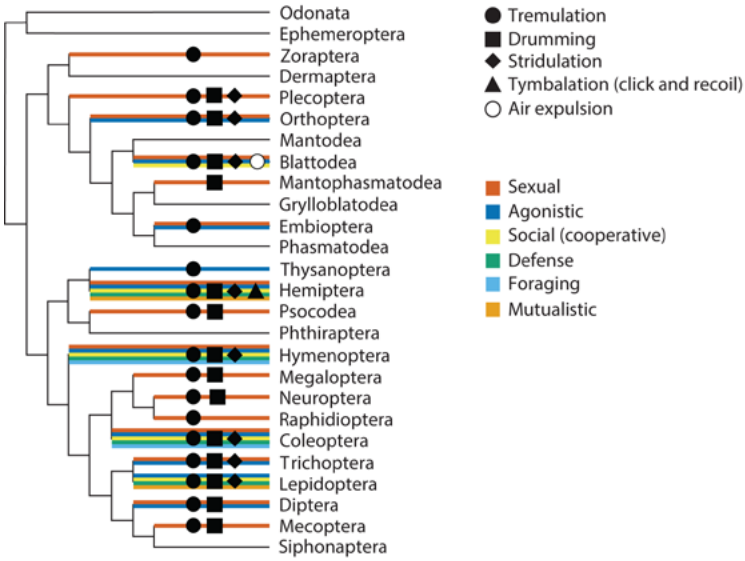
10.1146/annu-rev-ento-120220-095459

The review article, written at the invitation of the editors of the most prestigious journal in the field, is a synthesis of the knowledge of a group of leading researchers in the field of animal vibrational communication (biotremology) who, for the first time in nearly two decades, are systematically addressing the presence and role of vibratory signals in insects. Based on their comprehensive understanding of the subject, they provide a concise synthesis that includes the taxonomic distribution and mechanisms of this type of communication, present its basic characteristics and specifics, summarise key findings, ideas and concepts as well as new research topics, and highlight current research challenges in the field of insect biotremology. As the most important achievement of the 'Slovenian school' of biotremology in recent years, it emphasises research in an ecological context, which, together with interdisciplinary research on model species, gives us a new insight into the world around us.



Vibrational signalling mechanisms and contexts in which they are used set in a phylogenetic framework

Source: VIRANT-DOBERLET, Meta, STRITIH PELJHAN, Nataša, ŽUNIČ KOSI, Alenka, POLAJNAR, Jernej. Functional diversity of vibrational signaling systems in insects. *Annual review of entomology*. Jan. 2023, vol. 68, pp. 191-210, illustr. ISSN 1545-4487.

Iodine-catalysed dissolution of elemental gold in ethanol

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DOI:
10.1002/anie.202117587

Gold is a precious and widely used metal. Recycling gold from electronic components from waste is becoming necessary, as its quantity is limited, and current recycling practices are not in line with sustainable development. In collaboration with partners, we have developed a simple, economical, and environmentally friendly process to dissolve gold in ethanol with a catalytic amount of iodine, which can be regenerated with hydrogen peroxide within the catalytic cycle. The above collaboration and the success of the developed method stem from our research, including previous publications in *Chem. Commun.* 2004, 2614 (Jereb *et al.*) and *Green Chem.* 2005, 7, 100 (Jereb *et al.*). This is an important milestone in the chemistry of recycling. It opens the door to a more selective and sustainable future for the recycling of precious metals in general, as it, for example, avoids large excesses of reagents. The work was published and accompanied by a cover illustration in *Angew. Chem. Int. Ed.* 2022, *61,* e202117587 (Zupanc *et al.*), and the exceptional nature of the achievement is confirmed by the Journal's invitation to publish a review article on the subject in *Angew. Chem. Int. Ed.* 2023, e202214453 (Zupanc *et al.*).

Source: ZUPANC, Anže, HELIÖVAARA, Eeva, MOSLOVA, Karina, ERONEN, Aleksi, KEMELL, Marianna, PODLIPNIK, Črtomir, JEREB, Marjan, REPO, Timo. Iodine-catalysed dissolution of elemental gold in ethanol. *Angewandte Chemie: International edition.* [Print ed.]. 28 Mar. 2022, vol. 61, no. 14, str. 1-6, illustr. ISSN 1433-7851.

An oomycete NLP cytolysin forms transient small pores in lipid membranes

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https://www.science.org/doi/10.1126/sciadv.abj9406

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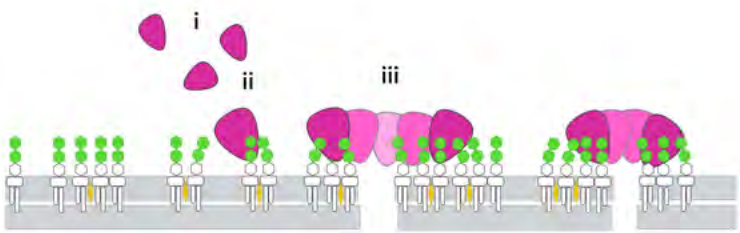
10.1126/sciadv.abj9406

Major crops such as potatoes, tomatoes, soybeans, tobacco, cocoa and grapevines are extremely susceptible to the attack of harmful microbes, leading to plant diseases and thus to enormous economic losses. Many pathogenic plant microbes secrete the so-called NLP proteins (Nep1-like proteins), which act cytotoxically by disrupting the plant cell membrane, thereby causing the death of plant tissue. It is known that NLPs require a specific lipid receptor on the cell surface to exert their effect, but the subsequent steps in the damage mechanism have not been explained until recently.

In our research, we have shown how NLP proteins damage the plant cell after binding to a specific lipid receptor by aggregating and triggering the formation of small transient pores in the cell membrane. The described mechanism is unique and differs from the hitherto known and described mechanisms of plasma membrane damage. It is also the first described mechanism of the pore-forming action of a protein on a plant cell. We have shown that NLP proteins are uniquely adapted to function in the specific plant environment. Understanding the molecular mechanism by which NLP proteins damage the plant cell is key to developing new, more effective approaches for plant protection.



A model of plant membrane damage induced by an NLP protein. Soluble NLP protein (i) binds to plant plasma membrane by specifically recognising negatively charged plant sphingolipids in the membrane (ii). The protein then assembles into aggregates that are heterogeneous in size and shape (iii). Legend: NLP protein (magenta), sterols (yellow), sugar head group of plant sphingolipids (green). Reproduced from Katja Pirc et al. An oomycete NLP cytolysin forms transient small pores in lipid membranes.

Source: PIRC, Katja, CLIFTON, Luke A., YILMAZ, Neval, SALTALAMACCHIA, Andrea, MALLY, Mojca, SNOJ, Tina, ŽNIDARŠIČ, Nada, SRNKO, Marija, BORIŠEK, Jure, PODOBNIK, Marjetka, DERGANC, Jure, ANDERLUH, Gregor, et al. An oomycete NLP cytolysin forms transient small pores in lipid membranes. *Science advances.* 11 Mar. 2022, vol. 8, no. 10, pp. 1-12. ISSN 2375-2548.

Record of violent earthquakes, glacial activity, and gravity phenomena in the Soča Valley sediments

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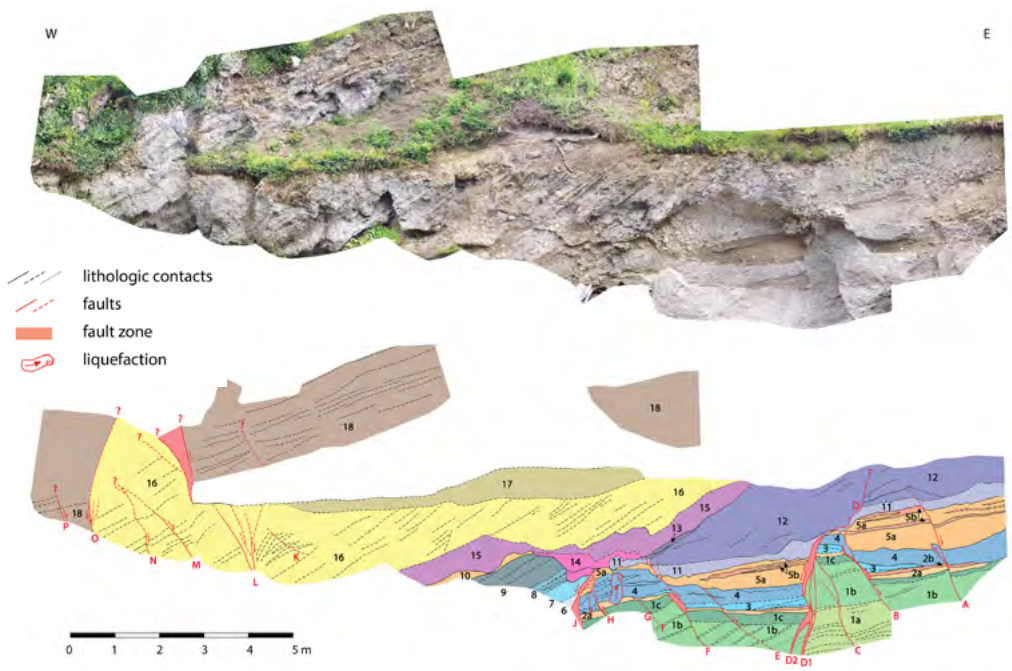
Hyperlink:
https://www.sciencedirect.com/science/article/pii/S0013795221005263?via%3Dihub

DOI:
10.1016/j.enggeo.2021.106515

The work covers various fields of geoscience and was carried out in cooperation between experts from the Geological Survey of Slovenia and renowned foreign researchers as part of the Dynamic Earth and Regional Geology research programmes, and the project Past Climate Change and Glaciation at the Alps-Dinarides Junction. The publication in the top-tier engineering-geological scientific journal Engineering Geology represents an example of the study of deformations in Quaternary sediments in areas where several mechanisms act simultaneously, together with the associated geological hazards. This represents a major challenge for research and is extremely rare in the literature. The research demonstrates remarkable rigor in the study of deformation mechanisms through the integration of multiple methods, and contributes to the development of an approach to better distinguish the consequences of violent earthquakes, glacial activity, and gravity phenomena. It is particularly valuable for engineering geologists and researchers facing similar challenges in their work. The results can be directly applied to the seismic hazard assessment at national and European level and to the reconstruction of glaciations in the Alps.



Source: JAMŠEK RUPNIK, Petra, ŽEBRE, Manja, JEŽ, Jernej, ZAJC, Marjana, PREUSSER, Frank, MONEGATO, Giovanni. Deciphering the deformation mechanism in Quaternary deposits along the Idrija Fault in the formerly glaciated Soča Valley, southeast European Alps. *Engineering geology.* 2022, vol. 297, 25 pp. ISSN 0013-7952.

Suspect and non-targeted screening-based human biomonitoring identified 74 biomarkers of exposure in urine of Slovenian children

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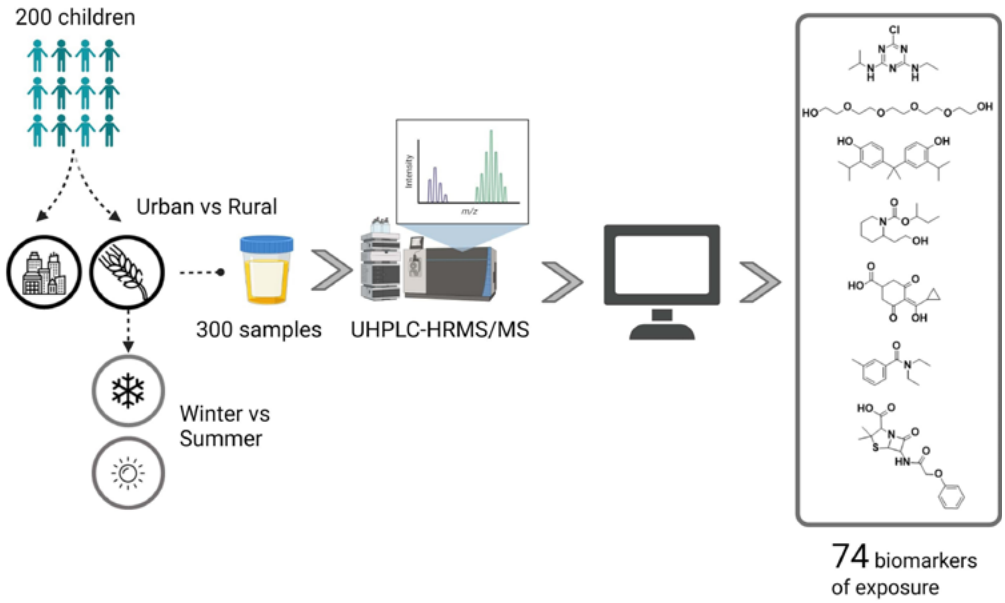
https://www.sciencedirect.com/science/article/pii/S0269749122013057

DOI:
10.1016/j.envpol.2022.120091

Human biomonitoring (HBM) provides information on patterns, extent, and quantity of human exposure to chemicals. Many of these chemicals have negative impacts on health, making exposure monitoring crucial for human well-being. Typically, we track chemicals with known concern regarding their negative effects, but we know little about those that are not monitored, yet they may pose significant health risks.

This study focused on developing a methodology for comprehensive monitoring of exposure to both known and unknown chemicals. Using the developed methodology, we analysed urine samples from Slovenian children and identified 74 different biomarkers of exposure, revealing not only exposure to expected chemicals but also previously unreported ones. The results indicate a significant extent of children's exposure, including chemicals that pose serious health risks. Consequently, the findings can serve as a basis for developing intervention measures to reduce the impact of chemicals on health. This work is important for the advancement of HBM and contributes to informing of public health.



Source: TKALEC, Žiga, CODLING, Garry, SNOJ TRATNIK, Janja, MAZEJ, Darja, KLÁNOVÁ, Jana, HORVAT, Milena, KOSJEK, Tina. Suspect and non-targeted screening-based human biomonitoring identified 74 biomarkers of exposure in urine of Slovenian children. *Environmental pollution.* 2022, vol. 313, pp. 120091-1-12009-11. ISSN 0269-7491.

8-Hydroxyquinolylnitrones as multifunctional ligands for the therapy of neurodegenerative diseases

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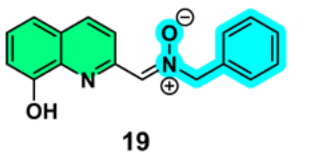
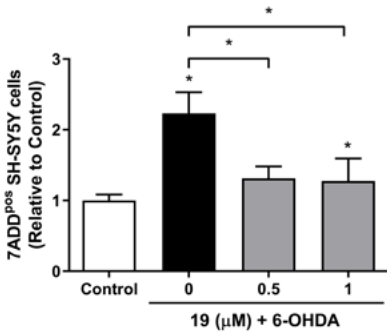
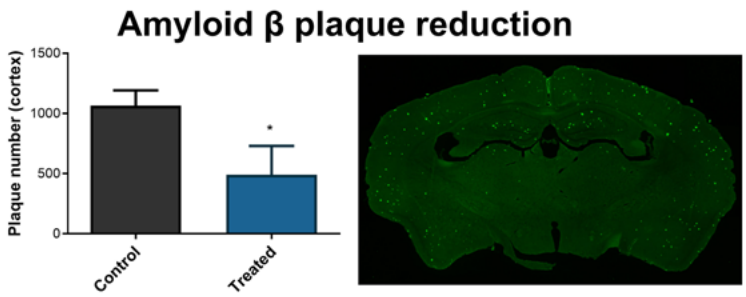
https://www.sciencedirect.com/science/article/pii/S2211383523000138

DOI:
10.1016/j.apsb.2023.01.013

The complex pathophysiology of Alzheimer's disease and other neurodegenerative diseases involving multiple processes makes effective therapy with drugs acting specifically on a target enzyme or structural protein impossible. The alternative is to utilise the so-called multifunctional ligands that act simultaneously on multiple target proteins, opening the possibility of more effective therapy for neurodegenerative diseases. In this multidisciplinary study, the authors discovered compound 19 that inhibits two enzymes involved in Alzheimer's disease, namely butyrylcholinesterase and monoamine oxidase B. Structural and kinetic experiments were used to investigate the compound's mechanism of action, and cell-based assays confirmed its neuroprotective effects. This multifunctional inhibitor improved the cognitive functions and memory of mice with induced symptoms of Alzheimer's disease, and also effectively reduced the accumulation of amyloid plaques in transgenic mice.







Source: KNEZ, Damijan, DIEZ-IRIEPA, Daniel, CHIOUA, Mourad, GOTTINGER, Andrea, MEDEN, Anže, PIŠLAR, Anja, KOS, Janko, ŽAKELJ, Simon, STOJAN, Jure, GOBEC, Stanislav, MARCO-CONTELLES, José, *et al.* 8-Hydroxyquinolylnitrones as multifunctional ligands for the therapy of neurodegenerative diseases. *Acta pharmaceutica sinica B.* 2023, vol. 13, no. 5, pp. 2152-2175, illustr. ISSN 2211-3843.

A model for communication and management support of natural hazards risk

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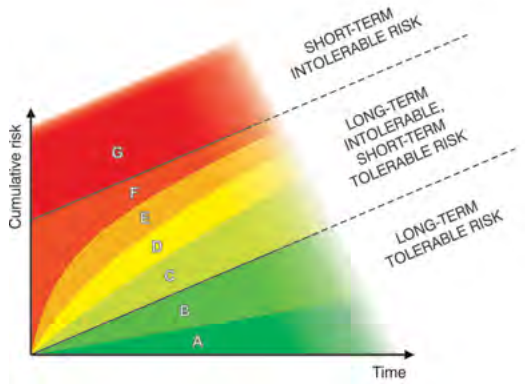
10.1016/j.ijdrr.2023.103672

It is difficult for stakeholders responsible for mitigating the effects of rare natural phenomena to develop an unbiased perception of the natural hazards risk, which slows down the development of actions to strengthen community resilience to natural disasters. To address this issue, we have developed a model for communication and management of natural hazards risk, also intended for non-experts in the field. The model incorporates the well-known seven-grade scale, consistent with the European labelling of product energy consumption. The novelty of the model is the distinction between long-term and short-term risk tolerance. By evaluating the cumulative risk over time, a model for gradual risk grade reduction is innovatively implemented in cases where the estimated risk is intolerable in the long term. The proposed model incentivises stakeholders to take action independently and provides a basis for developing long-term regulatory strategies to strengthen community resilience based on an unbiased risk estimation while considering society's capacity to implement the necessary measures. The model was successfully used in the seismic stress test of the building stock in Slovenia.



Risk tolerance

Grade	Risk level accord. to the long-term risk tolerance	Risk level accord. to the short-term risk tolerance	Type of actions (owners perspective)
A	TOLERABLE (negligible)	TOLERABLE (negligible)	BENEFICIAL
B	TOLERABLE (acceptable)	TOLERABLE (acceptable)	BENEFICIAL (transitioning towards neutral)
C			NEUTRAL
D			
E	INTOLERABLE	TOLERABLE (justifiable)	DETRIMENTAL (non-restrictive)
F			
G		INTOLERABLE	DETRIMENTAL (restrictive)

Source: BABIČ, Anže, LAZAR SINKOVIĆ, Nuša, DOLŠEK, Matjaž. A model for communication and management support of natural hazards risk. *International journal of disaster risk reduction.* 2023, no. May, art. 103672, year. 90, pp. 1-18, illustr. ISSN 2212-4209.

Improving an epoxidation catalyst with computational prediction and experimental verification

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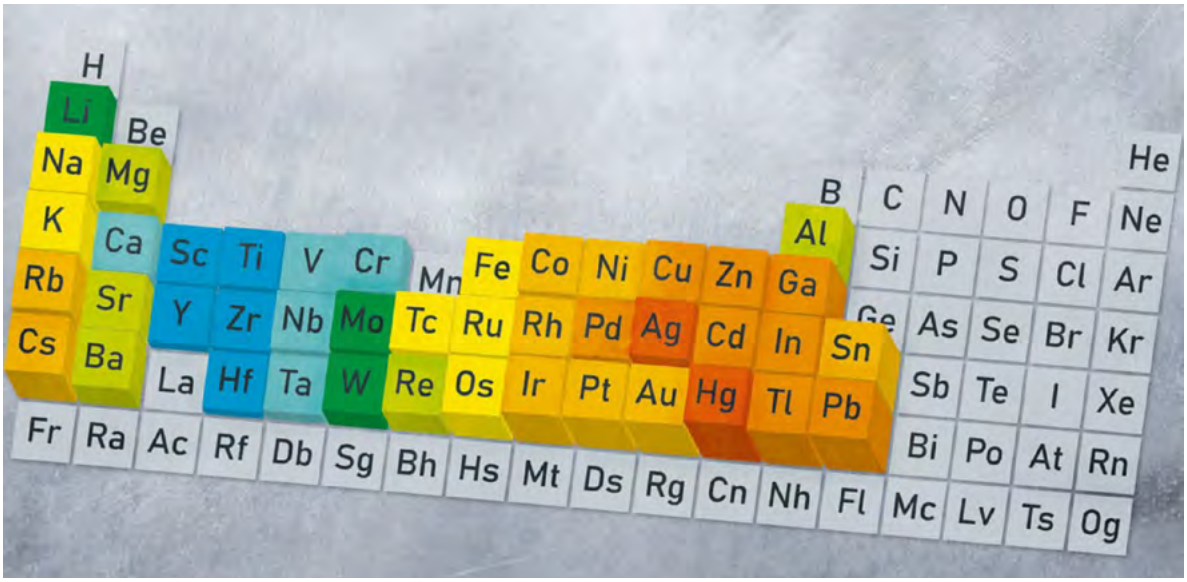
10.1002/anie.202305804

Epoxidation of ethylene is one of the most important selective oxidations, both industrially and commercially. Silver catalysts have been state-of-the-art for decades and their performance is continuously improving with empirical discoveries of dopants and co-catalysts. However, we have computationally screened the entire periodic system in the hope of finding an improved catalyst. We have used ab initio calculations, correlations and microkinetic modelling of the reactors, going beyond the usual simplified steady-state models or rate-determining modelling on fixed catalyst surfaces. We have performed detailed quantum chemical simulations of nine noble metals and then used this data to calculate the activity of all metals of the entire periodic system based on descriptors. We predicted that Ag/CuPb, Ag/CuCd and Ag/CuTl would outperform pure silver catalysts. They were also experimentally prepared and tested in the laboratory, where the results showed significantly higher performance than silver, which is in line with the predictions of the model. The developed method is general and allows us to find better catalysts for any industrially relevant reaction using heterogeneous catalysts, while at the same time allowing for fast screening tests by simplifying the calculation of a complex reaction mechanism into inexpensive descriptor calculations. This allows the performance of metals, alloys, nanoparticles, composites, etc. to be verified.



Source: HUŠ, Matej, GRILC, Miha, TERŽAN, Janvit, GYERGYEK, Sašo, LIKOZAR, Blaž, HELLMAN, Anders. Going beyond silver in ethylene epoxidation with first-principles catalyst screening. *Angewandte Chemie: international edition.* [Online ed.]. Aug. 2023, vol. 62, no. 31, art. no. e202305804, pp. 1-10, illustr. ISSN 1521-3773.

A new hydrogen peroxide purification process

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https://plus.cobiss.net/cobiss/si/sl/bib/125873155

DOI:
/

Gaseous substances that exceed their critical temperature and pressure (critical point) enter the state of a supercritical fluid (SCF). The use of SCFs can help address the shortcomings of many conventional methods for the processing and production of products. Belinka Perkemija d.o.o. produces hydrogen peroxide (H_2O_2) in a wide range of purity grades. H_2O_2 production at Belinka Perkemija d.o.o. is based on the anthraquinone process, which is ideally suited for use with supercritical CO_2 high-pressure technology. The core of the invention is a novel H_2O_2 purification process using the supercritical fluid $scCO_2$ in combination with tetrabutylurea (TBU) as the purification reagent.

The classical methods for purification of H_2O_2 are distillation, adsorption, ion exchange, crystallisation and membrane separation. These processes are very energy consuming. The proposed H_2O_2 purification process offers significant technical advantages as it involves fewer steps, consumes less energy, and requires fewer raw materials. The product obtained is purified H_2O_2. The results show a significant reduction in the concentration of organic matter in the crude H_2O_2. The use of advanced H_2O_2 purification technology, which produces a product of high purity consumes less energy and produces fewer toxic residues, is therefore of paramount importance to a company's competitiveness in the market. High pressure cleaning is a safe and environmentally friendly process that can bring the entire production closer to the concept of sustainable development.

Extraction column liquid - supercritical fluid (700 bar, 200 °C)

Source: KNEZ, Željko, CÖR ANDREJČ, Darija, KNEZ MAREVCI, Maša, GRČAR, Ivan, PODKORITNIK, Andrej, VIRANT, Matej, ŠORN, Gregor. *Nov postopek čiščenja vodikovega peroksida:* P-202200213, 26. 9. 2022. Ljubljana: Slovenian Intellectual Property Office, Ministry of the Economy, Tourism and Sport, 2022. 12 pp.

Perovskite/CIGS tandem solar cells: from certified 24.2% toward 30% and beyond

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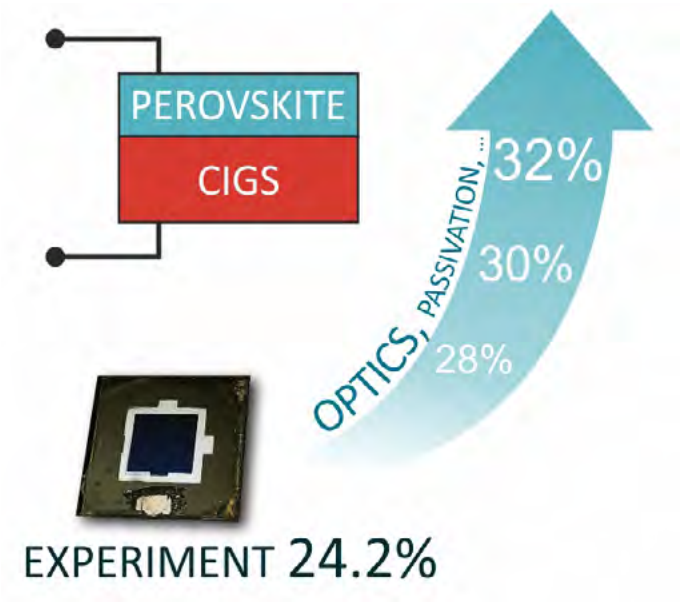
10.1021/acsenergylett.2c00274

Perovskite/CIGS tandem solar cells are a new photovoltaic technology that promises to further reduce the cost of solar modules. The paper presents a fabricated perovskite-CIGS tandem solar cell with a certified record power conversion efficiency of 24.2%. Guidelines for further optical enhancement of such tandem solar cells are also given in the paper, highlighting that even more than 30% is achievable. The potential of perovskite-CIGS tandem solar cells was also confirmed by the analysis of the temperature-dependent energy yield, which showed that such cells can produce up to 50% more energy than single-junction ones.

The record-breaking conversion efficiency was confirmed by measurements at an independent institute, which put it on the list of record solar cells published by the American institute NREL and the efficiency table published by the journal Progress in Photovoltaics. The results of the collaboration between the LPVO laboratory (research programme P2-0415) and the Helmholtz-Zentrum Berlin were published in an article in the recognised journal ACS Energy Letters (JCR IF = 24), which had 50 net citations in the first year and has been recognised as a highly cited paper by the Web of Science.



Source: JOŠT, Marko, KÖHNEN, Eike, AL-ASHOURI, Amran, BERTRAM, Tobias, TOMŠIČ, Špela, MAGOMEDOV, Artiom, KASPARAVIČIUS, Ernestas, KODALLE, Tim, LIPOVŠEK, Benjamin, GETAUTIS, Vytautas, SCHLATMANN, Rutger, KAUFMANN, Christian A., ALBRECHT, Steve, TOPIČ, Marko. Perovskite/CIGS tandem solar cells: from certified 24.2% toward 30% and beyond. *ACS energy letters.* Apr. 2022, vol. 7, no. 4, pp. 1298-1307, illustr. ISSN 2380-8195.

A global modelling framework for load forecasting in distribution networks

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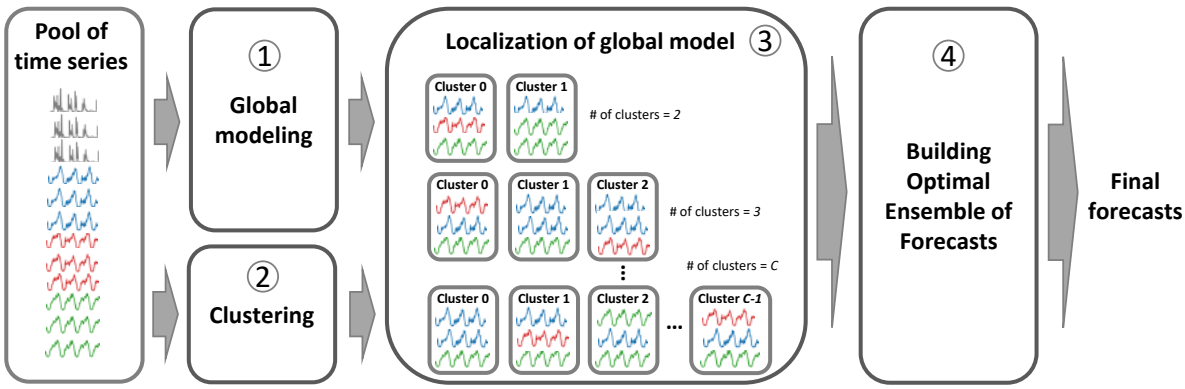
https://ieeexplore.ieee.org/document/10092804

DOI:
10.1109/TSG.2023.3264525

To reach the green transition goals, efficient load forecasting techniques are critically needed to ensure observability within distribution networks. These networks include a large number of different loads at various aggregation models, and it is impractical to develop individual forecasting models for each load separately. Additionally, such local models ignore the strong dependencies between different loads, require historical data to make forecasts, and are incapable of adjusting to changes in the load behaviour without retraining.

To address these issues, the authors propose a global modelling framework for load forecasting that, unlike its local competitors, relies on a single global model to generate forecasts. Such an approach significantly reduces the computational burden, efficiently exploits the cross-series information shared among different loads and facilitates forecasts when historical data are missing.

The experimental results show that the proposed framework outperforms naive benchmarks by more than 25% while exhibiting highly desirable characteristics when compared to the predominantly used local models.



High–level overview of the proposed global distribution-network load forecasting framework.

Source: GRABNER, Miha, WANG, Yi, WEN, Qingsong, BLAŽIČ, Boštjan, ŠTRUC, Vitomir. A global modeling framework for load forecasting in distribution networks. *IEEE transactions on smart grid.* [Prited ed.]. Nov. 2023, vol. 14, no. 6, pp. 4927-4941, illustr. ISSN 1949-3053.

DSR – Unsupervised deep learning for surface anomaly detection

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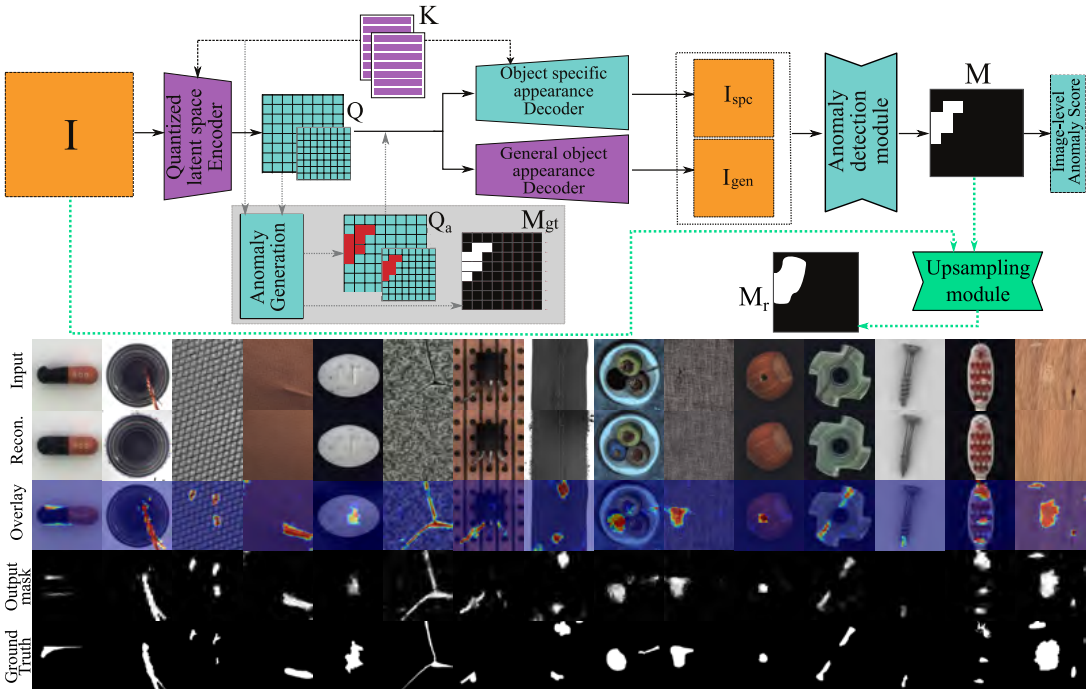
10.1007/978-3-031-19821-2_31

Within the framework of the Industry 4.0 paradigm, the importance of visual surface inspection processes is growing significantly in maintaining high-quality product standards. Our proposed approach advances these procedures by empowering machine vision systems with the capability to adapt more swiftly and effectively to new product introductions. The solution is based on unsupervised deep learning of quantised representations of the feature space with a dual decoder and the generation of synthetic anomalies in the feature space that lie close to the distribution of normal cases. Thus, constructing the model only requires images of defect-free surfaces, avoiding the need to collect images of damaged surfaces and manually label training images, which is highly welcome in practical applications. The developed and trained deep neural network predicts whether a given input image of a surface contains a defect and appropriately annotates it. The obtained results represent a breakthrough in this area, especially on images of real industrial problems, and indicate great potential for practical application. The approach has proven to be very general, as we have further enhanced it for anomaly detection in other modalities, such as audio recordings and 3D data.



Source: ZAVRTANIK, Vitjan, KRISTAN, Matej, SKOČAJ, Danijel. DSR – a dual subspace re-projection network for surface anomaly detection. In: AVIDAN, Shai (ur.). *Computer vision - ECCV 2022: 17th European Conference, Tel Aviv, Israel, October 23-27, 2022: proceedings. Part 31.* Cham: Springer, cop. 2022. Pp. 539-554, illustr. Lecture notes in computer science (Internet), 13691. ISBN 978-3-031-19821-2. ISSN 1611-3349.

Bacterial DNA recognition with advanced nanoplasmonics sensor

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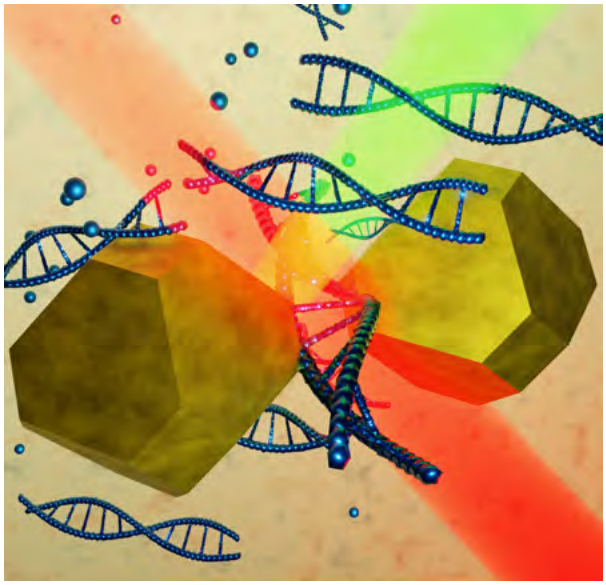
DOI:
10.1021/acs.nanolett.2c02835

Surface-enhanced Raman spectroscopy (SERS) has been demonstrated to have the ability to specify bacteria based on their genomic DNA content, which served as a "marker" to distinguish bioentities. Effective differentiation of bacterial species was achieved using nanogold clusters produced via a single-step plasma reduction of gold-containing vapoured precursor ions. SERS probing of small sample amounts in the nanogram range was possible due to a high enhancement factor (EF=10^7) in truncated and coupled plasmonic particles. Theoretical simulations verified that the strongest electric field confinement occurred in nanoscale gaps between gold dimers/chains, which amplified the photon scattering of molecular fingerprints from bacterial DNA fragments. The primary Raman modes associated with essential molecular vibrations of base pairs were separated and then utilised to estimate nitrogenous base content. The genetic composition (Guanine-Cytosine and Adenine-Thymine percentages) was validated through third-generation sequencing using nanopore technology. The results of the comparative analyses confirmed the usefulness of the SERS technique and its reliability, enabling extremely fast identification of pathogens in water and air.



Source: SHVALYA, Vasyl, MODIC, Martina, SKUBIC, Cene, NADIŽAR, Nejc, ZAVAŠNIK, Janez, VENGUST, Damjan, ZIDANŠEK, Aleksander, ROZMAN, Damjana, CVELBAR, Uroš, *et al.* Bacterial DNA recognition by SERS active plasma-coupled nanogold. *Nano letters.* Dec. 2022, vol. 22, no. 23, pp. 9757-9765, illustr. ISSN 1530-6992.

Degradation of water soluble poly(vinyl alcohol) with acoustic and hydrodynamic cavitation: laying foundations for microplastics

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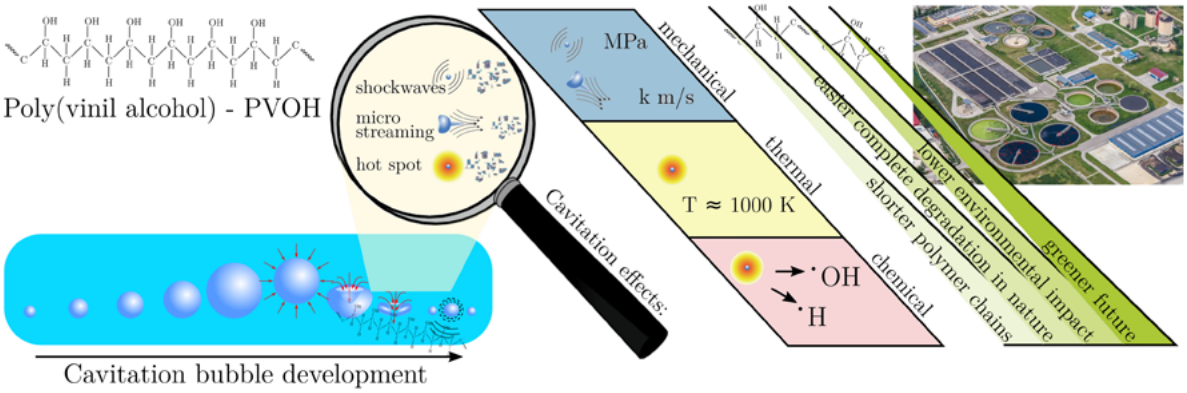
Hyperlink:
https://www.nature.com/articles/s41545-023-00248-8

DOI:
10.1038/s41545-023-00248-8

Poly(vinyl alcohol) - PVOH is one of the most commonly used water-soluble polymers and, like microplastics, poses an environmental threat because it is usually washed down the drain unnoticed and unobstructed. If not treated during wastewater treatment, it enters the aquatic ecosystem unimpeded. It is estimated that several thousand tonnes are flushed into the aquatic ecosystem annually. As part of our research, we were able to reduce its weight average molar mass by nearly 99% under selected cavitation conditions (from 124 kg mol^{-1} to 1.6 kg mol^{-1}), which could contribute significantly to its easier and faster ultimate degradation in the environment. The results on the water-soluble synthetic polymer PVOH provide a basis for further research on the degradation of (non-) water-soluble polymers.

Findings of the research allow us to understand how the mechanical and/or chemical effects of cavitation can be used to selectively and efficiently shorten polymer chains. This knowledge has already been applied in biopolymer research (cellulose fibres, chitin and chitosan) and is being used in parallel to develop and optimise a commercial cavitation system for the treatment of municipal, industrial and process wastewater.



Source: PETKOVŠEK, Martin, KRŽAN, Andrej, ŠMID, Alenka, ŽAGAR, Ema, ZUPANC, Mojca. Degradation of water soluble poly(vinyl alcohol) with acoustic and hydrodynamic cavitation: laying foundations for microplastics. *npj Clean water.* April 2023, vol. 6, pp. 1-11, illustr. ISSN 2059-7037.

Increased L-Selectin on monocytes is linked to the autoantibody profile in systemic sclerosis

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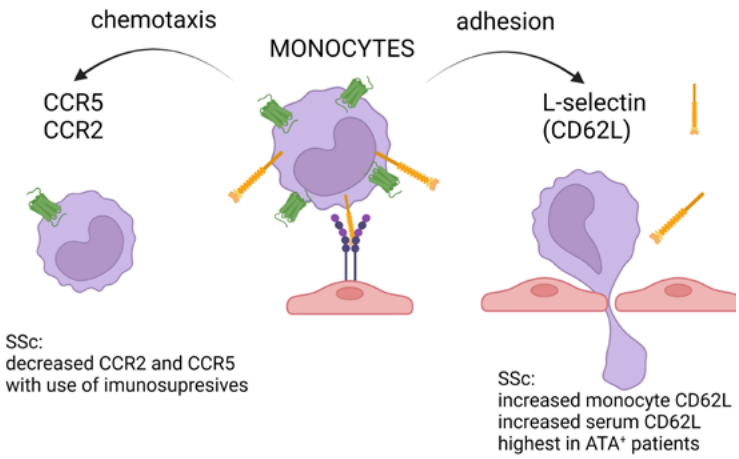
https://www.mdpi.com/1422-0067/23/4/2233

DOI:
10.3390/ijms23042233

Systemic sclerosis is a rare autoimmune disease of the connective tissue, progressive and currently incurable. At UKC Ljubljana, we collected a large Slovenian cohort of 38 patients and analysed the presence of adhesive and chemotactic molecules on the surface of monocytes which can affect the extravasation of these cells into the tissue. The surface adhesion molecule L-selectin (CD62L) was more abundant on monocytes in patients with systemic sclerosis, and at the same time, we confirmed elevated serum levels of CD62L which occur during the transition of cells into the tissue. We found that the serum of patients with severe systemic sclerosis course containing anti-topoisomerase I autoantibodies increases the presence of this adhesion molecule on the cell. Since monocytes are involved in the pathogenesis of systemic sclerosis, blocking this molecule could limit their entry into tissues.



SSc – systemic sclerosis; ATA – anti-topoisomerase I autoantibodies.

Source: BREZOVEC, Neža, PERDAN-PIRKMAJER, Katja, KURET, Tadeja, BURJA, Blaž, SODIN-ŠEMRL, Snežna, ČUČNIK, Saša, LAKOTA, Katja. Increased L-selectin on monocytes is linked to the autoantibody profile in systemic sclerosis. *International journal of molecular sciences.* 2022, vol. 23, no. 4, pp. 1-15, illustr. ISSN 1422-0067.

Alterations in immunophenotype and metabolic profile of mononuclear cells during follow up in children with multisystem inflammatory syndrome (MIS-C)

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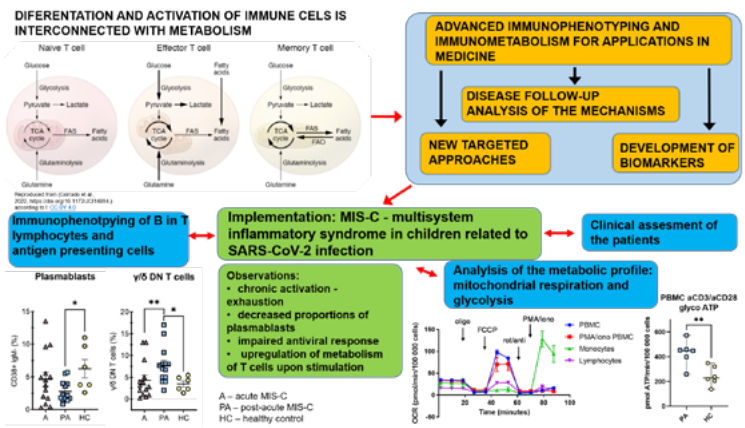
https://www.frontiersin.org/articles/10.3389/fimmu.2023.1157702/full

DOI:
10.3389/fimmu.2023.1157702

Metabolic reprogramming is now considered to be one of the central features of immune cells, providing unique opportunities for new biomarkers and strategies for improved immunotherapies. We integrated the analysis of antigen presenting cells, B and T lymphocytes with the analysis of the metabolic phenotype in convalescent children with multisystem inflammatory syndrome (MIS-C) after SARS-CoV-2 infection to unravel several new features of this disease. Remarkably, the impaired regulation of the immune system was evident in the convalescent phase even months after the acute phase and was manifested as an increased proportion of γ/δ double-negative T cells, a decreased proportion of plasmablasts, and an upregulation of energy metabolism of T cells upon stimulation. Data suggest that MIS-C causes long-term immune changes which may significantly impair antiviral immune defense. This contributes to the understanding of the mechanism of MIS-C and may help to improve the follow-up of patients.



Source: KOPITAR, Andreja Nataša, REPAS, Jernej, JANŽIČ, Larisa, BIZJAK, Maša, VESEL, Tina, EMERŠIČ, Nina, ZAJC AVRAMOVIČ, Mojca, IHAN, Alojz, AVČIN, Tadej, PAVLIN, Mojca. Alterations in immunophenotype and metabolic profile of mononuclear cells during follow up in children with multisystem inflammatory syndrome (MIS-C). *Frontiers in immunology.* 2023, vol. 14, pp. 1-16, illustr. ISSN 1664-3224.

Abl kinase-mediated FUS Tyr526 phosphorylation alters nucleocytoplasmic FUS localisation in FTLD-FUS

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Hyperlink:
https://academic.oup.com/brain/article/146/10/4088/7127731

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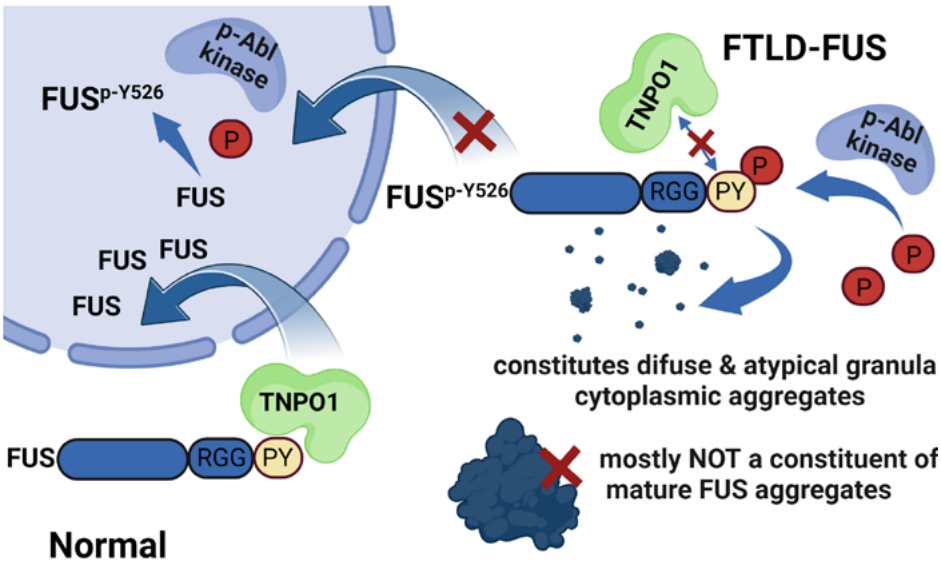
10.1093/brain/awad130

Neurodegenerative diseases such as dementia are characterised by the death of neurons. In the brains of these patients, there is an abnormal accumulation of certain proteins in the neurons, leading to their death. The abnormal accumulation of FUS protein in neurons is caused by mutations and post-translational modifications, such as phosphorylation of the last amino acid tyrosine. We have previously shown that this modification inhibits the nuclear localisation of FUS and accelerates its accumulation in the cytoplasm. By synthesising and validating a specific detector (antibody) for the modified last amino acid of FUS protein and advanced microscopy, we revealed the distribution pattern of soluble and insoluble FUS protein in cells. We confirmed the involvement of SRC family kinases in FUS phosphorylation in cortical brain neurons. Under conditions of oxidative stress, we demonstrated the direct involvement of Abl kinase in modified FUS sequestration in toxic aggregates. Our success is the identification of a novel role of Abl kinase in the intracellular localisation of FUS in neurons, which is critical for the development and progression of FUS-FTLD. Control of this mechanism would improve neuron survival.



Source: MOTALN, Helena, ČERČEK, Urša, YAMOAH, Alfred, TRIPATHI, Priyanka, ARONICA, Eleonora, GOSWAMI, Anand, ROGELJ, Boris. Abl kinase-mediated FUS Tyr526 phosphorylation alters nucleocytoplasmic FUS localization in FTLD-FUS. *Brain: journal of neurology.* Oct. 2023, vol. 146, no. 10, pp. 4088-4104, illustr. ISSN 0006-8950.

Characteristic metabolic brain patterns of neurodegenerative brain diseases

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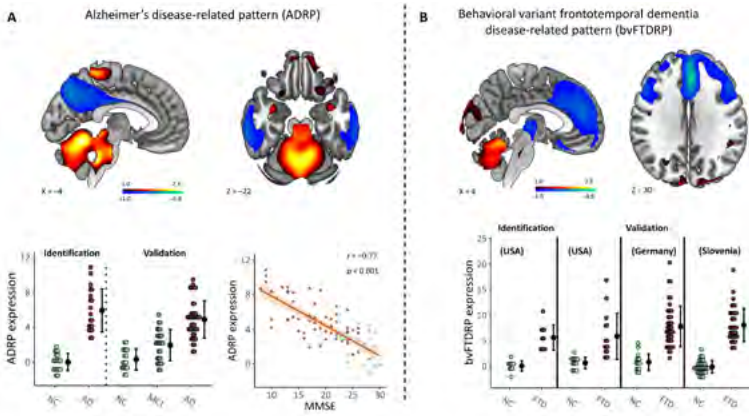
Hyperlinks:
https://www.nature.com/articles/s41582-022-00753-3

https://www.nature.com/articles/s41598-022-15667-9

DOI:
10.1038/S41582-022-00753-3

10.1038/s41598-022-15667-9

Dementia and parkinsonism are neurodegenerative diseases of the brain that represent an epidemic in aging developed societies and thus a major medical, social and economic challenge. A correct diagnosis in the earliest stages of the disease and an understanding of the pathophysiology of the disease are crucial for the good treatment effect of patients and for the development of more effective medications. In our research projects, we identified specific metabolic biomarkers of more common neurodegenerative brain diseases, validated them and transferred them into clinical practice. Specific metabolic characteristics of neurodegenerative diseases were identified using network analysis of metabolic brain images obtained by positron emission tomography and the radioligand ^{18}F-fluorodeoxyglucose. Based on these new biomarkers, we additionally developed and validated diagnostic algorithms that improve the diagnostic accuracy of neurodegenerative brain diseases and enable the study of the progression of the diseases. We published the results in nine original research articles in Q1 ranked journals (9/10 publications) and in a review article in the journal Nature Reviews Neurology, which placed our work in the treasury of research in the field of functional brain networks.



A. The metabolic brain pattern characteristic for Alzheimer's disease is depicted by areas of relatively increased metabolic activity (red) that are functionally connected to areas of decreased metabolic activity (blue). *Bottom part of the image: The pattern expression is lowest in healthy subjects (NC), slightly higher in subjects with mild cognitive impairment (MCI), and highest in those with Alzheimer's disease (AD). There is a negative correlation between the pattern expression and the cognitive performance score on the Mini-Mental State Examination (MMSE).*

B. The metabolic pattern characteristic of the behavioural variant of frontotemporal dementia. *Bottom part of the image: The pattern expression is low in healthy subjects (NC) and high in patients with frontotemporal dementia (FTD).*

Sources: PEROVNIK, Matej, RUS, Tomaž, SCHINDLBECK, Katharina A., EIDELBERG, David. Functional brain networks in the evaluation of patients with neurodegenerative disorders. *Nature Reviews Neurology* 2023, vol. 19, pp. 73-90.
PEROVNIK, Matej, TOMŠE, Petra, JAMŠEK, Jan, EMERŠIČ, Andreja, TANG, Chris Chengke, EIDELBERG, David, TROŠT, Maja. Identification and validation of Alzheimer's disease-related metabolic brain pattern in biomarker confirmed Alzheimer's dementia patients. *Scientific reports.* 2022, vol. 12, str. 1–11. ISSN 2045-2322.

Expression of inducible factors reprograms CAR-T cells for enhanced function and safety

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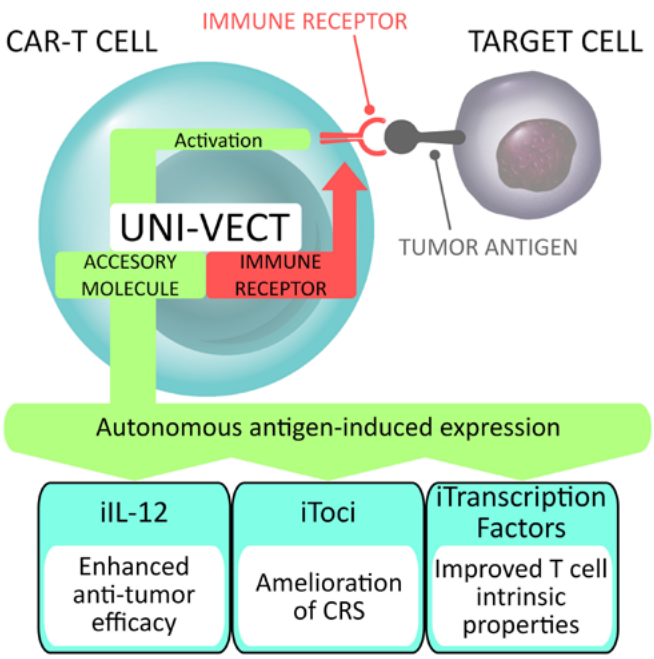
https://www.cell.com/cancer-cell/pdf/S1535-6108(22)00553-0.pdf

DOI:
10.1016/j.ccell.2022.11.006

Although cancer immunotherapy with CAR-T cells represents a paradigm shift in the treatment of certain blood cancers, this approach faces challenges in terms of efficacy and safety. Here, an international team of researchers has developed an innovative and broadly applicable genetic platform called Uni-Vect that enables CAR-T cells to produce additional molecules when they recognise cancer cells. These additional molecules upgrade the performance of CAR-T cells with new functions to increase efficacy or safety. The broad therapeutic application of the platform has been demonstrated *in vivo* by the antigen-dependent expression of (1) an immunostimulatory cytokine that enhances antitumour activity, (2) an antibody that ameliorates cytokine release syndrome, and (3) transcription factors that modulate T cell biology and improve their intrinsic properties. Uni-Vect was also used to characterise neoantigen-specific immune receptors. Overall, this work lays the foundation for the development of next-generation cellular immunotherapies while uncovering new aspects of CAR-T cell biology.



Source: SMOLE, Anže, BENTON, Alexander, POUSSIN, Mathilde A., EIVA, Monika A., MEZZANOTTE, Claudia, et al. Expression of inducible factors reprograms CAR-T cells for enhanced function and safety. *Cancer cell.* Dec. 2022, vol. 40, no. 12, pp. 1470-1487, e1-e7, illustr. ISSN 1535-6108.

Tumour budding and poorly differentiated clusters in colon cancer – different manifestations of partial epithelial-mesenchymal transition

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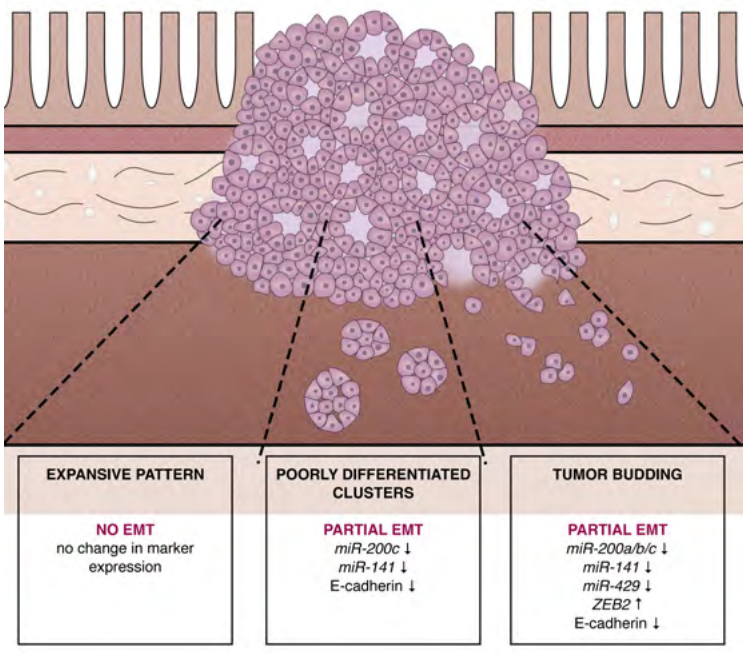
https://pubmed.ncbi.nlm.nih.gov/36062412/

DOI:
10.1002/path.5998

The invasive tumour front is the most significant part of the tumour regarding its progression and metastasizing. In colorectal carcinoma, morphological features including infiltrative growth, tumour budding and poorly differentiated clusters have a firmly established negative predictive value. Guidelines are now available describing how to analyse and grade tumour budding and poorly differentiated clusters in colorectal carcinoma. The pathogenetic mechanisms underlying tumour budding and poorly differentiated clusters have not been elucidated but are believed to be related to epithelial-mesenchymal transition (EMT). Pavlič *et al.* used a modern approach including laser microdissection and chose EMT biomarkers on the basis of their own previous studies (miR-200 family, ZEB1/2, RND3 in CDH1). Their results suggest that tumour budding and poorly differentiated clusters represent different manifestations of partial EMT. Tumour budding seems to be closer to complete EMT than poorly differentiated clusters. No evidence of EMT was found in invasive tumour front with an expansive growth pattern.



Source: PAVLIČ, Ana, BOŠTJANČIČ, Emanuela, KAVALAR, Rajko, ILIJEVEC, Bojan, BONIN, Serena, ZANCONATI, Fabrizio, ZIDAR, Nina (author, corresponding author). Tumour budding and poorly differentiated clusters in colon cancer - different manifestations of partial epithelial-mesenchymal transition. *The Journal of pathology.* Nov. 2022, vol. 258, no. 3, pp. 278-288, illustr. ISSN 0022-3417.

Tumour cell-based vaccine contributes to local tumour irradiation by eliciting a tumour model-dependent systemic immune response

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https://www.frontiersin.org/articles/10.3389/fimmu.2022.974912/full

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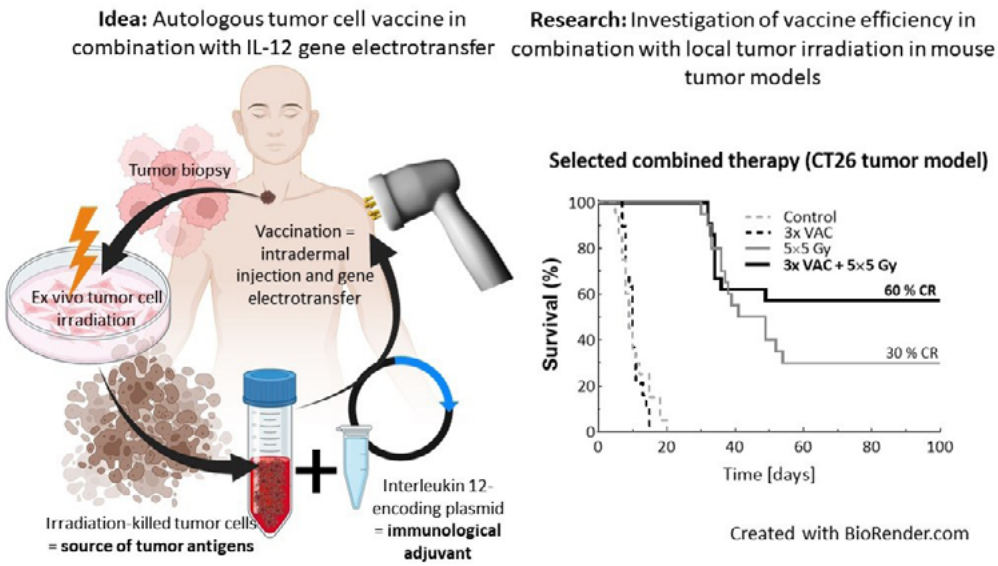
10.3389/fimmu.2022.974912

Tumour cells represent a valuable reservoir of tumour antigens suitable for the development of tumour vaccines. In this study, we formulated a vaccine from irradiation-killed tumour cells to which we added gene electrotransfer (GET) of interleukin 12 (IL-12) as an immunological adjuvant. We are currently exploring the use of IL-12 GET as an adjuvant to electrochemotherapy (ECT)-induced *in situ* vaccination. However, as both ECT and GET are thus far limited to superficial tumours, we opted for an *ex vivo* vaccine preparation in this study. This approach makes it applicable to the treatment of deeply situated tumours, utilising tumour biopsies as a source of antigens for an individualised tumour vaccine.

Our findings demonstrate that this vaccination strategy contributes to the efficacy of local tumour irradiation and prevents tumour regrowth. In addition, we observed both local and systemic immune responses to vaccination, which varied depending on the immunogenicity of the tumour model used.

The study marked the first steps towards validating this innovative approach. Furthermore, it highlighted the need for personalised vaccine development, considering both the inherent characteristics of the tumour and its microenvironment.



Source: REMIC, Tinkara, SERŠA, Gregor, LEVPUŠČEK, Kristina, LAMPREHT TRATAR, Urša, URŠIČ VALENTINUZZI, Katja, CÖR, Andrej, KAMENŠEK, Urška. Tumor cell-based vaccine contributes to local tumor irradiation by eliciting a tumor model-dependent systemic immune response. *Frontiers in immunology.* 5. 9. 2022, vol. 13, pp. 1-12. ISSN 1664-3224.

Ca2+ oscillations, waves, and networks in islets from human donors with and without type 2 diabetes

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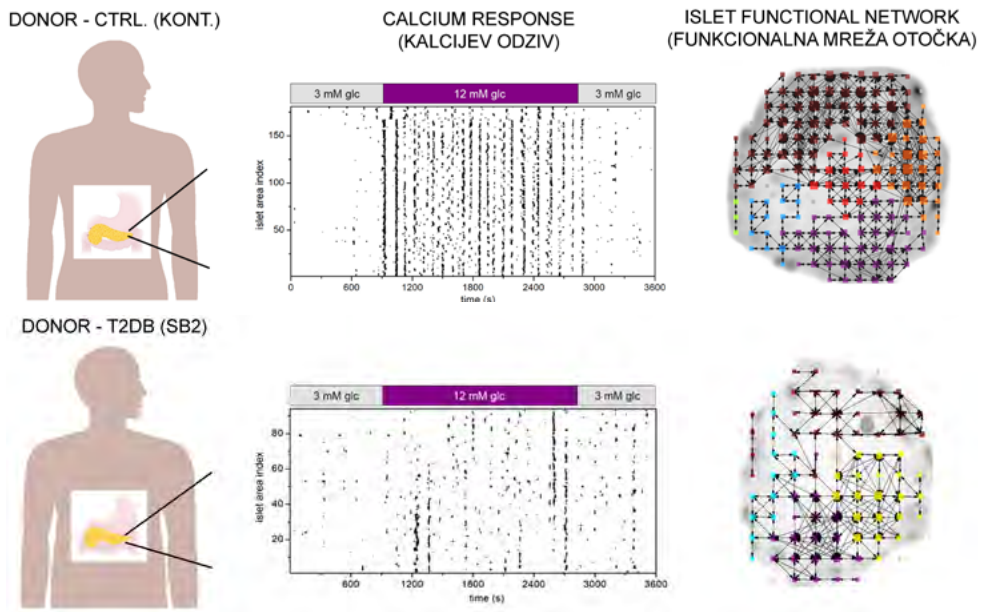
https://diabetesjournals.org/diabetes/article/71/12/2584/147556/Ca2-Oscillations-Waves-and-Networks-in-Islets-From

DOI:
10.2337/db22-0004

In the islets of Langerhans, hundreds of beta cells act in concert in normal and less concertedly in pathological stimulus-secretion coupling. We addressed the question of why there is less coordination in diabetes by technically challenging recording of calcium activity and analyses with advanced tools from the field of complex networks, which we pioneered in 2013 [Stožer *et al.* PLoS Comput Biol 2013], but in this study, we used rarely available human islets from both control and diabetic donors, which required us to pool our efforts with the Edmonton group. Our study is the first systematic description of oscillations, waves and networks in islets, and the results represent a new standard for future studies of calcium dynamics and will greatly help to identify the effect of new therapeutic approaches for diabetes. An image from the paper landed on the cover of the December 2022 issue of Diabetes, and the success was also reported on national television and on the radio show Ultrasound. Diabetes is published by the American Diabetes Association and is considered one of the leading journals in diabetes research.



Source: GOSAK, Marko, YAN-DO, Richard, LIN, Haopeng, MACDONALD, Patrick E., STOŽER, Andraž. *Ca*$^{2+}$ oscillations, waves, and networks in islets from human donors with and without type 2 diabetes. *Diabetes.* Dec. 2022, vol. 71, no. 12, pp. 2584-2596. ISSN 1939-327X.

Cambium and leaf phenology in pubescent oak

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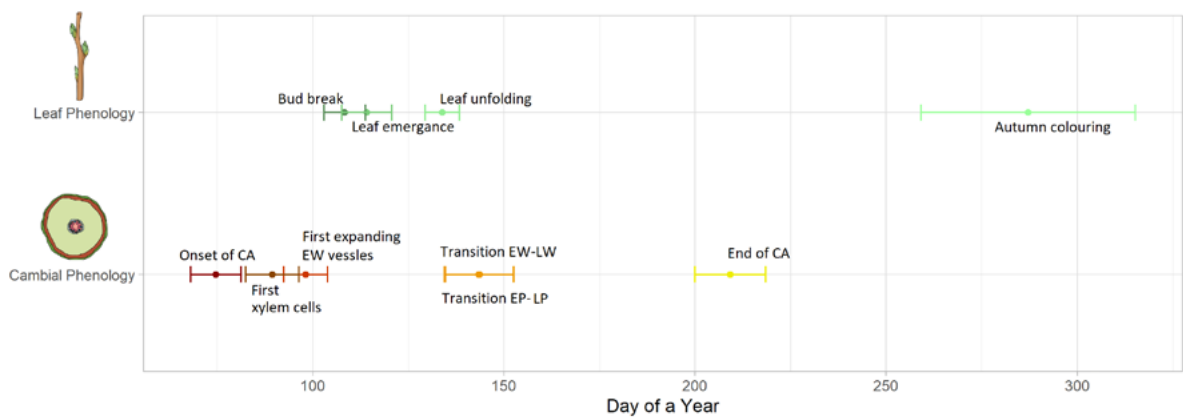
10.1016/j.scitotenv.2021.149968

Increased frequency and severity of stressful events affects the growth patterns and functioning of trees which adjust their phenology to given conditions. Here, the authors analysed environmental effects on the timing of leaf phenology, seasonal stem radial growth patterns, and xylem and phloem anatomy of *Quercus pubescens* in the sub-Mediterranean in the period 2014–2019, when various adverse weather events occurred. Results showed that the timings of leaf and cambium phenology do not occur simultaneously in *Q. pubescens*, reflecting different environmental and internal constraints. Although year-to-year variability in the timings of leaf and cambial phenology exists, their chronological sequence is fairly fixed. Rarely available phloem data permitted a comprehensive insight into the interlinkage of the timing of cambium and leaf phenology as well as adjustment strategies of vascular tissues in Mediterranean pubescent oak to various environmental conditions. Results suggest that predicted changes in climatic conditions for this area could affect the timings of leaf and stem cambial phenology of *Q. pubescens* in the coming years, which would affect stem xylem and phloem structure, hydraulic properties, and ultimately its performance.



Temporal sequence of leaf and cambium phenology in downy oak from the Podgorski Kras in the period 2014–2019

Source: GRIČAR, Jožica, JEVŠENAK, Jernej, HAFNER, Polona, PRISLAN, Peter, FERLAN, Mitja, LAVRIČ, Martina, VODNIK, Dominik, ELER, Klemen. Climatic regulation of leaf and cambial phenology in Quercus pubescens: their interlinkage and impact on xylem and phloem conduits. *Science of the total environment.* 2022, vol. 802, art. 149968, pp. 1-13, illustr. ISSN 0048-9697.

Is Douglas fir a suitable alternative for the Slovenian wood processing industry?

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Hyperlink:
https://www.frontiersin.org/articles/10.3389/fpls.2022.860734/full

DOI:
10.3389/fpls.2022.860734

Wood in outdoor applications is subject to various degradation factors. Wood degradation can be prevented by design measures, preservation, modification or the selection of naturally durable species. Unfortunately, most species in Europe do not have naturally durable wood. Non-native tree species represent a new source from which we can select timber species with better durability. The service life of wood above-ground applications is a function of the presence of biologically active compounds (extractives) and water performance. Recently, the Meyer-Veltrup model has been the most commonly used to determine the performance of wood in outdoor applications. Experience has shown that the durability of wood from native and new sites is not comparable. This paper presents original data on the natural durability of American Douglas-fir *(Pseudotsuga menziesii)*, which was introduced to Slovenia more than 100 years ago. Experimental data show that the heartwood of Douglas-fir is more durable than that of European larch *(Larix decidua)*. The results suggest that American Douglas fir, which grows in Central Europe, has great potential for the wood processing industry.

Source: HUMAR, Miha, VEK, Viljem, OVEN, Primož, LESAR, Boštjan, KRŽIŠNIK, Davor, KERŽIČ, Eli, HOČEVAR, Miha, BRUS, Robert. Durability and moisture dynamics of Douglas-fir wood from Slovenia. *Frontiers in plant science.* 2022, vol. 13, art. no. 860734, 15 pp., illustr. ISSN 1664-462X.

Lactic acid bacteria and bifidobacteria deliberately introduced into the agro-food chain do not significantly increase the anti-microbial resistance gene pool

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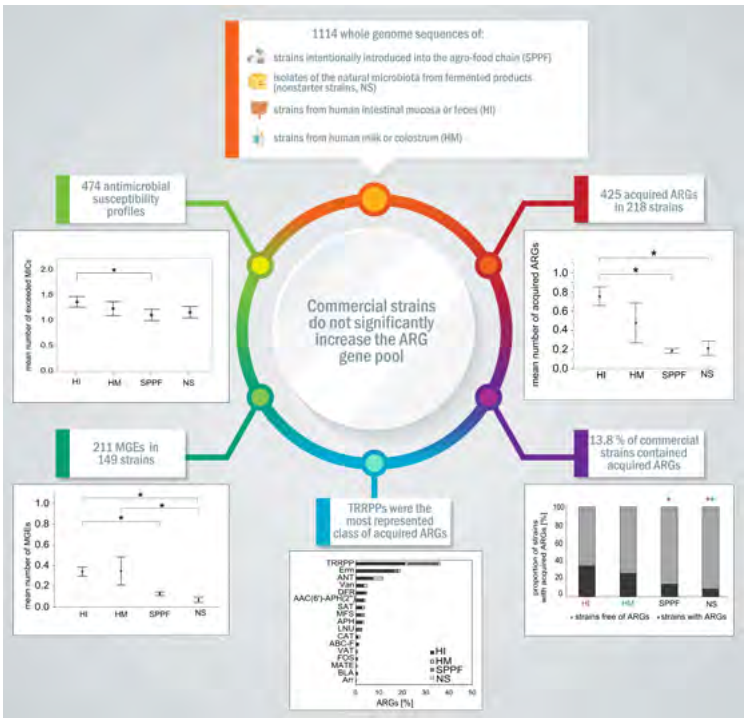
https://www.tandfonline.com/doi/full/10.1080/19490976.2022.2127438

DOI:
10.1080/19490976.2022.2127438

Lactic acid bacteria and bifidobacteria may serve as reservoirs of antimicrobial resistance (AR), but the risk posed by strains intentionally introduced into the agro-food chain has not yet been thoroughly investigated. The aim of this study was to evaluate whether probiotics, starter and protective cultures, and feed additives represent a risk to human health. Considering that transferable resistance was more common in strains of human origin, commercial strains do not significantly increase the AR gene pool and thus do not pose a serious threat to human health. Nevertheless, the results revealed that special attention should be paid to individual commercial strains, mostly probiotics that contain elements with a high potential for transferability in the gut microbiota. To the best of our knowledge, this was the first study of this group of bacteria on such a large scale, as advanced approaches (genomics, metagenomics) are slower to be implemented in commensal bacteria than in medically important bacteria. The results expand our knowledge of transferable resistance in the agro-food chain and provide a basis for risk assessment that is currently lacking.



Source: ROZMAN, Vita, MOHAR LORBEG, Petra, TREVEN, Primož, ACCETTO, Tomaž, GOLOB, Majda, ZDOVC, Irena, BOGOVIČ MATIJAŠIĆ, Bojana. Lactic acid bacteria and bifidobacteria deliberately introduced into the agro-food chain do not significantly increase the antimicrobial resistance gene pool. *Gut microbes.* 2022, no. 1, art. 2127438, pp. 1-17, illustr. ISSN 1949-0984.

In-depth study of tomato and weed viromes reveals undiscovered plant virus diversity in an agroecosystem

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Hyperlink:
https://microbiomejournal.biomedcentral.com/articles/10.1186/s40168-023-01500-6

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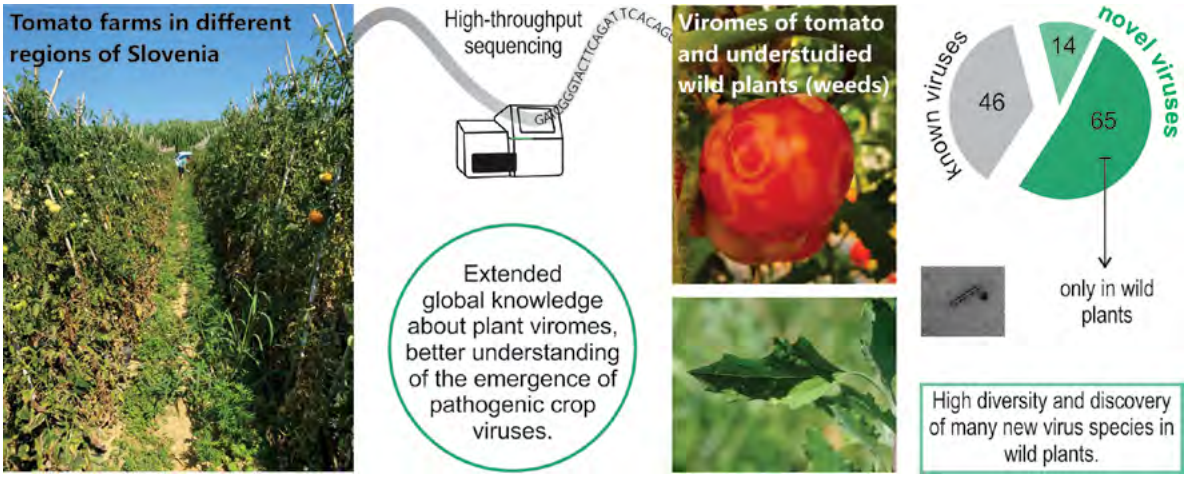
10.1186/s40168-023-01500-6

Plant viruses cause significant yield losses in agriculture and thus significantly affect our food security. To successfully combat the diseases they cause, knowledge about their presence and diversity in (agro) ecosystems is needed. In the past, most studies addressed crop viruses and less attention had been given to viruses of other plants. Using high-throughput sequencing, we have conducted the so far globally most extensive virome study of tomato and wild plants, within tomato farms in different parts of Slovenia. In these two fractions of the ecosystems, we discovered 125 plant virus species, among which 79 were novel species, mostly found in wild plants, which can represent a reservoir for the emergence of pathogenic viruses that could spill over to crops. We showed that even in relatively well-studied agroecosystems, such as tomato farms, a large part of very diverse plant viromes can still be unknown. This study contributed to extending the global knowledge of plant viromes, and represents a foundation for better understanding of the emergence of pathogenic plant viruses in crops.



Source: RIVAREZ, Mark Paul Selda, PECMAN, Anja, BAČNIK, Katarina, MAKSIMOVIĆ, Olivera, VUČUROVIĆ, Ana, SELJAK, Gabrijel, MEHLE, Nataša, GUTIÉRREZ-AGUIRRE, Ion, RAVNIKAR, Maja, KUTNJAK, Denis. In-depth study of tomato and weed viromes reveals undiscovered plant virus diversity in an agroecosystem. *Microbiome.* 2023, vol. 11, art. 60, pp. [1]-24, illustr. ISSN 2049-2618.

Patterns of human and porcine gammaherpesvirus-encoded BILF1 receptor endocytosis

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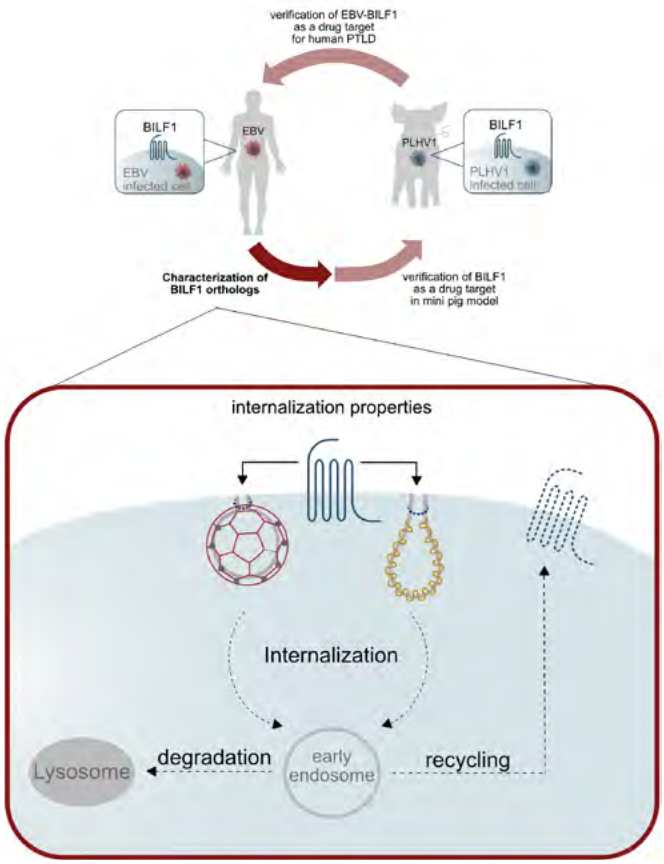
Hyperlink:
https://cmbl.biomedcentral.com/articles/10.1186/s11658-023-00427-y

DOI:
10.1186/s11658-023-00427-y

The achievement is the result of collaboration with Prof. Mette M. Rosenkilde of the University of Copenhagen in characterising the G protein-coupled receptors (GPCRs) encoded in porcine gammaherpesvirus (PLHV1-3) and the human Epstein-Barr virus. BILF1 receptors play an important role in the immunomodulatory and oncogenic properties of viruses. Using a novel real-time internalisation assay that allows measurement of receptor internalisation in living cells, we demonstrated the constitutive internalisation of all BILF1 receptors. Using different tools to silence endocytic proteins, we have shown clathrin-mediated endocytosis for BILF1 receptors and additionally, the involvement of caveolin-1 in BILF1 internalisation. Analyses of ß-arrestin knocked out cells and analyses of protein-protein interactions by BRET2 assay and ISM analysis showed that internalisation occurs independently of ß-arrestin. Furthermore, we have demonstrated receptor re-distribution to late endosomes/lysosomes and the ability of BILF1 receptors to recycle back to plasma membrane.



Source: MAVRI, Maša, GLISIC, Sanja, SENCANSKI, Milan, VRECL, Milka, ROSENKILDE, Mette Marie, SPIESS, Katja, KUBALE, Valentina. Patterns of human and porcine gammaherpesvirus-encoded BILF1 receptor endocytosis. *Cellular and molecular biology letters: international scientific journal.* 2023, vol. 28, [art. no.] 14, pp. 1-19, illustr. ISSN 1689-1392.

Treatment of spontaneous canine mast cell tumours by electrochemotherapy combined with IL-12 gene electrotransfer: comparison of intratumoural and peritumoural application of IL-12

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https://www.sciencedirect.com/science/article/pii/S1567576923005969?via%3Dihub

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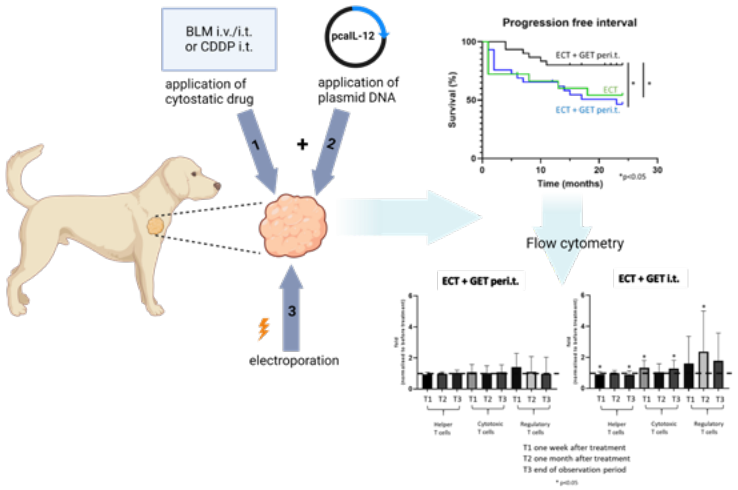
10.1016/j.intimp.2023.110274

The combined treatment of electrochemotherapy (ECT) and interleukin-12 (IL-12) gene electrotransfer (GET) has already shown to be safe and effective when treating various histological types of spontaneous tumours. As the routes of administration of IL-12 GET were either intratumoural (i.t.) or peritumoural (peri.t.), the objective of this clinical trial was to compare the two IL-12 GET routes of administration in combination with ECT and their contribution to the enhanced ECT response. Seventy-seven dogs with spontaneous mast cell tumours were divided into three groups: ECT + GET peri. t., ECT + GET i.t. and ECT alone. The results showed that local tumour control, disease-free interval and progression-free survival was significantly better in the ECT + GET i.t. group. The data were consistent with immunological tests, as we detected an increased percentage of antitumour immune cells in the blood after treatment in the ECT + GET i.t. group, which also indicated the induction of a systemic immune response. In addition, we did not observe any unwanted severe or long-lasting side effects. Finally, due to the more pronounced local response after ECT + GET i.t., we suggest that treatment response assessment should be performed at least two months after treatment, which meets the iRECIST criteria.



Source: LAMPREHT TRATAR, Urša, MILEVOJ, Nina, ČEMAŽAR, Maja, ŽNIDAR, Katarina, URŠIČ VALENTINUZZI, Katja, BROŽIČ, Andreja, TOMSIČ, Katerina, SERŠA, Gregor, TOZON, Nataša. Treatment of spontaneous canine mast cell tumors by electrochemotherapy combined with IL-12 gene electrotransfer: comparison of intratumoral and peritumoral application of IL-12. *International immunopharmacology.* 2023, vol. 120, [art. no.] 110274, pp. 1-13, illustr. ISSN 1878-1705.

Toward learning the principles of plant gene regulation

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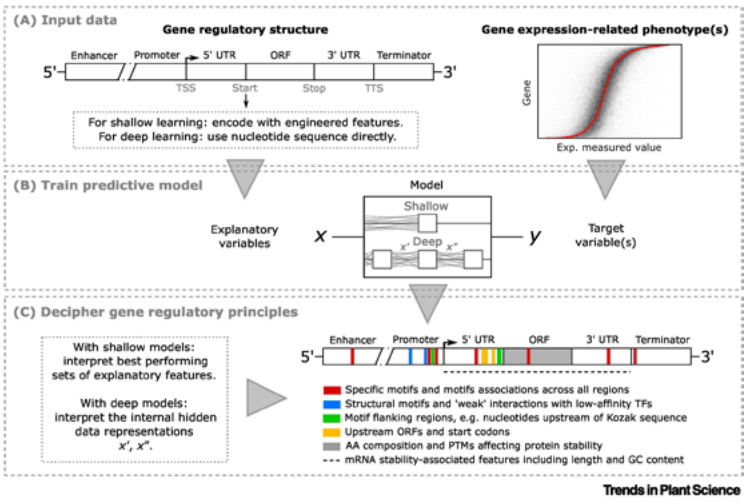
10.1016/j.tplants.2022.08.010

Advanced machine learning (ML) algorithms produce highly accurate models of gene expression, uncovering novel regulatory features in nucleotide sequences involving multiple cis-regulatory regions across whole genes as well as DNA structural properties. These broaden our understanding of gene regulation and point to new principles to test and adopt in the field of plant science. The aim of the present article is to give an overview of recent ML developments and uncovered regulatory principles, indicating how they can impact future research in the field of plant science.



Overview of data-driven machine learning to uncover the principles of plant gene regulation.
In supervised learning a model is trained to predict y (target variable) from the set of features x (explanatory variables) present in the training dataset. (A) x is a set of nucleotide sequences or numerical engineered features (e.g., position weight matrices, k-mer frequencies, DNA shape) and y describes some property related to gene expression [e.g. transcription factor (TF) binding, mRNA abundance, chromatin accessibility]. (B) Differing from classical shallow architectures, deep neural networks (DNNs) are abstracted by multiple hidden layers between x and y, each learning a new and informative representation of the data. For instance, the most frequently applied DNNs in genomics, 1D convolutional networks, scan DNA and learn to recognise different patterns such as partial and full motifs in early layers, combining these into associated sets in later layers. (C) Regulatory knowledge can be interpreted by either: (i) evaluating the performance of models trained on different subsets of explanatory variables, or (ii) inferring the representations learned by the hidden DNN layers (e.g. by occluding portions of the input sequence and measuring their effects on the output to reconstruct the most important motifs). Finally, the gene regulatory structure with recently uncovered regulatory elements is depicted (bottom right). Abbreviations: AA, amino acid; ORF, open reading frame; PTM, post-translational modification; TSS, transcription start site; TTS, transcription termination site; UTR, untranslated region.

Source: ZRIMEC, Jan, ZELEZNIAK, Aleksej, GRUDEN, Kristina. Toward learning the principles of plant gene regulation. *Trends in Plant Science.* [printed ed.] Dec. 2022, vol. 27, no. 12, pp. 1206-1208, illustr. ISSN 1360-1385.

Segmentation strategy of de novo designed four-helical bundles expands protein oligomerisation modalities for cell regulation

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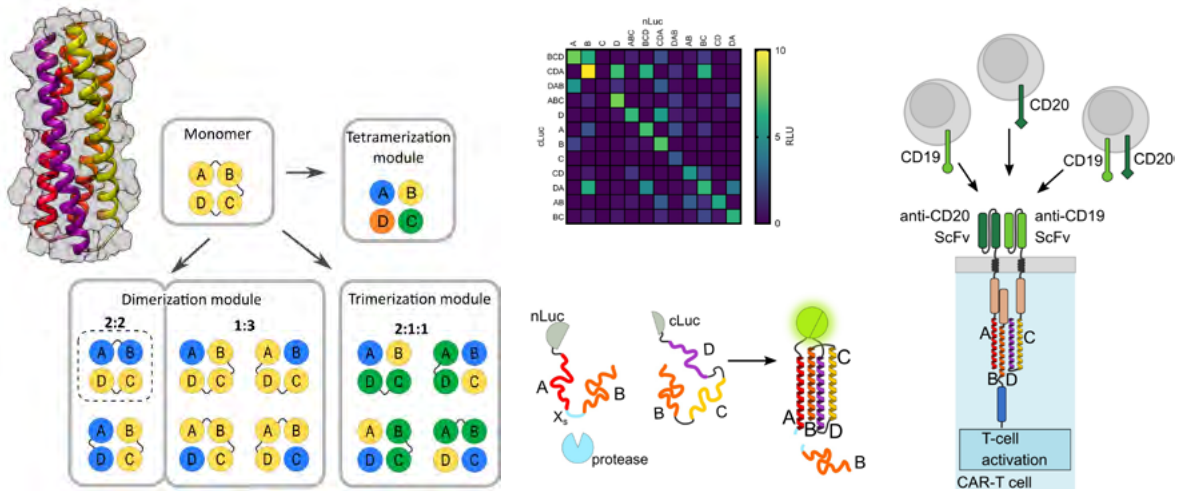
10.1038/s41467-023-37765-6

The technology of newly designed proteins enables great progress in the field of synthetic biology. Due to the rules for the selection of amino acids at certain positions, we can only prepare a limited α-helix that selectively connect with each other.

With the desire to overcome limitations and expand the possibilities of oligomerisation, the researchers of the National Institute of Chemistry embarked on research into four-helix bundles (4HB). We devised a 4HB segmentation strategy, where we segmented a 4HB into subunits in several different ways (1:3, 2:2, 1:2:1, 1:1:1:1), which use the assembly of two up to four different chains into a complex. In this way, we have created several different connection partners from a single 4HB.

To expand and demonstrate the wide application of newly prepared oligomerisation domains, we implemented 4HB segmentation for different biological processes: gene transcription regulators, protease-regulated dimerisation module and protease cascade, chemically inducible trimerisation module, and dual CAR-T module to recognise different combinations of ligands on cancer cells for use on therapeutic T cells.



Source: MERLJAK, Estera, MALOVRH, Benjamin, JERALA, Roman. Segmentation strategy of de novo designed four-helical bundles expands protein oligomerization modalities for cell regulation. *Nature communications.* 2023, vol. 14, art. no. 1995, pp. 1-12, illustr. ISSN 2041-1723.

How do Slovenian children perceive foreign languages?

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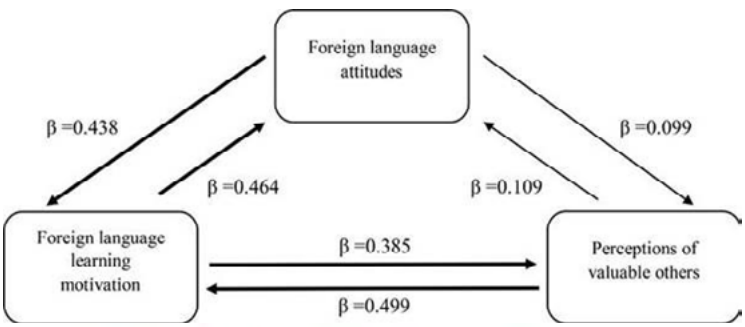
Attitudes towards languages play a crucial role in how children experience, understand, learn, and use different languages, as well as how they navigate intercultural communication. The purpose of the article was to explore the attitudes of Slovenian children towards foreign languages and the role of significant others (teachers, parents, peers) in this context. We surveyed 472 students in Slovenia, aged 8-9 years. The results indicate that children of this age group have markedly positive attitudes towards foreign languages and are highly motivated to learn them. Their perception of languages is closely linked to their experiences and the various contexts in which they are exposed to languages. Importantly, the results show that children's attitudes during this developmental period are largely dependent on their parents' and teachers' beliefs and less on their peers' attitudes. Participants in the study also expressed a considerable curiosity for languages and sensitivity to linguistic diversity. Additionally, we observed instances of emerging metalinguistic awareness. These findings reveal a complex interdependence between attitudes, motivation, and significant others, emphasising the importance of creating a supportive learning environment for multilingual development within the Slovenian educational context.



Source: BRATOŽ, Silva, ŠTEMBERGER, Tina, PIRIH, Anja. Slovenian children's perceptions of and attitudes towards foreign languages. *International journal of multilingualism.* Online ed. 2022, pp. 1-18, ISSN 1747-7530.

Drivers of corporate environmental and social responsibility practices: A comparison of two moderated mediation models

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https://www.sciencedirect.com/science/article/pii/S0148296323000103

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10.1016/j.jbusres.2023.113652

The article builds upon the literature on corporate sustainability, environmental management, and sustainability strategies. It focuses on the development and comparison of two structural models: one addressing the environmental dimension and the other addressing the social dimension of sustainability. In both models, moral motives have stronger effects on environmental/social responsibility strategy compared to instrumental motives, with the latter acting as a statistically significant mediator between motives and sustainable practices. The financial health of the company negatively moderates the relationship between strategy and practices in the environmental model, while its moderating role in the social model is not statistically significant, suggesting that sustainable practices are not limited to financially healthy companies. The presented study stands out among existing research by simultaneously investigating both dimensions, enabling a more detailed and precise understanding of different motives and the role of strategy as a mediator. The interesting results of the moderations offer valuable insights that can stimulate further discourse.

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Drivers of corporate environmental and social responsibility practices: A comparison of two moderated mediation models

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ABSTRACT

This paper adds to CSR, environmental management and strategy literature by examining motivating and enabling factors of corporate environmental and social responsibility practices. We develop and compare two moderated mediation models – one related to the environmental (Study 1) and the other to the social (Study 2) dimension of sustainability. Survey-based data collected from 236 companies in Study 1 and 219 companies in Study 2 along with data on firm financial health from an external source are used. In both models, the moral motives of "doing the right thing" have stronger effects on environmental/social responsibility strategy, which then acts as an important mediator for translating those motives into specific environmental/social practices. Moreover, financial health negatively moderates the strategy-practices relationship in the environmental model, while its moderation role is not significant in the social model, suggesting that sustainability practices are not necessarily limited to financially healthy firms. Our research casts fresh light on the (N)RBV and stakeholder theories, proposing their integration when discussing corporate environmental/social sustainability models.

Source: ČATER, Tomaž, ČATER, Barbara, MILIĆ, Patricia, ŽABKAR, Vesna. Drivers of corporate environmental and social responsibility practices: a comparison of two moderated mediation models. *Journal of business research.* [Printed ed.]. Apr. 2023, vol. 159, art. no. 113652, 17 pp. ISSN 0148-2963.

Learning and diffusion of knowledge in clean energy communities

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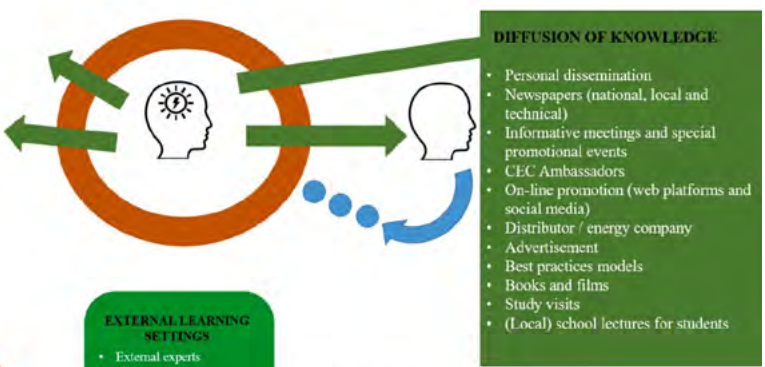
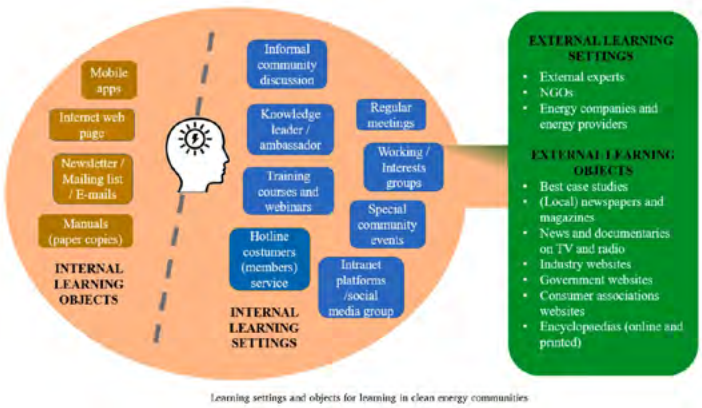
10.1016/j.eist.2023.100701

Clean energy communities (CEC) represent emerging socio-technical systems that offer a suitable alternative to non-sustainable energy production and consumption. CECs cultivate new knowledge of clean energy use and diffuse it among their members as well as interested publics outside the CECs. The scientific article aims to enlighten the role of learning and knowledge in energy transitions in general and CECs' knowledge circulation and learning in particular. The paper presents findings about the knowledge development and learning settings within CECs that provide the ways of cultivating knowledge within CECs and ways of disseminating this knowledge outside the CECs. The scientific article focuses on the comprehensive analysis of learning environments and the mapping of information flow processes based on empirical data derived from the experiences of CEC members. This research contributes to the energy transition literature by focusing on the overlooked perspective of learning and knowledge dissemination as an important part of a niche innovation setting. The information and results of the article are useful for different typologies of stakeholders: for future and current CEC members, for universities, non-governmental organisations, municipalities, ministries, etc.



Diffusion of knowledge in clean energy communities



Learning settings and objects for learning in clean energy communities

Source: MEDVED, Primož, GOLOB, Urša, KAMIN, Tanja. Learning and diffusion of knowledge in clean energy communities. *Environmental innovation and societal transitions.* 2023, vol. 46, art. 100701, pp. 1-16, illustr. ISSN 2210-4224.

Lost in translation: translating social justice into social care practice for LGBTI+ children and young people

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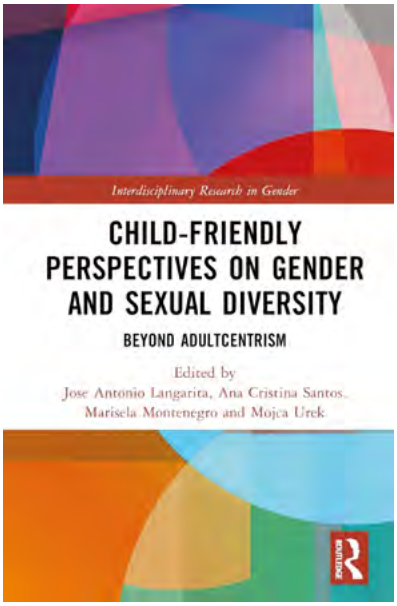
Hyperlink:
https://www.taylor-francis.com/books/edit/10.4324/9781003294719/child-friendly perspectives-gender-sexual-diversity-jose-antonio-langarita-ana-cristina-santos-marisela-montenegro-mojca-urek?refId=ba6b-d31e-c070-4750-bba9-e72d-2053ba87&context=ubx

DOI:
10.4324/9781003294719-12

The chapter of the book, published by the international publisher Routledge, where the first author is also co-editor, looks at the needs of LGBTI+ children and young people from the perspective of the most typical responses of social care services in Slovenia, while highlighting the gaps that arise at this intersection in everyday practice. To identify barriers and facilitators to strengthening inclusive practice, several factors are taken into account, such as the rate of violence against LGBTI+ youth in Slovenia, political and professional trends, the existence of professional codes of ethics, anti-oppressive approaches and equality policies, and others. The study partly draws on various data collected in Slovenia within the framework of the EU Diversity and Childhood research project (2019–2021), and in particular on further research of the author in this field financed by the Slovenian Research and Innovation Agency (targeted research project, research programme group). The study enables reflection on the gap between the claim of social justice and exclusionary practice in the area of gender diversity in social care settings, and provides recommendations to improve the response of professionals in cases of discrimination and violence against LGBTI+ children and young people.



Source: UREK, Mojca, JURČEK, Anže. Lost in translation: translating social justice into social care practice for LGBTI+ children and young people. In: LANGARITA ADIEGO, Jose Antonio (ur.), *et al. Child-friendly perspectives on gender and sexual diversity: beyond adultcentrism.* London; New York: Routledge, 2023. pp. 137-155. Interdisciplinary research in gender. ISBN 978-1-0322-7930-5, ISBN 978-1-0322-7935-0.

Urban tourism in Slovenia: characteristics and governance

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https://repozitorij.uni-lj.si/IzpisGradiva.php?id=142771&lang=slv

DOI:
/

The scientific monograph represents the most thorough coverage of urban tourism in Slovenia so far. The monograph is the result of interdisciplinary work and the use of qualitative and quantitative approaches. The work presents the development and effects of urban tourism on more than 300 pages with over 100 spreadsheets and graphics, special attention is paid to the impacts of the Covid-19 pandemic on this type of tourism. The impacts are identified by territorial impact assessment (method, developed within the project). The chapters deal with Ljubljana and Maribor in more detail, putting the social and spatial dimension of urban tourism in focus. Slovenian cities are reviewed in the context of central Europe and the tourism development of medium-sized cities. The added value of this work is a model of sustainable management of urban tourism, which can help different stakeholders improve tourism development and territorial governance in the cities. A glossary explains recent terms in the field and a set of data sheets of relevant indicators is added at the end of the book. The work is instrumental for researchers and students from different fields of study in Slovenia and abroad.

Cover: Manca Krošelj

Source: HORVAT, Uroš, KLEPEJ, David, KROŠELJ, Manca, MAROT, Naja, OGRAJENŠEK, Irena, STUBIČAR, Nina in URŠIČ, Matjaž, 2022, *Mestni turizem v Sloveniji: značilnosti in upravljanje.* (Marot N, Uršič M, ur.). Ljubljana: Biotechnical Faculty, 2022. ISBN 978-961-6379-61-8.

Effects of high- and low-load resistance training in patients with coronary artery disease: a randomised controlled clinical trial

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https://academic.oup.com/eurjpc/advance-article/doi/10.1093/eurjpc/zwac063/6580398

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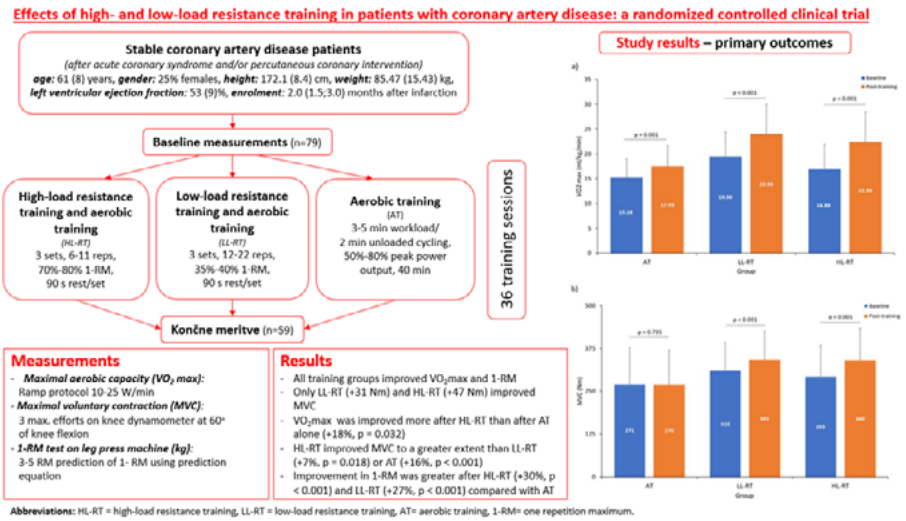
10.1093/eurjpc/zwac063

The implementation of high-load resistance training (HL-RT) remains underused due to safety considerations when compared with aerobic training (AT) in cardiac rehabilitation. The aim of our study was to examine the safety and efficacy of HL-RT in combination with AT and to compare its effects with the combination of low-load (LL-) RT and AT or with AT alone on maximal aerobic capacity (VO_2max, ml/kg/min) and muscle strength (MVC, Nm) in patients with coronary artery disease (CAD).

Stable patients with CAD were randomised to three training groups: combination of HL-RT (3 sets, 6-11 repetitions/set at 70-80% of maximal muscle strength), combination of LL-RT (3 sets, 12-22 repetitions/set at 35-40% of maximal muscle strength) and AT (3-5 min intervals at 50-80% of maximal power output). Every patient performed 24-36 training sessions, 2-3 times per week in a routine cardiac rehabilitation.

All training groups improved VO_2max ($p < 0.01$). HL-RT was superior to AT in improvement of VO_2max (+18%, $p = 0.032$). MVC was improved only following HL-RT (+47 Nm) and LL-RT (+31 Nm, both $p < 0.001$). Improvement in MVC was greater following HL-RT in comparison with LL-RT (+7%, $p = 0.018$) and AT (+16%, $p < 0.001$).

Our findings support the use of HL-RT in combination with AT in stable patients with CAD.



Source: KAMBIČ, Tim, ŠARABON, Nejc, HADŽIĆ, Vedran, LAINŠČAK, Mitja. Effects of high- and low-load resistance training in patients with coronary artery disease: a randomized controlled clinical trial. *European journal of preventive cardiology.* 2022, vol. 29, no. 15, pp. 1-5. ISSN 2047-4881.

Assessment of energy-efficient building details for seismic regions

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https://link.springer.com/book/10.1007/978-3-030-97556-2

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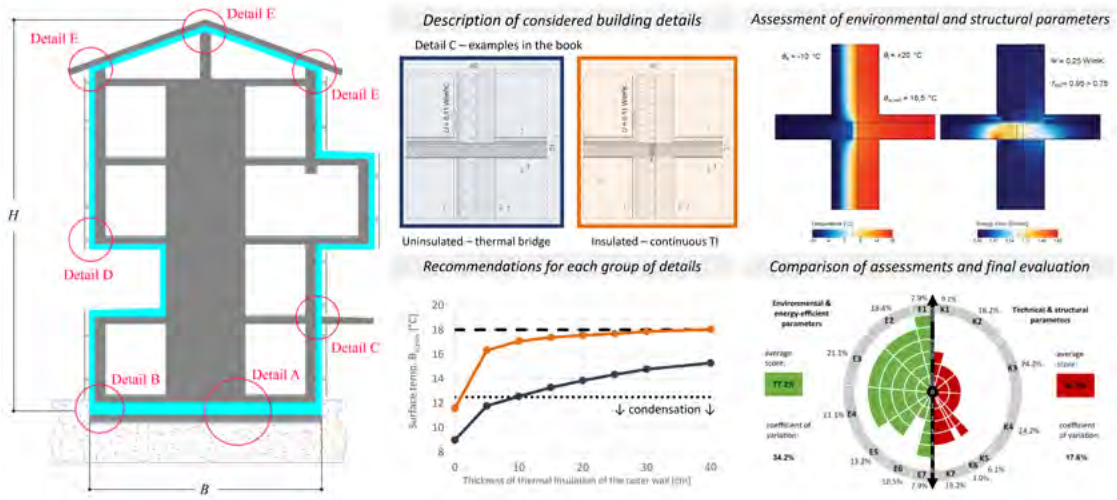
10.1007/978-3-030-97556-2

The monograph presents research on the reduced seismic resistance of energy-efficient and passive buildings. The scientific and professional contributions included in the monograph offer a better understanding of the seismic vulnerability of energy-efficient buildings and their problematic details, and strive to improve their seismic resistance.

The first part of the monograph presents a comprehensive overview of selected critical construction details of energy-efficient buildings that appear in Slovenia or in the wider Central European area. In the following part, the evaluation methodology of structural details on the external thermal envelope of the building is presented, in order to distinguish between good and bad solutions of construction details. The final part of the monograph presents realistic examples of the most frequently used construction details which are evaluated using the proposed methodology. For each detail, the evaluation results from the point of view of energy efficiency and from the point of view of construction or earthquake resistance are presented. These examples can be used to directly transfer knowledge into design practice. It turns out that not every energy-efficient detail is suitable for use in an earthquake prone zone like Slovenia. The scientific and professional contributions of the monograph contribute to a better understanding of the seismic vulnerability of energy-efficient buildings and their details, and promote sustainable building design. The monograph was published by Springer and is published in golden open access.



Source: AZINOVIĆ, Boris, KILAR, Vojko, KOREN, David. *Assessment of energy-efficient building details for seismic regions.* Cham: Springer, cop. 2022. 1 online source (1 file PDF (IX, 206 pp.)), illustr. Springer Tracts in civil engineering (Online). ISBN 978-3-030-97556-2. ISSN 2366-2603.

Organisational maturity for co-creation: developing a multi-attribute decision support model for public organisations

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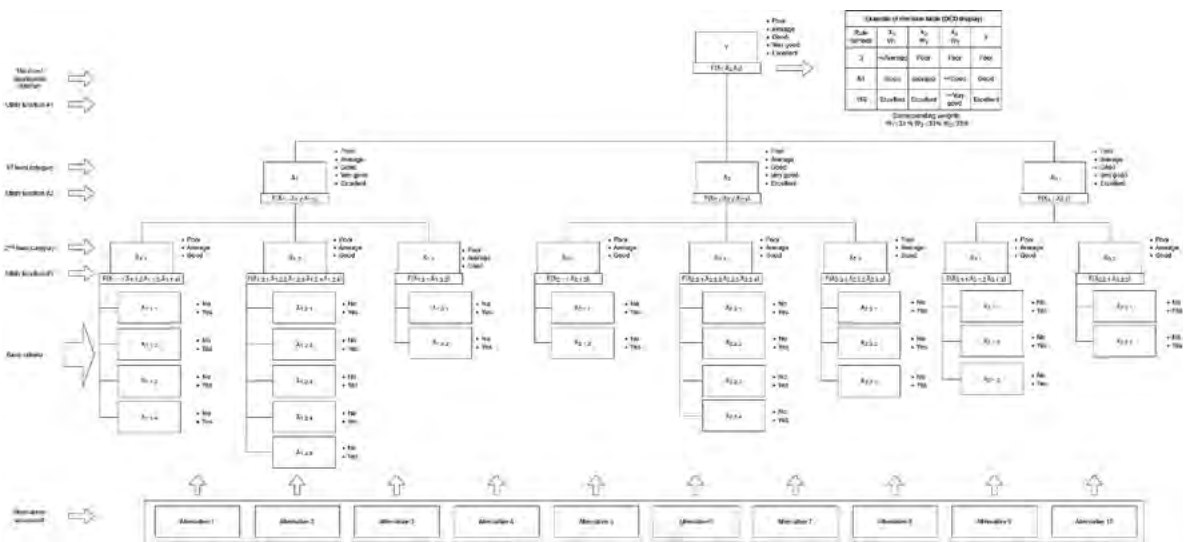
https://www.sciencedirect.com/science/article/pii/S0740624X21000599

DOI:
10.1016/j.giq.2021.101623

The paper, a result of the Horizon 2020 project COGOV (Grant Agreement No. 770591), outlines a multi-attribute decision support model aiding public organisations in measuring organisational maturity for co-creating public policies and services. This innovative, interdisciplinary approach integrates social science research knowledge with established multi-parameter decision modelling methods. Based on interviews conducted in Slovenia and the United Kingdom, and a systematic content analysis of relevant papers, we developed an evidence-based decision model. In addition to its theoretical contribution by conceptualising "organisational maturity for co-creation", the model has significant practical implications by providing a basis for systemic support to public organisations to strategically prepare for successful co-creation. This involves assessing organisational maturity, improving lower-rated segments, and eventually implementing co-creation. As such, the model is particularly beneficial for Eastern European countries, where cooperation with stakeholders lacks a strong tradition, as opposed to countries with an Anglo-Saxon administrative tradition, for example.



Source: JUKIĆ, Tina, PLUCHINOTTA, Irene, HRŽICA, Rok, VRBEK, Sanja. Organizational maturity for co-creation: Towards a multi-attribute decision support model for public organizations. *Government information quarterly: an international journal of policies, resources, services, and practices.* Jan. 2022, vol. 39, no. 1, pp. 1-20, illustr. ISSN 0740-624X.

Spiteful revenge – memory of Italian Fascist concentration camps

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https://plus.cobiss.net/cobiss/si/sl/bib/130293507

DOI:
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The book provides a synthesis of the overlooked history regarding the confinement and internment of Slovenian men and women during the Italian occupation of western Slovenia in the Second World War. Apart from presenting the advantages of oral history and memory studies for understanding the memory policy concerning the abovementioned period in Italy, the work also acts as a unique forensic reconstruction of the survivors' experience of the camps, introducing us to both the victims and perpetrators, with the former taking centre stage. They are the voices of people who still remembered everything sixty years after the war: the arrests, interrogations, transports to the camps or, rather, internment, lack of food, unbearable conditions of movement, humiliation, disease, and death. The internment of Slovenian men and women in Italian Fascist camps is one of the most violent and, hence, most traumatic chapters in the history of twentieth-century Slovenia. The volume brings forth an especially detailed description of the destiny of women, children, and elderly internees, for whom the scarcity of food and water, compounded by the guards' violent behaviour, often proved fatal. Further adding to the value of the volume are the victims' testimonies, which the authors have organised into sixteen chapters shedding light on daily life in the camps. The final result confirms that describing one's own experience may be viewed, with acceptable risks, of course, as a memory transfusion. When describing the conditions in the worst camps, we also did not forget the fate of Croatian men and women from the Čabar district of Gorski Kotar.

Author: Nikolaj Pirnat

Source: LUTHAR, Oto, VERGINELLA, Marta, STRLE, Urška. *Užaljeno maščevanje: spomin na italijanska fašistična taborišča.* 1. ed. Ljubljana: Založba ZRC, 2023. 378 pp. Zbirka Kulturni spomin. ISBN 978-961-05-0692-8. ISSN 2232-3872.

Origins of Mesoamerican astronomy and calendar

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https://www.science.org/doi/epdf/10.1126/sciadv.abq7675

DOI:
10.1126/sciadv.abq7675

Using aerial laser scanning (lidar) data, we analysed the orientations of a large number of ceremonial complexes in the area along the southern Gulf Coast in Mexico. Most of them marked sunrises or sunsets on specific dates, allowing the use of observational calendars that facilitated proper scheduling of subsistence-related ritual activities. The distribution pattern of dates recorded by the complexes built between 1100 and 750 BCE represents the earliest evidence of the use of the 260-day calendar, predating the earliest written records by almost a millennium. In addition, we have identified several early orientations to the major extremes of Venus and the Moon. Our results reveal that the observations leading to the sophisticated astronomical knowledge of the Classic and Postclassic periods were underway in a surprisingly early period, when the lifestyle of nomadic hunters and gatherers was only gradually replaced by sedentary communities practicing maize agriculture. The study exemplifies the potential of archaeoastronomical research of architectural orientations and the utility of a rigorous methodology used in the analyses of alignment data.

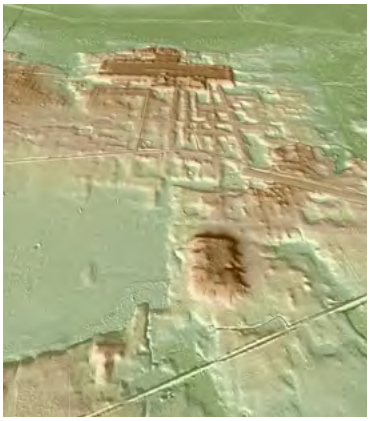

Figure 1:
The site of Aguada Fénix, viewing east. The Main Plateau in the background is the largest construction in the study area, measuring 1400 m in length (lidar-based 3D image by Takeshi Inomata).

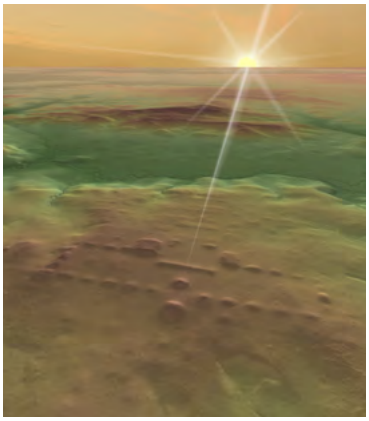

Figure 2:
The site of Buenavista on the day of sunrise alignment (lidar-based 3D image by Takeshi Inomata).

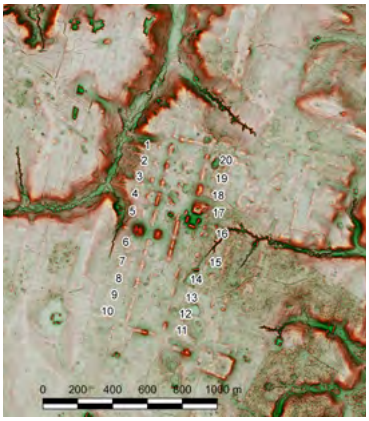

Figure 3:
The site of El Macabil (lidar-based image by Takeshi Inomata).

Source: ŠPRAJC, Ivan, INOMATA, Takeshi, AVENI, Anthony F. Origins of Mesoamerican astronomy and calendar: evidence from the Olmec and Maya regions. *Science advances.* Jan. 2023, vol. 9, no. 1: eabp8371, pp. 1-15, illustr. ISSN 2375-2548.

Migration of Alpine Slavs and machine learning

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https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0274687

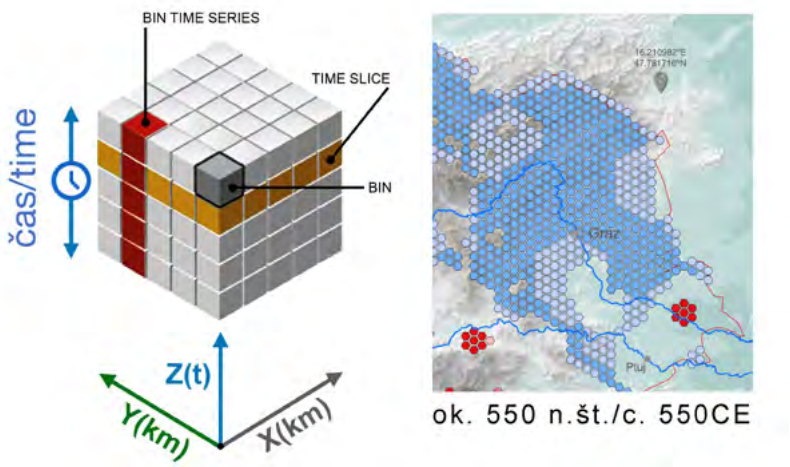
DOI:
10.1371/journal.pone.0274687

Most modern scholars of the early Middle Ages are sceptical or even categorically deny the existence of physical migration. The rapid spread of speakers of Slavic languages from Thessaloniki to Hamburg in the second half of the first millennium AD is therefore still unresolved.

As an answer to the question of why such a rapid spread occurred, the discipline currently offers three hypotheses. According to the first, it was a migration or displacement of large groups of people. According to the second, it was only the culture or even only the language spread. The third, the hybrid hypothesis, says that everything happened at the same time: migration, spread of culture and language.

A group of Slovenian and Austrian archaeologists focused on the latter. They tested the hypothesis by analysing the so-called Deep Data, using not only advanced spatial analysis but also one of the methods of artificial intelligence (figure, left).

Two physical migrations into the Eastern Alps were demonstrated. The first began shortly after 500 AD and spread from Prekmurje up the Mura and Drava rivers (figure, right). The second, which went up the Sava and across the Karavanke Mountains, occurred only in the decades before 700 AD. Based on a convergence of evidence from archaeology, linguistics and population genetics, the migrants were defined as Alpine Slavs, i.e. people who spoke a Slavic language and shared common ancestry with all other speakers of Slavic languages.



Source: ŠTULAR, Benjamin, LOZIĆ, Edisa, BELAK, Mateja, RIHTER, Jernej, KOCH, Iris, MODRIJAN, Zvezdana, MAGDIČ, Andrej, KARL, Stephan, LEHNER, Manfred, GUTJAHR, Christoph. Migration of Alpine Slavs and machine learning: space-time pattern mining of an archaeological data set. *PLoS ONE*. September 19, 2022, [vol.] 17, 9: e0274687, pp. 1-19, illustr., ISSN 1932-6203.

Fake news detection using large language models and knowledge graphs

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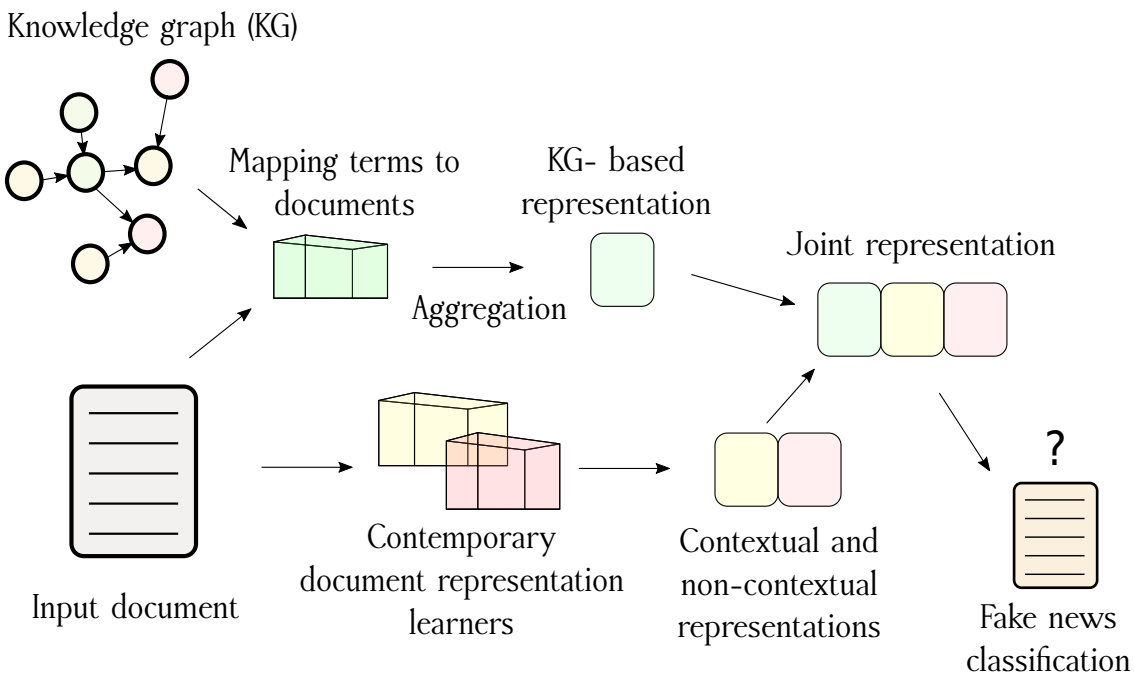
https://www.sciencedirect.com/science/article/pii/S0925231222001199

DOI:
10.1016/j.neucom.2022.01.096

Identifying fake news is crucial in the age of infodemics. This becomes particularly important during special circumstances, such as pandemics, wars and periods before elections, as only truthful information supports the public to make informed decisions. We present an original method for effectively detecting fake news.

While large language models trained on extensive data capture implicit relations between words, they do not leverage factual knowledge and relations from curated knowledge graphs. Our proposed method for document representation integrates both aspects and yields excellent results in identifying fake news in media texts and social media posts.

The proposed method is important not only as a step towards easier detection of fake news, but also as a way of presenting documents by taking facts from knowledge graphs into account. The published paper has been cited more than 50 times and also has potential for further improvements using state-of-the-art models, such as ChatGPT, where the inclusion of explicit knowledge is particularly important.



Source: KOLOSKI, Boshko, STEPIŠNIK PERDIH, Timen, ROBNIK ŠIKONJA, Marko, POLLAK, Senja, ŠKRLJ, Blaž. Knowledge graph informed fake news classification via heterogeneous representation ensembles. *Neurocomputing.* [Printed ed.]. 2022, vol. 496, Jul., pp. 208-226. ISSN 0925-2312.

Terminological counselling service – 10 years of helping terminology users

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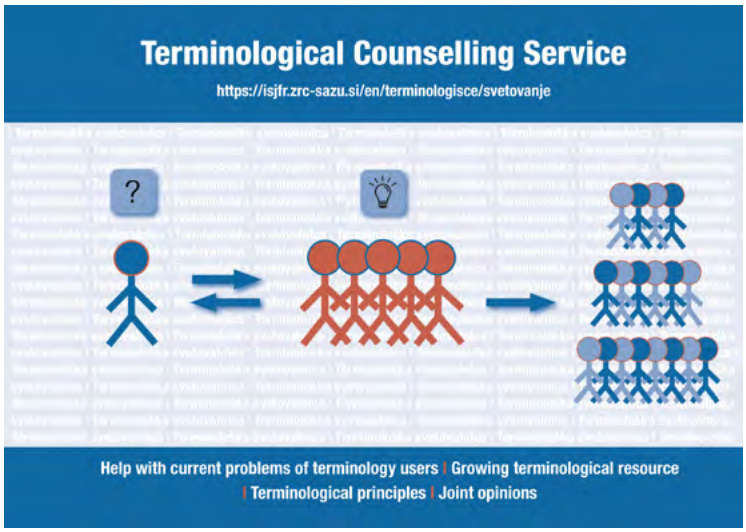
DOI:
10.1075/term.21046.zag

The Terminological Counselling Service is intended for subject field experts who need help in naming new concepts or in choosing the most appropriate term for a concept among several existing terms. This terminological service for solving terminological problems has been available on the Terminologišče website since 2013. Subject field experts submit their questions through an online form and receive an answer to their email address. The questions and answers are also published. In 10 years, 591 questions and answers have been published in the Terminological Counselling Service, and new ones are added weekly. This creates a valuable, growing terminological resource available to all terminology users.

A special feature of the Terminological Counselling Service is that the answer to each question is prepared by a group of 5 terminologists who are equally involved in the answering process. Each of them writes their own opinion on the terminological problem, which is then coordinated and written down. This makes the answers more objective and credible than if they were written by a single terminologist. The function of the Terminological Counselling Service and an analysis of terminology users' questions were the subject of an article published in the prestigious journal Terminology in 2023.



Source: ŽAGAR KARER, Mojca, FAJFAR, Tanja. Terminological problems of terminology users: analysis of questions in terminological counselling service on the Terminologišče website. *Terminology.* 2023, vol. 29, no. 1, pp. 78-102. ISSN 0929-9971.

The artifice of intelligence: Divine and human relationship in a robotic age

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Hyperlink:
https://www.fortresspress.com/store/product/9781506486901/The-Artifice-of-Intelligence

DOI:
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The recently published book offers an exceptional study of a very timely topic and represents one of the first truly comprehensive works in the field of digital theology, and thus a more than necessary examination of the nature of artificial intelligence. The monograph approaches this phenomenon in depth and confidently opens up questions that fundamentally affect the coexistence of humans and robots. The focus is on questions of mind, creation, responsibility, cognition, human exceptionalism, and the relationship of humans to other beings. The author treats the history of computer science in great detail, always placing it in the context of the religious relationship to man and his place in creation, which enables her to give a truly comprehensive treatment of the all-too-human process of the technologisation of many elements of modern life. The work is one of the very recent attempts to apply theological thinking to questions of artificial intelligence, and as such represents an outstanding contribution to digital theology and to future attempts to understand the nature of created beings and artificial intelligence.

Source: HERZFELD, Noreen. *The artifice of intelligence: divine and human relationship in a robotic age.* Minneapolis: Fortress Press, cop. 2023. XII, 208 pp. ISBN 978-1-5064-8690-1.

Natural and anthropogenic impacts on cave climates

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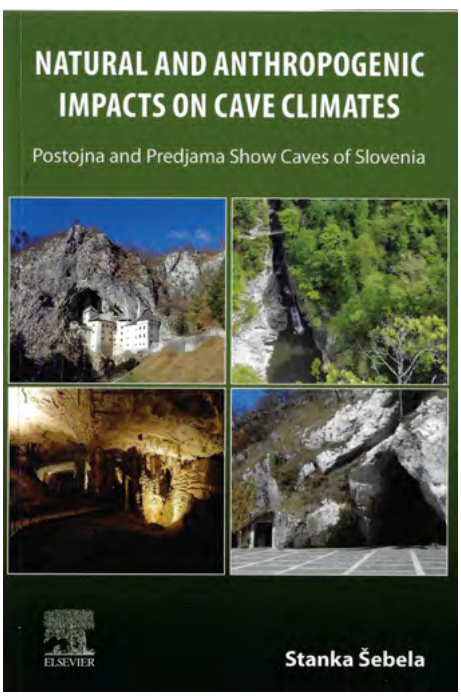
10.1016/B978-0-12-822954-5.00001-9

The monograph, published at the invitation of Elsevier scientific publisher, analyses measurements of cave microclimate in selected Slovene show caves. Based on continuous measurements (temperature, air pressure, carbon dioxide) natural and/or anthropogenic impacts on cave microclimate are analysed. The results present a unique view on several-years long monitoring of micro-climatic parameters in show caves especially in the Postojna and Predjama caves, which is rare globally. A strong anthropogenic impact is present in the touristic parts of the Postojna Cave, while the rise of temperature in the Predjama cave is linked to outside temperature. Less visited parts of the Postojna Cave, as with the Black Cave show stable conditions despite outside temperature increase, which is connected with entrance passage morphology and summer and winter ventilation. The rarely visited Otoška Jama cave shows even higher temperatures than are in the most visited parts of the Postojna Cave, which is due to the influence of the underground Pivka river. The uniqueness of the monograph is based on field monitoring of show cave microclimates, which has been ongoing since 2009, and with which it was possible to suggest mitigation steps to perform sustainable tourism in show caves.



Source: ŠEBELA, Stanka. *Natural and anthropogenic impacts on cave climates: Postojna and Predjama show caves of Slovenia.* Amsterdam; Oxford; Cambridge (MA): Elsevier, cop. 2022. VII, 275 pp., illustr. ISBN 978-0-12-822954-5.

Soil organic carbon stock capacity in karst dolines under different land uses

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Hyperlink:
https://www.sciencedirect.com/science/article/pii/S0341816222005343

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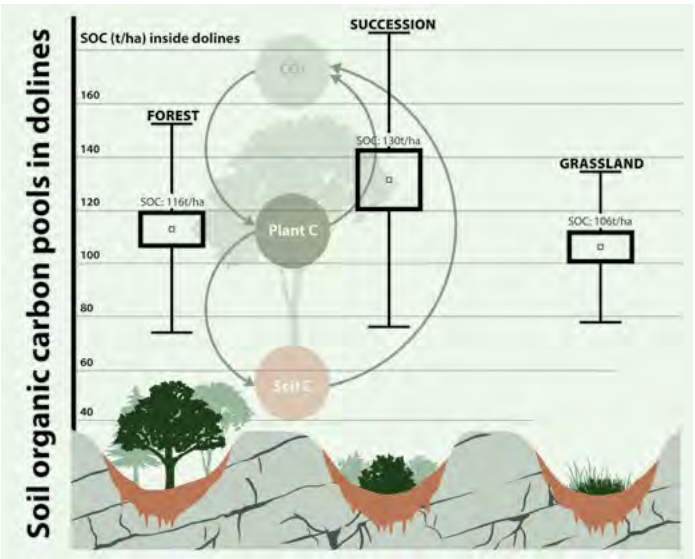
The paper highlights the importance of karst landscapes in terms of climate change and their role in the carbon cycle, especially in organic carbon sequestration.

Dolines are representative landforms in karst landscapes and occur all over the world. They have been identified in this study as natural pools for soil organic carbon (SOC) sequestration and are therefore important in terms of land use change and climate change. The SOC content was measured in forest, shrub and grassland soils of dolines in the Kras Plateau. Meadows showed the lowest stock (106 t/ha), shrubland the highest (130 t/ha) and forest in between with 116 t/ha. Given the trend of abandonment of agricultural land, an increase in the overgrowth of dolines can be expected, and thus an increase in the organic carbon stocks of forest soils. Conversely, there is a decrease in grassland at the expense of urban areas. In the Kras Plateau, the SOC sequestration potential in dolines in 2020 was 12,538 t/ha lower than in 2002, precisely due to the spreading of built-up areas over grasslands. In general, there is a lack of studies on the SOC stocks in dolines.

Our study is the first globally to provide results in this field and therefore provides an important basis for further research on organic carbon stocks in karst landscapes worldwide.



Source: BREG VALJAVEC, Mateja, ČARNI, Andraž, ŽLINDRA, Daniel, ZORN, Matija, MARINŠEK, Aleksander. Soil organic carbon stock capacity in karst dolines under different land uses. *Catena: an interdisciplinary journal of soil science, hydrology-geomorphology focusing on geology and landscape evolution.* [Printed ed.]. November 2022, vol. 218 [art. no. 106548], pp. 1-10, illustr. ISSN 0341-8162.

Publication in Biodiversity and Conservation

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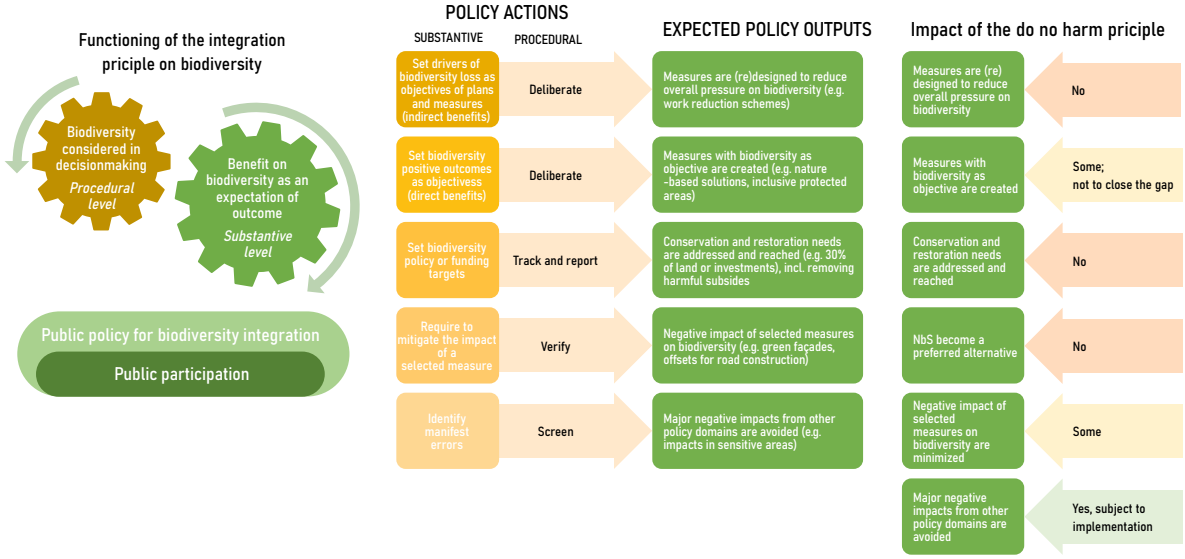
https://doi.org/10.1007/s10531-023-02542-w

DOI:
10.1007/s10531-023-02542-w

Although science widely supports moving towards transformative change through integrating biodiversity into decision-making, and arguing for the essential role of public authorities, it falls short on suggesting specific means to that end. This article considers the EU's approach to fostering the green transition as part of its post-pandemic recovery while exploring how the integration of biodiversity considerations could be integrated into decision-making. The rationale and implementation of the EU's *do no harm* principle is examined, which functioned as a condition for public funds. The analysis shows the abovementioned EU policy innovation has a very limited impact. The role of *do no harm* has been limited to validating, rather than initiating policy measures. It has failed to influence the design of measures such that they would benefit biodiversity and has not encouraged synergies between the climate and biodiversity goals. Based on the experience with *do no harm* as well as the more focussed regulatory action directed at the goal of climate neutrality, the article lists key steps for fostering biodiversity integration in policy planning and policy implementation. These steps encompass substantive and procedural approaches and aim for deliberation, target-setting, tracking, verification and screening. There is considerable scope for robust regulation to play a role in support of the biodiversity goals alongside transformative bottom-up initiatives.



Source: PENCA, Jerneja. Public authorities for transformative change: integration principle in public funding. *Biodiversity and conservation.* 2023, vol. 32, pp. 3615–3639, illustr. ISSN 0960-3115.

Slovenian Research and Innovation Agency

SHORT NAME:
ARIS

YEAR OF ESTABLISHMENT:
2023 (its predecessor Slovenian Research Agency 2004)

CORE ACTIVITY:
Performance of professional, development and executive tasks related to the implementation of the adopted Resolution on the Slovenian Scientific Research and Innovation Strategy or its individual parts, and other tasks promoting scientific research activities in order to ensure permanent, professional and independent decision-making on the selection of scientific research activities financed from the national budget.

NUMBER OF EMPLOYEES AS OF 31/ 12/ 2023 IN LINE WITH THE ESTABLISHMENT PLAN:
73

FUNDS RECEIVED FROM THE NATIONAL BUDGET ALLOCATED TO SCIENTIFIC RESEARCH ACTIVITIES IN THE 2023 FINANCIAL YEAR:
EUR 331.5 mio

BASIC DOCUMENTS:
Scientific Research and Innovation Activities Act (Official Gazette of the Republic of Slovenia, No. 186/21 and 40/23)

Decision establishing the Public Research Agency of the Republic of Slovenia (Official Gazette of the Republic of Slovenia, No. 103/22 and 125/22)

Decision establishing the Public Scientific Research and Innovation Agency of the Republic of Slovenia (Official Gazette of the Republic of Slovenia, No. 48/23)

Resolution on the Slovenian Scientific Research and Innovation Strategy 2030 (Official Gazette of the RS, No. 49/22)

WEBSITE:
https://www.aris-rs.si/en/index.asp