JOŽEF STEFAN INTERNATIONAL POSTGRADUATE SCHOOL

Summary of Self-Evaluation Report for 2020/21 Academic Year

Mission · Integration into Environment and Society · Study Programmes · Higher Education Teachers · Students · Student Achievements · Social Life · Student and Research Support

DEAN'S FOREWORD

Prof. Milena Horvat, Dean

The research and educational process in an intensive and innovative research environment is instrumental in strengthening the development potential of science and high technologies in the society. Precisely this is also the vision of the educational process at the Jožef Stefan International Postgraduate School (IPS), which interlaces basic research with postgraduate education and technological development. During the pandemic and limited social interactions, the IPS had to adjust its operating methods and focus on remote work. Modern communication tools allow to hold classes in a virtual environment, however this new modus operandi left a certain mark on a generation of students that will be hard to erase. Despite all the restrictions, the IPS students achieved enviable accomplishments in the 2020/21 academic year, which are also summarised in this short and colourful report. For several consecutive years, the IPS has been well above the Slovenian average by the quality and number of successfully completed doctoral dissertations and master theses, and is comparable with international universities. Establishing international connections and actively including students in Slovenian and international projects helps spread the word about the IPS around the country and worldwide. We are proud of our students' achievements, which are also a result of close collaboration with partner institutions that established the IPS back in 2004. A special thank you goes to the IPS supervisors and associates who also played a very important role in their students' successful work. The IPS will continue to create conditions for successful work of its students and actively include them in Slovenian and international research projects and research challenges in the industry, as well as create the best conditions for an active exchange of students that will compensate for the lack of social contact in the past years.

PRESIDENT'S FOREWORD

Prof. Vito Turk, President

The Jožef Stefan International Postgraduate School has been active for almost 20 years now and in the meantime it more than justified its establishment by doing quality work. It was established by the JSI academic sphere in collaboration with the industry, and it was later joined by the National institute of Biology and the Institute of Metals and Technology. All these scientific research institutions carry out independent or collaborative quality research that is often of interdisciplinary nature. Numerous excellent publications and awarded patents are a testament to the success of our graduates, which ranks our school, considering its size, among the very best of Slovenian science. It is also a fact that the IPS enrols, as a rule, students of very high quality into its study programmes, which successfully complete their studies in the research and educational process while being in constant contact with quality supervisors and, considering our circumstances, relatively modern equipment. Thus acquired knowledge helps them successfully take up new challenges at home and abroad. But it needs to be made clear that today higher education and science belong to the generation of no borders! This means that the path takes these generations to where they can nurture their ambitions and create normal living conditions. Unfortunately, this also includes some of our graduates which then choose to stay abroad. That is why it must be stated clearly that countries and theirs governments are solely responsible for the excellence in science. Developed countries are well aware of that and therefore rapidly invest significant financial resources in this field of the human mind. Only excellent knowledge with its ground breaking achievements can enable innovation and products on which the economic growth, standard of living, power and reputation of a country depend. Consequently there is no brain drain, but brain circulation. Unfortunately this is not the case in Slovenia. The longer we wait, the worse the situation. Unfortunately no progress can come from the promises that we have been listening to for many years now. Considering such working conditions, often incomparable with conditions from developed countries or even in some developing countries, our postgraduate school is more than successful.

Mission of Jožef Stefan IPS

The mission of the Jožef Stefan International Postgraduate School (hereinafter IPS) is **to ensure the highest quality of master and doctoral postgraduate studies** with the help of a research and educational process in an intensive R&D and innovative environment.

Additionally, the school aims **to contribute to strengthening the role of excellent science and high technologies** in the development potential of the society, which can significantly contribute to the **economic power and harmonious social development**. The IPS acts as a **centre of excellence** closely interlacing **basic research with postgraduate education and innovation development**.

Research achievements are directly incorporated into innovation projects aimed at developing production, service activities, and management. IPS masters and doctors, together with their supervisors and co-supervisors, contribute to new achievements in basic research and innovation development.

Slovenian Quality Assurance Agency for Higher Education (**NAKVIS**) established that in addition to the legal provisions, the IPS also meets the Criteria for Accreditation and Reaching Quality Standards, as defined in the Criteria, and therefore prolonged the accreditation of the school until 30 September 2024.

COLLABORATION WITH NATIONAL INSTITUTES

The basic strategy of the IPS is to **invite leading researchers** from the founding and partner institutes in the selected fields, and include them in the research and educational process of the school. In collaboration with the IPS founders and partners, who also provide state-of-the-art research infrastructure, the school therefore ensures material and intellectual capacities in order to educate new masters and doctors of science.

Jožef Stefan Institute (JSI)
Institute of Metals and Technology (IMT)
National Institute of Biology (NIB)

INDUSTRIAL PARTNERS

17 founders and associate partners:

BSH, Nazarje
Cosylab, Ljubljana
Domel, Železniki
ETI, Izlake
Gorenje, Velenje
HYB, Šentjernej
Kolektor Group, Idrija
LTH Castings, Škofja Loka
Luka Koper, Koper
Premogovnik Velenje, Velenje
Salonit, Anhovo
Slovenian Insurance Association, Ljubljana
Štore Steel, Štore
Telekom Slovenije, Ljubljana
Termoelektrarna, Šoštanj
Trimo, Trebnje
Unior, Zreče

The IPS was established mostly out of the need for an efficient transfer of excellent research achievements to the industry and the service sector.

The school aims to contribute to strengthening the role of excellent science and high technologies in the development potential of the society.

The IPS acts as a centre of excellence closely interlacing basic research with education and innovation development.

The IPS fosters collaboration with excellent Slovenian and international institutions, scientists and research groups.

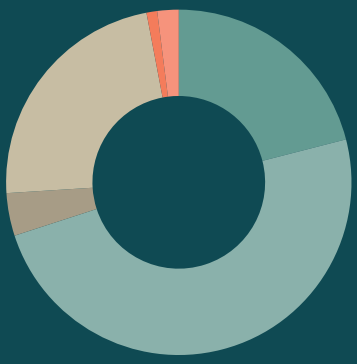
Integration of IPS into Environment and Society

The IPS cultivates this integration by directly connecting and implementing all its activities with founding and partner institutes, by contributing to the world treasury of knowledge, and by increasing the efficiency of drawing from it. Great concern is devoted to inviting excellent Slovenian and foreign institutions to collaborate with the IPS in the field of study programmes, projects and special actions by individually including international leading scientists as IPS visiting professors and by encouraging collaboration between IPS professors and leading research groups in the framework of joint projects.

IPS STUDENTS FROM AROUND THE WORLD

42 % of IPS students come from outside of Slovenia (shown as green on the map), mostly from Europe:

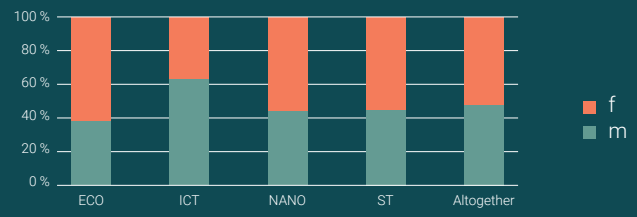
Argentina
Azerbaijan
Belgium
Benin
Bosnia and Herzegovina
Montenegro
the Philippines
Finland
Ghana
Greece
Croatia
India
Italy
China
Colombia
Kosovo
Cuba
Morocco
Germany
Pakistan
Romania
Russian Federation
North Macedonia
Serbia
Turkey
United Kingdom



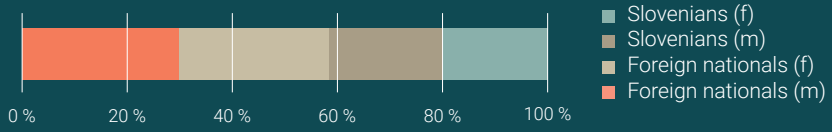
ENROLLED STUDENTS BY REGION

- EU countries
- Non-EU countries
- Africa
- Asia
- North and Central America
- South America

STUDENT STRUCTURE BY SEX AND STUDY PROGRAMMES



STUDENT STRUCTURE BY SEX AND NATIONALITY



COVID-19 RESPONSE

Here at IPS, we regularly monitor the current situation related to COVID-19 at home and abroad. All teaching, research and professional activities continue to take place without limitations. We inform our employees and students about the instructions of competent authorities regarding the prevention of SARS-CoV-2 virus infections, and we implement the preventive measures suggested by experts on a daily basis. Lectures and defences are carried out in accordance with the current epidemiological situation. When the circumstances do not allow the teaching activities to take place in person, we organise the lectures, consultations and defence sessions online through the Zoom app. Just like many other higher education institutions, we gained in the past two academic years extensive experience and adopted new approaches to virtual teaching and learning. Even if IPS work often takes place from home, the IPS Office ensures constant support to all students and provides virtual counselling. During the COVID-19 pandemic, the IPS also marked a decline in international mobility and a slower pace of studying. Despite the current difficult and uncertain conditions in the society, the IPS employees and students strive to keep the social life alive at the IPS. Students especially play an important role in doing so by organising various virtual events, among which we have to point out the successful organisation of the 13th IPS Students' Conference, even during the COVID-19 pandemic.

IPS PROJECTS

The IPS has its own research group which runs a Slovenian Research Agency (ARRS) programme and various projects. The school also acquired two **Interreg VA Italy-Slovenia** projects. The **TRAIN** project focuses on the topic of Big Data and disease models: A cross-border platform of validated kits for the biotech industry. The **GRENHULL** project covers the topic of innovative green technologies for ecological cleaning of biological incrustation on hulls in the Upper Adriatic. The school also prolonged the **Competence Centre for Factories of the Future** (KOC-TOP) project until 2022 and expanded the consortium to 50 partners. In 2021, the school acquired a two-year project **RESPO X** within the framework of **Erasmus+ KA2** Partnerships for cooperation in tertiary education, which led to a collaboration of IPS with three higher education institutions from Spain, Belgium and the Netherlands. The aim of the project is to develop and implement a RESPO X web application which provides the students a systematic solution in deciding regarding the optimal training for improving their professional and personal competences and skills necessary for future employment. The IPS also participates in the **IPM Decisions** project within the framework of the **Horizon 2020** programme which will develop a web platform designed for farmers and advisors to help them monitor and manage pests.

INTERNATIONAL AGREEMENTS

The IPS currently holds **42 collaboration** agreements with foreign research and higher education organisations (shown as dots on the map):

Adam Mickiewicz University, Poznań, Poland
Al-Farabi Kazakh National University, Almaty, Kazakhstan
Anadolu University, Eskisehir, Turkey
Aristotle University of Thessaloniki, Greece
Babeş-Bolyai University, Cluj-Napoca, Romania
Bauman University, Moscow, Russia
Deggendorf Institute of Technology, Germany
École Nationale Supérieure d'Informatique pour l'Industrie et l'Entreprise, Évry, France
Joint Institute for Nuclear Research, JINR, Dubna, Russia
Josip Juraj Strossmayer University of Osijek, Croatia
Korea Advanced Institute of Science and Technology, KAIST, Daejeon, South Korea
Mahatma Gandhi University, Kottayam, Kerala, India
Mining-Metallurgical Institute of Tajikistan, Tajikistan
Montanuniversität Leoben, Austria
Mustafa Kemal University, Antakya, Turkey
Nuclear Technology Development Center (CDTN), Belo Horizonte, Brazil
Roskilde University, Denmark
Sabanci University, Istanbul-Tuzla, Turkey
Slovak University of Technology in Bratislava, Slovakia
Technical University of Cluj-Napoca, Romania
Technical University of Darmstadt, Germany
Tokushima Bunri University, Tokyo, Japan
Tomas Bata University in Zlín, Czech Republic
Universidad Autonoma de Madrid, Spain
Universidade de São Paulo, Brazil
Universidad Nacional del Sur, Bahía Blanca, Argentina
Universitat de Barcelona, Spain
Universitatea din Bucuresti, Romania
University of Amsterdam, the Netherlands
University of Antwerp, Belgium
University of Belgrade, Serbia
University of Gdansk, Poland
University of Ioannina, Greece
University of Porto, Portugal
University of Salerno, Italy
University of Udine, Italy
University of Wrocław, Poland
University of Zagreb, Croatia
Università degli Studi di Perugia, Italy
Université de Limoges, France
Université de Lorraine, Nancy, France
Université François Rabelais, Tours, France
University of Ljubljana, Biotechnical Faculty, Slovenia
University of Parma, Italy
University of Nova Gorica, Slovenia
Zhejiang University, Hangzhou, China

Study Programmes

NANOSCIENCES AND NANOTECHNOLOGIES

master and doctoral degree programme

The Nanosciences and Nanotechnologies programme represents a field at the crossroads of physics, chemistry, and biology, combined with elements of electrical engineering, medicine, and environmental sciences. It explores nature and the use of systems with components of nanometric size. Potential applications can also be found in almost all economic sectors.

PROGRAMME PRESENTATION

The principal objective of studying nanosciences is t**o acquire the understanding of the structure and dynamics of materials at an atomic and molecular level**, which is also the basis for their macroscopic properties. Through knowledge of methods of atomic and molecular micromanipulation **we can build new molecules, devices and machines** with entirely new properties and possibilities of application. Some examples are projects aimed at building atomic-scale computer components, constructing new sensors at a molecular level, which can sense specific viruses and bacteria, magnets at a level of specific molecules, nanoparticles that serve as carriers of active substances for targeted cancer therapies, micromotors and molecules which can use sunlight to control environmental contaminants.

One of the programme's virtues is also **successfully ensuring multidisciplinary approaches** of nanophysics, nanochemistry, biosciences, material sciences and nanomechanics. This systematic cultivation of coordinated inter- and multi-disciplinary approaches allows for a **fast discovery of new fields of applications**. This is also supported by the project-oriented structure of the study programme, as all students are **directly involved in economic, national, and international projects**. Within the framework of projects and alongside research work, they discover and deepen the methods for creating, transferring and applying knowledge. Being involved in the projects gives the students a**ccess to the state-of-the-art research equipment** within the JSI, associate institutes, and centres of excellence.

PROGRAMME IN THE CONTEXT OF USER NEEDS

Nanosciences and Nanotechnologies is an interdisciplinary study programme covering the following research fields:

1. **new nanomaterials and nanochemistry,**
2. **nanophysics** (including physics of artificial nanostructures and the development of methods of research and nanomanipulation of atoms and molecules, and their dynamics),
3. **biosciences** (including biomedicine),
4. **advanced metallic materials**,
5. **nanomechanics** (including mechanics of time-dependent materials).

All the fields also include the fundamental knowledge needed for establishing successful communication with experts in the field of **commercial and civil law, microeconomics of companies and project management, and the basics of sustainable development**.

More information:

MASTER STUDIES

DOCTORAL STUDIES

The Nanosciences and Nanotechnologies programme attracts a lot of students each year. The principal reasons behind that are the prospects of nanotechnologies in relation to the development of high technologies and products with high added value. To the same extent, young researchers are also attracted by breakthrough research in this particular field, interesting international projects and excellent researchers acting as their supervisors.

The implementation of the study programme is interlaced with national and especially EU projects within which ICT achieves enviable results in both the scope and complexity of research which also directly involves the students of the school.

INFORMATION AND COMMUNICATION TECHNOLOGIES

master and doctoral degree programme

Information and Communication Technologies is an interdisciplinary postgraduate study programme following the latest tendencies in the field. With excellent research results it also directly contributes to surpassing the existing boundaries of knowledge and technologies in the field. The study programme includes the following fields: knowledge technologies, advanced internet technologies, computer structures and systems, information security systems, intelligent systems and robotics, and advanced concepts in telecommunications.

PROGRAMME PRESENTATION

The study programme is oriented towards **solving actual problems and challenges of the modern society**. Examples of such challenges are the **Future Internet** and the **Internet of Things** as factors that will have a decisive impact on the life of the society in the future years, and lately also the digitalisation of economic operators, the development of services of the digital market, and artificial intelligence. Despite concerns that the Future Internet and the Internet of Things interfere with the living space of an individual, they should in fact be **accepted as a challenge for further development and an opportunity to realise creative ideas**. The reoccurring economic crises will also shape the future of workplaces in numerous branches of economy. Basic knowledge of information and communication technologies is crucial even for our sole survival, while a more profound knowledge of the field is becoming **vital in research work, development of new products and services, economic analyses, medicine, and the entire field of sustainable development**.

PROGRAMME IN THE CONTEXT OF USER NEEDS

Modern information and communication technologies are of key importance for the economic and social progress: new and efficient ways of exchanging information expand the development possibilities of production, the service sector, scientific, cultural and social establishments, and in addition fundamentally support the transfer of knowledge with the aim of sustainably developing a knowledge society. In the increasingly globalised economy, the information and communication technologies are crucial for ensuring competitiveness and economic growth of companies, as well as entire countries.

Development of the knowledge society primarily depends on the development of the knowledge-based economy which further on depends on the most educated and enterprising experts who master quick access to information, efficient ways of managing it and recognising essential messages, as well as its incorporation into problem solving within the development and optimisation of new procedures, products, and services.
Information and communication technologies play an important role in increasing the employment structure in every single field since Europe – and Slovenia within – can face the world competition only with a highly competent workforce that masters digital skills and where the ability of quickly acquiring, managing, transferring and applying information is an inevitable requirement of the modern management.

For the needs of integration into the emerging European digital market, attention in delivering the learning content will be devoted to the digitalisation of the economy, which is a prerequisite for an equal position of economic operators in the implementation and operation of the digital market and related trust services.

The Information and Communication Technologies postgraduate study programme therefore provides to future masters and doctors of science fundamental knowledge in the given fields, while at the same time it prepares them for solving key development problems, such as increasing the efficiency of production and marketing processes, management support in companies, administrative authorities and in banking, upgrading business processes with ICT technology, ensuring business security, developing new branches of economy, environment and health protection, as well as creating new quality employment opportunities in all the given fields.

Within the programme, research is mostly conducted in the following fields:

1. **knowledge technologies,**
2. **advanced internet technologies,**
3. **computer structures and systems,**
4. **intelligent systems and robotics,**
5. **modern concepts in telecommunications.**

The application of acquired knowledge **includes management of networks, high performance computer resources and artificial intelligence technologies, as well as data mining for computer-assisted analysis of databases/data wa**rehouses generated as a result of scientific research in the fields of physics, chemistry, biology, biochemistry and pharmacology, bioinformatics, environmental sciences, and also in the fields of social and economic sciences, as well as the data that is accumulated as a result of ambient measurements and data acquisition on the Internet.

More information:

MASTER STUDIES

DOCTORAL STUDIES

ECOTECHNOLOGIES

master and doctoral degree programme

The Ecotechnologies programme incorporates science that supports the efforts of meeting the needs of the humankind in harmony with nature while causing as little damage to the environment as possible, especially by efficiently incorporating natural processes. As it is oriented towards solving actual problems, which calls for a comprehensive approach, ecotechnologies are characterised by bringing together achievements from natural, technological and social sciences, which are oriented towards sustainable development. That makes the multidisciplinary approach a strong characteristic of the Ecotechnologies programme. Emphasis is also placed on the environmental and economic approach.

PROGRAMME PRESENTATION

The strategy of sustainable development incorporates the **integration of environmental, technological, economic and social objectives, especially in production and consumption**. The study programme provides the acquisition of knowledge and the development of skills in order to be able to carry out competent research, **establish international connections, and manage sustainability-oriented development**, transfer and application of ecotechnologies.

The emphasis is placed on threefold qualifications:

- **broadening and deepening of scientific content, methods and techniques** in selected fields of natural sciences, technologies, engineering and informatics, which will support the strategic choice, development, transfer, optimisation, exploitation and supervision of selected ecotechnologies for **improving business efficiency while at the same time satisfying broader social interests in sustainable development**,
- developing competences and skills for **raising the quality of processes, products and services, and increasing the added value** while striving for excellence and maximal enforcement of the principles of sustainable development,
- **developing an integral way of thinking** which surpasses individual fields and develops competences for: communicating with experts from other disciplines and fields, **comprehensive problem definition, systemic approaches, decision-making and solving complicated problems** in teams, and strategic planning with a long-term perspective.

It should especially be emphasised that the school systematically steers the Ecotechnologies postgraduate study programme from the previously predominant environment protection content to a **more comprehensive orientation towards sustainable development, especially for improving the efficiency of using input materials and energy sources**. This requires a significantly stronger emphasis on a more efficient development and transfer of ecotechnologies and introducing sustainability-oriented consumption. Considering these demands, the Ecotechnologies programme requires the development and implementation of multidisciplinary synthesis methods, which the IPS systematically cultivates in the framework of postgraduate research oriented towards sustainable development.

More information:

MASTER STUDIES

DOCTORAL STUDIES

PROGRAMME IN THE CONTEXT OF USER NEEDS

The Ecotechnologies study programme is embedded in **development projects intended to achieve ecotechnological reform and progress in the production, service ac**tivities, and public services. The programme emphasises economic efficiency alongside environment protection. Most research is tied to solving actual problems in the following fields:

1. **tools for environmental quality control** which also include integrated modelling tools for political decision-making,
2. **development and testing of environmentally acceptable materials,**
3. **characterisation and treatment of waste and waste waters,**
4. **water management,**
5. **plasma technologies,**
6. **development of intelligent systems for environmental quality control,**
7. **sustainable civil engineering,**
8. **food and environmental health technologies.**

One of the programme's virtues is also that it successfully ensures **multidisciplinary approaches** which include the following fields: chemistry, geology, biochemistry, biological sciences, biotechnology, hydrology, ecotoxicology, chemical engineering, biostatistics, and modelling. In addition, these disciplines are to a great extent intertwined with tools that ensure **support to political decision-making in the field of environment and human health and/or ensure a practical value in the industrial environment**. This is also supported by the project organisation of executing the study programme, as all students are directly involved in economic, national, and international projects. Within the framework of projects and alongside research work, they discover and deepen the methods for creating, transferring and applying knowledge. Being directly involved in these projects gives the students access to the state-of-the-art research equipment within the JSI, associate institutes, and centres of excellence.

The implementation of the study programme is intertwined with national and especially EU projects within which the Ecotechnologies programme achieves enviable results – both in the scope and complexity of research which also directly involves the postgraduate students of the school.

SENSOR TECHNOLOGIES

doctoral degree programme

The Sensor Technologies programme is an interdisciplinary doctoral study programme that was first implemented in the 2016/2017 academic year. Sensors have become an invisible yet indispensable part of our world. For example, our cars are full of sensors for regulating the engine functioning, speed, fuel consumption, temperature, ventilation and, last but not least, our own safety. Environmental sensors are crucial for pollution control. Biosensors, among which nanosensors, promise considerable progress, especially in healthcare. Designing and manufacturing of so many different sensors is enabled by sensor technologies which are based on outstanding achievements in science and technology. The Sensor Technologies study programme connects knowledge from the fields of physics, chemistry, biology, materials, environmental and technical sciences, nanosciences and nanotechnologies, as well as information and communication technologies.

PROGRAMME PRESENTATION

The objective of the doctoral **degree programme is to acquire knowledge of sensors and s**ensor technologies from the selected fields of physics, chemistry, materials, environmental and technical sciences, nanosciences and nanotechnologies, as **well as information and communication technolo**gies. It also encourages the development of an integral way of thinking as a foundation for interdisciplinary research. Beside mastering the methods and techniques of research work, the students will also develop competences for conducting independent and team R&D work and for using the acquired knowledge in practice.

PROGRAMME IN THE CONTEXT OF USER NEEDS

The programme systematically **connects knowledge from the field of sensors and sensor technologies with great international expertise in order to educate a highly-skilled workforce** to support the penetration of economic development projects to the global market while at the same time ensuring socially balanced sustainable development.

This interdisciplinary study programme **provides the acquisition of knowledge and the development of skills in order to be able to carry out competent research, transfer the scientific achievements to industrial development, and establish international connections** in the following fields of sensor technologies:

1. sensors for ionizing photons and particles,
2. physical and chemical sensors,
3. biosensors,
4. information and communication technologies in sensorics.

The implementation of the study programme is intertwined with **national and international projects**, especially within the framework of the European Community, and projects carried out with partners from the industry.

More information: DOCTORAL STUDIES

Sensors help us recognise selected conditions in the environment in real time and react to them systematically. Their application possibilities therefore stretch to almost all fields of human activity. With increasing economic and environmental demands, the sensors have become an important integral part of the so-called "smart" devices and thus a promising opportunity for the economy.

IPS Teaching Staff

A great majority of IPS higher education teachers are employed full time at IPS founders and partners, especially at the Jožef Stefan Institute which is also the seat of the IPS. Supervisors are therefore available to collaborate with the students directly.

The structure of academic titles for **182** IPS higher education teachers is the following: **91** full professors, **47** associate professors, **44** assistant professors. We only have 6 teaching assistants as the research and education process of the postgraduate studies requires a predominantly highly demanding and individualised supervision work. The share of less demanding group forms of study, which normally require the help of teaching assistants, is very small. Considering the study fields and the standard of studies at the IPS, our postgraduate students are in fact already at the level of teaching assistants.

TEACHING STAFF SELECTION CRITERIA

The basic criteria for selecting the teaching staff of the Jožef Stefan International Postgraduate School are **their internationally highly acclaimed scientific quality, development-oriented attitude, and talent for supervising students**.
Since 2019, a domain has been available on the SICRIS website, which gives access to bibliographic indicators of performance for appointment to title. Among other criteria is also their creative role in national, European and international projects, where they also include the IPS students, and their willingness to adapt the study programmes according to the specific needs of a student's research work, i.e. the so-called "tailored studies".

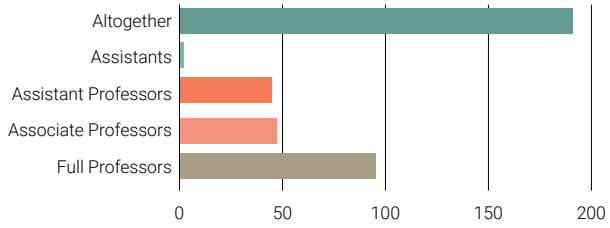
VISITING PROFESSORS

The IPS is especially interested in directly including **brilliant scientists** from leading research groups around the world in IPS programmes. Such groups usually operate within **acclaimed institutions**. The IPS systematically maintains personal contacts of its professors with colleagues from such research groups and invites them individually as visiting professors. These are as a rule brilliant scientists – experts in fields selected based on the **achievements** of the leading branches of science and economic interests.

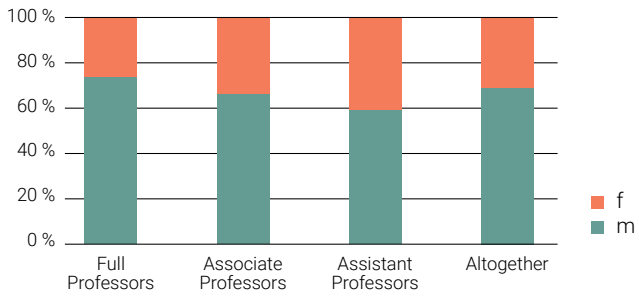
SUPERVISION

Master theses and doctoral dissertations are the main part of the studies at the IPS. The **quality of conceptualising** the topic of a master thesis or a doctoral dissertation is therefore at **the centre** of all student interactions with their higher education teachers and especially their supervisors. Supervision initiates the moment students **first come** to the IPS, when they start discussing their **"tailored studies"**, generally in breakthrough research fields or in fields that are economy- and development-oriented. It starts with the conceptualisation of the research topic, which is then discussed by the Study Commission and approved by the IPS Senate, and concludes with carefully monitoring the realisation of the master thesis or doctoral dissertation. Special attention of the IPS **is therefore devoted to the supervisor selection procedure which takes place in two phases**. The first supervisor helps the student as a mentor before the enrolment, especially in outlining the individually selected study programme, and monitors the student during the first semester. After that, the student can keep the same supervisor or select a new one. If the topic covers several specific fields, the student is appointed one or more co-supervisors. If the topics are directly development-oriented, the students are also appointed supervisors from the industry who help direct their research work systematically and apply their achievements into practice in real time.

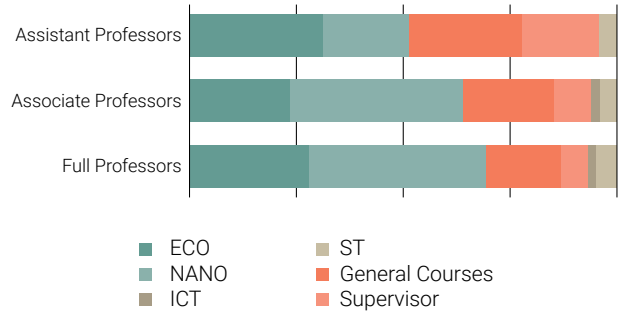
STRUCTURE OF ACADEMIC TITLES



HIGHER EDUCATION TEACHER STRUCTURE BY SEX



STRUCTURE BY ACADEMIC TITLES AND STUDY PROGRAMMES



QUALITY OF THE TEACHING STAFF

The quality of the majority of professors and assistant professors at the IPS is at an **enviably high level** according to scientific criteria. The same goes for their participation in **national and international projects**, whereas a lot of them are still gaining experience in directly transferring the research achievements into practice. To this end, we **enhanced our collaboration with the industry and the service sector**. Continuous professional training, both in the field of education and scientific research, is a compulsory element of the work of IPS higher education teachers. To develop the pedagogical skills of its teachers, the IPS offers them training in the field of higher education didactics (for example within the INOVUP project) and encourages mobility in the international environment.

The IPS regularly monitors the work of its professors by:

- assessing the **scope and quality of their scientific publications** in internationally renowned scientific journals and the scope of their citations – with a special emphasis on including the research achievements of IPS students,
- monitoring the participation of IPS supervisors and students in national and international projects,
- supporting the **collaboration** of IPS professors **with the industry**, especially in regard to target-oriented R&D projects, and protecting the intellectual property of their achievements,
- **evaluating**, with the help of committees, **the interim results** of the research and educational process for each student at research seminars held in each study year, and giving assessment and pointers for future work,

- regularly monitoring the work of supervisors within the framework of the Programme and Central Study Commissions with special committees designated for this purpose, from conceptualising the topic of doctoral dissertations to gradually realising the set out plans and finally assessing the quality of the submitted dissertations.
  In the 2020/2021 academic year, the IPS processed:
  17 master thesis topic proposals,
  40 doctoral dissertation topic proposals and
  7 master thesis proposals and
  31 doctoral dissertation proposals,
- anonymously surveying the students at the end of each academic year regarding the quality of the IPS teaching staff and informing all the participants of the outcomes. If the given results show less than 80 % of the maximum quality assessment (below 4 out of 5), the IPS Dean carries out individual interviews with the concerned parties and addresses the problems in board meetings. In the 2019/2020 academic year, the questionnaire was updated with new questions which were improved based on acquired experience.
  The results of the questionnaire for the 2020/2021 academic year were the following:
  average grade of professors was **4.44**,
  average grade of courses was **4.21**.

OUTSTANDING ACHIEVEMENTS AND AWARDS RECEIVED BY PROFESSORS 2020/2021

Prof. Borka Jerman Blažič – Puh Lifetime Achievement Award 2021 for her merit in the development of information and communication technologies and their implementation in the Slovenian society and economy

Prof. Dragan Mihailović – associate member of the Slovenian Academy of Sciences and Arts (SAZU)

Prof. Goran Dražić – Zois Award for top achievements in the field of transmission electron microscopy of materials

Prof. Aleš Lapanje and **Dr. Tomaž Rijavec** – bronze medal for technology titled "A method for making spatially defined aggregates by precisely positioning cells based on electrostatic interaction" at the 19th International Exhibition of Inventions ARCA 2021, Zagreb

Prof. Radmila Milačič, Prof. Janez Ščančar and **Dr. Janja Vidmar** – published a book titled "Analysis and Characterization of Metal-Based Nanomaterials" with Elsevier, May 2021

Prof. Tomaž Grušovnik – published a monograph in the prestigious collection "Slovenian Philosophical Thought"

Prof. Kristina Gruden – Pregl Award for Outstanding Scientific Achievements; listed among the ARRS 2021 Excellent in Science achievements for her contribution titled "Ménage à Trois: Unraveling the Mechanisms Regulating Plant-Microbe-Arthropod Interactions and Guidelines for Their Research"

Asst. Prof. Mojca Otoničar and **Prof. Tadej Rojac** – best achievement of ARRS 2021 Excellent in Science for their contribution titled "Disclosing the Influence of Polar Disorder on the Response Dynamics of Ferroelectric Materials"

Dr. Nataša Hojnik and **Dr. Martina Modic** – best achievement of ARRS 2021 Excellent in Science for their contribution titled "Unravelling the Pathways of Air Plasma Induced Aflatoxin B1 Degradation and Detoxification"

Prof. Dušan Turk – co-authored an article titled "X-Ray Screening Identifies Active Site and Allosteric Inhibitors of SARS-CoV-2 Main Protease" in the Science journal

Prof. Uroš Cvelbar – co-authored an article titled "Stabilization of Liquid Instabilities with Ionized Gas Jets" in the Nature journal

Prof. Igor Serša – co-authored an article on the topic of comparing high-resolution MR and ultrasound imaging of a nerve fascicle in the Radiology journal

1:2

The professor : student ratio at the IPS is generally higher than 1 : 2

The quality of the majority of professors and assistant professors at the IPS is at an enviably high level according to scientific criteria. The same goes for their participation in national and international projects.

Our professors receive prestigious awards and recognitions every year.

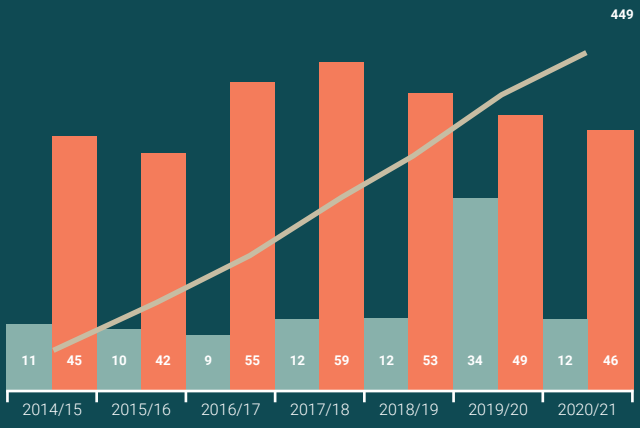
A significant factor of quality is the fact that the students work in their supervisors' research groups and are therefore normally in contact with them on a daily basis.

IPS Students

The school informs potential students about the studies at the IPS through responsible government institutions, media, invitations to IPS and JSI Open Days, IPS research and industrial partners, and, most efficiently, through personal contacts among potential candidates, students and the higher education teaching staff.

STARTING THE STUDIES

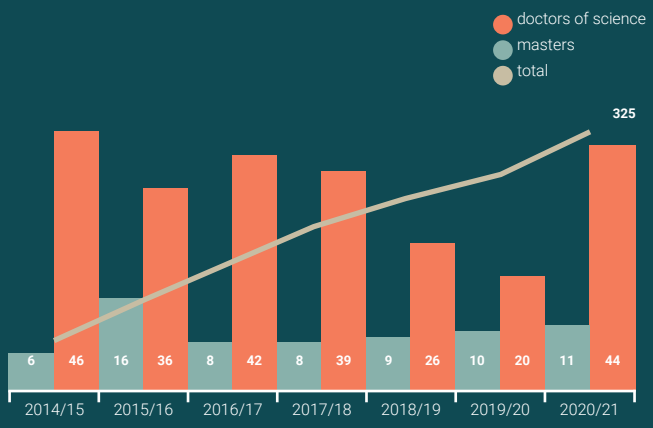
The IPS predominantly enrols students with considerable achievements from their undergraduate studies – the average grade of all students upon first enrolment at the IPS was nearly 9.0 in the 2020/21 academic year – 8.94 to be precise. However, undergraduate achievements are not the only criteria. The school holds systematic interviews with candidates for enrolment where we assess their creative disposition and research talent. An important role is also played by their potential employers, especially in the field of research and economy.



The graph shows the number of students enrolled in doctoral and master programmes, and the total per year.

COMPLETING THE STUDIES

The quality of master theses and especially doctoral dissertations at the IPS is high. The quality of the study process is at the European or even global level, as attested by student achievements, publications in high quality scientific journals, and patents.



The graph shows the number of completed master and doctoral studies, and the total per year.

The average grade from undergraduate studies of newly enrolled doctoral students per academic year:

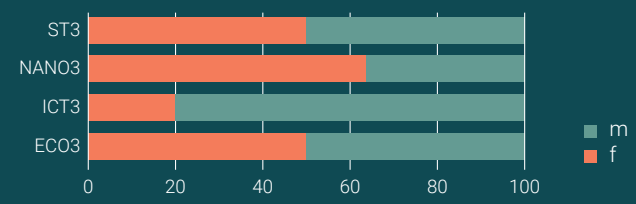
- 2014/2015 8,76
- 2015/2016 8,78
- 2016/2017 8,71
- 2017/2018 8,75
- 2018/2019 8,85
- 2019/2020 8,78
- **2020/2021 8,97**

Average time needed to complete the studies (applies to 2020/2021):

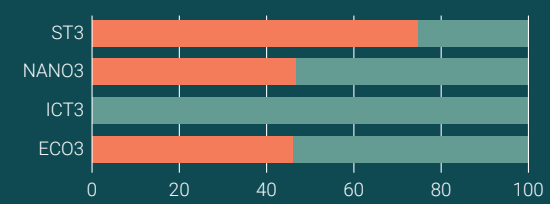
- Doctoral studies: **4,8 years**
- Master studies: **2,5 years**

STUDENT STRUCTURE BY SEX IN 2020/2021

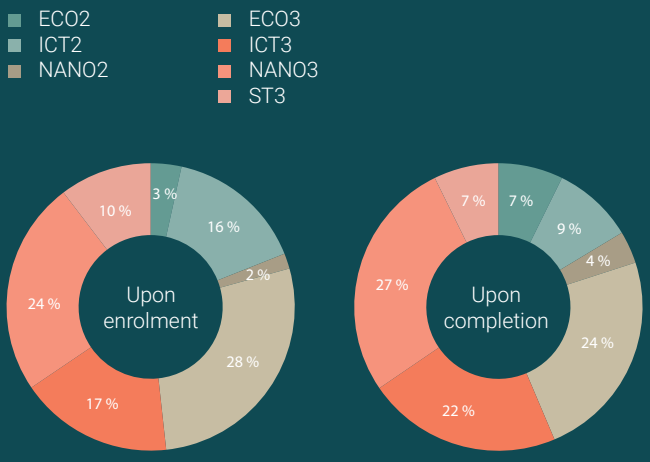
Doctoral students upon enrolment



Doctoral graduates upon completing their studies



STRUCTURE BY STUDY PROGRAMMES IN 2020/2021



STUDENT COUNCIL

The Student Council is an official **body of the Jožef Stefan International Postgraduate School** (IPS), as defined in the IPS Statute, and therefore participates and takes equal part in joint decision-making in the IPS Senate, Academic Council, and Governing Board sessions. The Student Council has the right and duty **to give opinion and take part in joint decision-making regarding all matters related to the rights and duties of students**. The Student Council consists of **12 elected representatives** of students who select two representatives from among the members as the president and the vice-president.

EMPLOYMENT PREPARATIONS

The IPS prepares its students for employment from the very beginning. **Employment is an important conversation topic** from the initial enrolment interview and the first meeting with a potential supervisor. Consequently, it also helps design the student's curriculum. The emphasis is even stronger when selecting the topic of a master thesis or a doctoral dissertation which is usually at least roughly related to the future employment of the candidate. Students have the possibility of collaborating with **co-supervisors from the industry** or working supervisors. During their studies, they can also go on industrial secondments. **The IPS offers its students possibilities to establish direct contacts with founders and partners from the industry and organises activities designated for this purpose** (arranging visits of students and their supervisors to the industry, holding talks with responsible development officials in the economy and the service sector, organising meetings with IPS students and potential employers, etc.).

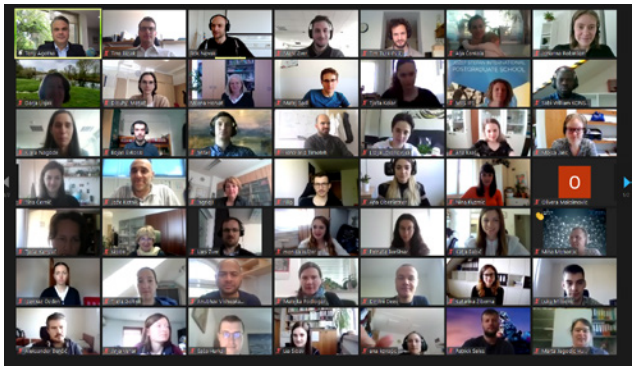
Employment of IPS doctoral graduates:
Out of **44 doctoral graduates** who completed their studies in the 2020/2021 academic year, **37 were employed in Slovenia** and **5 abroad**. We do not have employment information for 2 graduates.

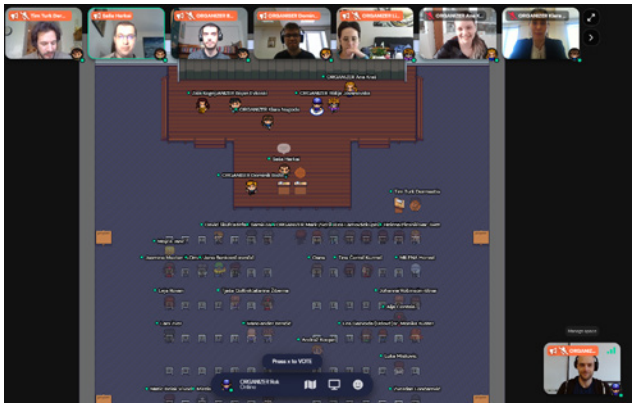
- Number of countries where they are employed: **6** (Slovenia, Ghana, Germany, Switzerland, United Kingdom, USA)
- Number of doctoral graduates who are employed in companies: **8**
- Number of doctoral graduates who are employed at foreign prestigious universities and research institutes: **3** (Helmholtz-Zentrum Dresden-Rossendorf, Faculty of Informatics of USI Università della Svizzera italiana, National Physical Laboratory – NPL).

IPS STUDENTS' CONFERENCE (IPSSC)

The most important event organised by the Student Council is the **annual Jožef Stefan International Postgraduate School Students' Conference** where the students from our school and also other faculties have the opportunity to **promote their research work**. At the beginning of the academic year, the students are invited to prepare a **presentation of their best research achievements in the form of a contribution and a poster** for the conference in May. The quality of submitted contributions is assured by a **careful review** which is done **by established researchers in specific fields**. Thus we can assure that students get proper feedback on their work from experienced scientists, and we ensure a higher quality of contributions.

May 2020/2021 marked already the **13th traditional IPSSC Students' Conference**. Despite the strong desire of organisers to carry out the event in person, the conference again had to take place online. For this purpose the IPS Student Council took advantage of the GatherTown web platform which enabled the participants to interact during the event and the students to present their virtual posters. The topic of the event was **"Through Knowledge Towards a Green New World"** which attracted the attention of many sponsors, such as Cinkarna Celje, Scan, Chemass, Sanolabor and Laško/Union, which joined the IPS, JSI and NIB as the main sponsors. More than 100 participants joined the event. The initial address which was given by IPS Dean Prof. Milena Horvat was followed by a **discussion with invited guest Anthony Agotha, diplomat of the European Union** from the field of EU Green Deal. The participants thus had the opportunity to ask and learn about various details, problems and solutions concerning the transition of the European Union and global economies towards a sustainable society. In addition to various lectures and activities that took place, **all students had the chance to present a summary of their work in three minutes**. This year, the awards for the best contributions went to Olivera Maksimović Carvalho Ferreira (best contribution), Žiga Tkalec (best poster), Saša Harkai (audience award) and Alja Čontala (most sustainable research work).





STUDENTS' ATTITUDE TOWARDS KNOWLEDGE IN SOCIETY AND ENVIRONMENT

IPS students take different roles to inform the public about knowledge and experience that they acquire during their studies and research work. They share their opinion through different communication channels: by attending and presenting at international symposia and conferences, participating in video presentations of research organisations, giving radio and TV interviews, writing national expert reports and bases, publishing scientific and professional articles and also through social networks, such as Twitter, within the framework of projects or their personal profiles. They gain experience by coordinating foreign visits to research groups and organising workshops and project meetings. They also act as editors of conference proceedings and international web portals, develop publicly accessible mobile and web applications and prepare databases. Some of them are already establishing themselves as visiting lecturers at foreign universities and working supervisors to master students.

STUDENTS' SCIENTIFIC RESEARCH EXCELLENCE

Within the framework of all study programmes, the students are systematically encouraged to write scientific articles for acclaimed international journals, scientific contributions for conferences, their abstracts and independent scientific compositions or chapters in monographs, patent applications, project proposals, and research reports, as well as to publish their research achievements in internationally acclaimed scientific journals and as patents.

PUBLICATIONS

The DELO newspaper analysed the data of eight Slovenian universities and postgraduate schools (published on 23 August 2019) and **established that the average number of publications per new doctor of science is the highest at the IPS**. A detailed examination of the published articles shows that their **number amounts to, on average, 4 articles per obtained doctoral degree in a 4-year period**, which is well above the average in the field of postgraduate studies of most universities. It should also be stressed that **more than a half of articles were published in international journals with impact factors** which contributed to a high number of citations. The articles written by IPS students and professors are also published in journals with the highest impact factor, i.e. **Nature and Science**.

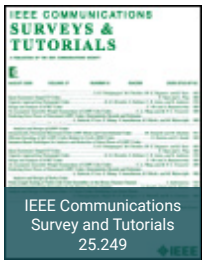
In the 2020/2021 academic year, **44 doctoral students** published a total of **139 scientific articles** in which they appeared as **lead authors** during the last five years prior to completing their studies at the IPS. Each doctoral graduate participated on average in 5**.68 publications in JCR**. **Average impact factor (IF*)** of journals where the IPS doctoral graduates published was **4.87**. If we only consider the contributions where the doctoral graduates acted as **leading authors**, the **IF** is even higher, i.e. **7.12**. **28 doctoral graduates** published an article with **first authorship** in journals with **IF higher than 5**, of which 7 in publications with **IF higher than 10**:

- IEEE Communications Surveys and Tutorials (IF=25.249),
- Trends in Biotechnology (IF=19.536),
- Applied Catalysis B Environmental (IF=19.503),
- Nano-micro Letters (IF=16.419),
- Information Fusion (IF=12.975),
- Trends in Food Science & Technology (IF=12.563),
- Journal of Hazardous Materials (IF=10.588).

Each doctoral graduate published on average 3.05 scientific contributions and 7.64 abstracts of scientific contributions at conferences. **5 doctoral graduates** participated in **8 granted patents** or **patent applications**.

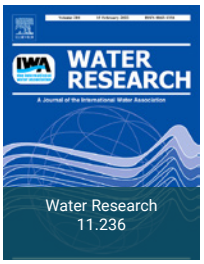
Following the analysis of annual reports on individual research work in the 2020/2021 academic year, the IPS students (additional year excluded):

- participated in the preparation and publication of at least **87 scientific articles**, of which in 47 publications as first authors,
- contributed to **43** publications which are categorised as **exceptional or of very high quality** according to the ARRS criteria,
- participated in the publication of 32 articles in journals with impact factor (IF) higher than 5, of which in **7 contributions in journals with IF higher than 9**.



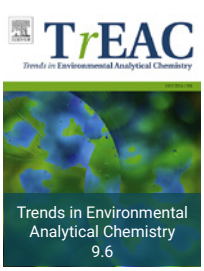
IEEE Communications Survey and Tutorials 25.249

Information Fusion 12.975

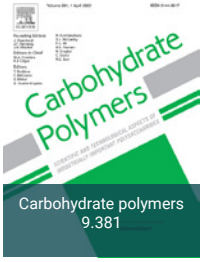


Water Research 11.236

Environment International 9.621



Trends in Environmental Analytical Chemistry 9.6



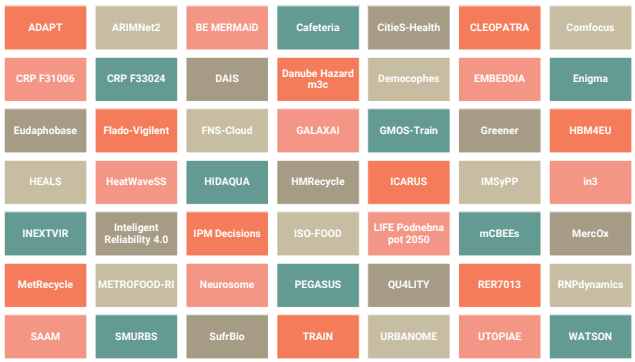
Carbohydrate polymers 9.381

	No. of doctoral graduates	No. of JCR publications per doctoral graduate	No. of articles with 1st authorship per doctoral graduate	Total no. of articles with 1st authorship	Average IF_{max} of journals with articles with 1st authorship	Publication with IF_{max}
ECO	13	6,23	3,31	43	5,992	10,588
ICT	12	5,25	3,58	43	8,294	25,249
NANO	15	4,47	2,60	39	7,769	19,536
ST	4	9,75	3,50	14	4,874	7,393

** IF of journals in 2020*

STUDENT PROJECTS

The students are involved in **national and international research or development projects and programmes, as well as in direct** IPS projects with our founders and other industrial partners. Within projects or programmes they work closely with supervisors and other members of the supervisory or research group. In the 2020/2021 academic year, IPS students participated in more than 50 international projects within the Horizon 2020, FP7, Interreg Italia-Slovenia, Interreg DanubeIAEA, LIFE+, REC-AG, ESA, Eurostars, and Euphresco projects. The students' research work relies also on numerous national projects within the programmes and calls of ARRS, HBM (Human Biomonitoring Programme), DEMO PILOTI II, RRI, OPKP (Open Platform for Clinical Nutrition), Ministry of Health, etc.



Student Achievements

ICT STUDENT ACHIEVEMENTS

GREGOR CERAR

and co-authors published an article titled "Machine Learning for Wireless Link Quality Estimation: A Survey" in the best journal form the field of telecommunications, i.e. IEEE Communications Surveys & Tutorials (IF=25.249). The article offers a comprehensive survey and an in-depth analysis of the field of estimating wireless link quality using models developed from data, presents a comparison of existing classifiers of wireless links, and introduces guidelines for collecting data on the quality of wireless links and their systematic preparation for further use. He won 1st place in the machine learning challenge at the 6th IRACON Training School.
DOI: 10.1109/COMST.2021.3053615

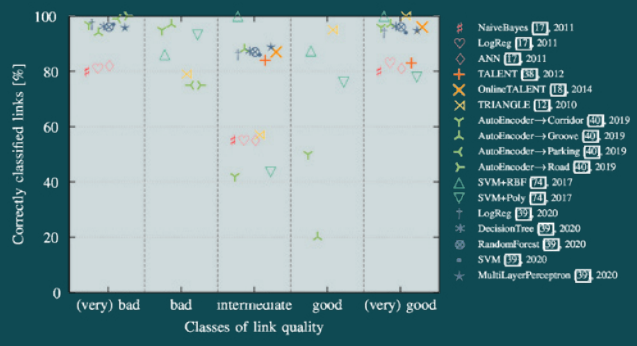
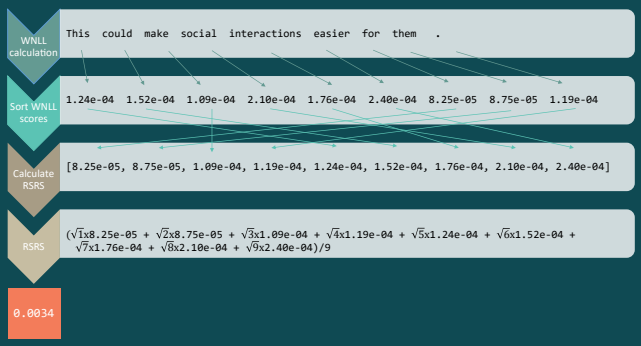


Figure: Empirical comparison of the wireless link quality classification performances.

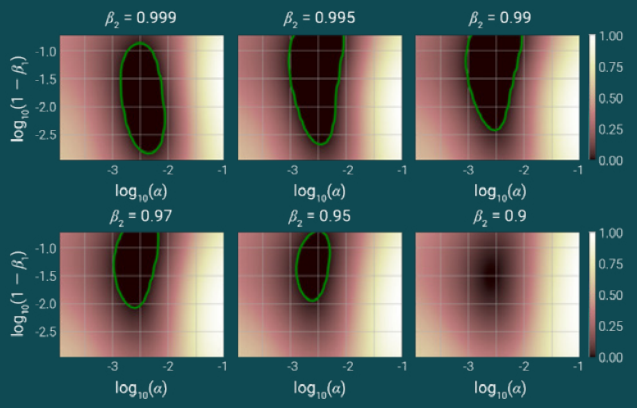
MATEJ MARTINC

who works on natural language processing participated in the past year in two international and four Slovenian research projects and (co)authored 15 contributions, among which "Supervised and unsupervised neural approaches to text readability" published in the Computational Linguistics journal. The article presents two new approaches for automatic detection of text readability using neural networks, which are also suitable for languages with fewer speakers, such as Slovenian.
DOI: 10.1162/coli_a_00398



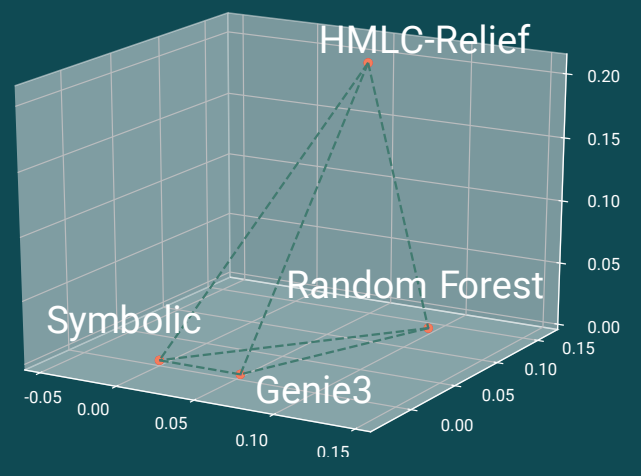
ROK HRIBAR

Published an article titled "Four algorithms to solve symmetric multi-type non-negative matrix tri-factorization problem" in the Journal of Global Optimization. With co-authors he developed four approaches to solving a complex optimisation problem of non-negative matrix tri-factorization which we encounter in data science and is related to data merging and clustering, as well as similarity prediction. Their performance was compared using data on protein similarity, facial images, sounds, voters, etc.
DOI: 10.1007/s10898-021-01074-3



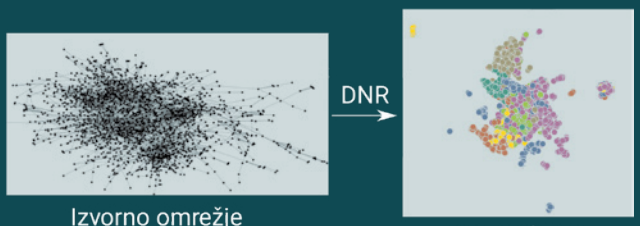
MATEJ PETKOVIĆ

During his studies, he mainly developed algorithms for feature ranking and construction in various learning scenarios, which includes supervised, semi-supervised, and unsupervised learning. The developed methods can be naturally classified into two groups: ensemble- and distance-based. In addition to methods for feature ranking, a method for comparing the similarity of feature rankings was also developed. The figure shows that the three ensemble-based methods (below) are closer (more similar) than the distance-based method (HMLC-Relief).
DOI: 10.1002/int.22390



BLAŽ ŠKRLJ

During his doctoral studies at the IPS, he worked on developing new scalable algorithms for representation learning. One of his main contributions is an approach to neuro-symbolic learning of node representations in everyday networks. Examples of such networks include social networks, protein binding networks, word networks, etc. Examples of applications of the developed methodology include effective functional annotation of unknown proteins and detection of "bots" in social networks.
DOI: 10.1002/int.22651



DAVID SUSIČ

participated in the research team of the JSI department against COVID (V. Janko, N. Reščič, C. Masi, T. Tušar, A. Vodopija, M. Marinko, M. Cigale, E. Dovgan, A. Gradišek, M. Luštrek, M. Gams) at the Pandemic Response Challenge, sponsored by Cognizant and organised by XPRIZE, a world leader in designing and executing incentive competitions for solving humanity's greatest challenges. The team won 2nd place at the competition, the goal of which is to use the power of data and artificial intelligence in the fight against the pandemic. In their research they used methods of multiobjective optimisation which are being developed at the Department of Intelligent Systems, where they have been researching the effects of various factors on the spread of the pandemic since its onset. They also developed a tool for visualising countermeasure programmes and their effects.
Published at: https://dis.ijs.si/


TEAM FROM E9 WINS SECOND PLACE
AT THE PANDEMIC RESPONSE CHALLENGE
AIMED AT FINDING BEST STRATEGIES AGAINST COVID

March 9th, 2021

Team JSI in Covid, whose members come from the Department of Intelligent Systems, won the second prize and $250K. The challenge was organized by XPRIZE, the world's leader in designing and operating incentive competitions to solve humanity's grand challenges, in partnership with Cognizant, one of the world's leading technology and professional services companies. The four-month global competition was designed to harness the power of data and artificial intelligence in equipping policymakers, health officials and business leaders with the insights and guidance necessary to implement public safety measures that help keep local economies open while minimizing virus outbreaks as vaccines become more widely available.

PRIZE

WINNER

Pandemic Response Challenge
2021

Matej Cigale, Carlo Maria De Masi, Erik Dovgan, Matjaž Gams, Anton Gradišek, Vito Janko, Mitja Luštrek, Matej Marinko, Nina Reščič, David Susič, Tea Tušar, Aljoša Vodopija

COMPETITION ACHIEVEMENTS

ADEM KIKAJ received the award for the best student paper from EWG-DSS at the 7th International Conference on Decision Support System Technology, ICDSST 2021, Loughborough, UK (DOI: 10.1007/978-3-030-73976-8_3)

B. KOLOSKI and his team won 1st place at the DragonHack in the category of Best Earth Observation Hack

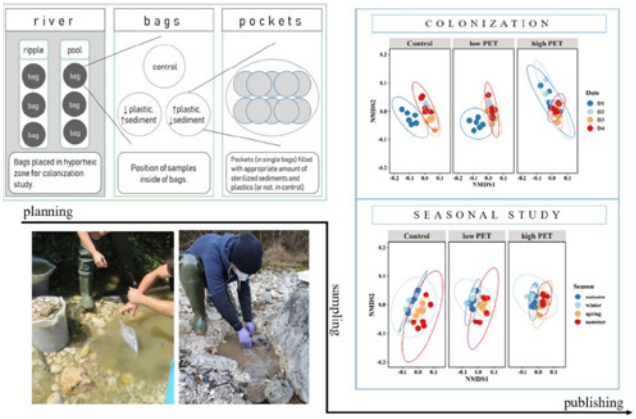
B. KOLOSKI, B. EVKOVSKI and their team won 1st place at the GreenHack in the category of Best Waste Management Hack

TOMAŽ STEPIŠNIK won 3rd place at European Space Agency competition on predicting planetary radii using satellite images of star transits.

ECO STUDENT ACHIEVEMENTS

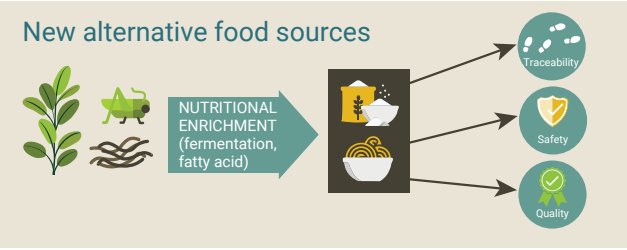
TJAŠA MATJAŠIČ

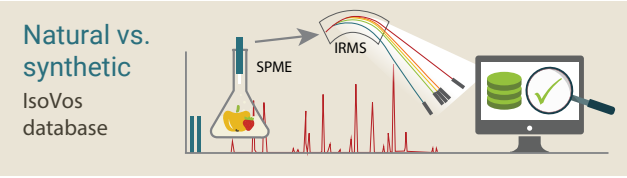
published an article titled "Presence of polyethylene terephtalate (PET) fibers in hyporheic zone alters colonization patterns and seasonal dynamics of biofilm metabolic functioning" in the Water Research journal. The study examined microbial colonisation (first month) and seasonal (one year) dynamics of microbial metabolic activity in the hyporheic zone in the presence and absence of PET fibre pollution. The hyporheic zone is an area where surface and groundwater mix in a river channel; it is where key ecosystem processes important for the self-purification capacity of rivers take place. The study found that microbial activity was reduced in all samples containing PET fibres compared to control samples. Samples containing PET fibres also showed greater potential for the conversion of complex synthetic polymers, which previous studies have already linked to polluted environments. Such long-term studies of inland water ecosystems are rare not only in Slovenia but also globally.



JASMINA MASTEN RUTAR, STAŠA HAMZIĆ GREGORČIČ, LIDIJA STROJNIK

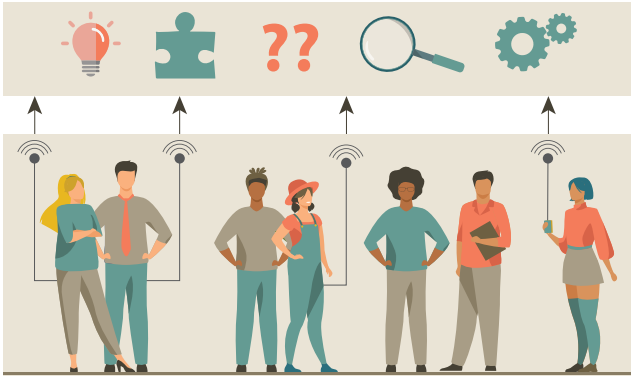
Exploring new alternative food sources, the geographical origin of Slovenian milk, and developing methods for determining adulteration (natural vs. artificial).
DOI: 10.3390/antiox10091366, 10.3390/foods10081729, 10.3390/foods10071550.





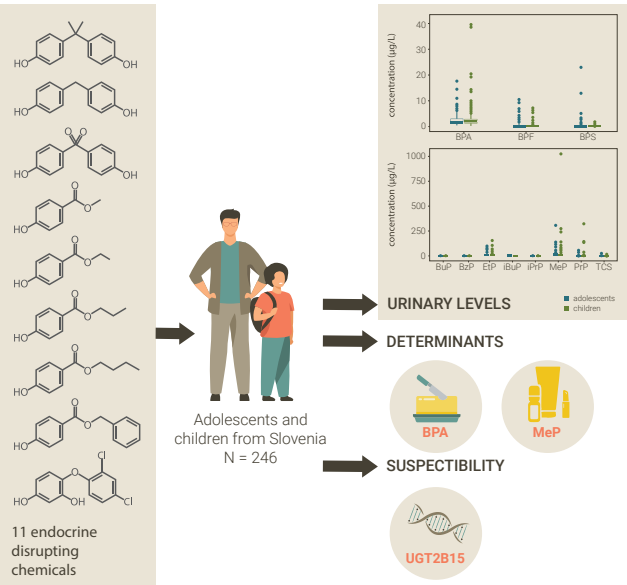
ROK NOVAK, JOHANNA ROBINSON

Including citizens in research activities brings new opportunities as well as challenges. The focus is particularly on air pollution in cities and the presence of other stressors in urban environments, which have a significant impact on human health and well-being.
DOI: 10.3390/ijerph182111614, 10.3390/ijerph182312544, 10.1080/09640568.2020.1853507.



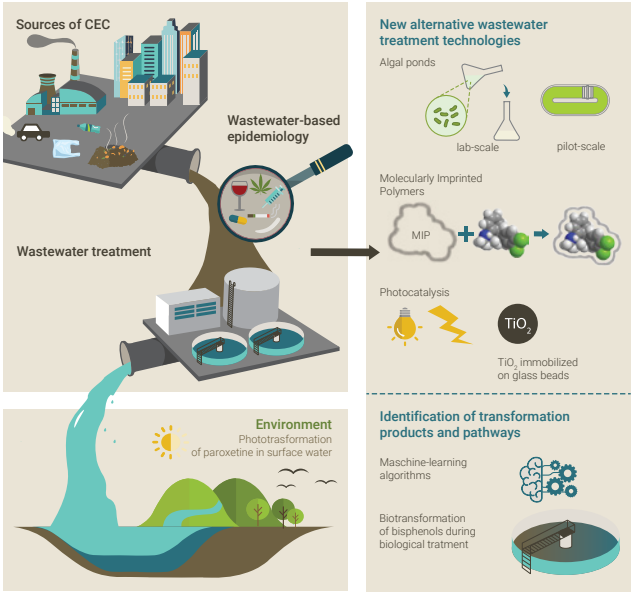
ŽIGA TKALEC, AGNETA RUNKEL

Chemicals that cause hormonal disruption are present everywhere, therefore people are exposed to these substances throughout their entire lives. The candidates were the first in Slovenia to demonstrate exposure to compounds such as phthalates, bisphenols, DINCH, parabens, and triclosan. The results of human biomonitoring revealed the level of exposure, the main routes of exposure, and especially the genetic sensitivity of children, adolescents, and adults.
DOI: 10.1016/j.envint.2020.106172, https://doi.org/10.1016/j.chemosphere.2021.131858, https://doi.org/10.1016/j.envint.2020.105985.



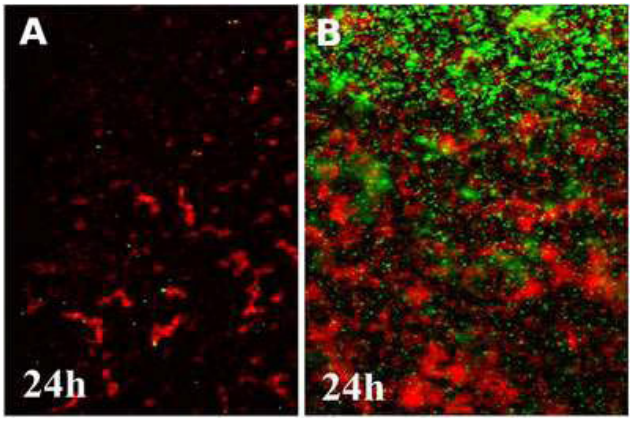
TAJA VEROVŠEK, DAVID ŠKUFCA, ANA KOVAČIČ, TJAŠA GORNIK

Occurrence, treatment, removal, and transformation of key and priority organic pollutants.
DOI: 10.1016/j.scitotenv.2021.150013, 10.1016/j.dib.2021.107614, 10.1016/j.scitotenv.2021.146949, 10.1016/j.chemosphere.2021.129786, 10.1016/j.jhazmat.2020.124079, 10.1016/j.scitotenv.2021.145380.



DMITRII DEEV

We have developed a method that "forces" bacteria to attach to surfaces and form biofilms. This process is particularly relevant for biotechnologically important strains, as they can lose their ability to form biofilms due to extensive cultivation in the laboratory. As proof of concept, we have shown that an artificial biofilm composed of (A) probiotic cells (red) can inhibit the sedimentation of potentially pathogenic E. coli. (B) In the control, the same pathogenic strain (green) can grow on the artificial biofilm of a non-probiotic strain (red).
DOI: 10.3389/fmats.2021.624631



DAVID ŠKUFCA

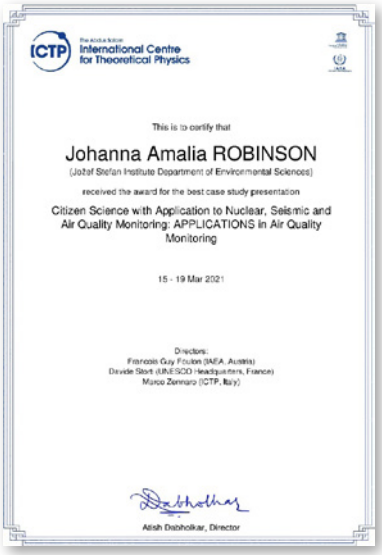
received an award from the University of Ljubljana's Research and Development Commission for his research entitled "Modern organic pollutants – how can we control them with algae?". The latter was recognised as one of the most excellent research achievements of the University of Ljubljana in 2021.

HELENA PLEŠNIK

received the Krka Prize for her research work at the 51st Krka call for best research projects. She received the prize for her master thesis titled "Determination of bacterial lignin degradation products by liquid chromatography coupled to mass spectrometry" which was done in the scope of the Aplavz project.

JOHANNA ROBINSON

is a young researcher who was awarded for the best presentation of a case study entitled "When Technology Fails: A Case Study of a Premature CS Tool" at Citizen Science with Application to Nuclear, Seismic and Air Quality Monitoring: APPLICATIONS in Air Quality Monitoring Workshop, held online from 15–19 March 2021, at the Abdus Salam International Centre for Theoretical Physics (ICTP) http://indico.ictp.it/event/9532/. For her PhD she is studying the user experience and motivation of volunteers who have participated in air quality-related Citizen Science projects and environmental health studies which are based on low-cost air quality sensor technologies.


ICTP International Centre for Theoretical Physics

This is to certify that

Johanna Amalia ROBINSON

(Jožef Stefan Institute Department of Environmental Sciences)

received the award for the best case study presentation

Citizen Science with Application to Nuclear, Seismic and Air Quality Monitoring: APPLICATIONS in Air Quality Monitoring

15 - 19 Mar 2021

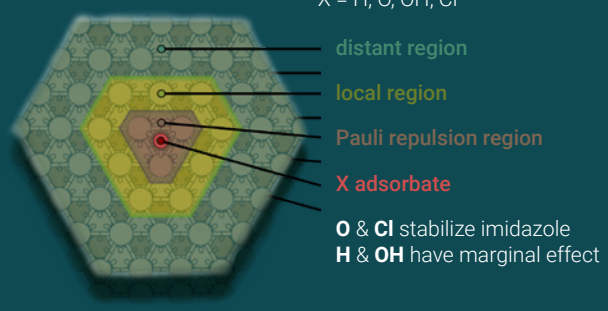
Directors:
Francois Gay Foulon (IAEA, Austria)
Davide Sisti (UNESCO Headquarters, France)
Marco Zennaro (ICTP, Italy)

Atish Dabholkar, Director

NANO STUDENT ACHIEVEMENTS

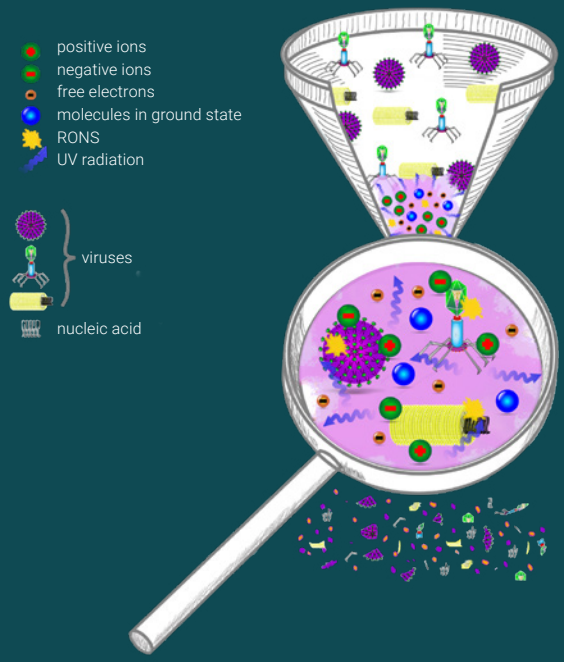
MATJAŽ DLOUHY

received the award for the best lecture held at the 27th edition of the traditional symposium Slovenian Chemistry Days organised by the Slovenian Chemical Society. In the awarded lecture titled "The effect of corrosion relevant species on the adsorption of imidazole on copper" the student presented the results of his study as a young researcher under the supervision of Prof. Dr. Anton Kokalj.



ARIJANA FILIPIĆ

During her doctoral studies she published a review article in one of the leading journals in the field of biotechnology, Trends in Biotechnology. The article comprehensively studied the impact of cold plasma on numerous viruses in and on various matrices. This was also the topic of Arijana's doctoral dissertation, which focused on the inactivation of waterborne viruses with cold atmospheric plasma. She also participated in two patent applications.
DOI: 10.1016/j.tibtech.2020.04.003

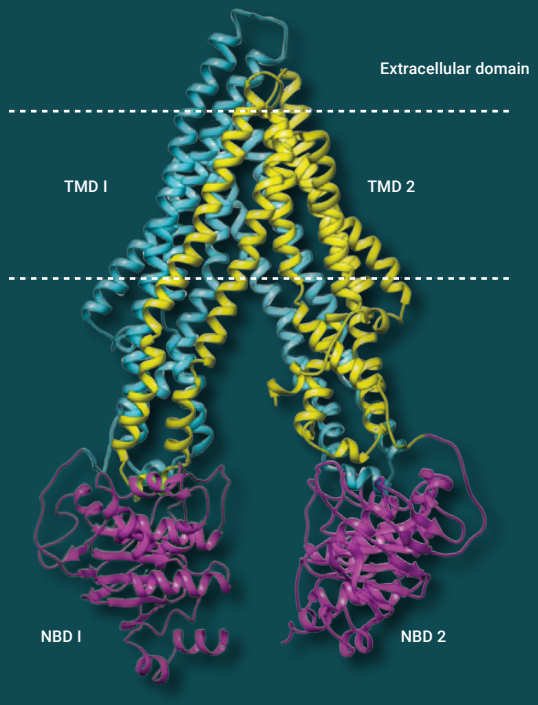


MATIC KORENT

focused in his doctoral dissertation on optimising the process of preparing magnetic materials and studying the improvement of the magnetic properties of hot-deformed Nd-Fe-B magnets for use in the automotive industry. During his doctoral studies, he collaborated with established institutions abroad as well as with the industry at home. During his professional training at the National Institute for Materials Science (NIMS) in Tsukuba, Japan, he studied the improvement of hot-deformed Nd-Fe-B magnets using diffusion of eutectic alloys. He concluded the successful collaboration by publishing an article in the Scripta Materialia journal. As a young researcher, he also participated in an industrial project and, at the end of the successful collaboration, wrote a patent application entitled "Procedure for improving the magnetic properties of MQP-B+Nd-Fe-B magnetic powders with a small proportion of intergranular phase and a process for making polymer-bonded magnets from these magnetic powders". Throughout his studies, he contributed to six articles, in three of which he was the first author, and two patent applications.
DOI: 10.1016/j.scriptamat.2021.114207

LIADYS MORA LAGARES

successfully defended her doctoral dissertation titled "In silico approaches to understand and predict the ligand-binding interactions of the human P-glycoprotein (ABCB1) membrane transporter" which addresses the problem of understanding ligand-P-glycoprotein interactions and the transport mechanism. The doctoral dissertation was prepared under the supervision of Prof. Dr. Marjana Novič and Prof. Dr. Emilio Benfenati with three publications as the first author in prestigious journals, the newest titled "Structure–Function Relationships in the Human P-Glycoprotein (ABCB1): Insights from Molecular Dynamics Simulations" published in the International Journal of Molecular Sciences. In addition, software has been developed that enables rapid and accurate prediction of potential new P-glycoprotein ligands, which is available to the public.
DOI: 10.3390/ijms23010362



NEELAKANDAN M SANTHOSH

Together with his colleagues, he developed a new rapid technique for designing unique broccoli-like vertical electrodes with carbon nanotubes/nickel sulphides for high-performance batteries and supercapacitors. The technique involves plasma deposition of carbon nanotubes, followed by treatment with H2S. Based on these findings, two European patents have been filed. These promising results were published in eight articles as first author, including in the Journal of Energy Chemistry, Nano-micro letters, and ACS Applied Materials and Interfaces.

DOI: 10.1021/acsami.1c03053, 10.1007/s40820-020-0395-5, 10.1016/j.jechem.2021.09.034

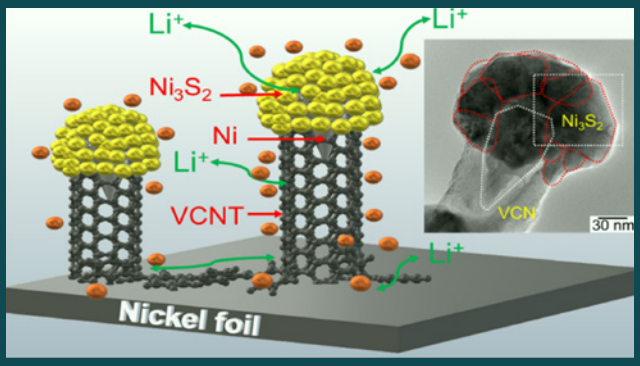
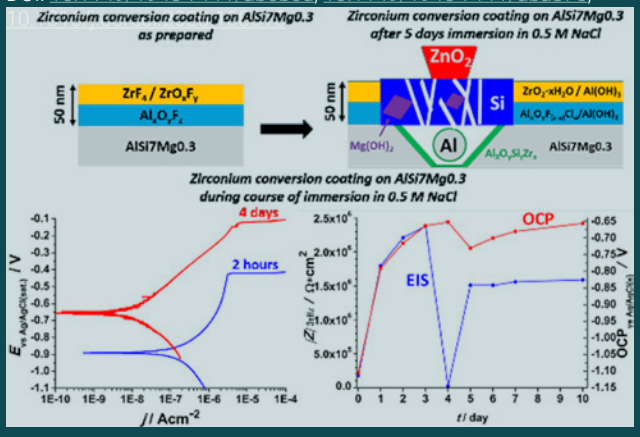


Figure: Schematic representation of broccoli-like electrode materials.

GAVRILO ŠEKULARAC

published three scientific articles with co-authors J. Kovač and I. Milošev in acclaimed journals with high impact factor, which deal with the formation and characterization of zirconium-based conversion coatings. The aim was to develop, optimise, and study the mechanism of zirconium oxide coating formation by conversion from a hexafluorozirconic acid solution to a series of different aluminium alloys. The influence of various conversion parameters on the degree of corrosion protection of coatings was investigated, and the mechanism of coating formation and protection on each individual alloy was established. This extensive research work was published in 2020 in three articles in the Journal of the Electrochemical Society and in Corrosion Science, which were downloaded more than 6,570 times and cited more than twenty times in less than a year.

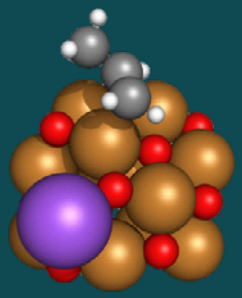
DOI: 10.1149/1945-7111/ab6b0d, 10.1149/1945-7111/aba875,



JANVIT TERŽAN

received the Pregl Award for Outstanding Doctoral Dissertation which is given by the National Institute of Chemistry for outstanding achievements in the field of chemistry and related sciences. During his studies at the Jožef Stefan International School he acquired essential knowledge that drastically contributed to the research work, the results of which have significantly improved the understanding of the formation of active oxygen species in epoxidation. All findings are regularly used in the scientific sphere to explain processes that are not always related to epoxidation. In relation to the topic of the doctoral research he published three articles in highly acclaimed scientific journals.

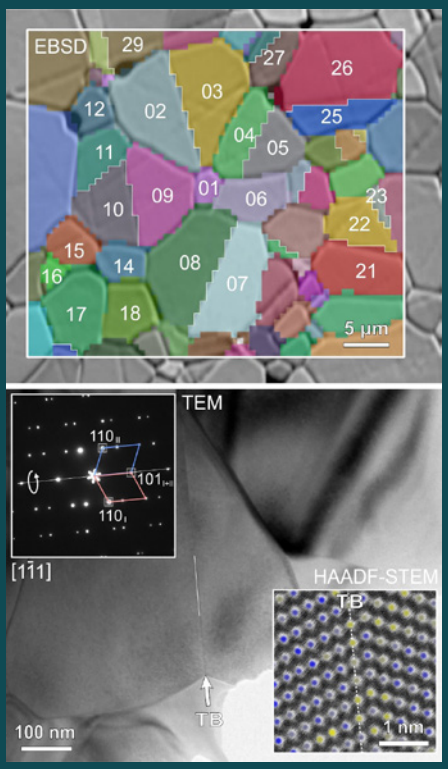
DOI: 10.1016/j.apsusc.2020.146854, 10.1016/japcatb.2018.05.092, 10.1021/acscatal.0c03340



SARA TOMINC

investigated in her doctoral dissertation titled "Charge compensation mechanisms and twinning in doped SnO2-based ceramics" the influence of pentavalent dopants on twinning and microstructure development in SnO2 ceramics. As an n-type semiconductor with a favourable combination of chemical, electrical, and optical properties, SnO2 is suitable for various applications, from transparent conductive films, sensors, and catalysts to varistors in compact ceramic form. In her work, the candidate focused on the synthesis of two compositions, SnO2–CoO–Nb2O5 and SnO2–CoO–Ta2O5, and proposed charge compensation mechanisms for both systems. In CoO–Nb2O5-doped SnO2 ceramics, she showed that Nb5+ ions compensate the incorporation of Co2+ and Sn2+ in an equimolar ratio, while in CoO–Ta2O5-doped SnO2 ceramics, the solubility of Ta in SnO2 is significantly lower and, consequently, the Co:Ta ratio is twice as high, indicating that Co2+ is the only divalent cation that compensates Ta5+ at Sn sites. In 2020, she published 2 articles in a leading journal in the field of ceramic materials, followed by a successful defence of her doctoral dissertation in front of an international committee in July 2021. Her research will be useful in the development of more powerful ceramic components for varistors and dielectrics.

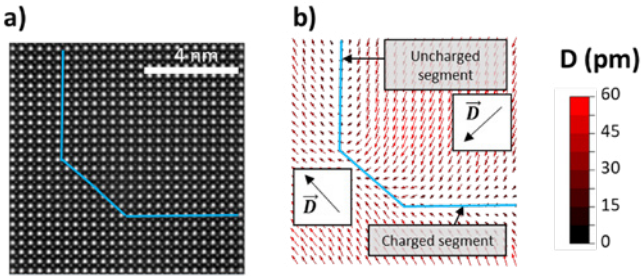
DOI: 10.1016/j.ceramint.2017.10.081, 10.1016/j.eurceramsoc.2019.09.028, 10.1016/j.jeurceramsoc.2020.03.062.



SENSOR TECH STUDENT ACHIEVEMENTS

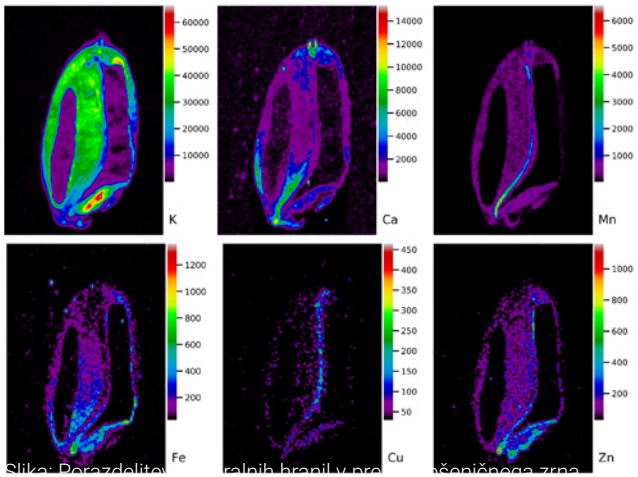
OANA CONDURACHE

As part of her doctoral research under the supervision of Prof. Dr. Andreja Benčan, she investigated the local properties of ferroelectric uncharged and nominally charged domain walls (DW) in polycrystalline bismuth ferrite using atomic resolution scanning transmission electron microscopy (STEM). It has been experimentally demonstrated that DWs differ in structure, morphology, and deformation distribution depending on their intrinsic charge state, indicating that they play different roles in the switching mechanism. As part of her research, she won two third places, namely at the YCN (Young Ceramists Network) competition "Pitch me your idea!" and at the student project competition at the 27th annual meeting of the Chemical Society of Slovenia.
DOI: 10.1063/5.0034699



KRISTINA ISAKOVIĆ

published an article titled "Upgrade of the external beamline at the microanalytical center of the Jožef Stefan Institute" in the Nuclear Instruments and Methods in Physics Research B journal. In the article, she presented the results of the characterisation of key properties of the renovated beamline with an external proton beam, which enables the analysis of objects in the external atmosphere. She successfully performed the first quantitative analyses of the distribution of mineral nutrients in plant samples.
DOI: 10.1016/j.nimb.2021.11.002

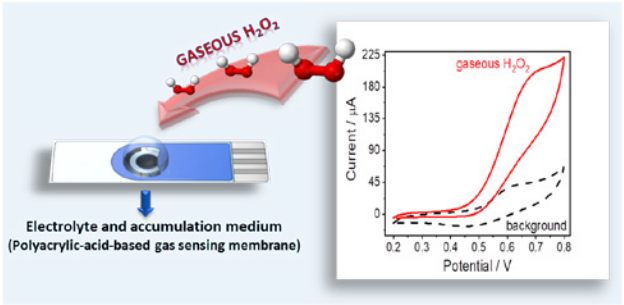


DŽEVAD KOZLICA

His research focuses on the electrochemical aspects of corrosion phenomena and the corrosion protection of aluminium, copper, and 2024 aluminium alloys, which are widely used in the automotive and aerospace industries. The basic idea is to develop a synergistic combination of two corrosion inhibitors that will demonstrate improved effectiveness in mitigating corrosion. The study investigated mixtures of organic compounds 2-mercaptobenzimidazole (MBI) and octylphosphonic acid (OPA) as inhibitors of copper and aluminium corrosion in chloride solution. The results show that MBI is a good inhibitor of copper corrosion, but not also for aluminium, while OPA behaves in the opposite way. Although the latter is not a suitable inhibitor for Cu, it can act synergistically and accelerate inhibition of Cu when added together with MBI. The authors presented a new mechanism of binding between the inhibitor and the metal substrate. The study presented on Al and Cu metals will be the basis for further studies on the 2024 aluminium alloy, which is used in the aerospace and automotive industries. The alloy contains copper as the main alloying element. Since its publication, the article has been cited more than twenty times in less than a year.
DOI: 10.1016/j.corsci.2020.109082

JELENA ISAILOVIĆ

successfully developed and studied a simple electrochemical sensing platform for sensitive detection of gaseous H2O2. They investigated two types of sensors; (i) one with a polyacrylic acid (PAA)-based sensing membrane applied to a supporting electrodes system with screen-printing, and (ii) another based on PAA with an additional MnO2-modified working electrode. Both sensors showed good electroanalytical performance with LOD of 3 µg m3 (MnO2/PAA sensor) and 2 µg m3 (PAA sensor) for gaseous H2O2.
DOI: 10.1016/j.snb.2021.131053

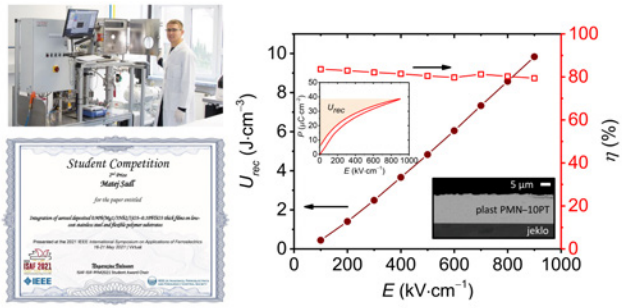


MAJA MAKAROVIČ

Under the supervision of Prof. Tadej Rojac, she researched the influence of point defects on the functional properties of ferroelectric ceramics based on bismuth ferrite. Combining experimental and theoretical studies, she showed how different point defects, depending on the conditions under which we excite the material, control macroscopic properties. Knowledge and understanding of these mechanisms is very important for the design of materials based on BFO ceramics, which have great potential in high-temperature piezoelectric applications. Her doctoral study is published in five scientific articles, among which one in Nature Materials, the most acclaimed journal in the field of materials. She also contributed to 43 conference papers.
DOI: 10.1063/5.0017374, 10.1038/nmat4799

MATEJ ŠADL

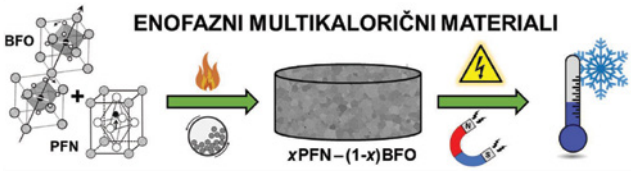
researched the preparation of thick layers of electronic ceramics on various substrates using the aerosol deposition method, which enables the densification of ceramics at room temperature. He applied layers of 0.9Pb(Mg1/3Nb2/3)O3–0.1PbTiO3 to steel substrates, thus preparing a capacitor structure with promising electrical energy storage capabilities. The results were published in the Acta Materialia journal. For his work he received two awards at conferences ISAF-ISIF-PMF 2021 and Crossnano Crossborder Workshop 2021.
DOI: 10.1016/j.actamat.2021.117403



Matej Šadl in the Ultracool lab, award from the ISAF-ISIF-PMF 2021 conference and results of thick layers with excellent electrical energy storage properties.

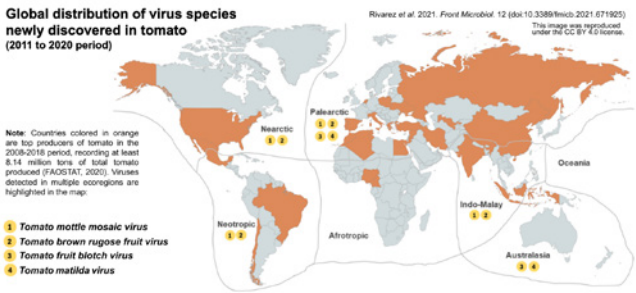
UROŠ PRAH

During his doctoral studies, he researched new single-phase multiferroic and multicaloric materials. The innovative approach of combining two or more caloric effects in a single material could play an important role in the future search for more environmentally friendly and energy-efficient new cooling technologies. Through the deliberate selection of (multi)ferroic materials and their targeted doping, he succeeded in preparing a material that exhibits the coexistence of the largest electrocaloric and magnetocaloric responses to date. The results were issued in two articles published in the Journal of Materials Chemistry C. During his studies, he (co) authored 12 JCR articles and 44 conference contributions.
DOI: 10.1039/C9TC05883D, 10.1039/D0TC02329A



MARK PAUL SELDA RIVAREZ

focuses his research on the diversity of viruses associated with tomatoes and weeds surrounding tomato growing areas in Slovenia using state-of-the-art metagenomic sequencing. At NIB, he conducted a comprehensive review of all reported viruses in tomatoes worldwide. He demonstrated that metagenomics accelerated the discovery of tomato viruses over the past decade and in generating ecological and epidemiological insights. The study was published in the Frontiers in Microbiology journal.
DOI: 10.3389/fmicb.2021.671925



Social Life at IPS

- Opening of the academic year
- Dean's Day and IPS picnic
- IPS Diploma Ceremony
- IPS Day
- IPS Open Day
- Participation at the Jožef Stefan Days
- Participation at the Researchers' Night

Quality Study and Research Support

ONLINE SUPPORT AND COMMUNICATION

After the IPS website was updated in 2018, in August 2021, the school started updating the IPS information system which is used to help the administration, students (e-Student) and professors (e-Professor). The talks regarding the update included all the interested parties, i.e. employees of the specialist services, and representatives of students and professors, who actively took part in setting up the new information system with their suggestions. As it is a complex and an overall demanding project, the work continues well into 2022. With the new system the students gained a better overview of the activities related to their studies (timetable and list of enrolled courses, exam dates, completed courses, documents they need during their studies). Professors gained a better overview of the implementation of the study process (information on students enrolled in a particular course, establishing direct communication with students, editing study materials, overview of the completed activities).

IPS OFFICE

Due to the ongoing COVID-19 pandemic in the 2021/2021 academic year and with the aim to ensure a safe and healthy environment for all participants, the school regularly adapted its activities according to the measures currently in place. The work was mostly carried out remotely, in a hybrid manner, or, if agreed upon beforehand, at the location. The study process and educational work were carried out without interruptions, ensuring that students and professors had access to all necessary information and documents. The school launched a new information system which enabled the employees of the IPS Office a more efficient and faster way of issuing documents related to the study process (enrolment certificates, transcripts of records, graduation certificates, exam applications, documents for the defence of seminars and theses, etc.). Employees of the IPS Office were available to students and professors via e-mail, phone, or, upon prior agreement, in person if the service could not be provided remotely.

ERASMUS EXCHANGE PROGRAMMES

In recent years, the school has been increasing the number of Erasmus+ student exchanges abroad, which were hampered during the reporting period due to the pandemic. Students complete internships lasting from 2 to 12 months at a selected foreign university or institute. They can choose any organisation in the Erasmus+ programme countries that they and their supervisor believe offers top-level knowledge complementary to the student's individual study programme at the IPS. Upon their return, they apply the knowledge they have acquired in their research work and pass it on to their colleagues. In the 2020/2021 academic year, a doctoral student spent three months in Tenerife, Spain, a master's student spent six months at the University of Innsbruck, Prof. Dr. Gregor Papa spent three months at the University of Osijek, and Prof. Dr. Aleksander Rečnik and Asst. Prof. Tea Zuliani at the University of Belgrade. In the same year, two doctoral students started their exchange, one in Vienna and one in Antwerp. The IPS hosted a student from the University of Barcelona for a 4-month study exchange and a researcher from the University of Belgrade for one week. A project with Al-Farabi University in Kazakhstan also concluded in this reporting period, in which Prof. Dr. Radojko Jaćimović gave lectures to their students during a one-week virtual visit.

RESEARCH EQUIPMENT

Within their research and educational programme, the IPS students have access to state-of-the-art research equipment within the framework of the founding and partner institutes (JSI, IMT, and NIB) and especially within the centres of excellence, in particular:

- the Centre of Excellence on Nanoscience and Nanotechnology (CENN Nanocentre),
- the Centre of Excellence for Integrated Approaches in Chemistry and Biology of Proteins (CE CIPKeBiP), and
- the Centre of Excellence for Advance Materials for the Future (CE NAMASTE).

In the scope of the projects designed for industrial partners, the IPS students are also directly involved in their respective research laboratories. The IPS also established its own research laboratory for developing measuring instruments for selective proximity detection of materials.

In this context, the IPS students have access to modern research equipment to work on their research tasks and are provided the expertise of highly qualified research instructors within the framework of expert groups from responsible institutions.

ALUMNI CLUB

The IPS established an Alumni programme. The primary tasks of the IPS Alumni Club are:

- providing study information,
- establishing connections for project work,
- organising visits to institutes and the industry in Slovenia and abroad,
- giving suggestions on how to improve the quality at all levels,
- increasing collaboration with research and industrial partners,
- organising an annual meeting with an excellent expert programme and a more relaxed social gathering.

CAREER CENTRE

At the IPS, we want to supplement our educational activities with the work of the Career Centre, where we enable our students to collaborate with the industry and institutes, learn about business in the real sector, become better prepared for work, and gain employment opportunities at reputable companies. We want to ensure that students participate in and fulfil research tasks related to current research in the economy as part of their regular education. In 2018, the IPS introduced a new elective course – Industrial Seminar. The Career Centre participates in organising and conducting seminars proposed by participating companies on topics that are relevant to both the company and students. In this way, the Career Centre serves as a point of contact between students, the school, graduates, and other employers. The Career Centre also assists prospective and current students in deciding on their studies, coordinates international exchanges, provides career planning advice, and monitors the career paths of its graduates.

The Career Centre also plays an important role in acquiring and implementing national and international projects in the field of pedagogy, higher education, and skills development for students (e.g., Erasmus+ strategic partnerships, Interreg programmes, Creative Path to Knowledge – PKP, Student Innovative Projects for Social Benefit – ŠIPK, Competence Centre). The IPS Career Centre offers its services for free.

During this academic year, **44** doctoral students published a total of **139** scientific articles as first authors.

We carry out **four** international projects and manage the **Competence Centre for Factories of the Future**.

Higher education teachers have achieved **15** outstanding accomplishments for which they received **top awards**.

IPS students participate in more than **50 international projects**

SUMMARY OF SELF-EVALUATION REPORT FOR 2020/21 ACADEMIC YEAR
Jožef Stefan International Postgraduate School

Content: IPS
Photos: Janez Marolt, Arne Hodalič, and Katja Bidovec
Photos of the Students' Conference: IPS
Design: DVOKOTNIK, Lenka Trdina s.p.

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