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NACIONALNI INŠTITUT ZA **BIOLOGIJO**
NATIONAL INSTITUTE OF **BIOLOGY**

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Bogata skupnost morskih nevretenčarjev na sedimentnem dnu s prevladujočimi kačjerepi (foto: B. Mavrič).

A rich community of marine invertebrates on the sediment bottom, dominated by brittle stars (Photo: B. Mavrič).

POSLANSTVO

Poslanstvo NIB je ustvarjanje novega znanja na področju bioloških znanosti za razumevanje življenjskih procesov ter ohranjanje biotske raznovrstnosti in zdravega okolja za doseganje večje kakovosti življenja in podporo trajnostnemu razvoju. Interdisciplinarno se povezujemo na področjih varstva narave in okolja, biotehnologije, informatike, farmacije in medicine, kmetijstva, gozdarstva, ribištva in hrane, turizma in pomorskega prometa ter prostorskega načrtovanja.

Poslanstvo izvršujemo:

- s prebojnimi temeljnimi raziskavami na področju bioloških in sorodnih naravoslovnih znanosti ter objavljanjem rezultatov raziskav v znanstvenih publikacijah;
- z aplikativnimi raziskavami in prenosom rezultatov v prakso za potrebe mednarodnih, evropskih, državnih in lokalnih organov in organizacij ter gospodarskih subjektov s ciljem izboljševanja kakovosti življenja in trajnostnega razvoja družbe;
- s sodelovanjem pri izobraževanju na dodiplomski, podiplomski in podoktorski ravni;
- s komuniciranjem znanosti različnim ciljnim skupinam in javnosti.

VIZIJA

NIB želi kot mednarodno uveljavljena neodvisna znanstveno-raziskovalna in razvojna institucija ustvarjati vrhunsko znanje ter razvijati tehnologije in izdelke na področju bioloških in sorodnih naravoslovnih ved, z dobro organiziranostjo in vrhunsko opremo vzdrževati zadovoljstvo in visoko motiviranost zaposlenih ter omogočiti razvoj vrhunskih kadrov za delovna mesta z visoko dodano vrednostjo v gospodarstvu in javnem sektorju. Svoj dolgoročni razvoj bomo zagotavljali v tesni povezavi z družbo in poslovnim sektorjem.

MISSION

The NIB's mission is to generate new knowledge in the biological sciences to understand life processes, as well as to maintain biodiversity and a healthy environment in order to achieve a better quality of life and support sustainable development. We work in interdisciplinary ways in the fields of nature and environment conservation, biotechnology, informatics, pharmacy and medicine, agriculture, forestry, fisheries and food, tourism, maritime transport, and spatial planning.

We fulfil our mission through:

- ground-breaking basic research in the biological and related life sciences and the publication of research results in scientific publications;
- applied research and transfer of results into practice for the needs of international, European, national and local authorities and organisations, as well as economic operators, with the aim of improving the quality of life and sustainable development of society;
- participation in education at undergraduate, postgraduate and postdoctoral levels;
- by communicating science to different audiences and the public.

VISION

As an internationally renowned independent scientific research and development institution, NIB aims to generate cutting-edge knowledge and develop technologies and products in the biological and related life sciences, to maintain employee satisfaction and high motivation through good organisation and state-of-the-art facilities, as well as to develop top-quality human resources for high added-value jobs in the economy and the public sector. We will ensure our long-term development in close cooperation with society and the business sector.

Morske zvezde iz rodu *Astropecten* najdemo pretežno na cirkalitoralnem sedimentnem dnu (foto: T. Makovec).

Starfish from the genus *Astropecten* are found mainly on the circalittoral sedimentary bottom (Photo: T. Makovec).

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DIREKTORICA: PROF. DR. **MAJA RAVNIKAR**
DIRECTOR: PROF. DR. **MAJA RAVNIKAR**

Ob preletu vseh aktivnosti in dogodkov, ki so zaznamovali leto 2022 na Nacionalnem inštitutu za biologijo, besedo direktorice zaradi številnih uspehov in dosežkov pišem s ponosom. Hkrati jo pišem z veliko odgovornostjo, ki jo s seboj prinaša zares ogromen napredek na vseh področjih Inštituta: njegova nagla rast, novogradnja, povečana raziskovalna infrastruktura, rastoča znanstvena odličnost, inovativnost, internacionalizacija in odprtost ter okrepljen prenos znanja in sodelovanja z okoljem. To besedo pišem tudi s skrbjo, kako uspešno kljubovati izzivom, ki jih prinašajo hitre ter pogosto nenadne družbene in okoljske spremembe. Predvsem pa jo pišem z neizmerno hvaležnostjo sodelavcem, ki so v preteklem letu pokazali, kaj pomenita predanost in sodelovanje, ter vsem sopotnikom Inštituta, ki so nam stali ob strani v skupnem doseganju raziskovalnih, poslovnih in organizacijskih dosežkov. Želim si, da bi se ob prebiranju tega poročila zavedali svoje edinstvene vloge v delovanju NIB ter začutili pomen svojega prispevka k udejanjanju in napredku znanosti.

As we look back over all the activities and events that have marked the year 2022 at the National Institute of Biology, it is with pride that I write these words, in view of the many successes and achievements. At the same time, I write it with the great responsibility that comes with the truly tremendous progress made in all areas of the Institute: its rapid growth, its new building, its increased research infrastructure, its growing scientific excellence, its innovation, its internationalisation and openness, as well as its enhanced knowledge transfer and collaboration with the community. I am also writing this with a concern about how to successfully meet the challenges posed by rapid and often sudden social and environmental changes. Above all, I would like to express immense gratitude to the colleagues who have shown over the past year what commitment and collaboration mean, and to all the Institute's fellow travellers who have stood by us in our shared pursuit of research, business and organisational achievements. I hope that as you read this report, you are aware of your unique role in the work of the NIB and feel the importance of your contribution to the realisation and advancement of science.

V letu 2022 smo z dokončanjem prve faze gradnje stavbe Biotehnološkega stičišča Nacionalnega inštituta za biologijo (BTS-NIB) prečkali pomemben mejnik v izvajanju tega zahtevnega in obsežnega projekta. Investicija, s katero smo pričeli julija 2021 in jo bomo zaključili decembra 2023, je vredna več kot 30 milijonov evrov, 80-odstotno je financirana iz evropskih kohezijskih sredstev, preostalo pa iz državnega proračuna. Polovica zaposlenih, in sicer Oddelek za biotehnologijo in sistemsko biologijo (FITO) ter Oddelek za genetsko toksikologijo in biologijo raka (GEN), se je že preselila v prostore prvega dela nove visokotehnološke gradnje, kjer prevladujejo laboratoriji in raziskovalni prostori. Selitev je predstavljala velik organizacijski izziv in napor. Na tem mestu se globoko zahvaljujem raziskovalcem in strokovnemu osebju NIB, ki so s svojo vztrajnostjo in znanjem omogočili zaključek prve faze gradnje zelo pomembne raziskovalne infrastrukture, ki predstavlja izjemen korak v razvoju tako Inštituta kot vseh ved o življenju v Sloveniji in širše.

In 2022, with the completion of the first phase of construction of the Biotechnological Hub of the National Institute of Biology (BTH-NIB), we crossed an important milestone in the implementation of this challenging and large-scale project. The investment, which started in July 2021 and will be completed in December 2023, is worth more than €30 million, 80% financed by the European Cohesion Fund and the rest by the national budget. Half of the staff, namely the Department of Biotechnology and Systems Biology (FITO) and the Department of Genetic Toxicology and Cancer Biology (GEN), have already moved into the first part of the new high-tech building, which is dominated by laboratories and research facilities. The move presented a major organisational challenge and effort. I would like to express my deepest gratitude to the researchers and professional staff of the NIB, whose perseverance and expertise have made it possible to complete the first phase of the construction of a very important research infrastructure, which represents a remarkable step in the development of the Institute and of all life sciences in Slovenia and beyond.

Iz naslova projekta BTS-NIB smo v letu 2022 realizirali investicijska vlaganja v okviru operacije »Nakup raziskovalne opreme NIB« ter izvedli preostale naložbe v osnovno opremo in vzdrževanje. Iz naslova operacije »Nakup raziskovalne opreme NIB« smo realizirali nabavo v vrednosti preko 5 milijonov evrov. Z načrtovanimi nabavami raziskovalne opreme v letu 2023 bo skupaj porabljenih preko 6 milijonov evrov, ki jih sofinancirata Evropski sklad za regionalni razvoj in Republika Slovenija – sedanje Ministrstvo za visoko šolstvo, znanost in investicije – v okviru Operativnega programa za izvajanje evropske kohezijske politike v obdobju 2014–2020. V skladu z načrtom investicijskega vzdrževanja je bila realizirana tudi sanacija brežine pri stavbi Morske biološke postaje Piran. Projekt Interreg Med SHAREMED je omogočil nakup in postavitev novega visokofrekvenčnega (HF) radarja, ki je pričel z delovanjem jeseni 2022. Skupaj še s tremi radarji na slovenski (ARSO) in italijanski obali (OGS, ARPA FVG) tvori HF radarski vozel Tržaškega zaliva ter generira produkte meritev površinskih tokov in valov za celoten zaliv.

The BTH-NIB project has been used to make capital investments in 2022 under the operation "Purchase of NIB research equipment" and to make the remaining investments in fixed equipment and maintenance. Under the operation "Purchase of NIB research equipment", we made purchases of over €5 million. The planned purchases of research equipment in 2023 will total over €6 million, co-financed by the European Regional Development Fund and the Republic of Slovenia – now the Ministry of Higher Education, Science and Investment – under the Operational Programme for the Implementation of the EU Cohesion Policy 2014–2020. The reconstruction of the seashore at the Marine Biology Station Piran building was also carried out in accordance with the investment maintenance plan. The Interreg Med SHAREMED project enabled the purchase and installation of a new high-frequency (HF)

Poleg novosti na področju infrastrukture so preteklo leto zaznamovale številne sistemske in upravljavske spremembe, v prvi vrsti novi Zakon o znanstvenoraziskovalni in inovacijski dejavnosti (ZZrID), ki je uvedel stabilno financiranje znanstvenoraziskovalne dejavnosti. To je botrovalo mnogim spremembam na področju internega upravljanja znanstvenoraziskovalne dejavnosti Inštituta, ki smo jih formalizirali z novimi pravnimi akti (Pravilnik o stabilnem financiranju znanstvenoraziskovalne dejavnosti, Pravilnik o izboru in financiranju mladih raziskovalk in raziskovalcev, Metodologija za izvajanje stabilnega financiranja znanstvenoraziskovalne dejavnosti) ter ustanovitvijo Komisije za stabilno financiranje NIB. Vlada Republike Slovenije je 25. avgusta 2022 sprejela nov Sklep o ustanovitvi javnega raziskovalnega zavoda NIB, s katerim smo uskladili Statut in nekatere druge interne akte Inštituta.

Sodelovanje NIB z domačimi gospodarskimi subjekti se je v letu 2022 v primerjavi z letom prej skoraj podvojilo. Finančno najpomembnejši del teh storitev so predstavljali projekti za testiranje učinkovitosti bioloških elementov, testiranje in validiranje laboratorijskih postopkov, izdelavo informacijskih rešitev za laboratorijske informacije, raziskave celične smrti v celičnih bankah, bakterijske in GSO analize itd., večinoma za farmacevtska, biotehnološka in druga podjetja. NIB je različne strokovno-razvojne naloge izvajal tudi za gospodarske družbe na področju monitoringa ogroženih vrst, analiz okoljskih dejavnikov, modeliranja ter razvoja analiz mutageničnosti in citotoksičnosti. V skladu z OECD načeli dobre laboratorijske prakse (DLP) je NIB za različne naročnike izvajal študije mutagenosti ter dodatna testiranja biokompatibilnosti medicinskih pripomočkov in materialov.

V letu 2022 smo kot koordinatorji pridobili projekt Horizon-Widera Twinning »Twinning for excellence to strategical advance research in carcinogenesis in cancer – CutCancer« pod vodstvom izr. prof. dr. Bojane Žegura (GEN), ki se je začel izvajati januarja 2023. Glavni namen projekta je okrepiti in povečati raziskovalno in inovacijsko zmogljivost ter odličnost NIB s sodelovanjem in usmerjenimi aktivnostmi s tremi mednarodno priznanimi institucijami, in sicer Univerzo Swansea v Veliki Britaniji, Univerzo v Stockholmu na Švedskem in Univerzitetnim medicinskim centrom Univerze Vrije v Amsterdamu na Nizozemskem.

radar, which became operational in autumn 2022. Together with three other radars on the Slovenian (ARSO) and Italian coasts (OGS, ARPA FVG), it forms the HF radar node of the Gulf of Trieste and generates surface current and wave measurement products for the whole Gulf.

In addition to new developments in infrastructure, the past year was marked by a number of systemic and governance changes, most notably the new Scientific Research and Innovation Activities Act (ZZrID), which introduced stable funding for scientific research activities. This led to many changes in the internal management of the Institute's scientific research activities, which were formalised by new legal acts (Rules on the Stable Financing of Scientific Research Activities, Rules on the Selection and Financing of Young Researchers, Methodology for the Implementation of the Stable Financing of Scientific Research Activities) and the establishment of the Commission for Stable Financing of the NIB. On 25 August 2022, the Government of the Republic of Slovenia adopted a new Decision on the establishment of the public research institute NIB, whereby the Statute and some other internal acts of the Institute were aligned.

NIB's cooperation with domestic economic operators almost doubled in 2022 compared to the previous year. Financially, the most important part of these services consisted of projects for bio-element potency testing, testing and validation of laboratory procedures, development of IT solutions for laboratory information, cell death research in cell banks, bacterial and GMO analysis, etc., mostly for pharmaceutical, biotechnology and other companies. The NIB also carried out various R&D tasks for companies in the fields of endangered species monitoring, environmental analysis, modelling and development of mutagenicity and cytotoxicity assays. In accordance with the OECD Principles of Good Laboratory Practice (GLP), NIB carried out mutagenicity studies and additional biocompatibility testing of medical devices and materials for various clients.

In 2022, we were awarded the Horizon-Widera Twinning project "Twinning for excellence to strategically advance research in carcinogenesis in cancer - CutCancer" as coordinators under the leadership of Assoc. Prof. Dr Bojana Žegura (GEN), which started in January 2023.

Raziskovalci NIB so v letu 2022 sodelovali v shemi The European Cooperation in Science and Technology (COST) pri 18 COST aktivnostih, pri čemer gre posebej izpostaviti projekt z naslovom »Evropska transdisciplinarna mrežna platforma za morsko biotehnologijo (European transdisciplinary networking platform for marine biotechnology)« pod vodstvom dr. Ane Rotter z Morske biološke postaje (MBP), v katerem ima NIB vlogo koordinatorja.

V financiranje je bil sprejet projekt »5xPRO Konzorcij projektnih pisarn za krepitev odličnosti, interdisciplinarnosti in mednarodne vpetosti slovenskega raziskovalnega prostora«, ki smo ga na javnem razpisu »Aktivnosti krepitve projektnih pisarn na javnih raziskovalnih organizacijah« prijavili v konzorciju petih javnih zavodov (Kemijski inštitut – koordinator, NIB, ZRC-SAZU, INZ in IMT) in katerega izvajanje se je začelo v letu 2023.

S komuniciranjem znanosti splošni javnosti pokažemo, kam je bil vložen njen denar, pri čemer predstavljamo različne izzive našega časa in navdušujemo mlade generacije za raziskovanje in poklic raziskovalca. V letu 2022 smo za knjigo *Očarljivi poskusi z rastlinami* avtoric prof. dr. Marine Dermastia, prof. dr. Maruše Pompe Novak in doc. dr. Špele Baebler (FITO), ki sta jo izdala Slovensko društvo za biologijo rastlin in NIB, prejeli Zlato hruško, znak kakovosti mladinskih knjig.

Po dveh letih premora je ponovno potekal v živo najbolj odmeven in obiskan dogodek za krepitev oceanske pismenosti, Dan odprtih vrat Morske biološke postaje, ki se ga je udeležilo preko 300 obiskovalcev. Na dnevu, s katerim 8. junija obeležujemo svetovni dan oceanov, se skozi številne delavnice in predavanja predstavimo javnosti, predvsem osnovnošolskim učencem. Tokratno osrednje predavanje »Znanje, ki ga potrebujemo za morje, kot si ga želimo« je bilo posvečeno OZN Desetletju oceanov 2021–2030.

V počastitev mednarodnega dneva biotske raznovrstnosti in svetovnega dneva čebel smo maja 2022 pripravili predstavitev dosežkov evropskega projekta LIFE NATURAVIVA, Biodiverziteta – umetnost življenja. Na dogodku so sodelavci Oddelka za raziskave organizmov in ekosistemov (EKOS) poleg obsega in uspehov projekta predstavili tudi novo knjigo *Neverjetna biodiverziteta Slovenije* avtorjev dr. Davorina Tometa in dr. Maje Opalički Slabe, v kateri so raziskovalci in partnerji projekta

The main objective of the project is to strengthen and enhance the research and innovation capacity and excellence of the NIB through collaborative and focused activities with three internationally renowned institutions, namely Swansea University in the UK, Stockholm University in Sweden and the University Medical Centre of the Vrije University Amsterdam in the Netherlands.

In 2022, NIB researchers participated in 18 COST activities under The European Cooperation in Science and Technology (COST) scheme, with a particular focus on the project "European transdisciplinary networking platform for marine biotechnology" led by Dr Anna Rotter from the Marine Biology Station (MBS), in which the NIB is the coordinator.

The project " 5xPRO Consortium of Project Management Offices for Strengthening Excellence, Interdisciplinarity and International Involvement of the Slovenian Research Area" was accepted for funding. The project was applied for in the public call "Activities for Strengthening Project Offices at Public Research Organisations" in a consortium of five public institutions (Institute of Chemistry – coordinator, NIB, ZRC-SAZU, INZ and IMT) and its implementation started in 2023.

By communicating science to the general public, we show where their money has been invested, presenting the various challenges of our time and inspiring the younger generations to explore and become researchers. In 2022, we were awarded the "Golden Pear", a quality label for youth books, for the book *Charming Experiments with Plants* by Prof. Dr Marina Dermastia, Prof. Dr Maruša Pompe Novak and Assoc. Prof. Dr Špela Baebler (FITO), published by the Slovenian Society of Plant Biology and the NIB.

After a two-year hiatus, the most high-profile and well-attended event for promoting ocean literacy, the Open Day of the Marine Biology Station, was held again in person, with over 300 visitors. On World Oceans Day on 8 June, we present ourselves to the public, especially primary school pupils, through a series of workshops and lectures. This year's keynote lecture, "The knowledge we need for the ocean we want", focused on the UN Decade of the Oceans 2021–2030.

LIFE NATURAVIVA izpostavili in opisali izjemno bogato in neverjetno naravo Slovenije ter jo opremili z več kot 140 fotografijami. Knjigo kot poslovno ali državniško darilo uporabljajo tudi najvidnejši slovenski gospodarski in politični subjekti.

Pri založbi NIB (MBP) je izšla tudi knjiga avtorja prof. dr. Lovrenca Lipeja *Podobe iz modrine*, zbirka kratkih esejev o biodiverziteti morja, ki jih je avtor vrsto let objavljal v svoji kolumni v Primorskih novicah in reviji »Potapljač« Potapljaške zveze Slovenije. Številni zapisi temeljijo na avtorjevih bogatih izkušnjah in doživetjih v več kot 60 letih. Knjiga je bila izdana s finančno podporo Slovenskega nacionalnega odbora Medvladne oceanografske komisije (IOC UNESCO) in Slovenske nacionalne komisije za UNESCO.

NIB je v maju v sodelovanju s Slovenskim društvom za biologijo rastlin in s številnimi drugimi organizacijami, ki se ukvarjajo z raziskavami rastlin in njihovim pomenom, znova uspešno izvedel dogodek »Dan očarljivih rastlin«. Delavnice za predstavitev rastlin je v organiziranih skupinah obiskalo približno tisoč osnovnošolcev iz cele Slovenije. V Sloveniji smo »Dan očarljivih rastlin« (ang. Fascination of Plants Day), 26. maj, ki je nastal leta 2012 na pobudo Evropske organizacije za raziskave rastlin EPSO (European Plant Science Organisation), obeležili že desetič.

Leta 2022 je minilo 25 let od podpisa prve pogodbe NIB o sodelovanju s Fitosanitarno inšpekcijo, s čimer smo uradno začeli izvajati del nalog, ki jih je morala Slovenija zagotoviti z vstopom v EU. Obvladovanje nevarnih karantenskih bolezni rastlin je bil namreč v skladu s pravnim redom EU eden izmed pogojev za vstop Slovenije na skupni trg kmetijskih proizvodov EU. Od preloma tisočletja je tako del dejavnosti FITO tesno povezan s področjem diagnostike povzročiteljev rastlinskih bolezni in s službami za varstvo rastlin. Stalno razvijamo nove občutljive diagnostične metode in preizkušamo najsodobnejše aparature, ki nam omogočajo, da iz najrazličnejših vzorcev zanesljivo in natančno določimo povzročitelje bolezni rastlin. Jubilej smo obeležili z različnimi dogodki in dejavnostmi preko celega leta.

Zaposleni na NIB svoje znanje z veseljem in ponosom predajamo novim generacijam in smo v študijskem letu 2021/2022 poučevali na partnerski Mednarodni podiplomski šoli Jožefa Stefana (MPŠ), na Univerzi v Ljubljani,

To celebrate the International Day for Biological Diversity and the World Bee Day in May 2022, we organised a presentation on the achievements of the European LIFE NATURAVIVA project, Biodiversity – The Art of Living. At the event, in addition to presenting the scope and successes of the project, the staff of the Department of Organisms and Ecosystems Research (EKOS) also presented the new book *Incredible Biodiversity of Slovenia* by Dr Davorin Tomet and Dr Maja Opalički Slabe, in which the LIFE NATURAVIVA researchers and partners highlighted and described Slovenia's incredibly rich and amazing nature, accompanied by more than 140 photographs. The book is also used as a business or protocol gift by Slovenia's most prominent economic and political entities.

The NIB (MBP) also published a book by Prof. Dr Lovrenc Lipej, *Images from the Blue*, a collection of short essays on marine biodiversity, which the author had published for many years in his column in the Primorske novice newspaper and in the "Potapljač" magazine of the Slovenian Diving Association. Many of the essays are based on the author's extensive experience and adventures over more than 60 years. The book was published with the financial support of the Slovenian National Committee of the Intergovernmental Oceanographic Commission (IOC UNESCO) and the Slovenian National Commission for UNESCO.

In May, the NIB, in cooperation with the Slovenian Society for Plant Biology and a number of other organisations involved in plant research and their significance, once again successfully organised the Fascination of Plants Day event. Around 1,000 primary school pupils from all over Slovenia attended the plant demonstration workshops in organised groups. In Slovenia, we celebrated the Fascination of Plants Day on 26 May for the tenth time, which was initiated in 2012 by the European Plant Science Organisation (EPSO).

In 2022, 25 years passed since the signing of the first NIB cooperation agreement with the Phytosanitary Inspection Service (PIS), officially launching the implementation of part of the tasks that Slovenia had to provide for when joining the EU. In fact, control of dangerous plant quarantine diseases was one of the conditions under EU law for Slovenia to enter the EU's common market for agricultural products. Since the turn of the millennium,

kjer je NIB pridruženi član, Univerzi v Novi Gorici, Univerzi na Primorskem, Univerzi v Mariboru, Univerzi Sigmunda Freuda v Ljubljani in Univerzi v Gdansku (Poljska).

Leto 2022 je bilo za NIB izrazito uspešno, zlasti pri prenosu znanstvenih dosežkov v prakso ter širjenju znanstvenih spoznanj med različne javnosti in uporabnike. Raziskovalci NIB so prejeli številne prestižne domače in mednarodne nagrade ter priznanja, tako za odlične znanstvene objave in dosežke ter njihovo komuniciranje kot tudi za družbeno koristne storitve in dognanja. Na podlagi izjemnih znanj, izkušenj in inovativnosti so bili mnogi imenovani v pomembne organe domačih in tujih institucij ter za urednike in člane uredniških odborov vidnih mednarodnih znanstvenih publikacij.

NIB je postal šesti zmagovalec slovenske nagrade Natura 2000. S prijavo »Monitoring in raziskave hroščev (Coleoptera) evropskega varstvenega pomena v Sloveniji« pod vodstvom doc. dr. Ala Vrezca (EKOS) smo zmagali v kategoriji Slovenski inovativni dosežki znanosti za Naturo 2000. Prejeli smo tudi nagrado za okolju prijazno storitev, ki jo podeljujeta Eko sklad in Časnik Finance. Nagrajena je bila platforma www.ciano.si avtoric doc. dr. Tine Eleršek in Maše Zupančič (GEN), ki združuje državljansko znanost z ozaveščanjem ljudi na temo cianobakterij. Njen namen je v raziskovalno delo vključiti državljane, ki lahko pomagajo pri spremljanju prekomerne razrasti cianobakterij v vodnih telesih.

Direktorica prof. dr. Maja Ravnikar je za svoj prispevek k revolucionarnim premikom pri odkrivanju in proučevanju virusov ter diagnostiki in odstranjevanju patogenih virusov prejela Zoisovo nagrado za vrhunske znanstvenoraziskovalne in razvojne dosežke na področju mikrobne biotehnologije.

Prejeli smo certifikat za sodelovanje pri »UNSGM Drylab EQAE 2021 external quality assurance exercises for the detection and characterization of viral pathogens as biological weapons with Next-Generation DNA Sequencing to further strengthen the bio-analytical reference laboratories in the UNSGM« v organizaciji Inštituta Robert Koch, ki je z analizo sekvenčnih podatkov (Illumina, Nanopore) ugotavljal prisotnost (pox)virusnih sekvenc v vzorcih »okuženih« ljudi, živali in celičnih linij, rekonstruiral genome poxvirusov in ugotavljal, ali so genetsko spremenjeni in predstavljajo potencialno biološko orožje.

part of FITO's activities have been closely linked to the field of plant pathogen diagnostics and plant protection services. We are continuously developing new sensitive diagnostic methods and testing state-of-the-art equipment that allows us to reliably and accurately identify plant pathogens from a wide range of samples. Our anniversary was celebrated with various events and activities throughout the year.

NIB employees are proud and happy to pass on our knowledge to new generations. In the 2021/2022 academic year we taught at the partner Jožef Stefan International Postgraduate School (IPS), the University of Ljubljana, where the NIB is an associate member, the University of Nova Gorica, the University of Primorska, the University of Maribor, the Sigmund Freud University of Ljubljana and the University of Gdansk (Poland).

The year 2022 was a highly successful one for the NIB, especially in transferring scientific achievements into practice and disseminating scientific knowledge to different audiences and users. NIB researchers have received a number of prestigious national and international prizes and awards, both for outstanding scientific publications and achievements and their communication, as well as for socially useful services and findings. On the basis of their outstanding skills, experience and innovation, many have been appointed to important bodies of national and international institutions and as editors and members of editorial boards of prominent international scientific publications.

The NIB is the sixth winner of the Slovenian Natura 2000 Award. With the entry "Monitoring and research on beetles (Coleoptera) of European conservation importance in Slovenia", led by Assoc. Prof. Dr Al Vrezec (EKOS), we won in the category Slovenian Innovative Achievements in Science for Natura 2000. We also won the award for Environmentally Friendly Service, bestowed by Eko sklad (Eco Fund) and the Časnik Finance newspaper. The award went to the www.ciano.si platform by Assoc. Prof. Dr Tina Eleršek and Maša Zupančič (GEN), which combines citizen science with raising people's awareness on the topic of cyanobacteria. The aim is to involve citizens in research work so that they can help monitor cyanobacterial overgrowth in water bodies.

Na NIB se zavedamo, da so kakovostni in motivirani kadri eden najpomembnejših pogojev za učinkovito delovanje organizacije. Spoštujemo celovitost svojih zaposlenih, kar se odraža v razumevanju njihovih poslovnih ter zasebnih potreb in želja. Prepričani smo, da le varno in prijazno delovno okolje doprinese k odličnim poslovnim rezultatom ter vsestranskemu zdravju zaposlenih in institucije. NIB je junija 2022 pridobil pristopni certifikat Družbeno odgovoren delodajalec (področje certificiranja je usklajevanje poklicnega in zasebnega življenja), ki ga podeljuje Revizorski svet Ekvilib Inštituta in temelji na smernicah mednarodnega standarda za družbeno odgovornost ISO 26000, katerega namen in cilj je izboljšanje družbeno odgovornega upravljanja v organizacijah in podjetjih v Sloveniji v odnosu do zaposlenih.

V prihodnost tako stopamo z jasno vizijo, ki ne dovoljuje, da bi bili cilji zdravih odnosov, upoštevanja svobode v raziskovalni in strokovni kreativnosti ter uravnoteženega napredka zgolj črke na papirju. Ob nizanju teh vrstic, ki podajajo le del najvidnejših uspehov Inštituta, vidim ljudi, ki so zaslužni za te uspehe. Vidim sodelavce, ki jim je mar.

To me bodri in navdaja z upanjem, da bomo, tako kot smo bili v preteklem letu, tudi v prihodnje složno kos izzivom, ki nam jih prinašajo druga faza zahtevnega projekta novogradnje in selitve, administrativne in kadrovske spremembe, vse zahtevnejša birokracija ter negotove finančne razmere.

To me veseli in navdaja s ponosom, da imam čast voditi Inštitut, katerega zaposleni so ne le izjemni znanstveniki in strokovnjaki, temveč sodelavci, ki želijo in znajo stopiti skupaj na poti razvoja sodobnega, mednarodno uveljavljenega, v gospodarstvo in širše družbeno okolje tesno vpetega Nacionalnega inštituta za biologijo.

Prof. dr. Maja Ravnikar
direktorica NIB

The Director, Prof. Dr Maja Ravnikar, was awarded the Zois Prize for Excellence in Microbial Biotechnology for her contribution to revolutionary advances in the discovery and study of viruses and the diagnosis and elimination of pathogenic viruses.

We received a certificate for our participation in the "UNSGM Dry-lab EQAE 2021 external quality assurance exercises for the detection and characterisation of viral pathogens as biological weapons with Next-Generation DNA Sequencing to further strengthen the bio-analytical reference laboratories in the UNSGM" organised by the Robert Koch Institute. This project analysed sequence data (Illumina, Nanopore) to identify the presence of (pox)viral sequences in samples from "infected" humans, animals and cell lines, reconstructed the genomes of poxviruses and determined whether they are genetically modified and constitute potential biological weapons.

At the NIB, we are aware that quality and highly motivated human resources are one of the most important conditions for the effective functioning of an organisation. We respect the integrity of our employees, which is reflected in our understanding of their business and personal needs and aspirations. We believe that only a safe and friendly working environment contributes to excellent business results and the all-round health of employees and the institution. In June 2022, the NIB was awarded the Socially Responsible Employer (the scope of certification is work-life balance) accession certificate by the Ekvilib Institute's Audit Board, based on the guidelines of the international standard for social responsibility ISO 26000, which aims to improve socially responsible management in organisations and companies in Slovenia in relation to their employees.

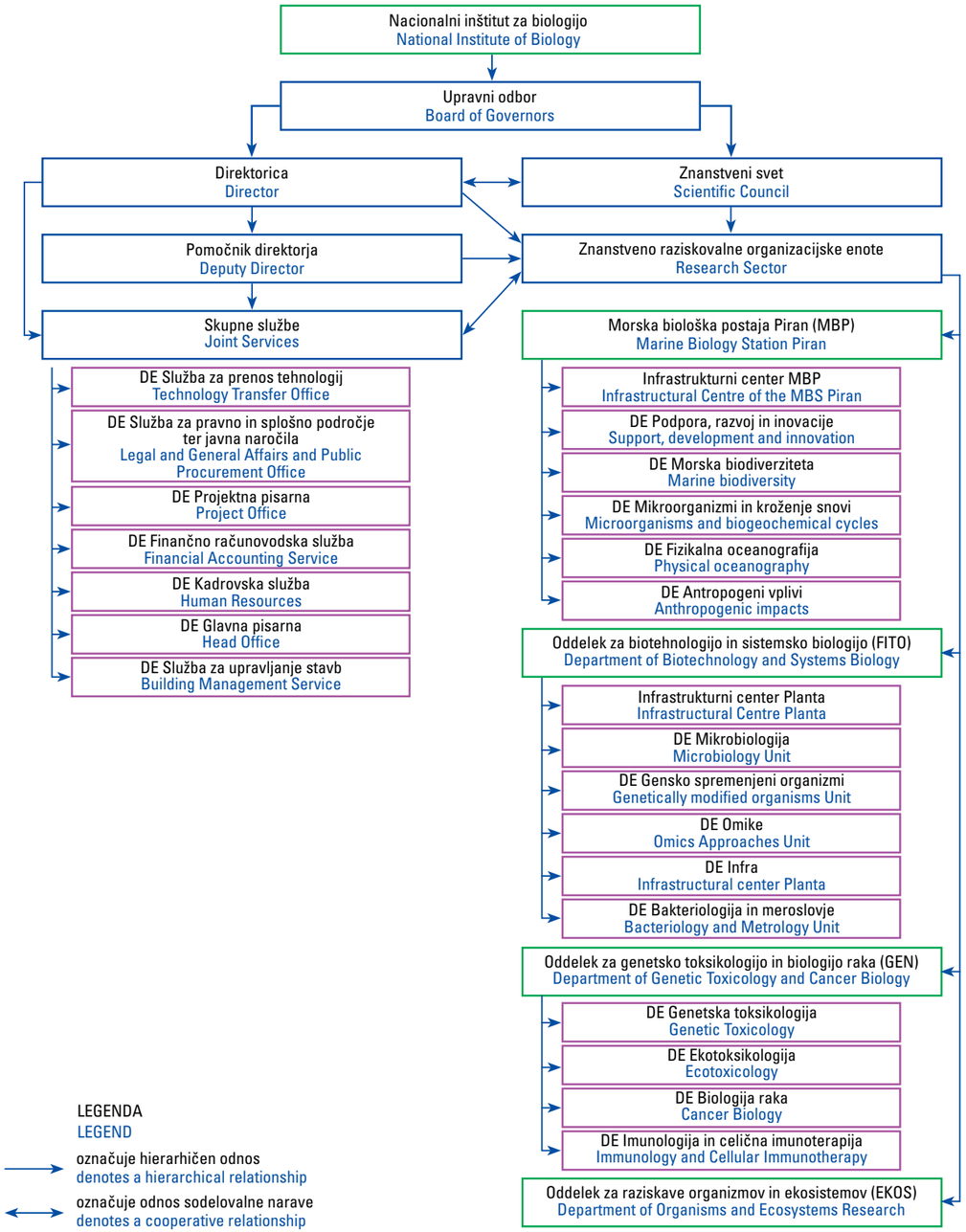
We are therefore moving into the future with a clear vision that does not allow the goals of healthy relationships, respect for freedom in research and professional creativity, as well as balanced progress to be mere letters on paper. As I write these lines, which give only a glimpse of some of the Institute's most notable successes, I see the people who are responsible for these successes. I see colleagues who care.

This encourages me and gives me hope that, as we have done over the past year, we will continue to meet the challenges posed by the second phase of a complex new building and relocation project, by administrative and staff changes, by an increasingly complex bureaucracy and by an uncertain financial situation.

It gives me great pleasure and pride to have the honour to lead an institute whose staff are not only outstanding scientists and experts, but colleagues who are willing and able to work together to develop a modern, internationally renowned National Institute of Biology, closely embedded in the economy and the wider society.

Prof. Dr. Maja Ravnikar
Director of the NIB

Organizacijska shema
Organizational Chart



Vodstvo inštituta
The Institute's Management

Direktorica Director

Prof. dr. Maja Ravnikar
Mandat Mandate: 1. 1. 2021 – 31. 12. 2025

Pomočnik direktorice za finančno računovodsko področje Deputy Director for Finance and Accounting

mag. Franc Potočnik (od from 1999)
Mandat Mandate: 1. 1. 2021 – 31. 12. 2025

Pomočnica direktorice za pravno in splošno področje ter javna naročila Assistant Director for Legal and General Affairs and Public Procurement

Alenka Tomšič
Mandat Mandate: 10. 3. 2021 – 31. 12. 2025

Upravni odbor Board of Governors

prof. dr. Franci Demšar, Nacionalna agencija Republike Slovenije za kakovost v visokem šolstvu Slovenian quality assurance agency for higher education – predsednik President

dr. Tomaž Boh, Ministrstvo za izobraževanje, znanost in šport Ministry of Education, Science and Sport

mag. Gašper Polajnar, Nacionalni inštitut za biologijo National Institute of Biology

dr. Ruth Rupreht, Ministrstvo za okolje in prostor Ministry of Natural Resources and Spatial Planning

prof. dr. Uroš Urleb, Biofarmacevtika Mengeš, Novartis

Mandat Mandate: 9. 9. 2022 – 9. 9. 2026

Znanstveni svet Scientific Council

Znanstveni svet NIB, katerega člani so izvoljeni za mandatno obdobje od 17. 6. 2020 do 16. 6. 2024, deluje v sestavi The Scientific Council of the NIB, whose members are elected for the term of office from 17. 6. 2020 to 16. 6. 2024, is composed of:

prof. dr. Marina Dermastia (predsednica President),
izr. prof. dr. Bojana Žegura (podpredsednica Vice-President),
prof. dr. Kristina Gruden,
prof. dr. Lovrenc Lipej,
dr. Nataša Mori,
izr. prof. dr. Patricija Mozetič,
doc. dr. Martina Orlando Bonaca,
prof. dr. Maja Ravnikar,
doc. dr. Al Vrezec,
doc. dr. Anže Županič.

Častni člani Honorary Members

prof. dr. Kazimir Tarman, od from 25. 10. 2010

dr. Guy Van Den Eede, od from 25. 10. 2010

prof. dr. Cornelis Johannes Forrendinis van Noorden, od from 14. 11. 2014

prof. dr. Tom Turk, od from 8. 11. 2017

akad. prof. dr. Matija Gogala, od from 21. 12. 2020

Strategija
Strategy

NIB ima strateške in dolgoročne cilje ter ključne pristope oziroma ukrepe za njihovo doseganje opredeljene v Strategiji NIB, ki jo je sprejel Upravni odbor NIB. Strategija NIB natančneje opredeljuje usmeritve in prednostne naloge za uresničevanje poslanstva in doseganje ciljev ob upoštevanju globalnih trendov in družbenih izzivov.

NIB s svojim znanjem ter vpetostjo v nacionalni, evropski in mednarodni raziskovalni prostor odgovarja na aktualne znanstvene in družbene izzive (kot so npr. okoljska in biodiverzitetna kriza, zagotavljanje varne hrane, dostopnost do vode, kakovostno življenje, sonaravni razvoj, hiter biotehnološki razvoj, digitalizacija, spreminjanje družbe, aktualne krize itd.) ter s svojimi rezultati prispeva k na znanju temelječi in vključujoči družbi. S svojo raznolikostjo in interdisciplinarnostjo ter prilagodljivostjo se hitro in učinkovito odziva na krizne in druge pomembne situacije, pri čemer sodeluje z različnimi deležniki družbe (npr. širša družba, javna uprava in drugi laboratoriji, ki izvajajo delo za javno upravo v EU in po svetu, gospodarstvo, strokovna javnost in izobraževalni procesi, splošna javnost).

V Strategiji NIB, ki temelji na številnih dokumentih in izhodiščih ter jih tudi vključuje, so poleg poslanstva in vizije jasno opredeljene vrednote NIB in naslednji strateški cilji:

- ustvarjanje vrhunske znanosti,
- prenos znanja uporabnikom,
- zaposlovanje, izobraževanje ter razvoj vrhunskega in zadovoljnega kadra,
- organiziranost, ki podpira doseganje odličnosti, in učinkovito odzivanje na aktualne izzive ter prizadevanje za neodvisnost pri delovanju,
- zagotavljanje vrhunske infrastrukture,
- trajnostno financiranje, ki omogoča stalno rast in razvoj.

Povezava do dokumenta:
https://www.nib.si/images/datoteke/STRATEGIJA_NACIONALNEGA_INTITUTA_ZA_BIOLOGIJO.pdf

The NIB's strategic and long-term objectives and the key approaches or actions to achieve them are set out in the NIB Strategy, which has been adopted by the NIB Governing Board. The NIB Strategy refines the orientations and priorities for achieving the mission and objectives, taking into account global trends and societal challenges.

The NIB responds to current scientific and societal challenges (such as the environmental and biodiversity crisis, food security, access to water, quality of life, sustainable development, rapid biotechnological development, digitalisation, changing societies, current crises, etc.) with its expertise and its involvement in the national, European and international research landscape, and contributes to a knowledge-based and inclusive society through its results. Its diversity, interdisciplinarity and flexibility enable it to respond quickly and efficiently to crises and other important situations, working with different stakeholders in society (e.g. society at large, public administration and other laboratories carrying out work for public administration in the EU and worldwide, the business sector, the professional community and educational processes, the general public).

The NIB Strategy, which builds on and integrates a number of documents and platforms, clearly defines the NIB's values and the following strategic objectives, in addition to its mission and vision:

- Creating world-class science,
- transferring knowledge to users,
- recruiting, educating and developing a top-quality and satisfied workforce,
- an organisation that supports the pursuit of excellence, responding effectively to current challenges and striving for operational independence,
- providing a world-class infrastructure,
- sustainable funding that enables continued growth and development.

Document link:
https://www.nib.si/images/datoteke/STRATEGIJA_NACIONALNEGA_INTITUTA_ZA_BIOLOGIJO.pdf

Pregled poslovanja NIB v letu 2022
Overview of the NIB's Operations in 2022

Leto 2022, polno velikih izzivov, je NIB zaključil uspešno. Med uspehi tega leta velja izpostaviti zaključek gradnje prve etape novega objekta Biotehnološkega stičišča Nacionalnega inštituta za biologijo (BTS-NIB), s primopredajo v decembru 2022. Zelo pomemben uspeh v letu 2022 predstavlja tudi pridobitev dodatnih sredstev za nakup raziskovalne opreme za novi objekt (sklenjena pogodba za investicijsko operacijo »Nakup raziskovalne opreme« z Ministrstvom za visoko šolstvo, znanost in inovacije v vrednosti 6.348.456 EUR). Nova raziskovalna oprema, ki je bila v pretežnem delu že nabavljena v letu 2022, bo omogočala polno izkoriščanje kapacitet novega objekta BTS-NIB takoj po vselitvi in pričetku dela. Tudi na drugih področjih poslovanja je NIB v letu 2022 dosegel veliko uspehov, ki so navedeni v nadaljevanju tega poročila.

Finančno je NIB v letu 2022 posloval zelo uspešno, kljub temu da so bili številni zaposleni zelo intenzivno vpeti v izvajanje investicije BTS-NIB, kar je zanje pomenilo veliko dodatno obremenitev, in kljub temu da je izvajanje investicije predstavljalo tudi finančno breme za poslovanje NIB. Ustvarjeni prihodki so znašali 13.207.553 EUR. Ustvarjeni prihodki so bili višji od načrtovanih za 1.218.949 EUR (10,17 %). Ustvarjeni presežek prihodkov nad odhodki (pred obračunom davka od dohodkov pravnih oseb) v višini 334.201 EUR je bistveno presegel načrtovanega (planiran je bil presežek odhodkov nad prihodki v višini 32.650 EUR).

The NIB completed the challenging year of 2022 successfully. Among the successes of the year, it is worth highlighting the completion of the construction of the first phase of the new Biotechnological Hub of the National Institute of Biology (BTH-NIB), with handover in December 2022. Another very important success in 2022 was the acquisition of additional funding for the purchase of research equipment for the new facility (contract concluded with the Ministry of Higher Education, Science and Innovation for the investment operation "Purchase of research equipment" worth €6,348,456). The new research equipment, most of which was already procured in 2022, will allow the new BTH-NIB facility to be fully utilised as soon as it is occupied and work starts. In other areas of its business, the NIB also achieved many successes in 2022, which are outlined later in this report.

Financially, the NIB performed very well in 2022, despite the fact that a number of employees were heavily involved in the implementation of the BTH-NIB investment, which placed a significant additional burden on them, and despite the fact that the implementation of the investment also placed a financial burden on the Institute's business operations. The revenue generated amounted to €13,207,553. The revenue generated was higher than planned by €1,218,949 (10.17%). The surplus of revenue over expenditure (before corporation tax) of €334,201 was significantly higher than planned (planned surplus of expenditure over revenue of €32,650).

V primerjavi z letom 2021 so bili realizirani prihodki NIB v letu 2021 višji za 952.291 EUR (7,94 %), realizirani odhodki pa za 1.289.166 EUR (10,75 %). Ustvarjeni poslovni izid v letu 2022 je bil zato nižji kot v letu 2021 (v letu 2021 ustvarjen presežek prihodkov nad odhodki pred obračunom davka od dohodka je znašal 671.075 EUR), vendar glede na vse pogoje poslovanja v letu 2022 še vedno odličen. Nominalno največja rast prihodkov v letu 2022 v primerjavi z letom 2021 je bila dosežena pri prihodkih od ARRS. Ti so v letu 2022 znašali 8.492.725 EUR in so bili od primerljivih prihodkov v letu 2021 višji za 1.523.058 EUR (12,70 %). Drugi realizirani prihodki v letu 2022 so bili nižji od ustvarjenih v letu 2021. Ostali realizirani prihodki v letu 2022 v okviru javne službe (v ta okvir sodijo prihodki od ministrstev ter njihovih organov in agencij, prihodki iz evropskega programa Obzorje 2020 in Obzorje Evropa ter drugih evropskih programov) v višini 3.295.186 EUR so bili za malenkost nižji od primerljivih v letu 2021, in sicer za 107.916 EUR (3,17 %). Ustvarjeni prihodki na trgu v letu 2022 v višini 1.220.887 EUR pa so bili nižji od primerljivih v letu 2021 za 645,870 EUR (34,60 %). Posebej izrazito je bilo zmanjšanje prihodkov na tujem trgu, kjer so realizirani prihodki v letu 2022 znašali 196.721 EUR, v letu 2021 pa 883.122 EUR. Razlog za tolikšno zmanjšanje je predvsem v tem, da je bila v letu 2021 izvedena prodaja določenega znanja spin-out podjetju Niba Labs, kar je za NIB posledično pomenilo prenehanje izvajanja določenih storitev z uporabo znanja, ki je bilo predmet prodaje.

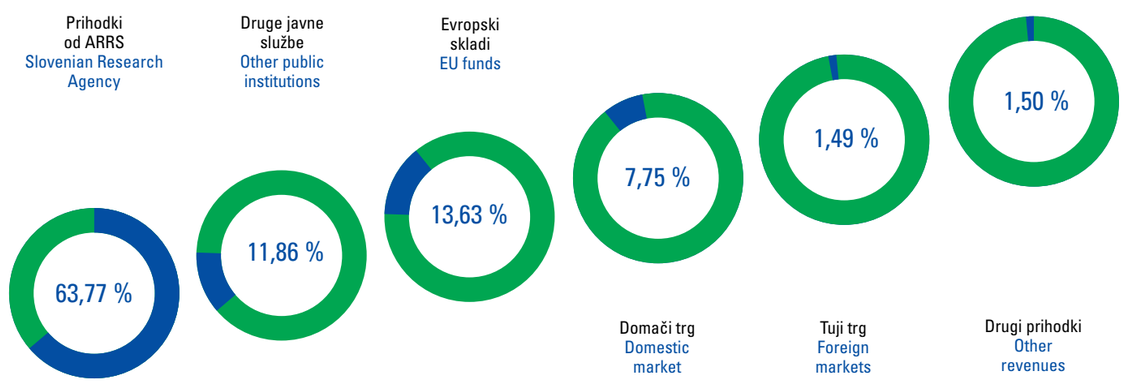
Compared to 2021, the realised revenue in 2021 was higher by €952,291 (7.94%) and realised expenditure by €1,289,166 (10.75%). The result generated in 2022 was therefore lower than in 2021 (in 2021 the surplus of revenue over expenses before income tax amounted to €671,075), but still excellent in 2022, given the business conditions. In nominal terms, the highest revenue growth in 2022 compared to 2021 was achieved in ARRS revenue. The latter amounted to €8,492,725 in 2022 and was €1,523,058 (12.70%) higher than the comparable revenue in 2021. Other revenue realised in 2022 was lower than that realised in 2021. Other public service revenue realised in 2022 (this includes revenue from Ministries and their bodies and agencies, revenue from the European Horizon 2020 and Horizon Europe programmes and other European programmes) amounting to €3,295,186 was slightly lower than the comparable revenue in 2021 by €107,916 (3.17%). However, the market revenue generated in 2022 of €1,220,887 was lower than the comparable figure for 2021 by €645,870 (34.60%). The decrease was particularly pronounced in the foreign market, where the revenue realised in 2022 amounted to €196,721 and in 2021 to €883,122. This decrease is mainly due to the sale in 2021 of certain know-how to the spin-out company Niba Labs, which meant that the NIB consequently ceased to provide certain services using the know-how that was the subject of the sale.

PRIHODKI V EUR REVENUES IN EUR	2022	STRUKTURA 2022 (%) STRUCTURE 2021 (%)	2021	INDEKS INDEX 2022/2021
ARRS / Slovenian Research Agency	8.422.440,00	63,77	6.969.667,12	120,84
Druga javna služba / Other public service	1.565.762,00	11,86	1.710.401,34	91,54
Evropski skladi / EU funds	1.799.710,00	13,63	1.692.700,59	106,32
Domači trg / Domestic market	1.024.166,00	7,75	983.635,25	104,12
Tuji trg / Foreign market	196.721,00	1,49	883.122,22	22,28
Drugi prihodki / Other revenues	198.754,00	1,50	15.735,31	1263,11
Skupaj prihodki / Total revenues	13.207.553,00	100,00	12.255.261,83	107,77

ODHODKI V EUR/EXPENSES IN EUR	2021	STRUKTURA 2021 (%) STRUCTURE 2021 (%)	2021	INDEKS / INDEX 2021/2020
Stroški dela / Labour	7.287.247,61	60,66	7.026.760,30	103,71
Stroški amortizacije / Amortization	602.309,49	5,04	584.281,07	103,09
Stroški materiala / Material	1.445.438,43	12,34	1.429.302,54	101,13
Stroški storitev / Services	3.196.552,17	21,16	2.450.971,04	130,42
Drugi stroški in odhodki / Other	341.804,07	0,80	92.871,53	368,04
Skupaj odhodki / Total expenditure	12.873.351,77	100,00	11.584.186,48	111,13

Rezultat poslovanja pred presežki / Business result before the use of carry-forward balance	334.201,23	671.075,35	49,8
Presežek prihodkov / Carry-forward balance of prior fiscal years	86.449,64	36.703,31	
Poslovni izid po uporabi presežka prihodkov / Business result after the use of carry-forward balance	420.650,87	707.778,66	59,43

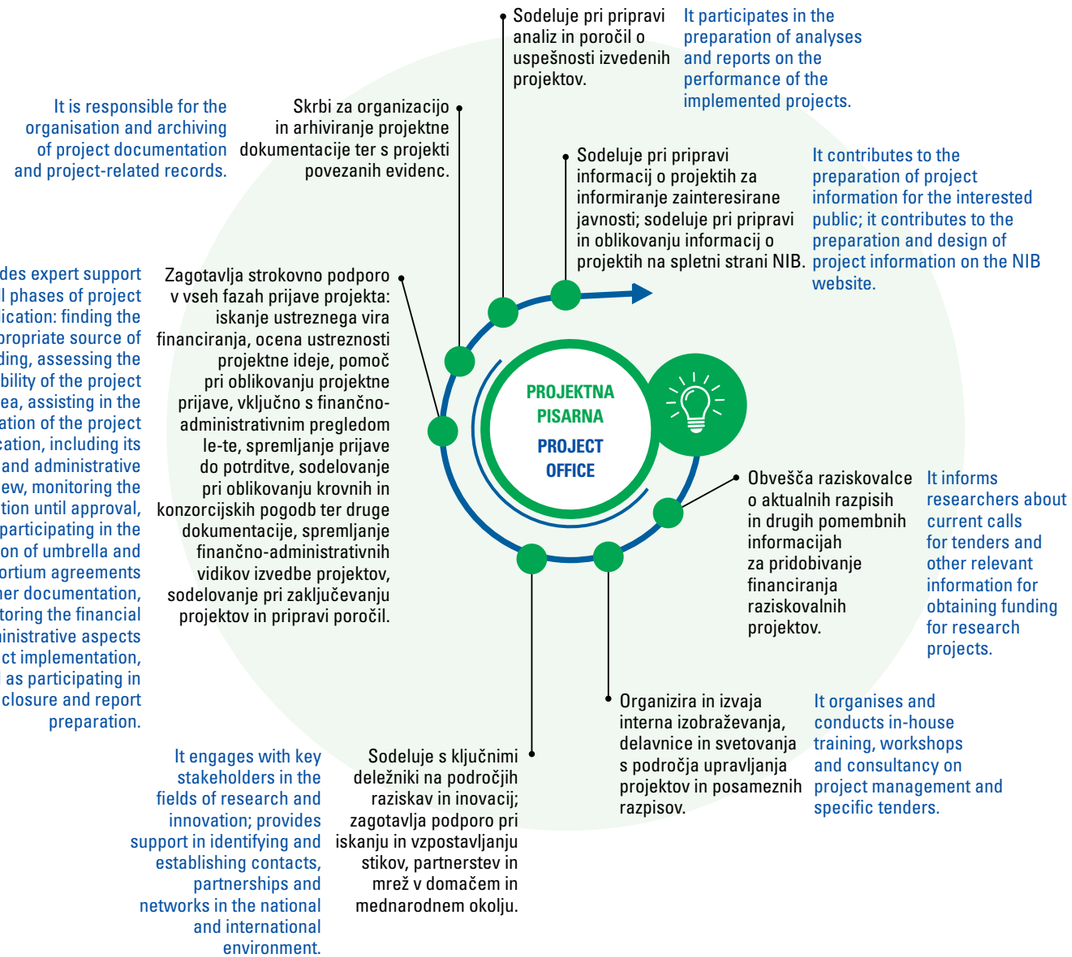
Struktura prihodkov NIB v letu 2022
Revenue Structure in 2022



Projektna pisarna
Project Office

Projektna pisarna NIB predstavlja osrednje mesto celovite informacijske, svetovalne in administrativne podpore raziskovalcem NIB pri načrtovanju, prijavah, izvedbi in spremljanju projektov.

The NIB Project Office is the focal point for comprehensive information, advice and administrative support to NIB researchers in the planning, application, implementation and monitoring of projects.



Izvajanje raziskovalnih programov in projektov
Implementing Research Programmes and Projects

NIB je v letu 2022 v okviru znanstveno raziskovalnega dela izvajal 8 raziskovalnih programov. Kot nosilec je NIB v letu 2022 izvajal 6 raziskovalnih programov:

P1-0237, »Raziskave obalnega morja«. Izvaja se v organizacijski enoti MBP v obsegu 7,78 FTE. V programski skupini, ki jo vodi dr. Patricija Mozetič, sodeluje 21 raziskovalcev, 2 upokojena raziskovalca, 4 tehnični sodelavci in 7 mladih raziskovalcev (MR). Obdobje financiranja 2020–2025;

P4-0165, »Biotehnologija in sistemska biologija rastlin«. Izvaja se v organizacijski enoti FITO v obsegu 5,40 FTE. V programski skupini, ki jo vodi dr. Kristina Gruden, sodeluje 20 raziskovalcev, 4 tehnični sodelavci in 11 MR. Obdobje financiranja 2022–2027;

P1-0255, »Združbe, interakcije in komunikacije v ekosistemih«. Izvaja se v organizacijski enoti EKOS v obsegu 6,40 FTE. V programski skupini, ki jo vodi dr. Meta Virant-Doberlet, sodeluje 17 raziskovalcev, dva upokojena raziskovalca, trije tehnični sodelavci in 6 MR. Program se izvaja tudi v soizvajalski organizaciji Prirodoslovni muzej Slovenije (0,19 FTE, 2 raziskovalca), obdobje financiranja 2017–2022;

P1-0245, »Ekotoksikologija, toksikološka genomika in karcinogeneza«. Izvaja se v organizacijski enoti GEN v obsegu 3,83 FTE. V programski skupini, ki jo vodi dr. Bojana Žegura, sodeluje 12 raziskovalcev, 3 tehnični sodelavci in 3 MR. Obdobje financiranja 2019–2024;

P4-0407, »Okoljska in aplikativna virologija: virusi, prijatelji in sovražniki«. Izvaja se v organizacijski enoti FITO v obsegu 1,59 FTE. V programski skupini, katere vodenje je v letu 2022 prevzel dr. Ion Gutierrez Aguirre, sodeluje 7 raziskovalcev, 3 tehnični sodelavci in 3 MR. Obdobje financiranja 2019–2024;

P4-0432, »Morska in mikrobna biotehnologija«. Izvaja se v organizacijski enoti MBP v obsegu 0,88 FTE. V programski skupini, ki jo vodi dr. Ana Rotter, sodelujeta 2 raziskovalca, 2 tehnična sodelavca in 1 MR. Obdobje financiranja 2022–2027.

In 2022, the NIB carried out 8 research programmes as part of its scientific research work. As a promoter, the NIB carried out 6 research programmes in 2022:

P1-0237, "Coastal marine research". It is implemented in the MBP organisational unit in the scope of 7.78 FTE. The programme team, led by Dr Patricija Mozetič, comprises 21 researchers, 2 retired researchers, 4 technical assistants and 7 young researchers (YR). Funding period 2020–2025;

P4-0165, "Plant biotechnology and systems biology". It is implemented in the FITO organisational unit in the scope of 5.40 FTE. The programme team, led by Dr Kristina Gruden, comprises 20 researchers, 4 technical assistants and 11 YR. Funding period 2022–2027;

P1-0255, "Communities, interactions and communications in ecosystems". It is implemented in the EKOS organisational unit in the scope of 6.40 FTE. The programme team, led by Dr Meta Virant-Doberlet, comprises 17 researchers, 2 retired researchers, 3 technical assistants and 6 YR. The programme is also implemented in a co-implementing organisation, the Natural History Museum of Slovenia (0.19 FTE, 2 researchers), funding period 2017–2022;

P1-0245, "Ecotoxicology, toxicological genomics and carcinogenesis". It is implemented in the GEN organisational unit in the scope of 3.83 FTE. The programme team, led by Dr Bojana Žegura, comprises 12 researchers, 3 technical assistants and 3 YR. Funding period 2019–2024;

P4-0407, "Environmental and applied virology: viruses, friends and foes". It is implemented in the FITO organisational unit in the scope of 1.59 FTE. The programme team, which was taken over by Dr Ion Gutierrez Aguirre in 2022, comprises 7 researchers, 3 technical assistants and 3 YR. Funding period 2019–2024;

P4-0432, "Marine and microbial biotechnology" . It is implemented in the MBP organisational unit in the scope of 0.88 FTE. The programme team, led by Dr Ana Rotter, comprises 2 researchers, 2 technical assistants and 1 YR. Funding period 2022–2027;

NIB je v letu 2022 sodeloval še v dveh programih kot soizvajalec:

P1-0143, »Kroženje snovi v okolju, snovna bilanca in modeliranje okoljskih procesov ter ocena tveganja«. Nosilec programa je Institut Jožef Stefan, vodja dr. Milena Horvat, obseg FTE za NIB 0,33. Sodeluje organizacijska enota MBP (1 raziskovalec in 1 upokojeni raziskovalec);

P4-0431 »Kmetijstvo naslednje generacije«. Nosilec programa je Kmetijski inštitut Slovenije, vodja Jaka Razinger; obseg za NIB je 0,29 FTE. Sodeluje organizacijska enota FITO (1 raziskovalec).

Poleg aktivnosti, financiranih v okviru stabilnega financiranja (1 infrastrukturni program, 8 raziskovalnih programov in 23 mladih raziskovalcev), je NIB v letu 2022 izvajal 41 temeljnih, 11 aplikativnih, 8 podoktorskih, 7 CRP projektov, 10 bilateralnih projektov in 4 mednarodne projekte ter 14 drugih projektov, ki se financirajo ali sofinancirajo iz proračuna pristojnega ministrstva neposredno ali posredno prek ARRS in iz proračunov drugih ministrstev.

NIB je v letu 2022 poleg nacionalnih projektov aktivno izvajal tudi številne evropske centralizirane in decentralizirane ter druge mednarodne projekte ter se potegoval za tržne projekte in jih tudi uspešno pridobival.

Vrsta projekta	Nosilec, koordinator	Sodelujoči, partner	SKUPAJ
ZNANSTVENORAZISKOVALNA DEJAVNOST ZA LETO 2022 IZ NASLOVA STABILNEGA FINANCIRANJA			
Infrastrukturni steber – ISF			
ARRS – infrastrukturni program (skupaj: 6,6 FTE)	1	0	1
Programski steber – PFS			
ARRS – raziskovalni programi (skupaj: 26,5 FTE)	6	2	8
ARRS – mladi raziskovalci	23		23
ZNANSTVENORAZISKOVALNA DEJAVNOST ZA LETO 2022 IZ DRUGIH VIROV FINANCIRANJA			
Projekti, ki se financirajo ali sofinancirajo iz proračuna ministrstva neposredno ali posredno preko ARRS in iz proračunov drugih ministrstev			
ARRS – temeljni projekti	24	17	41
ARRS – aplikativni projekti	6	5	11
ARRS – podoktorski projekti	8		8
ARRS – ciljni raziskovalni programi	6	1	7
ARRS – mednarodni projekti; bilateralni projekti	10		10
ARRS – mednarodni projekti (npr. Partnership for Research and Innovation in the Mediterranean Area (PRIMA), CEA, ERC komplementarne sheme, program MSCA Pečat odličnosti)	3	1	4
Drugi razpisi in sredstva ministrstev ter agencij (brez ARRS) Razvoj znanstvenih kadrov (npr. Ad Futura …), MIZŠ, MKGP, MZ …	4	3	7
Mednarodni projekti iz naslova kohezijske politike (ESRR – Evropski sklad za regionalni razvoj, ESS – Evropski socialni sklad, KS – Kohezijski sklad, ESPR – Evropski sklad za pomorstvo in ribištvo, EKSRP – Evropski kmetijski sklad za razvoj podeželja, NOO – Načrt za okrevanje in obnovo)	0	7	7
MEDNARODNI PROJEKTI			
Mednarodni projekti – okvirni program (FP7, H2020, HEU)	1	12	13
Drugi mednarodni centralizirani projekti (LIFE, EMPIR, EMFAF, ERASMUS+, EU4H, EDF, projekti generalnih direktoratov, npr. DG MARE, DG ENVIRONMENT, DG SANTE in drugi npr. Eco Innovation, BioDiv, ERA NET, EURAMET …)	1	14	15
Drugi mednarodni decentralizirani projekti, npr. Evropsko teritorialno sodelovanje (interregionalno, transnacionalno, čezmejno; npr. projekti INTERREG, ICGEB)		5	5
Drugi mednarodni projekti (npr. COST akcije, Norveški in EGP mehanizem, EFSA …)	20		20
TRŽNI PROJEKTI			
Domači trg – javna služba (domači naročniki; državne inštitucije, javni zavodi, društva ipd.)	21		21
Domači trg – gospodarstvo* (domači naročniki; gospodarske družbe, samostojni podjetniki …)	25		25
Tuji trg (tuji naročniki storitev, EESA)	11		11
Interno podprti projekti (Raziskovalni sklad NIB)	9		9
SKUPAJ	**179**	**67**	**246**

* Storitev GSO analize, bakterijske analize in analize mikroorganizmov se vsaka posebej upošteva kot en projekt, pri čemer je bilo za to skupino storitev prejetih okvirno 70 naročil. Podobno velja za storitve GLP, kjer bilo izvedenih storitev skupaj za 15 naročil.

NIB has participated in two more programmes in 2022 as co-implementer:

P1-0143, "Cycling of substances in the environment, mass balances, modelling of environmental processes and risk assessment". The programme is implemented by the Jožef Stefan Institute, headed by Dr Milena Horvat, with an FTE for the NIB of 0.33. The MBP organisational unit is involved (1 researcher and 1 retired researcher);

P4-0431, "Next Generation Agriculture". The programme is implemented by the Agricultural Institute of Slovenia, headed by Jaka Razinger; with an FTE for the NIB of 0.29. The FITO organisational unit is involved (1 researcher).

In addition to the activities funded under stable funding (1 infrastructure programme, 8 research programmes and 23 young researchers), in 2022 the NIB will carry out 41 basic, 11 applied, 8 postdoctoral, 7 CRP, 10 bilateral and 4 international projects, as well as 14 other projects funded or co-financed from the budget of the competent ministry, directly or indirectly through the ARRS and from the budgets of other ministries.

In addition to national projects, the NIB actively implemented a number of European centralised and decentralised projects and other international projects in 2022, as well as competed for and successfully won commercial projects.

Type of project	Promoter, coordinator	Participant, partner	TOTAL
SCIENTIFIC RESEARCH ACTIVITY IN 2022 UNDER STABLE FUNDING			
Infrastructure pillar – ISF			
ARRS – Infrastructure Programme (total: 6.6 FTE)	1	0	1
Programme pillar – PFS			
ARRS – research programmes (total: 26.5 FTE)	6	2	8
ARRS – young researchers	23		23
SCIENTIFIC RESEARCH ACTIVITY IN 2022 FROM OTHER SOURCES OF FUNDING			
Projects financed or co-financed from the ministry's budget directly or indirectly through ARRS and from the budgets of other ministries			
ARRS – basic projects	24	17	41
ARRS – applied projects	6	5	11
ARRS – postdoctoral projects	8		8
ARRS – targeted research programmes	6	1	7
ARRS – international projects; bilateral projects	10		10
ARRS – international projects (e.g. Partnership for Research and Innovation in the Mediterranean Area (PRIMA), CEA, ERC complementary schemes, MSCA Seal of Excellence programme)	3	1	4
Other calls for tenders and funding from ministries and agencies (excluding ARRS) Development of scientific personnel (e.g. Ad Futura…), Ministry of Education, Science and Sport, Ministry of Agriculture, Forestry and Food, Ministry of Health, etc.	4	3	7
International projects under the Cohesion Policy (ERDF – European Regional Development Fund, ESF – European Social Fund, CF – Cohesion Fund, EMFF – European Maritime and Fisheries Fund, EAFRD – European Agricultural Fund for Rural Development, RRP – Recovery and Resilience Plan)	0	7	7
INTERNATIONAL PROJECTS			
International projects – Framework Programme (FP7, H2020, HEU)	1	12	13
Other international centralised projects (LIFE, EMPIR, EMFAF, ERASMUS+, EU4H, EDF, DG projects e.g. DG MARE, DG ENVIRONMENT, DG SANTE and others e.g. Eco Innovation, BioDiv, ERA NET, EURAMET, etc.)	1	14	15
Other international decentralised projects, e.g. European Territorial Cooperation (interregional, transnational, cross-border; e.g. INTERREG, ICGEB projects)		5	5
Other international projects (e.g. COST Actions, Norwegian and EEA Mechanism, EFSA, etc.)	20		20
MARKETABLE PROJECTS			
Domestic market – public service (domestic clients; state institutions, public institutions, associations, etc.)	21		21
Domestic market – economy*(domestic clients; companies, sole traders, etc.)	25		25
Foreign market (foreign service providers, EESA)	11		11
Internally supported projects (NIB Research Fund)	9		9
TOTAL	**179**	**67**	**246**

* The services of GMO analysis, bacterial analysis and micro-organism analysis are each considered separately as one project, with approximately 70 orders received for this group of services. The same applies to GLP services, where a total of 15 orders were received.

S finančno podporo preko internega poziva Raziskovalnega sklada NIB v letu 2020 je bilo v letih 2021 in 2022 izvedenih osem manjših projektov. Dva projekta sta se uspešno zaključila že v letu 2021, vsi ostali pa v letu 2022. Ugotovitve in rezultati izvedenih projektov bodo v letu 2023 predstavljeni na »Dnevu NIB«.

Oddan je bil projekt 5xPRO, kjer Konzorcij projektnih pisarn za krepitev odličnosti, interdisciplinarnosti in mednarodne vpetosti slovenskega raziskovalnega prostora združuje 5 JRO (Kemijski inštitut – koordinator, NIB, ZRC-SAZU, INZ in IMT) in katerega izvajanje se začne v letu 2023.

Eno od pomembnih vodil NIB je racionalna in povezljiva uporaba opreme, zato se NIB poleg nabave lastne infrastrukture vključuje tudi v številne nacionalne in evropske raziskovalne infrastrukture ter infrastrukturne projekte, preko katerih ima dostop do širokega nabora raziskovalne opreme, hkrati pa svojo raziskovalno opremo ponuja v uporabo zunanjim uporabnikom.

Vključenost v raziskovalne infrastrukture oz. projekte v letu 2022

Št.	Raziskovalna infrastruktura	Opis	Vodja na NIB
1	LIFEWATCH-SI	NIB je vključen v slovenski konzorcij LifeWatch-SI in preko njega v infrastrukturo za e-znanost in tehnologijo za raziskave biotske raznovrstnosti in ekosistemov LifeWatch-ERIC, prispeva podatke iz morskega okolja ter sodeluje v skupnih akcijah konzorcija.	Andreja Ramšak
2	eLTER-SI	NIB je član slovenskega konzorcija eLTER-SI z namenom pospeševanja raziskovalnih dejavnosti na področju ekosistemov in kritičnih con ter njihovih socioekoloških raziskovanj in čimprejšnje vključitve v eLTER ESFRI.	Andreja Ramšak
3	ELIXIR	NIB je član ELIXIR, evropske raziskovalne infrastrukture za vede o življenju in biološke informacije, ki podpira raziskave na področju znanosti o življenju in njihov prenos v medicino, kmetijstvo, bioindustrije in družbo. V okviru slovenskega vozlišča ELIXIR NIB vodi vsebine na področju sistemske biologije in sistemske medicine.	Kristina Gruden
4	METROFOOD-RI	NIB je član METROFOOD-RI, evropske raziskovalne infrastrukture za promocijo meroslovja v hrani in prehrani.	Mojca Milavec
5	SiMBioN	NIB je s svojo veliko infrastrukturo za elektronsko in konfokalno mikroskopijo član slovenskega vozlišča SiMBioN kot dela evropske raziskovalne infrastrukture EURO-BIOIMAGING (EuBI) na področju biološkega, biomolekularnega, biokemijskega in medicinskega slikanja ter povezanih tehnologij.	Maruša Pompe Novak
6	Instruct-ERIC	NIB se je z veliko infrastrukturo za elektronsko mikroskopijo včlanil tudi v slovenski konzorcij Instruct.SI, preko katerega se Slovenija vključuje v evropsko raziskovalno infrastrukturo na področju strukturne biologije Instruct-ERIC.	Maruša Pompe Novak
7	EuroGOOS	NIB je povezan z evropskimi oceanografskimi mreženji, kot je EuroGOOS (Evropska globalna opazovalna oceanografska mreža) in v njenem okrilju MONGOOS (Sredozemska mreža operativne oceanografije).	Branko Čermelj
8	EMODnet	Podatkovne zbirke v okviru IC MBP tvorijo osnovo za integracijo v evropske infrastrukturne povezave, kot je EMODNet, ki omogoča dostop do javnih podatkov in metapodatkov o morju na poenoten način, obenem pa zagotavljata visoko kakovost storitev in produktov.	Branko Čermelj (vodja na NIB)

NIB si je v letu 2022 prizadeval tudi za vključitev v biobančni konzorcij BBMRI.SI oz. priključitev v slovensko vozlišče BBMRI-ERIC, ki je del evropske raziskovalne infrastrukture za biobančništvo. Ureditev formalnosti sledi v letu 2023.

With financial support through the NIB Research Fund internal call in 2020, 8 small projects were implemented in 2021 and 2022. Two projects were successfully completed in 2021 and all the others in 2022. The findings and results of the projects implemented will be presented at the “NIB Day” in 2023.

The 5xPRO project has been submitted, where the Consortium of Project Management Offices for Strengthening Excellence, Interdisciplinarity and International Involvement of the Slovenian Research Area brings together 5 public research organisations (the Institute of Chemistry - coordinator, NIB, ZRC-SAZU, INZ and IMT) and whose implementation will start in 2023.

One of the important guiding principles of the NIB is the rational and integrative use of equipment, which is why, in addition to the acquisition of its own infrastructure, the NIB is also involved in a number of national and European research infrastructures and infrastructure projects, through which it has access to a wide range of research equipment, while at the same time offering its research equipment to external users.

Involvement in research infrastructures or projects in 2022

No.	Research infrastructure	Description	Head at the NIB
1	LIFEWATCH-SI	The NIB is involved in the Slovenian LifeWatch-SI consortium and through it in the e-Science and Technology Infrastructure for Biodiversity and Ecosystem Research LifeWatch-ERIC, contributing marine data and participating in the consortium’s joint actions.	Andreja Ramšak
2	eLTER-SI	The NIB is a member of the Slovenian eLTER-SI consortium with the aim of promoting research activities in the field of ecosystems and critical zones and their socio-ecological research and to be included in eLTER ESFRI as soon as possible.	Andreja Ramšak
3	ELIXIR	The NIB is a member of ELIXIR, the European Research Infrastructure for Life Sciences and Biological Information, which supports life sciences research and its translation into medicine, agriculture, bioindustries and society. Within the Slovenian ELIXIR NIB node, the NIB leads content on systems biology and systems medicine.	Kristina Gruden
4	METROFOOD-RI	The NIB is a member of METROFOOD-RI, the European research infrastructure for the promotion of metrology in food and nutrition.	Mojca Milavec
5	SiMBioN	With its large electron and confocal microscopy infrastructure, NIB is a member of the Slovenian SiMBioN node as part of the EURO-BIOIMAGING (EuBI) European Research Infrastructure in the field of biological, biomolecular, biochemical and medical imaging and related technologies.	Maruša Pompe Novak
6	Instruct-ERIC	The NIB, with its large electron microscopy infrastructure, has also joined the Slovenian consortium Instruct.SI, through which Slovenia is part of the European research infrastructure in structural biology Instruct-ERIC.	Maruša Pompe Novak
7	EuroGOOS	The NIB is linked to European oceanographic networks such as EuroGOOS (European Global Ocean Observing System) and under its umbrella MONGOOS (Mediterranean Oceanographic Network for the Global Ocean Observing System).	Branko Čermelj
8	MONGOOS	The databases within the IC MBP form the basis for integration into European infrastructure links such as SEADATANET and EMODNET, which provide access to public marine data and metadata in a unified way, while ensuring high quality services and products.	Branko Čermelj (the leader on NIB)

In 2022, the NIB is also working towards joining the BBMRI.SI biobanking consortium or the Slovenian BBMRI-ERIC node, which is part of the European research infrastructure for biobanking. The formalities will follow in 2023.

Investicijska vlaganja
Investments

V letu 2022 je NIB realiziral investicije in investicijska vlaganja iz naslova projekta »Biotehnološkega stičišča NIB« (BTS-NIB) in projekta »Nakup raziskovalne opreme NIB« ter izvedel preostale investicije v osnovno opremo in investicijska vzdrževanja. V skladu z načrtom investicijskega vzdrževanja je bila realizirana sanacija brežine pri stavbi Morske biološke postaje Piran v višini 14.090 EUR.

NIB je v okviru projekta BTS-NIB v letu 2022 črpal avans v višini 2.690.941 EUR in s strani Ministrstva za visoko šolstvo, znanost in inovacije (MVZI) prejel še 6.683.278 EUR. MVZI je 28. 12. 2022 nakazalo dodatnih 8.238.094 EUR avansa za stroške, nastale v 2022, ki še niso bili vključeni v zahtevke za izplačilo, ter za stroške, ki bodo nastali v 2023.

Iz naslova operacije »Nakup raziskovalne opreme NIB« je NIB realiziral nabavo v vrednosti 5.309.788 EUR. Skupaj z načrtovanimi nabavami raziskovalne opreme v letu 2023 bo porabljenih 6.028.588 EUR sredstev, ki jih največ do višine 6.335.280 EUR z DDV sofinancirata Evropski sklad za regionalni razvoj in Republika Slovenija – Ministrstvo za vzgojo in izobraževanje v okviru Operativnega programa za izvajanje evropske kohezijske politike v obdobju 2014–2020.

NIB je v letu 2022 skupaj realiziral za 8.293.784 EUR nabav osnovnih sredstev. Od tega zneska je bilo aktiviranih za 7.456.832 EUR sredstev, razlika 836.952 EUR pa je v pridobivanju.

In 2022, the NIB implemented the investments and capital expenditure under the "NIB Biotechnology Hub" project (BTH-NIB) and the "Purchase of NIB research equipment" project, as well as the remaining investments in fixed equipment and maintenance. In accordance with the maintenance investment plan, the rehabilitation of the seashore at the Marine Biological Station Piran building was carried out, totalling €14,090.

In the framework of the BTS-NIB project, the NIB drew down an advance of €2,690,941 and received a further €6,683,278 from the Ministry of Higher Education, Science and Innovation in 2022. On 28.12.2022, the Ministry of Higher Education, Science and Innovation paid an additional advance of €8,238,094 for costs incurred in 2022 which have not yet been included in the payment claims and for costs to be incurred in 2023.

Under the operation "Purchase of NIB research equipment", the NIB made purchases worth €5,309,788. Together with the planned purchases of research equipment in 2023, €6,028,588 will be spent, co-financed up to a maximum of €6,335,280 including VAT by the European Regional Development Fund and the Republic of Slovenia – Ministry of Education under the Operational Programme for the Implementation of the European Cohesion Policy 2014–2020.

In total, the NIB has made fixed asset purchases of €8,293,784 in 2022. Of this amount, €7,456,832 have been capitalised and the balance of €836,952 is in the process of being acquired.

Gradnja objekta BTS-NIB
Construction of the BTH-NIB Facility

Po večletni pripravi projektne in investicijske dokumentacije za pridobitev sredstev za realizacijo investicije Biotehnološkega stičišča Nacionalnega inštituta za biologijo na Večni poti v Ljubljani je NIB konec junija 2021 z Ministrstvom za izobraževanje, znanost in šport podpisal Aneks k Pogodbi o sofinanciranju, s katerim je NIB pridobil 28,615 mio EUR, ki jih sofinancirata Ministrstvo za šolstvo, znanost in šport (po novem Ministrstvo za visoko šolstvo, znanost in inovacije) ter EU iz Evropskega sklada za regionalni razvoj.

V začetku julija 2021 je bila podpisana pogodba z izvajalcem GOI del Kolektor Kolingom, d. o. o., in nadzornikom nad izvajanjem GOI del Elea IC, d. o. o.

Konec avgusta 2021 je bila izdana sprememba gradbenega dovoljenja, s katero je bila dovoljena postavitev karantenskega rastlinjaka na streho severnega dela objekta BTS-NIB.

Gradnja objekta BTS-NIB, za katerega je projektno dokumentacijo izdelal arhitekturni biro Styria, d. o. o., iz Maribora, se je pričela julija 2021.

Objekt, ki bo meril v dolžino dobrih 152 m in v širino 23,5 m, bo imel 6.600 m^2 uporabne površine ter bo obsegal pritličje, nadstropje in tehnično etažo, na kateri bo na severni strani rastlinjak, na južni pa čebelnjak.

Projekt predvideva dvoetapno rušitev obstoječega objekta in dvoetapno gradnjo novega objekta. Pritličje in prvo nadstropje novega objekta sta vertikalno poravnana brez horizontalnih členitev. Tehnična etaža nad 1. nadstropjem je členjena v manjše posamezne objekte in zamaknjena proti notranjosti robnih zaključkov fasad in strehe. Objekt v stiku fasade in strehe z vencem ne presega 8 m višinskega gabarita, razen na delu, kjer bo stal rastlinjak, kjer je dovoljena višina 14 m. Nad omenjeno koto segajo dopustna nadvišanja tehničnih prostorov za naprave, potrebne za delovanje stavbe, ter dostopi na streho.

After several years of preparation of the project and investment documentation to obtain the funds for the realisation of the investment of the Biotechnology Hub of the National Institute of Biology at the Večna pot address, the NIB signed an Annex to the Co-financing Agreement with the Ministry of Education, Science and Sport at the end of June 2021, whereby the NIB obtained €28.615 million, co-financed by the Ministry of Education, Science and Sport (now Ministry of Higher Education, Science and Innovation) and the EU from the European Regional Development Fund.

The contract with the contractor of the construction and craft works, Kolektor Koling, d.o.o., and the supervisor of works, Elea IC, d.o.o., was signed at the beginning of July 2021.

At the end of August 2021, an amendment to the building permit was issued to allow the installation of a quarantine greenhouse on the roof of the northern part of the BTH-NIB building.

The construction of the BTH-NIB, for which the project documentation was prepared by the architecture firm Styria, d.o.o., from Maribor, started in July 2021.

The building, which will measure 152 m in length and 23.5 m in width, will have a usable surface area of 6,600 sq m and will comprise a ground floor, a first floor and a technical floor, with a greenhouse on the northern side and a beehive on the southern side.

The project envisages a two-stage demolition of the existing building and a two-stage construction of the new building. The ground floor and the first floor of the new building are vertically aligned without horizontal divisions. The technical floor above the first floor is divided into smaller individual buildings and offset to the inside of the edge finishes of the façades and roof. The building does not exceed 8 m in height at the junction of the façade and the roof with the wreath, except in the part where the greenhouse will be located, where a height of 14 m is permitted. Above this height, extensions to the technical spaces for the installations necessary for the operation of the building and access to the roof are permitted.

Objekt je členjen v sektorje, nizane od severa proti jugu od objekta A skrajno na severu do objektov B, C, D in E na jugu. V objektu A je locirano energetsko središče s komunalnimi priključki, s katerega se skladno z etapno izgradnjo preostalih sektorjev nizajo deli stavb z notranjimi hišnimi instalacijskimi razvodi.

Objekt je zasnovan kot niz laboratorijev, pisarn, predavalnic ter vseh pripadajočih tehničnih in servisnih prostorov in inštalacij. Etapnost gradnje je potrebna zaradi deljenih inštalacij z glavnim objektom Biološkega središča, ki morajo ves čas gradnje nemoteno delovati. Dostop in dovoz do objekta sta preko obstoječe interne dovozne ceste.

Umestitev novega objekta na predvideno lokacijo je načrtovana kot novogradnja na lokaciji obstoječega objekta s širitvijo, ki je v funkciji znanstvenoraziskovalne dejavnosti. Objekt predstavlja izrazni jezik sodobne arhitekture in hkrati odgovarja okolju, v katerem nastaja.

V zasnovi objekta je bilo treba upoštevati nekatera izhodišča, ki opredeljujejo zazidavo v njeni končni podobi v odnosu do ureditve območja posega in v odnosu do okolice. V urbanistični zasnovi novega objekta so bila tako upoštevana naslednja izhodišča: predhodna urbanistična komponenta, urbanistični parametri iz prostorskega akta in premoženjsko-pravno stanje zemljišč znotraj funkcionalne enote, vključno s predhodnim prostorskim preizkusom umestitve objekta na potencialno lokacijo, kar vse opredeljuje prostorsko zasnovo v njeni končni podobi, to je v odnosu do ureditve znotraj celotnega območja stavbnega kareja ter v odnosu do neposredne okolice.

Ker je načrtovani poseg v varovanem območju Krajinskega parka Tivoli, Rožnika in Šišenskega hriba, se vsa dela izvajajo s posebno skrbnostjo, da je čim manj posegov v varovani del črnojelševja. Prav tako je bil pred pričetkom izvajanja gradbenih posegov zaščiten drevored japonskih češenj.

V sklopu izvedbe celotne investicije so se po rušitvi obstoječega trakta NIB, imenovanega »Vhodni objekt«, in pilotiranju v letu 2021 v letu 2022 intenzivno izvajala gradbeno-obrtniška in inštalacijska dela na prvi etapi gradnje novega objekta BTS-NIB. Gradnja prve etape z vso pripadajočo komunalno in energetsko infrastrukturo, ureditvijo okolja in notranjo pohištveno ter tehnološko opremo je bila zaključena jeseni 2022. Po uspešno izvedenem tehničnem pregledu novembra 2022 je bilo v začetku decembra 2022 pridobljeno uporabno dovoljenje.

The building is divided into sectors, arranged in a north--south direction from building A in the north to buildings B, C, D and E in the south. Building A houses the energy centre with utility connections, from which, in line with the phased construction of the remaining sectors, parts of the buildings with internal installation ductworks are aligned.

The building is designed as a series of laboratories, offices, lecture rooms as well as all associated technical and service spaces and installations. The phasing of the construction is necessitated by the shared services with the main Biological Centre building, which must be kept operational throughout the construction period. Access to the facility is via the existing internal access road.

The placement of the new building on the envisaged location is planned as a new construction on the site of the existing building with an extension, which is in function of the scientific research activity. The construction of the facility follows the principles of contemporary architecture and at the same time responds to its environment.

The design of the building had to take into account certain starting points that define the development in its final form in relation to the layout of the area and in relation to its surroundings. The urban design of the new building therefore takes into account the following starting points: the previous urban design component, the urban design parameters of the spatial-planning act and the property-law status of the land within the functional unit, including a preliminary spatial test of the placement of the building on the potential site, all of which define the spatial design in its final form, i.e. in relation to the layout within the whole of the development area and in relation to the immediate surroundings.

As the proposed development is located within the protected areas of the Tivoli, Rožnik and Šišenski hrib Landscape Park, all works are carried out with special care to minimise encroachment into the protected part of the black alder forest. The avenue of Japanese cherry trees was also protected before construction work commences.

As part of the overall investment, following the demolition of the existing NIB tract, known as the "Entrance Building", and the piling in 2021, construction and installation works on the first phase of the construction of the new BTH-NIB building were intensively carried out in 2022. The construction of the first phase with all related

Raziskovalci so v začetku decembra pričeli s selitvijo opreme iz pisarniških kontejnerjev in drugega dela »Vhodnega objekta«, v drugi polovici decembra pa so že pričeli uporabljati novo zgrajene prostore v prvi etapi objekta BTS-NIB.

V začetku decembra 2022 je izvajalec že pričel z rušitvijo drugega dela »Vhodnega objekta« in odstranjevanjem pisarniških kontejnerjev, ki so jih raziskovalci začasno uporabljali, s čimer se je pričela gradnja druge etape BTS-NIB, ki bo zaključena do sredine oktobra 2023.

utility and energy infrastructure, environmental arrangements and interior furniture and technological equipment was completed in autumn 2022. Following a successful technical inspection in November 2022, the occupancy permit was obtained at the beginning of December 2022. In early December, the researchers started moving equipment out of the office containers and the second part of the "Entrance Building", and in the second half of December, they started using the newly constructed rooms in the first phase of the BTH-NIB building.

In early December 2022, the contractor had already started demolishing the second part of the "Entrance Building" and removing the office containers temporarily used by the researchers, thus starting the construction of the second phase of the BTH-NIB, which will be completed by mid-October 2023.

Načrtovana investicija
Biotehnološko stičišče NIB
(vir: Arhiv NIB).

Planned investment
Biotechnological Hub NIB
(Source: NIB archive).

Zaposleni v letu 2022
Employees in 2022

Inštitut je bil v letu 2022 sestavljen iz štirih raziskovalnih enot in Skupnih služb. Zaposleni v največjih dveh enotah predstavljajo 60 % vseh zaposlenih na NIB. Oddelek za biotehnologijo in sistemsko biologijo je na dan 31. 12. 2022 zaposloval 75 sodelavcev, enota Morska biološka postaja Piran 41, Oddelek za genetsko toksikologijo in biologijo raka 20, Oddelek za raziskave organizmov in ekosistemov 32, Skupne službe pa 24 sodelavcev.

Na NIB je bilo tako na dan 31. 12. 2022 192 zaposlenih, od tega 90 raziskovalcev, 20 mladih raziskovalcev ter 79 strokovno-tehničnih in administrativnih sodelavcev.

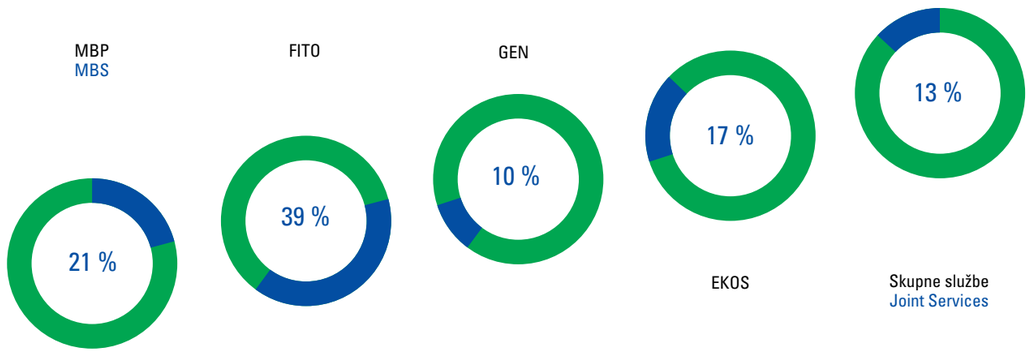
V letu 2022 se je na novo zaposlilo 25 sodelavcev, 16 jih je delovno razmerje na NIB prenehalo.

In 2022, the Institute was made up of four research units and Corporate Services. Employees in the two largest units represent 60% of the total NIB workforce. As of 31 December 2022, the Department of Biotechnology and Systems Biology had 75 staff, the Marine Biology Station Piran 41 staff, the Department of Genetic Toxicology and Cancer Biology 20 staff, the Department of Organisms and Ecosystems Research 32 staff and the Corporate Services 24 staff.

As of 31 December 2022, the NIB had 192 employees, including 90 researchers, 20 young researchers and 79 technical and administrative staff.

In 2022, 25 new staff members were recruited and 16 left the NIB.

Stanje po organizacijskih enotah na 31. 12. 2022
Number of Staff by Units on 31. 12. 2022

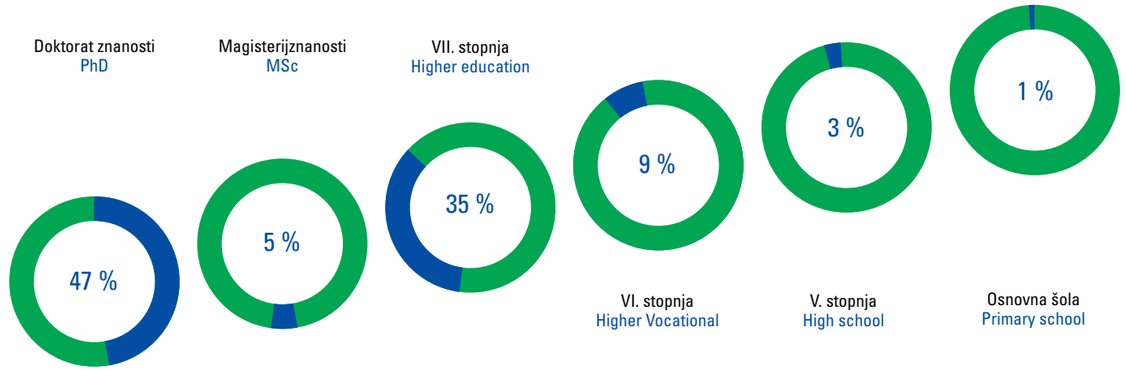


Izobrazbena struktura
Educational Structure

Na dan 31. 12. 2022 je bilo na Inštitutu zaposlenih 47 % delavcev z doktoratom znanosti, 5 % z magisterijem znanosti, 35 % s VII. stopnjo izobrazbe, 13 % pa z nižjo izobrazbo od VII. stopnje.

As at 31 December 2022, 47% of the Institute's staff had a PhD, 5% had a Master's degree, 35% had a level VII qualification and 13% had a qualification below level VII.

Izobrazbena struktura na dan 31. 12. 2022
Educational Structure on 31. 12. 2022



CERTIFIKAT »DRUŽBENO ODGOVOREN DELODAJALEC«
"SOCIALLY RESPONSIBLE EMPLOYER" CERTIFICATE

EVROPSKA UNIJA
EVROPSKI SOCIALNI SKLAD
NALOŽBA V VAŠO PRIHODNOST

Družbeno odgovoren delodajalec
Pristopni certifikat R.Š: 004/2022

Naložbo sofinancirata Republika Slovenija
in Evropska unija iz Evropskega socialnega sklada.

NIB je leta 2022 pristopil k uvedbi certifikata Družbeno odgovoren delodajalec, izbrano področje certificiranja je bilo usklajevanje poklicnega in zasebnega življenja. Pristopni certifikat, ki ga podeljuje Revizorski svet Ekvilib Inštituta in temelji na smernicah mednarodnega standarda za družbeno odgovornost ISO 26000, je bil pridobljen junija 2022.

In 2022, the NIB applied for the Socially Responsible Employer certification, with work-life balance as the chosen area of certification. This certificate, awarded by the Ekvilib Institute's Audit Board and based on the guidelines of the international social responsibility standard ISO 26000, was obtained in June 2022.

Doktorati, magisteriji in diplome v letu 2022
Doctoral Dissertations, Master's Theses and Undergraduate Theses in 2022

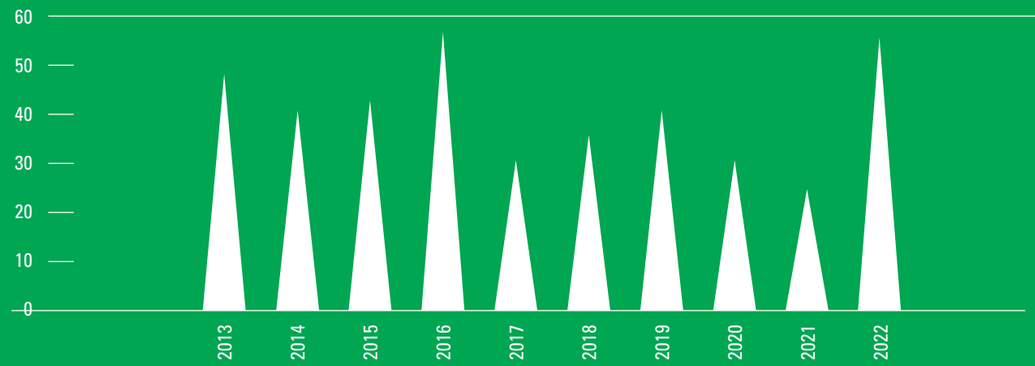
Svojo doktorsko disertacijo so pripravili pod (so)mentorstvom raziskovalcev z NIB in jo zagovarjali v letu 2022:

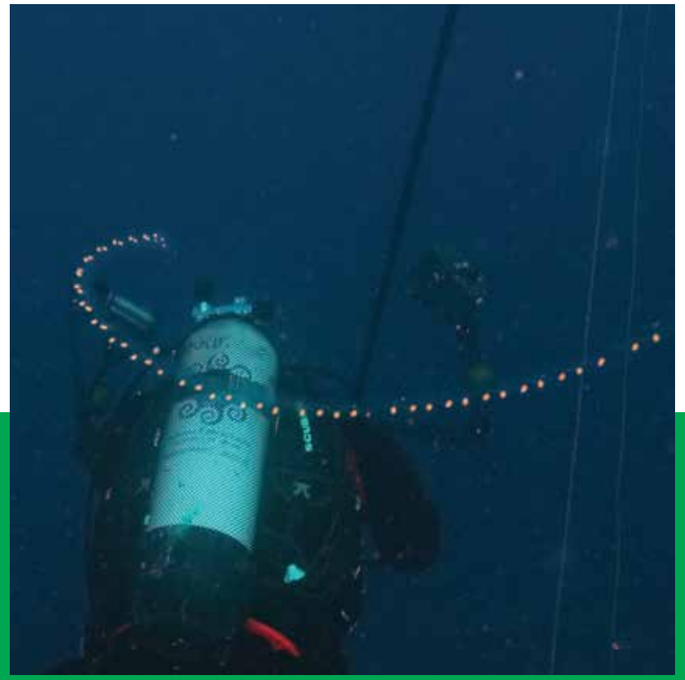
Doctoral dissertations under the (co)supervision of NIB researchers in the year 2022:

ŠTUDENT STUDENT	(SO) MENTOR (CO)SUPERVISOR
dr. Bernarda Majc (GEN)	Mentorica: prof. dr. Tamara Lah Turnšek (GEN), somentorica: dr. Metka Novak (GEN)
dr. Anja Pecman (FITO)	Mentorica: prof. dr. Maja Ravnikar (FITO), somentor: dr. Ion Guitierrez Aguirre (FITO)
dr. Mark Paul Selda Rivarez (FITO)	Mentor: doc. dr. Denis Kutnjak (FITO), somentorica: prof. dr. Maja Ravnikar (FITO)
dr. Špela Tomaž (FITO)	Mentorica: dr. Anna Coll (FITO)
dr. Mohammad Javad Malek-Hosseini	Mentor: izr. prof. dr. Matjaž Kuntner (EKOS)
dr. Katarina Bačnik (FITO)	Mentorica: prof. dr. Maja Ravnikar (FITO), somentor: dr. Denis Kutnjak (FITO)

Število diplomskih, magistrskih in doktorskih nalog pod(so)mentorstvom raziskovalcev z Nacionalnega inštituta za biologijo v obdobju 2013-2022

Number of Undergraduate Theses, Master's Theses and Doctoral Dissertations under (co)supervision of NIB researchers in years 2013-2022





Potapljanje v službi znanosti (foto: B. Mavrič).

Diving in the service of science (Photo: B. Mavrič).

Število zagovarjanih magistrskih in doktorskih nalog ter mentorstev in somentorstev s strani zaposlenih na NIB v letu 2022

Number of Master's Theses, Doctoral Dissertations, supervisions and co-supervisions by NIB employees in year 2022

magistska naloga / Master's Thesis	4
doktorska disertacija / Doctoral Dissertation	6
mentor pri doktorskih disertacijah / Supervisor for Doctoral Dissertations	7
mentor pri magistrskih delih / Supervisor for Master's Thesis	11
mentor pri diplomskih delih / Supervisor for Undergraduate Theses	13
somentor pri doktorskih disertacijah / Co-Supervisor for Doctoral Dissertations	7
somentor pri magistrskih delih / Co-Supervisor for Master's Thesis	15
somentor pri diplomskih delih / Co-Supervisor for Undergraduate Theses	2

Objave in citiranost v letu 2022
Publications and Citations in 2022

Objavljeni znanstveni članki (tipologija COBISS 1.01, 1.02 in 1.03) glede na leto objave, povprečni faktor vpliva po JCR (Journal Citation Reports), povprečno umeščenost revije, v kateri so bili objavljeni, v področne četrtine (kvartile) po JCR ter število čistih citatov po Web of Science/ Scopus:

Published scientific articles (typology COBISS 1.01, 1.02 and 1.03) by year, average Impact Factor (JCR), average journal quarter position (JCR) and number of pure citations in Web of Science/Scopus:

LETO YEAR	ŠTEVILO OBJAVLJENIH ZNANSTVENIH ČLANKOV / NUMBER OF PUBLISHED SCIENTIFIC ARTICLES	POVPREČNA UMEŠČENOST REVIJE V ČETRINE PO JCR / AVERAGE JOURNAL QUARTER POSITION (JCR)	ŠTEVILO ČISTIH CITATOV NUMBER OF PURE CITATIONS
2018	109	2	3505
2019	119	2	4186
2020	125	2	5967
2021	168	2	6760
2022	173	2	(h-indeks) 84

Najvplivnejše objave v letu 2022
The Most Influential Publications in 2022

NIB KOT VODILNI PARTNER V RAZISKAVI
NIB AS COORDINATOR IN RESEARCH

ŠTAMPAR, Martina, ŽABKAR, Sonja, FILIPIČ, Metka, ŽEGURA, Bojana. HepG2 spheroids as a biosensor-like cell-based system for (geno)toxicity assessment. *Chemosphere*, ISSN 0045-6535. [Print ed.], 2022, vol. 291, pt. 1, str. 1–11, ilustr., doi: 10.1016/j.chemosphere.2021.132805. [COBISS.SI-ID 84412419] IF 8.943

BREZNIK, Barbara, KO, Meng-Wei, TSE, Christopher, CHEN, Po-Chun, SENJOR, Emanuela, MAJC, Bernarda, HABIČ, Anamarija, ANGELILLIS, Nicolas, NOVAK, Metka, ŽUPUNSKI, Vera, MLAKAR, Jernej, NATHANSON, David, JEWETT, Anahid. Infiltrating natural killer cells bind, lyse and increase chemotherapy efficacy in glioblastoma stem-like tumorospheres. *Communications biology*, ISSN 2399-3642, 2022, vol. 5, str. 1–15, ilustr., doi: 10.1038/s42003-022-03402-z. [COBISS.SI-ID 107677443] IF 6.548

ŠTURM, Rok, LÓPEZ DÍEZ, Juan José, POLAJNAR, Jernej, SUEUR, Jérôme, VIRANT-DOBERLET, Meta. Is it time for ecotremology?. *Frontiers in ecology and evolution*, ISSN 2296-701X, 2022, vol. 10, str. 1–10, ilustr. doi: 10.3389/fevo.2022.828503. [COBISS.SI-ID 98504451] IF 4.496

ŽAGAR, Anamarija, SIMČIČ, Tatjana, DAJČMAN, Urban, MEGÍA-PALMA, Rodrigo. Parasitemia and elevation as predictors of hemoglobin concentration and antioxidant capacity in two sympatric lizards. *Comparative biochemistry and physiology : CBP. Part A, Molecular & integrative physiology*, ISSN 1095-6433, 2022, vol. 270, str. 1–10, ilustr. doi: 10.1016/j.cbpa.2022.111233. [COBISS.SI-ID 108380931] IF 2.888

PETEK, Marko, ZAGORŠČAK, Maja, BLEJEC, Andrej, RAMŠAK, Živa, COLL RIUS, Anna, BAEBLER, Špela, GRUDEN, Kristina. pISA-tree : a data management framework for life science research projects using a standardised directory tree. *Scientific data*, ISSN 2052-4463, 2022, vol. 9, str. 1–9, ilustr., doi: 10.1038/s41597-022-01805-5. [COBISS.SI-ID 130302467] IF 8.501

FILIPIĆ, Arijana, LUKEŽIČ, Tadeja, BAČNIK, Katarina, RAVNIKAR, Maja, JEŠELNIK, Meta, KOŠIR, Tamara, PETKOVŠEK, Martin, ZUPANC, Mojca, DULAR, Matevž, GUTIÉRREZ-AGUIRRE, Ion. Hydrodynamic cavitation efficiently inactivates potato virus Y in water. *Ultrasonics Sonochemistry*, ISSN 1350-4177, January 2022, vol. 82, str. [1–19], ilustr., doi: 10.1016/j.ultsonch.2021.105898. [COBISS.SI-ID 92812035] IF 9.336

OREL, Neža, FADEEV, Eduard, KLUN, Katja, LIČER, Matjaž, TINTA, Tinkara, TURK, Valentina. Bacterial indicators are ubiquitous members of pelagic microbiome in anthropogenically impacted coastal ecosystem. *Frontiers in microbiology*, ISSN 1664-302X, 2022, vol. 12, str. 1–21, ilustr. doi: 10.3389/fmicb.2021.765091. [COBISS.SI-ID 94163459] IF 6.064

TURK DERMASTIA, Timotej, DALL'ARA, Sonia, DOLENC, Jožica, MOZETIČ, Patricija. Toxicity of the Diatom Genus Pseudo-nitzschia (Bacillariophyceae) : insights from toxicity tests and genetic screening in the Northern Adriatic Sea. *Toxins : Elektronski vir*, ISSN 2072-6651, 2022, vol. 14, iss. 1, str. 1–17, ilustr. doi: 10.3390/toxins14010060. [COBISS.SI-ID 94153219] IF 5.075

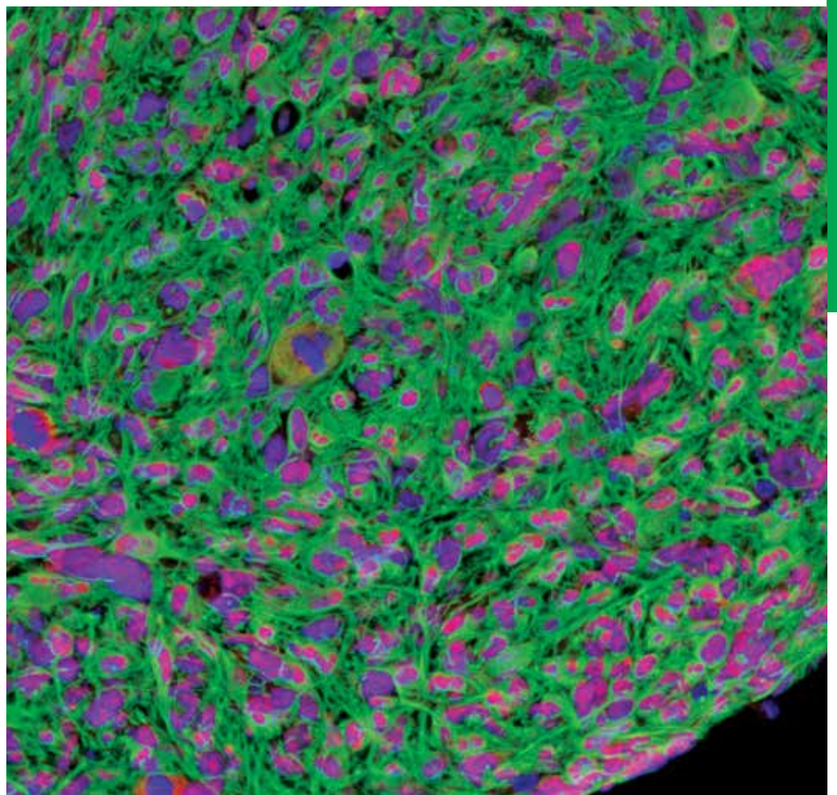
NIB KOT SODELUJOČI PARTNER V RAZISKAVI
THE NIB AS PARTNER IN RESEARCH

SMOLE, Anže, BENTON, Alexander, POUSSIN, Mathilde A., EIVA, Monika A., MEZZANOTTE, Claudia, et al. Expression of inducible factors reprograms CAR-T cells for enhanced function and safety. *Cancer cell*, ISSN 1535-6108, Dec. 2022, vol. 40, iss. 12, str. 1470–1487, e1-e7, ilustr., doi: 10.1016/j.ccell.2022.11.006. [COBISS.SI-ID 134077187] IF 38.585

GREGORIČ, Matjaž, KUTNJAK, Denis, BAČNIK, Katarina, GOSTINČAR, Cene, PECMAN, Anja, RAVNIKAR, Maja, KUNTNER, Matjaž. Spider webs as eDNA samplers : biodiversity assessment across the tree of life. *Molecular ecology resources,* ISSN 1755-098X, 2022, vol. 22, issue 7, str. 2534–2545, ilustr., graf. prikazi, tabele, doi: 10.1111/1755-0998.13629. [COBISS.SI-ID 108844291] IF 8.678

LIU, Tianyuan, SALGUERO, Pedro, PETEK, Marko, MARTINEZ-MIRA, Carlos, BALZANO-NOGUEIRA, Leandro, RAMŠAK, Živa, MCINTYRE, Lauren, GRUDEN, Kristina, TARAZONA, Sonia, CONESA, Ana. PaintOmics 4 : new tools for the integrative analysis of multi-omics datasets supported by multiple pathway databases. *Nucleic acids research*, ISSN 0305-1048, 2022, vol. 50, iss. W1, str. W551–W559, ilustr., doi: 10.1093/nar/gkac352. [COBISS.SI-ID 110574851] IF 19.160

BOŠKOVIĆ, Neda, JOKSIMOVIĆ, Danijela, BAJT, Oliver. Microplastics in fish and sediments from the Montenegrin coast (Adriatic Sea): similarities in accumulation. *Science of the total environment*, ISSN 0048-9697, 2022, vol. 850, [1]–11 str., ilustr., doi: 10.1016/j.scitotenv.2022.158074. [COBISS.SI-ID 122492419] IF 10.754



Fluorescenčno označene rakave celice v organoidu GBM (GFAP-zeleno SOX2-rdeče) (foto: B. Majc, A. Habič).

Fluorescently labeled cancer cells in GB organoid (GFAP-green, SOX2-red) (Photo: B. Majc, A. Habič).

Bibliografija inštituta v letih 2013 – 2022 (analitični podatki)
Institute's Bibliography in 2013 – 2022 (Analytical Data)

ZVRST DOKUMENTA TYPE OF DOCUMENT	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	SKUPAJ TOTAL
znanstveni članki z IF scientific papers with IF	83	79	80	82	97	91	99	109	139	150	1095
znanstveni članki brez IF other scientific papers	7	13	18	16	16	18	20	16	29	23	192
strokovni in poljudni članki professional and popular articles	62	45	43	62	58	49	44	60	66	70	625
objavljeni prispevki s kongresov published conference papers	24	16	17	16	24	17	11	9	6	7	165
povzetki s kongresov published conference paper abstracts	166	166	156	149	159	178	178	72	93	199	1717
poglavja v knjigah book chapters	28	11	9	7	18	8	30	63	55	30	273
knjige books	3	6	1	6	5	1	2	3	17	5	53
poročila reports	34	23	35	38	51	51	40	33	33	28	394
doktorska dela doctoral dissertations	9	8	4	4	2	6	2	2	6	3	53
magistrska dela master's theses	0	2	1	2	1	5	0	3	3	3	21
patenti patents	2	2	2	0	1	1	2	2	6	5	26
razno other	207	138	161	151	217	250	198	207	314	254	2218
SKUPAJ TOTAL	625	509	527	533	649	675	626	579	767	777	6732

Prispevki soavtorjev iz različnih oddelkov NIB so šteti enkrat.
Papers of co-authors from different NIB departments are counted once.

Uspehi, nagrade in priznanja v letu 2022
Achievements, Prizes and Awards in 2022

25 LET URADNE DIAGNOSTIKE POVZROČITELJEV BOLEZNI RASTLIN NA NACIONALNEM INŠTITUTU ZA BIOLOGIJO

Leta 2022 je minilo 25 let, odkar je Nacionalni inštitut za biologijo podpisal prvo pogodbo o sodelovanju s Fitosanitarno inšpekcijo in tako uradno začel izvajati del nalog, ki jih je morala Slovenija zagotoviti z vstopom v EU. Obvladovanje nevarnih karantenskih bolezni rastlin je bil namreč v skladu s pravnim redom EU eden od pogojev za vstop Slovenije na skupni trg kmetijskih proizvodov EU. Mejnik je bil počaščen z različnimi aktivnostmi med letom.

25 YEARS OF OFFICIAL DIAGNOSIS OF PLANT PATHOGENS AT THE NATIONAL INSTITUTE OF BIOLOGY

In 2022, 25 years passed since the signing of the first NIB cooperation agreement with the Phytosanitary Inspection Service (PIS), officially launching the implementation of part of the tasks that Slovenia had to provide for when joining the EU. In fact, control of dangerous plant quarantine diseases was one of the conditions under EU law for Slovenia to enter the EU's common market for agricultural products. The milestone was celebrated with various activities during the year.

PREDSTAVITEV KNJIGE »NEVERJETNA BIODIVERZITETA SLOVENIJE« IN DOGODEK OB ZAKLJUČKU PROJEKTA LIFE NATURAVIVA

Ljubljana, 20. maj 2022

V počastitev mednarodnega dneva biotske raznovrstnosti in svetovnega dneva čebel je Nacionalni inštitut za biologijo 20. maja 2022 pripravil predstavitev dosežkov evropskega projekta LIFE NATURAVIVA, Biodiverziteta – umetnost življenja. Na dogodku so poleg obsega in uspehov projekta predstavili tudi novo knjigo *Neverjetna biodiverziteta Slovenije*, v kateri so raziskovalci in partnerji projekta LIFE NATURAVIVA izpostavili in opisali izjemno bogato in neverjetno naravo Slovenije ter jo opremili z več kot 140 fotografijami.

PRESENTATION OF THE BOOK "INCREDIBLE BIODIVERSITY OF SLOVENIA" AND EVENT MARKING THE CONCLUSION OF THE LIFE NATURAVIVA PROJECT

Ljubljana, 20 May 2022

To celebrate the International Day for Biological Diversity and the World Bee Day in May 2022, the National Institute of Biology organised a presentation on the achievements of the European LIFE NATURAVIVA project, Biodiversity – The Art of Living. At the event, in addition to presenting the scope and successes of the project, the new book *Incredible Biodiversity of Slovenia* was presented; in it, the LIFE NATURAVIVA researchers and partners highlighted and described Slovenia's incredibly rich and amazing nature, accompanied by more than 140 photographs.

NACIONALNI INŠTITUT ZA BIOLOGIJO JE PREJEL PRISTOPNI CERTIFIKAT DRUŽBENO ODGOVOREN DELODAJALEC

Ljubljana, 27. september 2022

Certifikat Družbeno odgovoren delodajalec je nov certifikat, ki temelji na smernicah mednarodnega standarda za družbeno odgovornost ISO 26000, katerega namen in cilj je izboljšanje družbeno odgovornega upravljanja v organizacijah in podjetjih v Sloveniji v odnosu do zaposlenih. S tem Slovenija vstopa v obdobje strateškega upravljanja družbene odgovornosti.

NAGRADE MIROSLAVA ZEIA IN PRIZNANJA NACIONALNEGA INŠTITUTA ZA BIOLOGIJO TER SLOVESNOST OB ZAKLJUČKU PRVE FAZE GRADNJE BIOTEHNOLOŠKEGA STIČIŠČA NACIONALNEGA INŠTITUTA ZA BIOLOGIJO

Ljubljana, 10. januar 2023

Nacionalni inštitut za biologijo je že dvanajstič podelil nagrade in priznanja Nacionalnega inštituta za biologijo, poimenovana po prof. dr. Miroslavu Zeiu, ki je bil eden njegovih ustanoviteljev. Nagrade Miroslava Zeia so bile podeljene posameznikom za njihove izjemne dosežke na področju osnovnih in uporabnih raziskav ved o življenju ter uresničevanje vizij in poslanstva NIB. Slavnostna podelitev nagrad Miroslava Zeia in priznanj Nacionalnega inštituta za biologijo je bila v torek, 10. januarja 2023, v Plečnikovi dvorani Hotela Mons združena z obeležitvijo zaključka prve faze gradnje Biotehnološkega stičišča Nacionalnega inštituta za biologijo. Slavnostni govornik dogodka je bil minister za področje znanosti, dr. Igor Papič.

Velika nagrada Miroslava Zeia za življenjsko delo na področju dejavnosti NIB za leto 2022 je pripadla prof. dr. Metki Filipič. S predanostjo, odličnim delom in uspešnim vodenjem je svojo raziskovalno skupino umestila v svetovni vrh ter s tem prispevala k mednarodnemu ugledu Nacionalnega inštituta za biologijo.

Nagrado Miroslava Zeia za izjemne znanstvenoraziskovalne dosežke na področju dejavnosti NIB v zadnjih petih letih sta prejeli doc. dr. Špela Baebler in dr. Iva Hafner-Bratkovič.

THE NATIONAL INSTITUTE OF BIOLOGY RECEIVED THE SOCIALLY RESPONSIBLE EMPLOYER ACCESSION CERTIFICATE

Ljubljana, 27 September 2022

The Socially Responsible Employer certificate is a new certificate based on the guidelines of the international social responsibility standard ISO 26000, whose purpose and goal is to improve the socially responsible management in organisations and companies in Slovenia in relation to employees. This means that Slovenia is entering the era of strategic social responsibility management.

MIROSLAV ZEI PRIZES AND AWARDS OF THE NATIONAL INSTITUTE OF BIOLOGY AND THE CONCLUDING CEREMONY OF THE FIRST PHASE OF THE BIOTECHNOLOGY HUB OF THE NATIONAL INSTITUTE OF BIOLOGY

Ljubljana, 10 January 2023

The National Institute of Biology presented the twelfth National Institute of Biology prizes and awards, named after Prof. Dr Miroslav Zei as one of its founders. The Miroslav Zei prizes were presented to individuals for their outstanding achievements in basic and applied research in life sciences and in the pursuit of the NIB's vision and mission. The Miroslav Zei prize presentation and the National Institute of Biology awards ceremony was held on Tuesday, 10 January 2023, in the Plečnik Hall of Hotel Mons, in conjunction with the celebration of the completion of the first phase of the construction of the Biotechnology Hub of the National Institute of Biology. The guest speaker at the event was the Minister responsible for science, Dr Igor Papič.

The 2022 Miroslav Zei grand prize for lifetime achievement in NIB activities was presented to Prof Dr Metka Filipič. With her dedication, excellent work, and successful leadership, she made her research team one of the top teams in the world and thus contributed to the international reputation of the National Institute of Biology.

The Miroslav Zei prizes for outstanding scientific research achievements in NIB's activities were awarded to Ass. Prof. Dr Špela Baebler and Dr Iva Hafner-Bratkovič.

Strokovno nagrado Miroslava Zeia za izjemni prispevek na področju dejavnosti NIB za leto 2022 je prejel Tihomir Makovec. Tihomir Makovec se je v desetletjih dela na Morski biološki postaji Piran NIB izkazal kot zanesljiv vodja potapljaške baze, izjemen podvodni fotograf in inovator.

Priznanja NIB so dobili tudi novi doktorji znanosti, in sicer so to: dr. Katarina Bačnik, dr. Timotej Turk Dermastia, dr. Marc Paul Rivares, dr. Rok Šturm in dr. Eva Turk. Med njimi so zaradi vrste pomembnih objav v prvem avtorstvu in citatov nagrade NIB za izjemno doktorsko delo dobili dr. Katarina Bačnik, dr. Rok Šturm in dr. Eva Turk.

The Miroslav Zei professional prize for his outstanding contribution to NIB Activities for 2022 was awarded to Tihomir Makovec. During his decades of work at the Marine Biological Station Piran NIB, Tihomir Makovec has proven himself as a reliable diving base manager, an outstanding underwater photographer and innovator.

NIB awards were presented also to the new PhDs Dr Katarina Bačnik, Dr Timotej Turk Dermastia, Dr Marc Paul Rivares, Dr Rok Šturm and Dr Eva Turk. Among them, Dr Katarina Bačnik, Dr Rok Šturm and Dr Eva Turk were awarded NIB prizes for outstanding doctoral work for a number of important first-authored publications and citations.

RAZISKOVALCI NIB SO PREJELI VEČ NAGRAD SLOVENSKIH STROKOVNIH ZDRUŽENJ IN DRUGIH NAGRAD:

NIB RESEARCHERS RECEIVED SEVERAL PRIZES FROM SLOVENIAN PROFESSIONAL ASSOCIATIONS AND OTHER PRIZES:

ORGANIZACIJSKI ODBOR MEDNARODNEGA VIRTUALNEGA SIMPOZIJA »V VRTINCU SPREMEMB: POVEZANOST VODE, ŽIVLJENJA IN PODNEBJA« DOBITNIK PRIZNANJA PROMETEJ ZNANOSTI ZA ODLIČNOST V KOMUNICIRANJU 2021

Ljubljana, 21. junij 2022

Slovenska znanstvena fundacija je na slavnostni akademiji v Državnem zboru s priznanjem Prometej znanosti za odličnost v komuniciranju 2021 nagradila organizacijski odbor za aktualen in angažiran simpozij, ki sta ga oktobra 2021 organizirala Nacionalni inštitut za biologijo in gibanje Mladi za podnebno pravičnost. Pripravljen je bil tudi povzetek simpozija z naslovom Okoljski manifest.

THE ORGANISING COMMITTEE OF THE INTERNATIONAL VIRTUAL SYMPOSIUM "IN THE SWIRL OF CHANGE: THE INTERPLAY OF WATER, LIFE AND CLIMATE" RECEIVED THE PROMETHEUS OF SCIENCE AWARD FOR EXCELLENCE IN COMMUNICATION 2021

Ljubljana, 21 June 2022

The Slovenian Science Foundation awarded the Prometheus of Science Award for Excellence in Communication 2021 to the organising committee of a relevant and engaging symposium organised by the National Institute of Biology and the Youth for Climate Justice in October 2021 at a ceremony at the National Assembly. A summary of the symposium with the title Environment Manifesto was prepared as well.

NIB PREJEL NAGRADO ZA OKOLJU PRIJAZNO STORITEV

Ljubljana, 24. oktober 2022

Nacionalni inštitut za biologijo je prejel okoljsko nagrado za okolju prijazno storitev, ki jo podeljujeta Eko sklad in Časnik Finance. Nagrajeni so bili za platformo www.ciano.si, ki združuje državljansko znanost z ozaveščanjem ljudi o cianobakterijah. Njen namen je v raziskovalno delo vključiti državljane, ki nam lahko pomagajo pri spremljanju prekomerne razrasti cianobakterij v vodnih telesih.

NACIONALNI INŠTITUT ZA BIOLOGIJO POSTAL ŠESTI ZMAGOVALEC SLOVENSKE NAGRADE NATURA 2000

Ljubljana, 23. november 2022

Nacionalni inštitut za biologijo je s prijavo »Monitoring in raziskave hroščev (Coleoptera) evropskega varstvenega pomena v Sloveniji« po mnenju strokovne žirije zmagal v kategoriji slovenski inovativni dosežki znanosti za Naturo 2000.

ZOISOVA NAGRADA ZA ZNANSTVENO RAZISKOVALNE IN RAZVOJNE DOSEŽKE PROF. DR. MAJI RAVNIKAR

Ljubljana, 19. december 2022

Prof. dr. Maja Ravnikar, direktorica Nacionalnega inštituta za biologijo, je za svoj prispevek k revolucionarnim premikom pri odkrivanju in razširjanju virusov, diagnostiki in odstranjevanju patogenih virusov prejela Zoisovo nagrado za znanstvenoraziskovalne in razvojne dosežke na področju mikrobne biotehnologije.

THE NIB RECEIVED THE ENVIRONMENTALLY FRIENDLY SERVICE AWARD

Ljubljana, 24 October 2022

The National Institute of Biology also won the Environmentally Friendly Service award bestowed by Eko sklad and the Časnik Finance newspaper. They award was given for the www.ciano.si platform which combines citizen science with raising awareness about cyanobacteria. The aim is to involve citizens in research work so that they can help us monitor cyanobacterial overgrowth in water bodies.

THE NATIONAL INSTITUTE OF BIOLOGY BECAME THE SIXTH WINNER OF THE SLOVENIAN NATURA 2000 AWARD

Ljubljana, 23 November 2022

With its submission "Monitoring and research of beetles (Coleoptera) of European conservation importance in Slovenia", the National Institute of Biology won the category Slovenian Innovative Achievements in Science for Natura 2000, according to the expert jury.

THE ZOIS PRIZE FOR SCIENTIFIC RESEARCH AND DEVELOPMENT ACHIEVEMENTS TO PROF. DR MAJA RAVNIKAR

Ljubljana, 19 December 2022

Prof. Dr Maja Ravnikar, the Director of the National Institute of Biology, was awarded the Zois Prize for scientific research and development achievements in microbial biotechnology for her contribution to revolutionary advances in the discovery and spread of viruses and the diagnosis and elimination of pathogenic viruses.

Izumi in inovacije
Inventions and Innovations

Izumi in inovacije so rezultati raziskovalnega dela ter hkrati pomenijo nove možnosti in priložnosti za komercializacijo rezultatov v okviru sodelovanj z industrijskimi partnerji. Na NIB je področje izumov in inovacij v domeni Komisije za izume, sestavljene iz raziskovalcev, ki jih predlagajo oddelki NIB, Poslovnega odbora NIB ter predstavnikov Službe za prenos tehnologij.

V letu 2022 je bila na podlagi skupnega izuma raziskovalcev NIB in IJS vložena patentna prijava na patentni urad v EU, in sicer na področju razvoja metod za produkcijo virucidnih respiratornih mask.

Raziskovalci NIB so v sodelovanju z industrijskim partnerjem na podlagi izuma s področja razvoja samostojnih živolovnih foto pasti za vzorčenje ogroženih vrst žuželk vložili patentno prijavo na slovenski Urad za intelektualno lastnino.

V letu 2022 je NIB začel s prenovo sistema upravljanja izumov in inovacij. Namen je tudi vzpostaviti sistem za spremljanje vseh vrst inovacij na NIB. V okviru sistema kakovosti v skladu z veljavnim standardom ISO 9001 na

Inventions and innovations are the results of research work, but also represent new possibilities and opportunities for the commercialisation of results in the context of collaborations with industrial partners. At NIB, inventions and innovation are the domain of the Inventions Committee which consists of researchers nominated by NIB departments, the NIB Business Committee and representatives of the Technology Transfer Office.

In 2022, a patent application was filed with the EU Patent Office based on a joint invention by NIB and IJS researchers, for developing methods to produce virucidal respiratory masks.

In collaboration with an industrial partner, NIB researchers have filed a patent application with the Slovenian Intellectual Property Office for an invention in the field of developing self-contained live photo traps for sampling endangered insect species.

In 2022, NIB initiated a renovation of its invention and innovation management system. Its purpose is also to establish a system for monitoring all types of innovations at the NIB. In the context of the quality system in line with the applicable ISO 9001 standard, NIB also monitors improvements. A total of 17 improvements were introduced at NIB in 2022.

Prenos znanja v gospodarstvo
Transferring Knowledge to Business

DOMAČA TRŽNA DEJAVNOST, KI JO FINANCIRAJO GOSPODARSKI SUBJEKTI

Obseg sodelovanja z domačimi gospodarskimi subjekti se je v letu 2022 v primerjavi z letom prej skoraj podvojil.

Finančno najpomembnejši del storitev v tej dejavnosti, ki jih je NIB izvajal v letu 2022, so bili projekti za testiranje učinkovitosti bioloških elementov, testiranje in validiranje laboratorijskih postopkov, izdelava informacijskih rešitev za laboratorijske informacije, raziskave celične smrti v celičnih bankah, bakterijske in GSO analize ipd., večinoma za farmacevtska, biotehnološka in druga podjetja.

Sodelovanja s podjetji so se v letu 2022 izvajala tudi v okviru aplikativnih ARRS projektov, ki so jih sofinancirali industrijski partnerji, in sicer na področjih:

- naprednih pristopov priprave genskih konstruktov za namen celične imunoterapije;
- uporabe izbranih mikroorganizmov za uporabo v kozmetičnih izdelkih;
- inaktivacije z vodo prenosljivih virusov z uporabo plazme in hidrodinamične kavitacije;
- razvoja in uporabe novih pristopov za reševanje izzivov na področju čistosti in kvalitete terapevtskih virusov;
- vrednotenja varnosti kanabidiolov in
- visokozmogljivega sekvenciranja mikrobnih genomov za aplikacije v rastlinski patologiji.

NIB je različne strokovno-razvojne naloge v letu 2022 izvajal tudi za gospodarske družbe na področju monitoringa ogroženih vrst, analiz okoljskih dejavnikov, modeliranja ter analiz mutageničnosti in citotoksičnosti.

DOMESTIC MARKET ACTIVITY FINANCED BY ECONOMIC OPERATORS

The scope of NIB's cooperation with domestic economic operators almost doubled in 2022 compared to the previous year.

Financially, the most important part of the services within this activity performed by NIB in 2022 consisted of projects for bio-element potency testing, testing and validation of laboratory procedures, development of IT solutions for laboratory information, cell death research in cell banks, bacterial and GMO analysis, etc., mostly for pharmaceutical, biotechnology and other companies.

In 2022, collaborations with companies were carried out also in the context of applied ARRS projects that were co-financed by industrial partners in the following areas:

- advanced approaches in the preparation of gene constructs for cellular immunotherapy;
- use of selected micro-organisms for use in cosmetic products;
- inactivation of waterborne viruses using plasma and hydrodynamic cavitation;
- development and application of new approaches to address cleanliness and quality challenges

in therapeutic viruses;

- evaluation of the safety of cannabidiols; and
- high-performance sequencing of microbial genomes for applications in plant pathology.

Na področju razvoja diagnostične platforme za precizno zdravljenje s kanabinoidi bolnikov z glioblastomom se je tudi v letu 2022, preko slovenske podružnice, izvajalo raziskovalno sodelovanje z globalnim farmacevtskim podjetjem MGC Pharma.

V skladu z OECD načeli dobre laboratorijske prakse (DLP) je NIB za različne naročnike izvajal študije mutagenosti ter dodatna testiranja biokompatibilnosti medicinskih pripomočkov in materialov.

TRŽNA DEJAVNOST ZA TUJE NAROČNIKE

Obseg tržne dejavnosti v letu 2022 za tuje naročnike se je zmanjšal kot posledica realizacije licenčne pogodbe na področju razvoja molekularnih metod za karakterizacijo in kvantifikacijo virusov za genske terapije. Kljub temu so se tiste analitske storitve za tuja podjetja, ki niso bile prenesene, izvajale tudi v letu 2022.

Osmo leto zapored se je nadaljevalo izvajanje GSO analiz za Norwegian Veterinary Institute.

Med tujimi naročniki v tej kategoriji dejavnosti se je v letu 2022 nadaljevalo sodelovanje z EC JRC – Directorate F (predhodno IRMM), za katerega je NIB podobno kot v preteklih letih izvajal karakterizacije referenčnih materialov, določanje njihove stabilnosti in število kopij DNA.

Skupaj s švicarskim podjetjem aQuaTox-Solutions je bila v letu 2022 izvedena prva faza projekta razvoja sistemov ekotoksikoloških testov z uporabo metod umetne inteligence za testiranje varnosti kemikalij brez poskusov na živalih.

Na področju monitoringa, kartiranja obdelave in analize podatkov ogroženih vrst se je v letu 2022 izvajal tudi projekt za hrvaškega naročnika.

TRŽENJE PRODUKTOV IN STORITEV

S trženjem produktov in storitev se na NIB sistemsko ukvarja v letu 2010 ustanovljena Pisarna za prenos tehnologij, ki se je v začetku leta preimenovala v Službo za prenos tehnologij.

In 2022, the NIB also carried out various R&D tasks for companies in the fields of endangered species monitoring, environmental factor analysis, modelling and mutagenicity and cytotoxicity analysis.

Research collaboration with the global pharmaceutical company MGC Pharma through its Slovenian branch was running also in 2022 in the context of the development of a diagnostic platform for cannabinoid precision therapy for glioblastoma patients.

In accordance with the OECD Principles of Good Laboratory Practice (GLP), NIB carried out mutagenicity studies and additional biocompatibility testing of medical devices and materials for various clients.

MARKET ACTIVITY FOR FOREIGN CLIENTS

In 2022, the volume of market activity for foreign clients decreased as a result of the implementation of a licensing agreement for the development of molecular methods for the characterisation and quantification of viruses for gene therapies. Nevertheless, the analytical services for foreign companies that were not transferred were carried out in 2022 as well.

For the eighth year in a row, GMO analyses were carried out for the Norwegian Veterinary Institute.

Among the foreign clients in this category of activities, in 2022 the collaboration with the EC JRC - Directorate F (formerly IRMM) continued; as in previous years, NIB performed the characterisation of reference materials, the determination of their stability and number of DNA copies.

Together with the Swiss company aQuaTox-Solutions, the first stage of a project for developing ecotoxicological test systems using artificial intelligence methods to test the safety of chemicals without animal testing was carried out in 2022.

A project monitoring, mapping, processing, and analysis of endangered species data was also carried out in 2022 for a Croatian client.

V okviru projekta konzorcija KTT (Konzorcij pisarn za prenos tehnologij iz JRO v gospodarstvo) je Služba tudi v letu 2022 na nivoju inštituta izvajala podporo raziskovalcem pri dogovorih z zainteresiranimi partnerji iz gospodarstva za prenos tistih tehnologij, ki so bile v NIB razvite do stopnje komercializacije, ter za trženje pridobljenih patentov.

Posebna pozornost je bila v letu 2022 namenjena aktivnostim patentne zaščite in komercializacije rešitev na področju varstva rastlin.

V letu 2022 je bilo v naboru NIB aktivnih osem patentnih prijav NIB. Od tega dve na Evropskem patentnem uradu, ena na WIPO, dve na patentnem uradu ZDA in dve na slovenskem Uradu za intelektualno lastnino. Na Evropskem patentnem uradu je bila realizirana ena patentna prijava.

Na področju sodelovanja z gospodarstvom je bilo v letu 2022 realiziranih okrog 40 projektov, od tega tretjina s podjetji v tujini. Dodatno so bile realizirane tudi storitve na področjih GSO analiz, bakterijskih analiz, analiz mikroorganizmov in analiz v okviru GLP – okrog 85 naročil.

Večina teh nalog je bila opravljena za podjetja, s katerimi je bilo sodelovanje vzpostavljeno že v preteklosti. Okvirno 10 % je bilo novih sodelovanj.

Pisarna je v letu 2022 samostojno ali v sodelovanju z drugimi partnerji v konzorciju KTT organizirala oziroma raziskovalcem omogočala sodelovanje na izobraževanjih s področij izdelave poslovnih načrtov, trženja produktov in storitev ter obvladovanja intelektualne lastnine. Na NIB je bila med drugim organizirana delavnica »Oblikovanje, razvoj in predstavitev idej za trg«.

Zaposleni v Službi so se izobraževali in v okviru različnih delavnic izmenjavali dobre prakse prenosa tehnologij in zaščite intelektualne lastnine s kolegi v Sloveniji in izven Slovenije (Konferenca PODIM, Festival UNI MINDS (Univerza v Ljubljani, Univerza v Mariboru, Univerza na Primorskem); delavnica Mladi upi (IJS), izobraževalna delavnica Pisanje patentnih prijav (KI); Delavnica o zaščiti znanja (UP); sodelovanje na 15. Mednarodni konferenci o prenosu tehnologij (IJS).

MARKETING OF PRODUCTS AND SERVICES

The marketing of products and services is handled systematically at NIB by the Technology Transfer Office, which was established in 2010 and renamed to Technology Transfer Service at the beginning of this year.

In the context of the KTT project (Consortium of Technology Transfer Offices from PROs to Business), in 2022 the Service continued to support researchers at the level of the Institute in making arrangements with interested partners from business for the transfer of technologies that have been developed at the NIB to the commercialisation stage, and for the marketing of the patents obtained.

In 2022, particular attention was paid to patent protection and commercialisation activities in plant protection.

Eight NIB patent applications were active in the NIB pipeline in 2022. Of these, two are at the European Patent Office, one at WIPO, two at the US Patent Office and two at the Slovenian Intellectual Property Office. One patent application was completed at the European Patent Office.

In cooperation with business, around 40 projects were carried out in 2022, a third of them with companies abroad. In addition, services in the areas of GMO analysis, bacterial analysis, micro-organism analysis and GLP analysis were provided - around 85 orders.

Most of these tasks were provided for companies with which cooperation had been established in the past. Around 10% were new collaborations.

In 2022, the Office independently or together with other partners in the KTT Consortium organised or enabled the participation of researchers in trainings from the areas of preparing business plans, marketing of products and services and controlling intellectual property. Among others, the workshop “Designing, developing and presenting ideas for the market” was organised at NIB.

V letu 2022 so se začele prve aktivnosti za usposabljanje zaposlenih v Službi za prenos znanja za nudenje strokovne podpore raziskovalcem za sodelovanje v okviru razpisov platforme načrtovanega sklada CEETT (Central Eastern European Technology Transfer Platform) Proof of Concept SID banke, Hrvaške banke za obnovo in razvoj in Evropskega investicijskega sklada EIF ter nadaljevale aktivnosti za identifikacijo projektov NIB s tržnim potencialom za pridobivanje sredstev iz omenjenega sklada.

Raziskovalci NIB, oddelka GEN, so izdelali promocijski film o razvoju novih tehnologij zdravljenja tumorja možganov.

Služba je kontaktna točka na NIB za prenos informacij s strani SBRA iz Bruslja, tudi z namenom identifikacije možnih sodelovanj z industrijskimi partnerji.

V okviru aktivnosti prenosa tehnologij na NIB smo tako v letu 2022 sledili ciljem in ukrepom Resolucije o znanstvenoraziskovalni in inovacijski strategiji Slovenije 2030, povezanim s prepoznavo in razvojem potencialov na tistih področjih raziskav NIB, ki lahko pripomorejo k razvoju družbe kot celote, spodbujanjem tesnega sodelovanja med znanostjo, gospodarstvom in drugimi deležniki slovenskega inovacijskega okolja, promocijo prenosa znanja in razvojem inovacijskih kompetenc raziskovalcev NIB ter pomenom varovanja intelektualne lastnine, ustvarjene na NIB.

Posledično so naše aktivnosti sledile usmeritvam upravljanja Evropskega raziskovalnega prostora in Pakta za raziskave in inovacije, posebej na področjih, kjer so izpostavljena področja valorizacije znanja in izgradnje nacionalnih in regijskih inovacijskih ekosistemov.

Employees at the Office participated in trainings and exchanged good practices of technology transfer and intellectual property protection at different workshops with their colleagues in Slovenia and outside Slovenia (PODIM conference, UNI MINDS Festival (University in Ljubljana, University in Maribor, University of Primorska), the Young Hopes Workshop (IJS), Writing patent applications (KI); knowledge protection workshop (UP); participation at the 15th International Technology Transfer Conference (IJS).

In 2022, the first activities started for training employees at the Knowledge Transfer Service for providing professional support to researchers for participation at tenders of the planned CEETT (Central Eastern European Technology Transfer Platform) Proof of Concept of SID banka, the Croatian Bank for Reconstruction and Development and the European Investment Fund EIF and continued the activities for identifying NIB projects with market potential for obtaining finance from this fund.

The NIB researchers from the GEN department prepared a promotional film on the development of new technologies for treating brain tumours.

The service is a NIB contact point for information transfer from SBRA from Brussels, also to identify possible co-operations with partners in the industry.

In the context of technology transfer activities at the NIB in 2022, we followed the objectives and measures of the Resolution on the Scientific Research and Innovation Strategy of Slovenia 2030 related to the identification and development of potentials in areas of research at NIB that can contribute to the development of society as a whole, the promotion of close cooperation between science, business and other stakeholders in the Slovenian innovation environment, the promotion of knowledge transfer and the development of innovation competences of NIB researchers, and the importance of protecting the intellectual property created at the NIB.

Consequently, our activities have followed the orientations of the governance of the European Research Area and the Research and Innovation Pact, especially in the areas of knowledge valorisation and the building of national and regional innovation ecosystems.

DELOVANJE PRI UPRAVLJANJU ORGANIZACIJ

NIB je soustanovitelj dveh pravnih oseb:

- Tehnološkega parka Ljubljana, d. o. o., in
- Evropskega gospodarskega interesnega združenja Slovensko inovacijsko stičišče (SIS EGIZ).

NIB je v letu 2022 sodeloval pri upravljanju obeh pravnih subjektov.

Tehnološki park Ljubljana (TP) je v letu 2022 nadaljeval s potrebnimi konsolidacijami preteklega obdobja ter začel z realizacijo ciljev, povezanih s podporo vrhunskim start-upom in SME. Tako so v letu 2022 odprli Start-up center, kjer inovativna tehnološka podjetja dobijo pisarne po polovični ceni ter z vsebinsko podporo ekipe in skupnosti, ter postali najuspešnejši partner v EU po številu opravljenih ERASMUS izmenjav mladih podjetnikov.

Vodstvo in ekipa TP gradijo znamko TPLJ kot vrhunsko znamko za sodelovanje, rast in tehnologijo.

V okviru SIS EGIZ so se tudi v letu 2022 poleg upravljanja konzorcija SRIP Zdravje nadaljevale aktivnosti v povezavi z vzpostavitvijo kvalitetnega inovacijskega okolja v Sloveniji ter izvajale aktivnosti v zvezi s pripravo Strategije pametne specializacije (S5). Strokovnjaki NIB smo v okviru obeh pobud aktivno sodelovali.

ACTIVITIES IN ORGANISATION MANAGEMENT

NIB is the co-founder of two legal entities:

- Tehnološki park Ljubljana, d. o. o., and
- European Economic Interest Grouping Slovenian Innovation Hub (SIH-EEIG).

In 2022, NIB participated in the governance of both legal entities.

In 2022, Technology Park Ljubljana (TP) continued the necessary consolidations from the previous period and started to implement the objectives related to the support of top start-ups and SMEs. In 2022, they opened a Start-up Centre, where innovative tech companies can get offices at half price with substantive team and community support and became the most successful partner in the EU in terms of the number of ERASMUS exchanges of young entrepreneurs.

The management and TP team are building the TPLJ brand as a top brand for collaboration, growth, and technology.

In addition to the management of the SRIP Health consortium, in 2022 SIH-EEIG continued activities related to the establishment of a quality innovation environment in Slovenia and activities related to the preparation of the Smart Specialisation Strategy (S5). Experts from the NIB actively participated in both initiatives.

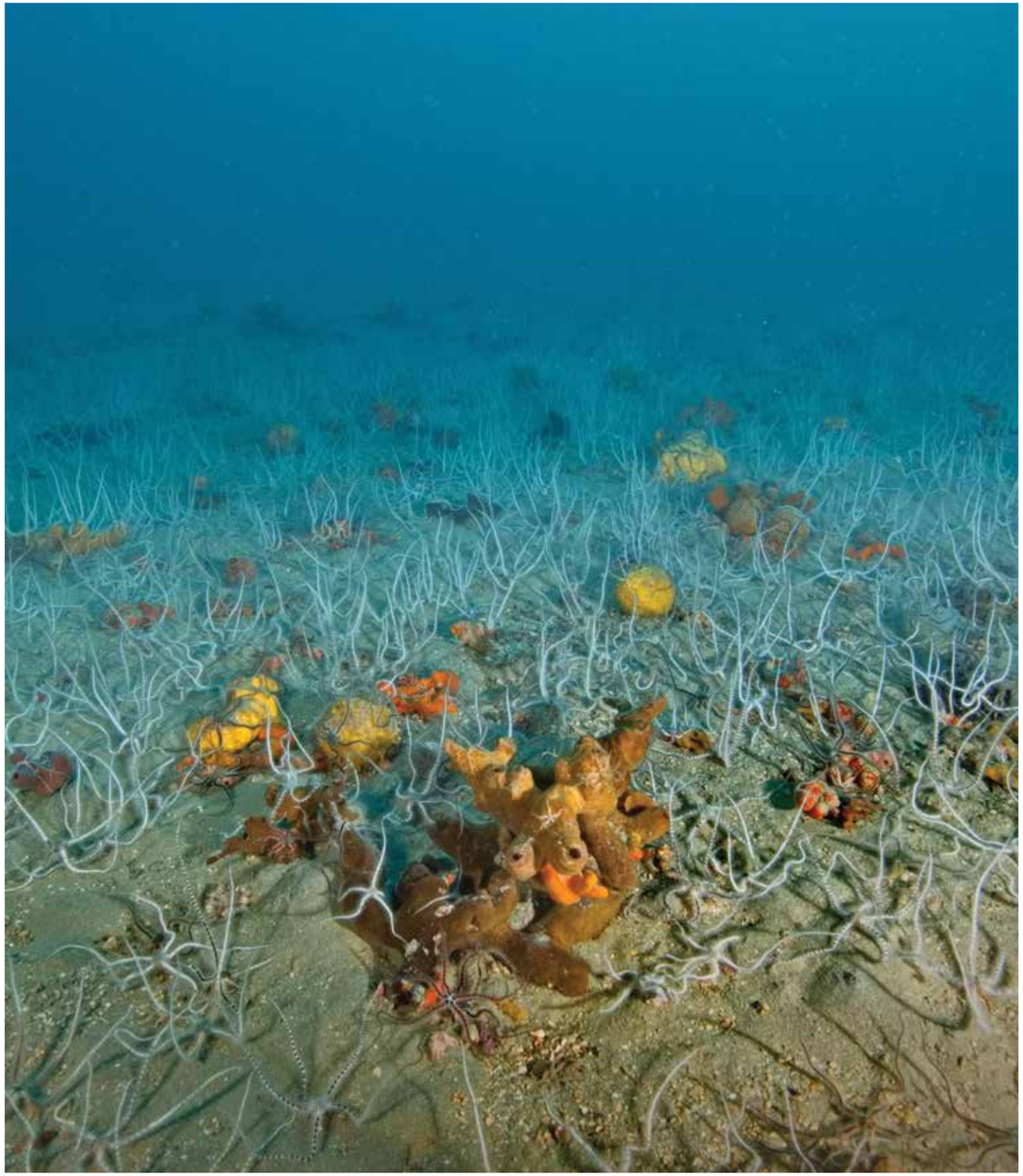
Skupne službe
Corporate services

Skupne službe izvajajo posamezne poslovne funkcije inštituta, kot so finance in računovodstvo, kadrovske zadeve, javna naročila, splošne zadeve, vodenje informacijskega sistema, administrativna podpora organom NIB in podobno. Poleg tega izvajajo podporne dejavnosti za raziskovalne organizacijske enote, zlasti administrativno-tehnično podporo vodenju projektov ter podporo prenosu znanja in tehnologij.

V sklopu Skupnih služb deluje tudi Biološka knjižnica, ki jo upravljata NIB in Oddelek za biologijo Biotehniške fakultete. Deluje na dveh lokacijah: v Biološkem središču v Ljubljani in na Morski biološki postaji Piran.

Corporate services carry out specific business functions of the Institute, such as finance and accounting, human resources, procurement, general affairs, management of the IT system, administrative support to the NIB bodies, etc. In addition, they carry out support activities for the research organisational units, in particular administrative and technical support for project management and support for knowledge and technology transfer.

The Corporate Services also include the Biological Library managed by NIB and the Biology Department of the Biotechnical Faculty. It operates in two locations: the Biological Centre in Ljubljana and the Marine Biology Station Piran.



Značilna muljevita puščava v osrednjem delu Tržaškega zaliva brsti z življenjem (foto: B. Mavrič).

The typical muddy desert in the central part of the Gulf of Trieste is bursting with life (Photo: B. Mavrič).

Na sedimentnem dnu med nevretenčarji prevladujejo morske vetrnice, spužve in kačjerepi (foto: T. Makovec).

Among the invertebrates on the sedimentary bottom, sea anemones, sponges and brittle stars prevail (Photo: T. Makovec).

OSEBJE
STAFF

DIREKTORICA DIRECTOR
Ravnikar, Maja

POMOČNIK DIREKTORJA ZA FINANČNO IN SPLOŠNO PODROČJE DEPUTY DIRECTOR FOR FINANCE AND GENERAL MATTERS
Potočnik, Franc

POMOČNICA DIREKTORICE ZA PRAVNO IN SPLOŠNO PODROČJE TER JAVNA NAROČILA ASSISTANT DIRECTOR FOR LEGAL AND GENERAL AFFAIRS AND PUBLIC PROCUREMENT
Tomšič, Alenka

GLAVNA PISARNA MAIN OFFICE
Jogan, Neža
Malec, Maja
Verbič Koprivšek, Maruša
(od from 21. 4. 2022)

GLAVNA PISARNA IN ODNOSI Z JAVNOSTMI MAIN OFFICE AND PUBLIC RELATIONS
Sinur, Katja

RAČUNOVODSTVO ACCOUNTING
Čižman, Anka
Jenko, Primož (od from 1. 9. 2022)
Pestotnik, Irena (do until 21. 10. 2022)
Praček, Mateja
Rebolj, Nataša
Remic, Vida (od from 10. 12. 2022)
Retelj, Andreja

KADROVSKE ZADEVE HUMAN RESOURCES
Goršič, Dunja

PROJEKTNA PISARNA PROJECT OFFICE
Končar, Helena
Miklič Milek, Damjana
Tekavec Bembič, Martina

PISARNA ZA PRENOS TEHNOLOGIJ TECHNOLOGY TRANSFER OFFICE
Vindišar, Jure

JAVNA NAROČILA LEGAL DEPARTMENT
Čretnik, Metka
Tomšič, Alenka

SLUŽBA ZA UPRAVLJANJE STAVB BUILDING MANAGEMENT SERVICE
Gostinčar, Majda
Mirnik, Lidija (do until 31. 5. 2022)
Plos, Mitja (od from 1. 5. 2022)

KNJIŽNJICA LIBRARY
Černač, Barbara
Glavač, Lučka

Morska biološka postaja Piran

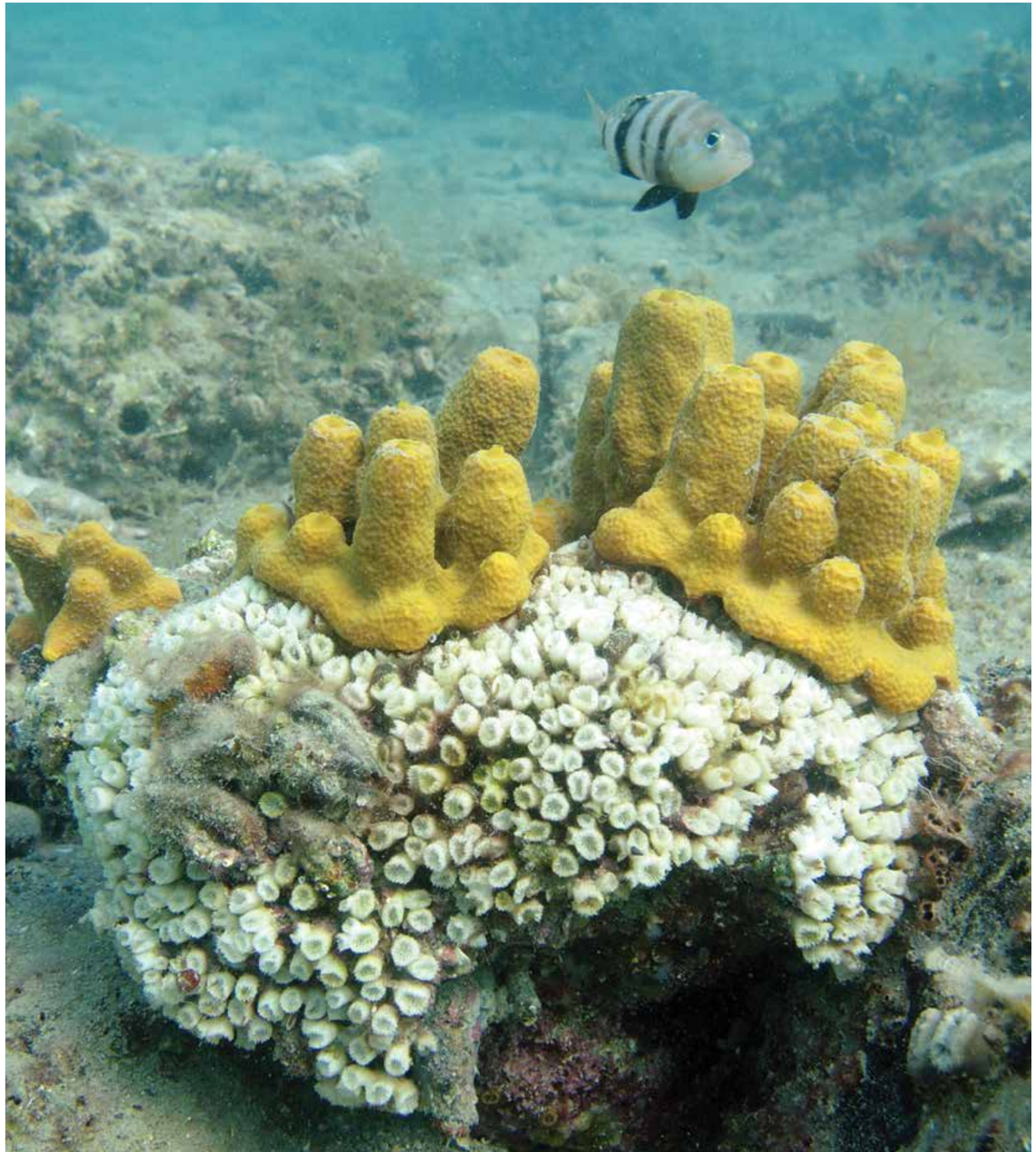
Marine Biology Station Piran

Znanost, ki jo potrebujemo za oceane, ki si jih želimo

(**DESETLETJE ZDRUŽENIH NARODOV ZA ZNANOST** O OCEANIH ZA TRAJNOSTNI RAZVOJ (2021-2030)

The science we need for the ocean we want

UNITED NATIONS DECADE 2021-2030: OCEANOGRAPHY FOR SUSTAINABLE DEVELOPMENT



Tudi v Sloveniji se soočamo z bledenjem koral zaradi podnebnih sprememb. Poginula kolonija sredozemske kamene korale (CC) prekrita s spužvo žveplenjačo (*Aplysina aerophoba*) (foto: B. Mavrič).

Slovenia is also affected by coral bleaching due to climate change. A dead colony of a Mediterranean stony coral (*Cladocora caespitosa*) covered with a sponge (*Aplysina aerophoba*) (Photo: B. Mavrič).

Sredozemska kamena korala je endemit Sredozemskega morja in ogrožena vrsta (foto: B. Mavrič).

The Mediterranean stony coral is endemic to the Mediterranean Sea and is an endangered species (Photo: B. Mavrič).

VODJA: IZR. PROF. DR. **PATRICIJA MOZETIČ**

HEAD: ASSOC. PROF. DR **PATRICIJA MOZETIČ**

Izr. prof. dr. Patricija Mozetič je od marca 2018 vodja enote Morska biološka postaja Piran in hkrati tudi vodja raziskovalnega programa ARRS »Raziskave obalnega morja« ter izredna profesorica za področje ekologije na Univerzi na Primorskem. Njeno področje dela so raziskave fitoplanktona obalnih morij, kar vključuje raziskave dolgoročnih sprememb fitoplanktonske združbe, zlasti v luči podnebnih sprememb, ekologije in taksonomije škodljivih cvetenj alg ter fotosintetskih lastnosti in primarne produkcije. Je predsednica Nacionalnega odbora za Medvladno oceanografsko komisijo (NO IOC) pri Slovenski nacionalni komisiji za UNESCO in zastopa Slovenijo v Medvladnem odboru za škodljiva cvetenja alg (program UNESCO/IOC HAB).

Assoc. Prof. Dr Patricija Mozetič has been the head of the Marine Biology Station Piran since March 2018 and at the same time also the head of the ARRS research programme “Coastal marine research” and Associate Professor of Ecology at the University of Primorska. Her research focuses on the phytoplankton of coastal seas, which includes studies on long-term changes in the phytoplankton community, in particular in the light of climate change, the ecology and taxonomy of harmful algal blooms, and photosynthetic traits and primary production. She is the Chairperson of the National Committee for the Intergovernmental Oceanographic Commission (IOC NC) of the Slovenian National Commission for UNESCO and represents Slovenia in the Intergovernmental Panel on Harmful Algal Blooms (UNESCO/IOC HAB Programme).

KLJUČNE DEJAVNOSTI

Na Morski biološki postaji Piran (MBP) raziskujemo morske ekosisteme in ustvarjamo znanja za razumevanje procesov in sprememb v morju.

Z interdisciplinarnim pristopom razvijamo na znanosti temelječe rešitve in naslavljamo pomembne socio-ekonomske izzive, ki so v središču svetovnih ali regijskih okoljskih motenj. Rešitve temeljijo na boljšem razumevanju biodiverzitete in njenih mehanizmov v ekosistemu severnega Jadrana in ob upoštevanju družbenih potreb, ki le v ravnovesju z varstvom narave ohranjajo zdrava morja. S tem nudimo strokovne podlage za trajnostni razvoj morskega in obalnega prostora.

Večina temeljnih raziskav poteka v okviru ARRS programa »Raziskave obalnega morja« (P1-0237), ki se v manjši meri dopolnjuje z raziskovalnim programom P1-0143, ki v glavnini poteka na IJS. V letu 2022 je na novo stekel ARRS program »Morska in mikrobna biotehnologija« (P1-0432), s čimer se je odprlo novo raziskovalno področje tako na NIB kot v Sloveniji nasploh, ki podpira strategijo modre rasti.

SPECIFIČNA PODROČJA RAZISKAV IN DRUGE DEJAVNOSTI MBP

- Proučevanje različnih ravni biološke raznovrstnosti – od genov, preko osebkov in populacij do raznovrstnosti habitatov in življenjskih združb (plankton, bentoški nevretenčarji, makroalge, obrežne ribje združbe, podvodni travniki, biogene formacije). V raziskave vključujemo pristope primerjalne genomike in evolucijske vidike ter poleg strukture proučujemo tudi procese.
- Raziskovanje raznovrstnosti avtotrofnih in heterotrofnih morskih mikroorganizmov, interakcij le-teh z drugimi organizmi, zlasti želatinoznim planktonom, ter vloge mikrobov pri pretvorbah organske snovi različnega izvora.
- Prepoznavanje gonilnih sil sprememb v morskem okolju in biodiverziteti. Poudarek je na antropogenih pritiskih in vplivih, ki so najpomembnejši dejavniki sprememb morskega okolja in biotske raznovrstnosti na lokalni in globalni ravni (podnebne spremembe, bioinvazija, onesnaževanje, evtrofikacija, urbanizacija, promet, marikultura).
- Proučevanje biogeokemičnih procesov v vodnem stolpcu in sedimentu, s poudarkom na kroženju živega srebra in razgradnji izbranih onesnažil s fotokemičnimi in mikrobnimi procesi. Posebno mesto med onesnažili ima (mikro)plastika. Učinke onesnažil v organizmih preučujemo predvsem na subcelični ravni.
- Študije dinamike vodnih mas v obalnem in odprtem morju z meritvami in modeliranjem, razvoj avtomatizirane obdelave podatkov ter krepitev razvoja opazovalne in informacijske infrastrukture na morju.
- Povezovanje znanj o raznolikosti morskih ekosistemov in organizmov z njihovo uporabnostjo kot virov za nove produkte in procese. Produkte uporabljamo za preizkušanje novih bioaktivnosti, ki se lahko uporabljajo v različnih industrijah (prehrambna, farmacevtska itd.). Z valorizacijo neizkoriščenih virov pa prispevamo h krožnemu gospodarstvu (npr. ribištvo, akvakultura) in višamo potencialni prenos raziskav.

Programske raziskave se dopolnjujejo z raziskavami temeljnih in uporabnih ARRS projektov, pri katerih imamo vlogo vodilnega ali sodelujočega partnerja in evropskih projektov iz različnih shem financiranja (H2020, HEU, Interreg, DG).

Na podlagi javnega pooblastila Agencije RS za okolje izvajamo programe monitoringa morja za vrednotenje ekološkega in okoljskega stanja z biološkimi elementi v skladu z državno in evropsko okoljsko zakonodajo (ODMS 2008/56/ES in ODV 2000/60/ES) ter sodelujemo pri oblikovanju evropskih okoljskih politik.

Z izvajanjem strokovnih nalog za različne uporabnike nudimo podporo tako državnim institucijam in javnim zavodom kot tudi lokalnim skupnostim in gospodarskim družbam pri trajnostno usmerjenem gospodarskem in družbenem razvoju obalnega prostora in morja. Raziskovalci MBP sodelujejo pri prenosu znanja in tehnologij v gospodarstvo z izvedbo oceanografskih in ekoloških raziskav ter do uporabnikov na področju ribištva in kmetijstva.

Povezujemo se v mrežo evropskih morskih bioloških postaj (MARS), smo člani združenja EuroMarine ter EuroGOOS in MONGOOS in njunih delovnih skupin

KEY ACTIVITIES

The Marine Biology Station Piran (MBS) researches marine ecosystems and creates knowledge for understanding processes and changes in the sea.

Through our interdisciplinary approach, we develop science-based solutions and address important socio-economic challenges that are the focal point of global or regional environmental disruptions. The solutions are based on a better understanding of biodiversity and its mechanisms in the ecosystem of the northern Adriatic Sea, while taking into account societal needs that maintain healthy seas only when in balance with nature conservation. In this way we provide an expert foundation for the sustainable development of the marine and coastal environment.

Most of the basic research is carried out in the context of the ARRS programme "Coastal marine research" (P1-0237), which is somewhat complemented by the research programme P1-0143 which mostly runs at IJS. In 2022, the new ARRS programme "Marine and microbial biotechnology" (P1-0432) was launched, opening a new research area both at NIB and in Slovenia in general, supporting the Blue Growth strategy.

SPECIFIC RESEARCH AREAS AND OTHER MBS ACTIVITIES

- Studying the different levels of biodiversity - from genes through individuals and populations to the diversity of habitats and biological communities (plankton, benthic invertebrates, macroalgae, coastal fish communities, seagrass meadows, biogenic formations). Our research includes comparative genomics methods and evolutionary perspectives, looking not only at the structure, but also at processes.
- Researching the diversity of autotrophic and heterotrophic marine micro–organisms, their interactions with other organisms, in particular gelatinous plankton, and the role of microbes in the transformation of organic matter of different origins.
- Identifying drivers of change in the marine environment and biodiversity. The focus is on anthropogenic pressures and impacts, which are the most important drivers of change in the marine environment and biodiversity at the local and global scales (climate change, bioinvasion, pollution, eutrophication, urbanisation, transport, mariculture).
- Study of biogeochemical processes in the water column and sediment, focusing on the mercury cycle and the decomposition of selected pollutants by photochemical and microbial processes. (Micro)plastics have a special place among pollutants. We study the effects of pollutants in organisms mainly at the subcellular level.
- Studies of coastal and offshore water mass dynamics through measurements and modelling, development of automated data processing and strengthening the development of offshore observation and information infrastructure.
- Connecting knowledge of the diversity of marine ecosystems and organisms with their usefulness as resources for new products and processes. The products are used to test new bioactivities that can be applied in different industries (food, pharmaceuticals, etc.). By valorising untapped resources, we contribute to the circular economy (e.g., fishing, aquaculture) and increase the potential research transfer.

The programme research is complemented by research in basic and applied ARRS projects in which we are the leading or collaborating partner, and European projects from various funding schemes (H2020, HEU, Interreg, DG).

Based on a public mandate from the Slovenian Environment Agency, we carry out marine monitoring programmes to assess the ecological and environmental status of biological elements in accordance with the national and European environmental legislation (MSFD 2008/56/EC and WFD 2000/60/EC); we also participate in the formulation of European environmental policies.

By carrying out expert tasks for various users, we provide support for government institutions and public bodies as well as local communities and companies,

(WGBIO in TTHF). Smo tudi partner v slovenskem konzorciju eLTER-SI in LifeWatch-SI; preko slednjega se povezujemo v evropsko infrastrukturo za e-znanost in tehnologijo za raziskave biotske raznovrstnosti in ekosistemov - LifeWatch-ERIC.

Z različnimi stalnimi dejavnostmi, kot so dan odprtih vrat Morske biološke postaje Piran, prispevki v poljudnih in strokovnih revijah, posredovanje informacij medijem in izvajanje predavanj za različne starostne skupine, prispevamo k širjenju znanja o morju in dvigu morske pismenosti pri strokovni in laični javnosti.

GLAVNI DOSEŽKI V LETU 2022

Projekti

V sklopu programa »Biodiversa+ 2021–2022« je bil odobren projekt PETRI-MED (*Plankton biodiversity through remote sensing and omlcs in the Mediterranean Sea*), ki ga koordinira španski inštitut ICM-CSIC iz Barcelone, MBP pa sodeluje kot partner. Cilj projekta je razviti nove strategije za določanje in spremljanje stanja in trendov diverzitete mikrobnega planktona v Sredozemskem morju, kar bo služilo kot podpora oceni vpliva povezanosti ekosistemov na lokalno biotsko raznovrstnost in delovanje morskih ekosistemov. Projekt bo stekel spomladi 2023.

Nadaljuje se vzdrževanje podatkovnih baz v okviru že tretjega tovrstnega projekta EMODNet Ingestion (EMODnet Ingestion and safe-keeping of marine data no. 3), kot tudi v letu 2021 uspešno zaključen projekt ljubiteljske znanosti Pirati plastike – dajmo, Evropa, ki v manjšem obsegu poteka v okviru Misije Obzorja Evropa: Zdravi oceani, morja, obalne in celinske vode.

Sodelavki MBP sta postali novi članici upravnega odbora COST akcije CA20137 (VOICES - Making Young Researchers' Voices Heard for Gender Equality).

Na lanskem ARRS razpisu za temeljne in aplikativne projekte smo bili uspešni s prijavama za podoktorski projekt *Diatomejski virusi in njihov vpliv na kroženje organske snovi v obalnem morju* in aplikativni projekt *Biotehnološki potencial izbranih mikroorganizmov iz Sečoveljskih solin za uporabo v kozmetičnih izdelkih*. Pri slednjem poleg partnerskih raziskovalnih institucij sodelujeta podjetji AlgEn in Soline, d. d. V financiranje je bila

in the sustainably oriented economic and social development of the coastal area and the sea. The researchers from the MBS participate in the knowledge and technology transfer to business by carrying out oceanographic and ecological research, and to users in fisheries and agriculture.

We are linked into a network of European marine biological stations (MARS), are members of the associations EuroMarine and EuroGOOS and MONGOOS and their working groups (WGBIO and TTHF). We are also a partner in the Slovenian consortium eLTER-SI and LifeWatch-SI; through the latter are linked to the European e-Science and Technology Infrastructure for Biodiversity and Ecosystem Research - LifeWatch-ERIC.

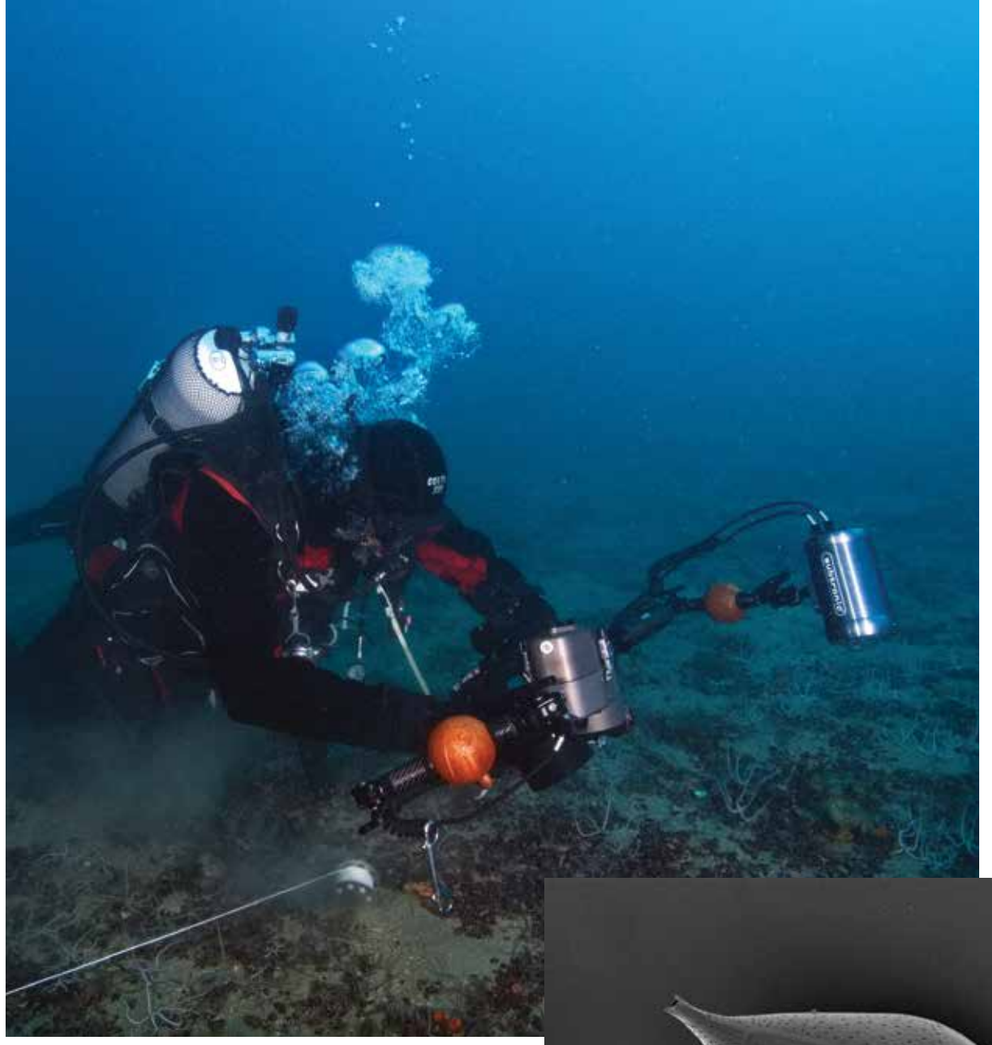
Through various ongoing activities, such as the Piran Marine Biological Station's Open Day, articles in popular and professional journals, sending information to the media and lectures for different age groups, we contribute to the spreading of knowledge about the sea and the raising of marine literacy among the professional and lay public.

MAIN ACHIEVEMENTS IN 2022

Projects

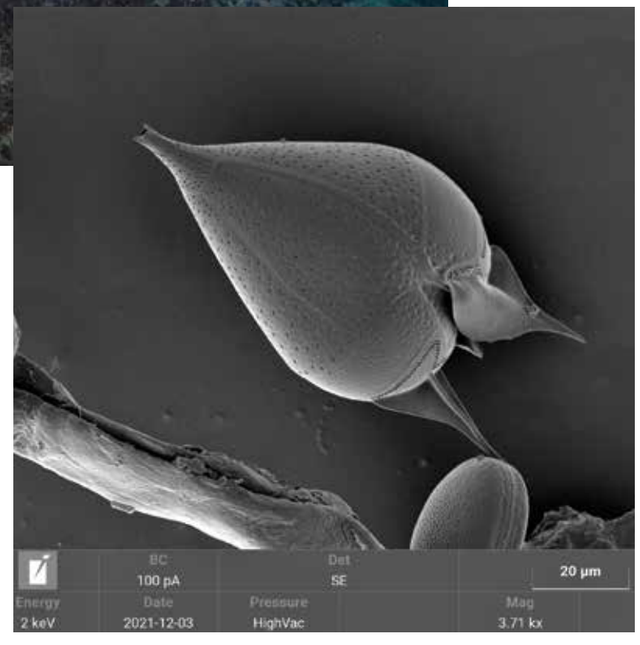
In the context of the programme "Biodiversa+ 2021–2022", the project PETRI-MED (*Plankton biodiversity through remote sensing and omics in the Mediterranean Sea*) was approved; it is coordinated by the Spanish institute ICM-CSIC from Barcelona, and the MBS is involved as a partner. The goal of the project is to develop new strategies to determine and monitor the status and trends in the diversity of microbial plankton in the Mediterranean Sea as support for the assessment of the impact of the connection of ecosystems on the local biodiversity and the functioning of marine ecosystems. This project will start in spring 2023.

The maintenance of the databases continues under the third EMODNet Ingestion project of this kind (EMODnet Ingestion and safe-keeping of marine data no. 3), as well as the citizen science project Plastic Pirates - Go Europe, successfully completed in 2021, which is being implemented on a smaller scale in the framework of the Horizon Europe Mission: Healthy Oceans, Seas, Coastal and Inland Waters.



Fotografiranje asociacije z rdečo algo *Peyssonnelia squamaria* (foto: B. Mavrič).

Photographing the association with the red alga *Peyssonnelia squamaria* (Photo: B. Mavrič).



Predstavnik fitoplanktona iz skupine dinoflagelatov, *Podolampas bipes*, pod vrstičnim elektronskim mikroskopom (foto: P. Slavinec).

Scanning electron micrograph of a planktonic dinoflagellate, *Podolampas bipes* (Photo: P. Slavinec).

sprejeta prijava projekta *Vpliv okoljskega stresa na zdravje in prirastek školjk ter izboljšave vzrejnih praks zaradi mikroplastike in podnebnih sprememb na* razpisu »CRP Naša hrana, podeželje in naravni viri« v letu 2022 (ARRS in MKGP).

MIZŠ je na prednostno listo raziskovalnih infrastruktur uvrstil tudi predlog MBP za vključitev v EMBRC-ERIC, kar je rezultat prizadevanj in sodelovanja v nedavno zaključenem evropskem projektu H2020 *AssemblePlus*.

Znanstvena odličnost

V letu 2022 smo objavili 34 izvirnih in 8 preglednih znanstvenih člankov. Od skupno 49 znanstvenih člankov jih je bilo 46 objavljenih v revijah s faktorjem vpliva (IF), večina (38) kategoriziranih kot veliki znanstveni dosežki (A'), 8 pa kot izjemni dosežki (A''). Štirje sodelavci so bili gostujoči uredniki revij *Frontiers in marine science* in *Drugs*.

Posebno omembo zaslužijo štirje članki iz kategorije A'', ki so izšli v revijah s faktorjem vpliva >10, pri katerih so bili sodelavci MBP prvi ali vodilni avtorji in soavtorji.

Članek *Microplastics in fish and sediments from the Montenegrin coast (Adriatic Sea): Similarities in accumulation* [COBISS.SI-ID 122492419] je plod slovensko-črnogorskega znanstvenega sodelovanja. Objavljen je bil v reviji *Science of the total environment* (IF10,754) (vodilni avtor Oliver Bajt) in predstavlja prvo študijo o kopičenju mikroplastike v ribah in sedimentu v črnogorskem delu Jadranskega morja. Rezultati študije narekujejo sprejetje ukrepov za zmanjšanje vnosa (mikro)plastike v morsko okolje.

V članku *Natural Analogues in pH Variability and Predictability across the Coastal Pacific Estuaries: Extrapolation of the Increased Oyster Dissolution under Increased pH Amplitude and Low Predictability Related to Ocean Acidification* [COBISS.SI-ID 118357507], ki je izšel v reviji *Environmental science & technology* (IF11,357) (prva avtorica Nina Bednaršek), so avtorji opisali biološke vplive dnevnih nihanj in daljših časovnih sprememb pH na avtohtone in tujerodne vrste ostrig v eksperimentalnih pogojih, rezultate pa preslikali na razmere v obalnih oceanskih območjih.

Two employees of the MBS became the new members of the board of the COST action CA20137 (VOICES - Making Young Researchers' Voices Heard for Gender Equality).

In last year's ARRS call for basic and applied projects, we were successful with applications for the postdoctoral project *Diatom viruses and their impact on the cycling of organic matter in the coastal sea* and the applied project *Biotechnological potential of selected micro-organisms from the Sečovlje Salina for use in cosmetic products*. In the latter, the companies AlgEn and Soline, d. d., participate together with partner research institutions. The project *Impact of environmental stress on the health and growth of bivalve molluscs and improvements in breeding practices in the face of microplastics and climate change* has been accepted for financing in the "CRP Our Food, rural areas and natural resources" call for proposals in 2022 (ARRS and Ministry of Agriculture, Forestry and Food.

The Ministry of Education, Science and Sport has also included MBS's proposal to join EMBRC-ERIC on its priority list of research infrastructures, as a result of the efforts and participation in the recently concluded European H2020 AssemblePlus project.

Scientific excellence

In 2022, we published 34 original and 8 review scientific articles. Out of 49 scientific articles, 46 were published in journals with an impact factor (IF), the majority (38) were categorised as major scientific achievements (A') and 8 as outstanding achievements (A''). Four employees were guest editors of the journals *Frontiers in marine science* and *Drugs*.

The four A'' papers published in journals with an impact factor >10, for which MBS employees were first or lead authors and co-authors, particularly deserve to be mentioned.

The article *Microplastics in fish and sediments from the Montenegrin coast (Adriatic Sea): Similarities in accumulation* [COBISS.SI-ID 122492419] is the fruit of a Slovenian-Montenegrin scientific cooperation. It was published in the journal *Science of the total environment* (IF 10.754) (leading author Oliver Bajt) and represents a first study on the accumulation of microplastics in fish and sediment in the Montenegrin part of the Adriatic Sea. The results of the study call for measures to reduce the input of (micro)plastics into the marine environment.

V preglednem članku *From the sea to aquafeed: A perspective overview* [COBISS.SI-ID 122492419] so avtorji izpostavili naraščajoči trend krožne rabe naravnih virov in razvoja novih vrednostnih verig krožnega gospodarstva, med drugim take, ki spodbujajo ponovno uporabo bioloških virov kot dragocenih sestavin krme. Pri članku, ki je izšel v reviji *Reviews in aquaculture* (IF 10,618), sta sodelovali Ana Rotter in Katja Klun.

Eden od rezultatov COST akcije MAF WORLD (CA20102) je kratek znanstveni prispevek *Protecting global marine animal forests* [COBISS.SI-ID 113305347] (soavtorica Andreja Ramšak), ki je izšel v prestižni reviji *Science* (IF 63,832). Gozdovi morskih živali, v katerih prevladujejo bentoški filtratorski organizmi, predstavljajo enega največjih biomov na Zemlji in nudijo pomembne ekosistemske storitve, a so hkrati tudi podvrženi različnim antropogenim pritiskom.

Kot dosežek izpostavljamo tudi znanstveno monografijo *Plastic pollution and marine conservation: approaches to protect biodiversity and marine life*, ki je izšla pri založbi Elsevier Academic Press [COBISS.SI-ID 94494979]. Pri tem smo bili souredniki (Martina Orlando Bonaca) in soavtorji petih poglavij, v katerih so avtorji predstavili ključne informacije o porazdelitvi, usodi in prenosu plastičnih odpadkov v morskem okolju, s posebnim poudarkom na vplivih na določene skupine morskih organizmov, prehranjevalne verige in na onesnaževanje s plastiko. Knjiga je bila konec leta 2022 tudi javno predstavljena strokovni in drugi zainteresirani javnosti.

Od 12. do 15. junija 2022 je potekal Mednarodni simpozij o interakcijah med sedimenti in vodo – IASWS 2022, ki sta ga organizirala Institut Jožef Stefan in MBP. Simpozij je bil hibriden, v živo pa se je odvijal v prostorih MBP v Piranu.

In the article *Natural Analogues in pH Variability and Predictability across the Coastal Pacific Estuaries: Extrapolation of the Increased Oyster Dissolution under Increased pH Amplitude and Low Predictability Related to Ocean Acidification* [COBISS.SI-ID 118357507] published in the journal *Environmental science & technology* (IF 11.357) (first author Nina Bednaršek), the authors described the biological influences of daily fluctuations and long-term pH changes on native and non-native oyster species under experimental conditions, and transpose the results to coastal ocean conditions.

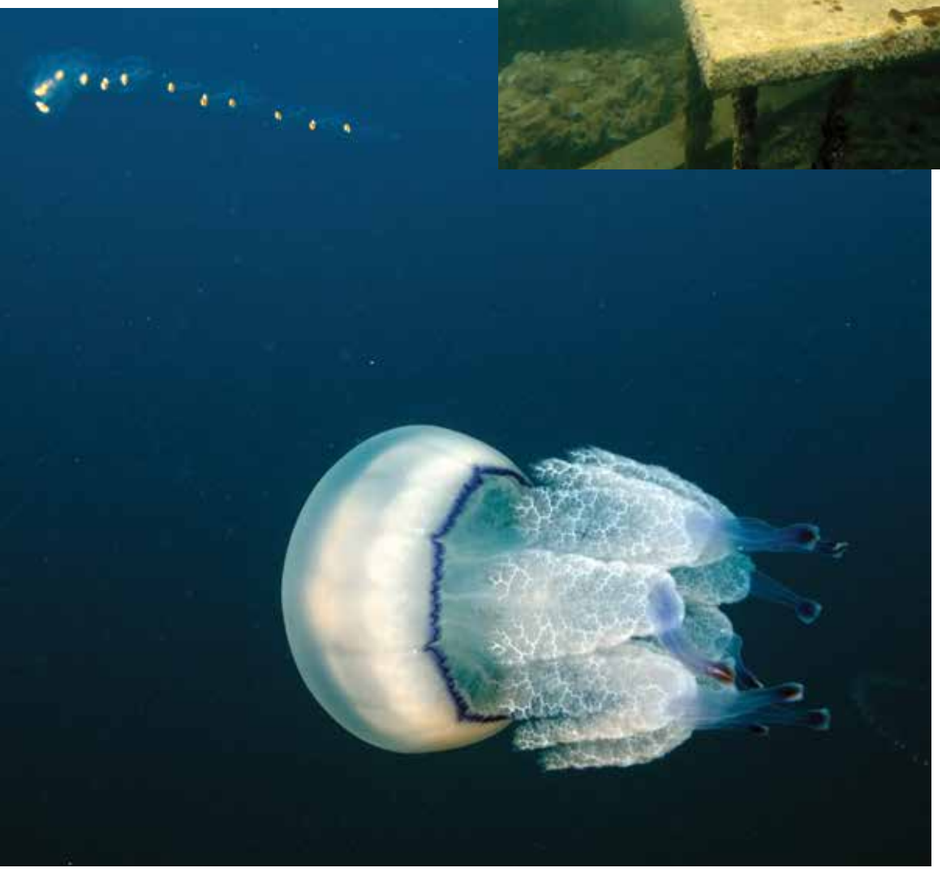
In the review article *From the sea to aquafeed: A perspective overview* [COBISS.SI-ID 122492419], the authors highlighted the increasing trend if circular use of natural resources and the development of new value chains of circular economy, among which some encourage the re-use of biological resources as valuable feed ingredients. Ana Rotter and Katja Klun co-authored the article, which was published in *Reviews in aquaculture* (IF 10.618).

One of the results of the COST action MAF WORLD (CA20102) is a short scientific paper *Protecting global marine animal forests* [COBISS.SI-ID 113305347] (co-author Andreja Ramšak), published in the prestigious journal *Science* (IF 63.832). Marine animal forests, in which benthic filter-feeding organisms prevail, represent one of the largest biomes on Earth and provide important ecosystem services, but are also subject to various anthropogenic pressures.

As an achievement, we would also like to highlight the scientific monograph *Plastic pollution and marine conservation: approaches to protect biodiversity and marine life* published by the Elsevier Academic Press [COBISS.SI-ID 94494979]. We were the co-editors (Martina Orlando Bonaca) and co-authors of five chapters in which the authors presented key information on the distribution, fate and transmitting of plastic waste in the marine environment, with special emphasis on the impact on specific groups of marine organisms, the food chains and plastic pollution. The book was publicly presented to the expert and other interest audience at the end of 2022.

Tihomir Makovec, prejemnik strokovne nagrade Miroslava Zeia za leto 2022, v svojem elementu (foto: B. Mavrič).

Tihomir Makovec, awarded the Miroslav Zei Professional Prize for 2022, in his element (Photo: B. Mavrič).



Dva predstavnika skupnosti želatinastega zooplanktona: kolonijski plaščar iz rodu Salpa in veliki klobučnjak *Rhizostoma pulmo* (foto: B. Mavrič).

Two representatives of the gelatinous zooplankton community: the colonial tunicate of the genus Salpa and the barrel jellyfish *Rhizostoma pulmo* (Photo: B. Mavrič).

Prispevek k promociji in popularizaciji znanosti

V letu 2022 smo organizirali osem delavnic in strokovnih srečanj – dogodkov za deležnike in medije na temo morske biotehnologije, onesnaževanja s plastiko in trajnostnega ribištva. Delavnice o morski biotehnologiji so potekale v okviru COST akcije Ocean4Biotech (CA18238), pri kateri je MBP koordinator in Interreg Med projekta B-Blue.

Novembra 2022 smo ob zaključni fazi projekta »Dobro za morje – dobro zame« (LAS Istre) na MBP organizirali okroglo mizo *Dobre prakse povezovanja ribištva in naravovarstva.* Dogodek je bil poljudne narave in namenjen najširši javnosti, vključno z mediji.

Raziskave in druge dejavnosti MBP so bile tudi v letu 2022 zelo odmevne v javnosti v obliki predavanj in drugih dogodkov za javnost, izdaj poljudnih publikacij, kot je knjiga *Podobe iz modrine* avtorja Lovrenca Lipeja, ter dogodkov in nastopov v elektronskih in tiskanih medijih.

Po dveh letih premora je najbolj odmeven in obiskan dogodek za krepitev oceanske pismenosti »Dan odprtih vrat Morske biološke postaje« ponovno potekal v živo. S tem dnevom (8. junij), ko obeležujemo svetovni dan oceanov, se skozi številne delavnice in predavanja predstavimo javnosti, predvsem osnovnošolskim učencem. Osrednje predavanje »Znanje, ki ga potrebujemo za morje, kot si ga želimo« je bilo posvečeno OZN Desetletju oceanov 2021–2030. Dogodka se je udeležilo preko 300 obiskovalcev in odziv je bil več kot odličen.

Contribution to the promotion and popularisation of science

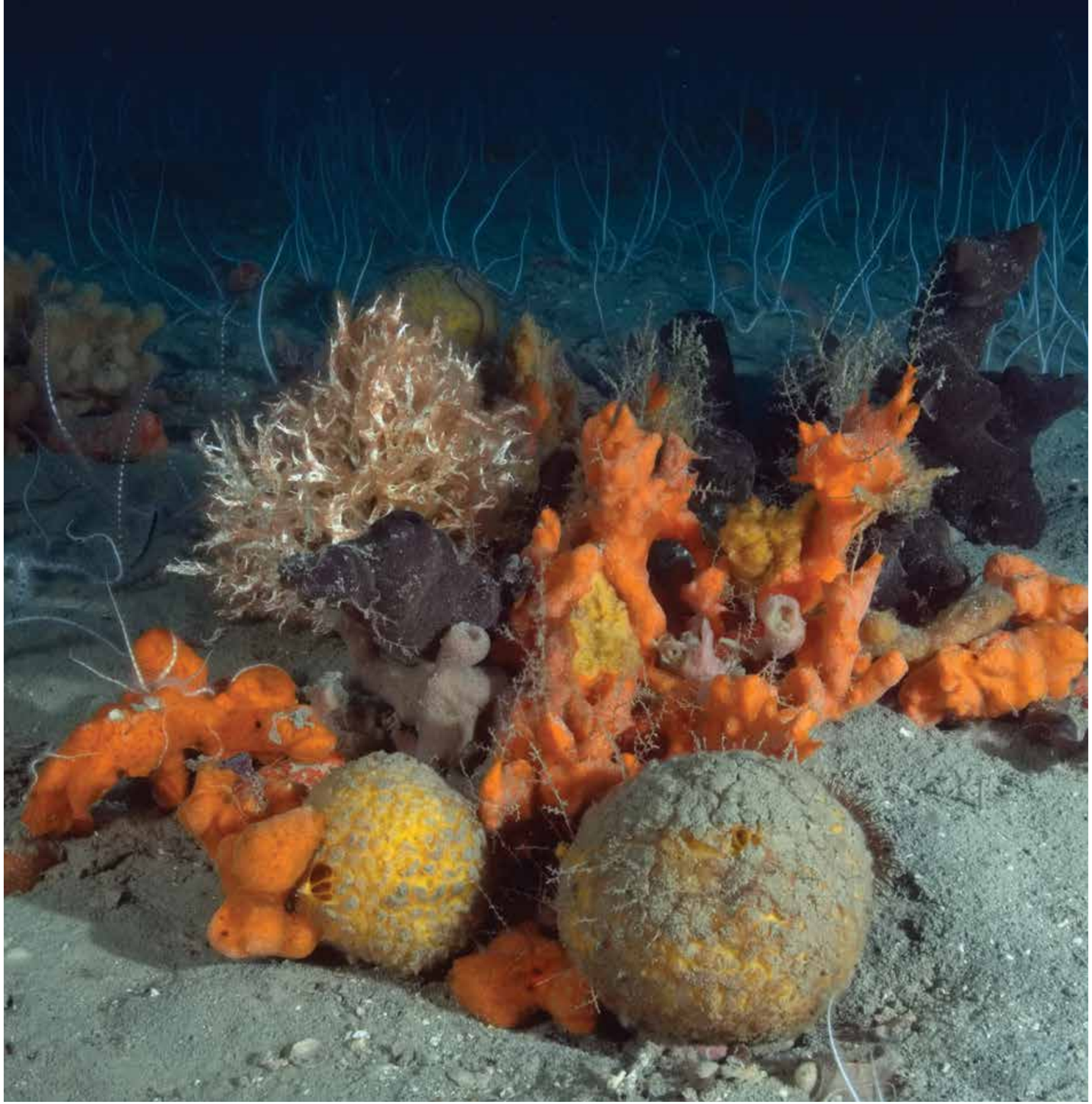
In 2022, we organised eight workshops and expert meetings – events for stakeholders and media on marine biotechnology, plastic pollution, and sustainable fishing. The workshops in marine biotechnology were held in the context of the COST action Ocean4Biotech (CA18238), coordinated by MBS, and the Interreg Med project B-Blue.

In November 2022, at the conclusion stage of the project "Good for the sea – good for me" (LAS Istria), we organised a panel discussion *Good practices of connecting fishing with nature conservation.* The nature of the event was popular, and it was aimed at the general public, including the media.

The MBS' research and other activities continued to draw a lot of public attention in 2022, with lectures and other public events, the publication of popular publications such as the book *Images from the Blue* by Lovrenc Lipej, and events and presentations in electronic and print media.

After a two-year hiatus, the most high-profile and well-attended event for promoting ocean literacy, the Open Day of the Marine Biology Station, was held again in person. On World Ocean Day (8 June), we present ourselves to the public, especially primary school pupils, through a series of workshops and lectures. The keynote lecture, "The sience we need for the ocean we want", focused on the UN Decade of the Oceans 2021–2030. The event had more than 300 visitors and the response was more than excellent.

Between 12 and 15 June 2022, The International Symposium on Interactions Between Sediments and Water - IASWS 2022, organised by the Jožef Stefan Institute and MBS, took place. This was a hybrid symposium and was held live at the MBS premises in Piran.

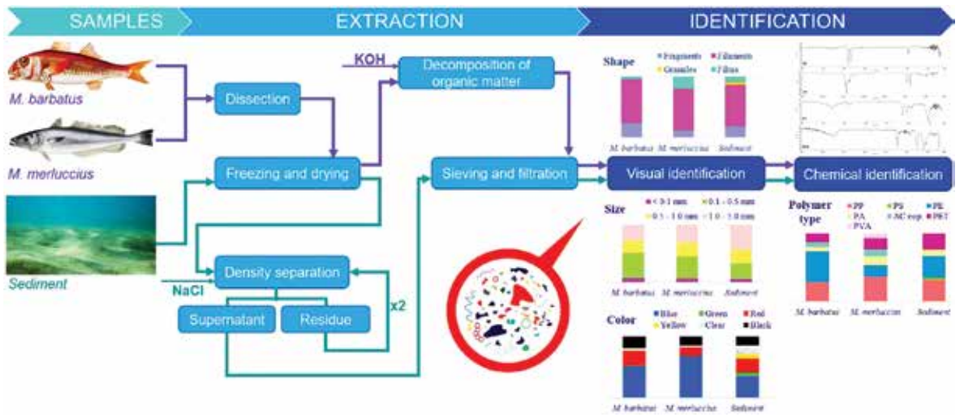


Ko barve spregovorijo: pestra množica pridnenih nevretenčarjev (foto: B. Mavrič).

When the colours speak: a diverse assemblage of bottom-dwelling invertebrates (Photo: B. Mavrič).

BIBLIOGRAFIJA
BIBLIOGRAPHY

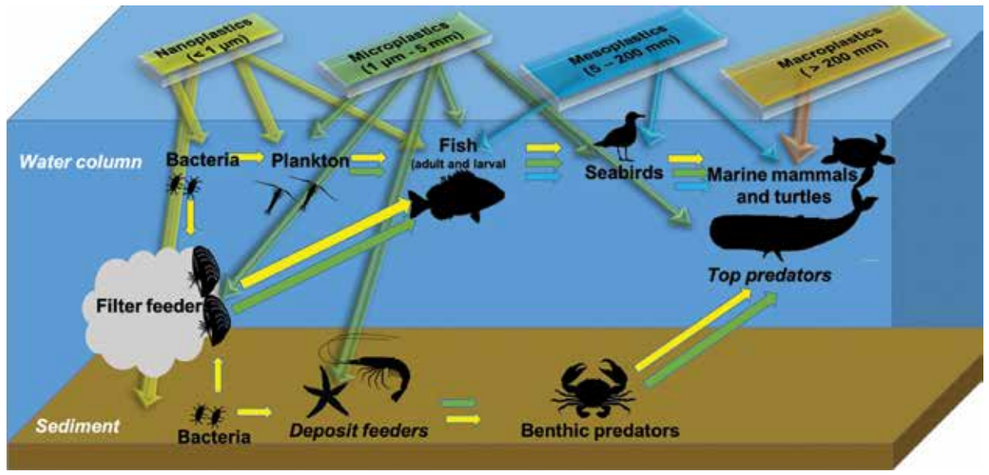
41	Izvirni znanstveni članek Original Scientific Article
4	Pregledni znanstveni članek Review Article
4	Kratki znanstveni prispevek Short Scientific Article
6	Strokovni članek Professional Article
11	Poljudni članek Popular Article
2	Objavljeni povzetek znanstvenega prispevka na konferenci (vabljeno predavanje) Published Scientific Conference Contribution Abstract (invited lecture)
20	Objavljeni povzetek znanstvenega prispevka na konferenci Published Scientific Conference Contribution Abstract
7	Samostojni znanstveni sestavek ali poglavje v monografski publikaciji Independent Scientific Component Part or a Chapter in a Monograph
4	Intervju Interview
2	Strokovna monografija Professional Monograph
1	Magistrsko delo Master's Thesis
6	Končno poročilo o rezultatih raziskav Final Research Report
4	Elaborat, predštudija, študija Treatise, Preliminary Study, Study
12	Radijska ali televizijska oddaja Radio or Television Broadcast
2	Zaključena znanstvena zbirka raziskovalnih podatkov Complete Scientific Database of Research Data
11	Druge monografije in druga zaključena dela Other Monographs and Other Completed Works
2	Strokovni film, videoposnetek ali zvočni posnetek Scientific Film, Scientific Sound or Video Publication
13	Radijski ali TV dogodek Radio or Television Event
5	Prispevek na konferenci brez natisa Unpublished Conference Contribution
1	Vabljeno predavanje na konferenci brez natisa Unpublished Invited Conference Lecture
5	Druga izvedena dela Other Performed Works
13	Uredništvo Editorship



Vnos in trofični prenos plastičnega onesnaženja v morskih prehranjevalnih spletih. Plastični odpadki vplivajo na vrste neposredno z zaužitjem ali zapletom ter posredno z zaužitjem virov hrane.
Vir: Academic Press: Elsevier, 2022; doi. org/10.1016/B978-0-12-822471-7.00007-9.

Kopičenje mikroplastike v ribah in sedimentu v črnogorskem delu Jadranskega morja.
Vir: Science of The Total Environment, 2022; doi: 10.1016/j. scitotenv.2022.158074.

Uptake and trophic transfer of plastic pollution in marine food webs. Plastic litter affects species directly by ingestion or entanglement, or indirectly via uptake of food sources.
Source: Academic Press: Elsevier, 2022; doi. org/10.1016/B978-0-12-822471-7.00007-9.



Accumulation of microplastics in fish and sediments in the Montenegrin marine environment (Adriatic Sea).
Source: Science of The Total Environment, 2022; doi: 10.1016/j. scitotenv.2022.158074.

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Oddelek za biotehnologijo in sistemsko biologijo

Department of Biotechnology and Systems Biology

Živjo, nebo,
snemi klobuk,
prihajam!

VALENTINA VLADIMIROVNA TEREŠKOVA,
PRVA ŽENSKA V VESOLJU IN EDINA ŽENSKA,
KI JE BILA SAMA NA VESOLJSKI ODPRAVI.

Hey sky,
take off your hat,
I'm on my way!

VALENTINA VLADIMIROVNA TERESHKOVA,
THE FIRST WOMAN IN SPACE AND THE ONLY WOMAN
TO HAVE BEEN ON A SOLO SPACE MISSION.

Izlet oddelka FITO
v Kulturno središče
evropskih vesoljskih
tehnologij (KSEVT)
v Vitanju

FITO excursion to
the Cultural Centre
of European Space
Technologies (KSEVT)
in Vitanje

Pet sekund
do izstrelitve!

Five seconds
to blast-off!

Ne moremo zanikati velike vloge žensk v svetovni skupnosti. Moj let le še povečuje prispevek žensk.

One cannot deny the great role women have played in the world community. My flight was yet another impetus to continue this female contribution.

VALENTINA VLADIMIROVNA TERESHKOVA,
THE FIRST WOMAN IN SPACE AND THE ONLY WOMAN TO HAVE BEEN ON A SOLO SPACE MISSION.

VODJA: PROF. DR. **KRISTINA GRUDEN**
HEAD: PROF. DR **KRISTINA GRUDEN**

Prof. dr. Kristina Gruden, znanstvena svetnica, je od leta 2021 vodja oddelka za biotehnologijo in sistemsko biologijo (FITO) ter redna profesorica na Univerzi v Ljubljani in na Mednarodni podiplomski šoli Jožef Stefan. Z raziskavami procesov na molekularni ravni želi razumeti delovanje rastlin v interakcijah z mikroorganizmi in njihovo odzivanje na stresne dejavnike okolja, kot so suša, vročina ali poplave. Za tovrstne raziskave razvija tudi napredna orodja in metodološke pristope za obdelavo in modeliranje velikih podatkov, ki interdisciplinarno povezujejo biologijo s statistiko, kmetijstvom, računalništvom in matematiko.

Prof. Dr Kristina Gruden, Scientific Advisor, is Head of the Department of Biotechnology and Systems Biology (FITO) since 2021 and full professor at the University of Ljubljana and the Jožef Stefan International Graduate School. The main topic of her research is understanding how plants function at the molecular level in their interactions with microorganisms and their responses to environmental stresses such as drought, heat, or flooding. For her research, she develops advanced tools and methodological approaches for processing and modelling big data, integrating biology with statistics, agriculture, computer science and mathematics in an interdisciplinary way.

KLJUČNE DEJAVNOSTI

Glavne raziskovalne usmeritve FITO so:

- preučiti odzive rastlin v kompleksnih okoljih z uporabo kombinacije celične, sistemske in sintetične biologije na molekulski ravni ter z razumevanjem časovne in prostorske dinamike procesov;
- preučiti biologijo, raznolikost, epidemiologijo, razvoj in razširjanje patogenih in nepatogenih rastlinskih mikroorganizmov ter razviti zanesljive vrhunske tehnološke platforme in teste za njihovo odkrivanje ter določanje njihovih lastnosti;
- pridobiti boljši vpogled v prisotnost in potencialno vlogo mikrobov, zlasti virusov, v različnih okoljih, kot so voda, zrak in zemlja, ter raziskati njihov pomen za zdravje ljudi in rastlin,
- razviti nove strategije varstva rastlin in strategije za varnost hrane, ki temeljijo na trajnostnih biotehnoloških metodah;
- razviti učinkovite in okolju prijazne sisteme deaktivacije ali uničevanja mikrobov, za uporabo na različnih matriksih;
- razviti holističen pristop določanja virusnih lastnosti na molekulski in morfološki ravni;
- v biomedicinskih proizvodnih procesih, kot sta proizvodnja cepiv in virusnih vektorjev za gensko terapijo, izboljšati določanje virusnih lastnosti;
- kontinuirana nadgradnja tehnološke platforme za podporo novemu razvoju orodij sistemske in kvantitativne molekularne biologije, vključno z napredno, meroslovno zanesljivo podporo. Orodja so uporabna na področjih farmakologije, zdravja ljudi in okolja;
- partnersko sodelovanje z drugimi raziskovalnimi skupinami na NIB, v Sloveniji in po svetu pri komplementarnih raziskavah za pridobivanje vrhunskega znanja;
- partnersko povezovanje z državnimi in evropskimi institucijami, visokošolskimi organizacijami in industrijo za skupni prispevek k reševanju aktualnih izzivov s področja delovanja oddelka.

KEY ACTIVITIES

FITO's research agenda includes:

- the study of plant responses in complex environments using a combination of cell, systems and synthetic biology at the molecular level and by understanding the temporal and spatial dynamics of processes;
- exploring the biology, diversity, epidemiology, evolution and distribution of pathogenic and non-pathogenic plant micro-organisms and to developing reliable cutting-edge technology platforms and assays for their detection and characterization;
- gaining a better understanding of the presence and potential role of microbes, in particular viruses, in different environments such as water, air and soil, and to investigate their relevance for human and plant health;
- the development of new strategies for crop protection and food safety based on sustainable biotechnological methods;
- the development of efficient and environmentally friendly microbial deactivation or killing systems that can be used on a variety of matrices;
- the development of a holistic approach to the determination of viral properties at the molecular and morphological level;
- improving the determination of viral properties in biomedical production processes, e.g., in the production of vaccines and viral vectors for gene therapy;
- continuous upgrading of the technology platform to support new developments in systems and quantitative molecular biology tools, including advanced, metrologically robust support. The tools are applicable in the fields of pharmacology, human health and the environment;
- collaborating in partnership with other research groups within or outside the NIB, in Slovenia and worldwide, on complementary research to generate cutting-edge knowledge;
- partnerships with Slovenian and European institutions, academic organizations and industry for joint contributions to solving current challenges in the fields of activity of FITO.

GLAVNI DOSEŽKI V LETU 2022

Naši rezultati so del svetovne zakladnice znanja

Konec leta 2022 smo se s selitvijo in zagonom novih sodobno opremljenih laboratorijev Biotehnološkega stičišča tudi po opremljenosti postavili ob bok najboljšim raziskovalnim skupinam z našega področja. Leto 2022 pa si bomo zapomnili tudi kot leto odličnih objav, saj je bilo kar 11 izvirnih znanstvenih člankov oddelka uvrščenih med izjemne znanstvene dosežke (A'').

Nič nima takšne moči, da razširi um, kot je sposobnost, da sistematično in poglobljeno raziskujemo vse, kar v življenju opazimo.

MARK AVRELIJ (121–180),
RIMSKI CESAR IN FILOZOF

Raziskava transkripcijskih faktorjev TGA, ki so ključni uravnalci genskega izražanja pri rastlinski imunosti, odvisni od salicilne kisline, je pokazala, da skrajšanje beljakovine lahko vodi do njenih različnih nalog.

»Daleč največja nevarnost umetne inteligence je, da ljudje prezgodaj sklepajo, da jo razumejo.«

ELIEZER YUDKOWSKY,
AMERIŠKI RAZISKOVALEC UMETNE INTELIGENCE

Kot produkt petletnega dela v številnih projektih je bil razvit in eksperimentalno validiran postopek za načrtovanje zaporedij DNK za nadzor izražanja genov na podlagi generativnega globokega učenja. Ta pristop lahko »napiše« (zasnuje) regulacijsko DNK na novo s ciljnimi nivoji izražanja genov v kvasovkah.

MAJOR ACHIEVEMENTS IN 2022

Our results are part of the world's treasure trove of knowledge

At the end of 2022, with the relocation and commissioning of the Biotechnology Hub's new state-of-the-art laboratories, we will also stand alongside the best research groups in our field in terms of equipment. And 2022 will also be remembered as a year of excellent publications, with 11 of the Department's original scientific papers being classified as Outstanding Scientific Achievements (A'').

Nothing has such power to broaden the mind as the ability to investigate systematically and truly all that comes under thy observation in life.

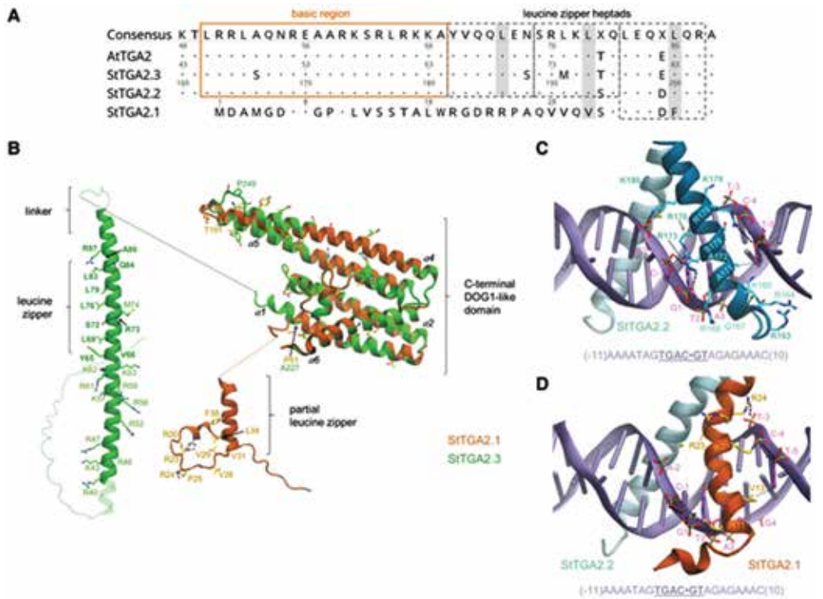
MARCUS AURELIUS (121 – 180),
ROMAN EMPEROR AND PHILOSOPHER

Analysis of TGA transcription factors, which are important regulators of gene expression in salicylic acid-mediated plant immunity, shows how protein truncations can lead to different functions and that such events should be carefully studied in other protein families.

"By far the biggest danger of AI is that people assume too early that they understand it."

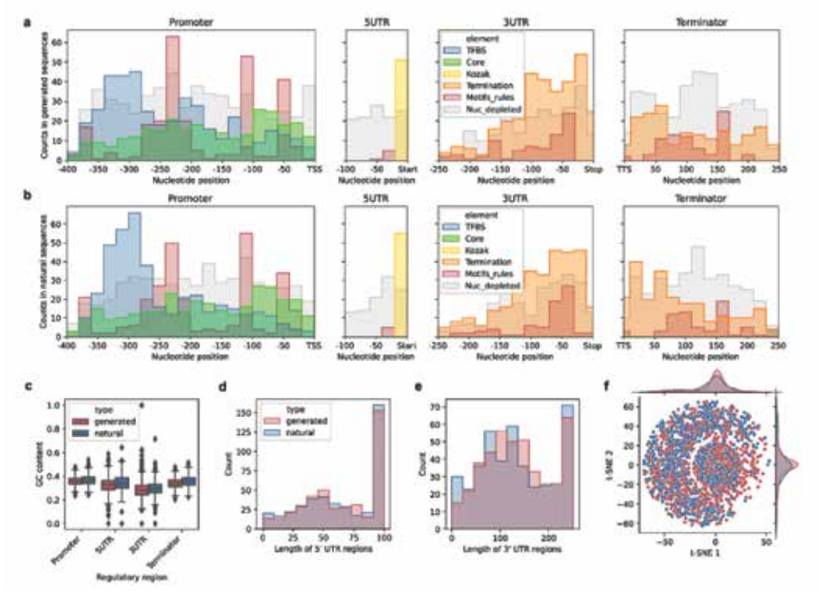
ELIEZER YUDKOWSKY,
AMERICAN AI RESEARCHER

As a product of 5 years of work in a number of projects, a procedure for designing DNA sequences to control gene expression based on generative deep learning has been developed and experimentally validated. This approach can 'rewrite' (design) regulatory DNA with target gene expression levels in yeast.



Primerjalna strukturna analiza in simulacija interakcije med N-koncem StTGA2.1 z domenama StTGA2.2 in StTGA2.3 bZIP. *Vir:* Plant Physiology 2022, kiac579; https://doi.org/10.1093/plphys/kiac579

Comparative structural analysis and simulations of StTGA2.1 N terminus interactions with StTGA2.2 and StTGA2.3 bZIP domains. *Source:* Plant Physiology 2022, kiac579; https://doi.org/10.1093/plphys/kiac579



Zaporedja, ustvarjena z globokim učenjem, imajo lastnosti naravne regulatorne DNK. *Vir:* Nature Communications, 2022; doi: 10.1038/s41467-022-32818-8

Deep learning-generated sequences exhibit properties of natural regulatory DNA. *Source:* Nature Communications, 2022; doi: 10.1038/s41467-022-32818-8

Pomembno je, da se nikoli ne nehamo spraševati.

ALBERT EINSTEIN (1879–1955), NAJVPLIVNEJŠI FIZIK VSEH ČASOV

V pionirski raziskavi inaktivacije virusov s hidrodinamsko kavitacijo so proučevali učinke hidrodinamske kavitacije na različne strukturne dele virusa in ocenili vlogo reaktivnih kisikovih zvrsti na inaktivacijo nevarnega krompirjevega virusa PVY^{NTN}. Izsledki raziskave so bili izbrani kot »Odlični v znanosti 2022« na področju biotehnologije.

Največja napaka je teoretizirati, preden imamo podatke.

SHERLOCK HOLMES, IZMIŠLJENI DETEKTIV, KI GA JE USTVARIL SIR ARTHUR CONAN DOYLE

Raziskovalci FITO so razvili orodje za shranjevanje podatkov raziskav.

Za razumevanje vzorca širjenja virusa in razvoj strategij za ublažitev njegovega širjenja je ključno testiranje.

LOUIS MANSKY, DIREKTOR INŠTITUTA ZA MOLEKULARNO VIROLOGIJO, UNIVERZA V MINNESOTI - TWIN CITIES

Članica FITO je sodelovala v veliki mednarodni skupini, ki je postavila standarde za izboljšano populacijsko testiranje na prisotnost SARS-CoV-2.

It is important to never stop questioning.

ALBERT EINSTEIN (1879-1955), THE MOST INFLUENTIAL PHYSICIST OF ALL TIME

A pioneering study on virus inactivation by hydrodynamic cavitation examined the effects of hydrodynamic cavitation on various structural parts of the virus and evaluated the role of reactive oxygen species in inactivating the dangerous potato virus PVYNTN. The research results were awarded Excellent in Science 2022 in the field of biotechnology.

It is a capital mistake to theorize before one has data.

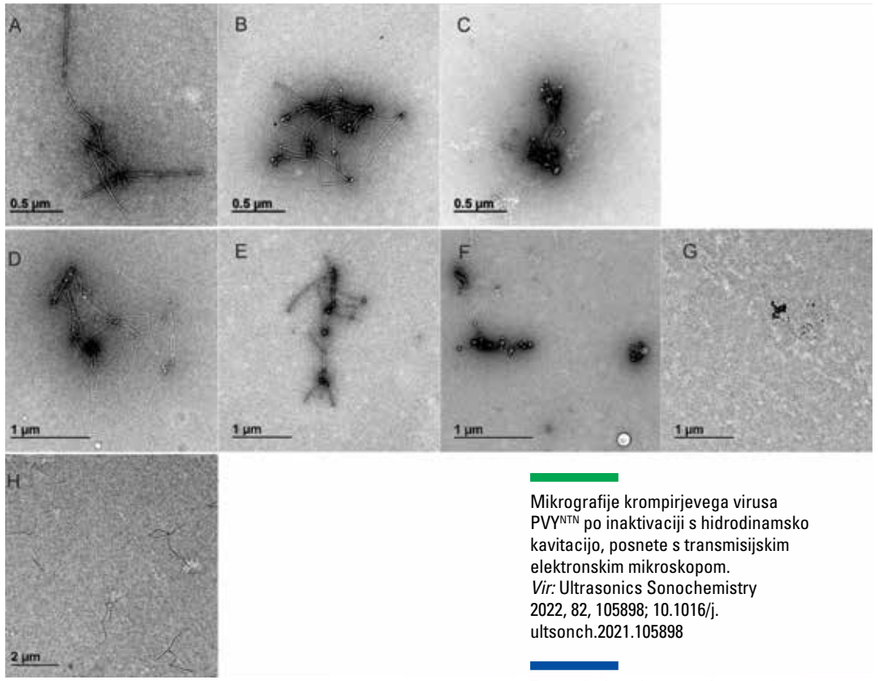
SHERLOCK HOLMES, A FICTIONAL DETECTIVE CREATED BY SIR ARTHUR CONAN DOYLE

FITO researchers have developed a tool for storing research data.

Testing is critical to understand the pattern of virus spread in order to develop strategies to mitigate spread.

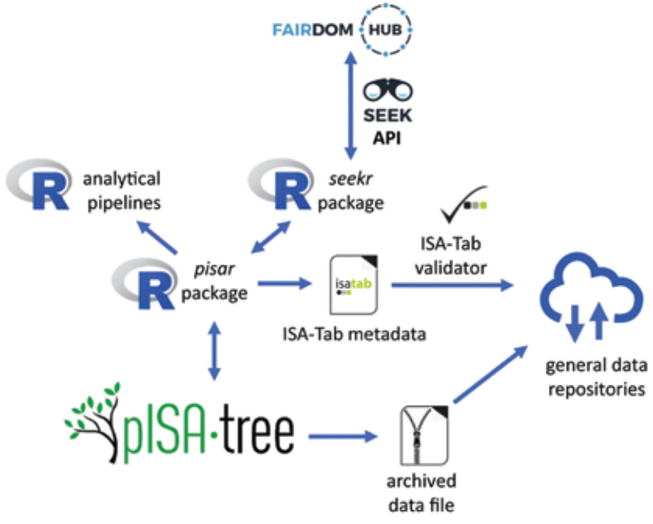
LOUIS MANSKY, DIRECTOR, INSTITUTE FOR MOLECULAR VIROLOGY, UNIVERSITY OF MINNESOTA - TWIN CITIES

The FITO member has participated in a large international group that has established standards for improved population screening for the presence of SARS-CoV-2.



Mikrografije krompirjevega virusa PVY^{NTN} po inaktivaciji s hidrodinamsko kavitacijo, posnete s transmisijskim elektronskim mikroskopom.
Vir: Ultrasonics Sonochemistry 2022, 82, 105898; 10.1016/j.ultsonch.2021.105898

Transmission electron micrographs of PVYNTN potato virus after hydrodynamic inactivation.
Source: Ultrasonics Sonochemistry 2022, 82, 105898; 10.1016/j.ultsonch.2021.105898



Tok informacije z orodjem pISA-tree med javnimi repozitoriji metapodatkov in okoljem za statistično obdelavo podatkov R.
Vir: Scientific data. 2022, 9, 1-9; https://doi.org/10.1038/s41597-022-01805-5

pISA-tree information flow between public metadata repositories and R analytical pipelines.
Source: Scientific data. 2022, 9, 1-9; https://doi.org/10.1038/s41597-022-01805-5

Z našim znanjem oblikujemo boljši svet za vse

V letu 2022 so člani FITO v sodelovanju z evropskim projektom Innovative Network for Next Generation Training and Sequencing of Virome (INEXTVIR), ki ga vodi članica FITO, organizirali mednarodno konferenco International Advances in Plant Virology (IAPV), ki je potekala v Ljubljani z odlično udeležbo več kot 120 strokovnjakov. Sodelovali so tudi pri organizaciji in izvedbi delavnic Wine, Piña Coladas and LAMP o detekciji patogenov v vinski trti in kokosovi palmi v okviru evropskega projekta TROPICSAFE. Kot partnerji v dveh evropskih referenčnih laboratorijih za bakteriologijo in virologijo (viruse, viroide in fitoplazme) (https://eurlplanthealth.pleio.nl/) so v letu 2022 organizirali delavnico o diagnostiki virusov. V okviru infrastrukturne mreže Elixir so izvedli delavnico o orodjih sistemske biologije v Sloveniji.

Znanstveniki se začenjamo učiti svojih obveznosti do splošne javnosti

Ni pomembno le, da si postavljamo vprašanja in najdemo odgovore nanje; kot znanstvenik sem se čutil dolžnega, da z odkritji seznanim javnost.

STEPHEN HAWKING (1942–2018),
FIZIK, MATEMATIK IN KOZMOLOG

With our knowledge we help to shape a better world for all

In 2022, FITO members, in collaboration with the European project Innovative Network for Next Generation Training and Sequencing of Virome (INEXTVIR), led by FITO member , organised the International Advances in Plant Virology (IAPV) conference, which took place in Ljubljana with an excellent turnout of more than 120 experts. They also participated in the organisation and delivery of the Wine, Piña Coladas and LAMP workshops on the detection of pathogens in grapevine and coconut palm in the framework of the European TROPICSAFE project. As partners in the two European Reference Laboratories for Bacteriology and Virology (viruses, viroids and phytoplasmas) (https://eurlplanthealth.pleio.nl/), they have organised a workshop on Virus Diagnosis in 2022. A workshop on systems biology tools in Slovenia was organised in the framework of the Elixir Infrastructure Network.

We scientists are beginning to learn what our responsibility is to the public.

Not only is it important to ask questions and find the answers, as a scientist I felt obligated to communicate with the world what we were learning.learning.

STEPHEN HAWKING (1942–2018),
PHYSICIST, MATHEMATICIAN, AND COSMOLOGIST,

S komuniciranjem znanosti splošni javnosti pokažemo, kam je bil vložen njen denar, a ji sočasno predstavljamo različne izzive našega časa in navdušujemo mlade generacije za raziskovanje in poklic raziskovalca. V letu 2022 smo za knjigo Očarljivi poskusi z rastlinami, ki sta jo izdala Slovensko društvo za biologijo rastlin in NIB, prejeli Zlato hruško, znak kakovosti mladinskih knjig. Člani FITO so na poljuden način javnost seznanjali tudi z raziskavami patogenov in njihovih interakcij z gostiteljskimi rastlinami, z virusi, vključno s še prisotnim SARS-CoV-2, v odpadnih vodah in kako lahko izničimo njihovo škodljivo delovanje. Javnost je izvedela nekaj tudi o matematičnem modeliranju in sistemski biologiji.

By bringing science closer to the general public, we show them where their money has been invested, but at the same time we introduce them to the various challenges of our time and inspire young generations to research and the profession of researcher. In 2022, NIB was awarded the Golden Pear, a quality label for youth books, for our book Charming Experiments with Plants, published by the Slovenian Society for Plant Biology and NIB. FITO members also popularly educated the public about research on pathogens and their interactions with host plants, viruses, including the still-present SARS-CoV-2, in wastewater, and how we can eliminate their harmful effects. The public also learned about mathematical modelling and systems biology.

Ustvarjamo kulturo priznanj

Iskreno, meni individualni dosežki, individualne nagrade pomenijo manj, kot mi pomeni tisto, kar moram narediti, da prispevam k ekipi.

SHERYL SWOOPES,
KOŠARKARICA, PREJEMNICA VSEH NAJPRESTIŽNEJŠIH PRIZNANJ V KOŠARKI IN TRIKRATNA OLIMPIJSKA PRVAKINJA Z REPREZENTANCO ZDA

Creating a culture of recognition

For me, honestly, it's not about individual accomplishments, individual award. It's about what I've got to do and how I can contribute to the team. For me, honestly, it's not about individual accomplishments, individual award. It's about what I've got to do and how I can contribute to the team.

SHERYL SWOOPES,
BASKETBALL PLAYER WHO RECEIVED ALL THE MOST PRESTIGIOUS AWARDS IN BASKETBALL AND WAS A THREE-TIME OLYMPIC CHAMPION WITH THE USA TEAM

V letu 2022 so bili člani FITO večkrat nagrajeni za svoje raziskovalno delo, obeležili pa smo tudi 25. obletnico uradne diagnostike povzročiteljev bolezni rastlin na NIB.

Maja Ravnikar je prejela Zoisovo nagrado za znanstvenoraziskovalne in razvojne dosežke na področju mikrobne biotehnologije za svoj prispevek k revolucionarnim premikom pri odkrivanju in razširjanju virusov, diagnostiki in odstranjevanju patogenih virusov.

In 2022, FITO members received several awards for their research and also celebrated the 25th anniversary of the official diagnosis of plant pathogens at NIB.

Maja Ravnikar received the Zois Award for scientific research and development achievements in the field of microbial biotechnology for her contribution to revolutionary developments in virus detection and propagation, diagnostics, and elimination of pathogenic viruses.

Posebne pozornosti znanstvene javnosti je bil deležen znanstveni članek s področja meroslovja, ki postavlja okvire za natančne, zanesljive in ponovljive meritve nukleinskih kislin, pri katerem je prva avtorica članica FITO Mojca Milavec. Članek je prejel nagrado »Best Paper Award«, ki jo podeljuje mednarodna organizacija Cooperation on International Traceability in Analytical Chemistry (CITAC).

Podjetje BIO-RAD je nagradilo Davida Dobnika in bivšega člana FITO Danya Morisseta s »Positive Droplet Award« v kategoriji javno zdravje.

Magistrska naloga Vide Modic, izdelane pod mentorstvom Anžeta Županiča, in doktorska naloga Katarine Bačnik, izdelane pod mentorstvom Maje Ravnikar in Denisa Kutnjaka, sta prejeli »Posebno Krkino pohvalo«.

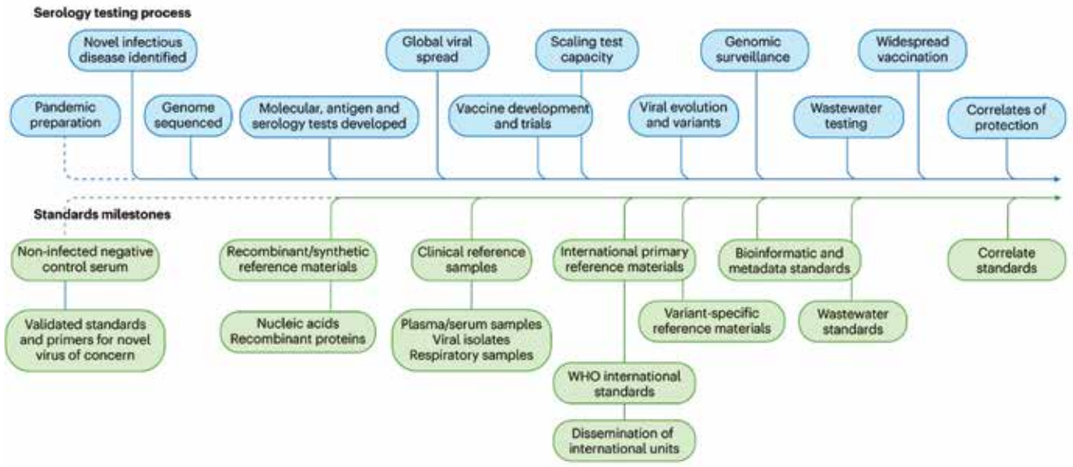
A scientific article in the field of metrology that sets the framework for accurate, reliable, and repeatable measurements of nucleic acids and whose first author is FITO member Mojca Milavec received special attention in the scientific community. The article received the Best Paper Award given by the international organization Cooperation on International Traceability in Analytical Chemistry (CITAC).

BIO- RAD honoured David Dobnik and former FITO member Dany Morisset with the Positive Droplet Award in the public health category.

The master's thesis of Vid Modic, prepared under the supervision of Anže Županič, and the PhD thesis of Katarina Bačnik, prepared under the supervision of Maja Ravnikar and Denis Kutnjak, received Special Krka Awards.

Arijana Filipić je imela na dogodku TEDxUniversityofLjubljana predavanje Plazma vs. virusi: Kdo bo zmagal?
Vir: Plazma vs. virusi: Kdo bo zmagal? | Arijana Filipić | TEDxUniversityofLjubljana - YouTube.

At the TEDxUniversityofLjubljana event, Arijana Filipić gave the talk Plasma vs. viruses: Who will win?
Source: Plazma vs. virusi: Kdo bo zmagal? | Arijana Filipić | TEDxUniversityofLjubljana - YouTube.



Shema mejnikov pri razvoju testiranja in postavljanja standardov med pandemijo covida-19.
Vir: Nature Biotechnology 2022, 40(11), 1563-1568; doi: 10.1038/s41587-022-01538-1

Schematic diagram illustrated key milestones in the development of testing and standars during COVID-19 pandemic.
Source: Nature Biotechnology 2022, 40(11), 1563–1568; doi: 10.1038/s41587-022-01538-1

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BIBLIOGRAPHY

43	Izvirni znanstveni članek Original Scientific Article
12	Pregledni znanstveni članek Review Article
7	Kratki znanstveni prispevek Short Scientific Article
7	Strokovni članek Professional Article
21	Poljudni članek Popular Article
5	Objavljeni povzetek znanstvenega prispevka na konferenci (vabljeno predavanje) Published Scientific Conference Contribution Abstract (invited lecture)
100	Objavljeni povzetek znanstvenega prispevka na konferenci Published Scientific Conference Contribution Abstract
4	Samostojni znanstveni sestavek ali poglavje v monografski publikaciji Independent Scientific Component Part or a Chapter in a Monograph
1	Predgovor, spremna beseda Preface, Afterword
1	Polemika, diskusijski prispevek, komentar Polemic, Discussion, Commentary
5	Intervju Interview
5	Doktorska disertacija Doctoral Dissertation
3	Magistrsko delo Master's Thesis
10	Končno poročilo o rezultatih raziskav Final Research Report
2	Elaborat, predštudija, študija Treatise, Preliminary Study, Study
9	Radijska ali televizijska oddaja Radio or Television Broadcast
1	Zaključena znanstvena zbirka raziskovalnih podatkov Complete Scientific Database of Research Data
17	Radijski ali TV dogodek Radio or Television Event
15	Prispevek na konferenci brez natisa Unpublished Conference Contribution
6	Vabljeno predavanje na konferenci brez natisa Unpublished Invited Conference Lecture
12	Uredništvo Editorship

Podelitev Zoisovih nagrad 2022
(foto: M. Verč).

Zois Awards 2022
(Photo: M. Verč).

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Oddelek za genetsko toksikologijo in biologijo raka

Department of Genetic Toxicology and Cancer Biology

KAKOVOST OKOLJA
IN ZDRAVJE LJUDI STA NELOČLJIVA.

THE QUALITY OF THE ENVIRONMENT
AND HUMAN HEALTH ARE INHERENTLY
CONNECTED.

Vse stvari so strup
in nič ni brez strupa;
samo odmerek naredi,
da stvar ni strup.

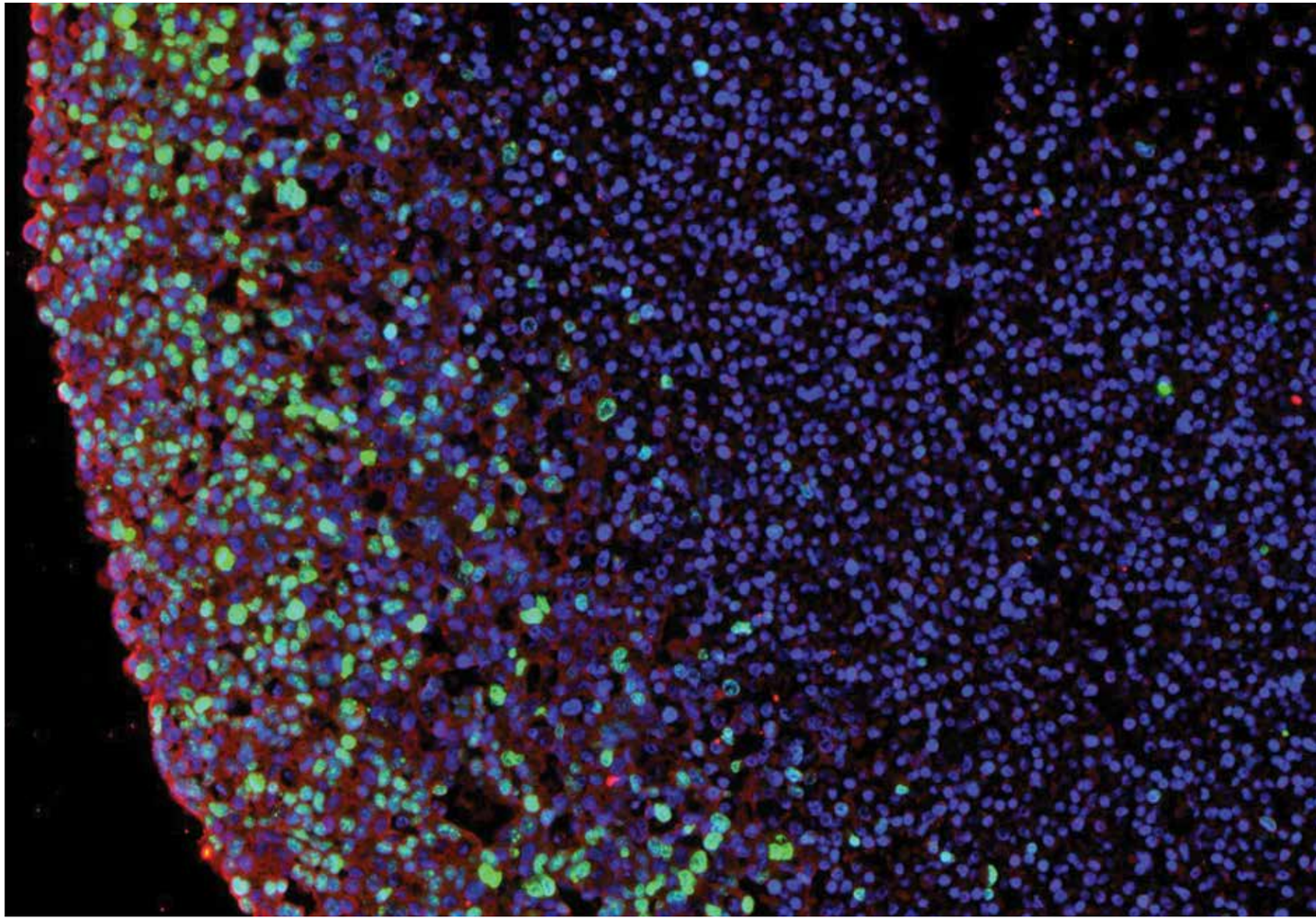
PARACELSUS, ROJEN THEOPHRASTUS PHILIPPUS
AUREOLUS BOMBASTUS VON HOHENHEIM (1493–1534),
»OČE« TOKSIKOLOGIJE

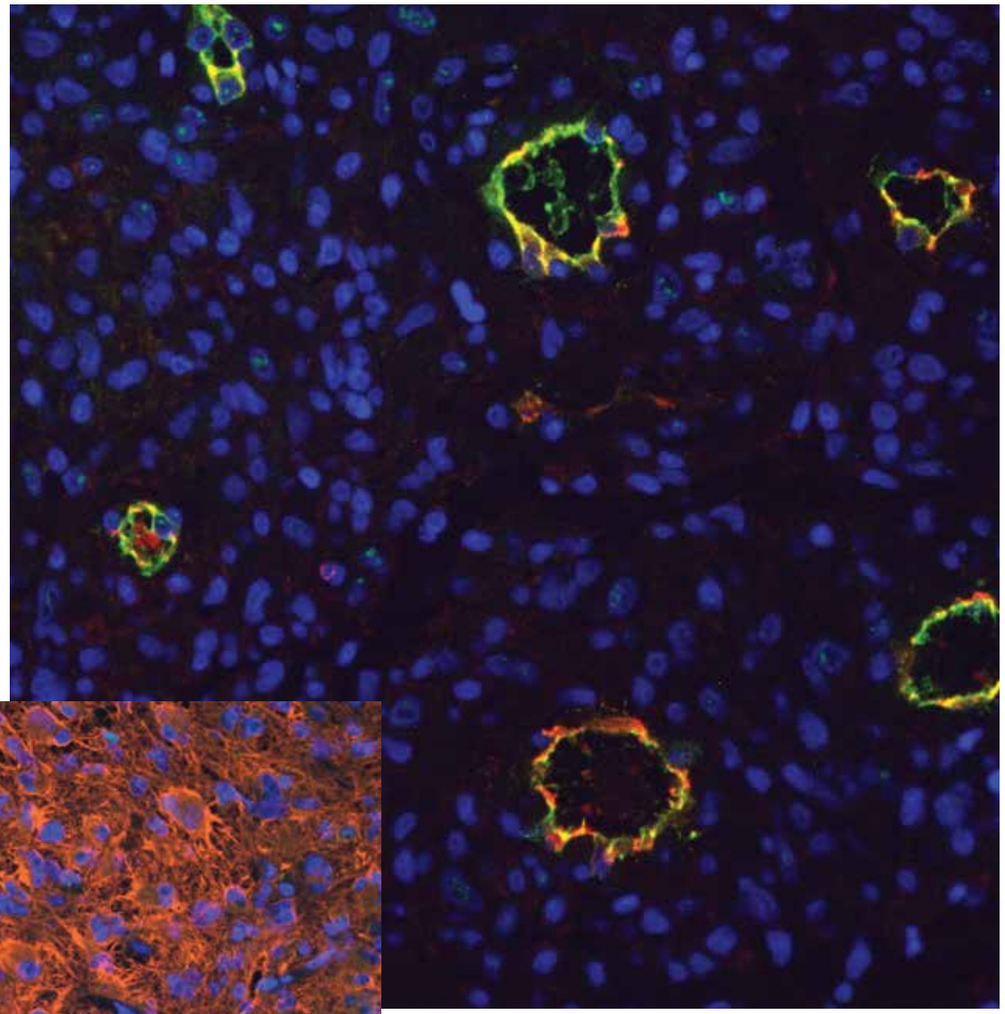
All things are poison
and nothing is without poison;
only the dose makes
that a thing is not poison.

PARACELSUS, BORN THEOPHRASTUS PHILIPPUS
AUREOLUS BOMBASTUS VON HOHENHEIM (1493–1534),
THE "FATHER" OF TOXICOLOGY

Fluorescenčno označene rezine sferoidov NCH421K Ki67 zeleno HIF-1a-rdeče (foto: A. Habič).

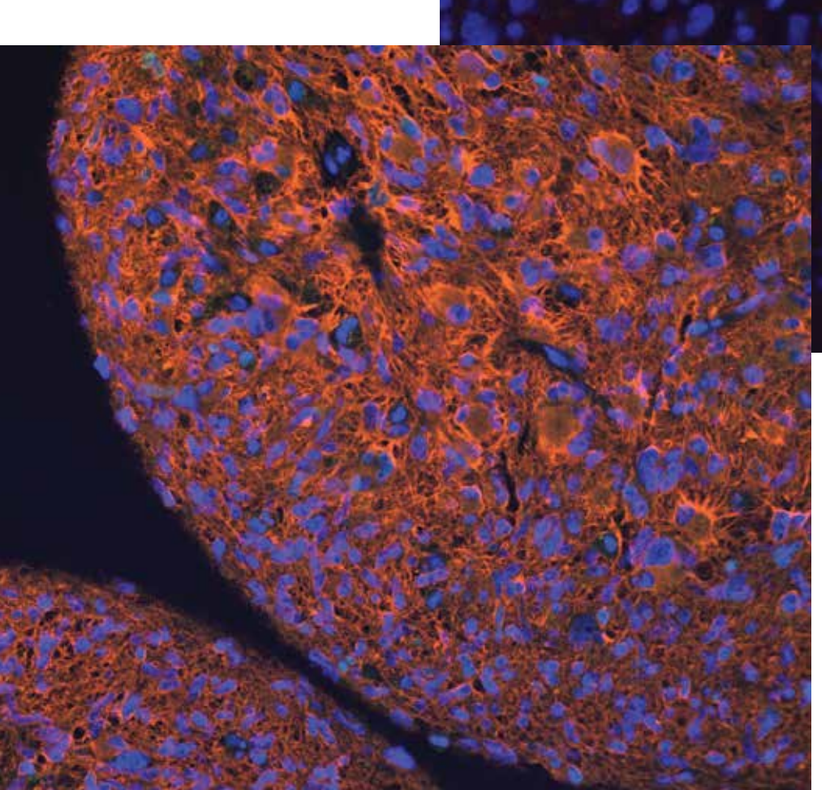
Fluorescently labeled NCH421K spheroids (Ki67-green, HIF-1a-red) (Photo: A. Habič).





Fluorescenčno označene žilne celice v tkivu glioblastoma (CD105-zeleno CD31-rdeče) (foto: B. Majc, A. Habič).

Fluorescently labeled vascular cells in glioblastoma tissue (CD105-green, CD31-red) (Photo: B. Majc, A. Habič).



Fluorescenčno označene rakave celice v organoidih GBM (p21-zeleno GFAP-rdeče) (foto: B. Majc).

Fluorescently labeled cancer cells in GB organoids (p21-green, GFAP-red) (Photo: B. Majc).

VODJA: IZR. PROF. DR. **BOJANA ŽEGURA**

HEAD: ASSOC. PROF. DR **BOJANA ŽEGURA**

Izr. Prof. Dr. Bojana Žegura, znanstvena svetnica, je od leta 2022 vodja Oddelka za genetsko toksikologijo in biologijo raka (GEN) ter izredna profesorica toksikologije na Biotehniški fakulteti Univerze v Ljubljani. Njeno raziskovalno področje so raziskave mehanizmov genotoksičnega in potencialno karcinogenega delovanja antropogenih in naravnih onesnažil okolja in hrane, raziskave potencialnih antigenotoksičnih snovi ter razvoj novih in vitro testnih sistemov za proučevanje genotoksičnosti. Njene raziskave so pomembno doprinesle tudi na področju znanosti o okolju, predvsem k razumevanju škodljivih vplivov naravnih toksinov in ostankov zdravil na okolje in zdravje ljudi.

Assoc. Prof. Dr Bojana Žegura, Scientific Advisor, has been the Head of the Department of Genetic Toxicology and Cancer Biology (GEN) since 2022 and Associate Professor of Toxicology at the Biotechnical Faculty, University of Ljubljana. Her research field include the research of mechanisms of genotoxic and potentially carcinogenic effects of anthropogenic and natural environmental and food pollutants, the investigation of potential antigenotoxic substances, and the development of new in vitro test systems for genotoxicity studies. Her research also made important contributions to environmental science, in particular to understanding the harmful effects of natural toxins and drug residues on the environment and human health.

KLJUČNE DEJAVNOSTI

Raziskovalno delo na Oddelku za genetsko toksikologijo in biologijo raka poteka v okviru raziskovalnega programa ARRS (P1-0245) z naslovom »Ekotoksiologija, toksikološka genomika in karcinogeneza« ter več domačih in mednarodnih raziskovalnih projektov. Raziskave so usmerjene v razumevanje kompleksnih mehanizmov, prek katerih okolje vpliva na zdravje ljudi, in obratno, kako človekove dejavnosti vplivajo na okolje.

Specifična področja naših raziskav so:

- Raziskave molekularnih mehanizmov toksičnega in genotoksičnega delovanja okoljskih onesnažil. Osredotočamo se na preučevanje potencialnih škodljivih učinkov posameznih onesnažil (bisfenoli, cianobakterijski toksini, mikotoksini, ostanki zdravil, nanodelci itn.) ter tudi njihovih zmesi na zdravje ljudi in vodne organizme.
- Ekološke raziskave površinskih voda in razvoj novih metodologij ekološkega vrednotenja kakovosti voda na osnovi analiz okoljske DNK v vodnih telesih.
- Raziskave napredovanja možganskih tumorjev gliomov, glioblastomskih matičnih celic ter njihove vloge pri napredovanju in odpornosti proti zdravljenju. Raziskave osredotočamo na preučevanje učinka rakavih matičnih celic in mikrookolja tumorjev na odpornost proti zdravljenju s kemo- in radioterapijo ter iskanje novih terapevtskih pristopov za kombinatorno zdravljenje.
- Razvoj sodobnih načinov zdravljenja ter diagnostike raka, avtoimunskih bolezni, pretiranih imunskih odzivov na okužbe in vrste drugih imunskih pomanjkljivosti zahteva podrobno preučevanje celičnih in molekularnih mehanizmov. Vzpostavljamo platforme za poglobljeno analizo imunskih celic in razvijamo inovativne celične imunoterapije naslednje generacije z izboljšano učinkovitostjo in/ali varnostjo. Primer je CAR (»Chimeric Antigen Receptor«) T celična imunoterapija, ki je prvi FDA-odobren pristop zdravljenja nekaterih oblik krvnega raka z uporabo gensko spremenjenih celic T in ponuja rešitve za zdravljenje do sedaj neozdravljivih bolezni.

KEY ACTIVITIES

The research work at the Department of Genetic Toxicology and Cancer Biology is carried out in the context of the ARRS research programme (P1-0245) entitled "Ecotoxicology, toxicological genomics and carcinogenesis" and several domestic and international research projects. The research focuses on the understanding of the complex mechanisms through which the environment impacts the health of people, and vice versa, how human activities impact the environment.

Specific areas of our research are:

- Research of molecular mechanisms of toxic and genotoxic effects of environmental pollutants. We focus on the study of potentially harmful effects of individual pollutants (bisphenols, cyanobacterial toxins, mycotoxins, drug residues, nanoparticles, etc.), as well as mixtures of these pollutants, on human health and aquatic organisms.
- Ecological research of surface waters and development of new methodologies for ecological assessment of water quality based on environmental DNA analysis in water bodies.
- Research into the growth of glioma brain tumours, glioblastoma stem cells and their role in growth and resistance to treatment. Our research focuses on the effect of cancer stem cells and the microenvironment of tumours on resistance to chemo- and radiotherapy, and on finding new therapeutic approaches for combinatorial treatment.
- The development of modern treatments and diagnostics for cancer, autoimmune diseases, exaggerated immune responses to infections and a range of other immunodeficiencies requires detailed studies of cellular and molecular mechanisms. We establish platforms for in-depth analysis of immune cells and develop innovative next-generation cell-based immunotherapies with improved efficacy and/or safety. An example is CAR ("Chimeric Antigen Receptor") T-cell immunotherapy, which is the first FDA-approved approach to treating some forms of blood cancer with genetically modified T-cells and provides solutions for the treatment of previously incurable diseases.

- Razvoj novih in vitro sistemov preizkušanja za nadomeščanje uporabe poskusnih živali v genetski toksikologiji in pri raziskavah raka. Razvijamo tridimenzionalne (3D) celične modele in modele z zarodki rib cebric (*Danio rerio*).

Na vseh raziskovalnih področjih partnersko sodelujemo z raziskovalnimi skupinami v Sloveniji in tujini. Za potrebe državnih institucij in partnerje iz gospodarstva izvajamo naročniške raziskovalne projekte in svetovanje. Izvajamo preizkušanja varnosti proizvodov za potrebe registracij (testiranje mutagenosti skladno z načeli dobre laboratorijske prakse (DLP) po OECD in preizkušanje biološke združljivosti medicinskih pripomočkov skladno s standardom ISO 10993-5.

- Development of new in-vitro testing systems to replace the use of test animals in genetic toxicology and cancer research. We develop three-dimensional (3D) cell models and embryo models of zebrafish (*Danio rerio*).

In all areas of research, we work as partners with research groups in Slovenia and abroad. We carry out commissioned research and consultancy projects for government institutions and partners from business. We carry out product safety testing for registration purposes (mutagenicity testing according to the OECD Principles of Good Laboratory Practice (GLP) and biocompatibility testing of medical devices according to ISO 10993-5.

GLAVNI RAZISKOVALNI DOSEŽKI V LETU 2022

Raziskave molekularnih mehanizmov toksičnega in genotoksičnega delovanja okoljskih onesnažil

Onesnaževanje okolja s toksičnimi snovmi je eden glavnih problemov današnjega časa ter predstavlja resno grožnjo za ekosisteme in zdravje ljudi. Izvor kemičnega onesnaženja so kemikalije, ki nastanejo zaradi človekove dejavnosti in se sproščajo v okolje, ter naravne spojine, ki jih proizvajajo različni organizmi. Kljub vse več dokazom o prisotnosti teh spojin v okolju in s tem v hrani, ki jo uživamo, še vedno obstajajo vrzeli v razumevanju, kako te kemikalije vplivajo na organizme, kar nam preprečuje ustrezno oceno tveganja za okolje in zdravje ljudi, zlasti za nastanek in razvoj rakavih obolenj. To so v okolju vseprisotni organizmi; zaradi povečane evtrofikacije celikih voda in klimatskih sprememb, pa so večkrat prisotne tudi strupene vrste. Že vrsto let preučujemo škodljivo delovanje naravnih toksinov, ki jih proizvajajo cianobakterije in alge. To so v okolju vseprisotni organizmi, ki jih zaradi povečane evtrofikacije celinskih voda in globalnega segrevanja vse pogosteje najdemo v vodnih okoljih zmernega pasu. V okviru programa ARRS smo v sodelovanju s kolegi z Inštituta za medicinske raziskave in medicino dela, Fakultete za farmacijo in biokemijo iz Zagreba ter Inštituta Ruđer Bošković iz Rovinja, Hrvaška, proučevali pojavljanje diatomej iz rodu *Pseudo-nitzschia* v Jadranskem morju in toksične lastnosti domoične kisline, ki jo le-te proizvajajo, kar smo objavili v A"

MAIN RESEARCH ACHIEVEMENTS IN 2022

Research of Molecular Mechanisms of Toxic and Genotoxic Effects of Environmental Pollutants

Environmental pollution with toxic substances is one of the major problems of our time and poses a serious threat to ecosystems and human health. The source of chemical pollution are chemicals generated as a result of human activity and released into the environment, and natural compounds produced by different organisms. Despite growing evidence of the presence of these compounds in the environment and consequently in the food we eat, there are still gaps in our understanding of how these chemicals affect organisms; this means we cannot adequately assess the risks to the environment and to human health, in particular for the development and progression of cancer. For many years, we have been studying the harmful effects of natural toxins produced by cyanobacteria and algae. These are organisms present everywhere which are increasingly found in aquatic environments in the temperate zone due to increased eutrophication of inland waters and global warming. In the context of the ARRS programme, in collaboration with colleagues from the Institute of Medical Research and Occupational Medicine from the Faculty of Pharmacy and Biochemistry in Zagreb and the Ruđer Bošković Institute, Rovinj, Croatia, we studied the occurrence of diatoms of the genus *Pseudo-nitzschia* in the Adriatic Sea and the toxic

članku v reviji Environmental Research (https://doi.org/10.1016/j.envres.2022.114108) in v reviji Toxicology (https://doi.org/10.1016/j.tox.2022.153157).

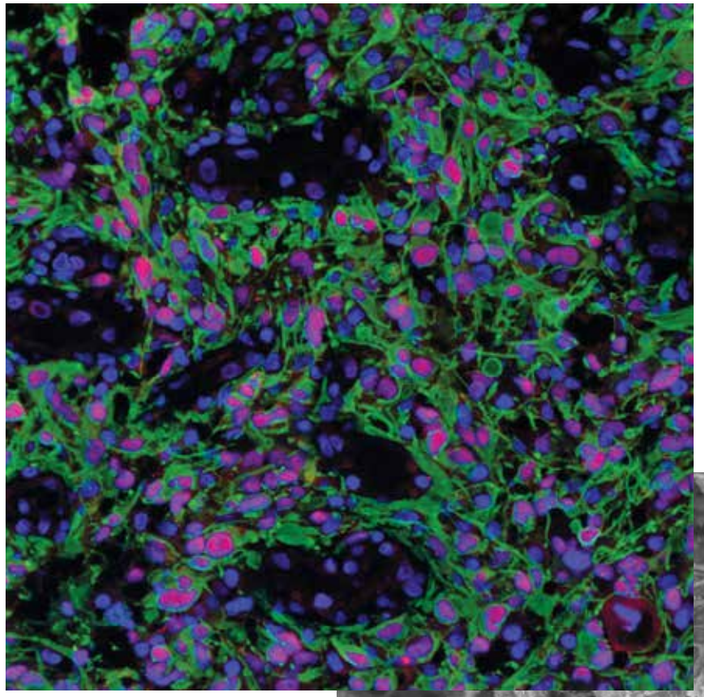
V zadnjih desetletjih se je močno povečala zaskrbljenost zaradi posebne skupine novih perečih onesnaževal, kot so ostanki zdravil, ki se pojavljajo v okolju, predvsem v vodnih telesih. Ostanki zdravil (npr. protirakava zdravila) lahko povzročajo številne škodljive učinke na zdravje ljudi in živali, kot so spremembe ali poškodbe dednega materiala, kar lahko privede do razvoja številnih obolenj, vključno z rakavimi obolenji. Po drugi strani lahko ostanki zdravil povzročajo spremembe, povezane z motnjami endokrinega sistema, ter veljajo za reproduktivne in razvojne strupe. Čeprav so ostanki zdravil v okolju večinoma prisotni v nizkih koncentracijah, pa predstavljajo potencialno nevarnost za zdravje ljudi in organizmov, ki v takšnih okoljih živijo, saj so tovrstne spojine lahko zelo aktivne v nizkih koncentracijah. V sodelovanju z Onkološkim inštitutom in Fakulteto za farmacijo v Ljubljani smo proučevali letalne in subletalne učinke tirozin kinaznih inhibitorjev na embrije rib cebric (*Danio rerio*) (https://doi.org/10.3390/toxics10010004), medtem ko smo v sodelovanju s Fakulteto za farmacijo proučevali učinke tirozin kinaznih inhibitorjev na androgene, estrogen α, glukokortikoidne in tiroidne receptorje, kar smo objavili v reviji Toxicology and Applied Pharmacology (https://doi.org/10.1016/j.taap.2021.115818). Fotodegradacijo in toksikološke lastnosti zdravila metoklopramid in njegovih fotoproduktov smo raziskovali v sodelovanju s Fakulteto za kemijski inženiring in tehnologijo iz Zagreba, Hrvaška. Izsledke študije smo objavili v A'' članku v reviji Science of the Total Environment (https://doi.org/10.1016/j.scitotenv.2021.150694).

V okviru raziskav programa ARRS in pogodbe z Ministrstvom za obrambo RS smo nadaljevali z ekološkimi raziskavami površinskih voda. Rezultate raziskav ekoloških procesov v akumulacijah, ki se uporabljajo tudi za hidroenergijo, smo v soavtorstvu objavili v reviji Fundamental and Applied Limnology (10.1127/fal/2021/1408). Za ARSO smo v letu 2022 opravljali tudi biološki monitoring izbranih zadrževalnikov. Na temo zaznavanja toksičnih cianobakterij na osnovi okoljske DNA v fitoplanktonu in fitobentosu smo v soavtorstvu objavili A'' članek v reviji Science of the Total Environment (https://doi.org/10.1016/j.scitotenv.2022.155175). Pojav cianobakterij v celinskih vodah in z njimi povezano sproščanje

properties of the domoic acid they produce; we published this in an A'' article in the journal Environmental Research (https://doi.org/10.1016/j.envres.2022.114108) and in the journal Toxicology (https://doi.org/10.1016/j.tox.2022.153157).

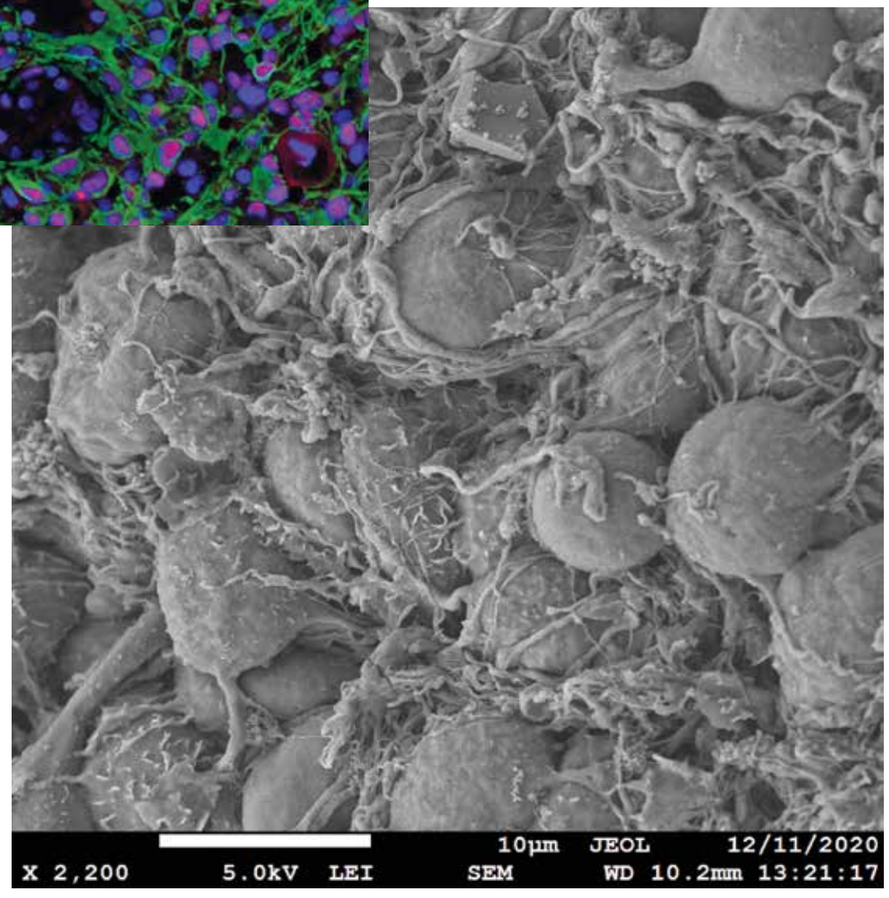
Recent decades saw a sharply increasing concern about a specific group of new threatening pollutants, such as medicine residues, which occur in the environment, especially in water bodies. Medicine residues (e.g., anticancer drugs) can cause several adverse health effects in humans and animals, such as alterations or damage to genetic material, which can lead to the development of a number of diseases, including cancer. On the other hand, medicine residues can cause changes associated with endocrine disruption and are considered reproductive and developmental toxins. Although medicine residues are mostly present in the environment at low concentrations, they pose a potential health risk to humans and the organisms that live in such environments, as such compounds can be very active at low concentrations. In collaboration with the Institute of Oncology and the Faculty of Pharmacy in Ljubljana, we studied the lethal and sublethal effects of tyrosine kinase inhibitors on zebrafish embryos (*Danio rerio*) (https://doi.org/10.3390/toxics10010004); in collaboration with the Faculty of Pharmacy, we studied the effects of tyrosine kinase inhibitors on androgen, oestrogen α, glucocorticoid and thyroid receptors, which we published in Toxicology and Applied Pharmacology (https://doi.org/10.1016/j.taap.2021.115818). The photodegradation and toxicological properties of metoclopramide and its photoproducts were studied in collaboration with the Faculty of Chemical Engineering and Technology, Zagreb, Croatia. The findings of the study were published in the A'' article in the journal Science of the Total Environment (https://doi.org/10.1016/j.scitotenv.2021.150694).

Within the framework of the ARRS research programme and a contract with the Ministry of Defence of the Republic of Slovenia, we continued our ecological research on surface waters. The results of our research on ecological processes in reservoirs, which are also used for hydropower, were published in co-authorship in the journal Fundamental and Applied Limnology (10.1127/fal/2021/1408). We carried out the biological monitoring of selected reservoirs for ARSO in 2022. We



Fluorescenčno označene rakave celice v tkivu GBM (GFAP-zeleno SOX2-rdeče) (foto: B. Majc, A. Habič).

Fluorescently labeled cancer cells in glioblastoma tissue (GFAP-green, SOX2- red) (foto: B. Majc, A. Habič).



Celice organoida GBM pod elektronskim mikroskopom (foto: M. Vittori).

Cells of GB organoid under the electron microscope (Photo: M. Vittori).

cianotoksinov v okolje namreč ogroža zdravje ljudi in živali, uničuje vodna okolja in s tem povzroča tudi ekonomsko škodo. Samo z zgodnjo in specifično zaznavo te toksične grožnje lahko pristojne institucije dovolj hitro ukrepajo, zmanjšajo razsežnosti in negativne posledice tega pojava ter tako izboljšajo upravljanje voda.

Raziskave iniciacije in razvoja raka

V okviru programa in projektov ARRS nadaljujemo z raziskavami molekularnih mehanizmov napredovanja raka in iskanjem novih pristopov zdravljenja, ki so nujni za učinkovitejše zdravljenje bolnikov z rakom. Naše raziskave se osredotočajo na najagresivnejši in najpogostejši možganski tumor glioblastom (GBM), ki je neozdravljiv. Najnovejše ugotovitve o biologiji in zdravljenju glioblastoma (GBM) smo objavili v znanstvenih revijah Communications Biology (https://doi.org/10.1038/s42003-022-03402-z) in International Journal of Molecular Sciences (https://www.mdpi.com/1422-0067/23/3/1784). V prvi študiji smo pokazali, da je terapija na osnovi naravnih celic ubijalk (NK) obetavna imunoterapevtska strategija pri zdravljenju glioblastoma, saj lahko NK celice uspešno lizirajo na standardno terapijo odporne matične celice glioblastoma. V naslednji študiji pa smo ugotovili, da sta ekspresija in aktivnost katepsina X povečana v človeških tkivih glioblastoma v primerjavi z gliomi nizke stopnje in netumorskimi možganskimi tkivi. Katepsin X je bil lokaliziran v celicah glioblastoma, pa tudi v makrofagih in mikrogliji, povezanih s tumorjem. Selektivni zaviralci katepsina X so zmanjšali sposobnost preživetja celic glioblastoma, pridobljenih iz bolnikov, kar kaže, da je katepsin X vključen v napredovanje glioblastoma in je lahko potencialna tarča za terapevtske pristope. V okviru raziskav o učinkih kanabinoidov smo ugotovili, da ima kanabigerol (CBG) protirakavo delovanje, saj spodbuja rast in invazijo rakavih celic ter sproži njihovo apoptozo v kombinaciji s kanabidiolom (CBD) (Cancers., https://doi.org/10.3390/cancers14235918). Študija z uporabo sintetičnega kanabinoida WIN 55,212–2 pa je pokazala, da se proliferacija celic raka slinavke močno zmanjša ter poveča njihova celična smrt, kar smo objavili v reviji Advances in Cancer Biology - Metastasis. (https://doi.org/10.1016/j.adcanc.2022.100043).

Research of the Initiation and Development of Cancer

Within the framework of the ARRS programme and projects, we continue to research the molecular mechanisms of cancer growth and search for new treatment approaches that are needed to treat cancer patients more effectively. Our research focuses on the most aggressive and common brain tumour, glioblastoma (GBM), which is incurable. The newest findings on biology and the treatment of glioblastoma (GBM) were published in the scientific journals Communications Biology (https://doi.org/10.1038/s42003-022-03402-z) and International Journal of Molecular Sciences (https://www.mdpi.com/1422-0067/23/3/1784). The first study demonstrated that therapy based on natural killer (NK) cells is a promising immunotherapeutic strategy for the treatment of glioblastoma, as NK cells can successfully lysate glioblastoma stem cells resistant to standard therapy. The next study found that the expression and activity of cathepsin X are increased in human glioblastoma tissues compared to low-grade gliomas and non-tumour brain tissues. Cathepsin X was localised in glioblastoma cells, as well as in tumour-related macrophages and microglia. Selective cathepsin X inhibitors reduced the viability of glioblastoma cells derived from patients, suggesting that cathepsin X is involved in glioblastoma growth and may be a potential target for therapeutic approaches. Research into the effects of cannabinoids has found that cannabigerol (CBG) has anticancer activity by stimulating the growth and invasion of cancer cells and inducing their apoptosis when combined with cannabidiol (CBD) (Cancers., https://doi.org/10.3390/cancers14235918). A study using the synthetic cannabinoid WIN 55,212-2 showed that the proliferation of pancreatic cancer cells is greatly reduced, and cell death is increased, which we published in Advances in Cancer Biology - Metastasis. (https://doi.org/10.1016/j.adcanc.2022.100043).

Imunologija in celična imunoterapija

V okviru dela, ki je bilo financirano tudi preko ARRS projekta J3-3084, NIB projekta 10ICIGEN in programa P1-0245, smo objavili raziskavo, ki opisuje razvoj inovativne genske platforme za nadgradnjo delovanja, učinkovitosti in varnosti celic CAR-T. Terapevtski učinek smo dokazali v predkliničnih *in vivo* modelih. Delo z naslovom »Expression of inducible factors reprograms CAR-T cells for enhanced function and safety« je bilo objavljeno v prestižni reviji Cancer Cell (IF = 38) (https://doi.org/10.1016/j.ccell.2022.11.006).

Raziskava v sodelovanju z Institutom Necker Enfants Malades v Parizu je bila objavljena v European Journal of Immunology (https://doi.org/10.1002/eji.202249845) in razkriva molekularne mehanizme, preko katerih regulatorne celice T uravnavajo imunske odzive in so ključni pri načrtovanju imunoterapij za avtoimunske bolezni. V okviru dela, ki je bilo financirano tudi preko ARRS projekta J3-3084, NIB projekta 10ICIGEN in programa P1-0245, smo v reviji Frontiers in Immunology objavili uvodnik, ki povzema članke znotraj raziskovalne tematike »The role of immune cells in the progression of autoimmune diseases affecting the CNS« (https://doi.org/10.3389/fimmu.2022.1078396), ki obravnavajo vlogo različnih imunskih celic pri različnih avtoimunskih obolenjih, ki prizadenejo centralni živčni sistem in lahko vplivajo na uspešnost terapevtskih pristopov.

Nove alternative za poskuse na živalih

V okviru ARRS projekta J1-2465, kjer razvijamo nove alternativne in vitro sisteme, ki bi v prihodnosti lahko nadomestili ali zmanjšali število poskusov na laboratorijskih živalih, smo uspešno razvili tridimenzionalni in vitro celični sistem, podoben biosenzorju, za preučevanje in preizkušanje genotoksičnega delovanja spojin na osnovi multiparametričnega simultanega zaznavanja specifičnih končnih učinkov, vključno z analizo celičnega cikla, celične proliferacije (marker Ki67) in DNK dvoverižnih prelomov (gH2AX) s pomočjo pretočne citometrije, kar smo objavili v A'' članku v reviji Chemosphere (https://doi.org/10.1016/j.chemosphere.2021.132805).

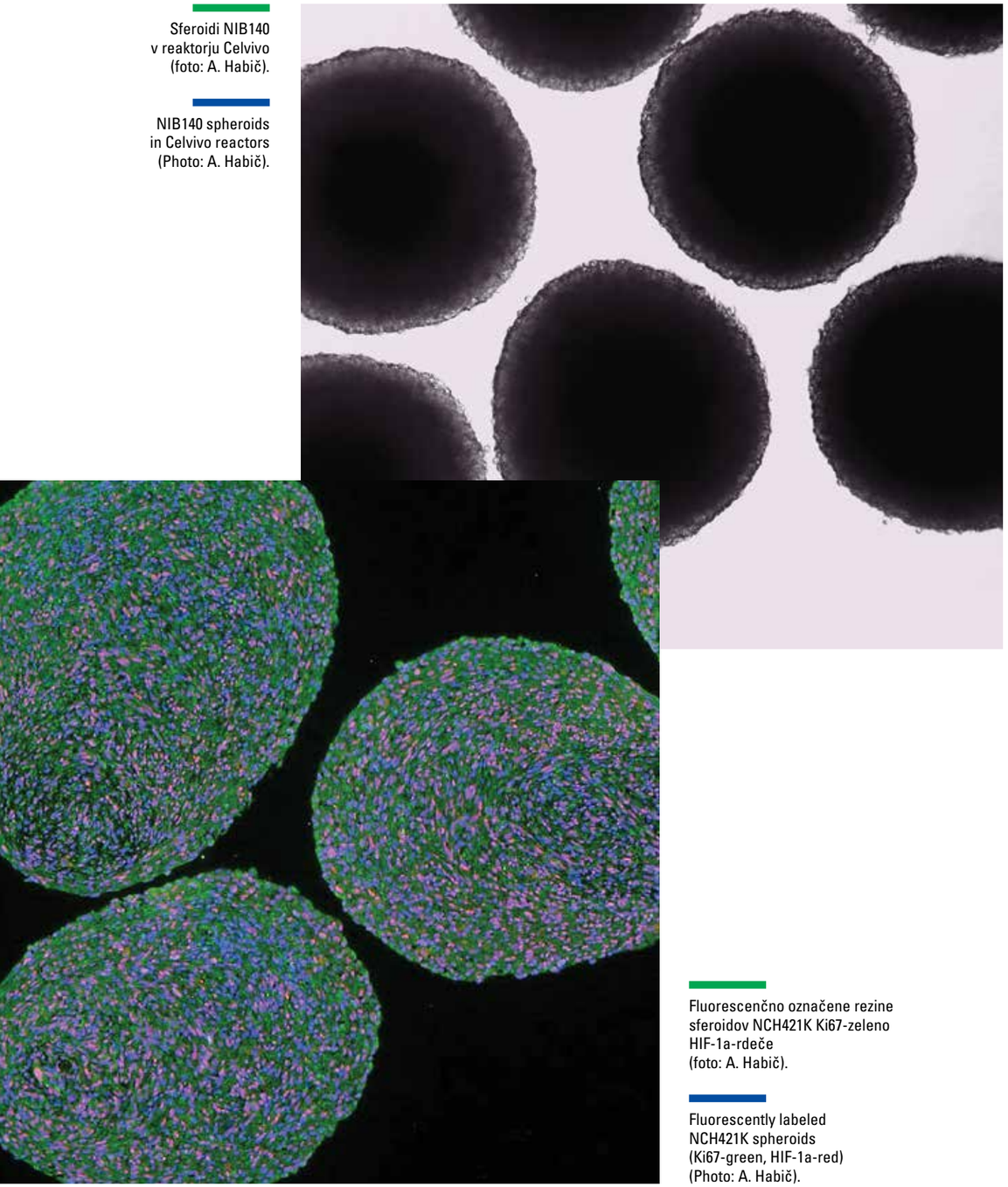
Immunology and Cellular Immunotherapy

As part of work also financed through the ARRS project J3-3084, the NIB project 10ICIGEN and the P1-0245 programme, we have published research describing the development of an innovative genetic platform to upgrade the performance, efficiency, and safety of CAR-T cells. The therapeutic effect has been demonstrated in pre-clinical and *in vivo* models. The paper entitled "Expression of inducible factors reprograms CAR-T cells for enhanced function and safety" was published in the prestigious Cancer Cell journal (IF = 38) (https://doi.org/10.1016/j.ccell.2022.11.006).

A research in collaboration with the Institute Necker Enfants Malades in Paris was published in the European Journal of Immunology (https://doi.org/10.1002/eji.202249845) and reveals the molecular mechanisms by which regulatory T cells regulate immune responses; these are the key to designing immunotherapies for autoimmune diseases. As part of the work also financed through the ARRS project J3-3084, the NIB project 10ICIGEN and the P1-0245 programme, we have published an editorial in the journal Frontiers in Immunology summarising the articles within the research theme "The role of immune cells in the progression of autoimmune diseases affecting the CNS" (https://doi.org/10.3389/fimmu.2022.1078396); they discuss the role of different immune cells in various autoimmune diseases affecting the central nervous system, which can impact the success of therapeutic approaches.

New Alternatives for Animal Testing

As part of the ARRS project J1-2465 where we develop new alternative in vitro systems that could replace or reduce the number of experiments on laboratory animals in the future, we have successfully developed a three-dimensional in vitro cellular system similar to a



Sferoidi NIB140 v reaktorju Celvivo (foto: A. Habič).

NIB140 spheroids in Celvivo reactors (Photo: A. Habič).

Fluorescenčno označene rezine sferoidov NCH421K Ki67-zeleno HIF-1a-rdeče (foto: A. Habič).

Fluorescently labeled NCH421K spheroids (Ki67-green, HIF-1a-red) (Photo: A. Habič).

GLAVNI PROJEKTI V LETU 2022

Leta 2022 smo kot vodilni partner pridobili tri projekte ARRS. Glavni namen ARRS projekta (J2-4428) »Zelene rešitve za trajnostno večnamensko upravljanje voda« je z znanstvenimi podatki, analizami in razvojem novih molekularnih in digitalnih orodij prispevati k izboljšanju upravljanja z vodami v smeri večje odpornosti jezer in zadrževalnikov. Sinergistično multidisciplinarno sodelovanje partnerjev bo zapolnilo vrzel med akademskimi krogi, podjetji in vladnimi organi ter izboljšalo usklajenost med teoretičnim znanjem o delovanju evtrofnih ekosistemov in zagotavljanjem konkretnih smernic za njihovo ohranjanje ter upravljanje.

ARRS projekt (J1-4395) »Razvoj novih večfunkcionalnih nanocimov na osnovi kovinskih oksidov in njihova toksikološka karakterizacija (NaNoZymSafe)« se bo osredotočal na proučevanje varnosti nanodelcev z encimskimi lastnostmi, ki se lahko uporabljajo v biomedicini, okoljskih tehnologijah, prehrambni industriji itd. Raziskali bomo morebitno genotoksično, pro- in antioksidativno delovanje nanocimov ter njihov morebiten škodljiv vpliv na organizme (alge, ribe cebrice). Projekt se vsebinsko dopolnjuje z mednarodnim projektom EU H2020- MSCA--RISE-2020 z naslovom Nanomaterials for Enzymatic Control of Oxidative Stress Toxicity and Free Radical Generation (NESTOR), pri katerem sodelujemo v konzorciju s partnerji iz Španije (koordinator), Italije in Argentine.

Glavni namen ARRS projekta (J3-4504) »Z vizualizacijo mikrookolja glioblastoma do boljše terapije« je razumevanje izredno heterogenega in imuno sovražnega mikrookolja glioblastoma ter njegove podporne vloge tumorju. Poleg tega smo v letu 2022 pridobili ARRS CEA projekt (NC-0023) »Inovativne sonde in inhibicija metaloproteaz za ciljanje glioblastomskih matičnih celic v tumorskem mikrookolju«. Projekt omogoča preučevanje vloge različnih proteaz pri invaziji možganskega tumorja glioblastoma, kjer bi učinkovito ciljali invazivne in na terapijo odporne rakave matične celice.

Poleg naštetih ARRS projektov, kjer delujemo v vlogi vodje, smo v letu 2022 pridobili še tri projekte, kjer sodelujemo kot partnerji, in sicer veliki ARRS projekt (J7-4635) »MitoCan – Predklinični razvoj novih zaviralcev mitohondrijskih ionskih kanalov za zdravljenje raka«,

MAIN PROJECTS IN 2022

In 2022, we were awarded three ARRS projects as lead partner. The main purpose of the ARRS project (J2-4428) "Green solutions for sustainable multi-purpose water management" is to contribute to improving water management towards more resilient lakes and reservoirs with scientific data, analysis, and the development of new molecular and digital tools. Synergistic multidisciplinary collaboration between partners will bridge the gap between academia, business and government bodies, and improve the coordination between theoretical knowledge on the functioning of eutrophic ecosystems and the provision of concrete guidance for their conservation and management.

The ARRS project (J1-4395) "Development of new multifunctional metal oxide-based nanozymes and their toxicological characterisation (NaNoZymSafe)" will focus on the study of the safety of nanoparticles with enzymatic properties, which can be used in biomedicine, environmental technologies, food industry, etc. We will investigate the potential genotoxic, pro- and antioxidant activity of the nanozymes, as well as the potential adverse effects on organisms (algae, zebrafish). The contents of the project are complementary to the EU H2020- MSCA-RISE-2020 international project Nanomaterials for Enzymatic Control of Oxidative Stress Toxicity and Free Radical Generation (NESTOR), in which we participate in a consortium with partners from Spain (coordinator), Italy and Argentina.

The main aim of the ARRS project (J3-4504) "Visualisation of the glioblastoma microenvironment for a better therapy" is to understand the highly heterogeneous and immune-hostile glioblastoma microenvironment and its supportive role for the tumour. In 2022, we have been also awarded the ARRS CEA project (NC-0023)

kjer je vodilni partner Fakulteta za farmacijo, UL, ARRS projekt (J1-4402) »Dinamični model molekulskega stroja DNA topoizomeraze tipa II in razvoj katalitičnih inhibitorjev«, kjer je vodilni partner Kemijski inštitut, ter ARRS projekt (J3-4516) »Vloga neoantigenov pri nedrobnoceličnem raku pljuč«, kjer je vodilni partner Univerzitetna klinika Golnik.

V letu 2022 smo nadaljevali z delom na ARRS projektu (J1-2465), kjer razvijamo alternativne in vitro celične modele z izboljšanimi lastnostmi v primerjavi s tradicionalnimi dvodimenzionalnimi (2D) celičnimi modeli, ter ARRS projektu (J1-2471), kjer proučujemo antigenotoksično in antioksidativno delovanje naravnih rastlinskih izvlečkov, kot sta rožmarinska kislina in ksantohumol. V sklopu ARRS projekta (J1-3019) želimo povečati razumevanje mehanizma tvorbe senescentnih celic in z zunanjimi intervencijami z molekulami poskušati modulirati število senescentnih celic v telesu. Nadaljujemo z raziskavami aplikativnega projekta (L3-3177), kjer proučujemo varnost kanabinoidov in pomen le-teh za javno zdravje in vedenje potrošnikov.

V letu 2022 smo nadaljevali z delom na ARRS projektu (J4-2550), ki ga vodi OE FITO, pomembnem za identifikacijo genskih determinant kemične toksičnosti pri zeleni algi *Chlamydomonas reinhardtii*, s čimer smo doprinesli novo znanje o molekularnih mehanizmih delovanja. Dolgoročni rezultat bo pospešitev razvoja novih načinov testiranja varnosti kemikalij in s tem zagotovitev varnejšega okolja.

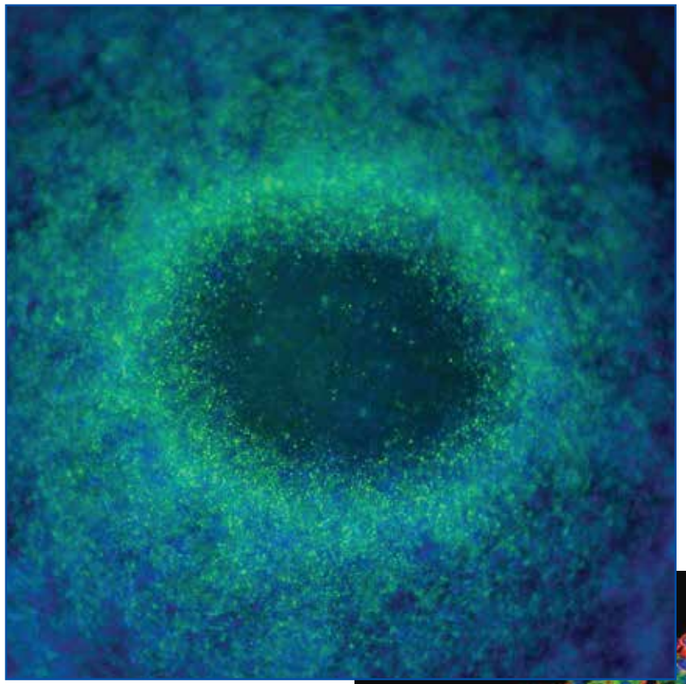
V sklopu ARRS projekta (J3-2526) smo preučevali niše glioblastomskih matičnih celic kot potencialne tarče za zdravljenje glioblastoma. Nadaljnje raziskave proteaznega zaviralca cistatin F, ki znižuje citotoksičnost efektorskih celic, kot so NK celice in citotoksični limfociti T v tumorskem mikrookolju, smo dopolnili v okviru ARRS projekta J3-2516. Prav tako v aplikativnem projektu (L3-3176) nadaljujemo z raziskavami, kjer proučujemo možnost uporabe mezenhimskih matičnih celic za zdravljenje bolezni covid-19.

"Innovative probes and inhibition of metalloproteases for targeting glioblastoma stem cells in the tumour microenvironment". The project enables the study of the role of different proteases in glioblastoma brain tumour invasion, where we would effectively target invasive and therapy-resistant cancer stem cells.

In addition to the above ARRS projects where we act as the lead partner, we have been awarded three more projects in 2022 in which we participate as partners, namely the large ARRS project (J7-4635) "MitoCan - Preclinical development of novel mitochondrial ion channel inhibitors for the treatment of cancer", where the Faculty of Pharmacy is the lead partner, UL, the ARRS project (J1-4402) "Dynamic model of DNA topoisomerase type II molecular machine and development of catalytic inhibitors", where the lead partner is the Institute of Chemistry, and the ARRS project (J3-4516) "Role of neoantigens in non-small-cell lung cancer", where the lead partner is the Golnik University Clinic.

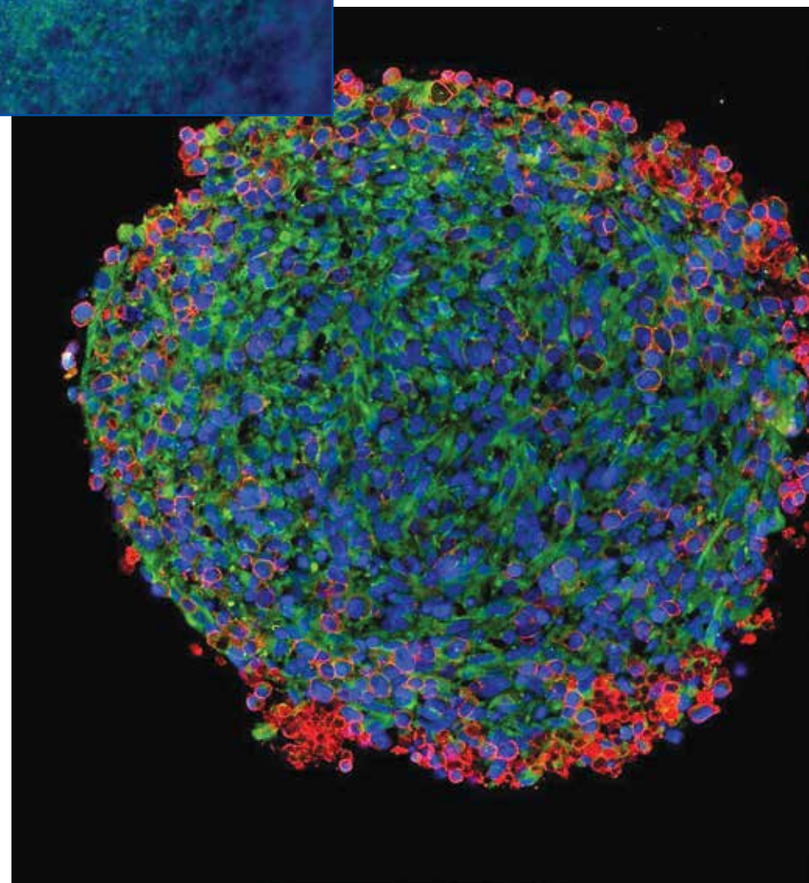
In 2022, we continued our work on the ARRS project (J1-2465), where we are developing alternative in vitro cell models with improved properties compared to traditional two-dimensional (2D) cell models, and on the ARRS project (J1-2471), where we are studying the antigenotoxic and antioxidant activity of natural plant extracts such as rosmarinic acid and xanthohumol. In the context of the ARRS project (J1-3019), we aim to increase our understanding of the mechanism of senescent cell formation and to attempt to modulate the number of senescent cells in the body by external molecular interventions. We are continuing our research on an applied project (L3-3177) which studies the safety of cannabinoids and their relevance to public health and consumer behaviour.

In 2022, we continued our work on the ARRS project (J4-2550), led by the OE FITO, relevant for the identification of genetic determinants of chemical toxicity in the green alga *Chlamydomonas reinhardtii*; this contributed new knowledge on molecular mechanisms of action. The long-term result will be an acceleration of the development of new testing methods for the safety of chemicals which will ensure a safer environment.



Infiltracija PBMC
v organoid GBM (PBMC-modro
apoptotične celice-zeleno)
(foto: A. Habič).

PBMC infiltration into the GB
organoid (PBMC- blue, apoptotic
cells-green)
(Photo: A. Habič).



Infiltracija NK92
v sferoid NIB140
(foto: A. Habič).

Infiltration NK92
in spheroid NIB140
(Photo: A. Habič).

Terensko delo,
Krizevci pri Ljutomeru
(foto: M. Zupančič).

Fieldwork Križevci
near Ljutomer
(Photo: M. Zupančič).

Vzorcenje alg
in cianobakterij
(foto: M. Zupančič)

Algae and
cyanobacteria sampling
(Photo: M. Zupančič).

V letu 2022 smo nadaljevali z ARRS projektom (J3-3084), kjer se osredotočamo na razvoj celic CAR-T, genetsko opremljenih za izboljšano delitev, obstojnost in protitumorsko delovanje, medtem ko v aplikativnem projektu (L4-3181) razvijamo napredne pristope za pripravo genskih konstruktov za razvoj celičnih terapij. V letu 2022 smo uspešno zaključili projekt »Znanstvena širitev NIB in nove raziskovalne smeri (NIB, 10ICIGEN)«.

Poleg nacionalnih projektov smo v letu 2022 pridobili tri evropske projekte v shemi Obzorje Evropa. V evropskem projektu Obzorje Evropa »Partnership for the Assessment of Risks from Chemicals (PARC; 101057014)«, ki se je začel maja 2022, sodeluje več kot 200 partnerjev iz Evrope. V okviru projekta PARC proučujemo mutageno delovanje mikotoksinov, ki jih proizvajajo plesni iz rodu *Alternaria*. Poleg tega razvijamo nove pristope za ugotavljanje negenotoksičnih karcinogenov. Razvijamo tudi nove in vitro 3D celične modele iz jetrnih rib cebric (*Danio rerio*), medtem ko na modelu embrijev rib cebric proučujemo škodljivo delovanje bisfenola A in številnih njegovih analogov. Decembra 2022 se je v shemi Obzorje Evropa začel projekt »Evidence driven indoor air quality improvement (EDIAQI; 101057497)«, kjer sodeluje 17 partnerjev in kjer bomo v naslednjih štirih letih obravnavali in proučevali nove grožnje onesnaženosti zraka v zaprtih prostorih. Vloga oddelka bo toksikološka karakterizacija zraka notranjih prostorov.

V letu 2022 smo kot koordinatorji pridobili projekt Horizon-Widera Twinning »Twinning for excellence to strategically advance research in carcinogenesis and cancer (CutCancer; 101079113)«, ki se je uradno začel januarja 2023. Glavni namen projekta je okrepiti in povečati raziskovalno in inovacijsko zmogljivost ter odličnost Nacionalnega inštituta za biologijo s sodelovanjem in usmerjenimi aktivnostmi s tremi mednarodno priznanimi institucijami, in sicer Univerza Swansea v Veliki Britaniji, Univerza Stockholm na Švedskem in VU Medical Center Amsterdam na Nizozemskem. Projekt CutCancer bo omogočil napredne raziskave karcinogeneze in odpornosti raka na zdravljenje z uporabo 3D celičnih modelov in vitro, visoko zmogljivih pristopov za vrednotenje genomske nestabilnosti, prostorske analize in analize na nivoju posameznih celic.

As part of the ARRS project (J3-2526), we have been studying glioblastoma stem cell niches as potential targets for the treatment of glioblastoma. Further research on the protease inhibitor cystatin F, which reduces the cytotoxicity of effector cells such as NK cells and cytotoxic T lymphocytes in the tumour microenvironment, has been completed in the context of the ARRS project J3-2516. We are also continuing our research in the applied project (L3-3176), where we are studying the possibility of using mesenchymal stem cells to treat the covid-19 disease.

In 2022, we continued the ARRS project (J3-3084) focusing on the development of CAR-T cells genetically equipped for improved division, persistence, and anti-tumour activity; in the applied project (L4-3181) we are developing advanced approaches for preparing genetic constructs for the development of cell therapies. In 2022, we successfully completed the project "NIB Scientific Expansion and New Research Directions (NIB, 10ICIGEN)".

In addition to national projects, we have been awarded three European projects under the Horizon Europe scheme in 2022. Over 200 partners from Europe participate in the European project Horizon Europe "Partnership for the Assessment of Risks from Chemicals (PARC; 101057014)" which started in May 2022. In the PARC project, we study the mutagenic action of mycotoxins produced by *Alternaria* moulds. In addition, we are developing new approaches to identify non-genotoxic carcinogens. We are also developing new in vitro 3D cell models from the liver of zebrafish (*Danio rerio*) and are studying the harmful effects of bisphenol A and its numerous analogues in zebrafish embryos. In December 2022, the project "Evidence driven indoor air quality improvement (EDIAQI; 101057497)" was initiated within the Horizon Europe scheme; it has 17 participating partners, and in the next four years we will be discussing and studying new threats of indoor air pollution. The role of our department will be the toxicological characterisation of indoor air.

In 2022, we were awarded the Horizon-Widera Twinning project "Twinning for excellence to strategically advance research in carcinogenesis in cancer (CutCancer; 101079113)" which officially started in January 2023. The main objective of the project is to strengthen and enhance the research and innovation capacity and excellence of the National Institute of Biology through collaborative and focused activities with three internationally renowned institutions, namely Swansea University in the UK, Stockholm University in Sweden, and the VU Medical Center Amsterdam in the Netherlands. The CutCancer project will allow advanced research on carcinogenesis and cancer treatment resistance using in vitro 3D cell models, high-performance approaches to assess genomic instability, spatial analysis, and single-cell analysis.

Cianobakterije
rodu *Microcystis*
pod mikroskopom
(foto: T.. Eleršek)

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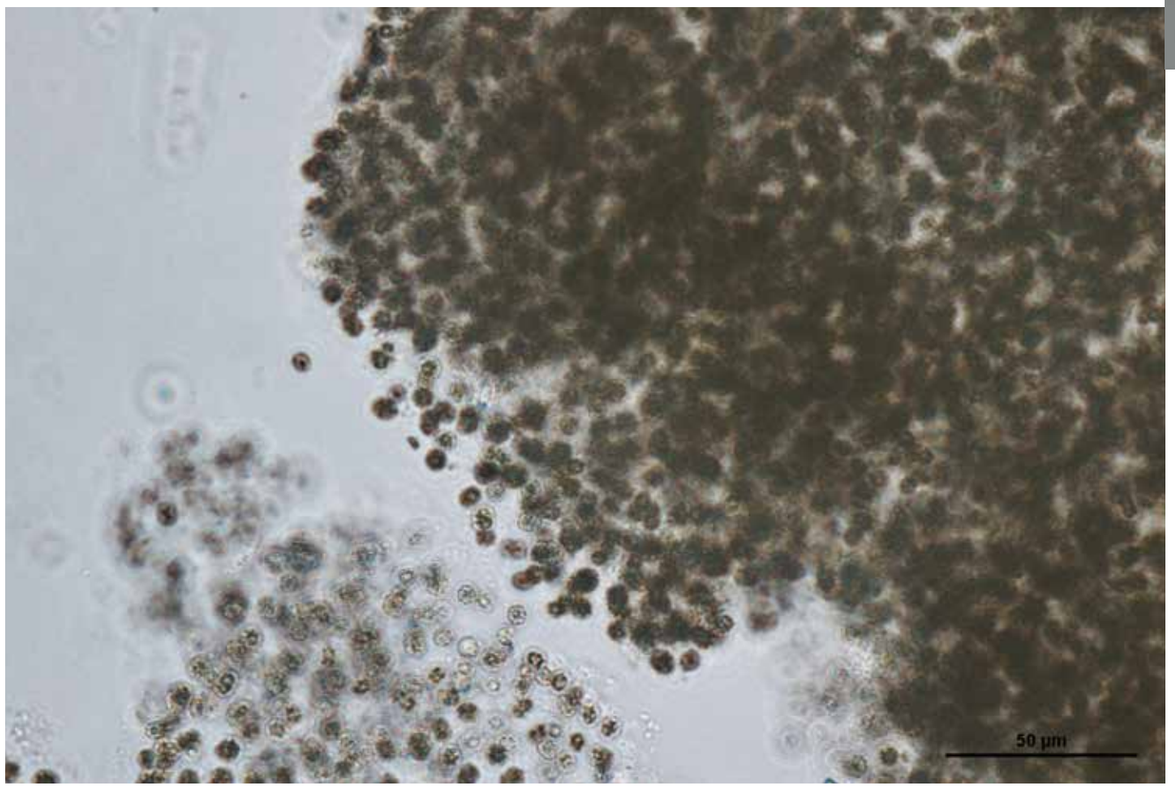

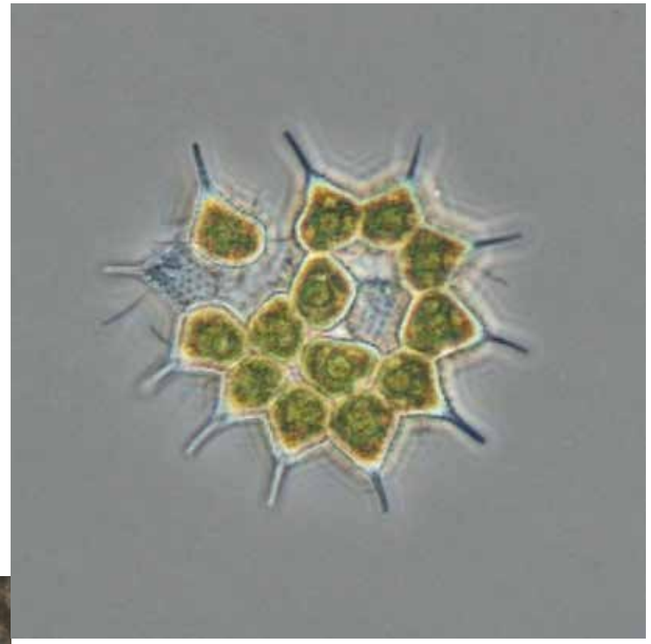

Alga *Pediastrum simplex*
pod mikroskopom
(foto: M. Zupančič)

Algae *Pediastrum simplex*
under the microscope
(Phoyto: M. Zupančič).

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4	Pregledni znanstveni članek Review Article
1	Kratki znanstveni prispevek Short Scientific Article
3	Strokovni članek Professional Article
5	Poljudni članek Popular Article
1	Objavljeni znanstveni prispevek na konferenci (vabljeno predavanje) Published Scientific Conference Contribution (Invited Lecture)
1	Objavljeni strokovni prispevek na konferenci (vabljeno predavanje) Published Professional Conference Contribution (Invited Lecture)
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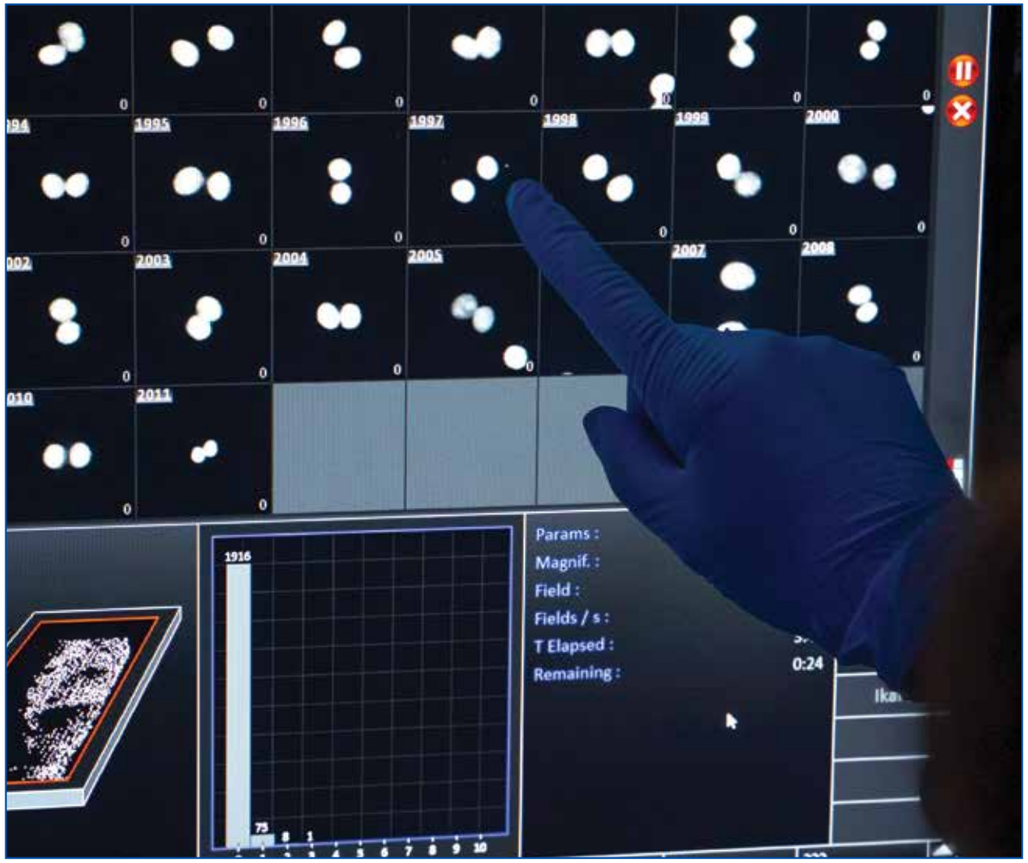
9	Objavljeni povzetek znanstvenega prispevka na konferenci (vabljeno predavanje) Published Scientific Conference Contribution Abstract (invited lecture)
28	Objavljeni povzetek znanstvenega prispevka na konferenci Published Scientific Conference Contribution Abstract
4	Polemika, diskusijski prispevek, komentar Polemic, Discussion, Commentary
1	Intervju Interview
1	Doktorska disertacija Doctoral Dissertation
1	Magistrsko delo Master's Thesis
2	Končno poročilo o rezultatih raziskav Final Research Report
9	Radijska ali televizijska oddaja Radio or Television Broadcast
1	Radijski ali TV dogodek Radio or Television Event
4	Prispevek na konferenci brez natisa Unpublished Conference Contribution
1	Vabljeno predavanje na konferenci brez natisa Unpublished Invited Conference Lecture
14	Uredništvo Editorship

Avtomatizirana analiza mikronukleusov

Automated analysis of micronuclei a marker for damage to chromosomes



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Department of Organisms and Ecosystems Research

NEOKRNJENI NARAVNI EKOSISTEMI SO NAŠE BOGASTVO

PRISTINE NATURAL ECOSYSTEMS ARE OUR ASSET

V okviru pilotnega monitoringa čebel v Sloveniji smo našli 239 vrst divjih čebel, med njimi tudi temnokrilega zemeljskega čmrlja *Bombus argillaceus*. (foto: B. Koderman)

During the pilot monitoring of bees in Slovenia, we found 239 species of wild bees, including the clay bumblebee *Bombus argillaceus*. (Photo: B. Koderman)

Hrošč puščavnik (*Osmoderma eremita*). (foto: D. Tome).

The Hermit Beetle (*Osmoderma eremita*). (Photo: D. Tome).

VODJA: IZR. PROF. DR. **META VIRANT-DOBERLET**

HEAD: ASSOC. PROF. DR. **META VIRANT-DOBERLET**

Izr. prof. dr. Meta Virant-Doberlet, znanstvena svetnica, je vodja Oddelka za raziskave organizmov in ekosistemov, ki je bil ustanovljen leta 2016. Je ena od vodilnih svetovnih avtoritet na področju vibracijske komunikacije nevretenčarjev. Njeno raziskovalno delo je usmerjeno na procese, ki so ključnega pomena ne le za evolucijo vibracijske komunikacije, temveč tudi za razumevanje splošnih osnovnih procesov sporazumevanja. Ima tudi pomembno vlogo pri razvoju in uporabi vibracijskih signalov kot novega, okolju prijaznega pristopa za nadzor žuželčjih škodljivcev. Kot priznanje za njene prelomne raziskave je prejela mednarodno nagrado »Insect Drummer Lifetime Achievement Award« ter nagrado Miroslava Zeia za izjemne znanstvene dosežke na področju dejavnosti NIB.

Assoc. Prof. Dr Meta Virant-Doberlet, scientific councillor, is the Head of the Department of Organisms and Ecosystems Research, which has been established in 2016. She is a leading authority on arthropod vibrational communication and her research is focused on processes shaping not only the evolution of vibrational communication, but are also central to understanding the communication in general. She also played an important role in developing the exploitation of vibrational signals as a new, alternative, environmentally-friendly approach for managing insect pests. In recognition of her ground-breaking studies she has been awarded international 'Insect Drummer Lifetime Achievement Award' and the Miroslav Zei award for Exceptional Scientific Achievements within the fields of Research at NIB.

KLJUČNE DEJAVNOSTI ODDELKA

Na Oddelku za raziskave organizmov in ekosistemov s temeljnimi in aplikativnimi raziskavami ustvarjamo vrhunsko znanje, potrebno za celostno razumevanje organizmov in njihove vloge v okolju – od nevronalnih mehanizmov zaznavanja okolja in komunikacije med celicami do evolucijskih procesov, ki so osnova biodiverzitete in interakcij v ekosistemih. Naše interdisciplinarno znanje in izkušnje uporabljamo za predloge učinkovitejših in bolj trajnostnih posegov v okolje.

Specifična področja raziskav so naslednja:

- biodiverziteta kopenskih in ekosistemov celinskih voda, vključno s podzemnimi ekosistemi;
- filogenija, taksonomija in biogeografija izbranih skupin pajkov, rakov in vretenčarjev;
- evolucija ekstremnih fenotipov;
- primerjalna genomika in izražanje svilnih genov pri pajkih;
- vibracijska komunikacija, v sklopu katere analiziramo naravno vibracijsko krajino, proučujemo komunikacijska omrežja, raziskujemo mehanizme produkcije vibracijskih signalov, analiziramo vedenjske odzive ter izvajamo nevrobiološke in ekofiziološke študije;
- vpliv podnebnih sprememb na biodiverziteto;
- prilagojenost izbranih vrst na spremembe dejavnikov v okolju na osnovi ekofizioloških študij;
- odnosi med tuje- in domorodnimi vrstami s podobnimi ekološkimi nišami;
- medvrstne interakcije in kompleksni odnosi med trofičnimi nivoji;
- medvrstne interakcije med ozko sorodnimi vrstami in posledice kompeticijskega izključevanja;
- plenilstvo in vloga končnih plenilcev v ekosistemih;
- populacijska kodinamika vrst v ekosistemu;
- raziskave ekoloških procesov v vodonosnikih;
- biofilmi celinskih voda ter njihov odziv na podnebne spremembe in nova onesnažila (npr. mikroplastika);
- pestrost, ekologija, monitoring in varovanje opraševalcev ter uporaba opraševalcev v kmetijstvu;
- biologija in ekologija hroščev s seznama vrst evropskega varstvenega pomena;
- interakcije človeka z okoljem v travniškem in mestnem okolju;
- razvoj alternativnih pristopov za nadzor žuželčjih škodljivcev;
- razvoj naprednih metod monitoringa naslednje generacije, vključno z okoljsko DNA;
- varstvena genomika dvoživk, plazilcev in rib;
- ohranjanje ogroženih vrst in njihovih življenjskih okolij (na regionalnem in globalnem nivoju), z ocenami njihove ogroženosti, predlogi za izboljšanje stanja ter izobraževanje in osveščanje javnosti o biodiverziteti.

KEY ACTIVITIES OF THE DEPARTMENT:

Through basic and applied research, the Department of Organisms and Ecosystems Research creates top-level knowledge necessary for comprehensive understanding of organisms and their role in the environment – from neural mechanisms underlying perception of the environment and intercellular communication to evolutionary processes creating biological diversity and interactions in ecosystems. We use our interdisciplinary know-how to propose more effective and more sustainable nature conservation approaches.

Our specific areas of research include:

- biodiversity of terrestrial and freshwater ecosystems, including underground ecosystems;
- phylogeny, taxonomy and biogeography of selected groups of spiders, crustaceans and vertebrates;
- evolution of extreme phenotypes;
- comparative genomics and expression of silk genes in spiders;
- vibrational communication, where we analyse the natural vibroscape, study communication networks, explore the generation mechanisms of vibration signals, analyse behavioural responses and perform neurobiological and eco-physiological studies;
- impacts of climate change on biodiversity;
- adaptation of selected species to changes in environmental factors based on eco-physiological studies;
- relationships between non-native and indigenous species with similar ecological niches;
- interspecific interactions and complex relationships between trophic levels;
- interspecific interactions between closely related species and effects if competitive exclusion;
- predation and the role of top predators in ecosystems;
- population co-dynamics of species in ecosystems;
- ecological processes in aquifers
- impact of climate change and newly emerging pollutants (i.e. microplastics) on freshwater biofilms;
- diversity, ecology, monitoring and protection of pollinators and their use in agriculture;
- biology and ecology of beetles from the Natura 2000 European list of species of European conservation importance;
- human interaction with the environment in grassland and urban environments;
- development of alternative approaches for the control of insect pests
- development of next-generation monitoring approaches including environmental DNA;
- conservation genomics of amphibians, reptiles and fish;
- protection of endangered species and their habitats (nationally and globally) and assessment of their conservation status, proposals of the status improvement, as well as education about the importance of biodiversity.

Rečna prodišča so vrhnji sloj obsežnih medzrnskih vodonosnikov, ki lahko segajo več 100 metrov v globino ter se raztezajo po celotnih rečnih dolinah in kotlinah. Ta, na videz negostoljubni habitat, gosti dragoceno podzemno biodiverziteto, očem nevidno, a izredno pestro in evolucijsko zagonetno.
(foto: D. Tome)

Gravel-beds are the top layer of extensive alluvial aquifers, which can reach more than 100 meters in depth and extend across entire river valleys. This seemingly inhospitable habitat hosts a valuable grounwater biodiversity, invisible, but extremely rich and evolutionarily enigmatic.
(Photo: D. Tome)

Pozidne kuščarice so najpogostejša slovenska vrsta plazilcev, katero srečamo tudi na naših dvoriščih. Ko se dva samca tako pomerita v močeh, pravimo temu da tekmujeta in to je eden izmed najpomembnejših odnosov med organizmi v naravi. (foto: D. Tome)

Common wall lizards are the most common species of reptiles in Slovenia and regular occupants of also our backyards. When two lizards combat like this, they compete and competition is one of the most important interactions between organisms in nature. (Photo: D. Tome)

GLAVNI DOSEŽKI V LETU 2022

Za zagotavljanje učinkovitega opraševanja pridelkov je treba določiti tako vrstno sestavo opraševalskih združb kot tudi njihove ekološke zahteve. Potencial, ki ga predstavljajo pestre opraševalske združbe, omejuje naše slabo poznavanje teh združb, kar je povezano tudi z nepoznavanjem vpliva različnih metod monitoringa in podnebnih razlik na večjem geografskem področju. Sodelovali smo pri evropski raziskavi divjih opraševalcev, objavljeni v reviji *Agriculture, Ecosystems and Environment*. Raziskava je potekala v 62 komercialnih sadovnjakih v zahodni in srednji Evropi in v njej je bil uporabljen standardiziran protokol monitoringa. Rezultati so pokazali precejšnje razlike v združbah opraševalcev, določenih z običajnimi metodami, in so pri tem tudi pokazali velik vpliv podnebja. Podatki, ki jih je posredovala raziskava, so pomembni za razumevanje in primerjanje rezultatov monitoringa na evropskem nivoju ter za oblikovanje politik za varstvo opraševalcev.

Multitrofični biodiverzitetni monitoring je osnova dolgoročnih ekoloških študij. V letu 2022 smo v reviji *Ibis* objavili raziskavo o odzivih treh sobivajočih vrst sov na populacijska nihanja v pestri združbi malih sesalcev, v kateri smo uporabili metode strojnega učenja za analizo podatkov. Ugotovili smo večjo občutljivost na nihanja malih sesalcev pri borealnih vrstah sov (koconogi čuk in kozača), ki dosežejo svojo južno mejo razširjenosti v Dinaridih, medtem ko se zdi, da so vrste zmernega pasu (lesna sova) manj prizadete.

V sodelovanju z Oddelkom za biotehnologijo in sistemsko biologijo, ZRC SAZU in Biotehniško fakulteto Univerze v Ljubljani smo v reviji *Molecular Ecology Resources* objavili članek, v katerem smo pokazali, da bi pajčje mreže zaradi svoje raznolikosti in razširjenosti v naravi lahko delovale kot zmogljivi biofiltri in bi zato lahko predstavljale obetaven nov vir okoljske DNK (eDNA). Uporaba eDNA iz pajčjih mrež ponuja številne možnosti uporabe, od spremljanja biotske raznovrstnosti, sledenja invazivnim in škodljivim vrstam, ocenjevanja prehrane živali in pridobivanja podatkov o podnebnih spremembah do študij o razširjenosti in nišah členonožcev, rastlin, gliv in bakterij.

MAJOR ACHIEVEMENTS IN 2022

Safeguarding crop pollination services requires the identification of the pollinator species involved and the provision of their ecological requirements. However, the potential for agro-ecological intensification of pollinator dependent crops by harnessing pollinator diversity is limited by our capacity to characterize the community of pollinator species, and to determine how it is influenced by different survey methods used, as well as by climatic variables at larger geographic scales. We were involved in the study published in *Agriculture, Ecosystems and Environment* in which the researchers surveyed wild bees using a standardized protocol in 62 commercial apple orchards in Western and Central Europe. Results showed significant divergence in pollinator communities determined by common methods as well as a significant influence of climate. The data from this study contribute to a better understanding of the results of different monitoring methods and to designing future policies to address the pressing issues that pollinators are facing.

Multitrophic biodiversity monitoring is a baseline for long-term ecological studies. We published in the journal *Ibis* a study on adaptive population responses of the three coexisting owl species to high amplitude fluctuations of diverse small mammal assemblages in which we used machine learning methods to analyse the data. We found higher sensitivity to small mammal fluctuations in boreal zone owl species (Boreal and Ural Owl), which reach their southern distribution limit in the Dinaric Alps, while temperate zone species (Tawny Owl) seemed to be less affected.

Together with the researchers from the Department of Biotechnology and Systems Biology, ZRC SAZU, and the University of Ljubljana, we have discovered that spider webs can represent powerful biofilters of environmental DNA (eDNA). The use of eDNA from spider webs offers numerous potential applications from biodiversity monitoring, tracking invasive and pest species, animal diet assessment, obtaining climate change data, to studies on the distribution and niches of arthropods, plants, fungi, and bacteria. The results of this study were published in the journal *Molecular Ecology Resources*.

Raziskave, ki opredeljujejo vpliv abiotskih dejavnikov na fiziološke procese v organizmih, so bistvenega pomena za razumevanje odzivov organizmov na različna okolja. V reviji *Comparative Biochemistry and Physiology* smo objavili rezultate raziskave fizioloških vidikov metabolizma pri dveh simpatričnih in ekološko podobnih evropskih vrstah kuščarjev v Sloveniji, pozidni kuščarici (*Podarcis muralis*) in velebitski kuščarici (*Iberolacerta horvathi*), povzorčeni po 830-metrskem višinskem gradientu. Naši rezultati so omogočili nov vpogled v odnose med fiziološkimi, biotskimi in okoljskimi značilnostmi pri simpatričnih kuščaricah, kar bo prispevalo k boljšemu razumevanju njihovih prilagoditev na okoljske razmere nasploh in v kontekstu podnebnih sprememb.

V živalskem svetu različni mehanizmi omogočajo izjemno hitre akcije ali reakcije s shranjevanjem energije v elastičnih strukturah, čemur sledi takojšnja sprostitev, kar spominja na funkcijo katapulta. Številni od teh mehanizmov se uporabljajo za lov plena ali izogibanje plenilcem. V reviji *Current Biology* smo v sodelovanju z raziskovalci iz Kitajske in Singapurja opisali prvi tak mehanizem v živalskem svetu, ki je namenjen za izogibanje spolnemu kanibalizmu.

V članku, objavljenem v reviji *Frontiers in Ecology and Evolution*, smo prvič predstavili koncept ekotremologije kot vede, ki preko vibracij podlage raziskuje ekološke procese in dinamiko ekosistemov. V članku izpostavljamo, da lahko informacijo, ki jo izluščimo iz vibracij podlage, prisotne v okolju, uporabljamo za izčrpno ocenjevanje in napovedovanje sprememb v ekosistemih. Izpostavili smo tudi ključna raziskovalna vprašanja in tehnične izzive ter identificirali možne aplikacije.

Intraspecifična genetska homogenizacija je oblika biotske homogenizacije, pri kateri se vzpostavi reprodukcija med predhodno prostorsko ločenimi populacijami ene vrste in s časom vodi v zmanjšanje variabilnosti genskega sklada. V članku, objavljenem v reviji *Biological Invasions,* avtorji obravnavajo primer genetske homogenizacije pri potočnih postrvih iz planote Vlasine v JV Srbiji, kjer se srečata donavsko in egejsko povodje, ki ju naseljujeta različni evolucijski liniji potočne postrvi. Napredne populacijsko genetske analize so pokazale kompleksno genetsko strukturo in razkrile različne stopnje introgresije donavskih populacij z egejskimi.

Studies which quantify the influence of abiotic factors on physiological variation are paramount to comprehend organismal responses to diverse environments. In the journal *Comparative Biochemistry and Physiology* we published the results of the study on physiological aspects of metabolism in two sympatric and ecologically similar European lizard species in Slovenia, *Podarcis muralis* and *Iberolacerta horvathi*, across an 830-m elevational gradient. Our results provided a novel insight into the relationships between physiological, biotic, and environmental traits in sympatric lizards that will contribute to understanding their adaptations to environmental conditions in general and in the context of climate change.

In the animal world, various mechanisms allow for extremely fast actions or reactions through storage of energy in elastic structures, followed by its instant release, resembling the function of a catapult. Many of these mechanisms are employed for prey capture or for predator avoidance. In the journal *Current Biology,* we described in collaboration with researchers from China and Singapore the first such superfast mechanism in the animal world used to avoid sexual cannibalism.

In the journal *Frontiers in Ecology and Evolution* we introduced the concept of ecotremology as a discipline studying substrate-borne vibrations as an approach to better understand ecological processes and ecosystem dynamics. We argued that information extracted from substrate vibrations present in the environment can be used to comprehensively assess and predict ecosystem changes. We identified and discussed the key research questions, as well as technical challenges associated with ecotremological studies and possible applications.

Intraspecific genetic homogenization is a form of biotic homogenization in which reproductive barriers between previously separate populations are broken down, resulting in a loss of genetic diversity. In the work published in the journal *Biological Invasions*, we described with collaborators a case study of brown trout in the Vlasina Plateau in Southeast Serbia, where two drainages, Danube and Aegean, are adjoining, each hosting its own evolutionary lineage of trout. The results of a state-of-the-art population genetic analysis revealed a complex genetic structure and revealed different stages of introgressive hybridization from the Aegean

Avtorji so ugotovili, da te introgresije niso posledica zgodovinskih geo(hidro)morfoloških sprememb, ampak podpornega vlaganja z lokalnimi, a že predhodno zelo močno introgresiranimi viri.

Pri založbi *Frontiers,* ki je tretja najbolj citirana in šesta največja znanstvena založba, je v letu 2022 pričela izhajati nova revija *Frontiers in Arachnid Science*. Kot področni glavni urednik jo vodi sodelavec Oddelka za raziskave organizmov in ekosistemov, izr. prof. dr. Matjaž Kunter, ki je sestavil uredniški odbor z več kot 100 vrhunskimi strokovnjaki na področju arahnologije. Revija bo objavljala strogo recenzirane, vrhunske raziskave o širokem spektru področij, ki se nanašajo na biologijo pajkovcev ter genetsko, ekološko in funkcionalno diverziteto.

Sodelovali smo pri zasnovi knjige *Biotremology: Physiology, Ecology and Evolution*, ki je izšla pri založbi Springer. Knjiga, pri kateri smo sodelovali kot uredniki ter prispevali pet poglavij, predstavlja pregled najnovejših raziskav in novih konceptov v raziskavah biotremologije, vede, ki proučuje interakcije, ki temeljijo na oddajanju in zaznavanju vibracij podlage.

V letu 2022 smo pričeli z izvajanjem novega projekta Evropskega partnerstva za inovacije (EIP) »Pomoč opraševalcem v intenzivni kmetijski krajini za podporo biodiverziteti« (EIP POMOP). Cilj projekta, ki ga koordinira NIB, je povezati raziskovalce, kmetijsko svetovalno službo in kmete za boljši prenos znanja na področju varovanja opraševalcev v kmetijstvu. Projekt se financira iz Programa razvoja podeželja 2014–2020 (iz Evropskega kmetijskega sklada za razvoj podeželja).

V letu 2022 smo zaključili s petletnim projektom LIFE NATURAVIVA, ki smo ga vodili na Oddelku za raziskave organizmov in ekosistemov. V projektu smo skupaj z devetimi partnerji po celi Sloveniji promovirali pomen biodiverzitete. Predvsem smo iskali inovativne rešitve, kako s temo biodiverzitete pritegniti pozornost ljudi, kar je eden večjih problemov po vseh razvitih državah. Ocenjujemo, da smo s projektom dosegli vsaj polovico Slovencev. Po meritvah, ki smo jih izvedli na začetku in koncu projekta, se poznavanje pojma biodiverziteta med državljani Slovenije povečalo za več kot 10 % – v veliki meri tudi zaradi našega projekta.

populations into the Danubian populations. The study showed that these introgressions were not due to historical geo(hydro)morphological changes but were a direct consequence of human-mediated translocations. These introgressions occurred despite the use of local sources, as those were found to be highly introgressed prior to local translocations within the Vlasina Plateau.

Frontiers, an open science platform, is the 3rd most-cited and 6th largest research publisher In 2022, a new journal was launched titled *Frontiers in Arachnid Science*, which is led by the field chief editor in arachnid science, Dr Matjaž Kuntner, who assembled an editorial board of over 100 leading experts worldwide in the field of arachnology. The journal will publish rigorously peer-reviewed, cutting-edge research on a broad range of topics connected with arachnid biology, as well as their genetic, ecological and functional diversity.

As editors, we collaborated on the development of the book *Biotremology: Studying Vibrational Behavior* published by Springer. The book to which we also contributed five chapters, presents an up-to-date state-of--the-art overview of the research and developing concepts in the field of biotremology, a discipline, which studies interactions guided by substrate-borne vibrations.

In 2022, we started implementing a new European Innovation Partnership (EIP) project “Supporting pollinators in intensive agricultural landscapes to promote biodiversity” (EIP POMOP). The project, coordinated by NIB, aims to bring together researchers, agricultural advisory service and farmers for better knowledge transfer in the field of pollinator conservation in agriculture. The project is funded by the Rural Development Program 2014-2020 (from the European Agricultural Fund for Rural Development).

In 2022, we completed a five-year Life NATURAVIVA project, which was led by the Department of Organisms and Ecosystems Research. The project consortium of nine partners promoted the importance of biodiversity across Slovenia. In particular, we were looking for innovative solutions to bring the topic of biodiversity to people’s attention, which is one of the major problems in all developed countries. We estimate that we have reached at least half of the Slovenian population.

Eden izmed inovativnih načinov promocije biodiverzitete, ki smo ga izvedli v okviru projekta LIFE NATURAVIVA, je bila izdaja premium kvalitetne knjige o biodiverziteti Slovenije z naslovom *Neverjetna*. Knjiga velikosti A4+ ima 248 strani, poudarek v njej je na fotografijah vrst in ekosistemov, ki tako ali drugače obeležujejo našo naravo. Kratka in inspirativna besedila je prispevalo 25 strokovnjakov z različnih področij proučevanja biodiverzitete. Ob koncu smo zbrali tudi mnenja številnih znanih Slovencev, nebiologov, o tem naravnem fenomenu. Knjigo smo izdali v 3000 izvodih, ki so pošli prej kot v enem letu, zato smo jih natisnili še 3000. Knjigo uporabljajo kot poslovno ali državniško darilo tudi najvidnejši gospodarski in politični subjekti, npr. podjetja, občine, ministrstva.

V času od 19. do 22. septembra 2022 smo na Morski biološki postaji v Piranu organizirali tretjo mednarodno konferenco o biotremologiji (3rd Biotremology Conference). Ker je konferenca potekala še v času ukrepov zaradi epidemije covida-19, smo jo izvedli v hibridni obliki, udeležilo pa se je je 55 raziskovalcev iz vsega sveta. Na konferenci predstavljeni prispevki so prikazali najnovejše rezultate raziskav, posvečenih vibracijskim interakcijam na različnih področjih od vedenja in ekologije do uporabe vibracijskih signalov pri nadzoru žuželčjih škodljivcev.

V sklopu projekta ECTO-HIGH, ki je bil financiran iz sredstev v okviru integriranega evropskega dolgoročnega projekta Skupnosti za ekosisteme, kritična območja in socialno-ekološko raziskovalno infrastrukturo (eLTER PLUS), smo organizirali odpravo v avstrijske Alpe, da bi zbrali vzorce tkiv za biokemično analizo metabolizma osmih modelnih vrst, ki predstavljajo šest taksonomskih skupin: kuščarji (Sauria, Reptilia), močeradi (Urodela, Amphibia), kačji pastirji (Odonata), kobilic (Orthoptera), dvoklopniki (Ostracoda) in postranice (Amphipoda). Glavni cilj projekta je razložiti visoko hitrost presnove pri ektotermnih organizmih kot prologuise na razmere v visokogorju.

V sodelovanju z ZRC SAZU smo izvedli biološko odpravo na Madagaskar. Osredotočili smo se na montanski deževni gozd v nacionalnih parkih Marojejy in Andasibe Mantadia. S serijo dnevnih in nočnih terenskih vzorčenj smo zajeli reprezentativen del favne pajkov in kačjih pastirjev. Nabran biološki material, ki je trenutno predmet laboratorijskih analiz, bo pomembno prispeval k poznavanju biodiverzitete in biogeografije ene od vročih točk našega planeta, kjer je deževni gozd izrazito ogrožen ekosistem.

According to the measurements we carried out at the beginning and end of the project, the knowledge of biodiversity among Slovenian citizens increased by more than 10% - in large part thanks to our project.

One of the innovative ways of promoting biodiversity that we have implemented in the framework of the Life NATURAVIVA project was the publication of a premium quality book on biodiversity in Slovenia entitled “Incredible”. The book is A4+ in size, has 248 pages and focuses on photographs of species and ecosystems that in one way or another celebrate our nature. Short and inspiring texts have been contributed by 25 experts from different fields of biodiversity studies. At the end, we have also gathered the opinions of many well-known Slovenes, non-biologists, on this natural phenomenon. The book was published in 3000 copies, which were distributed all in less than half a year, so we printed another 3000 copies afterwards. The book is also used as a business or state gift by the most prominent economic and political entities, e.g. companies, municipalities, ministries.

Between 19. – 22. September, we organized the 3rd International Conference on Biotremology taking place at the Marine Biological Station in Piran. Due to COVID-19 epidemiological concerns it was organized in a hybrid format. The conference was attended by 55 participants and presentations covered the latest research on the role of vibrational interactions in diverse topics, from behaviour and ecology to the use of vibrational signals in pest management.

The main objective of the project ECTO-HIGH, was to investigate the existence of a high-rate metabolic phenotype in ectotherms as an adaptation to altitude. The project was supported by the funds dedicated for Support for Transnational Access (TA) and/or Remote Access (RA) of the Integrated European Long-Term ecosystems, critical zone and socio-ecological Research infrastructure Advanced Community project (eLTER PLUS). eLTER PLUS scheme allowed us to organise a field expedition to the Austrian Alps to collect tissue samples for biochemical analysis of metabolism from eight model species representing six taxonomic groups: Lizards (Sauria, Reptilia), Salamanders (Urodela, Amphibia), Dragonflies (Odonata), Grasshoppers (Orthoptera), Ostracods (Ostracoda), and Amphipods (Amphipoda).

Ministrstvo za okolje in prostor je Nacionalni inštitut za biologijo z Oddelkom za raziskovanje organizmov in ekosistemov prepoznalo za v evropskem merilu pomembno raziskovalno inštitucijo za Naturo 2000 in ji je leta 2022 kot prvemu podelilo nagrado »Slovenski inovativni dosežki znanosti za Naturo 2000«. Nacionalna shema monitoringa hroščev, ki so jo že leta 2006 zasnovali raziskovalci Oddelka za raziskave organizmov in ekosistemov, je postala ključno sidrišče za vse ostale raziskovalne, naravovarstvene in gospodarske projekte na področju ohranjanja ogroženih vrst hroščev in upravljanja območij Natura 2000 v Sloveniji ter drugod po Evropi. Poleg tega smo bili tudi med finalisti za nagrado v kategoriji »Varstvo vrst in habitatnih tipov na območjih Nature 2000 v Sloveniji« s svojim aktivnim varstvom populacije hrošča puščavnika v osrednji Sloveniji. V skupini raziskovalcev, ki so prejeli nagrado, so Al Vrezec, Špela Ambrožič Ergaver, Andrej Kapla, Stiven Kocijančič, Alenka Žunič Kosi, Urška Ratajc in Matjaž Bedjanič.

Uporaba avtomatskih orodij za spremljanje živalskih populacij in ekoloških spremenljivk se povečuje, saj samodejno zbiranje podatkov zmanjša neposredne stroške opazovanja na terenu, omogoča časovno neprekinjeno opazovanje med vzorčenjem, zmanjša pristranskost opazovalcev in izboljša skladnost podatkov. Izziv obstoječih avtomatskih foto pasti je, da ujete živali ne preživijo, zato te pasti niso primerne za vzorčenje in spremljanje biodiverzitete žuželk. Še posebej se njihova uporaba odsvetuje pri vzorčenju redkih in ogroženih vrst, zato smo razvili foto past, ki omogoča avtomatsko ujetje žuželke, detekcijo in izpust z minimalnim tveganjem za ulovljene osebke. Za razvito past smo oddali tudi patentno prijavo.

In collaboration with ZRC SAZU we carried out a biological expedition to Madagascar. Field work was focused on the on montane rainforest in the Marojejy and Andasibe Mantadia National Parks. Here, we collected in a series of day- and night-time samplings a representative part of the fauna of spiders and dragonflies. The collected biological material that is currently being investigated in the laboratories will contribute significantly to the knowledge of the biodiversity and biogeography of one of the hotspots of our planet, where the rainforest is a highly threatened ecosystem.

The Ministry of the Environment and Spatial Planning recognized the National Institute of Biology with the Department of Organisms and Ecosystems Research as an important research institution for Natura 2000 on a European scale and in 2022 awarded it the “Slovenian innovative scientific achievements for Natura 2000” award. Researchers of the Department of organisms and Ecosystems research implemented a scheme for monitoring of beetles of European conservation concern in 2006 and now this scheme has become a key anchor for all other research in the field of conservation of endangered species of beetles and management of Natura 2000 areas in Slovenia and elsewhere in Europe. In addition, NIB-EKOS was also among the finalists for the award in the category “Protection of species and habitat types in the Natura 2000 areas in Slovenia” with active protection of the Hermit Beetle population in central Slovenia. The award went to a group of the following researchers: Al Vrezec, Špela Ambrožič Ergaver, Andrej Kapla, Stiven Kocijančič, Alenka Žunič Kosi, Urška Ratajc and Matjaž Bedjanič.

The use of automated tools to monitor animal populations and ecological variables is increasing because automated data collection reduces the direct costs of field observation, allows for continuous observation, reduces observer bias, and improves data consistency. The challenge with existing automatic phototraps is that the captured animals do not survive, which makes them less suitable for sampling and monitoring insect biodiversity, especially for monitoring rare and endangered species. To address this problem, we have developed a phototrap for which we also applied for a patent. This trap enables the automatic capture, detection, and release of insects with minimal risk to the captured animals.

Prva in druga izdaja knjige o biodiverziteti Slovenije z naslovom “Neverjetna”, ki je nastala v sklopu projekta LIFE NATURAVIVA.
(foto D. Tome)

The first and second edition of the book ‘Incredible’ dedicated to biodiversity in Slovenia. The book was published the framework of the project LIFE NATURAVIVA.
(Photo: D. Tome)

Podelitev nagrade »Slovenski inovativni dosežki znanosti za Naturo 2000« ter priznanja za uvrstitev med finaliste v kategoriji »Varstvo vrst in habitatnih tipov na območjih Nature 2000 v Sloveniji«.
(foto: J. Polajnar).

Ministry of the Environment and Spatial Planning (now Ministry of Natural Resources and Spatial Planning) awarded the National Institute of Biology with the Department of the »Slovenian innovative scientific achievements for Natura 2000« award for a development a scheme for monitoring of beetles of European conservation concern, as well as a certificate for a finalist in the category “Protection of species and habitat types in the Natura 2000 areas in Slovenia” for active protection of the Hermit Beetle population in central Slovenia.
(Photo: J. Polajnar)

BIBLIOGRAFIJA
BIBLIOGRAPHY

34	Izvirni znanstveni članek Original Scientific Article
2	Pregledni znanstveni članek Review Article
3	Kratki znanstveni prispevek Short Scientific Article
12	Strokovni članek Professional Article
7	Poljudni članek Popular Article
1	Objavljeni znanstveni prispevek na konferenci (vabljeno predavanje) Published Scientific Conference Contribution (Invited Lecture)
1	Objavljeni znanstveni prispevek na konferenci Published Scientific Conference Contribution
2	Objavljeni povzetek znanstvenega prispevka na konferenci (vabljeno predavanje) Published Scientific Conference Contribution Abstract (invited lecture)
37	Objavljeni povzetek znanstvenega prispevka na konferenci Published Scientific Conference Contribution Abstract
5	Samostojni znanstveni sestavek ali poglavje v monografski publikaciji Independent Scientific Component Part or a Chapter in a Monograph
1	Predgovor, spremna beseda Preface, Afterword
1	Polemika, diskusijski prispevek, komentar Polemic, Discussion, Commentary
3	Intervju Interview
3	Strokovna monografija Professional Monograph
1	Magistrsko delo Master’s Thesis
6	Končno poročilo o rezultatih raziskav Final Research Report
12	Radijska ali televizijska oddaja Radio or Television Broadcast
2	Zaključena znanstvena zbirka raziskovalnih podatkov Complete Scientific Database of Research Data
11	Druge monografije in druga zaključena dela Other Monographs and Other Completed Works
2	Strokovni film, videoposnetek ali zvočni posnetek/ Scientific film, scientific sound or video publication
9	Radijski ali TV dogodek Radio or Television Event
8	Prispevek na konferenci brez natisa Unpublished Conference Contribution
3	Vabljeno predavanje na konferenci brez natisa Unpublished Invited Conference Lecture
26	Uredništvo Editorship

Na Oddelku za raziskave organizmov in ekosistemov raziskovalci že več kot 25 let opravljajo populacijski monitoring gozdnih sov na območju Krima. Število kozač (*Strix uralensis* - na sliki je osebek temne različice) se je v tem času povečalo.
(foto: D. Tome)

Researchers from the Department of Organisms and Ecosystems Research carry out a population monitoring of forest owls on mt. Krim for more than 25 years. In this period number of Ural owls (*Strix uralensis* – here shown as dark variation) has increased.
(Photo D. Tome)

S skeniranjem QR kode lahko prisluhnete posnetku vibracijske krajine iz Bistre na Ljubljanskem barju.
(avtor posnetka: R. Šturm).

By scanning this QR code you can listen to a vibroscape recording from Bistra at Ljubljana Marsh
(Recorded by: R. Šturm).

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TEHNIČNI SODELAVCI
in ADMINISTRATIVNA PODPORA
TECHNICAL STAFF
and ADMINISTRATIVE SUPPORT
Ambrožič Ergaver, Špela
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Jerebic, Andreja
Kablar, Danijel
Kapla, Andrej
Kocijančič, Stiven
Koderman, Blaž
Pibernik, Mojca

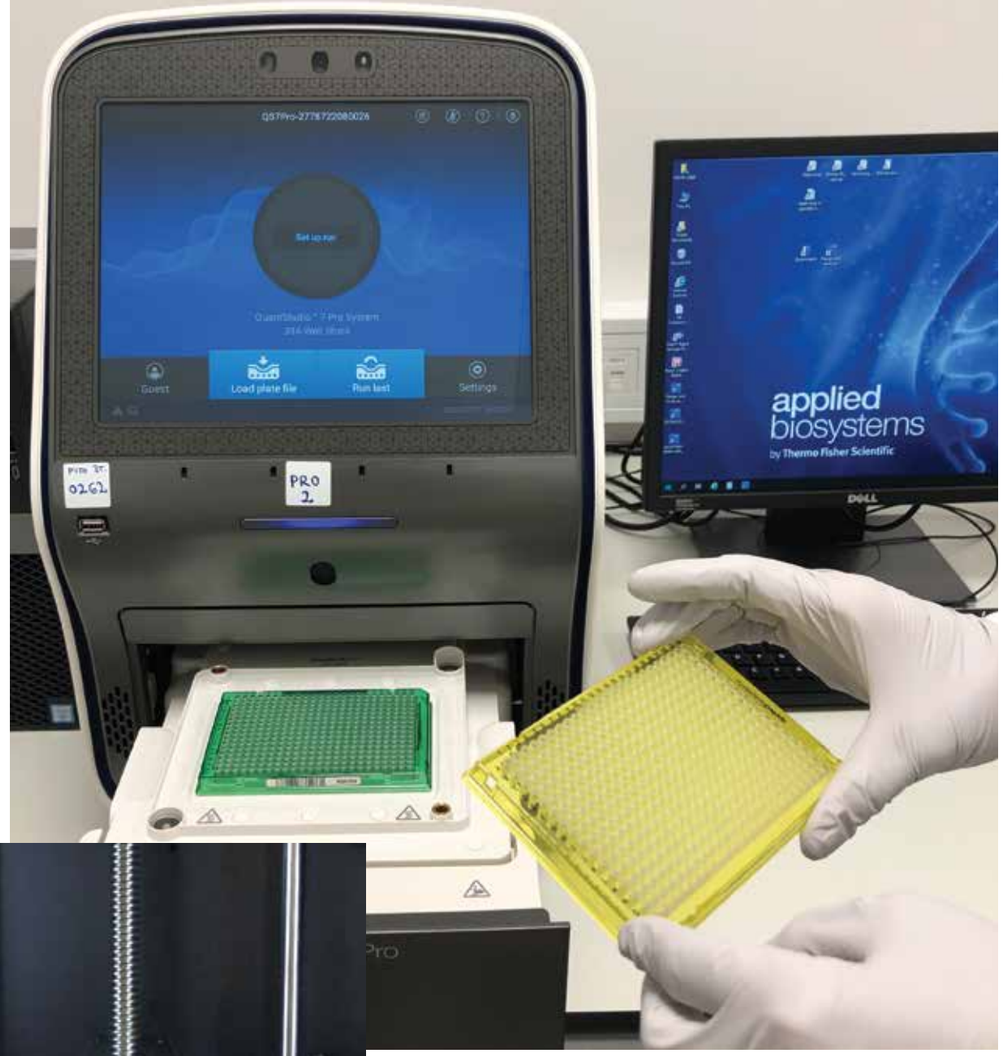
Infrastrukturni center NIB
NIB Infrastructural Centre

Namizni masni spektrometer za avtomatsko identifikacijo mikroorganizmov (MALDI, Bruker).

Benchtop mass spectrometer for automated microbial identification system (MALDI, Bruker).

Aparatura za PCR v realnem času (QuantStudio7 Pro) .

Real-time PCR instrument (QuantStudio7 Pro).



Sistem za slikanje celih rastlin Newton 7.0 BIO (Vilber).

Whole plant imaging system Newton 7.0. BIO (Vilber).

VODJA: PROF. DR. **MARUŠA POMPE NOVAK**

HEAD: PROF. **MARUŠA POMPE NOVAK**, PHD

Infrastrukturni center NIB (IC NIB) sestavljata dva programsko in organizacijsko zaključena centra: Infrastrukturni center Planta (IC Planta), ki deluje pod okriljem Oddelka za biotehnologijo in sistemsko biologijo, in Infrastrukturni center MBP (IC MBP) na Morski biološki postaji Piran (MBP).

The NIB Infrastructural Centre (IC NIB) consists of two distinct centres in terms of programmes and organisation: Infrastructural Centre Planta (IC Planta), which is part of the Department of Biotechnology and Systems Biology, and Infrastructural Centre MBP (IC MBP) as part of Marine Biology Station Piran (MBP).

IC NIB je tudi v letu 2022 zagotavljal sodelovanje med raziskovalci različnih raziskovalnih programov, projektov in institucij, povezovanje raziskovalcev z uporabniki raziskav iz vrst drugih proračunskih uporabnikov in industrije ter stik s pedagoškim procesom. IC NIB je v letu 2022 prav tako pomenil osnovo za sodelovanje pri evropskih in drugih mednarodnih projektih. Z moderno in dobro vzdrževano (v skladu z ISO 17025) raziskovalno opremo IC NIB so se izvajali tudi projekti, katerih naročniki so bila podjetja, ki pričakujejo dokazila o nadzoru kakovosti za izvajanje storitev. Oprema IC NIB je bila tudi podpora tehnološkemu razvoju in razvoju metod ter izvajanju specializiranih analiz.

Tematike raziskav in analiz, za katere se je uporabljala velika infrastrukturna oprema IC NIB, so bile izjemno raznovrstne. Veliko število uporabnikov in raznovrstnost tematik kaže na izjemen pomen vsebine IC NIB za slovenski prostor, in sicer na zelo raznovrstnih področjih raziskovalnega dela ter aplikacij pri delu za podjetja, državne in vladne organe in resorje ter za pedagoško delo.

IC MBP je podpora raziskovalni in aplikativni dejavnosti za ministrstva in druge državne organe ter pedagoškim dejavnostim MBP. Tehnološko napredna oprema omogoča najsodobnejše raziskave na morju in uvršča IC MBP med vodilne raziskovalne centre na območju Sredozemlja. MBP je tudi Nacionalni podatkovni center za morske podatke (NODC). Infrastruktura IC MBP zagotavlja visoko kakovost podatkov o stanju na morju, ki so na voljo v skoraj realnem času.

IC Planta je podpora raziskovalni dejavnosti, ministrstvom, inšpektoratom in drugim državnim organom, podjetjem in pedagoški dejavnosti. Vsa velika infrastrukturna oprema IC Planta je tehnološko izjemno zahtevna ter skrbno, redno in strokovno vzdrževana. Veliko infrastrukturno opremo IC Planta uporabljajo tudi uporabniki iz drugih organizacij. Za pogoste uporabnike so organizirani tečaji za uporabo opreme, mogoča pa je tudi uporaba opreme v obliki storitev in naročil analiz.

In 2022, the IC NIB continued to ensure cooperation among the researchers of various research programmes, projects and institutions as well as the networking of researchers with the research users from among other budget users and the industry and contact with the pedagogical process. The IC NIB continued to serve as the basis for cooperation in European and other international projects in 2022. The modern and well-maintained (pursuant to ISO 17025) IC NIB research equipment was also used to carry out other projects for companies that expect evidence of quality control for the provision of services. IC NIB equipment also served as support for technological development, the development of methods and the performance of specialised analyses.

The subjects of research and analyses carried out by the IC NIB's large infrastructural equipment were extremely diverse. The large number of users and the diversity of subjects demonstrate the exceptional significance of IC NIB-based content for the Slovenian area in a wide variety of research work fields and applications in work for companies, state and government bodies, line ministries and for pedagogical work.

The IC MBP supports research and applied activities for ministries and other state bodies as well as educational activities carried out at the MBP. The technologically advanced equipment enables state-of-the-art research at sea and places IC MBP among the leading centres in the Mediterranean. The MBP serves as the National Oceanographic Data Centre (NODC). The IC MBP's infrastructure ensures high-quality data on sea conditions that is available in near real-time.

IC Planta supports research activities, ministries, inspection and other state bodies, enterprises and educational activities. All IC Planta's large infrastructural equipment is technologically highly advanced and carefully, regularly and professionally maintained. IC Planta's large equipment is also used by other organisations. Training courses in equipment use are organised for frequent users, but it is also possible to use the equipment on a service-based system or for individual analysis orders.

Veliko infrastrukturno opremo IC Planta so v letu 2022 sestavljali:

- dva presevna elektronska mikroskopa (Talos L120C in Philips CM100) s CCD-kamerami in vso potrebno opremo za pripravo vzorcev,
- konfokalni mikroskop (Leica Stellaris 5) in konfokalni stereomikroskop (Leica TCS LSI),
- aparatura za slikanje rastlin (Vilber Newton 7.0 BIO),
- sistem za avtomatizirano vizualizacijo in analizo živih celic (oCelloScope),
- aparature za PCR v realnem času (Roche Light Cycler 480, ABI 7900HT Fast, ABI PRISM ViiA7, ABI QuantStudio7 Flex in ABI QuantStudio7 Pro),
- aparature za digitalni PCR (Biorad QX100, Biorad QX200, Biorad QXone, Stilla Technologies Naica in Fluidigm BioMark HD),
- robot za pipetiranje (Hamilton Microlab STARlet),
- ultracentrifuga (Beckman Coulter Optima XPN-90),
- sistem za hitro pripravo in koncentriranje bioloških vzorcev z možnostjo bioloških analiz na gojiščih,
- namizni masni spektrometer za avtomatsko identifikacijo mikroorganizmov (Bruker MALTI TOF Biotyper),
- komore za gojenje rastlin in tkivnih kultur ter komore za ločeno gojenje rastlin in
- dva karantenska rastlinjaka.

Mogoča je tudi uporaba spektrofluorimetrov (SynergyMx, BioTek) in sistema za identifikacijo bakterij z analizo celičnih maščobnih kislin s plinsko kromatografijo (Sherlock Microbial Identification System).

In 2022, the large infrastructural equipment of IC Planta consisted of:

- two Transmission electron microscopes (Talos L120C and Philips CM100) with two CCD cameras and all necessary equipment for sample preparation;
- Confocal microscope (Leica Stellaris 5) and Confocal stereomicroscope (Leica TCS LSI);
- Whole plant imaging system Newton 7.0. BIO (Vilber)
- Automated microbial live-cell imaging and analysis system (oCelloScope)
- Real-time PCR instruments (Roche Light Cycler 480, ABI 7900HT Fast, ABI PRISM ViiA7, ABI QuantStudio7 Flex and ABI QuantStudio7 Pro);
- Digital PCR instruments (Biorad QX100, Biorad QX200, Biorad QXone, Stilla Technologies Naica and Fluidigm BioMark HD);
- Robot for pipetting (Hamilton Microlab STARlet);
- Ultracentrifuge (Optima XPN-90);
- System for rapid preparation and concentration of biological samples with the possibility of biological analysis on the media;
- Benchtop mass spectrometer for automated microbial identification system (MALDI Biotyper® sirius RUO, BRUKER);
- Growth chambers for plant and tissue culture breeding (Kambič) and Plant growth chambers for separate breeding (Kambič);
- two Quarantine greenhouses.

Additionally, it is possible to use Spectrofluorimeters (SynergyMx, BioTek) and the system for the identification of microorganisms using fatty acid methyl ester analysis by gas chromatography (Sherlock Microbial Identification System).

Veliko infrastrukturno opremo IC MBP so v letu 2022 sestavljali:

- raziskovalno plovilo Sagita s sodobno navigacijsko in raziskovalno opremo, različnimi vzorčevalniki, akustičnim tokomerom in sodobno multiparametrično sondo,
- oceanografska boja Vida z meteorološkimi merilnimi instrumenti, multiparametričnimi sondami in akustičnim tokomerom,
- manjše plovilo Carolina,
- visokofrekvenčni radar Wera,
- vrstični elektronski mikroskop – SEM (Tescan MIRA LMU), epifluorescentni mikroskop in stereomikroskop z digitalno kamero in nastavkom za flourescenco ter
- aparatura za pomnoževanje DNA v realnem času (Thermo Fisher QuantiStudio 3).

IC NIB svojo veliko infrastrukturno opremo redno dopolnjuje in posodablja. V letu 2022 je bila dopolnitev velike infrastrukturne opreme IC NIB še posebej obsežna, k čemur je v veliki meri pripomogla pridobitev dodatnih sredstev za investicijsko operacijo »Nakup raziskovalne opreme« od Ministrstva za visoko šolstvo, znanost in inovacije v okviru gradnje novega objekta Biotehnološkega stičišča Nacionalnega inštituta za biologijo (BTS-NIB), v katerega se je med drugim po zaključku prve faze gradnje v decembru 2022 preselil IC Planta.

V letu 2022 je IC NIB svojo opremo dopolnil z invertnim konfokalnim mikroskopom nove generacije (Leica Stellaris 5), ki se uporablja za opazovanje lokacije molekul in interakcij med molekulami v živih rastlinah v času brez vnaprejšnje priprave preparatov. Ima izjemno občutljiv detektor HyD S, ki omogoča hitrejše zajemanje slike, kar je ključno za spremljanje znotrajceličnih sprememb v realnem času. Poleg tega novi detektor omogoča boljše razmerje med signalom in šumom ter akumulacijo signala. Omogoča izbiro poljubnega območja valovnih dolžin svetlobe – na tak način na slikah ni motečega ozadja, ki je posledica nespecifične fluorescence preiskovanega vzorca, poleg tega pa je možno spremljati več označenih molekul v celici hkrati.

In 2022, the large infrastructural equipment of the IC MBP consisted of:

- Sagita research vessel with modern navigation and research equipment, various samplers, an acoustic current meter and a modern multiparametric CTD probe;
- Vida oceanographic buoy with meteorological measuring instruments, multiparametric CTD probes and an acoustic current meter;
- Carolina smaller vessel;
- Wera high-frequency radar;
- Scanning electron microscope - SEM (Tescan MIRA LMU), Epifluorescence Microscope and stereomicroscope with digital camera and fluorescence attachment, and
- Real-time PCR instrument (Thermo Fisher QuantStudio3).

The IC NIB regularly supplements and updates its large infrastructural equipment. In 2022, the NIB IC's large infrastructure equipment was particularly extensively upgraded, largely due to the additional funding obtained for the investment operation »Purchase of Research Equipment« from the Ministry of Higher Education, Science and Innovation in the framework of the construction of the new Biotechnology Hub of the National Institute of Biology (BTS-NIB), to which, among others, IC Planta was relocated after the completion of the first phase of construction in December 2022.

In 2022, IC NIB supplemented its equipment with a new Inverted confocal laser scanning microscope (Leica Stellaris 5) that that is used to observe the locations of molecules and the interactions between molecules in living plants in real time without prior preparation. It has an ultra-sensitive HyD S detector that enables faster image capture, which is key to monitoring internal changes in real time. In addition, the new detector provides a better signal-to-noise ratio and signal accumulation. It allows the selection of an arbitrary range of light wavelengths, in this way there is no disturbing background in the images, which is a result of the non-specific fluorescence of the investigated sample, and it is also possible to monitor several labelled molecules in the cell at the same time.

Motoriziran Pokončni Epifluorescentni mikroskop (Axio Imager Z2 Zeiss) združuje odlično optiko, delo s fluorescenco in različne metode kontrasta prepuščene svetlobe. Upravljalnik kontrasta in upravljalnik svetlobe ves čas zagotavljata definirane pogoje in ponovljive rezultate. Instrument ima tri različne objektive, LED presevno in fluorescenčno osvetlitev s hitrim preklopi valovnih dolžin. Mikroskop je opremljen z monokromatsko kamero za fluorescenco, z ločljivostjo 12M pikslov. Vključena je programska oprema ZEN Pro za kontrolo vseh motoriziranih komponent mikroskopa, kamere, generiranje eksperimentov, večkanalni zajem, interaktivna merjenja, avtomatsko analizo s pomočjo strojnega učenja, modul za združevanje več vidnih polj v posamično sliko ali zajem na več mestih preparata ter modul za ekspresijo genov in proteinov.

Avtomatizirani stereo mikroskop z digitalno kamero in nastavkom za flourescenco (Leica M205 FCA) se uporablja za fotografiranje morskih živali in rastlin z visoko ločljivostjo. Zajame več slik na različnih fokusnih ravninah in ustvari sestavljeno sliko z razširjenim globinskim poljem. Tehnologija TripleBeam odstranjuje ozadje oz. »šum« z uvedbo tretjega optičnega zooma, kar zagotavlja jasen fluorescenčni signal na »brezšumnem« črnem ozadju. Objektiv 2.0x PlanApo z nastavljivim lomnim količnikom omogoča ostro slikanje tudi pri opazovanju vzorcev, potopljenih v vodno raztopino, s čimer kompenzira neskladje lomnih količnikov med zrakom in vodo. Sistem omogoča hitro menjavo zooma in fluorescentnih filtrov ter je podprt s programsko platformo LAS X.

Sistem za slikanje celih rastlin Newton 7.0 BIO (Vilber) omogoča prostorsko in časovno sledenje bioluminiscence in fluorescence v intaktnih rastlinah. Velikost komore in vidnega polja omogoča slikanje rastlin od velikosti kalčka do srednje velike rastline. Široko spektralno območje kamere in set osmih ozkopasovnih filtrov omogočata zajemanje in razločevanje signala več fluorescentnih proteinov. Sistem je podprt s programsko opremo za obdelavo in kvantifikacijo slik.

Motorised Upright Epifluorescence Microscope (Axio Imager Z2 Zeiss) combines excellent optics, work with fluorescence and various methods of contrast of transmitted light. Contrast control and light control ensure defined conditions and reproducible results at all times. The instrument has three different objectives and fluorescent lighting with fast switching of wavelengths. The microscope is equipped with a monochromatic camera for fluorescence, resolution 12M pixels. ZEN Pro software is included for control of all motorized components of the microscope, cameras, experiment generation, multi-channel capture, interactive measurements, automatic analysis with the help of machine learning, a module for combining multiple fields of view into a single image or capture at multiple points of the preparation and expression modules genes and proteins.

Automated stereomicroscope with digital camera and fluorescence attachment (Leica M205 FCA) is used for high-resolution imaging of marine animal and plant samples. It captures multiple images at different focal planes to create a composite image with extended depth of field. The TripleBeam technology eliminates background »noise« by introducing a third optical zoom, providing a clear fluorescence signal against a noise-free, black background. The 2.0x PlanApo objective with adjustable refractive index allows for sharp imaging even when observing samples immersed in a watery solution, compensating for refractive index mismatch between air and water. The system enables quick zoom and fluorescent filter changes and is supported by the LAS X software platform.

Whole plant imaging system Newton 7.0. BIO (Vilber) enables following bioluminescence and fluorescence in intact plants in spatial and temporal manner. Dimensions of the chamber and field of vision enable imaging of samples of different sizes, from seedlings to plants of medium height. Wide spectral range of the camera and a set of 8 filters enable detection and separation of the signal of multiple fluorescent proteins. System is supported by software for image processing and quantification.

Sistem za avtomatizirano vizualizacijo in analizo živih celic (oCelloScope) je sistem za avtomatizirano *in vitro* analizo rasti in morfologije celic v tekočini (npr. mikroorganizmov v tekoči kulturi) na podlagi spremljanja slik rasti skozi čas. Prednost aparature je, da omogoča analizo tako na podlagi merjenja optične gostote kot tudi na podlagi analize zajete slike celic ter omogoča natančno analizo rasti tudi pri nizkih in visokih koncentracijah. Celice je mogoče spremljati brez predhodnega barvanja ali obdelave v mikrotiterskih ploščicah s 6 do 96 luknjicami.

Automated microbial live-cell imaging and analysis system (oCelloScope) enables sensitive and detailed in vitro monitoring of biological growth and development in solutions (e.g. monitoring microorganisms in liquid culture). The system enables two types of analysis: optical density measurements and images acquisition. The measurements can be run through time for longer periods, and therefore, the system enables accurate growth measurements and analysis for low and high cell concentrations. The cells can be monitored in standard microtiter plates, from 6 to 96 wells.

Namizni masni spektrometer za avtomatsko identifikacijo mikroorganizmov (MALDI Biotyper® sirious RUO, BRUKER) je masni spektrometer, ki za svoje delovanje uporablja MALDI-TOF (Matrix-Assisted Laser Desorption/Ionization Time-Of-Flight) tehnologijo. Z določitvijo edinstvenega proteomskega prstnega odtisa mikroorganizma, ki ga nato primerja s proteomskimi vzorci mikroorganizmov v referenčni knjižnici, omogoča identifikacijo mikroorganizmov do nivoja vrste v le nekaj minutah. Sistem omogoča razširitev referenčne knjižnice z uporabnikovo knjižnico, ki vsebuje spektre mikroorganizmov, ki jih je uporabnik sam posnel.

Benchtop mass spectrometer for automated microbial identification system (MALDI Biotyper® sirious RUO, BRUKER) is a microbial identification system based on MALDI-TOF (Matrix-Assisted Laser Desorption/Ionization Time-Of-Flight) mass spectrometry. The system determines the unique proteomic fingerprint of an organism, and matches characteristic patterns with an extensive reference library, what enables unbiased identification of microorganisms within a few minutes down to the species level. The reference library can be extended with users own library created from microorganism entries.

Ultracentrifuga (Optima XPN-90) omogoča centrifugiranje pri zelo visokih obratih. S tem omogoča npr. sedimentacijo virusnih delcev oziroma ločevanje le-teh v različnih gradientih.

Ultracentrifuge (Optima XPN-90) enables centrifugation at very high speeds, thus enables e.g. the sedimentation of viral particles or the separation of only these in different gradients.

Aparatura za digitalno PCR (Stilla naica), ki je sestavljena iz aparatur Geode in Prism6, omogoča večtarčno določanje nukleinskih kislin. Geode je generator kapljic in PCR, Prism6 pa *čitalnik z vgrajenim računalnikom, ki omogoča vizualizacijo reakcije do ravni posameznih kapljic. Aparatura omogoča uporabo hidrolizirajočih sond v šestih kanalih, kar omogoča večkanalno* večtarčno določanje, in uporabo interkalacijskih barvil (npr. EvaGreen). Sistem omogoča ponovno pridobitev vzorca po PCR in uporabo v nadaljnji analizi.

Digital PCR instrument (Stilla naica) allows multi-target determination of nucleic acids. The system comprises of Geode, which doubles as the droplet generator and PCR cycler, and Prism6, a reader with an integrated computer that visuals the PCR reaction down to the level of individual droplets. The system enables the use of hydrolysis probe in six channels, allowing for multi-channel multiplexing, as well as the use of intercalating dye chemistry (e.g. EvaGreen). The system enables recovery of the sample following PCR and use in downstream analysis.

Aparatura za PCR v realnem času (QuantStudio7 Pro) omogoča izvajanje verižne reakcije s polimerazo v realnem času (kvantitativni PCR, qPCR) in post-PCR analizo. Za vzbujanje fluorescentnih barvil uporablja močan vir svetlobe, in sicer dolgoživo belo diodo, dve posebni ločeni optični namizji in posebne polprepustne leče s po šestimi optično ločenimi vzbujevalnimi filtri ter šestimi emisijskimi filtri, kar omogoča natančno razlikovanje med različnimi fluorescentnimi barvili. Za detekcijo fluorescence uporablja CCD kamero. Aparatura omogoča eno- ali večbarvno detekcijo (single ali multiplex kvantitativne reakcije). Sistem je zelo občutljiv, omogoča detekcijo 1 kopije tarčnega zaporedja v reakcijski mešanici. Linearnost je zagotovljena preko 10 logaritemskih redov.

Real-time PCR instrument (QuantStudio7 Pro) allows real-time polymerase chain reaction (quantitative PCR, qPCR) and post-PCR analysis. It uses a powerful light source for excitation of the fluorescent dyes, namely a long-lived white diode and two special separate optical tables and special semi-transparent lenses with six optically separate excitation filters and six emission filters each, which allow accurate discrimination between the different fluorescent dyes. It uses a CCD camera to detect fluorescence. The instrument allows single or multiplex detection (single or multiplex quantitative reactions). The system is very sensitive, allowing the detection of 1 copy of the target sequence in the reaction mixture. Linearity is guaranteed over 10 logarithmic orders.

Invertni konfokalni mikroskop nove generacije (Leica Stellaris 5).

Inverted confocal laser scanning microscope (Leica Stellaris 5).

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DICTIONARY, ENCYCLOPAEDIA, LEXICON, MANUAL, ATLAS, MAP

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ODDELEK ZA BIOTEHNOLOGIJO IN SISTEMSKO BIOLOGIJO
DEPARTMENT OF BIOTECHNOLOGY AND SYSTEMS BIOLOGY

IZVIRNI ZNANSTVENI ČLANEK
ORIGINAL SCIENTIFIC ARTICLE

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SAMOSTOJNI ZNANSTVENI SESTAVEK ALI POGLAVJE V MONOGRAFSKI PUBLIKACIJI
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COMPLETE SCIENTIFIC DATABASE OF RESEARCH DATA

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ODDELEK ZA GENETSKO TOKSIKOLOGIJO IN BIOLOGIJA RAKA
DEPARTMENT OF GENETIC TOXICOLOGY AND CANCER BIOLOGY

IZVIRNI ZNANSTVENI ČLANEK
ORIGINAL SCIENTIFIC ARTICLE

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Potapljanje je včasih vse prej kot prijetno; vzorčenje v Luki Koper (foto: B. Mavrič).

Diving can sometimes be anything but pleasant; sampling in the Port of Koper (Photo: B. Mavrič).

ODDELEK ZA RAZISKAVE ORGANIZMOV IN EKOSISTEMOV

DEPARTMENT OF ORGANISMS AND ECOSYSTEMS RESEARCH

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